CA-1: Visible Lasers

Chair: Richard Paul Mildren, Macquarie University, Sydney, Australia

Time: Monday, 8:30–10:00 Location: TRACK 1

Invited CA-1.1 8:30 TRACK 1
Tb-doped Materials for Visible Lasers — •Ryo Yasuhara, Hegnjun Chen, and Hiyori Uehara — National Institute for Fusion Science, Toki, Japan
Tb3+ activated visible lasers pumped by blue semiconductor lasers are investigated for the efficient high energy and high peak power.

Oral CA-1.2 9:00 TRACK 1
Enhanced absorption efficiency in UV-pumped Tb^{3+}:LLF — •Sascha Kalusniak, Hiroki Tanaka, Elena Castellano-Hernández, and Christian Kränkel — Leibniz-Institut für Kristallzüchtung (IKZ), Berlin, Germany
We investigate UV pumping of Tb-based lasers and demonstrate significantly higher optical-to-optical efficiencies compared to conventional cyan-blue pumping. Spectroscopy reveals higher UV absorption cross sections and efficient population of the upper laser level by cross-relaxation.

Oral CA-1.3 9:15 TRACK 1
Self-Pulsation and Active Q-switching of Tb:YLF Lasers Pumped by InGaN Diode Lasers — •Yuta Shioya, Tatsuzo Uchida, and Fumihiko Kannari — Department of Electronics and Electrical Engineering, Keio University, Yokohama, Japan
We employed polarization-combined two 2W-InGaN LDs (488 and 487 nm) for pumping and experimentally studied CW Tb3+:YLF lasers and Q-switching operations with an acousto-optic modulator (AOM) and a Co:MALO saturable absorber.

Oral CA-1.4 9:30 TRACK 1
Miniaturized passively Q-switched Pr:YLF Laser — •Moritz Badtke, Hiroki Tanaka, Lenn Ollenburg, Sascha Kalusniak, and Christian Kränkel — Leibniz-Institut für Kristallzüchtung (IKZ), Berlin, Germany
We demonstrate a Pr:YLF laser at 640 nm passively Q-switched by a Co:MgAl2O4 spinel saturable absorber. A miniaturized linear cavity as short as 8 mm enables to achieve sub-10 ns pulse durations.

Oral CA-1.5 9:45 TRACK 1
8.5W Linear and 3.6W Ring TEM_{00} Diode-Pumped Alexandrite Lasers — •Goronwy Tawy[1], Ara Minassian[2], and Michael J. Damzen[1] — [1]Photonics Group, Imperial College London, London, United Kingdom — [2]Unilase Ltd, London, United Kingdom
We present record power levels for red-diode-pumped Alexandrite lasers in TEM_{00} operation. 8.5W is obtained with $M^2 < 1.1$ in a linear cavity and a 3.6W from a ring laser with $M^2 = 1.2$.

CB-1: Photonic Crystal and Membrane Lasers

Chair: Stephen Sweeney, University of Surrey, Guildford, United Kingdom

Time: Monday, 8:30–10:00 Location: TRACK 2

Invited CB-1.1 8:30 TRACK 2
Heterogeneously integrated membrane lasers and photonic crystal lasers — •Shinji Matsuo, Koji Takeda, Takuro Fujii, and Hidetaka Nishi — NTT Device Technology Labs, NTT Corporation, Atsugi, Japan
We will describe our recent results on membrane DFB laser array and photonic crystal lasers. We have succesfully demonstrated heterogeneous integration of III-V photonic devices on Si substrate.

Oral CB-1.2 9:00 TRACK 2
Comparison of electrically and optically pumped buried-heterostructure photonic crystal lasers — •Evangelos Dimopoulos, Yi Yu, Aurimas Sakanas, Andrey Marchevsky, Meng Xiong, Kristoffer Skaftved Mathiesen, Elizaveta Semenova, Kresten Yvind, and Jesper Mørk — DTU Fotonik, Technical University of Denmark, Kongens Lyngby, Denmark
The properties of buried-heterostructure photonic crystal nanolasers are studied by employing electrical and optical pumping. Using the rate equations and the spectral evolution of the laser the thermal properties and injection efficiency are being investigated.

Oral CB-1.3 9:15 TRACK 2
Rate equation analysis of slow-light photonic crystal lasers — Marco Saldutti and •Mariangela Gioannini — Politecnico di Torino, Torino, Italy
We derive laser rate equations including slow-light effect and coupling, induced by gain, between photonic crystal waveguide Bloch modes. We apply it to the calculation of the laser modulation bandwidth and energy cost per bit.

Oral CB-1.4 9:30 TRACK 2
Design strategy for broadband MECSELs — •Hermann Kahle, Hoy-My Phung, Philipp Tatar-Mathes, Patrik Rajala, and Mircea Guina — Optoelectronics Research Centre (ORC), Physics Unit / Photonics, Faculty of Engineering and Natural Sciences, Tampere University, Tampere, Finland
First results of MECSELs with semiconductor gain membranes, designed to possess a broad tuning range are presented. The MECSEL operates at room temperature around 1 μm and the membrane contains two different kinds of quantum wells.

Oral CB-1.5 9:45 TRACK 2
Quantum dot membrane external-cavity surface-emitting laser (MECSEL) at 1.5 μm — •Hoy-My Phung[1], Philipp Tatar-Mathes[1], Cyril Paranthoen[2], Christophe Levallois[2], Nicolas Chevalier[2], Hermann Kahle[1], Mehdi Alouini[2], and Mircea Guina[1] — [1]Optoelectronics Research Centre (ORC), Physics Unit / Photonics, Faculty of Engineering and Natural Sciences, Tampere University, Tampere, Finland — [2]Institut FOTON, UMR-CNRS 6082, Institut National des Sciences Appliquées de Rennes, University of Rennes, Rennes, France
We report an InAs quantum dot MECSEL, which provides an output power of 320 mW around 1.5 μm with 86 nm tunability at room temperature operation and silicon carbide heat spreaders.

CE-1: Photonic Structures

Chair: Stavros Pissadakis, Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology - Hellas (FORTH), Heraklion, Greece

Time: Monday, 8:30–10:00 Location: TRACK 3

Keynote CE-1.1 8:30 TRACK 3
Interplay between order and disorder in natural photonic structures — Lukas Schertel, Gianni Jacucci, Gea Theodora van der Kerhof, and •Silvia Vignolini — University of Cambridge, Cambridge, United Kingdom
Colours in living organisms are often created by scattering of nanostructured materials, rather than absorption. Here we revise how the interplay between order and disorder in natural photonic structures affect their optical appearance.

Oral CE-1.2 9:15 TRACK 3
First Observation of Phonon-induced Ballistic Motion in Photonic Nanostructures — •Tongjun Liu[1], Jun-Yu Ou[1], Kevin MacDonald[1], and Nikolay Zheludev[1,2] — [1]University of Southampton, Southampton, Hampshire , United Kingdom — [2]Nanyang Technological University, Singapore, Singapore
The components of photonic and opto/electro-mechanical nanostructures are subject to picometre-scale thermal movements, which affect their optical properties. We present the first observation of short-timescale ballistic (non-Brownian) phonon-driven motion in a microcantilever.

Oral CE-1.3 9:30 TRACK 3

Switchable optical strong PUFs via polymer dispersed liquid crystals — •Sara Nocentini[1,2], Ulrich Ruehrmair[3], Mauro Barni[4], Diederik S. Wiersma[1,2,5], and Francesco Riboli[2,6] — [1]National Institute of Metrological Research (INRiM), 10135 Turin, Italy — [2]Europeran Laboratory of Nonlinear Spectroscopy (LENS), 50019 Sesto Fiorentino, Italy — [3]LMU München Faculty of Physics, D-80799 München, Germany — [4]University of Siena, Department of Information Engineering and Mathematical Sciences, 53100 Siena, Italy — [5]University of Florence, Department of Physics, 50019 Sesto Fiorentino, Italy — [6]National Research Center - National Optical Institute (CNR-INO), 50019 Sesto Fiorentino, Italy

Physical unclonable functions (PUFs) have been proposed for secure authentication processes in open networks. We demonstrate reconfigurable and switchable all-optical strong PUFs based on polymer dispersed liquid crystals characterized by an enhanced complexity thanks to material reconfigurability.

Oral CE-1.4 9:45 TRACK 3

Lensless and Optical Physically Unclonable Function with Fibrous Media — •Min Seok Kim[1], Gil Ju Lee[1], Seung Ho Choi[2], Jung Woo Leem[3], Young L. Kim[3], and Young Min Song[1] — [1]Gwangju Institute of Science and Technology, Gwangju, South Korea — [2]Yonsei University, Wonju, South Korea — [3]Purdue University, West Lafayette, USA

Combination of Physically unclonable functions (PUF) and fibrous medium can potentially increase hardware and information security. Here, we propose a strong lensless, optical, portable PUF device with fibrous medium having inherent stochastic pinholes.

CF-1: Ultrashort Pulse Generation

Chair: Hanieh Fattahi, MPI for the Science of Light, Erlangen, Germany

Time: Monday, 8:30–10:00 Location: TRACK 4

Oral CF-1.1 8:30 TRACK 4

Kerr-lens mode locked, synchronously pumped, ultra-broadband breathing pulse optical parametric oscillator — •Jintao Fan[1,2], David Zuber[1,2], Robin Mevert[1,2], Tino Lang[3], Thomas Binhammer[4], and Uwe Morgner[1,2,5] — [1]Leibniz Universität Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering-Innovation Across Disciplines), Hannover, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [4]neoLASE GmbH, Hannover, Germany — [5]Laser Zentrum Hannover e.V., Hannover, Germany

Beneficial from a breathing pulse design, we demonstrate a Kerr-lens mode locked non-collinear optical parametric oscillator, which is capable of delivering stable ultrabroadband signal spanning from 628 nm to 890 nm at -10 dB level.

Oral CF-1.2 8:45 TRACK 4

Ultra-broadband, high power, femtosecond non-collinear optical parametric oscillator in the visible — •Robin Mevert[1,2], Yuliya Binhammer[1,2], Christian Markus Dietrich[1,2], José Ricardo Cardoso de Andrade[1,2], Luise Beichert[1,2], Thomas Binhammer[3], Jintao Fan[1,2], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany — [3]neoLASE GmbH, Hannover, Germany

Optical parametric oscillators are novel laser sources for the creation of tunable ultrashort laser pulses. We present a fast-tunable, high power non-collinear optical parametric oscillator which covers nearly the complete visible spectral range (VIS-NOPO).

Oral CF-1.3 9:00 TRACK 4

Towards Sub-10-fs Visible μJ Pulses at 1 MHz Repetition Rate From an Optical Parametric Amplifier — •Sven Kleinert[1,2], Ayhan Tajalli[3], David Zuber[1,2], José R.C. Andrade[4], and Uwe Morgner[1,2,5] — [1]Institute of Quantum Optics, Leibniz Universität Hannover, 30167 Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation Across-Disciplines), 30167 Hannover, Germany — [3]Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — [4]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, 12489 Berlin, Germany — [5]Laser Zentrum Hannover e.V., 30419 Hannover, Germany

We present a compact visible optical-parametric amplifier delivering pulses with an energy of 2μJ and a Fourier-transform-limited pulse duration below 7fs at 1MHz repetition rate. The system is pumped by a CPA-free solid-state amplifier.

Oral CF-1.4 9:15 TRACK 4

Soliton-effect self-compression: limits and high repetition rate scaling — •Daniel Schade[1,2], Johannes R. Koehler[1], Felix Köttig[1], Philip St.J. Russell[1,2], and Francesco Tani[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

We identify the boundaries of multi-parameter space within which soliton-effect self-compression is optimal in gas-filled hollow-core fibres, taking account of modulational instability, self-focusing, third-order dispersion, photoionisation, and the effects of scaling to MHz-level repetition rates.

Oral CF-1.5 9:30 TRACK 4

Gas Mixtures to Suppress Thermal Buildup Effects Caused by High-Repetition-Rate Photoionization of Confined Gases — Johannes R. Koehler[1], Daniel Schade[1,2], Philip St.J. Russell[1,2], and •Francesco Tani[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

The buildup of ionisation-related thermal density depressions affects pulse compression at high repetition rates in heavier noble gases. Adding lighter gases with high thermal conductivity accelerates heat dissipation, significantly reducing buildup effects.

Oral CF-1.6 9:45 TRACK 4

Nonlinear pulse compression in double-pass multiple plate compression — •Bo-Han Chen[1], Jia-Xuan Su[1], Jhan-Yu Guo[1], Kai Chen[2,3], Shang-Da Yang[1], and Chih-Hsuan Lu[1] — [1]Institute of Photonics Technologies, National Tsing Hua University, Hsinchu 30013, Taiwan — [2]Robinson Research Institute, Faculty of Engineering, Victoria University of Wellington, Wellington 6012, New Zealand — [3]The Dodd-Walls Centre for Photonic and Quantum Technologies, Dunedin 9016, New Zealand

A new double-pass multiple plate compression (DPMPC) scheme is first demonstrated, compressing the pulse from 190 fs to 17.8 fs with 57 % throughput and good beam quality.

CG-1: Ultrafast Dynamics in Solids

Chair: Hiroki Mashiko, NTT Basic Research Laboratories, Kanagawa, Japan

Time: Monday, 8:30–10:00 Location: TRACK 5

Invited CG-1.1 8:30 TRACK 5

Ab Initio Description of Ultrafast Dynamics in Solids — •Kazuhiro Yabana — University of Tsukuba, Tsukuba, Japan

We have developed an ab initio theoretical and computational description of light matter interaction solving coupled dynamics of light propagation, electronic, and ionic motions. We show several applications in ultrafast nano-optics.

Oral CG-1.2 9:00 TRACK 5

Observation of Dynamical Bloch Oscillations in Dielectrics — Jan Reislöhner, Doyeong Kim, and •Adrian Pfeiffer — Friedrich-Schiller-Universität Jena, Jena, Germany

The effect that the current alternates direction when the electrons leave the first Brillouin zone is observed with noncollinear spectroscopy. The onset of Bloch oscillations is mapped into an interference trace.

Oral CG-1.3 9:15 TRACK 5

Reconstruction of Ultrafast Exciton Dynamics with a Phase-retrieval Algorithm — •Bruno Moio[1,2], Gian Luca Dolso[1], Giacomo Inzani[1], Nicola Di Palo[1], Rocío Borrego-Varillas[2], Mauro Nisoli[1,2], and Matteo Lucchini[1,2] — [1]Department of Physics, Politecnico di Milano, Milan, Italy — [2]Institute for Photonics and Nanotechnologies, IFN-CNR, Milan, Italy

We present ePIX, a novel iterative algorithm for the reconstruction of ultrafast exciton dynamics from attosecond transient reflectivity traces. Based on ptychographic techniques, our method guarantees high accuracy and robustness with respect to experimental noise.

Oral CG-1.4 9:30 TRACK 5

Light field-driven electron dynamics in 2D-materials — •Tobias Boolakee[1], Christian Heide[1,2], Heiko B. Weber[1], and Peter Hommelhoff[1] — [1]Department of Physics, Friedrich-Alexander Universität Erlangen-Nürnberg, 91058 Erlangen, Germany — [2]now at PULSE Institute, Departments of Photon Science and Applied Physics SLAC/ Stanford University, Menlo Park, CA, 94025, USA

We demonstrate sub-femtosecond coherent control on electrons in 2D-materials using carrier-envelope phase-controlled femtosecond laser pulses. Ultrafast currents reveal the intricately coupled inter- and intra-band carrier dynamics imprinted by the shape of the optical field.

Oral CG-1.5 9:45 TRACK 5

Contribution of free carriers to light absorption upon intense light-semiconductor interaction — •Richard Hollinger[1,2], Elissa Haddad[3], Maximilian Zapf[4], Valentina Shumakova[5], Paul Herrmann[1], Robert Röder[4], Ingo Uschmann[1], Udo Reislöhner[1], Audrius Pugžlys[5], Andrius Baltuška[5], Francois Légaré[3], Michael Zürch[1,6,7,8], Carsten Ronning[4,9], Christian Spielmann[1,2,9], and Daniil Kartashov[1,9] — [1]Institute of Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Jena, Germany — [2]Helmholtz Institute Jena, Jena, Germany — [3]Centre Énergie Matériaux et Télécommunications, Institut National de la Recherche Scientifique, Varennes, Canada — [4]Institute for Solid State Physics, Friedrich-Schiller-University Jena, Jena, Germany — [5]Institute for Photonics, Technical University Vienna, Vienna, Austria — [6]Fritz Haber Institute, Berlin, Germany — [7]Department of Chemistry, University of California Berkeley, Berkeley, USA — [8]Lawrence Berkeley National Laboratory, Materials Sciences Division,, Berkeley, USA — [9]Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany

We investigated the absorption of intense, long wavelength light by using the onset of stimulated emission in ZnO thin films. The wavelength dependence of the lasing threshold intensity reveals the important role of free carriers.

CK-1: Periodic Components

Chair: Olivier Gauthier-Lafaye, LAAS-CNRS, Toulouse, France

Time: Monday, 8:30–10:00 Location: TRACK 6

Invited CK-1.1 8:30 TRACK 6

Stacked Photonic Systems Composed of Resonant Metasurfaces and Other Functional Layers — •Isabelle Staude — Friedrich Schiller University, Jena, Germany

Stacking of Mie-resonant all-dielectric metasurfaces and other functional layers offers interesting new opportunities for tailoring the response of the metasurface system. This talk will discuss several examples of such stacked systems, which we experimentally realized.

Oral CK-1.2 9:00 TRACK 6

Uniformly-Distributed Energy Losses in Photonic Gratings Enabled by Exceptional Points in Band Diagrams — •Alexander Yulaev[1,2], Sangsik Kim[3], Qing Li[4], Daron A. Westly[1], Brian J. Roxworthy[1], Kartik Srinivasan[1], and Vladimir Aksyuk[1] — [1]Physical Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA — [2]Department of Chemistry and Biochemistry, University of Maryland, College Park, MD 20742, USA — [3]Department of Electrical and Computer Engineering, Texas Tech University, Lubbock, TX 79409, USA — [4]Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Wave penetration in uniform lossy materials is typically accompanied by an exponential decay. We demonstrate spatially uniform energy losses across hundred-micrometer long photonic gratings carefully tuned to operate between exceptional points in their band diagram.

Oral CK-1.3 9:15 TRACK 6

Designing Out-of-Plane Tilted Bragg Gratings for Arbitrary Beam Shaping — •Dong-Woo Ko, James C. Gates, and Peter Horak — Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

We investigate grating-based couplers theoretically to deliver light from integrated waveguides into free space above the chip. Analytical and numerical models determine nonuniform grating periods and index contrasts required to generate arbitrary beam shapes.

Oral CK-1.4 9:30 TRACK 6

Fiber System with Nanostructured Components for Generation of Optical Vortex Beam — •Hue Thi Nguyen[1,2], Adam Filipkowski[1,2], Krzysztof Switkowski[3], Dariusz Pysz[2], Wieslaw Krolikowski[4,5], and Ryszard Buczynski[1,2] — [1]University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland — [2]Łukasiewicz Institute of Microelectronics and Photonics, Al. Lotników 32/46, 02-668 Warsaw, Poland — [3]Warsaw University of Technology, Koszykowa 75, 00-662 Warsaw, Poland — [4]Australian National University, Canberra, ACT 0200, Australia — [5]Texas A&M University , Qatar, Qatar

We report on optical performance of a compact nano-structured gradient index micro-lenses. These two-component systems which are rigidly integrated at fiber end and used for generation of high-quality vortices with low numerical aperture.

Oral CK-1.5 9:45 TRACK 6

Multiple vibro-polaritons formation from a polyethylene film embedded in a resonant mid-infrared cavity — Mario Malerba, Mathieu Jeannin, Adel Bousseksou, Raffaele Colombelli, and •Jean-Michel Manceau — Centre de Nanosciences et Nanotechnologies, Palaiseau, France

We resolve the dispersion of multiple vibro-polariton modes issued from the coupling of several vibrational bands of the methylene group with a resonant modes of a mid-infrared micro-cavity. The experimental results are in excellent agreement with numerical simulations.

EB-1: Quantum Networks

Chair: Hugues de Reidmatten, ICFO Barcelona, Spain

Time: Monday, 8:30–10:00 Location: TRACK 7

Keynote EB-1.1 8:30 TRACK 7

Quantum Multiplexing — •William Munro — 1. NTT Basic Research Laboratories and Research Center for Theoretical Quantum Physics. NTT Corporation, Atsugi, Japan

Quantum networking will enable information transmission in ways unavailable in the classical world. Here we introduce the concept of quantum multiplexing which encodes multiple qubits of information onto a photon to overcome scarce resource issues.

Oral EB-1.2 9:15 TRACK 7

Entanglement Based Quantum Networks: Protocols, AI control plane & coexistence with classical communication. — •Siddarth Koduru Joshi[1], Zixin Huang[2], Alasdair Fletcher[3], Naomi Solomons[1], Ittoop Vergheese Puthoor[4], Yoann Pelet[1], Djeylan Aktas[1], Cosmo Lupo[2], Armanda O. Quintavalle[2], Sören Wengerowsky[5], Rodrigo Stange Tessinari[1], Obada Alia[1], Rui Wang[1], Marcus Clark[1], Natarajan Venkatachalam[1], Emilio Hugues-Salas[1], George Kanellos[1], Martin Lončarić[6], Sebastian Neumann[5], Bo Liu[7], Thomas Scheidl[5], Željko Samec[6], Laurent Kling[1], Alex Qiu[1], Reza Nejabati[1], Dimitra Simeonidou[1], Erika Andersson[4], Stefano Pirandola[3], Rupert Ursin[5], Mario Stipčević[7], and John Rarity[1] — [1]University of Bristol, Bristol, United Kingdom — [2]The University of Sheffield, Sheffield, United Kingdom — [3]University of York, York, United Kingdom — [4]Heriot-Watt University, Edinburgh, United Kingdom — [5]Institute for Quantum Optics and Quantum Information - Vienna (IQOQI), Vienna, Austria — [6]Ruder Bošković Institute, Zagreb, Croatia — [7]College of Advanced Interdisciplinary Studies, NUDT, Changsha, China

We present a multi-user quantum network and experimental implementations of unconditionally secure digital signatures, 5 different anonymity protocols, authentication transfer protocol, network flooding, Artificial Intelligence network control plane and coexistence between classical and quantum signals.

Oral EB-1.3 9:30 TRACK 7

Flexible entanglement distribution with an AlGaAs chip for quantum networks — •Félicien Appas[1], Florent Baboux[1], Maria I. Amanti[1], Aristide Lemaître[2], Fabien Boitier[3], Eleni Diamanti[4], and Sara Ducci[1] — [1]Laboratoire Matériaux et Phénomènes Quantiques, Université de Paris, CNRS-UMR 7162, Paris, France — [2]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [3]Nokia Bell Labs, Nozay, France — [4]Sorbonne Université, CNRS, LIP6, Paris, France

We combine an on-chip, telecom, broadband entangled photon source with industry-grade flexible wavelength management techniques to demonstrate reconfigurable entanglement distribution over up to 75 km between up to 8 users in a resource-optimized quantum network.

Oral EB-1.4 9:45 TRACK 7

OpenQKD Use-case for Securing Sensitive Medical Data at Rest and in Transit — Bernhard Zatoukal[1], Florian Kutschera[2], •Andreas Poppe[2], Werner Strasser[1], Bernd Stockinger[3], Luka Brcic[4], Lisa Setaffy[5], Kurt Zatloukal[4], Heimo Müller[4], Markus Plass[4], Bettina Kipperer[4], and Sigurd F. Lax[5] — [1]fragmentiX, Klosterneuburg, Austria — [2]AIT Austrian Institute of Technology GmbH, Vienna, Austria — [3]Citycom Telekommunikation GmbH, Graz, Austria — [4]Medical University Graz, Graz, Austria — [5]Hospital (LKH)-Graz II, Graz, Austria

Secure keys from QKD systems have been used by AES-encryptors to distribute large images and sensitive genome data and store them using secret sharing methods under real-world conditions in Graz

EC-1: Band Topology - I

Chair: Oded Zilberberg, ETH, Zurich, Switzerland

Time: Monday, 8:30–10:00 Location: TRACK 8

Invited EC-1.1 8:30 TRACK 8

Photonic topological Z2 Insulators — •Alexander Szameit — Institute for Physics, University of Rostock, Rostock, Germany

We introduce a photonic topological Floquet Z2-insulator with fermionic time reversal symmetry (TRS). Our experiments demonstrate the characteristic protected counter-propagating edge modes and unequivocally prove the presence of fermionic TRS in this bosonic system.

Oral EC-1.2 9:00 TRACK 8

Topological Photonics with Embedded Quantum Dots — •Andrew Foster[1], Mahmoud Jalalimehrabad[1], Rene Dost[1], Edmund Clarke[2], Pallavi Patil[2], Maurice Skolnick[1], and Luke Wilson[1] — [1]Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom — [2]EPSRC National Epitaxy Facility, University of Sheffield, Sheffield, United Kingdom

We demonstrate a chiral interface using semiconductor quantum dots (QDs) coupled to topological photonic waveguides. Chiral coupling is shown to extend to QDs in ring resonator structures, providing a route to Purcell-enhanced chiral light-matter interactions.

Oral EC-1.3 9:15 TRACK 8

Measuring topological invariants in polaritonic graphene — •Philippe St-Jean[1], Alexandre Dauphin[2], Pietro Massignan[2,3], Bastian Real[4], Omar Jamadi[4], Marijana Milicevic[1], Aristide Lemaître[1], Abdelmounaim Harouri[1], Luc Le Gratiet[1], Isabelle Sagnes[1], Sylvain Ravets[1], Jacqueline Bloch[1], and Alberto Amo[1] — [1]Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]ICFO, Barcelona, Spain — [3]Universitat Politecnica de Catalunya, Barcelona, Spain — [4]PHLAM - Université de Lille, Lille, France

Using a honeycomb polaritonic lattice, we elaborate and demonstrate a scheme for measuring topological invariants of 2D chiral Hamiltonians directly from the bulk. We also extend our scheme to critically compressed honeycomb lattices, where Dirac cones have merged.

Oral EC-1.4 9:30 TRACK 8

Measuring Non-Hermitian Topological Invariants with Exciton Polaritons — •Eliezer Estrecho[1], Rui Su[2], Dąbrówka Biegańska[3], Yuqing Huang[2], Matthias Wurdack[1], Maciej Pieczarka[1,3], Andrew G. Truscott[1], Timothy C.H. Liew[2], Elena Ostrovskaya[1], and Qihua Xiong[2,4] — [1]The Australian National University, Canberra, Australia — [2]Nanyang Technological University, Singapore, Singapore — [3]Wrocław University of Science and Technology, Wrocław, Poland — [4]Tsinghua University, Beijing, China

We present the measurement of the novel non-Hermitian topological invariant in the dispersion of exciton polaritons, hybrid particles of light and matter, based on lead halide perovskites.

Oral EC-1.5 9:45 TRACK 8

Optical Analogue of Dresselhaus Spin-Orbit Interaction in Photonic Graphene — •Dmitry Krizhanovskii — University of Sheffield, Sheffield, United Kingdom

We report on the experimental realization of a synthetic non-Abelian gauge field for photons in a honeycomb microcavity lattice. The effective magnetic field associated with TE-TM splitting has the symmetry of Dresselhaus spin-orbit interaction around Dirac points.

JSI-1: Theory and Numerical Modeling for Nanophononics

Chair: Sebastian Volz, The University of Tokyo, Tokyo, Japan

Time: Monday, 8:30–10:00 Location: TRACK 9

Invited JSI-1.1 8:30 TRACK 9

Ab initio modeling of thermal effects in 2D van der Waals materials — •Mathieu Luisier, Sara Fiore, Teutë Bunjaku, Jonathan Backman, Cedric Klinkert, and Aron Szabo — Integrated Systems Laboratory, ETH Zurich, Zurich, Switzerland

In this presentation, the thermal transport properties of two-dimensional van der Waals materials composed of layered transition metal dichalcogenides will be discussed based on ab initio quantum transport simulations. The influence of disorder will be highlighted.

Oral JSI-1.2 9:00 TRACK 9

Thermal boundary conductance of Si/Ge interface by anharmonic phonon non-equilibrium Green function formalism — •Yangyu Guo, Zhongwei Zhang, Marc Bescond, Masahiro Nomura, and Sebastian Volz — Institute of Industrial Science, The University of Tokyo, Tokyo, Japan

This work presents a study of heat transport at Si/Ge interface by anharmonic phonon non-equilibrium Green's function formalism, and quantify the contribution of anharmonicity to thermal boundary conductance.

Oral JSI-1.3 9:15 TRACK 9

"Hot" electron generation in plasmonic nanostructures – thermal vs. non-thermal effects — Yonatan Dubi[1], Subhajit Sarkar[1], •Ieng Wai Un[2], and Yonatan Sivan[2] — [1]Department of Chemistry, Ben Gurion University, Beer Sheva, Israel — [2]School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

We have developed a self-consistent theory for determining the electron distribution in plasmonic nanostructures under continuous-wave illumination, allowing, for the first time, a comparison of heating and non-thermal effects in the steady-state electron distributions.

Oral JSI-1.4 9:30 TRACK 9

Temperonic Crystal: A Superlattice for Temperature Waves in Graphene — Marco Gandolfi[1], Claudio Giannetti[2], and •Francesco Banfi[3] — [1]CNR-INO and Department of Information Engineering, University of Brescia, Brescia, Italy — [2]Department of Physics and I-LAMP, Università Cattolica del Sacro Cuore, Brescia, Italy — [3]FemtoNanoOptics group, Université de Lyon, Institut Lumière Matière, Université Lyon 1 and CNRS, Villeurbanne, France

The temperonic crystal, a periodic structure with a unit cell made of two slabs sustaining temperature wavelike oscillations on short timescales, is introduced. Results are shown for the paradigmatic case of a graphene-based temperonic crystal.

Oral JSI-1.5 9:45 TRACK 9

Terahertz Full-polarization-state Detection by Nanowires — •Kun Peng[1], Dimitars Jevtics[2], Fanlu Zhang[3], Sabrina Sterzl[1], Djamshid A. Damry[1], Mathias U. Rothmann[1], Benoit Guilhabert[2], Michael J. Strain[2], Hark H. Tan[3,4], Laura M. Herz[1], Lan Fu[3,4], Martin D. Dawson[2], Antonio Hurtado[2], Chennupati Jagadish[3,4], and Michael B. Johnston[1] — [1]Department of Physics, University of Oxford, Oxford, United Kingdom — [2]Institute of Photonics, SUPA Department of Physics, University of Strathclyde, Glasgow, United Kingdom — [3]Department of Electronic Materials Engineering, Research School of Physics, The Australian National University,, Canberra, Australia — [4]ARC Centre of Excellence on Transformative Meta Optical Systems, Research School of Physics, The Australian National University, Canberra, Australia

We present a polarization-sensitive cross-nanowire detector that can measure the full polarization state of a terahertz pulse over a single scan without crosstalk, which promise to expand terahertz time-domain spectroscopy and imaging into new applications.

JSII-1: Strong-field THz Generation

Chair: Peter Uhd Jepsen, DTU Fotonik, Kgs. Lyngby, Denmark

Time: Monday, 8:30–10:00 Location: TRACK 10

Invited JSII-1.1 8:30 TRACK 10

High harmonic generation from low dimensional materials — •koichiro tanaka — Department of Physics, Kyoto University, Kyoto, Japan

We show recent progress of high harmonic generation in solids, especially focusing low dimensional materials such as graphene, transition metal dichalcogenides, and carbon nanotubes.

Oral JSII-1.2 9:00 TRACK 10

Terahertz pulse generation by laser-created, magnetized plasmas — •Colomban Tailliez[1,2], Xavier Davoine[1,2], Laurent Gremillet[1,2], Arnaud Debayle[1,2], and Luc Bergé[1,2] — [1]CEA, DAM, DIF, Arpajon, France — [2]Université Paris-Saclay, CEA, LMCE, Bruyères-le-Châtel, France

Relativistic interactions between a laser and strongly magnetized, underdense plasmas are able to produce high-intensity, few-cycle Cerenkov wake radiation in the Terahertz domain. 1D and 2D Particle-in-Cell simulations highlight the influence of various cyclotron/plasma frequencies.

Oral JSII-1.3 9:15 TRACK 10

Multi-mW-level, air-plasma induced ultra-broadband THz pulses for nonlinear THz spectroscopy — •Binbin Zhou, Mattias Rasmussen, and Peter Uhd Jepsen — DTU Fotonik, Technical University of Denmark, Kongens Lyngby, Denmark

We demonstrated multi-mW-level, ultra-broadband THz pulse generation from 2-color air-plasma driven by a standard 1 kHz commercial OPA. Such extremely short and energetic THz pulses are uniquely useful for nonlinear THz spectroscopy investigations.

Oral JSII-1.4 9:30 TRACK 10

Mechanisms of Terahertz Generation under Femtosecond Pulses propagation in Nanocomposites — •Olga Fedotova[1], Anton Husakou[2], Grigory Rusetsky[1], Alexander Fedotov[3], Oleg Khasanov[1], Tatsiana Smirnova[4], Usman Sapaev[5], and Igar Babushkin[6,7,2] — [1]Scientific-Practical Materials Research Centre NAS Belarus, Minsk, Belarus — [2]Max Born Institute, Berlin, Germany — [3]Belarusian State University, Minsk, Belarus — [4]International Sakharov Environmental Institute BSU, Minsk, Belarus — [5]Tashkent State Technical University, Tashkent , Uzbekistan — [6]Institute of Quantum Optics, Leibnitz Hannover University, Hannover , Germany — [7]Cluster of Excellence PhoenixD, Hannover , Germany

Intensive femtosecond pulse propagating through nanocomposite consisted of the semiconductor quantum dots incorporated into a dielectric matrix may yield terahertz pulse due to the contribution of large permanent dipole moments as well as transition dipole moments between the excitonic states

Oral JSII-1.5 9:45 TRACK 10

Quantum Interference Terahertz Generation from ZnTe — •Luke Peters, Juan Sebastian Totero Gongora, Vittorio Cecconi, Jacob Tunesi, Luana Olivieri, Alessia Pasquazi, and Marco Peccianti — Emergent Photonics Lab, University of Sussex, Brighton, United Kingdom

We demonstrate a novel scheme based on two-color quantum interference to augment the THz emission from ZnTe in transmission. The generation mechanism is phase-matching free due to confinement of the interactions at the crystal surface.

ED-1: Precision Spectroscopy and Fundamental Metrology I

Chair: Piotr Wcislo, Nicolaus Copernicus University, Torun, Poland

Time: Monday, 8:30–10:00 Location: TRACK 11

Invited ED-1.1 8:30 TRACK 11

Improved Determination of Fundamental Constants and Test of Fundamental Physics with Doppler-Free THz Spectroscopy of HD^+ — Soroosh Alighanbari[1], Gouri Giri[1], •Florin Lucian Constantin[1,2], Vladimir Korobov[3], and Stephan Schiller[1] — [1]Institut für Experimentalphysik, Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany — [2]Laboratoire PhLAM, CNRS UMR 8523, University of Lille, Villeneuve d'Ascq, France — [3]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia

Improved precision of Doppler-free rotational spectroscopy of trapped and laser-cooled HD^+ ions allows to confirm accurately high-precision ab-initio molecular ion quantum theory calculations and to determine fundamental constants more precisely than the CODATA2018 values.

Oral ED-1.2 9:00 TRACK 11

Bending modes metrology beyond 12 μm — •Riccardo Gotti[1], Marco Lamperti[1], Davide Gatti[1], Mohammad Khaled Shakfa[2], Elisabetta Canè[3], Filippo Tamassia[3], Peter Schunemann[4], Paolo Laporta[1], Aamir Farooq[2], and Marco Marangoni[1] — [1]Dipartimento di Fisica - Politecnico di Milano and IFN-CNR, Lecco, Italy — [2]King Abdullah University for Science and Technology, Clean Combustion Research Center, Thuwal, Saudi Arabia — [3]Università di Bologna, Dipartimento di Chimica Industriale, Bologna, Italy — [4]BAE Systems, Inc., Nashua, USA

Bending modes metrology through a comb-referenced widely tunable nonlinear laser source is demonstrated. We report 30 kHz uncertainty in the CO2 line center frequency determination and an extensive study of the ν11 band of benzene.

Oral ED-1.3 9:15 TRACK 11

High-Resolution Measurements of Halogenated Volatile Organic Compounds Using Frequency Comb Fourier Transform Spectroscopy — •Adrian Hjältén[1], Ibrahim Sadiek[2], Chuang Lu[1], Francisco Senna Vieira[1], Michael Stuhr[3], Matthias Germann[1], and Aleksandra Foltynowicz[1] — [1]Department of Physics, Umeå University, Umeå, Sweden — [2]Leibniz Institute for Plasma Science and Technology (INP), Greifswald, Germany — [3]Institute of Physical Chemistry, University of Kiel, Kiel, Germany

We use mid-infrared optical frequency comb Fourier transform spectroscopy to measure and assign high-resolution absorption spectra of methyl iodide, CH_3I, and dibromomethane, CH_2Br_2, around 3.3 μm. We also provide the first assessment of linestrengths of the ν_4 band of CH_3I.

Oral ED-1.4 9:30 TRACK 11

Frequency Comb Fourier Transform Spectroscopy at 8 μm Using a Compact Difference Frequency Generation Source — •Matthias Germann[1], Adrian Hjältén[1], Karol Krzempek[2], Arkadiusz Hudzikowski[2], Aleksander Głuszek[2], Dorota Tomaszewska[2], Grzegorz Soboń[2], and Aleksandra Foltynowicz[1] — [1]Department of Physics, Umeå University, Umeå, Sweden — [2]Laser and Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland

Using a compact fiber-based difference frequency generation comb and a Fourier transform spectrometer we record Doppler-limited spectra of the ν_1 band of N_2O at 1285 cm^{-1} and obtain line positions with an average precision below 200 kHz.

Oral ED-1.5 9:45 TRACK 11

Gapless high-resolution QCL dual-comb spectroscopy with real-time data processing for dynamic gas-phase measurements — •Michele Gianella[1], Simon Vogel[1], Kenichi Komagata[2], Johannes Hillbrand[3], Filippos Kapsalidis[3], Béla Tuzson[1], Akshay Nataraj[1], Mattias Beck[3], Andreas Hugi[4], Markus Mangold[4], Pierre Jouy[4], Thomas Südmeyer[2], Jérôme Faist[3], and Lukas Emmenegger[1] — [1]Laboratory for Air Pollution / Environmental Technology, Empa, Dübendorf, Switzerland — [2]Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtelâtel, , Neuchâtel, Switzerland — [3]Institute for Quantum Electronics, ETH Zurich, Zürich, Switzerland — [4]IRsweep AG, Stäfa, Switzerland

We demonstrate gapless, high resolution absorption measurements with QCL dual-comb spectroscopy and fast parallel data processing enabling near real-time observations of dynamic processes.

JSV-1: Flexible Photonic Materials and Integration

Chair: Giancarlo C. Righini, Nello Carrara Institute of Applied Physics, Florence, Italy

Time: Monday, 8:30–10:00 Location: TRACK 12

Invited JSV-1.1 8:30 TRACK 12

A universal approach for photonic integration on flexible substrates — Zequn Chen[1,2], Ye Luo[1,2], Hui Ma[3], Maoliang Wei[3], Jialing Jian[1,2], Yuting Ye[1,2], Lichun Wang[3], Yilin Shi[1,2], Renjie Tang[1,2], Chunlei Sun[1,2], Junying Li[3], Chuyu Zhong[3], Jianghong Wu[1,2], Hongtao Lin[3], and •Lan Li[1,2] — [1]Key Laboratory of 3D Micro/Nano Fabrication and Characterization of Zhejiang Province, School of Engineering, Westlake University, Hangzhou, China — [2]Institute of Advanced Technology, Westlake Institute for Advanced Study,, Hangzhou, China — [3]College of Information Science & Electronic Engineering, Zhejiang University, Hangzhou, China

We demonstrate a universal approach for the fabrication of flexible photonics. The developed approach shows few limitations on the selection of optical materials and enables novel 3D photonic integrations for sensing and biological applications.

Oral JSV-1.2 9:00 TRACK 12

Ultra-high numerical aperture meta-fiber for flexible optical trapping — •Malte Plidschun[1,2], Haoran Ren[3], Jisoo Kim[1,2], Ronny Förster[1], Stefan A. Maier[3,4], and Markus A. Schmidt[1,2,5] — [1]Leibniz Institute of Photonic Technology, Jena, Germany — [2]Abbe Center of Photonic and Faculty of Physics, FSU Jena, Jena, Germany — [3]Chair in Hybrid Nanosystems, Nanoinstitute Munich, LMU München, München, Germany — [4]Department of Physics, Imperial College London, London, United Kingdom — [5]Otto Schott Institute of Material Research, FSU Jena, Jena, Germany

We demonstrate the concept, design and application of a meta-lens enhanced single-mode fiber for trapping of single silica microbeads and E. coli bacteria, reaching an unprecedented ultra-high numerical aperture of 0.88 with only one fiber.

Oral JSV-1.3 9:15 TRACK 12

Tunable Coupling of Photonic Molecules on Flexible Elastomer Substrates — •Simon Woska, Pascal Rietz, Osman Karayel, and Heinz Kalt — Institute of Applied Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

Photonic molecules of whispering gallery mode cavities are structured on liquid crystal elastomer substrates. Using temperature as external stimulus, the photonic molecule's inter-cavity gap is controlled, and its coupling strength is precisely and reversibly tuned.

Oral JSV-1.4 9:30 TRACK 12

Flexible Photonics Embedded into Advanced Composites — •Christopher Holmes[1], Mike Godfrey[2], Paolo Mennea[1], Senta Jantzen[1], Daniel Bull[2], and Janice Dulieu-Barton[3] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]School of Engineering, University of Southampton, Southampton, United Kingdom — [3]Bristol Composite Institute, University of Bristol, Bristol, United Kingdom

We embed flexible (50 μm thick) planar silica glass into advanced composites, namely carbon fibre and glass reinforced polymer. We demonstrate unique triaxial strain sensing capability and switching of optical signals within composite structure.

Oral JSV-1.5 9:45 TRACK 12

Second-Harmonic Generation Tuning by Stretching Arrays of GaAs Nanowires — •Grégoire Saerens[1], Esther Bloch[1], Kristina Frizyuk[2], Viola Vogler-Neuling[1], Elizaveta Semenova[3,4], Elizaveta Lebedkina[3], Mihail Petrov[2], Rachel Grange[1], and Maria Timofeeva[1] — [1]ETH Zürich, Optical Nanomaterial Group, Institute for Quantenelectronics, Departement of Physics, 8093 Zürich, Switzerland — [2]ITMO University, Kronverkskiy prospect 49, 197101 St. Petersburg, Russia — [3]DTU Fotonik, Technical University of Denmark, 2800 Kongens Lyngby, Denmark — [4]NanoPhoton-Centor for Nanophotonics, Technical University of Denmark, 2800 Kongens Lyngby, Denmark

We study optical performances of ordered arrays of GaAs nanowires and present experimental enhancement of the second-harmonic signal by 2.2 times under 25% stretching. After considering the NWs' size distribution, simulations deliver 1.8 times enhancement.

PL-1: Welcome Words and World of Photonics Congress Plenary Talk by 2020 Nobel Prize Co-Laureate

Time: Monday, 11:00–12:30 Location: TRACK 1

Plenary PL-1.1 11:00 TRACK 1
A 40-Year Journey — •Reinhard Genzel — Max Planck Institute for Extraterrestrial Physics, Garching, Germany

I discuss our 40-year journey to study the mass distribution in the Center of our Milky Way and the existence of a four million solar mass object, which must be a single massive black hole.

CE-2: Semiconductor for Photonic Devices

Chair: Dieter Bimberg, TU Berlin, Berlin, Germany

Time: Monday, 14:30–16:00 Location: TRACK 1

Oral CE-2.1 14:30 TRACK 1
Mid-infrared type-I InGaSb/GaSb quantum well SESAM — •B. Ozgur Alaydin, Jonas Heidrich, Marco Gaulke, Matthias Golling, Ajanta Barh, and Ursula Keller — Institute of Quantum Electronics, Zürich, Switzerland

We present a type-I InGaSb/GaSb quantum well mid-infrared SESAM operating at 2.35 μm with Fsat of 10.59 μJ/cm2, ΔR of 1.69%, ΔRns of 0.81%, and ideally suited fast recovery time (τ2 = 1.9 ps).

Oral CE-2.2 14:45 TRACK 1
Ge-on-Si Single-Photon Avalanche Diode Detectors with Low Noise Equivalent Power in the Short-Wave Infrared — •Ross Millar[1], Jaroslaw Kirdoda[1], Fiona Thorburn[2], Laura Huddleston[2], Derek Dumas[1], Zoë Greener[2], Kateryna Kuzmenko[2], Peter Vines[2], Lourdes Ferre-Llin[1], Xin Yi[2], Scott Watson[1], Bhavana Benakaprasad[1], Angus Bruce[1], Gerald Buller[2], and Douglas Paul[1] — [1]University of Glasgow, Glasgow, United Kingdom — [2]Heriot Watt University, Edinburgh, United Kingdom

Ge-on-Si Single-Photon Avalanche Diode (SPAD) detectors are demonstrated at 1310 nm with record low noise-equivalent powers (7.7×10^{-17}WHz$^{-1/2}$), using a 26 μm diameter pixel fabricated with a Si foundry compatible pseudo-planar process.

Invited CE-2.3 15:00 TRACK 1
Novel concepts for III-N-based vertical cavity surface emitting lasers — •Armin Dadgar — Institut für Physik, Fakultät für Naturwissenschaften, Otto-von-Guericke-Universität Magdeburg, Magdeburg, Germany

We discuss and demonstrate highly conductive epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting GaN:Ge tunneling contacts are demonstrated.

Oral CE-2.4 15:30 TRACK 1
Impact of high temperature post-treatment on photoluminescence performance of passivated InP/In0.53Ga0.47As/InP nanopillars — •Ekaterina Malysheva, Daniele Pellegrino, Andrea Fiore, Kevin Williams, and Victor Calzadilla — Eindhoven University of Technology, Eindhoven, Netherlands

The effect of high temperature post treatment was investigated on InP/InGaAs/InP pillars, passivated with ammonium sulfide and SiOx coating. Passivation efficiency was shown to increase for treatment temperature up to 500 °C.

Oral CE-2.5 15:45 TRACK 1
Growth of site-controlled InAs/GaAs quantum dot arrays for integration into photonic devices — •Charlotte Ovenden[1], Aristotelis Trapalis[1], Dominic J. Hallett[2], Pallavi K. Patil[3], Edmund Clarke[3], Maurice S. Skolnick[2], Ian Farrer[1], and Jon Heffernan[1] — [1]Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield, United Kingdom — [2]Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom — [3]EPSRC National Epitaxy Facility, University of Sheffield, Sheffield, United Kingdom

We demonstrate the growth of low linewidth, site-controlled quantum dot arrays, where the use of a scalable fabrication process and thin re-growth buffer makes them suitable for incorporation into single mode nano-photonic devices.

CD-1: Nonlinear Metasurfaces

Chair: Mikko Huttunen, Tampere University, Tampere, Finland

Time: Monday, 14:30–16:00 Location: TRACK 2

Invited CD-1.1 14:30 TRACK 2
Ultrafast and Nonlinear Semiconductor Metasurfaces — •Igal Brener — Sandia National Labs, Albuquerque, USA

In this talk, I will describe some of our recent work on harmonic generation from nonlinear metasurfaces, ultrafast switching and diffraction, transient frequency conversion and perfect absorbing metasurfaces for THz emission and detection.

Oral CD-1.2 15:00 TRACK 2
Nonlinear Circular Dichroism in the Second-Harmonic Generation from AlGaAs Nanoparticle Dimers — •Elizaveta Melik-Gaykazyan[1], Kristina Frizyuk[2], Jae-Hyuck Choi[3,4], Mihail Petrov[2], Hong-Gyu Park[3,5], and Yuri Kivshar[1] — [1]Research School of Physics, Australian National University, Canberra, Australia — [2]Department of Physics and Engineering, ITMO University, St. Petersburg, Russia — [3]Department of Physics, Korea University, Seoul, Republic of Korea — [4]University of Southern California, Los Angeles, USA — [5]KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, Republic of Korea

We experimentally demonstrate the effect of nonlinear circular dichroism in a dimer of Mie-resonant AlGaAs nanoparticles originated by the multipolar nature of their optical response and depending on a material's crystalline axis orientation.

Oral CD-1.3 15:15 TRACK 2
Intersubband Polaritonic Metasurfaces for Second Harmonic Generation with High Conversion Efficiency — •Jonas Krakofsky[1], Gerhard Böhm[1], Mikhail Belkin[1], Ahmed Mekawy[2], Sander Mann[2], and Andrea Alú[2] — [1]Walter Schottky Institute, Munich, Germany — [2]CUNY, New York, USA

In this work we present a new attempt to overcome saturation effects of nonlinear intersubband polaritonic metasurfaces using GaAsSb as a small linewidthmaterial and new nano resonator designs.

Oral CD-1.4 15:30 TRACK 2
All-dielectric metasurface with enhanced third-harmonic dichroism driven by quasi-BIC — •Marco Gandolfi, Andrea Tognazzi, Davide Rocco, Luca Carletti, and Costantino De Angelis — CNR-INO and Department of Information Engineering, University of Brescia, Brescia, Italy

We design chiral Si metasurfaces supporting quasi-BIC for enhanced nonlinear circular dichroism (up to 99.9%) and high TH conversion efficiency (0.01 W^{-2}). Tuning mode interference allows selective linear and nonlinear circular dichroism.

Oral CD-1.5 15:45 TRACK 2
Resonantly Enhanced Third Harmonic Up-conversion of 2.4 micron Excitation using Amorphous Germanium Zero Contrast Gratings — •Lal Krishna A.S., Rabindra Biswas, Jyothsna KM, Sruti Menon, and Varun Raghunathan — Indian Institute of Science, Bengaluru, India

We experimentally demonstrate resonant one-dimensional amorphous-Germanium zero contrast grating structures for frequency up-conversion. For ~2.4 um fundamental excitation, the structures achieve 900 times resonant enhancement of the third-harmonic signal at ~800 nm wavelength.

CA-2: 2-μm Lasers

Chair: Pavel Loiko, CNRS, CIMAP, University of Caen, France

Time: Monday, 14:30–16:00 Location: TRACK 3

Invited CA-2.1 14:30 TRACK 3

GaSb-based SESAM technology for mid-IR ultrafast lasers — •Mircea Guina — Tampere University, Tampere, Finland

The key features of GaSb-based semiconductor saturable absorber mirrors are reviewed in connection with performance they enable when used for mode-locking a large variety of ultrafast solid-state lasers emitting at 2μm window and beyond.

Oral CA-2.2 15:00 TRACK 3

Diode-pumped Femtosecond Modelocked Tm,Ho:CLNGG laser at 2093 nm — •Mustafa Hamdan[1], Sergei Tomilov[1], Zhongben Pan[2], Yicheng Wang[1], and Clara J. Saraceno[1] — [1]Ruhr-Universität Bochum, Bochum, Germany — [2]Institute of Chemical Materials, Mianyang, China

We demonstrated a 2-μm diode-pumped modelocked Tm,Ho:CLNGG laser with 213-fs pulse duration and 200-mW output power at 102-MHz. To the best to our knowledge, this is the shortest pulse duration from a Tm,Ho-codoped diode-pumped laser.

Oral CA-2.3 15:15 TRACK 3

Sub-50-fs SESAM mode-locked Tm,Ho:Ca(Gd,Lu)AlO4 laser — •Li Wang[1], Weidong Chen[2], Yongguang Zhao[1], Zhongben Pan[1], Mark Mero[1], Xavier Mateo[3], Pavel Loiko[4], Mircea Guina[5], Uwe Griebner[1], and Valentin Petrov[1] — [1]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [2]Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, China — [3]Universitat Rovira i Virgili (URV), Tarragona, Spain — [4]Université de Caen, Caen, France — [5]Reflektron Ltd., Tampere, Finland

We report on the first sub-50-fs mode-locked 2-μm solid-state laser using Tm,Ho:Ca(Gd,Lu)AlO4 as a gain medium, to generate pulses as short as 47 fs at 2033 nm with a repetition rate of ~78.3 MHz.

Oral CA-2.4 15:30 TRACK 3

40 W SESAM-modelocked Ho:YAG thin-disk laser at 2090 nm — •Sergei Tomilov[1], Martin Hoffmann[1], Jonas Heidrich[2], Behçet Özgür Alaydin[2], Matthias Golling[2], Yicheng Wang[1], Ursula Keller[2], and Clara J. Saraceno[1] — [1]Photonics and Ultrafast Laser Science, Ruhr-Universität Bochum, Bochum, Germany — [2]Department of Physics, Institute for Quantum Electronics, ETH Zürich, Zürich, Switzerland

We demonstrate high-power SESAM, soliton-modelocking of a Ho:YAG thin-disk oscillator, delivering an output power of 40.5 W with pulse duration of 1.66 ps at a repetition rate of 52.2 MHz, corresponding to a pulse energy of 0.78 μJ.

Oral CA-2.5 15:45 TRACK 3

High Energy Cryogenically Cooled Ho:YAG Oscillator — •Miftar Ganija[1,2], Keiron Boyd[1,2], Alexander Hemming[2], Neil Carmody[2], Nikita Simakov[2], Peter Veitch[1], and Jesper Munch[1] — [1]Department of Physics and IPAS, Adelaide, Australia — [2]Directed Energy Technologies and Effects Defence Science and Technology Group, Edinburgh, Australia

We report efficient, cryogenically cooled, continuous wave and pulsed Ho:YAG lasing with excellent beam quality. We demonstrate average powers of 60 W and pulse energies 310 mJ with a 100 Hz PRF without thermal degradation.

CH-1: Gas Sensing

Chair: Cristian Focsa, Université de Lille, Lille, France

Time: Monday, 14:30–16:00 Location: TRACK 4

Oral CH-1.1 14:30 TRACK 4

Up in the air! Trace-gas sensing aboard flying platforms — •Béla Tuzson, Manuel Graf, Philipp Scheidegger, Herbert Looser, André Kupferschmid, and Lukas Emmenegger — Laboratory for Air Pollution / Environmental Technology, Empa, Dübendorf, Switzerland

Our fundamental reconsideration of the main components of QCL based spectrometers led to rugged and lightweight instruments that opened up remarkable options in environmental sciences. We highlight their potential using field application results.

Oral CH-1.2 14:45 TRACK 4

Fourier transform spectrometer developed for high repetition rate mid-infrared supercontinuum sources — •Amir Khodabakhsh, Mohammadreza Nematollahi, Khalil Eslami Jahromi , Roderik Krebbers, Muhammad A. Abbas, and Frans J. M. Harren — Trace Gas Research Group, Department of Molecular and Laser Physics, Institute for Molecules and Materials, Radboud University, Nijmegen, Netherlands

We developed a compact and fast-scanning Fourier transform spectrometer based on a mid-infrared supercontinuum source capable of baseband balanced detection as well as synchronous demodulation referenced to the repetition rate of the supercontinuum source.

Oral CH-1.3 15:00 TRACK 4

Post signal processing for CO gas spectroscopy using chip-based supercontinuum source — •Joonhyuk Hwang[1], Duk-Yong Choi[2], Fabian Rotermund[1], Kwang-hoon Ko[3], and Hansuek Lee[1,4] — [1]department of physics, korea advanced institute of science and technology (kaist), daejeon, South Korea — [2]laser physics centre, research school of physics, australian national university, canberra, Australia — [3]quantum optics division, korea atomic energy research institute, daejeon, South Korea — [4]graduate school of nanoscience and technology, korea advanced institute of science and technology, daejeon, South Korea

We propose post-processing method to extract molecular ro-vibrational absorption lines. Distinct transition bands of CO gas are achieved by transmitting a chip-based supercontinuum into gas cell, along with high-pass filtering of the signal.

Oral CH-1.4 15:15 TRACK 4

Sensitive multi-species gas sensing with supercontinuum-based photoacoustic spectroscopy — •Tommi Mikkonen[1], Tuomas Hieta[2], Goëry Genty[1], and Juha Toivonen[1] — [1]Photonics Laboratory, Physics Unit, Tampere University, Tampere, Finland — [2]Gasera Ltd, Turku, Finland

We improved the sensitivity of supercontinuum-based broadband photoacoustic spectroscopy in the mid-infrared by employing a miniature multipass cell. We demonstrated the system's ability to separate spectrally overlapping hydrocarbons from a gas mixture.

Oral CH-1.5 15:30 TRACK 4

Part-per-billion optical sensing of carbon monoxide based on QEPAS and PTS detection modules — •Davide Pinto[1], Harald Moser[1], Johannes P. Waclawek[1], Stefano Dello Russo[2], Pietro Patimisco[2], Vincenzo Spagnolo[2], and Bernhard Lendl[1] — [1]Institute of Chemical Technologies and Analytics, Technische Universität Wien, Vienna, Austria — [2]PolySense Lab - Dipartimento Interateneo di Fisica, University and Politecnico of Bari, Bari, Italy

A mid-IR laser-based gas sensor system for part-per-billion detection of carbon monoxide in nitrogen is presented. The sensing scheme relies on two interchangeable compact modules capable of probing either pressure or thermal waves.

Oral CH-1.6 15:45 TRACK 4

Monitoring of peroxy radicals by chemical amplification enhanced photoacoustic spectroscopy — •Gaoxuan Wang[1], Ahmad Lahib[2], Marius Duncianu[2], Qian Gou[3], Philip S. Stevens[4], Sébastien Dusanter[2], Alexandre Tomas[2], Markus W. Sigrist[5], and Weidong Chen[1] — [1]Laboratoire de Physicochimie de l'Atmosphère, Université du Littoral Côte d'Opale, 59140 Dunkerque, France — [2]IMT Lille Douai, Université de Lille, 59000 Lille, France — [3]School of Chemistry and Chemical Engineering, Chongqing University, 401331 Chongqing, China — [4]Paul H. O'Neill School of Public and Environmental Affairs, Indiana University, Bloomington, IN 47405, USA — [5]Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland

Measurements of peroxy radicals using photoacoustic spectroscopy enhanced by chemical amplification was demonstrated. 1-σ limit of detection of about 12 pptv was achieved in 90 s integration time at a relative humidity of 9.8%.

CJ-1: Coherent Beam Combining

Chair: Mikhail Likhachev, Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russia

Time: Monday, 14:30–16:00 Location: TRACK 5

Oral CJ-1.1 14:30 TRACK 5

Four-channel coherently combined Tm-doped fiber chirped-pulse amplification system delivering 1 mJ-pulses at 98 kHz repetition rate — •Tobias Heuermann[1,2], Ziyao Wang[1], Mathias Lenski[1], Martin Gebhardt[1,2], Christian Gaida[3], Arno Klenke[1,2], Michael Müller[1], Christian Grebing[1,4], and Jens Limpert[1,2,4] — [1]Institute of Applied Physics, Friedrich Schiller University Jena, Jena, Germany — [2]Helmholtz Institute Jena, Jena, Germany — [3]Active Fiber Systems GmbH, Jena, Germany — [4]Fraunhofer Institute for optics and fine mechanics, Jena, Germany

We report our first results on the coherent combination of four Tm-doped fiber amplifiers delivering 1 mJ pulse energy and 98 W average power at a repetition rate of 98 kHz.

Oral CJ-1.2 14:45 TRACK 5

4-channel Coherently Combined Long-term-stable Ultrafast Thulium-doped Fiber CPA — •Christian Gaida[1], Fabian Stutzki[1], Martin Gebhardt[2,3], Tobias Heuermann[2,3], Sven Breitkopf[1], Tino Eidam[1], Jan Rothhardt[2,3,4], and Jens Limpert[1,2,3,4] — [1]Active Fiber Systems GmbH, Jena, Germany — [2]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [3]Helmholtz-Institute Jena, Jena, Germany — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We demonstrate the coherent combination of four thulium-doped fiber amplifiers. The system delivers pulses with <120 fs FWHM duration with up to 228 μJ of pulse energy at a center wavelength of 1940 nm.

Oral CJ-1.3 15:00 TRACK 5

Beam Pointing Estimation in Target-in-the-loop Coherent Beam Combination through 300m Atmospheric Turbulence — •Laurent Lombard, Bastien Rouzé, Hermance Jacqmin, Anasthase Liméry, Anne Durécu, and Pierre Bourdon — Onera, the French aerospace lab, Palaiseau, France

Beam pointing in target-in-the-loop coherent-beam-combination of seven fiber amplifiers at 300m is simultaneously estimated in far- and near-fields. Both measurements agree and support the idea of an access to tip/tilt from the emitter side.

Oral CJ-1.4 15:15 TRACK 5

Optimizing rod-type multicore fiber amplifiers in coherently-combined laser systems — •Albrecht Steinkopff[1], Christopher Aleshire[1], Cesar Jauregui[1], Arno Klenke[1,2], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We will present theoretical investigations on the power and energy scaling potential of coherently-combined multicore fiber amplifiers, including thermal considerations and the limitations stemming thereof. Furthermore, we will show strategies to counteract these effects.

Oral CJ-1.5 15:30 TRACK 5

PISTIL interferometry diagnosis on a 61 channels coherent beam combining digital laser — •Bastien Rouzé[1], Séverine Bellanger[2], Ihsan Fsaifes[2], Cindy Bellanger[1], Matthieu Veinhard[2], Jean-Christophe Chanteloup[2], and Jérôme Primot[1] — [1]DOTA, ONERA, Université Paris-Saclay, Palaiseau, France — [2]LULI, CNRS, Ecole Polytechnique, CEA, Sorbonne Université, Institut Polytechnique de Paris, Palaiseau, France

A PISton and TILt (PISTIL) interferometry is applied on 61 channels coherent beam combining femtosecond digital laser. Extraction of piston, tip and tilt per sub-pupils and segmented wavefront analysis are conducted/presented.

Oral CJ-1.6 15:45 TRACK 5

1 kW average power emission from an in-house 4x4 multicore rod-type fiber — •Arno Klenke[1,2], Albrecht Steinkopff[1], Christopher Aleshire[1], Cesar Jauregui[1], Stefan Kuhn[3], Johannes Nold[3], Nicoletta Haarlammert[3], Thomas Schreiber[3], Andreas Tünnermann[1,2,3], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We present a rod-type multicore fiber delivering up to 1kW of average power. The in-house manufactured fiber contains 4x4 cores and a shared pump cladding in an all-glass structure and is suitable for coherent combination.

CK-2: Novel Integrated Components

Chair: Béatrice Dagens, C2N CNRS - Université Paris-Saclay, Palaiseau, France

Time: Monday, 14:30–16:00 Location: TRACK 6

Invited CK-2.1 14:30 TRACK 6

Receiver-less silicon-germanium avalanche p-i-n photodetectors — •Daniel Benedikovic[1,2], Leopold Virot[3], Guy Aubin[1], Jean-Michel Hartmann[3], Farah Amar[1], Xavier Le Roux[1], Carlos Alonso-Ramos[1], Eric Cassan[1], Delphine Marris-Morini[1], Frederic Boeuf[4], Jean-Marc Fedeli[3], Christophe Kopp[3], Bertrand Szelag[3], and Laurent Vivien[1] — [1]Universite Paris-Saclay, CNRS, Centre de Nanosciences et Nanotechnologies, Palaiseau, France — [2]University of Žilina, Dept. Multimedia and Information-Communication Technologies, Žilina, Slovakia — [3]University Grenoble Alpes and CEA, LETI, Grenoble, France — [4]STMicroelectronics, Crolles, France

We report on compact and high-performing silicon-germanium avalanche photodetectors with double p-i-n heterojunctions. We succeeded in having credible 40 Gbps on-chip detection at mainstream telecom waveband, leaving out additional electronic amplification stages.

Oral CK-2.2 15:00 TRACK 6

RF Frequency locking of electrically driven III-V Optomechanical resonator — •Inès Ghorbel[1,2], Sylvain Combrié[1], Robert Horvarth[2], Aude Martin[1], Rémy Braive[2,3], and Alfredo De Rossi[1] — [1]Thales Research and Technology, Palaiseau, France — [2]Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [3]Université Paris Diderot, Paris, France

A piezoelectric electro-optomechanical crystal made of Indium Gallium Phoshpide is demonstrated. The electromechanical actuation results in a coupling rate equal to 1μHz and is used for injection locking by an external generator

Oral CK-2.3 15:15 TRACK 6

Optical Gyrator and Microwave-to-Optical Converter using HBAR modes — •Anat Siddharth[1], Terence Blésin[1], Hao Tian[2], Wenle Weng[1], Rui Ning Wang[1], Junqiu Liu[1], Sunil A. Bhave[2], and Tobias J. Kippenberg[1] — [1]Laboratory of Photonics and Quantum Measurements, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland — [2]OxideMEMS lab, Purdue University, West Lafayette, USA

We demonstrate efficient modulation of optical resonators by partially releasing the substrate of an integrated MEMS-photonic stack. The increased interaction between the microwave and optical signals enables to realize gyrators as well as MW-optical converters.

Oral CK-2.4 15:30 TRACK 6

High-Overtone Bulk Acoustic Resonators (HBAR) as cryogenic high-frequency Acousto-optic Modulators — •Stefano Valle and Krishna Coimbatore Balram — University of Bristol, Bristol, United Kingdom

We report the first micro-mechanical acousto-optic modulator operating at 10 K in the range between 1 GHz and 3 GHz configured as double resonant configuration, to explore alternative route to efficient quantum optomechanic transduction.

Oral CK-2.5 15:45 TRACK 6

Highly-efficient GaAs/AlGaAs Nanopillars and NanoLEDs via SiNx Surface Passivation — Bejoys Jacob, Filipe Camarneiro, Jerome Borme, Jana Nieder, and •Bruno Romeira — INL - International Iberian Nanotechnology Laboratory, Braga, Portugal

We report an extremely low surface recombination velocity value of 3400cm/s in passivated GaAs/AlGaAs nanopillars. The remarkable suppression of surface recombination is crucial for the development of highly-efficient nanoLEDs and nanolasers for nanophotonic integrated circuits.

CM-1: Laser Induced Periodic Surface Structures

Chair: Joern Bonse, BAM, Berlin, Germany

Time: Monday, 14:30–16:00 Location: TRACK 7

Invited CM-1.1 14:30 TRACK 7

Controlling Surface Properties by Fabricating Single and Multi-Scaled Periodic Surface Structures using Laser Based Microfabrication Methods — •Andrés Fabián Lasagni[1,2], Stephan Milles[1], Felix Bouchard[1], Robert Baumann[1], Bogdan Voisiat[1], and Marcos Soldera[1,3] — [1]Technische Universität Dresden, Dresden, Germany — [2]Fraunhofer-Institut für Werkstoff- und Strahltechnik (IWS), Dresden, Germany — [3]Universidad Nacional del Comahue, Neuquen, Argentina

In this work, we report on the fabrication of multi-functional surfaces by combining deterministic periodic structures with feature sizes in the micrometer, submicrometer and nanometer range-scales. This is achieved by combining different laser-based microfabrication techniques.

Oral CM-1.2 15:00 TRACK 7

Femtosecond laser-induced oxidation in the formation of periodic surface structures — •Camilo Florian Baron[1,2], Jean-Luc Déziel[3], Sabrina V. Kirner[1], Jan Siegel[4], and Jörn Bonse[1] — [1]Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany — [2]Princeton Institute for the Science and Technology of Materials, Princeton, USA — [3]Département de Physique, Université Laval, Québec, Canada — [4]Laser Processing Group, Instituto de Óptica IO-CSIC, Madrid, Spain

Laser-induced oxide graded layers may contribute to the formation of a new type of embedded low-spatial frequency LIPSS with an anomalous orientation parallel to the laser polarization. In this contribution, we explore this effect experimentally with femtosecond laser pulses.

Oral CM-1.3 15:15 TRACK 7

Anisotropic Resistivity ITO Surfaces produced by Laser-induced Self-organization at the Nanoscale — •Manuel Macias-Montero[1], Carmen Lopez-Santos[2,3], Daniel Puerto[1], Jan Siegel[1], Camilo Florian[1], Jorge Gil-Rostra[2], Víctor López-Flores[2], Ana Borrás[2], Agustín R. González-Elipe[2], and Javier Solis[1] — [1]Laser Processing Group, Instituto de Óptica (IO-CSIC), Madrid, Spain — [2]Nanotechnology on Surfaces Group, Instituto de Ciencia de Materiales de Sevilla (US-CSIC), Sevilla, Spain — [3]Departamento de Física Atómica, Molecular y Nuclear, Facultad de Física, Universidad de Sevilla, Sevilla, Spain

Highly anisotropic resistivity surfaces are produced in indium tin oxide (ITO) films by fs-laser induced self–organization at the nanoscale. Anisotropy is caused by the formation of laser–induced periodic surface structures (LIPSS) extended over cm–sized regions.

Oral CM-1.4 15:30 TRACK 7

Tailored Sub-micrometer Periodic Surface Structures via Ultrashort Pulsed Direct Laser Interference Patterning — •Fotis Fraggelakis[1], George Tsibidis[1], and Emmanuel Stratakis[1,2] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), Heraklion, Greece — [2]Department of Physics, University of Crete, Heraklion, Greece

In this work, an experimental and theoretical approach is presented to investigate the previously unexplored fundamental mechanisms for the formation of unprecedented laser-induced topographies on stainless steel following proper combinations of Direct Laser Interference Patterning with Ultrashort Pulses.

Oral CM-1.5 15:45 TRACK 7

Ultrafast laser processing of nanostructured patterns for the control of cell adhesion and migration on titanium alloy — •Xxx Sedao[1,2], Antoine Klos[3], Tatiana Itina[1], Cyril Mauclair[1,2], Christophe Donnet[1], Alain Guignandon[3], Virginie Dumas[4], and Clémentine Didier[4] — [1]University of Lyon, Jean Monnet University, UMR 5516 CNRS, Laboratory Hubert Curien, Saint-Étienne, France — [2]GIE Manutech-USD, Saint-Etienne, France — [3]University of Lyon, Jean Monnet University, INSERM U1059-SAINBIOSE, Saint Priest en Jarez, France — [4]University of Lyon, National School of Engineers of Saint-Etienne, Laboratory of Tribology and Systems Dynamics, UMR 5513 CNRS, Saint-Etienne, France

The ultrafast laser induced nanoscale structures influence surface wettability and protein adsorption and thus influence focal adhesions formation and finally induce shape-based mechanical constraint on cells, known to promote osteogenic differentiation.

JSIII-1: Theoretical Perspectives in Attochemistry

Chair: Fernando Martin, Universidad Autonoma de Madrid, Madrid, Spain

Time: Monday, 14:30–16:00 Location: TRACK 8

Invited JSIII-1.1 14:30 TRACK 8

Steering Nuclear Motion by Ultrafast Multistate Non Equilibrium Electronic Quantum Dynamics in Atto Excited Molecules — •Francoise Remacle — University of Liege, Liege, Belgium

Coherence driven ultrafast femtosecond non equilibrium multistate quantum dynamics in atto excited molecules : bond making in norbornadiene and isotope effect and structural rearrangements in the methane cation

Oral JSIII-1.2 15:00 TRACK 8

Novel Isotope Effect in Coherent Non-adiabatic Dynamics Induced by an Attosecond Pulse — •Ksenia Komarova[1], Francoise Remacle[1,2], and Raphael Levine[1] — [1]Fritz Haber Research Center, The Hebrew University of Jerusalem, Jerusalem, Israel — [2]Theoretical Physical Chemistry, RU MOLSYS, University of Liège, Liege, Belgium

Non-adiabatic dynamics in the case of attosecond coherent pumping to multiple electronic states is shown to lead to a quantal isotope effect governed by coherence between the coupled wave packets

Oral JSIII-1.3 15:15 TRACK 8

Attosecond Pulse Trains with Time-Dependent Spin Angular Momentum — •Laura Rego, Julio San Román, Luis Plaja, and Carlos Hernández-García — Grupo de Investigación en Aplicaciones del Láser y Fotónica, Salamanca University, Salamanca, Spain

We present a technique to generate attosecond pulse trains whose polarization varies sequentially from pulse to pulse. This is accomplished by driving high-order harmonic generation with two time-delayed bichromatic counter-rotating fields carrying orbital angular momentum.

Oral JSIII-1.4 15:30 TRACK 8

Ultrafast Optical Rotation for Extremely Sensitive Enantio-Discrimination — •David Ayuso[1,2], Andres Ordonez[2], Misha Ivanov[1,2,3], and Olga Smirnova[2,4] — [1]Department of Physics, Imperial College London, London, United Kingdom — [2]Max-Born-Institut, Berlin, Germany — [3]Institute für Physik, Humboldt-Universität zu Berlin, Berlin, Germany — [4]Technische Universität Berlin, Berlin, Germany

We introduce ultrafast optical rotation: a highly efficient method for chiral discrimination using few-cycle pulses. Sub-cycle optical control enables full control over the enantio-sensitive response of matter in a molecule-specific manner and on ultrafast timescales.

Oral JSIII-1.5 15:45 TRACK 8

Enantio-sensitive unidirectional light bending — •Andres Ordonez[1,2], David Ayuso[1,3], Piero Decleva[4], Misha Ivanov[1,3,5], and Olga Smirnova[1,2] — [1]Max-Born-Institut, Berlin, Germany — [2]Technische Universität Berlin, Berlin, Germany — [3]Imperial College London, London, United Kingdom — [4]Università degli Studi di Trieste, Trieste, Italy — [5]Humboldt-Universität zu Berlin, Berlin, Germany

We introduce structured light with zero net chirality displaying a charge-polarized-like pattern of chirality, allowing perfect enantiomeric discrimination within the dipole approximation on ultrafast time scales, opposite enantiomers emitting harmonics in opposite directions.

EF-1: Mode-Locking Phenomena

Chair: Kathy Lüdge, Technical University, Berlin, Germany

Time: Monday, 14:30–16:00 Location: TRACK 9

Invited EF-1.1 14:30 TRACK 9

Quantum Coherence and Fast-Gain Effects in Laser Modelocking: The Coherent Master Equation — Auro M. Perego[1], Stephane Barland[2], Franco Prati[3], and •Germán J. de Valcárcel[4] — [1]Aston University, Birmingham, United Kingdom — [2]Université Côte d'Azur, CNRS, Valbonne, France — [3]Università dell'Insubria, Como, Italy — [4]Universitat de València, Burjassot, Spain

We present a master equation for modelocking that incorporates fast-gain dynamics and quantum coherence. Its divergent predictions from Haus master equation for AM modelocking are validated by experiment. Passive modelocking via saturable absorption is addressed.

Oral EF-1.2 15:00 TRACK 9

Time-Localized Fourier Patterns — •A. Bartolo[1], N. Vigne[2], M. Marconi[1], G. Huyet[1], G. Beaudoin[3], K. Pantzas[3], I. Sagnes[3], J. Javaloyes[4], S. Gurevich[5], A. Garnache[2], and M. Giudici[1] — [1]Université Côte d'Azur, Centre National de La Recherche Scientifique, Valbonne, France — [2]Institut d'Electronique et des Systèmes, Centre National de la Recherche Scientifique, University of Montpellier, Montpellier, France — [3]Centre for Nanosciences and Nanotechnology, CNRS, Université Paris-Saclay, Paris, France — [4]Departament de Física and IAC-3, Universitat de les Illes Balears, Palma de Mallorca, Spain — [5]Institute for Theoretical Physics, University of Münster, Münster, Germany

We show that self-imaging VECSEL can host temporally-localized pulses spatially organized as Fourier patterns.

Oral EF-1.3 15:15 TRACK 9

Self-Starting Temporal Cavity Solitons in a Laser-based Microcomb — •Antonio Cutrona[1], Pierre-Henry Hanzard[1], Maxwell Rowley[1], Boris Malomed[2,3], Gian-Luca Oppo[4], Juan Sebastian Totero-Gongora[1], Marco Peccianti[1], and Alessia Pasquazi[1] — [1]Emergent Photonics Lab (Epic), Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom — [2]Department of Physical Electronics, School of Electrical Engineering, Faculty of Engineering and the Center for Light-Matter Interaction, Tel Aviv University, Tel Aviv, Israel — [3]Instituto de Alta Investigación, Universidad de Tarapacá, Arica, Chile — [4]SUPA, Department of Physics, University of Strathclyde, Glasgow, United Kingdom

Self-starting of stable temporal laser-cavity solitons in a micro-ring cavity nested into an amplifying fiber loop is demonstrated. Group velocity mismatch and gain dispersion are used to control the soliton multiplicity at the output.

Oral EF-1.4 15:30 TRACK 9

Wiggling Temporal Localized States in Passively Mode-Locked Vertical External Cavity Surface Emitting Lasers — •Denis Hessel[1,2], Julien Javaloyes[1], and Svetlana Gurevich[2] — [1]Departament de Física, Universitat de les Illes Balears & Institute of Applied Computing and Community Code (IAC-3), Cra. de Valldemossa, km 7.5, E-07122 Palma de Mallorca, Spain — [2]Institute for Theoretical Physics, University of Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster, Germany

We analyze the dynamics of temporal localized states in a system composed of coupled optical micro-cavities. We show that third order dispersion and the detuning between two micro-cavities lead to wiggling pulse oscillations.

Oral EF-1.5 15:45 TRACK 9

Symmetry-broken pulse-timing sequences in micropillar lasers with optical delayed feedback — Venkata Anirudh Pammi[1], Soizic Terrien[2], Neil G. Broderick[2], Rémy Braive[1], Grégoire Beaudoin[1], Isabelle Sagnes[1], Bernd Krauskopf[2], and •Sylvain Barbay[1] — [1]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]The Dodd-Walls Centre for Photonic and Quantum Technologies, The University of Auckland, Auckland, New Zealand

Micropillar lasers can sustain temporal dissipative solitons when subjected to delayed optical feedback. These systems can converge from a variety of initial conditions to a handful of equidistant and symmetry-broken pulsing patterns.

EG-1: Emission Control at the Nanoscale

Chair: Costanza Toninelli, CNR/INO Florence, Florence, Italy

Time: Monday, 14:30–16:00 Location: TRACK 10

Invited EG-1.1 14:30 TRACK 10

Entanglement generation in semiconductor nanostructures — Laia Ginés[1], Junior R. Gonzales Ureta[1], Magdalena Moczala-Dusanowska[2], Jonathan Jurkat[2], Sven Höfling[2], Christian Schneider[3], and •Ana Predojević[1] — [1]Department of Physics, Stockholm University, 10691 Stockholm, Sweden — [2]Technische Physik, Physikalisches Institut and Würzburg-Dresden Cluster of Excellence ct.qmat, Universität Würzburg, Am Hubland, D-97074 Würzburg, Germany — [3]Institute of Physics, University of Oldenburg, D-26129 Oldenburg, Germany

We present several devices capable of enhanced and broadband collection of pairs of entangled photons emitted by a single semiconductor quantum dot.

Oral EG-1.2 15:00 TRACK 10

Using a Plasmonic Nanolens To Observe Quantum Emitters — •Oluwafemi Ojambati — Cavendish Laboratory, Department of Physics, JJ Thompson Avenue, University of Cambridge, Cambridge, United Kingdom

Positional information inside a plasmonic hotspot is usually inaccessible. We reconstruct the positions of emitters inside a nanogap with a plasmonic nanolens, which confines fields that interact with single molecules to yield quantum effects.

Oral EG-1.3 15:15 TRACK 10

uW Pumping for MHz Photon Pair Generation Rates Enabled by $\chi^{(2)}$ Organic Chromophores — •Killian Keller[1], Michael Doderer[1], Miranda Davis[1], Kartik Srinivasan[2], Juerg Leuthold[1], and Christian Haffner[1,2] — [1]Institute of Electromagnetic Fields, Zurich, Switzerland — [2]Physical Measurement Laboratory, Gaithersburg, USA

Simulation of photon-pair sources in a photonic-organic platform are presented. Using mode-matching and programmable quasi-phase-matching, peak efficiencies of 0.75 GHz/mW are reached, featuring a minimum of 100 MHz/mW with a fabrication tolerance of 57.6 nm.

Oral EG-1.4 15:30 TRACK 10

Single-molecule imaging of LDOS modification by an array of plasmonic nanochimneys — •R. Margoth Córdova-Castro[1], Dirk Jonker [2], Bart van Dam[1], Guillaume Blanquer[1], Yannick De Wilde[1], Ignacio Izeddin[1], Arturo Susarrey-Arce[2], and Valentina Krachmalnicoff[1] — [1]1. Institut Langevin, ESPCI Paris, Université PSL, CNRS., Paris, France — [2]Mesoscale Chemical Systems, MESA+ Institute, University of Twente., Enschede, Netherlands

We perform nanometer-resolved imaging of the modification of the LDOS by simultaneously mapping the position and decay rate of photoactivatable single-molecules on a nanoarray of plasmonic nanochimneys with a field of view of ~10 μm2.

Oral EG-1.5 15:45 TRACK 10

Strain tuning of single-molecule-based single photon sources — •Anastasios Fasoulakis[1,2], Kyle D. Major[1], Rowan A. Hoggarth[1], and Alex S. Clark[1] — [1]Centre for Cold Matter, Blackett Laboratory, Imperial College London, London, United Kingdom — [2]Quantum Engineering Technology Labs, H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom

We will present experiments that demonstrate strain tuning of the frequency of the zero phonon line resonances of single dibenzoterrylene molecules at cryogenic temperature, and support our measurements with molecular dynamics calculations.

EH-1: Extreme and Ultrafast Phenomena in Plasmonics and Metamaterials

Chair: Paloma Huidobro, University of Lisbon, Lisbon, Portugal

Time: Monday, 14:30–16:00 Location: TRACK 11

Invited EH-1.1 14:30 TRACK 11

Light-matter interaction control with multilayer epsilon -near-zero metamaterials — •Humeyra Caglayan — Tampere University, Tampere, Finland

In this study, we obtained epsilon-near-zero metamaterial at visible range by designing and fabricating a metal-dielectric multilayer hyperbolic metamaterial. We have used the ENZ feature of these metamaterials to control linear and nonlinear properties.

Oral EH-1.2 15:00 TRACK 11

Time Diffraction in an Epsilon-Near-Zero Metasurface — •Romain Tirole[1], Taran Attavar[1], Jakub Dranczewski[1], Emanuele Galiffi[1], John Pendry[1], Stefan Maier[1,2], Stefano Vezzoli[1], and Riccardo Sapienza[1] — [1]Imperial College London, London, United Kingdom — [2]Ludwig-Maxilimians-Universitat Munchen, Munich, Germany

A deeply subwavelength film of Indium-Tin-Oxide exhibits strong and efficient all-optical modulation at its Berreman mode, with time diffraction leading to the redshift and broadening of a probe beam.

Oral EH-1.3 15:15 TRACK 11

Temporal Dynamics of Strongly Coupled Epsilon Near-Zero Plasmonic Systems — •Mehdi Haji Ebrahim[1], Andrea Marini[2], Vincenzo Bruno[3], Daniele Faccio[3], and Matteo Clerici[1] — [1]James Watt School of Engineering, University of Glasgow, G12 8QQ, Glasgow, United Kingdom — [2]Department of Physical and Chemical Sciences, University of L'Aquila, Via Vetoio, 67100, L'Aquila, Italy — [3]School of Physics and Astronomy, University of Glasgow, G12 8QQ, Glasgow, United Kingdom

We demonstrate a significant slow-light effect in a deeply subwavelength epsilon near-zero plasmonic system, particularly pronounced near the system excitation frequencies. This effect yields a group index as high as 1600 for Silicon Carbide.

Oral EH-1.4 15:30 TRACK 11

Photoinduced symmetry-breaking for all-optical ultrafast dichroism in plasmonic metasurfaces — •Andrea Schirato[1,3], Margherita Maiuri[1,2], Andrea Toma[3], Silvio Fugattini[3], Remo Proietti Zaccaria[3,4], Paolo Laporta[1,2], Peter Nordlander[5,6], Giulio Cerullo[1,2], Alessandro Alabastri[5], and Giuseppe Della Valle[1,2] — [1]Dipartimento di Fisica, Politecnico di Milano, Milan, Italy — [2]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Milan, Italy — [3]Istituto Italiano di Tecnologia, Genoa, Italy — [4]Cixi Institute of Biomedical Engineering, Chinese Academy of Sciences, Ningbo, China — [5]Department of Electrical and Computer Engineering, Rice University, Houston, USA — [6]Department of Physics and Astronomy, Laboratory for Nanophotonics, Houston, USA

We theoretically predict and demonstrate via polarisation-resolved ultrafast pump-probe spectroscopy a sub-picosecond broadband dichroism driven by the transient spatial inhomogeneities at the nanoscale of photoexcited hot carriers in a highly symmetric plasmonic metasurface.

Oral EH-1.5 15:45 TRACK 11

Hot Electrons Remote Excitation and their Ultrafast Dynamics — •Romain Hernandez[1], Renato Juliano-Martins[1], Mario Lodari[3,4], Michele Celebrano[2], Marco Finazzi[2], Lamberto Duo[2], Giovanni Isella[3,4], Marlene Petit[1], Adrian Agreda[1], Jean-Claude Weeber[1], Alexandre Bouhelier[1], Monica Bollani[3,4], Olivier Demichel[1], Paolo Biagioni[2,4], and Benoit Cluzel[1] — [1]Laboratoire Interdisciplinaire Carnot de Bourgogne, Dijon, France — [2]Politecnico di Milano, Milano, Italy — [3]L-NESS, Como, Italy — [4]IFN-CNR, Milano, Italy

The hot-electrons generation and dynamics are studied within plasmonic devices by : a) their remote production with propagative Surface Plasmons (SPs) and b) localized SPs within Schottky barrier device

CG-2: Controlled and Intense XUV Light

Chair: Thomas Pfeifer, Max-Planck Institute for Nuclear Physics, Heidelberg, Germany

Time: Monday, 14:30–16:00 Location: TRACK 12

Invited CG-2.1 14:30 TRACK 12

Attosecond metrology at Free Electron Lasers — •Giuseppe Sansone — Albert-Ludwigs-University, Freiburg, Germany

I will present experimental data and simulations on the correlation analysis technique recently used at the seeded FEL FERMI for the temporal characterization and shaping of attosecond pulse trains.

Oral CG-2.2 15:00 TRACK 12

Extreme Ultraviolet Second Harmonic Generation using a seeded soft X-ray laser — •Tobias Helk[1,2], Emma Berger[3,4], Lars Hoffmann[3,6], Adeline Kabacinski[5], Julien Gautier[5], Fabien Tissandier[5], Jean Philippe Goddet[5], Stephane Sebban[5], Christian Spielmann[1,2], and Michael Zürch[3,4,6] — [1]Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Friedrich-Schiller University, Jena, Germany — [2]Helmholtz Institute Jena, Jena, Germany — [3]Department of Chemistry, University of California, Berkeley, USA — [4]Materials Science Division, Lawrence Berkeley National Laboratory, Berkeley, USA — [5]Laboratoire d'Optique Applique, ENSTA Paris, Ecole Polytechnique, CNRS, Institut Polytechnique de Paris, Palaiseau, France — [6]Fritz Haber Institute of the Max Planck Society, Berlin, Germany

Lab-scale sources accelerate the understanding of nonlinear processes on the surface and inside the material. For the first time a second harmonic process in the soft X-ray regime with a table-top setup was realized.

Oral CG-2.3 15:15 TRACK 12

FLASH2020+: The New High Repetition Rate Coherent Soft X-Ray Facility — •E. Allaria, M. Beye, I. Hartl, M. Kazemi, T. Lang, L. Scharper, S. Schreiber, and the FLASH2020+ team — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany, Hamburg, Germany

With the ongoing upgrades FLASH2020+ will extend capabilities of existing Free-Electron-Lasers. Combining a superconducting electron-beam accelerator with a new external seeding scheme, FLASH2020+ will provide up to 1 MHz repetition rate highly coherent pulses.

Oral CG-2.4 15:30 TRACK 12

Attosecond control of multi-photon multiple ionization dynamics — Martin Kretschmar, Johannes Tümmler, Ingo Will, Tamás Nagy, Marc J. J. Vrakking, and •Bernd Schütte — Max-Born-Institut, Berlin, Germany

We demonstrate attosecond control of the multi-photon multiple ionization dynamics of argon. While the Ar^{2+} ion yield is weakly modulated in an autocorrelation measurement, the Ar^{3+} autocorrelation trace shows strong oscillations attributed to direct two-photon absorption.

Oral CG-2.5 15:45 TRACK 12

Spectrally Tunable Attosecond Pulse Generation — •Lénárd Gulyás Oldal[1,2], Peng Ye[1], Zoltán Filus[1], Tamás Csizmadia[1], Tímea Grósz[1], Massimo De Marco[1], and Balázs Major[1] — [1]ELI-ALPS, ELI-HU Non-Profit Ltd., Wolfgang Sandner utca 3., H-6728 Szeged, Hungary — [2]Institute of Physics, University of Szeged, Dóm tér 9., H-6720 Szeged, Hungary

We propose and demonstrate a method to generate high-order harmonics in rare-gas atoms with tunable photon energy and spectral width in a way that can be easily adopted to already implemented beamlines worldwide

PL-2: CLEO/Europe Plenary Talk

Time: Monday, 16:30–17:30 Location: TRACK 1

Plenary PL-2.1 16:30 TRACK 1

not yet filled — •Robert Boyd — , ,

not yet filled

CC-1: THz Strong Field Applications

Chair: Fülöp József András, ELI-ALPS, Szeged, Hungary

Time: Monday, 18:00–19:30 Location: TRACK 1

Invited CC-1.1 18:00 TRACK 1

Ultrafast structural dynamics of strongly-THz-driven materials — •Matthias Hoffmann — SLAC National Accelerator Laboratory, Menlo Park, USA

Intense THz pulses efficiently couple to low-energy degrees of freedom in complex materials such as optical phonons or magnons. Simultaneously, ultrafast x-ray or electron diffraction can be used to track structural changes with femtosecond resolution.

Oral CC-1.2 18:30 TRACK 1

High-harmonic generation from doped Si pumped with intense THz pulses — •Fanqi Meng[1], Frederik Walla[1], Qamar ul-Islam[1], Mark D. Thomson[1], Sergey Kovalev[2], Jan-Christoph Deinert[2], Igor Ilyakov[2], Min Chen[2], Alexey Ponomaryov[2], Sergey G. Pavlov[3], Heinz-Wilhelm Hübers[3,4], Nikolay V. Abrosimov[5], and Hartmut G. Roskos[1] — [1]Physikalisches Institut, Goethe-Universität Frankfurt, Frankfurt am Main, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [3]Institute of Optical Sensor Systems, German Aerospace Center (DLR), Berlin, Germany — [4]Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany — [5]Leibniz-Institut für Kristallzüchtung (IKZ), Berlin, Germany

We report the high harmonic generation (HHG) up to ninth order from a boron-doped Si at room temperature, pumped with intense terahertz pulses. The HHG is modeled by assuming nonparabolicity of the valance band.

Oral CC-1.3 18:45 TRACK 1

Ultrafast electron diffraction powered with a Terahertz-driven pulse compressor — •Dongfang Zhang[1], Tobias Kroh[1,2], Felix Ritzkowsky[1,2], Timm Rohwer[1], Moein Fakhari[1], Huseyin Cankaya[1,2], Anne-Laure Calendron[1], Nicholas H. Matlis[1], and Franz X. Kärtner[1,2] — [1]Center for Free-Electron Laser Science, Deutsches Elektronen Synchrotron, Hamburg, Germany — [2]Department of Physics and The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Hamburg, Germany

We built an ultrafast electron diffractometer with a Terahertz-driven pulse compressor to probe the ultrafast dynamics of single-crystal silicon. We demonstrate high-quality diffraction with improved time resolution.

Oral CC-1.4 19:00 TRACK 1

Ion evaporation by single-cycle terahertz pulses — •Mincheng Tang[1], Jonathan Houard[1], Laurent Arnoldi[1], Matthias Boudant[1], Anas Ayoub[1], Antoine Normand[1], Gerald Da Costa[1], Ammar Hideur[2,3], and Angela Vella[1,3] — [1]GPM UMR CNRS 6634, Normandie Université, Université-INSA de Rouen, Saint Etienne du Rouvray, France — [2]CORIA UMR CNRS 6614, Normandie Université,Université-INSA de Rouen, Saint Etienne du Rouvray, France — [3]Institut Universitaire de France, (IUT), France

Coupling picosecond duration terahertz pulses to metallic nano-structures allows the generation of extremely localized and intense electric fields. Here, using single-cycle terahertz pulses, we demonstrate the control over field ion emission from metallic nano-tips.

Oral CC-1.5 19:15 TRACK 1

Emission of Terahertz Waves from Curved Two-Color Filaments Produced by 2D Airy Wave Packets — •Anastasios D. Koulouklidis[1], Dimitris Mansour[1,2], Dimitris G. Papazoglou[1,2], and Stelios Tzortzakis[1,2,3] — [1]Institute of Electronic Structure and Laser, FORTH, Heraklion, Greece — [2]Department of Materials Science and Technology, University of Crete, Heraklion, Greece — [3]Science Program, Texas A\&M University at Qatar, Doha, Qatar

We report on THz generation from curved filaments produced by 2D Airy wave packets. Due to the curvature of the plasma channel, non-concentric THz beams with different polarizations are generated.

CL-1: Laser-Tissue Interactions and Surgery

Chair: Molly May, Division of Biomedical Physics, Medical University Innsbruck, Innsbruck, Austria

Time: Monday, 18:00–19:30 Location: TRACK 2

Tutorial CL-1.1 18:00 TRACK 2

Picosecond Infrared Laser (PIRL)-Ohmics: Fundamental Single Cell Limit to Minimally Invasive Surgery and Biodiagnostics — •R. J. Dwayne Miller — University of Toronto, Toronto, Canada

An atomic level understanding of strongly driven phase transitions has led to the achievement of scar free surgery with intact molecular fingerprints for surgical guidance and new abilities to correlate molecular structure to cell/tissue function.

Oral CL-1.2 19:00 TRACK 2

Bone tissue ablation by industrial fs laser systems — •Laura Gemini, Samy Al Bourgol, Guillaume Machinet, Marc Faucon, and Rainer Kling — ALPhANOV, Talence, France

Carbonization-free fs-laser ablation of porcine femur was achieved with ablation rates up to 0.7 mm3/s, thus becoming a competitive approach in the frame of bone surgery. The possibility of upscaling the process was also demonstrated.

Oral CL-1.3 19:15 TRACK 2

Printing of living cells by using ultra-short laser pulses — •Jun Zhang[1,2,3,4], Patrick Byers[1], Yasemin Geiger[1,2], Denitsa Docheva[4], Hauke Clausen-Schaumann[2,3], Stefanie Sudhop[2,3], and Heinz. P Huber[1] — [1]Lasercenter, Munich University of Applied Sciences, Lothstrasse 34, 80335 , Munich, Germany — [2]Center for Applied Tissue Engineering and Regenerative Medicine CANTER, Munich University of Applied Sciences, Lothstrasse 34, 80335 , Munich, Germany — [3]Center for NanoScience, University of Munich, 80799 , Munich, Germany — [4]Experimentelle Unfallchirurgie, Klinik und Poliklinik für Unfallchirurgie, Am Biopark 9, 93053 , Regensburg, Germany

We present a new ultra-short laser pulse-based method for the efficient and precise single cell printing which avoids the use of non-biological inorganic absorption layers.

EJ-1: Optical Computing and Artificial Intelligence

Chair: Kestutis Staliunas, Unitversitat Politecnica de Catalunya, Spain

Time: Monday, 18:00–19:30 Location: TRACK 3

Invited EJ-1.1 18:00 TRACK 3

Scalable photonics: an optimized approach — •Jelena Vuckovic — Stanford University, Stanford, USA

Classical and quantum photonics with superior properties can be implemented in a variety of photonic materials by combining state of the art optimization and machine learning techniques (photonics inverse design) with new fabrication approaches.

Invited EJ-1.2 18:30 TRACK 3

Predicting Supercontinuum Generation Dynamics Using a Neural Network — •Lauri Salmela[1], Mathilde Hary[1,2], John M Dudley[2], and Goëry Genty[1] — [1]Photonics Laboratory, Tampere University, Tampere, Finland — [2]Institut FEMTO-ST, Université Bourgogne Franche-Comté CNRS UMR 6174, Besançon, France

We show that machine learning models using two different architectures can learn a wide range of ultrafast nonlinear dynamics scenarios ranging from pulse compression to supercontinuum generation from only the input pulse and fibre characteristics.

Oral EJ-1.3 19:00 TRACK 3

Optically-addressed spatial light modulator for the Ising machine implementation — •Vladimir Semenov[1], Xavier Porte[1], Claudio Conti[2,3], Ibrahim Abdulhalim[4], Laurent Larger[1], and Daniel Brunner[1] — [1]FEMTO-ST Institute/Optics Department, CNRS & University Bourgogne Franche-Comté, Besançon, France — [2]Dipartimento di Fisica, Università di Roma "La Sapienza", Rome, Italy — [3]Institute for Complex Systems, National Research Council (ISC-CNR), Rome, Italy — [4]Department of Electrooptics and Photonics Engineering, Ben Gurion University, Beer Sheva, Israel

Ising machines are powerful concepts to solve combinatorial problems. Emulations in classical hardware are very inefficient, and we show that this challenge can be alleviated by realizing Ising models in optically-addressed spatial light modulators.

Oral EJ-1.4 19:15 TRACK 3

Computing Continuous Nonlinear Fourier Spectrum of Optical Signal with Artificial Neural Networks — •Egor Sedov[1,2], Jaroslaw Prilepsky[1], Igor Chekhovskoy[2], and Sergei Turitsyn[1,2] — [1]Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom — [2]Novosibirsk State University, Novosibirsk, Russia

We propose the artificial neural network architecture that can efficiently perform the nonlinear Fourier optical signal processing. The performance of the new method is analysed considering the error between the precomputed and predicted nonlinear spectra.

JSV-2: Flexible Photonic Devices

Chair: Juejun Hu, Massachusetts Institute of Technology, Cambridge, USA

Time: Monday, 18:00–19:30 Location: TRACK 4

Invited JSV-2.1 18:00 TRACK 4

Flexible Hybrid Semiconductor Membrane Photonic Devices Based on Micro Transfer Printing Process — •Weidong Zhou — University of Texas at Arlington, Arlington, USA

We report here progresses on hybrid semiconductor membrane photonic devices for 3D integrated chips, from earlier work on flexible LEDs arrays and flexible detector arrays to recent work on large area multi-wavelength 2D laser arrays and on-chip spectrometers.

Invited JSV-2.2 18:30 TRACK 4

Photonic glass systems fabricated by RF sputtering on flexible substrates — •Alessandro Chiasera[1], Osman Sayginer[2,1], Erica Iacob[3], Anna Szczurek[1,4], Kamila Startek[5,6], Lam Thi Ngoc Tran[1], Stefano Varas[1], Justyna Krzak[4], Oreste Bursi[2,1], Daniele Zonta[2,1,7], Anna Lukowiak[6], Giancarlo Righini[8], and Maurizio Ferrari[1] — [1]IFN-CNR CSMFO Laboratory and FBK Photonics Unit, Trento, Italy — [2]Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy — [3]Fondazione Bruno Kessler, Sensors and Devices, Micro Nano Facility, Trento, Italy — [4]Department of Mechanics, Materials and Biomedical Engineering, Wroclaw University of Science and Technology, Wroclaw, Poland — [5]Lukasiewicz Research Network - PORT, Polish Center for Technology Development, Wroclaw, Poland — [6]Institute of Low Temperature and Structure Research, Wroclaw, Poland — [7]Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, United Kingdom — [8]Istituto di Fisica Applicata Nello Carrara IFAC-CNR, MipLab, Sesto Fiorentino, Italy

Glass-based 1D photonic crystals and planar waveguides are fabricated by the rf-sputtering technique on different substrates such as PMMA, PEEK, and SiO2. The features of the samples are measured and compared before and after deformation.

Oral JSV-2.3 19:00 TRACK 4

A flexible polymer waveguide platform with low-loss optical interfaces — Shaoliang Yu, Haijie Zuo, Tian Gu, and •Juejun Hu — MIT, Cambridge, USA

We demonstrated a flexible polymer waveguide platform with low propagation loss and excellent mechanical ruggedness. We also realized ultra-compact waveguide bends and broadband, low-loss optical interface with fibers based on microfabricated quadratic reflectors.

Oral JSV-2.4 19:15 TRACK 4

3D Integrated Photonics Platform with Deterministic Geometry Control — •Jérôme Michon[1], Sarah Geiger[1,2], Lan Li[3,4], Claudia Gonçalves[5], Hongtao Lin[6], Kathleen Richardson[5], Xinqiao Jia[2], and Juejun Hu[1] — [1]Massachusetts Institute of Technology, Cambridge, USA — [2]University of Delaware, Newark, USA — [3]Westlake University, Hangzhou, China — [4]Westlake Institute for Advanced Studies, Hangzhou, China — [5]University of Central Florida, Orlando, USA — [6]Zhejiang University, Hangzhou, China

We report a fully-packaged 3D integrated photonics platform with devices placed at arbitrary pre-defined locations in 3D. We further demonstrated the application of the platform to mechanical strain sensing.

JSII-2: Applications of Strong THz Fields

Chair: Franz Kärtner, DESY, Hamburg, Germany

Time: Monday, 18:00–19:30 Location: TRACK 5

Invited JSII-2.1 18:00 TRACK 5

Generating THz fields and Delivering Them to Samples for Maximum Effect — •Keith A. Nelson — Massachusetts Institute of Technology, Cambridge, USA

THz spectroscopy may be conducted with fields delivered to samples through free space or through direct coupling between the THz generation medium and the sample with no free-space THz propagation.

Oral JSII-2.2 18:30 TRACK 5

THz-driven Electron Deflection for Streaking and Undulators — •David Rohrbach[1], Zoltan Ollmann[1], Mozhgan Hayati[1], Carl B. Schroeder[2], Hyun Woo Kim[3], In Hyung Baek[3], Key Young Oang[3], Mi Hye Kim[3], Young Chan Kim[3], Kyu-Ha Jang[3], Young Uk Jeong[3], Wim P. Leemans[4], and Thomas Feurer[1] — [1]Institute of Applied Physics, University of Bern, Bern, Switzerland — [2]Lawrence Berkeley National Laboratory, Berkeley, USA — [3]Quantum-beam based Radiation Research Center, KAERI, Daejeon, South Korea — [4]Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

We introduce THz-driven split-ring-resonators for electron bunch manipulation with applications in electron streaking and short-period undulators. While a single resonator facilitates bunch length measurements with 10fs resolution, an array can serve as 1mm period undulator.

Oral JSII-2.3 18:45 TRACK 5

Enantioselective Orientation of Chiral Molecules Induced by Terahertz Pulses with Twisted Polarization — •Ilia Tutunnikov[1], Long Xu[1], Robert W. Field[2], Keith A. Nelson[2], Yehiam Prior[1], and Ilya Sh. Averbukh[1] — [1]Weizmann Institute of Science, Rehovot, Israel — [2]Massachusetts Institute of Technology, Cambridge, USA

We theoretically demonstrate enantioselective control of molecular orientation using strong THz pulses with twisted polarization. We show that the induced orientation persists on the nanosecond time scale after the field is over.

Oral JSII-2.4 19:00 TRACK 5

Ultrafast Mode Switching of Metamaterials Driven by Intense THz Field-Induced Impact Ionization — •Bong Joo Kang[1], David Rohrbach[1], Fabian Brunner[1], Salvatore Bagiante[1,2], Hans Sigg[2], and Thomas Feurer[1] — [1]Institute of Applied Physics, University of Bern, 3012 Bern, Switzerland — [2]Laboratory for Micro- and Nanotechnology, Paul Scherrer Institute, 5232 Villigen, Switzerland

We report ultrafast THz-field induced mode switching of metamaterials on semiconductor substrates with different band gaps. We establish the dominant carrier generation mechanism and present detailed system dynamics.

Oral JSII-2.5 19:15 TRACK 5

Semi-classical calculations of nonlinear terahertz conductivity in semiconductor nanoparticles — •Hynek Nemec and Jiri Kucharik — Institute of Physics, Czech Academy of Sciences, Prague, Czech Republic

Nonlinear terahertz conductivity of free-electron gas enclosed in semiconductor nanoparticles is calculated by semi-classical Monte-Carlo method. The result show that confinement-induced nonlinearities may be much stronger than the intrinsic nonlinear response of bulk semiconductors.

ED-2: Comb Sources and Applications

Chair: Aleksandra Foltynowicz, Umeå University, Umeå, Sweden

Time: Monday, 18:00–19:30 Location: TRACK 6

Oral ED-2.1 18:00 TRACK 6

Coherent mid-infrared dual-comb spectroscopy enabled by optical injection locking of quantum cascade laser frequency combs — •Johannes Hillbrand, Mathieu Bertrand, Filippos Kapsalidis, Mattias Beck, and Jerome Faist — Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland

We investigate optical injection locking of the offset frequency of QCL frequency combs to a single-mode QCL. When both combs are locked, the dual-comb beating consists of a harmonic series of lines with resolution-limited linewidth.

Oral ED-2.2 18:15 TRACK 6

Near-Infrared 10-GHz Astrocomb With Mode Identification — •Yuk Shan Cheng[1], Dong Xiao[2], Richard A. McCracken[1], and Derryck T. Reid[1] — [1]Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom — [2]CAS Key Laboratory of Astronomical Optics & Technology and National Astronomical Observatories, Nanjing Institute of Astronomical Optics & Technology, Nanjing, China

We present a 10-GHz astrocomb spanning 1.15–1.8 μm and based on a spectrally broadened degenerate optical parametric oscillator. Absolute mode identification is provided by a Fourier-transform spectrometer cross-calibrated to the comb-mode spacing.

Invited ED-2.3 18:30 TRACK 6

Single-pixel massively parallel coherent LiDAR using on dual soliton microcombs — •Johann Riemensberger, Anton Lukashchuk, Maxim Karpov , Junqiu Liu, and Tobias J. Kippenberg — Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland

We show a novel architecture for massively parallel FMCW LiDAR based on dispersive spreading and multiheterodyne mixing of two chirped photonic chip-based soliton microcombs using a single laser source and a single coherent receiver.

Oral ED-2.4 19:00 TRACK 6

Carrier-Free Dual-Comb Distance Metrology Using Two-Photon Detection — •Hollie Wright[1], Jinghua Sun[2], David McKendrick[3], Nick Weston[3], and Derryck Reid[1] — [1]Scottish Universities Physics Alliance (SUPA), Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom — [2]School of Electronic Engineering and Intelligentization, Dongguan University of Technology, Dongguan, China — [3]Renishaw Plc, Edinburgh, United Kingdom

By using cross-polarized dual combs and two-photon detection we demonstrate carrier-phase-insensitive time-of-flight distance measurement at 1555 nm with 93 nm precision and sampling rates exceeding by 2.4 the conventional dual-comb metrology aliasing limit.

Oral ED-2.5 19:15 TRACK 6

Electro-Optic Frequency Combs for Rapid Sensing of Optomechanical Sensors — •David Long, Benjamin Reschovsky, Feng Zhou, Yiliang Bao, Ramgopal Madugani, Richard Allen, Thomas LeBrun, and Jason Gorman — National Institute of Standards and Technology, Gaithersburg, USA

Electro-optic frequency combs were employed to interrogate cavity optomechanical accelerometers. This approach allows for rapid sensing with high dynamic range. We describe approaches for comb generation as well as measurements in comparison with acceleration standards.

EB-2: Integrated Devices and Memories

Chair: Eleni Diamanti, CNRS Paris, France

Time: Monday, 18:00–19:30 Location: TRACK 7

Invited EB-2.1 18:00 TRACK 7

Quantum Networks with Artificial Atoms in Scalable Photonic Circuits: Architecture Designs to Proof of Concept Systems — •Dirk Englund — MIT, Cambridge, USA — Brookhaven National Laboratory, Upton, NY, USA

This talk discusses quantum memory-integrated photonic circuits for applications in modular quantum computers and in distributed quantum communication networks. It considers system architecture designs, protocols, experiments, and coherent interfaces to superconducting quantum computing machines.

Oral EB-2.2 18:30 TRACK 7

Entanglement Between a Telecom Photon and a Spin-Wave Solid-State Multimode Quantum Memory — •Jelena V. Rakonjac[1], Dario Lago-Rivera[1], Alessandro Seri[1], Margherita Mazzera[1,2], Samuele Grandi[1], and Hugues de Riedmatten[1,3] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [2]Institute of photonics and quantum sciences, SUPA, Heriot-Watt University, Edinburgh, United Kingdom — [3]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We demonstrate entanglement between a telecom photon and a solid-state multimode quantum memory. The entanglement is maintained for an optical excitation (with a fidelity high enough to violate a Bell inequality) and a spin-wave excitation.

Oral EB-2.3 18:45 TRACK 7

Towards satellite-suited noise-free quantum memories — •Luisa Esguerra[1,2], Leon Meßner[1,2], Elizabeth Robertson[1,2], Mustafa Gündoğan[1,3], and Janik Wolters[1,2] — [1]German Aerospace Center (DLR), Institute of Optical Sensor Systems, Berlin, Germany — [2]TU Berlin, Institute for Optics and Atomic Physics, Berlin, Germany — [3]Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany

Transmission losses in long-distance quantum communication may be compensated by quantum memories on satellites. We demonstrate a warm EIT-based Cesium vapour memory with a signal-to-noise level of unity for input signal pulses containing $\bar{\mu}_1 = 0.013$ photons.

Oral EB-2.4 19:00 TRACK 7

Erbium Dopants in a Cryogenic High-Q resonator — Benjamin Merkel[1,2], Alexander Ulanowski[1,2], Pablo Cova Farina[1,2], and •Andreas Reiserer[1,2] — [1]Max-Planck-Institute of Quantum Optics, Garching, Germany — [2]Munich Center for Quantum Science and Technology (MCQST), München, Germany

A high-finesse optical resonator enables coherent interactions between individual erbium dopants and photons at telecommunication wavelength. This establishes a novel hardware platform with unique properties towards the implementation of global quantum networks and repeaters.

Oral EB-2.5 19:15 TRACK 7

Optical readout of a superconducting single photon detector with a cryogenic modulator — •Frederik Thiele[1], Thomas Hummel[1], Felix vom Bruch[2], Victor Quiring[2], Raimund Ricken[2], Harald Herrmann[2], Christof Eigner[2], Christine Silberhorn[2], and Tim J. Bartley[1] — [1]Mesoscopic Quantum Optics, Paderborn, Germany — [2]Integrated Quantum Optics, Paderborn, Germany

We report on the readout of a SNSPD using a lithium niobate waveguide polarisation modulator at cryogenic temperature. This is an important step towards the development of feedforward modulation based on single photon events.

CD-2: Solitons

Chair: Cristina Masoller, Universitat Politècnica de Catalunya, Barcelona, Spain

Time: Monday, 18:00–19:30 Location: TRACK 8

Oral CD-2.1 18:00 TRACK 8

Generation of Dispersive Waves via Intermodal Cross-phase Modulation — •Maximilian Timmerkamp[1], Niklas M. Lüpken[1], Ramona Scheibinger[2], Kay Schaarschmidt[2], Markus A. Schmidt[2,3], Klaus-J. Boller[4,1], and Carsten Fallnich[1,4] — [1]Institute of Applied Physics, University of Münster, Münster, Germany — [2]Leibniz Institute of Photonic Technology, Jena, Germany — [3]Otto Schott Institute of Material Research, University of Jena, Jena, Germany — [4]MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands

We present the generation of dispersive waves via intermodal cross-phase modulation. A low-intensity transverse mode radiates a dispersive wave on account of the interaction with a higher-order soliton in a different orthogonal mode.

Oral CD-2.2 18:15 TRACK 8

Emergence of Laser Cavity-Solitons in a Microresonator-Filtered Fiber Laser — •Maxwell Rowley[1], Pierre-Henry Hanzard[1], Antonio Cutrona[1], Sai T. Chu[2], Brent E. Little[3], Roberto Morandotti[4,5], David J. Moss[6], Juan Sebastian Totero Gongora[1], Marco Peccianti[1], and Alessia Pasquazi[1] — [1]University of Sussex, Brighton, United Kingdom — [2]City University Hong Kong, Hong Kong, China — [3]Xi'an Institute of Optics and Precision Mechanics, Xi'an, China — [4]INRS-EMT, Montreal, Canada — [5]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology, Chengdu, China — [6]Optical Sciences Centre, Swinburne University of Technology, Swinburne, Australia

The parameter space, defined by simple global controls, is probed in a microresonator-filtered fiber laser. We identify a distinct region that clearly admits solitons and we investigate the role of slow nonlinearities in their emergence

Oral CD-2.3 18:30 TRACK 8

High Efficiency Raman Soliton Generation in Passive Silica Fiber — •Md Hosne Mobarok Shamim, Imtiaz Alamgir, and Martin Rochette — Department of Electrical and Computer Engineering, McGill University, Montreal, Canada

We report the highest energy conversion efficiency for soliton self-frequency shift based on a passive silica fiber. The soliton is tunable over 310 nm above the thulium band with a conversion efficiency up to 84.6%.

Oral CD-2.4 18:45 TRACK 8

Temporal Cavity Soliton in a Coherently Driven Active Fiber Resonator — •Nicolas Englebert, Carlos Mas Arabí, Pedro Parra-Rivas, Simon-Pierre Gorza, and François Leo — Université libre de Bruxelles, Bruxelles, Belgium

We theoretically describe and experimentally demonstrate the existence of temporal solitons in a coherently driven laser, pumped below its lasing threshold. These new pulses share the properties of mode-locked lasers and passive resonators solitons.

Oral CD-2.5 19:00 TRACK 8

Mid-infrared soliton self-frequency shift using ultra-low pump pulse energy — •Imtiaz Alamgir[1], Md Hosne Mobarok Shamim[1], Wagner Correr[2], Younès Messaddeq[2], and Martin Rochette[1] — [1]McGill University, Montréal, Canada — [2]Université Laval, Québec City, Canada

We generate Raman solitons tunable within the spectral range of 2.0-2.6 μm from an ultralow pump pulse energy of 64 pJ. This is the lowest pump energy ever used to obtain wideband soliton shift.

Oral CD-2.6 19:15 TRACK 8

Tunable Topological Phase Transition in Interacting Soliton Lattices — •Domenico Bongiovanni[1,2], Dario Jukić[3], Zhichan Hu[1], Frane Lunić[4], Yi Hu[1], Daohong Song[1], Roberto Morandotti[2,5], Zhigang Chen[1,6], and Hrvoje Buljan[1,4] — [1]TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin 300457, China — [2]INRS-EMT, 1650 Blvd. Lionel-Boulet, Varennes, QC J3X 1S2, Canada — [3]Faculty of Civil Engineering, University of Zagreb, Zagreb 10000, Croatia — [4]Department of Physics, Faculty of Science, University of Zagreb, Zagreb 10000, Croatia — [5]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu 610054, China — [6]Department of Physics & Astronomy, San Francisco State University, San Francisco, CA 94132, USA

We demonstrate dynamical topological phase transitions entirely driven by nonlinearity, which constitute an example of emergent nonlinear topological phenomena. These transitions in our system occur due to soliton interactions forming Su-Schrieffer-Heeger lattices.

EI-1: Towards Applications and Perovskites

Chair: Alexander Holleitner, Technische Universität München, Munich, Germany

Time: Monday, 18:00–19:30 Location: TRACK 9

Invited EI-1.1 18:00 TRACK 9

Ultrafast machine vision with 2D semiconductor photodiode arrays — Lukas Mennel, Joanna Symonowicz, Matthias Paur, Aday Molina-Mendoza, Dmitry Polyushkin, and •Thomas Mueller — Vienna University of Technology, Vienna, Austria

We demonstrate that a 2D semiconductor photodiode array can itself constitute an artificial neural network that can simultaneously sense and process optical images without latency.

Oral EI-1.2 18:30 TRACK 9

Broadband Optical Parametric Amplification by 2D Semiconductors — •Chiara Trovatello[1,2], Andrea Marini[3], Xinyi Xu[1], Changhwan Lee[1], Fang Liu[1], Nicola Curreli[4], Cristian Manzoni[5], Stefano Dal Conte[2], Kaiyuan Yao[1], Alessandro Ciattoni[6], James Hone[1], Xiaoyang Zhu[1], P. James Schuck[1], and Giulio Cerullo[2,5] — [1]Columbia University, New York , USA — [2]Politecnico di Milano, Milan, Italy — [3]Università dell'Aquila, L'Aquila, Italy — [4]IIT, Genova, Italy — [5]IFN-CNR, Milano, Italy — [6]CNR-SPIN, L'Aquila, Italy

We demonstrate single-pass optical parametric amplification (OPA) in monolayer semiconducting transition-metal dichalcogenides. Our experimental findings of OPA efficiency and polarization dependence are fully supported by first-principle calculations of the nonlinear response within a tight-binding model.

Oral EI-1.3 18:45 TRACK 9

High-Speed Graphene Photodetection: 300 GHz is not the Limit. — •Stefan M. Koepfli[1], Michael Baumann[1], Sascha Giger[1], Killian Keller[1], Yannik Horst[1], Yannick Salamin[2], Yuriy Fedoryshyn[1], and Juerg Leuthold[1] — [1]ETH Zurich, Institute of Electromagnetic Fields (IEF), 8092 Zurich, Switzerland — [2]Now in Massachusetts Institute of Technology, Research Laboratory of Electronics, MA02139 Cambridge, USA

We demonstrate the fastest measurement of a graphene photodetector up to 330GHz. We investigate the behaviour of three different operation mechanisms – photovoltaic, photoconductive and bolometric by measuring gate and bias voltage sweeps at high frequencies.

Oral EI-1.4 19:00 TRACK 9

Ultrafast spin relaxation mechanisms in layered hybrid perovskites — •Franco V. A. Camargo[1], Soumen Ghosh[1], Sean A. Bourelle[2], Timo Neumann[3], Ravichandran Shivanna[2], Richard H. Friend[2], Giulio Cerullo[1], and Felix Deschler[3] — [1]IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy — [2]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [3]Walter-Schottky-Institute, Physics Department, Technical University Munich, Munich, Germany

We combine ultrafast Faraday rotation and transient absorption to study spin relaxation in layered perovskites, revealing different mechanisms following different excitation wavelengths.

Oral EI-1.5 19:15 TRACK 9

Synchronized Injection of Charge Carriers in Perovskite Light Emitting Transistors — •Maciej Klein[1,3], Bryan Cheng[1], Jia Li[3], Annalisa Bruno[3], and Cesare Soci[1,2,3] — [1]Division of Physics and Applied Physics, Nanyang Technological University, Singapore, Singapore — [2]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore, Singapore — [3]Energy Research Institute @ NTU (ERI@N), Research Techno Plaza, Nanyang Technological University, Singapore, Singapore

We report enhancement of the brightness of hybrid perovskite light emitting transistors operated with independent pulsing of drain and gate bias voltages, attributed to compensation of space-charge effects and improved timing of carrier injection.

JSIII-2: Experimental Progress in Attochemistry

Chair: Mauro Nisoli, Politecnico di Milano, Milan, Italy

Time: Monday, 18:00–19:30 Location: TRACK 10

Invited JSIII-2.1 18:00 TRACK 10

Attosecond Noncollinear Four Wave Mixing — •Stephen Leone — University of California, Berkeley, USA

The background-free method of attosecond extreme ultraviolet plus optical pulse four-wave mixing allows a new level of time-dynamic analysis, and multidimensional methods with near infrared pulse shaping can be used to isolate individual states.

Oral JSIII-2.2 18:30 TRACK 10

Real-Time Probing of Atmospheric Photochemical Reaction by Ultrashort Eextreme Ultraviolet Pulses: Nitrous Acid Release from o-Nitrophenol — •Taro Sekikawa[1], Yuki Nitta[1], Oliver Schalk[2], Hironori Igarashi[2], Satoi Wada[3], Takuro Tsutsumi[3], Kenichiro Saita[4], and Tetsuya Takatsugu[4,5] — [1]Department of Applied Physics, Hokkaido university, Sapporo, Japan — [2]University of Copenhagen, Copenhagen, Denmark — [3]Graduate School of Chemical Sciences and Engineering, Hokkaido University, Sapporo, Japan — [4]Department of Chemistry, Hokkaido University, Sapporo, Japan — [5] Institute for Chemical Reaction Design and Discovery, Hokkaido University, Sapporo, Japan

Photolysis of o-nitrophenol, contained in brown carbon in the atmosphere, was investigated by time-resolved photoelectron spectroscopy with EUV light and by theoretical calculations to disentangle all reaction steps from the excitation to the dissociation.

Oral JSIII-2.3 18:45 TRACK 10

Delayed Ring-Opening in 1,3-Cyclohexadiene upon Photoexcitation to a Higher State Probed by Time-Resolved Soft X-Ray Absorption — Yutaro Kurimoto[1], Nariyuki Saito[2], Yorihisa Ishii[3], Teruto Kanai[2], Jiro Itatani[2], Kenichiro Saita[3], Tetsuya Taketsugu[3,4], and •Taro Sekikawa[1] — [1]Department. of Applied Physics. Hokkaido University, Sapporo, Japan — [2]Institute for Solid State Physics, University of Tokyo, Kashiwa, Japan — [3]Department of Chemistry, Hokkaido University, Sapporo, Japan — [4]Institute for Chemical Reaction Design and Discovery, Hokkaido University,, Sapporo, Japan

Time-resolved soft x-ray absorption spectroscopy based on high harmonic generation confirms that the ring of 1,3-cyclohexadiene is opened about 400 fs later upon photoexcitation to a higher excited state.

Invited JSIII-2.4 19:00 TRACK 10

Ultrafast Exciton Dynamics in Poly(3-hexylthiophene) Probed with Time Resolved X-ray Absorption Spectroscopy at the Carbon K-edge — •Douglas Garratt[1], Lukas Misiekis[1], David Wood[1], Esben Witting-Larsen[1], Mary Matthews[1], Oliver Alexander[1], Peng Ye[1], Sebastian Jarosch[1], Artem Bakulin[2], Tom Penfold[3], and Jon Marangos[1] — [1]The Blackett Laboratory Laser Consortium, Department of Physics, Imperial College London, London, United Kingdom — [2]Department of Chemistry and Centre for Processable Electronics, Imperial College London, London, United Kingdom — [3]Chemistry—School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom

We apply transient X-ray absorption spectroscopy at the carbon K-edge to study exciton dynamics in poly(3-hexylthiophene). We observe a direct, spectroscopic signature of rapid exciton localisation in the material on a sub 50 fs timescale.

EF-2: Turbulence and Nonlinear Effects

Chair: Julien Javaloyes, University of Balearic Islands, Palma, Spain

Time: Monday, 18:00–19:30 Location: TRACK 11

Oral EF-2.1 18:00 TRACK 11

Ultra-Broadband Stochastic Resonance of Light Enabled by Memory Effects in the Nonlinear Response — •Kevin J.H. Peters[1], Zhou Geng[1], Kiana Malmir[2], Jason M. Smith[2], and Said R.K. Rodriguez[1] — [1]Center for Nanophotonics, AMOLF, Amsterdam, Netherlands — [2]Department of Materials, University of Oxford, Oxford, United Kingdom

We report the first observation of non-Markovian stochastic resonance, using a thermo-optical nonlinear cavity. Memory effects attributed to a non-instantaneous nonlinear response dramatically enhance the stochastic resonance bandwidth.

Oral EF-2.2 18:15 TRACK 11

Turbulence control by non-Hermitian potentials — •Salim Benadouda Ivars[1], Muriel Botey[1], Ramon Herrero[1], and Kestutis Staliunas[1,2] — [1]Universitat Politècnica de Catalunya (UPC), Barcelona, Spain — [2]Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We propose a new method to actively influence the energy cascade through wavenumbers which is responsible of the appearance of turbulent flows. The method is based on the asymmetric properties of non-Hermitian potentials.

Oral EF-2.3 18:30 TRACK 11
Dynamics of Photon Statistics and Coherent Structures during the Turn on Transient of a Long Laser — •Amy Roche[1,2,3], Svetlana Slepneva[1,2,3], Uday Gowda[2,3], Anton Kovalev[4], Evgeny Viktorov[4], Alexander Pimenov[4], Andrei Vladimirov[5,6], Mathias Marconi[1], Massimo Giudici[1], and Guillaume Huyet[1] — [1]Université Côte d'Azur, CNRS, INPHYNI, Nice, France — [2]Centre for Advanced Photonics and Process Analysis and Department of Physical Sciences, Munster Technological University, Cork, Ireland — [3]Tyndall National Institute, University College Cork, Cork, Ireland — [4]ITMO University, Saint Petersburg, Russia — [5]Weierstrass Institute, Berlin, Germany — [6]Lobachevsky State University of Nizhny Novgorod, 603950, Russia
We analyse the turn-on transient of a long laser and show that the evolution of the intensity and of the field coherence occur on two significantly different time scales.

Oral EF-2.4 18:45 TRACK 11
Testing Critical Slowing Down as a Bifurcation Indicator in a Low-dissipation Laser System — M. Marconi[1], C. Métayer[2], A. Acquaviva[2], J. M. Boyer[2], A. Gomel[3], T. Quiniou[3], C. Masoller[4], M. Giudici[1], and •J.R. Tredicce[2] — [1]Université Côte d'Azur, CNRS-UMR 7010, Institut de Physique de Nice, Valbonne, France — [2]Université de la Nouvelle Calédonie, ISEA, Nouméa, Nouvelle Calédonie, France — [3]Universidad de Buenos Aires, Departamento de Física, Buenos Aires, Argentina — [4]Departamento de Física, Universitat Politecnica de Catalunya, Barcelona, Spain
Critical Slowing Down is commonly perceived as an indicator of an incoming bifurcation. Here we show that, in a solid-state laser where pump is linearly swept in time, it takes place well beyond the bifurcation point.

Invited EF-2.5 19:00 TRACK 11
Nonlinear Dynamics in Semiconductor Ring Lasers: From Phase Turbulence to Solitons — •Marco Piccardo[1], Benedikt Schwarz[2], Lorenzo Columbo[3], Franco Prati[4], Luigi Lugiato[4], Massimo Brambilla[5], Alessandra Gatti[6], Carlo Silvestri[3], Mariangela Gioannini[3], Dmitry Kazakov[1], Nikola Opacak[2], Maximilian Beiser[2], Johannes Hillbrand[2], Yongrui Wang[7], Alexey Belyanin[7], and Federico Capasso[2] — [1]Harvard University, Cambridge, USA — [2]TU Wien, Vienna, Austria — [3]Politecnico di Torino, Torino, Italy — [4]Universitá dell'Insubria, Como, Italy — [5]Universitá e Politecnico di Bari, Bari, Italy — [6]CNR, Milano, Italy — [7]Texas A&M University, College Station, USA
We introduce a framework capturing at the same time the physics of two distinct classes of frequency comb generators based on active and passive nonlinear optical media: ring quantum cascade lasers and Kerr microresonators.

CH-2: Raman Spectroscopy

Chair: Anderson Gomes, Federal University of Pernambuco, Recife, Brazil

Time: Monday, 18:00–19:30 Location: TRACK 12

Invited CH-2.1 18:00 TRACK 12
Quantitative coherent Raman scattering microscopy for bioimaging — •Paola Borri — Cardiff University, Cardiff, United Kingdom
Our laboratory has developed a range of label-free chemically-specific coherent Raman scattering microscopes featuring innovative excitation/detection schemes including hyperspectral acquisition, quantitative volumetric imaging, and interferometric detection. Their application to bioimaging will be showcased.

Oral CH-2.2 18:30 TRACK 12
Sub-Optical-Cycle Light-Matter Energy Transfer Dynamics in Molecular Vibrational Spectroscopy — •Theresa Buberl[1], Martin Peschel[2], Maximilian Högner[1], Regina de Vivie-Riedle[2], and Ioachim Pupeza[1,3] — [1]Max-Planck-Institut für Quantenoptik, Garching, Germany — [2]Ludwig-Maximilians-Universität München, Munich, Germany — [3]Ludwig-Maximilians-Universität München, Garching, Germany
The complete energy transfer dynamics between field-controlled mid-infrared optical waveforms and vibrating molecules in aqueous solution is recorded with field-resolved spectroscopy on a sub-optical-cycle timescale for the first time, and is reproduced by ab-initio calculations.

Oral CH-2.3 18:45 TRACK 12
Targeted single-beam CARS using phase-and-polarization shaping — •Ruan Viljoen[1], Dirk Spangenberg[2], Pieter Neethling[1], Alexander Heidt[2], Thomas Feurer[2], and Erich Rohwer[1] — [1]Laser Research Institute, Stellenbosch, South Africa — [2]Institute for Applied Physics, Bern, Switzerland
I^2PIE compressed supercontinuum pulses from a femtosecond oscillator pumped ANDi-PCF are phase shaped, using an SLM in a 4f-shaper geometry, with quadratic phase functions. Specific Raman transitions in single-beam CARS measurements are successfully targeted.

Oral CH-2.4 19:00 TRACK 12
Advancing Stimulated Raman Scattering spectroscopy using Squeezed Light — •Rayssa Bruzaca de Andrade[1], Kirstine Berg-Sørensen[2], Tobias Gehring[1], and Ulrik Lund Andersen[1] — [1]Center for Macroscopic Quantum States bigQ, Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark
Quantum technology can improve state-of-the-art microscopes. Here we present squeezed light enhanced stimulated Raman spectroscopy imaging.

Oral CH-2.5 19:15 TRACK 12
Spectral Vector Beams for High-Speed Spectroscopic Measurements — •Lea Kopf[1], Juan Deop Ruano[1], Timo Stolt[1], Mikko J. Huttunen[1], Frédéric Bouchard[2], and Robert Fickler[1] — [1]Photonics Laboratory, Physics Unit, Tampere University, FI-33720 Tampere, Finland — [2]National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario K1A 0R6, Canada
We introduce a novel method to generate beams with frequency-dependent polarization, i.e. spectral vector beams. They allow determining changes in the spectrum by only using polarization measurements, thus enabling GHz read-out rates.

CA-P: CA Poster Session

Time: Monday, 10:00–11:00 Location: TRACK 1

CA-P.1 10:00 TRACK 1
Highly-efficient Resonantly Diode-pumped 2 μm Thulium Lasers — •Jan Sulc, Michal Nemec, Jan Kratochvil, Karel Veselsky, and Helena Jelinkova — Czech Technical University in Prague, FNSPE, Prague, Czech Republic
Thulium-based lasers (Tm:YAP, Tm:YAG, Tm:YLF) were tested under CW 1.7 μm diode excitation. In a longitudinal pumping arrangement, efficiencies reaching quantum limit were obtained for all samples with multi-watt level output.

CA-P.2 10:00 TRACK 1
Photothermal-controlled relative frequency stabilization of Nd:YVO4-based monolithic microchip single mode laser with SHG — •Grzegorz Dudzik — Wroclaw University of Science and Technology, Wroclaw, Poland
Microchip resonator Nd:YVO4/YVO4/KTP/Er:Glass with second-harmonic generation and relative frequency stabilization to 127I2 iodine vapor atomic transition is presented. Auxiliary 976nm beam is absorbed in Er:Glass leading to the laser frequency control induced by photothermal effect.

CA-P.3 10:00 TRACK 1

2 μm MOPA Laser Based on Cryogenically Cooled Tm:Y2O3 Transparent Ceramic — •Fangxin Yue[1,2,3], Venkatesan Jambunathan[1], Samuel Paul David[1], Xavier Mateos[2], Jan Sulc[3], Martin Smrz[1], and Tomas Mocek[1] — [1]HiLASE Center, Institute of Physics Czech Academy of Sciences, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic — [2]Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili, Campus Sescelades, c/Marcel·lí Domingo, s/n., E-43007 Tarragona, Spain — [3]Faculty of Nuclear Sciences and Phys. Eng., Czech Technical University in Prague, Brehova 7, 115 19 Prague, Czech Republic

We demonstrated a MOPA laser based on cryogenically cooled Tm:Y2O3 transparent ceramics emitting around 1932 nm. A maximum output energy of 2.94 mJ at 10 Hz with a pulse width of 32 ns was achieved.

CA-P.4 10:00 TRACK 1

Er:YAP laser and gain-switching generation of 186 ns pulses at 2.92 μm — •Richard Švejkar, Jan Šulc, Michal Němec, and Helena Jelínková — Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Prague, Czech Republic

Compact gain-switched Er:YAP laser emitting at 2920 nm was tested for the first time. Using short (11 mm long) laser resonator the pulse duration 186±1 ns with repetition rate 200 Hz were achieved.

CA-P.5 10:00 TRACK 1

Widely tunable Tm^{3+}:LuF_3-CaF_2 diode pumped laser — •Karel Veselský[1], Jan Šulc[1], Helena Jelínková[1], Maxim E. Doroshenko[2], Kseniia A. Pierpoint[2], Vasilii A. Konyushkin[2], and Andrey N. Nakladov[2] — [1]FNSPE, Czech Technical University in Prague, Prague, Czech Republic — [2]A. M. Prokhorov General Physics institute, Russian Academy of Sciences, Moscow, Russia

One of the largest tunability of 250 nm (1785-2035 nm) from thulium-doped fluoride crystal was achieved with a new Tm^{3+}:LuF_3-CaF_2 crystal. The laser performance of the diode-pumped laser was investigated.

CA-P.6 10:00 TRACK 1

4.7–5.1 μm Lasing in Cr^{2+},Fe^{2+}:$Zn_{1-x}Mn_xSe$ ($x \approx 0.4$) Single Crystal under 1.73 μm and 2.94 μm Pumping — •Adam Riha[1], Maxim Doroshenko[2], Helena Jelinkova[1], Michal Nemec[1], Michal Jelinek[1], Miroslav Cech[1], Nazar Kovalenko[3], and Igor Terzin[3] — [1]Czech Technical University in Prague, FNSPE, Prague, Czech Republic — [2]Prokhorov General Physics Institute, Moscow, Russia — [3]Institute for Single Crystals, NAS of Ukraine, Kharkiv, Ukraine

Two different Q-switched lasers pumping at ~1.73 μm through the $Cr^{2+} \rightarrow Fe^{2+}$ ions energy transfer and at ~2.94 μm via direct excitation of Fe^{2+} ions of the Cr^{2+},Fe^{2+}:$Zn_{1-x}Mn_xSe$ ($x \approx 0.4$) single crystal are reported.

CA-P.7 10:00 TRACK 1

RE-doped LGSB (RE = Nd, Yb) as New High Performance Near-Infrared Laser Crystals — •Madalin Greculeasa[1,2], Alin Broasca[1,2], Flavius Voicu[1], Stefania Hau[1], Gabriela Croitoru[1], Catalina Brandus[1], George Stanciu[1], Cristina Gheorghe[1], and Lucian Gheorghe[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Solid-State Quantum Electronics Laboratory, Magurele, Romania — [2]Doctoral School of Physics, University of Bucharest, Faculty of Physics, Magurele, Romania

Near-infrared laser emission performances yielded by 4.6-at.% Nd:LGSB and 12.9-at.% Yb:LGSB laser crystals are presented. The obtained results prove the favorable intrinsic properties of these laser media to generate laser emission with high efficiencies.

CA-P.8 10:00 TRACK 1

Transient Frequency Dynamics in Single-Longitudinal-Mode Diamond Raman Lasers — •Seyed Abedi, Douglas Little, Ondrej Kitzler, David Spence, and Richard Mildren — Macquarie University, Sydney, Australia

We report a long-pulse diamond Raman laser exhibiting thermally-induced chirp at rates up to 0.2~MHz per microsecond . Prospects for a "fast" thermo-optical actuator leveraging diamond's high thermal conductivity are discussed.

CA-P.9 10:00 TRACK 1

High-Efficiency CW and Passively-Q-Switched Operation of a 2050 nm Tm3+:Y2O3 Ceramic Laser In-Band Fiber-Laser Pumped at 1670 nm — •Oleg Antipov[1,2], Yuriy Getmanovskiy[1,3], Anton Dobrynin[2], Haitao Huang[4], Deyuan Shen[4], Jun Wang[4], and Stanislav Balabanov[5] — [1]Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia — [2]Nizhny Novgorod State University, Nizhny Novgorod, Russia — [3]Nizhny Novgorod State Technical University, Nizhny Novgorod, Russia — [4]Jiangsu Normal University, Xuzhou, China — [5]Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia

A Tm3+:Y2O3 ceramic laser at 2050 nm with the L-shaped cavity in-band pumped by a fiber laser at 1670 nm was studied in the CW and passively Q-switched regimes. Kilohertz Q-switched operation was achieved by an intracavity Cr2+:ZnSe saturable absorber.

CA-P.10 10:00 TRACK 1

Development of a Yellow Laser Source at 577 nm for Ophthalmology Applications — •Venkatesan Jambunathan[1], Samuel Paul David[1], Fangxin Yue[1], Xavier Mateos[2], Ondrej Novak[1], Martin Smrz[1], and Tomas Mocek[1] — [1]HiLASE Center, Institute of Physics of the Czech Academy of Sciences, Za Radnicí 828, 25241, Dolní Břežany, Czech Republic — [2]Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili, Campus Sescelades, c/Marcel·lí Domingo, s/n., E-43007 , Tarragona, Spain

We demonstrated a compact yellow laser source emitting at 577 nm that has potential in ophthalmology applications. This is achieved by constructing a laser setup with proper combination of gain, Raman and frequency doubling media.

CA-P.11 10:00 TRACK 1

Multiwavelength Ultrafast SRS Oscillation in Pb(MoO4)0.5(WO4)0.5 Mixed Crystal with Combined Frequency Shifts on Stretching and Bending Vibrations of Molybdate and Tungstate Anionic Groups — •Milan Frank[1], Sergei Smetanin[2], Michal Jelínek[1], David Vyhlídal[1], Ksenia Gubina[2], Vladislav Shukshin[2], Petr Zverev[2], and Václav Kubeček[1] — [1]Czech Technical University in Prague, FNSPE, Prague, Czech Republic — [2]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia

We present multiwavelength ultrafast oscillation in synchronously pumped Raman laser based on a Pb(MoO4)0.5(WO4)0.5 crystal. The output radiation with slope efficiency of 1.5% and 9.5% was achieved at wavelengths of 1171/1176 and 1217/1222 nm, respectively.

CA-P.12 10:00 TRACK 1

Design of intra-cavity phase masks for high power flat-top Yb:YAG thin-disk cavities — •Vincent Fortin, Marie-Christine Nadeau, and Stéphane Petit — Université Bordeaux- CNRS- CEA, CELIA, UMR 5107, Talence, France

We report on simulations to design and implement graded-phase mirrors in Yb:YAG thin-disk cavities with a flat-top fundamental mode on the disk. Compared to fundamental Gaussian cavities, it could enable more efficient thin-disk laser systems.

CA-P.13 10:00 TRACK 1

Picosecond and Femtosecond Mode-Locked Lasers Based on Yb:LuAP Crystal — •Alexander Rudenkov[1], Viktor Kisel[1], Anatol Yasukevich[1], Karine Hovhannesyan[2], Ashot Petrosyan[2], and Nikolay Kuleshov[1] — [1]Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — [2]Institute for Physical Research, National Academy of Sciences, Ashtarak-2, Armenia

Average output power of 7W with 28.1% optical efficiency and 130fs pulse duration obtained at 1016.9nm central wavelength. 2ps pulses with 12W average power and 38% optical efficiency obtained at 999.2nm central wavelength.

CA-P.14 10:00 TRACK 1

Performance of mid-IR high-power ZGP OPO compared in linear and non-planar ring resonators — •Manuel A. Medina[1,2], Marcin Piotrowski[1], Martin Schellhorn[1], Christian Mueller[1], Gerhard Spindler[3], Frank Wagner[2], Antoine Berrou[1], and Anne Hildenbrand-Dhollande[1] — [1]French-German Research Institute of Saint-Louis (ISL), Saint-Louis, France — [2]Aix Marseille Univ.,CNRS,Cetntrale Marseille,Institut Fresnel, Marseille, France — [3]Untere Gaisackerstrs.,10,79761, Waldshut-Tiengen, Germany

We compare the performance in terms of output power, efficiency and beam quality of three types of mid-IR ZGP OPOs at high repetition rate: linear, RISTRA and FIRE cavities.

CA-P.15 10:00 TRACK 1

Exploring the Topological Charge and Shape of an Optical Vortex Generated with Wavelength-Detuned Spiral Phase Plates — •Oana-Valeria Grigore[1], Alexandru Craciun[1,2], Nicolaie Pavel[1], and Traian Dascalu[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Solid-State Quantum Electronics Laboratory, Magurele, Romania — [2]Doctoral School of Physics, University of Bucharest, Faculty of Physics, Magurele, Romania

A procedure to determine topological charge and sign of vortex beams generated by a spiral phase plate illuminated at a wavelength different than the designed one is proposed, showing good agreement between experiments and simulations.

CA-P.16 10:00 TRACK 1

Luminescent and laser properties of rare earth doped selenide glasses in the mid-infrared — Mikhail Churbanov[2], Boris Denker[1], Boris Galagan[1], •Vasily Koltashev[3], Victor Plotnichenko[3], Maxim Sukhanov[2], Sergey Sverchkov[1], and Alexander Velmushov[2] — [1]Prokhorov General Physics Institute of RAS, Moscow, Russia — [2]Devyatykh Institute of Chemistry of High-Purity Substances of RAS, Nizhny Novgorod, Russia — [3]Prokhorov General Physics Institute of RAS, Dianov Fiber Optics Research Center, Moscow, Russia

5-6 μm laser action was demonstrated in Tb-doped and Pr-doped ultrapure selenide glasses. Sensitization of Ce3+ by Dy3+ enabled to uncover the 7.5 ms long Ce3+ luminescence at 3.5-6 μm, also promising for lasing.

CA-P.17 10:00 TRACK 1

Low-Quantum-Defect CW and Q-Switched Operation of a Tm3+:YAP Laser with the In-Band Fiber-Laser Pumping — •Oleg Antipov[1,2,3], Yuriy Getmanovskiy[1,3,4], Anton Dobrynin[2], Irina Shestakova[5], Alexander Shestakov[5], Stanislav Balabanov[6], and Sergey Larin[7] — [1]Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod , Russia — [2]Nizhny Novgorod State University, Nizhny Novgorod , Russia — [3]Novosibirsk State University, Novosibirsk, Russia — [4]Nizhny Novgorod State Technical University, Nizhny Novgorod , Russia — [5]Research Institute "Polus", Moscow, Russia — [6]Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod , Russia — [7]"NTO IRE-Polys", , Fryazino Moscow region, Russia

In-band fiber laser pumped Tm3+:YAP laser at 1896 nm, 1935 nm or 1985 nm was studied in the CW, actively and passively Q-switched regimes. The Q-switched operation was achieved using an intracavity acousto-optical modulator or a Cr2+:ZnSe saturable absorber.

CA-P.18 10:00 TRACK 1

Diode Bar Pumping of Single Mode Solid State Lasers — Lyuben S Petrov[1], Kaloyan Georgiev[1], Anton Trifonov[2], and •Ivan Buchvarov[1,3] — [1]Physics Department, Sofia University, Sofia, Bulgaria — [2]IBPhotonics Ltd, Sofia, Bulgaria — [3]John Atanasoff Center for Bio and Nano Photonics (JAC BNP), Sofia, Bulgaria

A method for optimization of a diode beam-shaping device for diode bar longitudinally pumping of solid-state-lasers is presented. Efficient diode-bar-pumped single mode operation of Yb-KGW fs-regenerative amplifier and Nd:YAP laser oscillators are demonstrated.

CA-P.19 10:00 TRACK 1

Evaluating Thermal Interface Materials for Mounting Slab Laser Crystals — •Jake Sanwell, Hannah Turner, Daniel Morris, and M.J.Daniel Esser — Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We present a method for comparatively evaluating solid thermal interface materials for mounting slab and disk solid-state laser geometries. Indium foil and soft PGS are found to be the most practical materials for this application.

CB-P: CB Poster Session

Time: Monday, 10:00–11:00 Location: TRACK 2

CB-P.1 10:00 TRACK 2

High Power Diffraction Limited 1550 nm Superluminescent Diodes — •Jenna Campbell, Michelle Labrecque, Fatt Foong, Daniel Renner, Milan Mashanovitch, and Paul Leisher — Freedom Photonics, Santa Barbara, USA

In this work, we present record results from high-power 1550 nm diffraction limited superluminescent diodes. We demonstrate symmetric broad bandwidth emission (>60 nm) with low ripple (< 1dB) and 120 mW of output power.

CB-P.2 10:00 TRACK 2

Externally Wavelength-Stabilized Single Mode Lasers with 65% Conversion Efficiency and 50 pm Spectral Width at 1 W Output — •Martin Wilkens, Götz Erbert, Hans Wenzel, Andre Maaßdorf, Jörg Fricke, Andrea Knigge, and Paul Crump — Ferdinand-Braun-Institut gGmbH, Berlin, Germany

Low loss, narrow spectrum, wide tuning range external wavelength stabilization of advanced waveguide (highly vertically asymmetric, lateral mode-filtered) single mode diode lasers is demonstrated, showing their suitability for use in dense wavelength beam combining systems.

CB-P.3 10:00 TRACK 2

Miniaturized Master-Oscillator Power-Amplifier emitting at 626 nm — •Gunnar Blume, Morten Drees, Johannes Pohl, David Feise, Alexander Sahm, and Katrin Paschke — Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik (FBH), Berlin, Germany

An all-semiconductor single longitudinal mode laser source at 626 nm in a small sized, sealed package was developed. It uses a DBR-RWL as master-oscillator and a tapered amplifier at low internal temperature to achieve approximately 200 mW.

CB-P.4 10:00 TRACK 2

Manipulation of Temporal Localized Structures in a VECSEL With Optical Feedback — •Thomas Seidel[1,2], Adrián Bartolo[3], Nathan Vigne[4], Arnaud Garnache[4], Grégoire Beaudoin[5], Isabelle Sagnes[5], Massimo Giudici[3], Julien Javaloyes[1], Svetlana V. Gurevich[1,2], and Mathias Marconi[3] — [1]Dpt. de Física, Universitat de les Illes Balears & IAC-3, Campus UIB, E-07122 Palma de Mallorca, Spain — [2]Institute for Theoretical Physics & Center for Nonlinear Science (CeNoS), University of Münster, Schlossplatz 2, 48149 Münster, Germany — [3]Université Côte d'Azur, Centre National de La Recherche Scientifique, Institut de Physique de Nice, F-06560 Valbonne, France — [4]Institut d'Electronique et des Systèmes, UMR5214, University of Montpellier, 34000 Montpellier, France — [5]Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, UMR 9001, 91120 Palaiseau, France

We analyze the effect of optical feedback on the dynamics of mode-locked semiconductor lasers operated in the regime of temporal localized structures. Depending on the feedback delay harmonic solutions can be either reinforced or hindered.

CB-P.5 10:00 TRACK 2

Optical Injection Dynamics of VCSEL Frequency Combs — •Yaya Doumbia[1,2], Delphine Wolfersberger[1,2], Krassimir Panajotov[3,4], and Marc Sciamanna[1,2] — [1]Chaire Photonique, CentraleSupélec, 2 Rue Edouard Belin 57070 , Metz, France — [2]Université de Lorraine, CentraleSupélec, LMOPS, 2 Rue Edouard Belin 57070 , Metz, France — [3]Brussels Photonics Group (B-PHOT), Vrije Universiteit Brussel, Brussels, Belgium — [4]Institute of Solid-State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria

We analyze theoretically and experimentally the dynamics of a VCSEL with frequency comb injection. The VCSEL shows two tunable combs with orthogonal polarization and a bandwidth up to 13 times that of the injected comb.

CB-P.6 10:00 TRACK 2

withdrawn

CB-P.7 10:00 TRACK 2

Dual Wavelength Laser Designed for Locking to Cs-133 Atomic Transitions — Wenxuan Qi[1], •Bocheng Yuan[1], Jianqin Shi[1], Yunshan Zhang[1], Xiangfei Chen[2], John H. Marsh[3], and Lianping Hou[3] — [1]Nanjing University of Posts and Telecommunications, Nanjing, China — [2]National Laboratory of Solid State Microstructures, Nanjing University, Nanjing, China — [3]James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom

A laterally coupled dual-wavelength laser operating at 894 nm with a frequency separation at 9.19 GHz is designed for miniature atomic clocks and room temperature magnetometers.

CB-P.8 10:00 TRACK 2

Observation of the Turn-on Delay in InAs- and InP-based Quantum Cascade Lasers under Pulsed Pumping with Non-zero Rise-time — •Evgeniia Cherotchenko[1], Vladislav Dudelev[1], Dmitry Mikhailov[1], Sergey Losev[1], Andrey Babichev[2,3], Andrey Gladyshev[2], Innokenty Novikov[1,2,3], Andrey Lutetskiy[1], Dmitry Veselov[1], Sergey Slipchenko[1], Nikita Pikhtin[1], Leonid Karachinsky[1,2,3], Dmitry Denisov[2], Vladimir Kuchinskii[1], Elena Kognovitskaya[1], Anton Egorov[3], Roland Tessier[4], Alexei Baranov[4], and Grigorii Sokolovskii[1] — [1]Ioffe Institute, Saint Petersburg, Russia — [2]Connector Optics LLC, Saint Petersburg, Russia — [3]ITMO University, Saint Petersburg, Russia — [4]IES, University of Montpellier, Montpellier, France

We observe unexpectedly long turn-on delay reaching ~10ns and its non-monotonous dependence on pumping amplitude in InAs- and InP-based quantum-cascade lasers under non-zero rise-time pulse-pumping. Our numerical simulations qualitatively agree with these measurements.

CB-P.9 10:00 TRACK 2

Investigation of Scattering Losses in a Buried Tunnel Junction 4 um GaSb VCSEL — •Andrea Simaz[1], Pierluigi Debernardi[2], Mina Beshara[1], and Mikhail A. Belkin[1] — [1]Walter Schottky Institute c/o Technical University of Munich, D-85748 Garching bei München, Germany — [2]CNR-IEIIT c/o Politecnico di Torino, 10129 Torino, Italy

Scattering losses in a 4 mu GaSb VCSEL are analyzed using a 3D vectorial optical solver by parametrically varying transverse and longitudinal dimension of the buried tunnel junction and an optimized structure is proposed.

CB-P.10 10:00 TRACK 2

Phase-incoherent photonic molecules in V-shaped mode-locked VECSELs — Jan Hausen[1], Julien Javaloyes[2], Svetlana Gurevich[2,3], and •Kathy Lüdge[1] — [1]Institute of Theoretical Physics, Technische Univ. Berlin, Berlin, Germany — [2]Departament de Fisica, Universitat de les Illes Balears & Institute of Applied Computing and Community Code, Palma de Mallorca, Spain — [3]Institute for Theoretical Physics, University of Münster, Münster, Germany

We find clusters of globally-bound but locally-independent pulses in mode-locked VECSELs in the long-cavity regime below threshold. Our analytics predicts the pulse distance while a bifurcation analysis yields regions of stability of the phase-incoherent clusters.

CB-P.11 10:00 TRACK 2

Ultra-short pulse non-classical light emitters utilizing multiple wide quantum wells — •Nicolas Torcheboeuf[1], Valentin Mitev[1], Laurent Balet[1], Philippe Renevey[1], Michel Krakowski[2], Patrick Resneau[2], Alexandre Larrue[2], Jean-Pierre Legoec[2], Yannick Robert[2], Eric Vinet[2], Michel Garcia[2], Olivier Parillaud[2], Bruno Gerard[2], and Dmitri Boiko[1] — [1]Centre Suisse d'Electronique et de Microtechnique SA (CSEM), Neuchâtel, Switzerland — [2]III-V Lab, Palaiseau, France

We report superradiance pulse emitters utilizing quantum-confined Stark effect in multiple wide-quantum-well heterostructure. The light pulses of duration is 1.2 ps and energy 80 pJ is a mixed photon state with non-classical correlations g(3)g(3)*>g(2)g(4).

CB-P.12 10:00 TRACK 2

2 Gbit/s QPSK Wireless Transmission System with Injection-locked Quantum-dash Laser 28 GHz MMW Source at 1610 nm — •Qazi Tareq[1], Amr M. Ragheb[2], Maged A. Esmail[3], Saleh Alshebeili[2], and Mohammed Zahed M. Khan[1] — [1]Electrical Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia — [2]Electrical Engineering Department, King Saud University, Riyadh, Saudi Arabia — [3]Communications and Networks Engineering Department, Prince Sultan University, Riyadh, Saudi Arabia

First demonstration of 28-GHz wireless transmission of 2-Gbit/s QPSK signal over 4-m channel link is reported that utilizes an L-band ~1610-nm InAs/InP quantum-dash laser based MMW source with ~19-kHz linewidth and ~-122-dBc/Hz phase noise.

CB-P.13 10:00 TRACK 2

Effects of Two-photon Absorption and Non-linear Index in InP-based Passive Waveguides on Integrated Extended Cavity Semiconductor Lasers — •Erwin Bente, Stefanos Andreou, Yuqing Jiao, and Kevin Williams — Eindhoven University of Technology, Eindhoven, Netherlands

Effects of two-photon absorption and the non-linear refractive index in InP rib waveguides and InGaAsP/InP ridge waveguides on picosecond pulses as well as the effects on integrated extended cavity modelocked lasers are studied theoretically.

CB-P.14 10:00 TRACK 2

Spatially Modeless Laser Cavity based on III-V Semiconductor technology: Non linear localized light — •Nathan Vigne[1], Adrien Bartolo[2], Grégoire Beaudoin[5], Konstantinos Pantzas[5], Mathias Marconi[2], Julien Javayoles[3], Svetlana Gurevich[4], Isabelle Sagnes[5], Massimo Giudici[2], and Arnaud Garnache[1] — [1]Institut d'Electronique et des Systèmes, Centre National de la Recherche Scientifique, Université de Montpellier, Montpellier, France — [2]Institut de Physique de Nice, Centre National de la Recherche Scientifique, Université Côte d'Azur, Nice, France — [3]Departament de Física , Universitat de les Illes Balears & IAC-3, Mallorca, Spain — [4]Institute for Theoretical Physics & Center for Nonlinear Science, University of Münster, Münster, Germany — [5]Center for Nanosciences and Nanotechnologiy, Centre National de la Recherche Scientifique, Université Paris-Saclay, Palaiseau, France

A Spatially Modeless surface emitting Laser Cavity based on III-V Semiconductor technology has been designed and studied. Localized light structures have been observed and study. On and Off axis light wave emission have been observed.

CB-P.15 10:00 TRACK 2

Sensitivity to High Energy Proton Irradiation of 650 nm Vertical Cavity Surface Emitting LASERs in emitter and receiver mode — •Heinz-Christoph Neitzert — Salerno University, Dept. of Industrial Engineering, Fisciano (SA), Italy

Good stability of 650nm VCSELs under high energy proton irradiation for emitter operation was observed. An irradiation induced increase of the reverse bias current, however, could limit the possible device operation in avalanche receiver mode.

CB-P.16 10:00 TRACK 2

Gain-Switched Laser Self-Injection Locked to a WGM Microresonator — •Artem Shitikov[1], Valery Lobanov[1], Nikita Kondratiev[1], Ilya Gorelov[2], and Igor Bilenko[1,2] — [1]Russian Quantum Center, Moscow, Russia — [2]M.V. Lomonosov Moscow State University, Moscow, Russia

We demonstrated experimentally that gain-switched operation is possible in the self-injection locking regime. It allowed to generate optical frequency combs with line spacing equal to modulation frequency from kHz up to GHz.

CB-P.17 10:00 TRACK 2

Hybrid integration of InAs/GaAs quantum dot microdisk lasers on silicon — •Natalia Kryzhanovskaya[1], Eduard Moiseev[1], Anna Dragunova[1], Fedor Zubov[1,2], Mikhail Maximov[1,2], Nikolay Kalyuzhnyy[3], Sergey Mintairov[3], Marina Kulagina[3], Alexey Nadtochiy[1], and Alexey Zhukov[1] — [1]HSE University, St.Petersburg, Russia — [2]Alferov University, St.Petersburg, Russia — [3]Ioffe Institute, St.Petersburg, Russia

We demonstrated cw lasing of injection-pumped microdisk quantum dot lasers transferred to silicon. The hybrid integration method allows individual addressing to a microdisk. The electrical, threshold, spectral, and thermal characteristics of a microlaser transferred to silicon remains unchanged.

CB-P.18 10:00 TRACK 2

High-power pulsed semiconductor lasers (905 nm) with an ultra-wide aperture (800 μm) based on epitaxially integrated triple heterostructures — Sergey Slipchenko[1], •Alexander Podoskin[1], Polina Gavrina[1], Nikita Pikhtin[1], Petr Kop'ev[1], Timur Bagaev[2], Maxim Ladugin[2], Anatoliy Padalitsa[2], and Alexander Marmalyuk[2] — [1]Ioffe Institute, Saint-Petersburg, Russia — [2]Stel'makh Research and Development Institute "Polyus", Moscow, Russia

High-power pulsed ultra-wide-aperture (800 μm) semiconductor lasers (905 nm) based on epitaxially integrated triple heterostructures are developed. A slope of 2.2-2.9 W/A and a peak power of 216 W are observed at 90 A/100 ns.

CB-P.19 10:00 TRACK 2

Spatiotemporal stabilization and field localization in Edge-Emitting laser bars by PT-symmetric potentials — •Judith Medina[1], Ramon Herrero[1], Muriel Botey[1], and Kestutis Staliunas[1,2] — [1]Departament de Física, Universitat Politècnica de Catalunya (UPC), Barcelona, Spain — [2]. Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We propose to control the intrinsic spatiotemporal turbulent dynamics of an array of edge-emitting semiconductor lasers by a PT-symmetric coupling between neighbouring lasers. Numerical simulations show temporal stabilization and spatial concentration of the output emission.

CB-P.20 10:00 TRACK 2

Generation of fast physical periodic patterns with high intra-pattern diversity using semiconductor lasers with optical feedback — •Apostolos Argyris[1], Janek Schwind[1,2], and Ingo Fischer[1] — [1]Instituto de Física Interdisciplinar y Sistemas Complejos IFISC (CSIC-UIB), Palma de Mallorca, Spain — [2]Institute of Applied Physics, University of Münster, Münster, Germany

We show that semiconductor lasers with short optical feedback can emit periodic signals that consist of equidistant frequency tones. By tuning the tones' relative power, we generate sub-nanosecond, clock-free, repetitive patterns with high intra-pattern diversity.

CB-P.21 10:00 TRACK 2

Simultanious generation of pulse trains with different periods in a class C quantum-dot heterolaser — •Vladimir Kocharovsky[1], Alexey Mishin[1], Vitaly Kocharovsky[1,2], Ekaterina Kocharovskaya[1], and Alexey Seleznev[1] — [1]Institute of Applied Physics, Russian Academy of Science, Nizhny Novgorod, Russia — [2]Department of Physics and Astronomy, Texas A\& M University, College Station, USA

We find an intriguing regime of simultaneous emission of different quasiperiodic pulse trains in a class C heterolaser that supports two or more superradiant or automodulated modes as well as many quasi-stationary, partially self-locked modes.

CI-P: CI Poster Session

Time: Monday, 10:00–11:00 Location: TRACK 3

CI-P.1 10:00 TRACK 3

Interferometric Coupling-based Modulator for Large-Scale Integrated Photonic Systems — Enxiao Luan, Sreenil Saha, Behrooz Semnani, Mahsa Salmani, and •Armaghan Eshaghi — Huawei Canada, Toronto, Canada

In this design, two symmetic interferometric-couplers, containing active index modulation elements inside, are introduced to the add-drop microring modulator for an intensity tuning purpose at a fixed wavelength, which eliminates the optical crosstalk issue.

CI-P.2 10:00 TRACK 3

Fast eigenvalue evaluation of the direct Zakharov-Shabat problem in telecommunication signals using adaptive phase jump tracking — •Igor Chekhovskoy[1], Sergey Medvedev[2,1], Irina Vaseva[2,1], Egor Sedov[1,3], and Mikhail Fedoruk[1,2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Federal Research Center for Information and Computational Technologies, Novosibirsk, Russia — [3]Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom

We propose a new fast method with adaptive step size (phase jump tracking) for determining the discrete spectrum of the Zakharov-Shabat problem. This method is based on moving on a complex plane along special trajectories.

CI-P.3 10:00 TRACK 3

Low-power sub-diffraction optical data storage using lanthanide-doped upconversion nanoparticles — •Simone Lamon[1,2], Yiming Wu[3], Qiming Zhang[1], Xiaogang Liu[3,4], and Min Gu[1,2] — [1]Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai 200093, China, Shanghai, China — [2]Laboratory of Artificial-Intelligence Nanophotonics, School of Science, RMIT University, Melbourne 3001, Australia, Melbourne, Australia — [3]Department of Chemistry, National University of Singapore, Singapore, 117543, Singapore, Singapore, Singapore — [4]The N.1 Institute for Health, National University of Singapore, Singapore, 117456, Singapore, Singapore, Singapore

Far-field super-resolution optical techniques show the potential for sub-diffraction three-dimensional optical data storage towards petabyte-level single-disk capacity. We present low-power sub-diffraction optical data storage using lanthanide-doped upconversion nanoparticles in a polymer matrix based nanocomposite.

CI-P.4 10:00 TRACK 3

Multicolor Tunable Photonic Reservoir Computing — •Behrooz Semnani, Mahsa Salmani, Enxiao Luan, Sreenil Saha, and Armaghan Eshaghi — Huawei Technologies , Toronto, Canada

This paper proposes a new on-chip photonic reservoir computing platform which employs frequency parallelization combined with on-chip photonic matrix multiplication arrangements to significantly boost the computational power of the reservoir.

CI-P.5 10:00 TRACK 3

Noise properties of cascaded optical majority gates — •Elena Volkova, Sergey Kontorov, Vladimir Lyubopytov, Tuomo von Lerber, Franko Küppers, and Arkady Shipulin — Skolkovo Institute of Science and Technology, Moscow, Russia

Noise development in a chain of optical majority gates is investigated numerically. Dynamics of semiconductor lasers is studied in the frame of Lang-Kobayashi equations with noise. A maximum possible number of cascaded optical gates is determined.

CI-P.6 10:00 TRACK 3

Convolutional Neural Networks with Multiple Layers per Span for Nonlinearity Mitigation in Long-Haul WDM Transmission Systems — •Oleg Sidelnikov[1], Alexey Redyuk[1,2], Stylianos Sygletos[3], Mikhail Fedoruk[1,2], and Sergei Turitsyn[1,3] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Federal Research Center for Information and Computational Technologies, Novosibirsk, Russia — [3]Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom

In this work, we study the effect of the number of deep convolutional neural network layers on the efficiency of nonlinear distortion compensation in long-haul WDM transmission systems.

CI-P.7 10:00 TRACK 3

Complex fully connected neural networks for nonlinearity compensation in long-haul transmission systems — •Stepan Bogdanov and Oleg Sidelnikov — Novosibirsk State University, Novosibirsk, Russia

The complex-valued fully connected neural networks are applied for nonlinearity compensation in fiber optic communication systems. The superiority of a such approach over the real-valued neural networks and linear compensation schemes is demonstrated.

CI-P.8 10:00 TRACK 3

Ultra-Broadband Beam Splitting in Three-Waveguide System with Dissipation — Rim Alrifai[1], Virginie Coda[1], Jonathan Peltier[1], Andon Rangelov[2], and •Germano Montemezzani[1] — [1]Université de Lorraine, CentraleSupélec, LMOPS, Metz, France — [2]Department of Physics, Sofia University, Sofia, Bulgaria

Light dissipation in the central of three parallel waveguides permits to achieve ultra-broadband beam splitting with an overall 3 dB loss. Analogy to quantum population transfer through a decaying intermediate state is addressed.

JSV-P: JSV Poster Session

Time: Monday, 10:00–11:00 Location: TRACK 4

JSV-P.1 10:00 TRACK 4

Focusing light through a free-form scattering medium — •Alfredo Rates[1], Aurèle J. L. Adam[2], Wilber L. IJzerman[3,4], Ad Lagendijk[1], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Optics Research Group, Department of Imaging Physics, Delft University of Technology, Delft, Netherlands — [3]CASA, Department of Mathematics and Computer Science, Eindhoven University of Technology, Eindhoven, Netherlands — [4]Signify Research, Eindhoven, Netherlands

We use wavefront shaping to enhance the intensity in a free-form sample, comparing the efficiency when the sample is flat and when the sample is curved.

JSV-P.2 10:00 TRACK 4

Highly emissive point-like source of white light based on graphene excited by a CW laser — •Mateusz Oleszko, Taras Hanulia, Przemyslaw Wiewiorski, Robert Tomala, and Wieslaw Strek — Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw, Poland

Point-source emitting broad spectrum of visible light was developed. Our study shows that the emissivity of a laser-induced light source is strongly dependent on morphology of the excited material.

EA-P: EA Poster Session

Time: Monday, 13:30–14:30 Location: TRACK 1

EA-P.1 13:30 TRACK 1

Echoes in a Single Quantum Kerr-nonlinear Oscillator — •Ilia Tutunnikov, Rajitha Viswambharan, and Ilya Sh. Averbukh — Weizmann Institute of Science, Rehovot, Israel

We theoretically study the echo phenomenon in a single impulsively excited ("kicked") Kerr-nonlinear oscillator. These echoes may be useful for studying decoherence processes in a number of systems related to quantum information processing.

EA-P.2 13:30 TRACK 1

Mixing of Multi-Spectral Quantum States Generated in a Single Pulse with a Dispersion-Engineered Nonlinear Waveguide Crystal — •Yuta Yamagishi[1], Aruto Hosaka[1], Kazufumi Tanji[1], Sunao Kurimura[2], and Fumihiko Kannari[1] — [1]Keio University, Yokohama, Japan — [2]National Institute for Materials Science, Tsukuba, Japan

As a method of quantum pulse gating in a quantum simulator, an arbitrary mixing method of multimode quantum states prepared in the frequency domain is experimentally demonstrated.

EA-P.3 13:30 TRACK 1

Dynamics of ultrafast twin beam generation in gas-filled hollow-core photonic crystal fibres — •Markus Lippl[1,2], Maria V. Chekhova[1,2], and Nicolas Y. Joly[1,2,3] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany — [3]Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany

We study the dynamics of twin-beam generation by 300 fs pulses at 808 nm in Xe-filled hollow-core photonic crystal fibre, focusing on the evolution of the time-frequency Schmidt modes an the joint spectral intensity.

EA-P.4 13:30 TRACK 1

Implementing observation-dependent enhancement and suppression of two-photon coincidences in the Hong-Ou-Mandel experiment — •Max Ehrhardt, Matthias Heinrich, and Alexander Szameit — Universität Rostock, Institut für Physik, Rostock, Germany

We investigate the Hong-Ou-Mandel interference of photon pairs in birefringent waveguides with polarization-dependent losses. Depending on the detection basis, we show seamless tunability all the way from enhancement to full suppression of indistinguishable photons.

EA-P.5 13:30 TRACK 1

Fiber Source of Biphotons with Ultrabroad Frequency Tuneability — •Santiago Lopez-Huidobro[1,2], Markus Lippl[1,2], Nicolas Joly[2,1,3], and Maria V. Chekhova[1,2] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]University of Erlangen-Nuremberg, Erlangen, Germany — [3]Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany

We report a correlated photon-pair source with an ultrabroad frequency tuneability produced in a gas-filled hollow-core photonic crystal fiber based on a four-wave mixing process, where the phase matching strongly depends on the gas pressure.

EA-P.6 13:30 TRACK 1

Coherence of a dynamically decoupled single neutral atom — Chang Hoong Chow[1], •Boon Long Ng[1], and Christian Kurtsiefer[1,2] — [1]Center for Quantum Technologies, 3 Science Drive 2, Singapore — [2]Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore

We apply dynamical-decoupling on magnetic-sensitive ground states of ^{87}Rb atom, motivated by the availability of closed optical transition with the excited state. Coherence time of 7ms is achieved, indicating improvement over two orders of magnitude.

EA-P.7 13:30 TRACK 1

Quantum advantage in interferometry using single photons emitted from 2D hexagonal boron nitride — •Tobias Vogl[1,2], Heiko Knopf[1,3], Maximilian Weissflog[1], Ping K. Lam[4], and Falk Eilenberger[1,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University, Jena, Germany — [2]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [3]Fraunhofer-Institute for Applied Optics and Precision Engineering IOF, Jena, Germany — [4]Department of Quantum Physics, Australian National University, Canberra, Australia

We present a test of Born's rule using a multi-path interferometer and a quantum light source based on microcavity-integrated hexagonal boron nitride. Using single photon states leads to a fundamental quantum advantage over coherent states.

EA-P.8 13:30 TRACK 1

Broadband Mid-IR Spectroscopy with Near-IR Grating Spectrometers — •Paul Kaufmann[1], Helen Chrzanowski[1], Aron Vanselow[1,2], and Sven Ramelow[1,3] — [1]Humboldt-Universität zu Berlin, Berlin, Germany — [2]Inria Paris, Paris, France — [3]IRIS Adlershof, Berlin, Germany

We demonstrate fast, mid-infrared (3.2-4.3 μm) spectroscopy with high resolution (1.5 cm−1) based on nonlinear interferometry with undetected photons using a commercial, Si-CCD based grating spectrometer.

EA-P.9 13:30 TRACK 1

Engineered Correlated Loss For an Integrated Source of Photon Pairs with ∼ 100 dB Pump Self-Rejection — •Pablo de la Hoz[1], Anton Sakovich[2], Alexander Mikhalychev[2], Matthew Thornton[1], Natalia Korolkova[1], and Dmitri Mogilevtsev[2] — [1]School of Physics and Astronomy, University of St Andrews, North Haugh KY16 9SS, St Andrews , United Kingdom — [2]B. I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Nezavisimosti Ave. 68-2, 220072, Minsk, Belarus

We present a theoretical proposal for the design of an integrated source of entangled photon pairs which feature an in-built mechanism for an on-chip pump suppression level exceeding 100dB

EA-P.10 13:30 TRACK 1

Spectral density and non Markovianity in optical quantum complex network — •Paul Renault[1], Johannes Nokkala[2], Francesco Arzani[1], Thibault Michel[1,4], Ganael Roeland[1], Alex Davis[1], Roberta Zambrini[3], Sabrina Maniscalco[2], Nicolas Treps[1], Jyrki Piilo[2], and Valentina Parigi[1] — [1]Laboratoire Kastler Brossel, Sorbonne University, Paris, France — [2]Turku Centre for Quantum Physics, Turku, Finland — [3]IFISC (UIB-CSIC), Instituto de Fisica Interdisciplinar y Sistemas Complejos, Palma de Mallorca, Spain — [4]Department of Quantum Science, ANU, Canberra, Australia

Multimode optical parametric processes can be tailored and arranged as complex quantum networks. Here we show experimental results for the simulation of structured environments and the probing of their spectral density and non-Markovianity

EA-P.11 13:30 TRACK 1

Towards waveshape-insensitive flying qubit gates — •Ihar Babushkin, Uwe Morgner, and Ayhan Demircan — Institute of Quantum Optics, Leibniz University, Welfengarten 1, 30167, Hannover, Germany

We show that so-called coherent photon conversion, together with a network of linear optical elements allow for gates processing photons correctly independently on the temporal/spatial waveshape of photons or correlations between them.

EA-P.12 13:30 TRACK 1

Direct measurement of the photon exchange phase — •Konrad Tschernig[1,2], Chris Müller[2,3], Malte Smoor[3], Tim Kroh[2,3], Janik Wolters[4,5], Oliver Benson[2,3], Kurt Busch[1,2], and Armando Pèrez-Leija[1,2] — [1]Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Berlin, Germany — [2]Institut für Physik, Humbold-Universität zu Berlin, Berlin, Germany — [3]IRIS Adlershof, Humbold-Universität zu Berlin, Berlin, Germany — [4]Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Berlin, Germany — [5]Technische Universität Berlin, Berlin, Germany

We report the measurement of the particle exchange phase of photons, providing direct evidence for the bosonic symmetry of two-photon wavefunctions and revealing the geometric phase $\phi_g = \pi$ associated with the physical exchange of two particles.

EA-P.13 13:30 TRACK 1

Ultra-Wide Photon-Pair Source in the Mid-Infrared on a Silicon Chip — •Lawrence M. Rosenfeld, Sabine Wollmann, Jonathan C. F. Matthews, and John G. Rarity — Quantum Engineering Technology Labs, University of Bristol, Bristol, United Kingdom

Photon-pair sources are fundamental to integrated quantum photonics. We demonstrate a silicon intermodal photon source pumped at 2.09 um generating photons at 1.53 um realising ultra-wide spectral detuning. This work enables new sensing technologies on-chip.

EA-P.14 13:30 TRACK 1

Position-controlled quantum emitters with reproducible emission wavelength in hBN — •Clarisse Fournier, Alexandre Plaud, Sébastien Roux, Stéphanie Buil, Xavier Quélin, Julien Barjon, Jean-Pierre Hermier, and Aymeric Delteil — Université Paris-Saclay, UVSQ, CNRS, GEMaC, Versailles, France

We demonstrate deterministic activation of quantum emitters in the bidimensional material hBN (hexagonal boron nitride) using an electron beam. The single photon sources exhibit narrow and reproducible emission that persists up to room temperature.

EB-P: EB Poster Session

Time: Monday, 13:30–14:30 Location: TRACK 2

EB-P.1 13:30 TRACK 2

Advances on Chip-Based QKD in Bristol Quantum Network — •Djeylan Aktas[1], Lawrence Rosenfeld[1], Friederike Jöhlinger[2], Elliott Hastings[2], and John G. Rarity[1] — [1]Quantum Engineering Technology Labs, H. H. Wills Physics Laboratory & Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom — [2]Quantum Engineering Technology Labs & Quantum Engineering Centre for Doctoral Training, Centre for Nanoscience and Quantum Information, Bristol, United Kingdom

Integrated Photonics provide compact platform to implement photonic circuits amenable to manufacture thus providing a compelling technology to implement QKD. We are developing devices for QKD systems allowing for a scalable approach in Quantum Networks.

EB-P.2 13:30 TRACK 2

The Multi-Output Quantum Pulse Gate: a Novel High-Dimensional QKD Decoder — Jano Gil-Lopez, •Laura Serino, Matteo Santandrea, Werner Ridder, Vahid Ansari, Benjamin Brecht, and Christine Silberhorn — Integrated Quantum Optics Group, Institute for Photonic Systems (PhoQS), Paderborn University, Paderborn, Germany

We present an integrated engineered sum-frequency generation process that enables to decode information encoded in temporal modes of photons. This provides a reading device for high-dimensional, temporal-mode-based quantum key distribution compatible with standard telecom systems.

EB-P.3 13:30 TRACK 2

A portable and compact decoy-state QKD sender — •Michael Auer[1,2,3], Peter Freiwang[1,2], Adomas Baliuka[1,2], Maximilian Schattauer[1], Lukas Knips[1,2,4], and Harald Weinfurter[1,2,4] — [1]Ludwig-Maximilians-Universität, 80797 München, Germany — [2]Munich Center for Quantum Science and Technology, 80799 München, Germany — [3]Universität der Bundeswehr München, 85577 Neubiberg, Germany — [4]Max-Planck-Institut für Quantenoptik, 85748 Garching, Germany

We present a small-size, low-power QKD sender capable of running the decoy protocol by electrically modulating the intensity of four VCSELs, fully preserving timing accuracy as well as pulse-shape even for a 100MHz repetition rate.

EB-P.4 13:30 TRACK 2

On the Impact of Center Frequency Drifts on QKD Performance in WDM-based Nodes — •Dimitris Zavitsanos[1], Argiris Ntanos[1], Panagiotis Toumasis[1], Adam Raptakis[1], Konstantinos Tokas[1], Konstantina Kanta[1], Christos Kouloumentas[1,2], Giannis Giannoulis[1], and Hercules Avramopoulos[1] — [1]School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece — [2]Optagon Photonics, Ag. Paraskevi 15341, Athens, Greece

We study on the frequency shift impact on the performance of a BB84 QKD link by experimentally addressing the total photon count rate associated with the spectral leakage factor in a WSS-based node.

EB-P.5 13:30 TRACK 2

Optical Ranging using a Subthreshold Laser Diode — •Peng Kian Tan[1] and Christian Kurtsiefer[1,2] — [1]Centre for Quantum Technologies, Singapore, Singapore — [2]National University of Singapore, Singapore, Singapore

Thermal light exhibits photon bunching behaviour, which can be used for timing correlation despite being a stationary source. This property is demonstrated in an optical ranging experiment using a laser diode operating below lasing threshold.

EB-P.6 13:30 TRACK 2

Distributed Coherent Absorption in Quantum Networks for Deterministic Entanglement Generation — •Anton N. Vetlugin[1], Ruixiang Guo[1], Cesare Soci[1], and Nikolay I. Zheludev[1,2] — [1]Nanyang Technological University, Singapore, Singapore — [2]University of Southampton, Southampton, United Kingdom

We demonstrate that distributed coherent absorption offers a robust and efficient way to generate quantum entanglement in multi-nodal quantum networks. Proof-of principle experiment in a bi-nodal network is reported.

EB-P.7 13:30 TRACK 2

Sub-diffraction near-field imaging with undetected photons using thin sources of photon pairs — •Elkin A. Santos[1], Sina Saravi[1], Andres Vega[1], Thomas Pertsch[1,2], and Frank Setzpfandt[1] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We propose an imaging scheme with undetected photons that goes beyond the diffraction limit by transferring near-field information at one wavelength to a far-field information at its paired wavelength in an ultrathin photon-pair source.

EB-P.8 13:30 TRACK 2

SPAD array with high spatial resolution for quantum imaging — •André Stefanov[1], Bänz Bessire[1], Manuel Unternährer[1], Bruno Eckmann[1], Leonardo Gasparini[2], and Matteo Perenzoni[2] — [1]Institute of Applied Physics, Bern, Switzerland — [2]Fondazione Bruno Kessler FBK,, Trento, Italy

We present a new SPAD array sensor capable of detecting high order correlations between photons with high temporal (sub-nanosecond) and spatial (224 x 272 pixels) resolution.

EB-P.9 13:30 TRACK 2

Information Analysis for Quantum Imaging Optimization — •Alexander Mikhalychev[1], Ilya Karuseichyk[1], Svetlana Vlasenko[1], Bänz Bessire[2], Dmitry Lyakhov[3], Dominik Michels[3], André Stefanov[2], and Dmitri Mogilevtsev[1] — [1]B.I. Stepanov Institute of Physics of NAS of Belarus, Minsk, Belarus — [2]King Abdullah University of Science and Technology, Thuwal, Saudi Arabia — [3]Institute of Applied Physics, University of Bern, Bern, Switzerland

We apply an information-based approach to optimization of several imaging schemes (SOFI and quantum imaging with biphotons and pseudo-thermal light) and show that maximal resolution corresponds to finite correlations order and correlation length of photons.

EB-P.10 13:30 TRACK 2

A General Framework for Multimode Gaussian Quantum Optics and Photodetection — •Oliver F. Thomas[1,2], Will McCutcheon[1,3], and Dara P. S. McCutcheon[1] — [1]H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom — [2]Quantum Engineering Centre for Doctoral Training, H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom — [3] BBQLabs, Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We develop a broadly applicable framework of multimode Gaussian optics and photon detection to uncover previously unknown trade-offs and limitations of single photon sources based on non-linear parametric processes including interference visibilities and generation rates.

EB-P.11 13:30 TRACK 2

Optimization of a cavity-QED system for fast two-qubit gates — •Rui Asaoka[1], Takeru Utsugi[2], Yuuki Tokunaga[1], Rina Kanamoto[3], and Takao Aoki[2] — [1]NTT Secure Platform Laboratories, NTT Corporation, Tokyo, Japan — [2]Department of Applied Physics, Waseda University, Tokyo, Japan — [3]Department of physics, Meiji University, Kanagawa, Japan

We model and analyze the error due to the distortion of photon pulse in a controlled phase flip gate using cavity quantum electrodynamics. From this analysis, we found that cavity length has an optimal value.

EB-P.12 13:30 TRACK 2

Towards Conditional Quantum Phase Gates Based on Strongly-Coupled Charged Quantum Dot-Micropillar Cavities — •Michael Haider[1], Mirella Koleva[2], Oliver Maier[3], Kai Müller[1], Christian Jirauschek[1], and Gabriela Slavcheva[2,3] — [1]Technical University of Munich, Munich, Germany — [2]Quantopticon Ltd., London, United Kingdom — [3]Johannes Kepler University Linz, Linz, Austria

We investigate polarization rotation of light transmitted through a single negatively charged quantum dot inside a high-Q micropillar cavity, operating in the strong coupling regime. The rotation angle is approximately 127 degrees.

EB-P.13 13:30 TRACK 2

Efficient and stable fiber-to-chip coupling enabling the injection of telecom quantum dot photons into a silicon photonic chip — •Stephanie Bauer[1], Dongze Wang[1], Niklas Hoppe[2], Cornelius Nawrath[1], Julius Fischer[1], Simone L. Portalupi[1], Michael Jetter[1], Manfred Berroth[2], and Peter Michler[1] — [1]Institut für Halbleiteroptik und Funktionelle Grenzflächen (IHFG), Center for Integrated Quantum Science and Technology (IQst) and SCoPE, University of Stuttgart, Stuttgart, Germany — [2]Institute of Electrical and Optical Communications Engineering, University of Stuttgart, stuttgart, Germany

Here, we present an efficient and stable fiber-to-chip coupling, which enables the injection of single photons from telecom quantum dots into an SOI photonic chip. A proof-of-principle Hanbury-Brown and Twiss measurement was performed to demonstrate single-photon behavior.

EB-P.14 13:30 TRACK 2

Green laser threshold magnetometry based on absorption by nitrogen-vacancy centers in a diamond within an external cavity laser — James Webb[1], •Andreas Poulsen[1], Robert Staacke[2], Jan Meijer[2], Kirstine Berg-Sørensen[3], Ulrik Andersen[1], and Alexander Huck[1] — [1]Center for Macroscopic Quantum States (BigQ), Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]Division of Applied Quantum System, Felix Bloch Institute for Solid State Physics, Leipzig University, Leipzig, Germany — [3]Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark

We investigate the use of green pump absorption by nitrogen-vacancy centers in an external cavity for laser threshold magnetometry. Sensitivities in the $\mathrm{pT}/\sqrt{\mathrm{Hz}}$ range are predicted using realistic cavity and material parameters.

EB-P.15 13:30 TRACK 2

Coupling Erbium Dopants to Nanophotonic Silicon Structures — •Andreas Gritsch[1,2], Lorenz Weiss[1,2], Johannes Früh[1,2], Florian Burger[1,2], Stephan Rinner[1,2], and Andreas Reiserer[1,2] — [1]Max-Planck-Institut für Quantenoptik, Garching, Germany — [2]Munich Center for Quantum Science and Technology (MCQST), Ludwig-Maximilians-Universität München, München, Germany

We implanted erbium dopants into nanophotonic silicon waveguides and cavities. We observe incorporation at well-defined lattice sites with narrow linewidths which is promising for the implementation of a scalable platform for distributed quantum information processing.

EB-P.16 13:30 TRACK 2

Nuclear spin precession in MEMS vapour cells - key element of a nuclear magnetic resonance gyroscope — •Janine Riedrich-Moeller, Riccardo Cipolletti, Marc Schmid, Thomas Buck, Robert Roelver, and Tino Fuchs — Robert Bosch GmbH, Corporate Sector Research and Advance Engineering, Advanced Technologies and Micro Systems, Renningen, Germany

We report on free-induction decay measurements of nuclear spin precession of Xenon atoms confined in a small-sized vapour cell. The experiment is an important step towards the realization of a compact nuclear magnetic resonance gyroscope.

EB-P.17 13:30 TRACK 2

On chip time-resolved multiphoton interference — •Patrick Yard, Alex Jones, Stefano Paesani, Jacob Bulmer, and Anthony Laing — University of Bristol, Bristol, United Kingdom

We use fast detection to interfere spectrally distinguishable photons, emitted from integrated silicon microring resonators. We model this interference, including realistic experimental errors, and show a statistical fidelity with our data of 95%.

EB-P.18 13:30 TRACK 2

Single-shot integrated multi-photon split state tomography — •Jihua Zhang and Andrey A. Sukhorukov — ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Nonlinear Physics Centre, Research School of Physics, The Australian National University, Canberra, Australia

We propose a segmented coupled waveguide array as a new form of compact optical quantum circuit and apply it for the on-chip multi-photon split state tomography with optimized performance and no need of reconfigurability.

EB-P.19 13:30 TRACK 2

Complex two-mode quadratures - a generalized formalism for continuous-variable quantum optics — •Leon Bello[1], Yoad Michael[1], Michael Rosenbluh[1], Eliahu Cohen[2], and Avi Pe'er[1] — [1]Department of Physics and BINA Center of Nanotechnology, Bar-Ilan University, Ramat Gan, 5290002, Israel — [2]Faculty of Engineering and BINA Center of Nanotechnology, Bar-Ilan University, Ramat Gan, 5290002, Israel

We introduce a set of complex quadrature operators that treats degenerate and non-degenerate squeezing on the same footing. These complex operators describe the SU(1,1) algebra of two-photon devices and directly relate to observable physical quantities.

EB-P.20 13:30 TRACK 2

Continuous variable multimode quantum states via symmetric group velocity matching — •Victor Roman-Rodriguez[1], Benjamin Brecht[2], Srinivasan Kaali[3], Christine Silberhorn[2], Nicolas Treps[3], Eleni Diamanti[1], and Valentina Parigi[3] — [1]LIP6, Sorbonne Universite, Paris, France — [2]Integrated Quantum Optics Group, Paderborn University, Paderborn, Germany — [3]Laboratoire Kastler Brossel, Sorbonne Universite, Paris, France

In this work, we study the symmetric group velocity matching condition and the engineering of multimode spectral parameters in non-linear waveguides to generate scalable and configurable continuous variable optical quantum networks via ultrafast parametric down-conversion.

EB-P.21 13:30 TRACK 2

Sensing a THz Electric Field with Cold and Trapped Molecular Ions — •Florin Lucian Constantin — Laboratoire PhLAM, CNRS UMR 8523, University of Lille, Villeneuve d'Ascq, France

Comparison of two-photon rovibrational spectroscopy measurements of trapped and laser-cooled HD^+ ions with ab-initio quantum theory predictions may enable improved characterization of the amplitudes and phases of the Cartesian components of a THz electric field.

EB-P.22 13:30 TRACK 2

Nolinear Transmission Line Model of a Josephson Traveling-Wave Parametric Amplifier including Noise and Dissipation — •Yongjie Yuan, Michael Haider, Johannes Russer, Peter Russer, and Christian Jirauschek — Technical University of Munich, Munich, Germany

We present a nonlinear transmission line model for a Josephson traveling-wave parametric amplifier including noise and dissipation. Telegrapher's equations are derived for a nonlinear transmission line including resistive losses and noise in the substrate.

EB-P.23 13:30 TRACK 2

Non-Local Control of Light Dissipation with Pancharatnam-Berry Phase — •Ruixiang Guo[1], Anton N. Vetlugin[1], Cesare Soci[1], and Nikolay I. Zheludev[1,2] — [1]Centre for Disruptive Photonic Technologies, Nanyang Technological University,, singapore, Singapore — [2]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, , Southampton , United Kingdom

We experimentally demonstrate for the first time that absorption of one of the photons from the entangled pair can be switched on and off by controlling the Pancharatnam-Berry phase of the other photon

EB-P.24 13:30 TRACK 2

Temporal Resolution of Partially Coherent Sources — •Syamsundar De[1], Jano Gil-Lopez[1], Benjamin Brecht[1], Christine Silberhorn[1], Luis L. Sánchez[2,3], Zdeněk Hradil[4], and Jaroslav Řeháček[4] — [1]Paderborn University, Paderborn, Germany — [2]Universidad Complutense, Madrid, Spain — [3] Max-Planck-Institut für die Physik des Lichts, Erlangen, Germany — [4]Palacký University, Olomouc, Czech Republic

The impact of coherence on the resolution limit is subject to current debate. Here, we unambiguously resolve this dispute by realizing precise measurements of the time-shift between optical pulses with varying degrees of mutual coherence.

EB-P.25 13:30 TRACK 2

Dissipative phase transition in systems with two-photon driving and dissipation near the critical point — •Valentin Yu. Mylnikov, Sergey O. Potashin, Grigorii S. Sokolovskii, and Nikita S. Averkiev — Ioffe Institute, St. Petersburg, Russia

We study dissipative phase transition near the critical point for a system with two-photon driving and dissipation and predict the power-law behavior of the anomalous average both theoretically and with numerical simulations.

EB-P.26 13:30 TRACK 2

Variation of the Hong-Ou-Mandel interference dip with crystal length — •Sandeep Singh[1,2], Varun Sharma[1], Vimlesh Kumar[1], and G.K. Samanta[1] — [1]Photonic Sciences Lab., Physical Research Laboratory, ahmedabad, India — [2]Indian Institute of Technology-Gandhinagar, Gandhinagar, India

We experimentally studied the variation of Hong-Ou-Mandel (HOM) interference characteristics with the length of the nonlinear crystal producing single photons and achieved a HOM dip of width as narrow as 8.2 ± 0.2 μm using continuous-wave pumping.

EB-P.27 13:30 TRACK 2

Divergence of single photons with different orbital angular momentum — •Vimlesh Kumar, Varun Sharma, Sandeep Singh, and G.K. Samanta — Physical Research Laboratory, Ahmedabad, India

We experimentally measure the divergence of single-photon carrying different orbital-angular-momentum (OAM). Using vortex beam pumped parametric-down-conversion process, we observed that the single-photons detected through the coincidence imaging has OAM dependence divergence similar to the pump.

EB-P.28 13:30 TRACK 2

Coupling light to higher order transverse modes of a near-concentric optical cavity — Adrian Nugraha Utama[1], •Chang Hoong Chow[1], Chi Huan Nguyen[1], and Christian Kurtsiefer[1,2] — [1]Centre for Quantum Technologies, 3 Science Drive 2, Singapore — [2]Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore

We investigate the mode matching to selective higher order transverse modes in a near-concentric cavity by shaping the wavefront of an incoming Gaussian beam using a phase spatial light modulator.

EB-P.29 13:30 TRACK 2

Pulsed double-pass tapered amplifier for a multi-rail quantum memory in warm Cs vapor — •Leon Meßner[1,2], Luisa Esguerra[1,2], Mustafa Gündoğan[3,1], and Janik Wolters[1,2] — [1]Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Optical Sensor Systems, Berlin, Germany — [2]Technische Universität Berlin, Institut für Optik und Atomare Physik, Berlin, Germany — [3]Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany

We present a laser source for use in multi-rail EIT quantum memory experiments in warm Cs vapor cells.

EJ-P: EJ Poster Session

Time: Monday, 13:30–14:30 Location: TRACK 3

EJ-P.1 13:30 TRACK 3

Modelling Analytically the Dynamic Response of Thermo-Optic Phase Shifters — •Andrea Crespi[1,2], Simone Atzeni[1,2], Ciro Pentangelo[1,2], Francesco Ceccarelli[2,1], and Roberto Osellame[2,1] — [1]Dipartimento di Fisica - Politecnico di Milano, Milano, Italy — [2]Istituto di Fotonica e Nanotecnologie - Consiglio Nazionale delle Ricerche (IFN-CNR), Milano, Italy

We develop an analytical model for heat diffusion that describes both static and dynamic responses of thermo-optic phase shifters. This model works in typical geometrical settings of waveguide devices and fits to different fabrication platforms.

EJ-P.2 13:30 TRACK 3

Simulating physics of tomographically reconstructed photonic crystals — •Lars J. Corbijn van Willenswaard[1,2], Jens Wehner[3], Nicolas Renaud[3], Matthias Schlottbom[2], Peter Cloetens[4], Jaap J.W. van der Vegt[2], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Mathematics of Computational Science (MACS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [3]Netherlands eScience Center, Amsterdam, Netherlands — [4]ESRF–The European Synchrotron, Grenoble, France

Manufacturing effects make real photonic crystals structurally different from the design crystals used for computations. We propose a computation using the reconstructed geometry of a real crystal to overcome this difference.

EJ-P.3 13:30 TRACK 3

Multiscale FEM for light propagation through locally periodic complex photonic structures — •Marek Kozon[1,2], Lars J. Corbijn van Willenswaard[1,2], Willem L. Vos[1], Matthias Schlottbom[2], and Jaap J. W. van der Vegt[2] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Mathematics of Computational Science (MACS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands

Computational modelling of realistic photonic crystals is a notoriously difficult problem, especially due to its multiscale character. Here, we propose a multiscale FEM method to tackle this issue and apply it to several research problems.

EJ-P.4 13:30 TRACK 3

Accurate beam propagation methods assisted by ray-tracing — •Alexandru Craciun[1,2] and Traian Dascalu[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Atomistilor 409, Magurele 077125, Romania — [2]Doctoral School of Physics, University of Bucharest, Atomistilor 405, Magurele 077125, Romania

We present a geometrical optics based propagation method that handles interference effects. We also present a version of Debye-Wolf integral, for which ray information is used to compute the amplitude strength factor and optical aberrations.

EJ-P.5 13:30 TRACK 3

Carrier dynamics in nitrogen-doped graphene under THz radiation — •Roozbeh Anvari and Marc M. Dignam — Department of Physics, Engineering Physics & Astronomy, Queen's university, Kingston, Canada

Our calculations show the time evolution of the intarband current density of various nitrogen-doped graphene structures in response to pulsed terahertz fields. Our results explore the role of doping in terahertz mobility, and harmonic generation.

EJ-P.6 13:30 TRACK 3

Optimizing the laser diode ray tracing model for LERP system simulation based on likelihood image sampling — •Elisavet Chatzizyrli[1,3], Moritz Hinkelmann[1,3], Angeliki Afentaki[1], Roland Lachmayer[1,2,3], Joerg Neumann[1,3], and Dietmar Kracht[1,3] — [1]Laser Zentrum Hannover e.V., Hanover, Germany — [2]Institute of Product Development, Leibniz University of Hanover, Hanover, Germany — [3]Cluster of Excellence PhoenixD, Hanover, Germany

A ray tracing laser source model based on likelihood image sampling from experimental beam profile measurements was developed, which shows improved accuracy in multimode laser-excited remote phosphor system simulations.

EJ-P.7 13:30 TRACK 3

Complete design of a fully integrated tunable graphene-based plasmon coupler for the infrared — Aswani Natarajan, Guillaume Demésy, and •Gilles Renversez — Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, 13013, Marseille, France

A fully integrated efficient and tunable surface plasmon coupler composed of a realistic non-tapered dielectric waveguide with graphene patches and sheet is designed for the infrared and optimized through rigorous numerical and theoretical studies.

PL-3: EQEC Plenary Talk and Award Ceremony

Time: Tuesday, 8:30–10:30 Location: TRACK 1

Plenary PL-3.1 8:30 TRACK 1

Attosecond Interferometry — •Nirit Dudovich — Weizmann Institute of Science, Rehovot, Israel

Attosecond interferometry reveals the internal coherence in ultrafast electronic phenomena. I will describe advanced interferometry schemes, resolving a range of processes – from tunneling and photoionization in atomic systems to ultrafast chiral phenomena and attosecond scale currents in solids.

Award Ceremony

EA-1: Waveguide-QED and Atom-light Interfaces

Chair: David Wilkowski, Centre for Quantum Technologies, Singapore

Time: Tuesday, 11:00–12:30 Location: TRACK 1

Oral EA-1.1 11:00 TRACK 1

Correlating Photons Using the Collective Nonlinear Response of Atoms Weakly Coupled to an Optical Mode — •Jürgen Volz[1,2], Adarsh Prassad[2], Jakob Hinney[2], Sahand Mahmoodian[3], Klemens Hammerer[3], Samuel Rind[2], Philipp Schneeweiss[1,2], Max Schemmer[1], Anders Sørensen[4], and Arno Rauschenbeutel[1,2] — [1]Humboldt-Universität zu Berlin, Berlin, Germany — [2]TU Wien-Atominstitut, Wien, Austria — [3]Leibniz University Hannover, Hannover, Germany — [4]University of Copenhagen, Copenhagen, Denmark

We demonstrate collective enhancement of weak atomic nonlinearities. This enhancement manifests itself as an atom number-dependent change of the second order correlation of the transmitted light from flat over photon anti-bunching to strong photon-bunching.

Oral EA-1.2 11:15 TRACK 1
Cold atoms trapped around a nanofiber: a tool to probe collective quantum phaenomena — •Jérémy Berroir[1], Tridib Ray[1], Neil V. Corzo[1], Jérémy Raskop[1], Dmitriy V. Kupriyanov[2], Alban Urvoy[1], and Julien Laurat[1] — [1]Laboratoire Kastler-Brossel, Sorbonne Université, CNRS, ENS-Université PSL, Collège de France, Paris, France — [2]Department of Theoretical Physics, St-Petersburg State Polytechnic University, St.-Petersburg, Russia
We report on storage and retrieval of a single collective excitation in an atomic ensemble coupled to an optical nanofiber. We show theoretical and experimental advances on controllable atomic Bragg mirrors and atomic cavity systems.

Oral EA-1.3 11:30 TRACK 1
Describing collectively enhanced nonlinearity in large ensemble of two-level emitters — •Martin Cordier, Max Schemmer, Philipp Schneeweiss, Jürgen Volz, and Arno Rauschenbeutel — Humboldt-Universität zu Berlin, Berlin, Germany
We present an intuitive analytical model that allows one to calculate, in the low saturation regime, the full temporal and spectral quantum state of light resulting from the interaction with N two-level emitters.

Oral EA-1.4 11:45 TRACK 1
Systematic design of a novel photonic crystal waveguide platform for coupling guided light with trapped cold atoms — •Adrien Bouscal[1], Alban Urvoy[1], Jérémy Berroir[1], Tridib Ray[1], Malik Kemich[2], Sukanya Mahapatra[2], Fabrice Raineri[2,3], Ariel Levenson[2], Kamel Bencheikh[2], Christophe Sauvan[4], Jean-Jacques Greffet[4], and Julien Laurat[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL, Collège de France, Paris, France — [2]Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, Palaiseau, France — [3]Université de Paris, Paris, France — [4]Laboratoire Charles Fabry, Institut d'Optique Graduate School, Université Paris-Saclay, Palaiseau, France
We present a proposal for trapping Rb cold atoms near a novel design of a GaInP photonic crystal waveguide. Purcell factors higher than unity are predicted for atoms sitting in the two-color dipole trap.

Oral EA-1.5 12:00 TRACK 1
Single-Photon Source with Near-Millisecond Memory based on Room-Temperature Atomic Vapour — •Michael Zugenmaier, Rebecca Schmieg, Karsten B. Dideriksen, and Eugene S. Polzik — Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark
We present a room-temperature single-photon source based on Raman scattering from an atomic vapour cell. The system features a built-in near-millisecond memory that allows deterministic and efficient conversion during readout.

Oral EA-1.6 12:15 TRACK 1
Spectroscopy of Rubidium with a Tuneable Single Photon Source — •Paul Burdekin[1], Samuele Grandi[1,2], Rielly Newbold[1], Rowan Hoggarth[1], Kyle Major[1], Edward Hinds[1], and Alex Clarke[1] — [1]Centre for Cold Matter, Blackett Laboratory, Imperial College London, London, United Kingdom — [2]ICFO, Barcelona, Spain
We present our work on single-photon-level spectroscopy of rubidium and on frequency-tuning the photon emission from dibenzoterrylene molecules. We discuss future plans to interface dibenzoterrylene emission with rubidium atoms to build a quantum memory.

EB-3: Photonic Quantum Computation
Chair: Christine Silberhorn, University of Paderborn, Paderborn, Germany

Time: Tuesday, 11:00–12:30 Location: TRACK 2

Invited EB-3.1 11:00 TRACK 2
The quest of quantum advantage with a photonics platform — •Fabio Sciarrino — Sapienza Università di Roma, Roma, Italy
Boson sampling is a computational problem that has been proposed as a candidate to obtain an unequivocal quantum computational advantage. We will review recent advances in photonic boson sampling, describing both the technological improvements achieved and the future challenges.

Oral EB-3.2 11:30 TRACK 2
Experimental demonstration of quantum advantage for NP verification — •Federico Centrone[1,2], Niraj Kumar[3], Eleni Diamanti[1], and Iordanis Kerenidis[3] — [1]Sorbonne Université, CNRS, LIP6, Paris, France — [2]Université de Paris, CNRS, IRIF, Paris, France — [3]School of Informatics, University of Edinburgh, Edinburgh, United Kingdom
We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

Oral EB-3.3 11:45 TRACK 2
Quantum Optical Implementation of a non-Abelian U(3) Holonomy — •Vera Neef, Julien Pinske, Friederike Klauck, Lucas Teuber, Mark Kremer, Max Ehrhardt, Matthias Heinrich, Stefan Scheel, and Alexander Szameit — Institut für Physik, Universität Rostock, Rostock, Germany
We experimentally realize a U(3) holonomy. By adiabatically propagating quantum states in appropriately designed photonic waveguide systems, we evolve on closed loops within a degenerate subspace of dark states, resulting in a non-Abelian geometric phase.

Oral EB-3.4 12:00 TRACK 2
Versatile Photonic Entanglement Synthesizer in the Spatial Domain — •David Barral[1], Mattia Walschaers[2], Kamel Bencheikh[1], Valentina Parigi[2], Juan Ariel Levenson[1], Nicolas Treps[2], and Nadia Belabas[1] — [1]Centre de Nanosciences et de Nanotechnologies C2N, Palaiseau, France — [2]Laboratoire Kastler Brossel, Paris, France
We present a spatial entanglement synthesizer based on evanescently coupled nonlinear waveguides. Our integrated-optics scheme is platform-independent and thus compatible with future light-based quantum technologies to generate robustly large or versatile multimode entangled states.

Oral EB-3.5 12:15 TRACK 2
Quantum Photonic Processor based on Programmable Integrated Silicon Nitride Circuits — •Jörn Epping[1], Caterina Taballione[1], Reinier van der Meer[2], Henk Snijders[1], Peter Hooischuur[2], Ben Kassenberg[1], Michiel de Goede[1], Pim Venderbosch[1], Chris Toebes[2], Hans van den Vlekkert[1], Pepijn Pinkse[1,2], and Jelmer Renema[1] — [1]QuiX BV, Enschede, Netherlands — [2]University of Twente, Enschede, Netherlands
We report the demonstration of a 12-mode quantum photonic processor which is the largest universal quantum photonic processor to date. The processor is a fully reconfigurable linear interferometer using silicon nitride waveguide technology.

CC-2: Nonlinear THz Spectroscopy and Techniques
Chair: Benedict Murdin, University of Surrey, Guildford, United Kingdom

Time: Tuesday, 11:00–12:30 Location: TRACK 3

Keynote CC-2.1 11:00 TRACK 3
Nonlinear THz spectroscopy to study the solvent dynamics in water — •Martina Havenith — Department of Physical Chemistry II, Ruhr University Bochum, Bochum, Germany
We developed nonlinear terahertz spectroscopy to record precise absorption of solvated samples. Our study unravelled unknown phases of water under nanoconfinement and provided a local, label free probe on protonation state of amino acids

Oral CC-2.2 11:45 TRACK 3

Ultrafast Coherent Spectroscopy with Field Resolution at Mid-Infrared and THz Frequencies — •Thomas Deckert[1,2], Jonas Allerbeck[1,2], Laurens Spitzner[2], Takayuki Kurihara[3,2], and Daniele Brida[1,2] — [1]Université du Luxembourg, Luxembourg, Luxembourg — [2]Universität Konstanz, Konstanz, Germany — [3]The University of Tokyo, Tokyo, Japan

Noncollinear two-dimensional spectroscopy in the mid infrared enables phase-sensitive investigation of coherent low-energy dynamics in semiconductors and strongly correlated materials in a perturbative excitation regime as shown by preliminary measurements on indium antimonide.

Oral CC-2.3 12:00 TRACK 3

Enhanced electro-optic on-chip detection based on integrated nonlinear phase-shifters — •Alexa Herter[1], Francesca Fabiana Settembrini[1], Amirhassan Shams-Ansari[2], Marko Lončar[2], Jérôme Faist[1], and Ileana-Cristina Benea-Chelmus[3] — [1]Quantum Optoelectronics Group, ETH Zürich, Zürich, Switzerland — [2]Laboratory for Nanoscale Optics, Harvard University, Cambridge, USA — [3]Capasso Group, Harvard University, Cambridge, USA

We investigate the potential of thin-film lithium niobate based electro-optic phase-shifters, integrated into a on-chip Mach-Zehnder-geometry for sub-cycle high-sensitivity electric field measurements in the THz-regime.

Oral CC-2.4 12:15 TRACK 3

Ultrafast Electro-Optic Modulation in CdSe/CdS Quantum Dots by intense THz Pulses — •Claudia Gollner[1], Rokas Jutas[1], Dmitry N. Dirin[2,3], Simon C. Boehme[2,3], Andrius Baltuška[1,4], Maksym V. Kovalenko[2,3], and Audrius Pugžlys[1,4] — [1]TU Wien, Photonics Institute, Vienna, Australia — [2]Institute of Inorganic Chemistry, Department of Chemistry and Applied Biosciences, ETH Zürich, Zurich, Switzerland — [3]Empa-Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland — [4]Center for Physical Sciences & Technology, Vilnius, Lithuania

We demonstrate that through the quantum confined Stark effect a free-space, ultrafast THz signal can be directly encoded onto an optical signal probing the absorption of a film consisting of CdSe/CdS quantum dots.

CL-2: Biological and Clinical Applications

Chair: Caron Jacobs, University of Cape Town, South Africa

Time: Tuesday, 11:00–12:30 Location: TRACK 4

Invited CL-2.1 11:00 TRACK 4

Digital droplet microfluidic integrated Lab-in-a-fiber detection of SARS-CoV-2 viral RNA — •Helen Parker[1], Sanghamitra Sengupta[1], Achar Harish[1], Ruben Soares[2], Haakan Joensson[2], Walter Margulis[1,3], Aman Russom[2], and Fredrik Laurell[1] — [1]KTH Royal Institute of Technology, Stockholm, Sweden — [2]Science for Life Laboratory, KTH Royal Institute of Technology, Solna, Sweden — [3]Research Institute of Sweden, Stockholm, Sweden

We present a Lab-in-fiber (LIF) device combining loop-mediated isothermal amplification (LAMP), droplet microfluidics, and optofluidics to detect and quantify viral RNA for COVID-19 diagnostics. Our device offers an attractive alternative to well-established Lab-on-chip techniques

Oral CL-2.2 11:30 TRACK 4

Remote heart sound characterization and classification using computational imaging — •Lucrezia Cester[1], Ilya Starshynov[1], Yola Jones[2], Pierpaolo Pellicori[2], and Daniele Faccio[1] — [1]School of Physics and Astronomy,University of Glasgow, glasgow, United Kingdom — [2]Robertson Centre for Biostatistics, University of Glasgow, glasgow, United Kingdom

We show a method to retrieve heartbeat valve sounds remotely with laser light with high SNR. Wavelet data analysis isolates detailed sound signals beyond heart-beat amplitudes. An ANN can accurately classify heart condition and pathologies.

Oral CL-2.3 11:45 TRACK 4

Thermoregulation of immune cell dynamics — •Stefan Wieser[1], Ivan Company[1], Bernard Ciraulo[3], Costanza Agazzi[1], Jaime Arroyo[3], Romain Quidant[3], and Verena Ruprecht[2] — [1]ICFO - Institute of Photonic Sciences, Castelldefels, Spain — [2]CRG - Centre of Genomic Regulation, Barcelona, Spain — [3]ETH - Zürich, Zürich, Switzerland

How fever and cold affect single immune cell dynamics remains an open question. Here we show that immune cell migration and polarization is regulated by temperature variations using a digital holographic thermo-microscope.

Oral CL-2.4 12:00 TRACK 4

Handheld instrument for the measurement of Macular Pigment Optical Density using structured light — •Dimitrios Christaras[1,3], Juan Mompean[2], Harilaos Ginis[1], and Pablo Artal[2] — [1]Department of Research, Athens Eye Hospital, Athens, Greece — [2]Laboratorio de Optica, Universidad de Murcia, Murcia, Spain — [3]UCL Institute of Ophthalmology, London, United Kingdom

A handheld instrument for the in-vivo measurement of macular pigment optical density was developed. The fundus is illuminated using structured light and a photodetector records the reflected signal resulting to a rapid, accurate and repeatable measurement.

Oral CL-2.5 12:15 TRACK 4

A Novel NIR-Absorber Developed with Mesoporous Silica Nanoparticles for Photothermal Applications — •Pinar Beyazkilic[1], Samet Akcimen[1], Yakup Midilli[1], Bulend Ortac[1], and Caglar Elbuken[1,2] — [1]Bilkent University, National Nanotechnology Research Centre, TR-06800, Ankara, Turkey — [2]University of Oulu, Faculty of Biochemistry and Molecular Medicine, Faculty of Medicine, FI-90014, Oulu, Finland

Novel photothermal material is developed from mesoporous silica nanoparticles functionalized with a diimmonium-based dye. Nanoparticles show strong NIR absorption and reproducible heat generation performance under NIR light revealing their potential in therapeutic applications.

EE-1: Ultrafast Phenomena in Waveguides

Chair: Olga Kosareva, Moscow State University, Russia

Time: Tuesday, 11:00–12:30 Location: TRACK 5

Oral EE-1.1 11:00 TRACK 5

Energy Noise and Timing Jitter of Few-Femtosecond Pulses Generated by Resonant Dispersive Wave Emission in Hollow-Core Waveguides — •Christian Brahms and John C. Travers — Heriot-Watt University, Edinburgh, United Kingdom

We numerically investigate the energy and timing fluctuations of tuneable resonant dispersive wave emission in hollow-core waveguides. We find that for saturated generation conditions, the generated pulses can be exceptionally stable while maintaining few-femtosecond duration.

Oral EE-1.2 11:15 TRACK 5

Spatiotemporal Imaging of 2D polariton wavepackets — •Yaniv Kurman[1], Raphael Dahan[1], Hanan Herzig Shenfux[2], Kangpeng Wang[1], Michael Yannai[1], Yuval Adiv[1], Ori Reinhardt[1], Luiz H. G. Tizei[3], Steffi Woo[3], Jiahan Li[4], James H. Edgar[4], Mathieu Kociak[3], Frank H. L. Koppens[2,5], and Ido Kaminer[1] — [1]Technion, Israel Institute of Technology, Haifa, Israel — [2]ICFO-Institut de Ciències Fotòniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona), Spain — [3]CNRS, Université Paris-Saclay, Orsay, France — [4]Kansas State University, Manhattan, KS, USA — [5]ICREA-Institució Catalana de Recerca i Estudis Avanats, Barcelona, Spain

We measure the spatiotemporal dynamics of 2D phonon-polariton wavepackets using an ultrafast electron microscope. The electron probe enables recording non-destructively the propagating wavepacket from its formation, unveiling phenomena of light acceleration & deceleration.

Invited EE-1.3 11:30 TRACK 5

Second order nonlinearity in Silicon Nitride waveguides via photo-induced self-organized gratings — •Camille-Sophie Brès — Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

We review our recent results on characterizing and increasing the efficiency of optically-induced second-order nonlinearity in silicon nitride, in an effort to bring reconfigurable three-wave mixing processes on chip.

Oral EE-1.4 12:00 TRACK 5

Real-time measurements and simulations of incoherent supercontinuum dynamics and rogue waves in a noise-like pulse dissipative soliton fibre laser — •Fanchao Meng[1], Coraline Lapre[1], Cyril Billet[1], Jean-Marc Merolla[1], Christophe Finot[2], Thibaut Sylvestre[1], Goery Genty[3], and John M. Dudley[1] — [1]Institut FEMTO-ST, Université Bourgogne Franche-Comté CNRS UMR 6174, Besançon, France, Besançon, France — [2]Laboratoire Interdisciplinaire Carnot de Bourgogne, Université Bourgogne Franche-Comté CNRS UMR 6303, Dijon, France, Dijon, France — [3]Photonics Laboratory, Tampere University, Tampere, FI-33104, Finland , Tampere, Finland

Numerical simulations and real-time characterization experiments reveal unstable femtosecond dynamics and rogue wave statistics in a dissipative soliton fibre laser. The physics of this "noise-like pulse" regime is shown to arise from incoherent supercontinuum dynamics.

Oral EE-1.5 12:15 TRACK 5

Full-field Real-Time Measurement of Ultrafast Soliton Fission — •Francesca Gallazzi[1], Shanti Toenger[1], Mikko Närhi[1], John M. Dudley[2], and Goëry Genty[1] — [1]Photonics Laboratory, Tampere University, Tampere, Finland — [2]Institut FEMTO-ST, Université Bourgogne Franche-Comté CNRS UMR 6174, Besançon, France

We characterize in real time the full-field associated with soliton fission induced by noise-seeded modulation instability using Fourier Transform spectral interferometry combined with an ultrabroadband reference field.

CK-3: Integrated Photonics Devices

Chair: Stéphane Calvez, LAAS-CNRS, France

Time: Tuesday, 11:00–12:30 Location: TRACK 6

Invited CK-3.1 11:00 TRACK 6

Directional Coupling of Emitters Into Waveguides: A Symmetry Perspective — Aristidis Lamprianidis[1], Xavier Zambrana-Puyalto[2], Carsten Rockstuhl[1], and •Ivan Fernandez-Corbaton[1] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Istituto Italiano di Tecnologia, Genova, Italy

Experiments have shown strongly directional coupling of near-field emissions onto waveguides. We provide new physical insights into this effect by analyzing the symmetries and symmetry-breakings of the emitter-waveguide system, leading to a new experimental proposal.

Oral CK-3.2 11:30 TRACK 6

Coherent Perfect Absorption in coupled Nano-Opto-ElectroMechanical Systems — •Franck Correia[1], Guilhem Madiot[1], Sylvain Barbay[1], and Rémy Braive[2] — [1]Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]Université de Paris, Paris, France

The common realization of coherent perfect absorption with a photonic system is a Fabry-Pérot cavity with two counter-propagating laser fields whose relative phase and intensities are controlled. Here we demonstrate this concept with nano-opto-electromechanical systems.

Oral CK-3.3 11:45 TRACK 6

Efficient, low crosstalk and compact programmable photonic circuits by 3D femtosecond laser micromachining — •Francesco Ceccarelli[1,2], Ciro Pentangelo[2,1], Simone Atzeni[2,1], Andrea Crespi[2,1], and Roberto Osellame[1,2] — [1]Istituto di Fotonica e Nanotecnologie - Consiglio Nazionale delle Ricerche (IFN-CNR), Milano, Italy — [2]Dipartimento di Fisica - Politecnico di Milano, Milano, Italy

Thermally-reconfigurable photonic processors suffer from large power dissipation and crosstalk. We show that thermally-insulating microstructures reduce them of an order of magnitude in reconfigurable femtosecond laser written circuits. This performance dramatically improves in vacuum.

Oral CK-3.4 12:00 TRACK 6

Waveguide subwavelength gratings bridged thin-film LiNbO3 ridge-waveguide grating couplers — •Sipan Yang[1,2], Yaqian Li[2], Jinbin Xu[2], and Xiulan Cheng[1,2] — [1]Department of Micro-nano Electronics, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, Shanghai , China — [2]Center for Advanced Electronic Materials and Devices (AEMD), Shanghai Jiao Tong University, Shanghai , China

A ridge-waveguide grating coupler integrated with waveguide subwavelength gratings structure is fabricated on thin-film LiNbO3. A high coupling efficiency of -5.35 dB/coupler for TE input signals and over 90 nm 3-dB bandwidth are achieved.

Oral CK-3.5 12:15 TRACK 6

Magneto-biplasmonic slot waveguide isolator — •Sevag Abadian[1], Giovanni Magno[1,2], Vy YAM[1], and Beatrice Dagens[1] — [1]Universite Paris-Saclay, Palaiseau, France — [2]Politecnico di Bari, Bari, Italy

Integration of optical isolators remains one of the main technological issue for photonic circuits. We present here a new concept of magnetoplasmonic isolator which enables broadband isolation ratio up to 20dB with reduced insertion losses.

EH-2: New Perspectives in Metamaterials and Nanophotonics

Chair: Vassili Fedotov, University of Southampton, Southampton, United Kingdom

Time: Tuesday, 11:00–12:30 Location: TRACK 7

Keynote EH-2.1 11:00 TRACK 7

Challenges and Opportunities for Computational Nanophotonics — •Carsten Rockstuhl — Karlsruhe Institute of Technology, Karlsruhe, Germany

I discuss four recent developments in the field of computational nanophotonics: (a) multi-physics problem, (b) inverse design, (c) the use of methodologies from the field of artificial intelligence, and (d) multi-scale modelling.

Oral EH-2.2 11:45 TRACK 7

Crystalline atomically-thin films boost the nonlinear optical response — •Alvaro Rodriguez Echarri[1], Fadil İyikanat[1], Joel Cox[2,3], and Javier García de Abajo[1,4] — [1]ICFO – Institut de Ciències Fotòniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain, Castelldefels, Spain — [2]Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — [3]Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — [4]ICREA – Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys 23, 08010 Barcelona, Spain, Barcelona, Spain

The nonlinear optical properties of few-atom-tick films are investigated through rigorous quantum-mechanical simulations, in which we consider noble metals and different crystallographic orientations.

Oral EH-2.3 12:00 TRACK 7

Trapping, Dragging and Boosting Light with Dynamical Metamaterials — •Emanuele Galiffi[1], Paloma A. Huidobro[2], Andrea Alu[3], and J. B. Pendry[1] — [1]Imperial College London, London, United Kingdom — [2]Instituto Superior Tecnico, University of Lisbon, Lisbon, Portugal — [3]Photonics Initiative, ASRC, City University of New York, New York, USA

Dynamically modulated systems offer novel directions for wave control: we demonstrate how time-modulation of material properties can trap light near surfaces, drag it without material motion, and amplify it unidirectionally, demonstrating a new amplification mechanism.

Oral EH-2.4 12:15 TRACK 7

Optical Magnetism without Metamaterials — •Jinxiang Li[1], Nikitas Papasimakis[1], Kevin F. MacDonald[1], and Nikolay I. Zheludev[1,2] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore, Singapore

We show that metamaterial structuring is not necessary for the manifestation of optical magnetism: a strong optical magnetic response is an essential characteristic feature of a thin layer of homogeneous dielectrics.

CI-1: Broadband Systems

Chair: Fabio Pittala, Huawei Technologies, Munich, Germany

Time: Tuesday, 11:00–12:30 Location: TRACK 8

Oral CI-1.1 11:00 TRACK 8

O+E-band Transmission over 50-km SMF using A Broadband Bismuth Doped Fibre Amplifier — •Yang Hong, Kyle R. H. Bottrill, Yu Wang, Naresh K. Thipparapu, Jayanta K. Sahu, Periklis Petropoulos, and David J. Richardson — Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

We demonstrate the first transmission experiment utilising a 115-nm BDFA and achieve >65-Gb/s adaptively-loaded DMT transmission across the wavelength range from 1350 nm to 1460 nm over a SMF length of 50 km.

Oral CI-1.2 11:15 TRACK 8

7-Ring-Air-Core Trench-Assisted Fibre Supporting >300 Radially Fundamental OAM Modes Across S+C+L Bands — •Yingning Wang[1], Kunbi Zhu[1], Yuxi Fang[1], Wenpu Geng[1], Wenqian Zhao[1], Changjing Bao[2], Yange Liu[1], Weigang Zhang[1], Yongxiong Ren[2], Zhongqi Pan[3], and Yang Yue[1] — [1]Nankai University, Tianjin, China — [2]University of Southern California, Los Angeles, USA — [3]University of Louisiana at Lafayette, Lafayette, USA

we propose and design a multi-ring-air-core trench-assisted fibre with 7 rings each supporting 58 OAM modes (i.e. 406 ones in total) at 1550 nm with low-level interring crosstalk after 100-km fibre propagation.

Invited CI-1.3 11:30 TRACK 8

Machine learning enabled Raman amplifiers — •Darko Zibar — DTU Fotonik, Kgs. Lyngby, Denmark

Advances in machine learning are spurring a new generation of optical communication and measurement systems. We demonstrate how machine learning can be used to realize arbitrary gains of Raman amplifiers in a controlled way

Oral CI-1.4 12:00 TRACK 8

Optical Data Transmission with a Dissipative Kerr Soliton in an Ultrahigh-Q MgF_2 Microresonator — •Shuya Tanaka[1], Shun Fujii[1,2], Koshiro Wada[1], Hajime Kumazaki[1], Soma Kogure[1], Shun Tasaka[1], Tamiki Ohtsuka[1], Satoki Kawanishi[1], and Takasumi Tanabe[1] — [1]Department of Electronics and Electrical Engineering, Faculty of Science and Technology, Keio University, Yokohama, Japan — [2]Quantum Optoelectronics Research Team, RIKEN Center for Advanced Photonics, Saitama, Japan

We achieved WDM transmission over 40 km with the densest carrier spacing using a dissipative Kerr soliton from an MgF_2 microresonator. The result suggests the possibility of providing extremely high spectral efficiency.

Oral CI-1.5 12:15 TRACK 8

Subwavelength spaced optical phased array with a wide beam-steering for near-visible infrared applications — •Shahryar Sabouri, Mircea Traian Catuneanu, Luis Angel Mendoza Velasco, Mohammad Taghi Fathi, and Kambiz Jamshidi — Integrated Photonic Devices Group, Chair of Radio Frequency and Photonics Engineering, Communications Laboratory, Faculty of Electrical and Computer Engineering, Technische Universität Dresden, Dresden, Germany

We demonstrate a SiN-based array of 8 end-fire emitters with 800 nm spacing. The device is characterized at a wavelength of 852 nm. By considering 12 thermo-optical phase shifters, a beam-steering of $\pm 30^\circ$ is achieved.

EJ-2: Nonlinear Optics Modeling

Chair: Stefan Skupin, University of Lyon, France

Time: Tuesday, 11:00–12:30 Location: TRACK 9

Oral EJ-2.1 11:00 TRACK 9

How carrier memory enters the Haus master equation of mode-locking — Jan Hausen[1], Svetlana Gurevich[2,3], Kathy Lüdge[1], and •Julien Javaloyes[3] — [1] Institute of Theoretical Physics, Technische Universität Berlin, Berlin, Germany — [2] Institute for Theoretical Physics, University of Münster, Münster, Germany — [3]Departament de Física, Universitat de les Illes Balears and IAC-3, Palma, Spain

We present a generalization of the Haus master equation for mode-locking in which a dynamical boundary condition allows describing complex pulse trains, such as the Q-switched and harmonic transitions, and weak interactions between localized states.

Oral EJ-2.2 11:15 TRACK 9

Bright localized patterns in singly resonant optical parametric oscillators — •Pedro Parra-Rivas, Carlos Mas-Arabí, and Francois Leo — Université Libre de Bruxelles, Bruxelles, Belgium

We study the formation, bifurcation structure and stability of localized patterns arising in singly resonant optical parametric oscillators. We show that these states undergo homoclinic snaking and we characterize their different dynamical regimes.

Oral EJ-2.3 11:30 TRACK 9

Dispersive Instabilities In Passively Mode-Locked Integrated External-Cavity Surface-Emitting Lasers — Christian Schelte[1,2], •Denis Hessel[1,2], Julien Javaloyes[1], and Svetlana Gurevich[1,2,3] — [1]Departament de Física, Universitat de les Illes Balears & Institute of Applied Computing and Community Code (IAC-3), Cra. de Valldemossa, km 7.5, E-07122 Palma de Mallorca, Spain — [2]Institute for Theoretical Physics, University of Münster, Wilhelm-Klemm-Str. 9, 48149 Münster, Germany — [3]Center for Nonlinear Science (CeNoS), University of Münster, Corrensstr. 2, 48149 Münster, Germany

We investigate a pulse instability appearing in passively mode-locked integrated external-cavity surface-emitting lasers. A train of satellites on the leading edge of a pulse becomes unstable due to carrier interaction and third order dispersion.

Oral EJ-2.4 11:45 TRACK 9

Orbital Edge and Corner States in Su-Schrieffer-Heeger Optical Lattices — •Domenico Bongiovanni[1,2], Zhichan Hu[1], Dario Jukić[3], Yi Hu[1], Daohong Song[1], Hrvoje Buljan[1,4], Roberto Morandotti[2,5], and Zhigang Chen[1,6] — [1]TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China — [2]INRS-EMT, 1650 Blvd. Lionel-Boulet, Varennes, QC J3X 1S2, Canada — [3]Faculty of Civil Engineering, University of Zagreb, Zagreb 10000, Croatia — [4]Department of Physics, Faculty of Science, University of Zagreb, Zagreb 10000, Croatia — [5]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu 610054, China — [6]Department of Physics & Astronomy, San Francisco State University, San Francisco, CA 94132, USA

We numerically and experimentally investigate corner and edge topological states in finite Su-Schrieffer-Heeger photonic lattices, focusing mainly on robust but poorly studied orbital states in both one- and two-dimensional systems.

Oral EJ-2.5 12:00 TRACK 9

Soliton blockade in bi-directional Kerr microresonators — •Zhiwei Fan and Dmitry V. Skryabin — University of Bath, Bath, United Kingdom

We report a method to block or release the unidirectional frequency comb by controlling the pump frequency offset between the counter-rotating waves.

Oral EJ-2.6 12:15 TRACK 9

Optical Pulse Propagation in Graphene-comprising Waveguides: Beyond the Perturbative Nonlinear Regime — •Alexandros Pitilakis and Emmanouil E. Kriezis — Aristotle University of Thessaloniki, Thessaloniki, Greece

We present a consolidated overview of electromagnetic nonlinearity in graphene, spanning perturbative and thermodynamic regimes. Our focus is on all-optical applications of highly confining NIR photonic waveguide structures, where graphene is in-plane and patterned.

CD-3: Microresonators and Waveguides

Chair: Markus Schmidt, Friedrich Schiller University, Jena, Germany

Time: Tuesday, 11:00–12:30 Location: TRACK 10

Oral CD-3.1 11:00 TRACK 10

Dynamics of Fully Integrated Self-Injection Locked Optical Frequency Microcomb — •Andrey Voloshin[1,2], Nikita Kondratiev[1], Grigoriy Lihachev[2], Junqiu Liu[2], Valery Lobanov[1], Nikita Dmitriev[1], Wenle Weng[2], Tobias Kippenberg[1], and Igor Bilenko[1,3] — [1]Russian Quantum Center (RQC), Moscow, Russia — [2]Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland — [3]Faculty of Physics, M.V. Lomonosov Moscow State University, Moscow, Russia

We demonstrate a chip-scale 30 GHz single soliton microcomb based on DFB laser locked to a SiN microresonator. We propose novel theoretical and experimental approaches to explain dynamics of self-injection locking, modified by Kerr nonlinearity.

Oral CD-3.2 11:15 TRACK 10

Low-threshold frequency comb generation using second-order nonlinearities in lithium niobate whispering gallery resonators — •Jan Szabados[1], Karsten Buse[1,2], and Ingo Breunig[1,2] — [1]Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg , Germany — [2]Fraunhofer Institute for Physical Measurement Techniques IPM, Freiburg, Germany

We generate frequency combs in millimeter-sized microresonators based purely on $\chi(2)$ –nonlinear-optical processes (second-harmonic generation, sum-frequency generation and optical parametric oscillation) using 85 μW pump power. Sub-μW thresholds are within reach using chip-integrated resonators.

Oral CD-3.3 11:30 TRACK 10

Optical Memory Based on Counterpropagating Light in Microresonators — •Leonardo Del Bino[1,2,3], Niall Moroney[1,2,4], and Pascal Del'Haye[1,5] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]National Physical Laboratory, Teddington, United Kingdom — [3]Heriot-Watt University, Edinburgh, United Kingdom — [4]Imperial College London, London, United Kingdom — [5]FAU Erlangen-Nurnberg, Erlangen, Germany

We demonstrate how symmetry-broken states arising from the Kerr nonreciprocity in microresonators can be used for all-optical memories and logic gates. We explore different materials allowing bitrates of 10Gbps or power as low as 1μW.

Oral CD-3.4 11:45 TRACK 10

Advances in Pockels-effect-based adiabatic frequency conversion in lithium niobate high-*Q* optical microresonators — •Yannick Minet[1,2], Michael Basler[3], Hans Zappe[2], Karsten Buse[1,4], and Ingo Breunig[1,4] — [1]Laboratory for Optical Systems, Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg, Germany — [2]Gisela and Erwin Sick Chair of Micro-optics, Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg, Germany — [3]Fraunhofer Institute for Applied Solid State Physics IAF, Freiburg, Germany — [4]Fraunhofer Institute for Physical Measurement Techniques IPM, Freiburg, Germany

Employing thinner resonators and specially designed GaN-based pulse generators now 80 GHz of mode-hop-free tuning within nanoseconds via Pockels-effect-based adiabatic frequency conversion in high-Q lithium niobate microresonators is feasible.

Oral CD-3.5 12:00 TRACK 10

Nonlinear Broadening of Electro-Optic Frequency Combs in All-Normal Dispersion Si3N4 Waveguides — •Israel Rebolledo-Salgado[1,2], Zhichao Ye[1], Simon Christensen[3], Fuchuan Lei[1], Krishna Twayana[1], Martin Zelan[2], Jochen Schröder[1], and Victor Torres-Company[1] — [1]Dept. Microtechnology and Nanoscience, Chalmers University of Technology, Gothenburg, Sweden — [2]Measurement Science and Technology, RISE Research Institutes of Sweden, Boras, Sweden — [3]Photonics Department, Technical University of Denmark, Lyngby, Denmark

We demonstrate nonlinear broadening of an electro-optic frequency comb at 25 GHz repetition rate in a 20 cm long normal-dispersion low-loss silicon nitride waveguide.

Oral CD-3.6 12:15 TRACK 10

Electro-optic Kerr Modulation in Wide Silicon Waveguides in the Mid-IR — •Benjamin D.J. Sayers, Lawrence M. Rosenfeld, and Joshua W. Silverstone — University of Bristol, Bristol, United Kingdom

We demonstrate phase shifts using the electro-optic Kerr effect in wide silicon waveguides. This preliminary work shows potential to reduce loss in such phase shifters using novel waveguide geometries in the mid-infrared.

CH-3: Advanced Optical Sensing Techniques

Chair: Hatice Altug, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Time: Tuesday, 11:00–12:30 Location: TRACK 11

Oral CH-3.1 11:00 TRACK 11

Collective measurements achieving super resolution — •Jessica O. de Almeida[1], Maciej Lewenstein[1,2], and Michail Skoteiniotis[3] — [1]ICFO - Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Av. Carl Friedrich Gauss 3, 08860, Castelldefels (Barcelona), Spain — [2]ICREA, Pg. Lluís Companys 23, 08010, Barcelona, Spain — [3]Física Teòrica: Informació i Fenòmens Quàntics, Departament de Física, Universitat Autònoma de Barcelona, E-08193, Bellaterra (Barcelona), Spain

We use techniques of statistical inference, to analyse a measurement strategy to estimate the separation between two incoherent light sources independently of their centroid position, and in the limit of large number of photons.

Oral CH-3.2 11:15 TRACK 11

Super-Resolved Localization of Overlapping Sources Using SUPPOSe — •Guillermo Brinatti Vazquez[1], Axel M. Lacapmesure[1], Micaela Toscani[1], Sandra R. Martínez[2], and Oscar E. Martínez[1] — [1]Laboratorio de Fotónica, Instituto de Ingeniería Biomédica, CONICET - FIUBA, Buenos Aires, Argentina — [2]Instituto de Investigaciones Matemáticas Luis A. Santaló. CONICET, FCEyN-UBA., Buenos Aires, Argentina

The simultaneous localization of sources overlapping within the PSF is performed using the SUPPOSe deconvolution algorithm improved in speed for this sparse situations, by replacing the genetic algorithm by a stochastic gradient descent method.

Oral CH-3.3 11:30 TRACK 11

Hadamard-transform high spectral resolution and broadband stimulated Raman Scattering microspectroscopy using an acousto-optic tunable filter — •Luca Genchi[1], Andrea Bucci[1], Sergey P. Laptenok[1], Alessandro Giammona[1], and Carlo Liberale[1,2] — [1]Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia — [2]Computer, Electrical and Mathematical Sciences and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

We present a high spectral resolution multiplexing acquisition modality for stimulated Raman scattering microscopy using the Hadamard transform. We demonstrate improved signal to noise ratio over conventional acquisitions in the Raman fingerprint and CH-stretch regions.

Oral CH-3.4 11:45 TRACK 11

Finesse-Enhanced Measurement of Thermal Capillary-Waves at Liquid-Phase Boundaries — •Elad Haber[1], Mark Douvidzon[1], and Tal Carmon[2] — [1]Technion, Israel Institute of Technology, Haife, Israel — [2]Tel Aviv University, Tel Aviv, Israel

We report on a device, that optically interrogates capillary. Our resolution scales with wavelength divided by cavity finesse and achives angstrom scale resolution. We show preliminary results in distinguishing between viscosities.

Oral CH-3.5 12:00 TRACK 11

Frequency-Modulated Portable Light Source for Coherent Raman Imaging with Enhanced Sensitivity — •Maximilian Brinkmann[1], Thomas Würthwein[2], Tim Hellwig[1], Kristin Wallmeier[2], and Carsten Fallnich[2,3,4] — [1]Refined Laser Systems GmbH, Münster, Germany — [2]Institute of Applied Physics, University of Münster, Münster, Germany — [3]Cells in Motion Interfaculty Centre, Münster, Germany — [4]University of Twente, Enschede, Netherlands

We present a fiber optical parametric oscillator, combining a rapid and wide tunability across 780–980 nm within only 5 ms with a frequency modulation at 20 MHz for coherent Raman imaging with enhanced sensitivity.

Oral CH-3.6 12:15 TRACK 11

Plastic sorting with an integrated NIR spectral sensor — •Fang Ou[1,2], Kaylee D. Hakkel[1], Maurangelo Petruzzella[1,2], Anne van Klinken[1], Francesco Pagliano[1,2], Rene P.J. van Veldhoven[1], and Andrea Fiore[1] — [1]Department of Applied Physics and Institute for Photonic Integration, Eindhoven University of Technology, Eindhoven, Netherlands — [2]MantiSpectra B.V., Eindhoven, Netherlands

We describe a method for classifying plastic types that take advantage of a miniaturised, low-cost, robust and mass-producible NIR spectral sensor based on integrated photonics technology, which opens new horizons for on-site materials sensing applications.

CF-2: Ultrafast UV Sources

Chair: John Tisch, Imperial College London, London, United Kingdom

Time: Tuesday, 11:00–12:30 Location: TRACK 12

Invited CF-2.1 11:00 TRACK 12

Progress in Soliton Dynamics in Hollow Capillary Fibres — •John C. Travers, Christian Brahms, Teodora F. Grigorova, Athanasios Lekosiotis, and Federico Belli — School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We review soliton dynamics in hollow-capillary fibres: self-compression to subcycle optical attosecond pulses at gigawatt peak power in the near and mid-infrared, and efficient conversion to few-femtosecond pulses tunable across the VUV and DUV.

Oral CF-2.2 11:30 TRACK 12

High repetition rate high harmonic generation with ultra-high photon flux — Maxim Tschernjaew[1], •Steffen Hädrich[1], Robert Klas[2,3], Martin Gebhardt[2,3], Roland Horsten[4], Sven Weerdenburg[4], Sergey Pyatchenkov[4], Wim Coene[4,5], Jan Rothhardt[2,3], Tino Eidam[1], and Jens Limpert[1,2,3,6] — [1]Active Fiber Systems GmbH, Jena, Germany — [2]Institut of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [3]Helmholtz-Institute Jena, Jena, Germany — [4]Optics Research Group, Delft University of Technology, Delft, Netherlands — [5]ASML Netherlands B.V., Veldhoven, Netherlands — [6]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We present a HHG source providing a large photon flux between 66eV and 150eV. It is driven by a 100W fiber-laser system equipped with a post-compression unit whose output is focused into a gas jet.

Oral CF-2.3 11:45 TRACK 12

Circularly Polarized DUV Pulses via Dispersive Wave Emission in Hollow Capillary Fibers — •Athanasios Lekosiotis, Christian Brahms, Federico Belli, Teodora F. Grigorova, and John C. Travers — Heriot-Watt University, Edinburgh, United Kingdom

We report the generation of ultra-short, circularly polarized pulses tunable in the DUV via soliton dynamics in stretched hollow capillary fibers. Our technique allows energy up-scaling and extension to the VUV.

Oral CF-2.4 12:00 TRACK 12

Time-resolved Photoelectron Momentum Microscopy using a 1 MHz High-Harmonic Generation Beamline — •G. S. Matthijs Jansen, Marius Keunecke, David Schmitt, Wiebke Bennecke, Christina Möller, Marcel Reutzel, Daniel Steil, Sabine Steil, and Stefan Mathias — 1. Physical Institute, University of Göttingen, Göttingen, Germany

Based on various recent experimental results, we present a novel setup for time-resolved extreme ultraviolet photoemission spectroscopy, providing full three-dimensional photoemission spectra from a 1 MHz high-harmonic generation source.

Oral CF-2.5 12:15 TRACK 12

Tunable Pulse Shape DUV Photocathode Laser for X-ray Free Electron Lasers at DESY — •Chen Li[1], Oender Akcaalan[1], Maik Frede[2], Uwe Gross-Wortmann[1], Christian Mohr[1], Oliver Puncken[2], Caterina Vidoli[1], Lutz Winkelmann[1], and Ingmar Hartl[1] — [1]Deutsches Elektronen-Sychrotron, Hamburg, Germany — [2]neoLASE GmbH, Hanover, Germany

We report on a 1-20ps tunable pulse duration deep UV photocathode laser for high repetition-rate x-ray free electron-lasers. We generate 5-10μJ pulses at 257.5nm in 800μs burst at 1MHz with 100ms burst separation.

SP-1: Herbert Walter Award & Wolfgang Peter Schleich Talk

Time: Tuesday, 14:30–16:00 Location: TRACK 1

Keynote SP-1.1 14:30 TRACK 1

Cavity QED, Cold Atoms and the Riemann Zeta Function — •Wolfgang Peter Schleich — Universität Ulm, Institut für Quantenphysik, Ulm, Germany — Institute of Quantum Technologies, German Aerospace Center (DLR), Ulm, Germany — Hagler Institute for Advanced Study and Department of Physics and Astronomy, Texas A&M University, College Station, USA — Institute for Quantum Science and Engineering (IQSE), Texas A&M University, College Station, USA — Texas A&M AgriLife Research, Texas A&M University, College Station, USA

We summarize our work on the Quantum FEL, cold atoms in space and the realization of the Riemann zeta function by a quantum optical system and connect these topics to Herbert Walther.

ED-3: Precision Spectroscopy and Fundamental Metrology II

Chair: Markku Vainio, Univeristy of Helsinki, Helsinki, Finland

Time: Tuesday, 16:30–18:00 Location: TRACK 1

Oral ED-3.1 16:30 TRACK 1

Double-Resonance Spectroscopy of Methane Using a Comb Probe — •Vinicius Silva de Oliveira[1], Isak Silander[1], Lucile Rutkowski[2], Alexandra C. Johansson[1], Grzegorz Soboń[3], Ove Axner[1], Kevin K. Lehmann[4], and Aleksandra Foltynowicz[1] — [1]Department of Physics, Umeå University, Umeå, Sweden — [2]Université de Rennes, CNRS, IPR (Institut de Physique de Rennes)-UMR 6251, Rennes, France — [3]Laser and Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland — [4]Departments of Chemistry and Physics, University of Virginia, Charlottesville, VA, USA

We use a 3.3 μm continuous wave pump and a 1.67 μm comb probe to detect and assign sub-Doppler $3\nu_3 \leftarrow \nu_3$ transitions in methane. We achieve high absorption sensitivity using an enhancement cavity for the comb probe.

Oral ED-3.2 16:45 TRACK 1

Comb-calibrated Stimulated-Raman Spectroscopy of H2 — •Marco Lamperti[1], Lucile Rutkowski[2], Daniele Ronchetti[1], Davide Gatti[1], Riccardo Gotti[1], Giulio Cerullo[1], Franck Thibault[2], Hubert Jozwiak[3], Szymon Wojtewicz[3], Piotr Maslowski[3], Piotr Wcislo[3], Dario Polli[1], and Marco Marangoni[2] — [1]Politecnico di Milano and IFN-CNR, Lecco, Italy — [2]University of Rennes, CNRS, Rennes, France — [3]Nicolaus Copernicus University, Torun, Poland

H2 is a benchmark system for fundamental physics, yet spectroscopy is hindered by the lack of dipole moment. We present a comb-calibrated coherent Raman spectrometer for advanced studies of its Q(1) 1-0 line

Oral ED-3.3 17:00 TRACK 1

Dual-comb cavity-enhanced absorption and dispersion spectroscopy from cavity mode widths and mode shifts measurement — •Dominik Charczun[1], Akiko Nishiyama[1], Grzegorz Kowzan[1], Agata Cygan[1], Thibault Voumard[2], Thibault Wildi[2], Tobias Herr[2], Ewelina Obrzud[3], Victor Brasch[3], Daniel Lisak[1], and Piotr Masłowski[1] — [1]Institute of Physics, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University in Toruń , Toruń , Poland — [2]Center for Free-Electron Laser Science (CFEL), German Electron-Synchrotron (DESY), Hamburg, Germany — [3]3. CSEM - Swiss Center for Electronics and Microtechnology, Neuchâtel, Switzerland

We show the first dual-comb measurement of widths and positions of enhancement cavity modes delivering molecular absorption and dispersion spectra. This approach does not require reference spectrum or correction for the comb-cavity mode frequency mismatch

Oral ED-3.4 17:15 TRACK 1

Mid-infrared dual-comb absorption and dispersion spectroscopy and temperature measurement in a plasma — •Muhammad Ali Abbas, Frans J.M. Harren, Luuk van Dijk, Roderik Krebbers, Khalil Eslami Jahromi, Mohammadreza Nematollahi, and Amir Khodabakhsh — Radboud University Nijmegen, Nijmegen, Netherlands

We present an asymmetric mid-infrared dual-comb spectrometer with 5 GHz spectral resolution for time-resolved plasma diagnostics of methane and ethane, with 20μs time resolution, and measure the rovibrational temperature distribution of methane inside the plasma.

Invited ED-3.5 17:30 TRACK 1

Precision Frequency Comb Spectroscopy of Single Molecular Ions — •David Leibrandt — National Institute of Standards and Technology, Boulder, CO, USA — University of Colorado, Boulder, CO, USA

We use quantum-logic techniques to prepare and detect pure quantum states of a singular molecular ion, and demonstrate precision two-photon terahertz rotational spectroscopy with an optical frequency comb, achieving eleven digit resolution.

CD-4: Microresonators

Chair: Victor Torres Company, Chalmers University of Technology, Gothenburg, Sweden

Time: Tuesday, 16:30–18:00 Location: TRACK 2

Invited CD-4.1 16:30 TRACK 2

Nonlinear and Quantum Photonics in Chip-Integrated Microresonators — •Kartik Srinivasan — National Institute of Standards and Technology, Gaithersburg, USA — Joint Quantum Institute, University of Maryland, College Park, USA

In this talk, I will describe our efforts in developing quantum and classical resources that connect the visible and telecommunications wavelength bands through chip-integrated Kerr nonlinear resonators.

Oral CD-4.2 17:00 TRACK 2

Spontaneous polarization symmetry breaking of light in a microresonator — •Niall Moroney[1,2], Leonardo Del Bino[1], Michael T. M. Woodley[2,3,4], Shuangyou Zhang[1], Lewis Hill[5], Valentin J. Wittwer[6], Thomas Südmeyer[6], Thibault Wildi[7], Gian-Luca Oppo[5], Michael Vanner[2], Victor Brasch[8], Tobias Herr[7], and Pascal Del'Haye[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Imperial College London, London, United Kingdom — [3]National Physical Laboratory, London, United Kingdom — [4]Herriot-Watt University, Edinburgh, United Kingdom — [5]University of Strathclyde, Glasgow, United Kingdom — [6]Université de Neuchâtel, Neuchâtel, Switzerland — [7]Center for Free-Electron Laser Science (CFEL), Hamburg, Germany — [8]Swiss Center for Electronics and Microtechnology (CSEM), Neuchâtel, Switzerland

We demonstrate the spontaneous symmetry breaking of the polarisation state of light. Linearly polarised light is input to a fibre cavity in which the Kerr nonlinearity causes the cavity field to acquire a random chirality.

Oral CD-4.3 17:15 TRACK 2

Nonlinear Frequency Conversion in the Hybrid Si_3N_4 - $LiNbO_3$ Integrated Platform — •Mikhail Churaev[1], Annina Riedhauser[2], Rui Ning Wang[1], Charles Möhl[2], Viacheslav Snigirev[1], Simon Hönl[2], Terence Blésin[1], Daniele Caimi[2], Junqiu Liu[1], Youri Popoff[2,3], Paul Seidler[2], and Tobias J. Kippenberg[1] — [1]Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland — [2]IBM Research Europe, Rüschlikon, Switzerland — [3]ETH Zürich, Zürich, Switzerland

We demonstrate optical frequency comb generation in hybrid high-Q optical microresonators fabricated using direct wafer bonding of photonic Damascene silicon nitride wafer with thin-film lithium niobate-on-insulator (LNOI). The devices enable direct phase control via Pockels effect.

Oral CD-4.4 17:30 TRACK 2

Four-wave mixing and Arnold tongues in high finesse Kerr ring microresonators — •Danila Puzyrev, Zhiwei Fan, Alberto Villois, and Dmitry Skryabin — University of Bath, Bath, United Kingdom

We find that the four-wave mixing threshold conditions in the high finesse Kerr ring microresonators break the pump laser parameter space into a sequence of Arnold tongues. We report synchronisation and frequency-domain symmetry breaking inside the tongues.

Oral CD-4.5 17:45 TRACK 2

Ultra-Deep Multi-Notch Microwave Photonic Filter utilising On-Chip Brillouin procesing and Microring Resonators — •Matthew Garrett[1,2], Yang Liu[1,2], Duk-Yong Choi[3], Kunlun Yan[3], Stephen J. Madden[3], and Benjamin J. Eggleton[1,2] — [1]Institute of Photonics and Optical Science (IPOS), School of Physics, The University of Sydney, NSW 2006, Australia, Sydney, Australia — [2]The University of Sydney Nano Institute (Sydney Nano), The University of Sydney, NSW 2006, Australia, Sydney, Australia — [3]Laser Physics Centre, Australian National University, Canberra, ACT 2601, Australia, Canberra, Australia

We present a multi-notch microwave photonic filter that cascades integrated microring resonators and on-chip Brillouin scattering to create spectrally-selective RF destructive interference, achieving a filter rejection of > 37 dB from 2 dB ring rejection.

CG-3: Ultrafast Spectroscopy

Chair: Yann Mairesse, University of Bordeaux, CELIA, Bordeaux, France

Time: Tuesday, 16:30–18:00 Location: TRACK 3

Tutorial CG-3.1 16:30 TRACK 3

First principles modeling of ultrafast pump probe spectroscopies — •Angel Rubio — Max Planck /Institute for the Structure and Dynamics of Matter, Hamburg, Germany — Center for Computational Quantum Physics Flatiron Institute, New York, USA

We will review the recent advances in the first principles modeling of ultrafast phenomena in molecules and solids. We will treat light-matter interactions beyond perturbative regimes to account for novel hybrid-light matter states and describe strongly non liner phenomena.

Oral CG-3.2 17:30 TRACK 3

Attosecond Ionization Time Delay Around a Shape Resonance in Nitrogen Measured by the RABBIT-2ω method — •Vincent Loriot[1], Alexandre Marciniak[1], Saikat Nandi[1], Gabriel Karras[1], Marius Hervé[1], Eric Constant[1], Etienne Plésiat[2], Alicia Palacios[2], Fernando Martin[2], and Franck Lépine[1] — [1]Institute of Light and Matter, Lyon, France — [2]Universidad Autonoma de Madrid, Madrid, Spain

We implement a self-calibrated variant of the RABBITT protocol (that reduce spectral congestion) to measure the photoelectron trapping near a molecular shape resonance at the attosecond timescale.

Oral CG-3.3 17:45 TRACK 3

Measurement of Time Delay in Giant Plasmonic Resonance by Recollision Process of High Harmonic Generation — •Dong Hyuk Ko[1], Graham G. Brown[1], Chunmei Zhang[1], and Paul B. Corkum[1,2] — [1]University of Ottawa, Ottawa, Canada — [2]National Research Council of Canada, Ottawa, Canada

The time-dependent response of the giant plasmonic resonance in Xe has been investigated by employing the *in situ* measurement method of high harmonic generation using recollision electrons as exquisitely sensitive probes of ultrafast multi-electron interactions.

CA-3: High-intensity and Nonlinear Systems

Chair: Nicolaie Pavel, National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania

Time: Tuesday, 16:30–18:00 Location: TRACK 4

Invited CA-3.1 16:30 TRACK 4

Technology Development for Ultra-Intense OPCPA Systems — •Jake Bromage, Seung-Whan Bahk, Ildar Begishev, Sara Bucht, Christophe Dorrer, Chengyong Feng, Brittany Hoffman, Cheonha Jeon, Chad Mileham, James Oliver, Richard Roides, Milton Shoup, Michael Spilatro, Benjamin Webb, and Jonathan Zuegel — Laboratory for Laser Energetics, University of Rochester, Rochester, USA

Technologies developed for MTW-OPAL, a midscale prototype all-OPCPA system, will be reviewed, highlighting 140-nm-wide amplification in DKDP to >10 J with 30% efficiency and subsequent recompression to 20 fs.

Oral CA-3.2 17:00 TRACK 4

Laser power stabilization for Advanced VIRGO — Frédéric Cleva[1], Jean-Pierre Coulon[1], Li Wei Wei[1], Margherita Turconi[1], Mourad Merzougui[1], Eric Genin[2], Gabriel Pillant[2], and •Fabien Kéfélian[1] — [1]ARTEMIS, Université Côte d'Azur - Observatoire de la Côte d'Azur - CNRS, Nice, France — [2]European Gravitational Observatory, Cascina, Italy

We present the laser power stabilization in Advanced VIRGO using very high photocurrent photodiodes with excellent spatial uniformity. The RIN is currently 2.5E-9 $Hz^{-1/2}$ and will be able to reach 1.2E-9 $Hz^{-}1/2$ for the most sensitive configuration

Oral CA-3.3 17:15 TRACK 4

160W Cryogenic Regenerative Yb:YLF Amplifier — •Mikhail Pergament[1], Umit Demirbas[1,4], Martin Kellert[1], Jelto Thesinga[1], Yi Hua[1,2], and Franz Kaertner[1,2,3] — [1]Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Physics Department, University of Hamburg, Hamburg, Germany — [3]The Hamburg Centre for Ultrafast Imaging,, Hamburg, Germany — [4]Laser Technology Laboratory, Antalya Bilim University, Antalya, Turkey

We demonstrate cryogenic Yb:YLF regenerative amplifier, using E//a and E//c axes. The amplifier generates up to 160 W with 16 mJ pulses at 10kHz has 2.2% RMS noise, and could be compress to sup-ps durations

Oral CA-3.4 17:30 TRACK 4

Highly tunable, multi-GHz repetition rate optical parametric oscillator driven by an electro-optic comb — •Hanyu Ye[1], Valerian Freysz[2], Ramatou Bello-Doua[3], Lilia Pontagnier[1], Giorgio Santarelli[1], Eric Cormier[1,4], and Eric Freysz[2] — [1]Laboratoire Photonique Numérique et Nanosciences (LP2N), Talence, France — [2]Université de Bordeaux, CNRS, LOMA, Talence, France — [3]ALPhANOV, Institut d'optique d'Aquitaine, Talence, France — [4]Institut Universitaire de France (IUF), Paris, France

We present an optical parametric oscillator (OPO) synchronously pumped by an electro-optic comb. The OPO delivers sub-picosecond signal pulses across 1.5-1.7 μm with flexible repetition rate ranging from 1 to 14 GHz.

Oral CA-3.5 17:45 TRACK 4

Tunable repetition rate OPO pumped by high power femtosecond harmonic-order controlled mode–locked ytterbium rod-type fiber laser. — •Valerian FREYSZ and Eric FREYSZ — Univ. Bordeaux, LOMA, UMR-5798, F 33400 Talence, France

Tunable repetition rate OPO pumped by high-power femtosecond harmonic-order controlled mode–locked ytterbium rod-type fiber laser, provides femtosecond pulses tunable from 1.4 μm to 1.7 μm at different repetition rates without any changes of the OPO.

EC-2: Nonlinear Topology

Chair: Henning Schomerus, Lancaster University, Lancaster, United Kingdom

Time: Tuesday, 16:30–18:00 Location: TRACK 5

Invited EC-2.1 16:30 TRACK 5

Topological optical frequency combs and dissipative Kerr super-solitons — •Sunil Mittal[1], Gregory Moille[2,1], Kartik Srinivasan[2,1], Yanne K. Chembo[1], and Mohammad Hafezi[1] — [1]University of Maryland, College Park, College Park, USA — [2]National Institute of Standards and Technology, Gaithersburg, USA

We propose the generation of nested coherent optical frequency combs and dissipative Kerr super-solitons in a two-dimensional array of coupled ring resonators that creates a synthetic magnetic field, and thereby, exhibits topological edge states for photons.

Oral EC-2.2 17:00 TRACK 5

First realization of a nonlinearity-induced topological insulator — •Lukas J. Maczewsky[1], Matthias Heinrich[1], Mark Kremer[1], Sergey K. Ivanov[2,3], Max Ehrhardt[1], Franklin Martinez[1], Yaroslav V. Kartashov[3,4], Vladimir V. Konotop[5,6], Lluis Torner[4,7], Dieter Bauer[1], and Alexander Szameit[1] — [1]University Rostock, Institut für Physik, Rostock, Germany — [2]Moscow Institute of Physics and Technology, Moscow, Russia — [3]Institute of Spectroscopy, Russian Academy of Sciences, Moscow, Russia — [4]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science & Technology, Barcelona, Spain — [5]Departamento de Física, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal — [6]Centro de Física Teórica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal — [7]Universitat Politècnica de Catalunya, Barcelona, Spain

A nonlinear photonic Floquet topological insulator in which the non-trivial topological phase itself is brought about by the self-action of a propagating wave packet is presented, and its protected edge states are experimentally demonstrated.

Oral EC-2.3 17:15 TRACK 5

Quantized Nonlinear Pumping with Photons — •Marius Jürgensen, Sebabrata Mukherjee, and Mikael Rechtsman — Pennsylvania State University, University Park, PA 16802, USA

We theoretically propose and experimentally demonstrate quantized nonlinear Thouless pumping, despite non-uniform occupation of topological bands; the effect has no analogue in the linear domain. We observe the effect in arrays of coupled waveguides.

Oral EC-2.4 17:30 TRACK 5

Non-linearities in a driven-dissipative SSH lattice — •Nicolas Pernet[1], Philippe St-Jean[1], Dmitry Solnyshkov[2], Guillaume Malpuech[2], Nicola Carlon Zambon[1], Bastian Real[3], Omar Jamadi[3], Aristide Lemaître[1], Martina Morassi[1], Luc Le Gratiet[1], Teo Baptiste[1], Abdelmounaim Harouri[1], Isabelle Sagnes[1], Alberto Amo[3], Sylvain Ravets[1], and Jacqueline Bloch[1] — [1]Centre de Nanosciences et Nanotechnologies (C2N), CNRS, Université Paris-Saclay, Palaiseau, France — [2]Institut Pascal, CNRS, Université Clermont Auvergne, Clermont-Ferrand, France — [3]Physique des Lasers Atomes et Molécules, CNRS, Université de Lille, Lille, France

We study the nonlinear response of the bulk of the Su Schrieffer Heeger model. Taking advantage of the non-Hermitian nature of our system we unveil new stable solutions that have no counterpart in conservative systems.

Oral EC-2.5 17:45 TRACK 5

Nonlinear Control of PT-symmetry and Topological States — •Shiqi Xia[1], Dimitrios Kaltsas[2], Daohong Song[1], Ioannis Komis[2], Jingjun Xu[1], Alexander Szameit[3], Hrvoje Buljan[1,4], Konstantinos Makris[2,5], and Zhigang Chen[1,6] — [1]The MOE Key Laboratory of Weak-Light Nonlinear Photonics, TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China — [2]Department of Physics, University of Crete, Heraklion, Greece — [3]Institut für Physik, Universität Rostock, Rostock, Germany — [4]Department of Physics, Faculty of Science, University of Zagreb, Zagreb, Croatia — [5]Institute of Electronic Structure and Laser (IESL) – FORTH, Heraklion, Greece — [6]Department of Physics and Astronomy, San Francisco State University, California, USA

We demonstrate that optical nonlinearity can effectively modulate the loss of a defect potential in a non-Hermitian topological lattice, leading to single-channel switching between PT and non-PT-symmetric regimes and maneuver of topological zero modes.

EI-2: From Single Photons to Engineered Photonic Environments

Chair: Rudolf Bratschitsch, University of Münster, Münster, Germany

Time: Tuesday, 16:30–18:00 Location: TRACK 6

Oral EI-2.1 16:30 TRACK 6

Bound in the continuum modes in indirectly-patterned hyperbolic media — •Hanan Hezig Sheinfux[1], Lorenzo Orsini[1], Minwoo Jung[2], Iacopo Torre[1], Matteo Ceccanti[1], Rinu Abraham Maniyara[1], David Barcons Ruiz[1], Sebastian Castilla[1], Niels C.H. Hesp[1], Eli Janzen[3], Valerio Pruneri[1], James H. Edgar[3], Gennady Shvets[2], and Frank H. Koppens[1] — [1]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — [2]Cornell University, Ithaca, USA — [3]Kansas State University, Manhattan, USA

We study a new type of nanocavity, where multimodal interference enhances internal reflections. Using near-field microscopy, we observe the unprecedented combination of high quality factors, above 100, in nanocavity volumes as small as 100*100*3nm^3.

Oral EI-2.2 16:45 TRACK 6

Enhanced light-matter interaction in atomically thin semiconductors and 2D single photon emitters coupled to dielectric nano-antennas — •Luca Sortino[1], Panaiot Zotev[1], Riccardo Sapienza[2], Stefan Maier[2,3], and Alexander Tartakovskii[1] — [1]Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom — [2]Department of Physics, Imperial College London, London, United Kingdom — [3]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universitat Munchen, Munich, Germany

Mie resonances in dielectric nanostructures represent a novel platform for engineering light-matter interaction at the nanoscale. In our work, we integrated atomically thin WSe_2 with gallium phosphide nano-antennas and demonstrate the luminescence enhancement in 2D excitons and native quantum emitters.

Oral EI-2.3 17:00 TRACK 6

Gate-switchable arrays of single photon emitters in monolayer MoS2 — •Alexander Hötger[1], Katja Barthelmi[1], Ana Micevic[1], Julian Klein[2], Lukas Sigl[1], Florian Sigger[1], Elmar Mitterreiter[1], Samuel Gyger[3], Takashi Taniguchi[4], Kenji Watanabe[4], Michael Lorke[5], Matthias Florian[5], Frank Jahnke[5], Val Zwiller[3], Klaus Jöns[6], Ursula Wurstbauer[7], Christoph Kastl[1], Kai Müller[1], Jonathan Finley[1], and Alexander Holleitner[1] — [1]Walter Schottky Institut and Physics Department, TUM, Munich, Germany — [2]Department of Materials Science and Engineering, MIT, Cambridge, USA — [3]KTH Royal Institute of Technology, Stockholm, Sweden — [4]National Institute for Materials Science, Tsukuba, Ibaraki, Japan — [5]Institut für Theoretische Physik, Universität Bremen, Bremen, Germany — [6]Department of Physics, Paderborn University, Paderborn, Germany — [7]Institute of Physics, University of Münster, Münster, Germany

We demonstrate the deterministic generation and gate-switching of quantum emitter arrays in monolayer MoS2 embedded in field-effect structures.

Oral EI-2.4 17:15 TRACK 6

Trions and excitons in optical spectra of TMDCs — •Vasili Perebeinos[1], Yaroslav Zhumagulov[2,3], Alexei Vagov[3], Paulo Faria Junior[2], and Dmitry Gulevich[3] — [1]University at Buffalo, Buffalo, USA — [2]University of Regensburg, Regensburg, Germany — [3]ITMO University, St. Petersburg, Russia

We quantify the role of strong Coulomb interaction, which leads to tightly bound excitons and trions. We solve for the three-particle wavefunction for trions and report absorption and photoluminescence spectra as a function of doping and temperature.

Oral EI-2.5 17:30 TRACK 6

Fully tuneable Bloch-Band polaritons emerging from WS2 monolayer excitons in an optical lattice at room temperature — •Lukas Lackner[1], Marco Dusel[2], Carlos Anton-Solanas[1], Heiko Knopf[3], Falk Eilenberger[3], Oleg Egorov[4], Sven Schröder[5], Sven Höfling[2], and Christian Schneider[1] — [1]University of Oldenburg, Oldenburg, Germany — [2]University Würzburg, Würzburg, Germany — [3]Friedrich Schiller University, Jena, Germany — [4]Friedrich Schiller University, Jena, Germany — [5]Fraunhofer IOF, Jena, Germany

We study room temperature exciton-polaritons in a WS2-monolayer integrated in a fully tuneable photonic lattice, imprinted in an open cavity. Our study aims at the implementation of a highly versatile plaform to study non-linear, interacting bosons in lattices.

Oral EI-2.6 17:45 TRACK 6

Position-dependent valley polarization and valley coherence of WS2 monolayers — •Irina Komen, Sabrya Van Heijst, Sonia Conesa-Boj, and L. Kuipers — Delft University of Technology, Delft, Netherlands

We characterize the polarization properties of the photoluminescence from CVD-grown WS2 monolayer flakes. We find an inverse relationship between the non-uniform WS2 photoluminescence intensity, the valley polarization and the valley coherence.

EH-3: Advanced Control of Light with Metasurfaces

Chair: Vincenzo Galdi, University of Sannio, Benevento, Italy

Time: Tuesday, 16:30–18:00 Location: TRACK 7

Invited EH-3.1 16:30 TRACK 7

Emerging Directions in Local and Nonlocal Flat Optics — •Francesco Monticone — Cornell University, Ithaca, USA

We discuss our recent efforts on different topics at the frontier of the field of flat optics, including fundamental limits and tradeoffs of metalenses, metasurface junctions supporting new types of guided waves, and nonlocal flat-optics.

Oral EH-3.2 17:00 TRACK 7

High-Q collective resonances in plasmonic metasurfaces with ultra-weak angular dispersion — •Yao Liang[1], Baohua Jia[2], and Yuri Kivshar[1] — [1]Australia National University, Canberra, Australia — [2]Swinburne University of Technology, Melbourne, Australia

We experimentally demonstrate an unprecedented high-Q (~30) surface lattice resonance with extremely weak angular dispersion in a plasmonic metasurface, which is excited by using a high numerical aperture objective (NA = 0.4).

Oral EH-3.3 17:15 TRACK 7

Non-Diffracting Metallic Metasurfaces with High Directional Sensitivity — •Jon Gorecki[1], Oleksandr Buchnev[1], Christopher Bailey[2], Tamsin Cookson[2], Malgosia Kaczmarek[2], Pavlos Lagoudakis[2], and Vassili Fedotov[1] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom

We report a special class of metasurfaces in which transmission spectra displays a strong amplitude dependence with illumination angle. The effect is confined to a narrow wavelength band and responds up to angles of 60°.

Oral EH-3.4 17:30 TRACK 7

Magneto-optics in type-II hyperbolic metamaterial nanoantennas — Joel Kuttruff[1,2], Alessio Gabbani[3], Gaia Petrucci[3], Yingqi Zhao[4], Marzia Iarossi[4], Esteban Pedrueza-Villalmanzo[5], Alexandre Dmitriev[5], Antonietta Parracino[6], Giuseppe Strangi[7,8], Daniele Brida[1], Francesco De Angelis[4], Francesco Pineider[3], and •Nicolò Maccaferri[1] — [1]University of Luxembourg, Luxembourg, Luxembourg — [2]University of Konstanz, Konstanz, Germany — [3]Università di Pisa, Pisa, Italy — [4]Istituto Italiano di Tecnologia, Genova, Italy — [5]University of Gothenburg, Gothenburg, Sweden — [6]Istituto di Struttura della Materia, Roma, Italy — [7]Case Western Reserve University, Cleveland, USA — [8]Università della Calabria, Cosenza, Italy

We study magneto-optical circular dichroism in type-II hyperbolic nanoantennas. Experiments and numerical simulations reveal a broadband response, which we ascribe to the excitation of electric and magnetic dipole modes coupled to an external magnetic field.

Oral EH-3.5 17:45 TRACK 7

Giant Optical Chirality in All-dielectric Halide Perovskite Metasurfaces — Guankui Long[1,2], •Giorgio Adamo[1], Jingyi Tian[1], Elena Feltri[1,3], Harish N. S. Krishnamoorthy[1], Maciej Klein[1,2], and Cesare Soci[1,2] — [1]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, 21 Nanyang Link, Singapore 637371, Singapore, Singapore — [2]Energy Research Institute @ NTU (ERI@N), Research Techno Plaza, Nanyang Technological University, 50 Nanyang Drive, Singapore, Singapore, Singapore — [3]Department of Physics, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy, Milano, Italy

We report giant chirality in all-dielectric halide perovskite metasurfaces. With circular dichroism potentially as high as 45% and remarkable light-emission properties, halide perovskite metasurfaces can rival conventional dielectric platforms for low cost, active metadevices.

CB-2: High Power Semiconductor Lasers

Chair: Ute Troppenz, Fraunhofer Institute for Telecommunications, Heinrich-Herz-Institute, Berlin, Germany

Time: Tuesday, 16:30–18:00 Location: TRACK 8

Oral CB-2.1 16:30 TRACK 8

Increased Conversion Efficiency at 800 W Continuous Wave Output From Single 1-cm Diode Laser Bars at 940 nm — •Paul Crump[1], Arne Meissner-Schenk[2], Thorben Kaul[2], Stephan Strohmaier[2], Matthias M. Karow[1], Anisuzzaman Boni[1], Andre Maaßdorf[1], Dominik Martin[1], and Günther Tränkle[1] — [1]Ferdinand-Braun-Institut GmbH, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany — [2]TRUMPF Laser GmbH, Niederlassung Berlin, Berlin, Germany

1-cm laser bars with 4mm resonators emitting at 940 nm that integrate extreme triple asymmetric epitaxial designs, wide-aperture-emitter layouts and advanced coolers enable 800W continuous wave output power with over 60% conversion efficiency (67.5% peak).

Oral CB-2.2 16:45 TRACK 8

Watt-Class Single Mode 885 nm Diode Lasers — •Jenna Campbell, Michelle Labrecque, Fatt Foong, Daniel Renner, Milan Mashanovitch, and Paul Leisher — Freedom Photonics, Santa Barbara, USA

In this work, we demonstrate watt-class diffraction limited diode lasers at 885 nm. Our ridge waveguide lasers deliver >1800 mW output power and exhibit a peak electrical to optical efficiency of 42%.

Oral CB-2.3 17:00 TRACK 8

Pump laser diode optimized for lowered operating voltage while maintaining high power conversion efficiency — •Jari Nikkinen, Soile Talmila, Ville Vilokkinen, Petri Melanen, Jari Sillanpää, and Petteri Uusimaa — Modulight Inc., Tampere, Finland

There is increasing demand for high-power, high-brightness, and high-efficiency laser diodes for kW-level fiber laser pumping. We present >12W pump laser diode optimized for lowered operating voltage while maintaining high efficiency of 60%

Oral CB-2.4 17:15 TRACK 8

Vertical design approach for suppressing power saturation in GaAs-based high-power diode lasers — •Seval Arslan, Anisuzzaman Boni, Andre Maaßdorf, Götz Erbert, Dominik Martin, Jörg Fricke, and Paul Crump — Ferdinand-Braun-Institut gGmbh, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany

Pulsed testing of high-power diode lasers using extreme triple asymmetric epitaxial designs reveals strong improvement in bias driven losses at high temperature compared to a baseline, as needed to obtain high power under CW operation.

Oral CB-2.5 17:30 TRACK 8

Role of Temperature Nonuniformity on Longitudinal Current Crowding in High Power Diode Lasers — •Paul Leisher, Michelle Labrecque, Elliot Burke, Kevin McClune, Daniel Renner, and Jenna Campbell — Freedom Photonics LLC, Santa Barbara, USA

Longitudinal current crowding has recently been shown to limit the efficiency of cavity length scaling in high power diode lasers. We report on the role of temperature nonuniformity on the longitudinal current crowding effect.

Oral CB-2.6 17:45 TRACK 8

DBR-tapered lasers at 783 nm with narrowband emission and output powers up to 7 W — •Bernd Sumpf, Lara Sophie Theurer, Martin Maiwald, André Müller, André Maaßdorf, Jörg Fricke, Peter Ressel, and Günther Tränkle — Ferdinand-Braun-Institut gGmbH, Berlin, Germany

Wavelength stabilized, high-power DBR tapered diode lasers emitting at 783 nm with output powers up to 7 W and a narrow spectral linewidth below 80 pm will be presented.

CE-3: Fabrication and Characterization Techniques

Chair: Michael Jetter, University of Stuttgart, Stuttgart, Germany

Time: Tuesday, 16:30–18:00 Location: TRACK 9

Oral CE-3.1 16:30 TRACK 9

Photo-deflection technique for characterization of chirality in diffractive metasurfaces — Grigore Leahu[1], •Emilija Petronijevic[1], Roberto Li Voti[1], Alessandro Belardini[1], Tiziana Cesca[2], Carlo Scian[2], Giovanni Mattei[2], and Concita Sibilia[1] — [1]University of Rome La Sapienza, Rome, Italy — [2]University of Padova, Padova, Italy

Here we show that a local, low-cost, scattering-free, non-destructive photo-deflection technique can be used to detect optical chirality in diffracted orders of a metasurface, with high sensitivity.

Oral CE-3.2 16:45 TRACK 9

Heterodyne detection applied to the characterization of nonlinear integrated waveguides — •meryem Ibnoussina — Laboratoire Interdisciplinaire Carnot de Bourgogne , Dijon, France

In this work, we present a technique relying on heterodyne interferometry for the characterization of nonlinear waveguides. This method can cope with a small nonlinear phase shift, low power, and large propagation loss.

Oral CE-3.3 17:00 TRACK 9

Unified FROG for characterizing 205 nm to 2000 nm, s or p polarization, from 2-cycle to 100 ps. — •Derrek Wilson[1,2], Alicia Ramirez[1], Philippe Lassonde[2], Mayank Kumar[2], Adrien Longa[2], Antoine Laramee[2], Heide Ibrahim[2], Francois Legare[2], and Bruno Schmidt[1] — [1]few-cycle inc., Varennes, Canada — [2]INRS-EMT, Varennes, Canada

A Frequency Resolved Optical Gating instrument accepting s or p polarized input pulses ranging from 205 nm to 2000 nm, durations from 2 cycles to 100 ps, and nano-Joule energies is presented.

Oral CE-3.4 17:15 TRACK 9

Low random duty-cycle errors in periodically-poled KTP revealed by sum-frequency generation — •Felix Mann, Helen Chrzanowski, and Sven Ramelow — Humboldt-Universität zu Berlin, Institut für Physik, Berlin, Germany

We have characterised bulk ppKTP regarding to its poling quality and hence its suitability as quantum frequency converter platform. From our measurements we can conclude low random duty cyle errors and low parasitic SPDC noise.

Oral CE-3.5 17:30 TRACK 9

Surface State Spectroscopy: Experimental Evaluation of Surface Charge Density and Spontaneous Polarization of ZnO. — •Yury Turkulets, Varun Thakur, and Ilan Shalish — Ben Gurion University, Beer Sheva, Israel

We present a method for quantitative characterization of surface states. Using the proposed technique we were able to experimentally obtain, for the first time, the spontaneous polarization of ZnO.

Oral CE-3.6 17:45 TRACK 9

Sub-ps laser damage resistance of optical coatings for reflective components — •Marek Stehlík, Frank Wagner, and Laurent Gallais — Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, Marseille, France

We present experimental results on the Laser-Induced Damage Threshold at 500fs / 1030nm of dielectric coatings. The tested materials are intended to be used for the fabrication of Grating Waveguide Structures (GWS) enabling polarization, wavelength, or pulse duration tuning.

CH-4: Fiber-based Sensors II

Chair: Jian-Jang Huang, National Taiwan University, Taiwan

Time: Tuesday, 16:30–18:00 Location: TRACK 10

Oral CH-4.1 16:30 TRACK 10

BIO-Bragg gratings: structured molecular networks for on-fiber bioanalysis — Augusto Juste-Dolz[1], •Martina Delgado-Pinar[2], Miquel Avellà-Oliver[1,4], Estrella Fernández[1], Daniel Pastor[3], Miguel V. Andrés[2], and Ángel Maquieira[1,4] — [1]Instituto Interuniversitario de Investigación de Reconocimiento Molecular y Desarrollo Tecnológico (IDM), Universitat Politècnica de València, Universitat de València, Valencia, Spain — [2]Laboratory of Fiber Optics - Institut de Ciència dels Materials (ICMUV), Universitat de València, Paterna, Spain — [3]Photonics Research Labs, Universitat Politècnica de València, Valencia, Spain — [4]Departament de Química, Universitat Politècnica de València, Valencia, Spain

Bio-Bragg gratings are unlabelled, on-fiber biosensors based on the patterning of a periodic network of bioreceptors on the surface of a microfiber. Multiplexation and tunability perspectives, and minimized non-specific bindings in human serum are demonstrated.

Oral CH-4.2 16:45 TRACK 10

A High Sensitivity Ethanol Sensor Based on Photo-imprinted, Micro-ring Resonators on Optical-Fiber Tapers — Vasileia Melissinaki, Odysseas Tsilipakos, Maria Kafesaki, Maria Farsari, and •Stavros Pissadakis — Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece

A highly sensitive ethanol vapour sensor based on the imprinting of micro-ring resonators onto optical fiber tapers, using multi-photon lithography is presented. This hybrid, sensing probe readily achieves ethanol detection levels of 0.5ppm.

Oral CH-4.3 17:00 TRACK 10

Bend Sensor based on Eccentrical Bragg Gratings in Polymer Optical Fibres — •Lennart Leffers[1], Julia Locmelis[1], Kort Bremer[1], Bernhard Roth[1,3], and Ludger Overmeyer[1,2,3] — [1]Hannover Centre for Optical Technologies, Gottfried Wilhelm Leibniz University Hanover, Nienburger Str. 17, Hanover, Germany — [2]Institute for Transport and Automation Technology, Gottfried Wilhelm Leibniz University Hanover, An der Universität 2, Hanover, Germany — [3]Cluster of Excellence PhoenixD, Gottfried Wilhelm Leibniz University Hanover, Welfengarten 1, Hanover, Germany

Bend sensing through eccentric FBGs in multimode polymer optical fibres is reported. Depending on FBG number, position and depth, 1D and 3D measurements are possible with prospect for diagnosis of musician's focal dystonia in future.

Oral CH-4.4 17:15 TRACK 10

Superiority of a Square-core Multimode Fiber for Imaging and Spectroscopy — •Zhouping Lyu[1], Matthias C. Velsink[1,2], Pepijn W.H. Pinkse[2], and Lyubov. V. Amitonova[1,3] — [1]Advanced Research Center for Nanolithography (ARCNL), Science Park 106, 1098XG, Amsterdam, Netherlands — [2]MESA+ Institute for Nanotechnology, University of Twente, PO Box 217, 7500AE, Enschede, Netherlands — [3]Department of Physics and Astronomy, Vrije Universiteit Amsterdam, De Boelelaan 1081, 1081HV, Amsterdam, Netherlands

For fiber based imaging and spectroscopy, a round-core multimode fiber (MMF) is commonly used. We experimentally and theoretically demonstrate that because of the homogeneous mode distribution, a square-core MMF is superior to a round-core MMF.

Oral CH-4.5 17:30 TRACK 10

Optical Fibre Humidity Sensor for Accessing the Wetting Condition of Oak Barrels — Nikos Poumpouridis [1,2], Zacharias Diamantakis [3,4], Nikos Gavalas [3,5], Vasilis Laderos [3,6], Stavros Pissadakis[1], and •Maria Konstantaki[1] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology – Hellas, Heraklion, Greece — [2]Physics Department, University of Crete, Heraklion, Greece — [3]Winemakers' Association of the Department of Heraklion - Wines of Crete, Heraklion, Greece — [4]Diamantakis Winery, Heraklion, Greece — [5]Gavalas Crete Wines, Heraklion, Greece — [6]Idaia Winery, Heraklion, Greece

A Fabry Perot optical fibre sensor with a hydroscopic photo- resin cavity is developed for monitoring the evolution of moisture content along the walls of oak barrels used in wine ageing

Oral CH-4.6 17:45 TRACK 10

Photonic lantern for multiplexing fiber Fabry-Perot sensors — •Jose Flores[1], Joseba Zubia[1], and joel Villatoro[1,2] — [1]University of the Basque Country, Bilbao, Spain — [2]IKERBASQUE, Basque Foundation fos Science, Bilbao, Spain

In this work, we report on the use of a photonic lantern for multiplexing fiber Fabry-Perot interferometric sensors, hence to monitor multiple parameters. The interferometers must have proper cavity lengths to avoid crosstalk.

EB-4: Nonclassical Light Sources

Chair: Christoph Becher, Universität des Saarlandes, Saarbrücken, Germany

Time: Tuesday, 16:30–18:00 Location: TRACK 11

Oral EB-4.1 16:30 TRACK 11

Nonlinear waveguides for integrated quantum light source — •Renato Domeneguetti[1], Hauke Conradi[2], Moritz Kleinert[2], Christian Kießler[3], Michael Stefszky[3], Harald Herrmann[3], Christine Silberhorn[3], Ulrik Andersen[1], Jonas Neergaard-Nielsen[1], and Tobias Gehring[1] — [1]Center for Macroscopic Quantum States bigQ, Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]Fraunhofer Heinrich Hertz Institute, Berlin, Germany — [3]Integrated Quantum Optics, Paderborn University, Paderborn, Germany

We experimentally investigate the generation of continuous-wave optical squeezing from a titanium-indiffused lithium niobate waveguide resonator at low and high frequencies. The device promises integration with different platform chips for more complex optical systems.

Oral EB-4.2 16:45 TRACK 11

Indistinguishable photons from a tin-vacancy spin in diamond — •Johannes Görlitz[1], Robert Morsch[1], Dennis Herrmann[1], Pierre-Olivier Collard[2], Takayuki Iwasaki[3], Takashi Taniguchi[4], Matthew Markham[2], Mutsuko Hatano[3], and Christoph Becher[1] — [1]Saarland University, Saarbrücken, Germany — [2]Element Six Global Innovation Centre, Harwell Oxford, United Kingdom — [3]Tokyo Institute of Technology, Tokyo, Japan — [4]National Institute for Material Science, Tsukuba, Japan

The tin-vacancy centre in diamond is a promising candidate for realising an elementary node in quantum networks.We here investigate the emission of indistinguishable single photons and the long-term stability of the emission line.

Oral EB-4.3 17:00 TRACK 11

Investigation of Resonance Fluorescence in the Telecom C-Band from In(Ga)As Quantum Dots — •Cornelius Nawrath, Hüseyin Vural, Julius Fischer, Richard Schaber, Simone Luca Portalupi, Michael Jetter, and Peter Michler — Institut für Halbleiteroptik und Funktionelle Grenzflächen, Center for Integrated Quantum Science and Technology (IQST) and SCoPE, University of Stuttgart, Stuttgart, Germany

As potential light sources for quantum communication, semiconductor quantum dots emitting around 1550nm are highly promising. We present an in-depth study on resonance fluorescence properties of In(Ga)As quantum dots emitting in the telecom C-band.

Oral EB-4.4 17:15 TRACK 11

Bright Purcell enhanced single-photon source in the telecom O-band based on a quantum dot in a circular Bragg grating — •Sascha Kolatschek, Stephanie Bauer, Cornelius Nawrath, Jiasheng Huang, Julius Fischer, Robert Sittig, Michael Jetter, Simone Luca Portalupi, and Peter Michler — Institut für Halbleiteroptik und Funktionelle Grenzflächen, Center for Integrated Quantum Science and Technology (IQST) and SCoPE, University of Stuttgart, Stuttgart, Germany

Quantum dots are excellent single-photon emitters with performances mainly limited by the high refractive index contrast. We present a bright Purcell enhanced telecom O-band quantum dot using a cicular Bragg grating cavity.

Invited EB-4.5 17:30 TRACK 11

A fast and bright source of coherent single photons — •Richard Warburton — Department of Physics, University of Basel, Basel, Switzerland

A single photon source is reported with a total end-to-end efficiency of 57%. The coherence of the photons is high – the two-photon interference visibility is 97.5%.

ED-4: Frequency Standards and Miniaturized Comb Platforms

Chair: Frans Harren, Radboud University, Nijmegen, The Netherlands

Time: Tuesday, 18:30–20:00 Location: TRACK 1

Invited ED-4.1 18:30 TRACK 1

Optical atomic clocks for chronometric leveling — •Tanja Mehlstäubler — Physikalisch-Technische Bundesanstalt, Braunschweig, Germany — Leibniz Universität Hannover, Hannover, Germany

I will introduce the concepts of optical clocks and their use for fundamental tests of the standard model as well as novel applications of clocks for mapping the Earth's geoid.

Oral ED-4.2 19:00 TRACK 1

Spectral Hole Burning for Ultra-stable Lasers — •Shuo Zhang[1], Nemanja Lučić[1], Nicolas Galland[1,2], Roldolphe Le Targat[1], Alban Ferrier[3], Phillippe Goldner[3], Bess Fang[1], Signe Seidelin[2,4], and Yann Le Coq[1] — [1]LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Paris, France — [2]Univ. Grenoble Alpes, CNRS, Grenoble INP and Institut Néel, Grenoble, France — [3]Institut de Recherche de Chimie Paris, Université PSL, Chimie ParisTech, CNRS, Paris, France — [4]Institut Universitaire de France, Paris, France

Ultra-stable lasers achieved by the spectral hole burning in rare-earth ion-doped crystals are realized and studied. Ultimate precision is evaluated from sensitivity measurements to various parameters (E-field, temperature, acceleration, detection noise).

Oral ED-4.3 19:15 TRACK 1

More Than 34 dB Backscattering Suppression in Microresonators — •Andreas Ø. Svela[1,2,3], Jonathan M. Silver[4], Leonardo Del Bino[2], Shuangyou Zhang[2], Michael M. T. Woodley[1], Michael R. Vanner[1,3], and Pascal Del'Haye[2,5] — [1]Blackett Laboratory, Imperial College London, London, United Kingdom — [2]Max Planck Insitute for the Science of Light, Erlangen, Germany — [3]Clarendon Laboratory, Univeristy of Oxford, Oxford, United Kingdom — [4]National Physical Laboratory, Teddington, United Kingdom — [5]Friedrich Alexander University Erlangen-Nuremberg, Erlangen, Germany

We demonstrate a method for reducing backscattering of light in whispering-gallery-mode resonators, achieving >34 dB suppression of the intrinsic backscattering level. The method relies on positioning a sub-wavelength-size scatterer within the resonator's evanescent field.

Oral ED-4.4 19:30 TRACK 1

Broadband Optical Spectrum Downconversion to RF Using Integrated Dual-Comb Source — •Nikita Dmitriev[1,2], Andrey Voloshin[1,5], Sergey Koptyaev[3], and Igor Bilenko[1,4] — [1]Russian Quantum Center, Moscow, Russia — [2]Moscow Institute of Physics and Technology, Dolgoprudny, Russia — [3]Samsung R&D Institute Russia, SAIT-Russia Laboratory, Moscow, Russia — [4]Faculty of Physics, M.V. Lomonosov Moscow State University, Moscow, Russia — [5]Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Luasanne, Switzerland

For the first time, dual-comb operation of packaged fully integrated microcombs based on LD-pumped high-Q SiN microresonators down-converted 300 nm wide optical spectrum down-conversation to RF. It provides a route to an integrated broadband spectrometer.

Oral ED-4.5 19:45 TRACK 1

Spectra Characterization of Ring Quantum Cascade lasers — •Bo Meng, Mathieu Betrand, Johannes Hillbrand, Mattias Beck, and Jérôme Faist — ETH, Zurich, Switzerland

The spectra of mid-infrared frequency comb based on the ring QCLs with the optimized structure reported. The spectra show multiple phase transitions, with a spectrum regime that be fitted by a sech2 function.

EA-2: Cold Molecules

Chair: Jürgen Volz, Humboldt Universität, Berlin, Germany

Time: Tuesday, 18:30–20:00 Location: TRACK 2

Tutorial EA-2.1 18:30 TRACK 2

not yet filled — •Ed Narevicius — , ,
not yet filled

Oral EA-2.2 19:30 TRACK 2

What could THz radiation bring to the field of ultracold gases? — •Adrien Devolder[1], Michele Desouter-Lecomte[2], Osman Atabek[3], Eliane Luc-Koenig[4], and Olivier Dulieu[4] — [1]Chemical Physics Theory Group, Department of Chemistry, and Center for Quantum Information and Quantum Control, University of Toronto, Toronto, Canada — [2]Institut de Chimie Physique, CNRS, Université Paris-Sud, Université Paris-Saclay, Orsay, France — [3]Institut des Sciences Moléculaires d'Orsay, CNRS, Université Paris-Sud, Université Paris-Saclay, Orsay, France — [4]Laboratoire Aimé Cotton, CNRS, Université Paris-Sud, ENS Paris-Saclay, Université Paris-Saclay, Orsay, France

New developments of THz source open new perspectives in control of ultracold systems. We propose two potential applications: control of scattering length and new paths for the formation of ultracold molecules.

Oral EA-2.3 19:45 TRACK 2

Optical shielding of destructive chemical reactions between ultracold ground-state NaRb molecules — •Andrea Orban[1], Ting Xie[2], Maxence Lepers[3], Olivier Dulieu[2], and Nadia Bouloufa-Maafa[2] — [1]Institute for Nuclear Research (ATOMKI), H-4001 Debrecen, Pf. 51, Hungary — [2]Universite Paris-Saclay, CNRS, Laboratoire Aime Cotton, 91405 Orsay, France — [3]Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS, Universite de Bourgogne Franche-Comte, 21078 Dijon, France

Optical shielding of destructive chemical reactions between ultracold ground-state NaRb molecules will be presented. The proposed optical shielding leads to dramatic suppression of inelastic collisions which opens the possibility for strong increase of trapping time.

CG-4: Chemical Reactions and Molecular Dynamics

Chair: Mathieu Gisselbrecht, Lund University, Lund, Sweden

Time: Tuesday, 18:30–20:00 Location: TRACK 3

Oral CG-4.1 18:30 TRACK 3

Ultrafast dynamics of correlation bands following XUV molecular photoionization — •Alexie Boyer[1], Marius Hervé[1], Victor Despré[2], Pablo Castellanos Nash[3], Vincent Loriot[1], Audrey Scognamiglio[1], Gabriel Karras[1], Richard Brédy[1], Eric Constant[1], Alexander Tielens[3], Alexander Kuleff[2], and Franck Lépine[1] — [1]Univ Lyon, Univ Claude Bernard Lyon 1, CNRS, Institut Lumière Matière, Villeurbanne, France — [2]Theoretische Chemie, PCI, Universität Heidelberg, Heidelberg, Germany — [3]Leiden Observatory, Leiden University, Leiden, Netherlands

The relaxation timescales of correlation bands, features created by electron correlation, are measured experimentally in several molecules. A simple model based on Fermi golden rule is proposed to explain the size-dependency of the results.

Oral CG-4.2 18:45 TRACK 3

Coherent control of ultrafast XUV transient absorption — •Peng Peng[1,2], Yonghao Mi[1], Marianna Lytova[2], Mathew Britton[2], Xiaoyan Ding[1,2], Andrei Naumov[1], Paul Corkum[1,2], and David Villeneuve[1,2] — [1]Joint Attosecond Science Laboratory, National Research Council and University of Ottawa, Ottawa, Canada — [2]Department of Physics, University of Ottawa, Ottawa, Canada

We demonstrated coherent control of molecular absorption line shape and optical gain in ultrafast XUV transient absorption spectroscopy of hydrogen and deuterium molecules.

Oral CG-4.3 19:00 TRACK 3

Femtosecond-resolved Rydberg states dynamics in chiral molecules — •Vincent Wanie[1,2], Etienne Bloch[3], Erik P. Månsson[1], Lorenzo Colaizzi[1,4], Krishna Saraswathula[1], Sergey Riabchuk[4], François Légaré[2], Andrea Trabattoni[1], Marie-Catherine Heitz[5], Nadia Ben Amor[5], Valérie Blanchet[3], Yann Mairesse[3], Bernard Pons[3], and Francesca Calegari[1,4,6,7] — [1]Center for Free-Electron Laser Science, DESY, Hamburg, Germany — [2]Institut National de la Recherche Scientifique, Varennes, Canada — [3]Université de Bordeaux - CNRS - CEA, Talence, France — [4]Universität Hamburg, Hamburg, Germany — [5]Université Toulouse UPS CNRS, Toulouse, France — [6]The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany — [7]Institute for Photonics and Nanotechnologies CNR-IFN, Milano, Italy

By exploiting the temporal resolution provided by a unique light source delivering few-femtosecond ultraviolet pulses, the ultrafast relaxation dynamics of photoexcited chiral molecules was studied using time-resolved circular dichroism measurements over few tens of femtoseconds.

Oral CG-4.4 19:15 TRACK 3

Probing influence of molecular dynamic polarization in photoemission delays near giant resonance in C60 — •Shubhadeep Biswas[1,2], A. Trabattoni[3], P. Rupp[1,2], Q. Liu[1,2], J. Schötz[1,2], P. Wnuk[1,2], M. Galli[4,5], E. P. Mansson[3,4], V. Manie[3,4,6], M. Nisoli[4,5], U. D. Giovannini[7,8], A. Rubio[7,9], M. Magrakvelidze[10], H. Chakraborty[11], M. F. Kling[1,2], and F. Calegari[3,4,12] — [1]Physics Department, Ludwig-Maximilians-Universität Munich, Munich, Germany — [2]Max Planck Institute of Quantum Optics, Garching, Germany — [3]Center for Free-Electron Laser Science, DESY, Hamburg, Germany — [4]CNR-IFN, Milano, Italy — [5]Department of Physics, Politecnico di Milano, Milano, Italy — [6]INRS, Varennes (Qc), Canada — [7]MPSD and CFEL, Hamburg, Germany — [8]Dip. di Fisica e Chimica, Università degli Studi di Palermo, Palermo, Italy — [9]CCQ, The Flatiron Institute, New York, USA — [10]Department of Physics, University of Mary Washington, Fredericksburg, USA — [11]Department of Natural Sciences, D L Hubbard Center for Innovation, Northwest Missouri State University, Maryville, USA — [12]Institut für Experimentalphysik, Universität Hamburg, DESY, Hamburg, Germany

Measurement of photoemission delays for C60 around giant plasmon resonance, using attosecond streaking metrology. Combined experimental and theoretical investigations reveal the influence of dynamic polarizability and collective excitation.

Oral CG-4.5 19:30 TRACK 3

Inner Valence Hole Migration in Isopropanol — •Oliver Alexander[1], Thomas Barillot[1], Bridgette Cooper[1,2], Taran Driver[1,3,4], Douglas Garratt[1], Siqi Li[4], Andre Al Haddad[5,6], Alvaro Sanchez-Gonzales[1], Marcus Agaker[7,8], Christopher Arrel[6], Vitali Averbukh[1], Michael Bearpark[1], Nora Berrah[9], Cristoph Bostedt[5,6,10], John Bozek[10], Chris Brahms[1], Philip Buksbaum[3], A Clark[10], Gilles Doumy[5], Raymund Feifel[11], Leszek Fransinski[1], Sebastian Jarosch[1], Allan Johnson[1], Ludwig Kjellsson[7], Premsyl Kolorenc[12], Yoshiaki Kumagai[5], Esben Larsen[1], Paloma Maria-Hernando[1], Michael Robb[1], Jan-Erik Rubensson[7], Marco Ruberti[1], Conny Sathe[8], Richard Squibb[11], John Tisch[1], Kiyoshi Ueda[13], Morgane Vacher[14], Daniel Walke[1], Thomas Wolf[3], David Wood[1], Vitali Zhaunerchyk[11], Aorui Tan[1], Peter Walter[4], Timur Osipov[4], Agostino Marinelli[4], Timothy Maxwell[4], Ryan Coffee[4], Alberto Lutman[4], James Cryan[4], and Jonathan Marangos[1] — [1]Imperial College London, London, United Kingdom — [2]University College London, London, United Kingdom — [3]Stanford PULSE Institute, California, USA — [4]SLAC National Accelerator Laboratory, California, USA — [5]Argonne National Laboratory, Argonne, USA — [6]Paul-Scherrer Institute, Villigen, Switzerland — [7]Uppsala University, Uppsala, Sweden — [8]MAX IV Laboratory, Lund, Sweden — [9]University of Connecticut, Connecticut, USA — [10]EPFL, Lausanne, Switzerland — [11]University of Gothenberg, Gothenberg, Sweden — [12]Charles University, Prague, Czech Republic — [13]Tohoku Universy, Sendai, Japan — [14]Universite du Nantes, Nantes, France

Correlated neutral eigenstates and virtual orbitals drive purely electronic charge motion within a cation following photoemission. We employ novel detection methods in a few-femtosecond two-colour X-ray pump-probe arrangement to measure this in isopropanol.

Oral CG-4.6 19:45 TRACK 3

Time-resolved water-window X-ray spectroscopy of chemical reactions and charge dynamics in nano-solids in a liquid phase — •Tadas Balciunas[1], Yi-Ping Chang[1], Zhong Yin[2], Aaron Terpstra[1], Cédric Schmidt[1], Jacques-E Moser[3], Jean-Pierre Wolf[1], and Hans Jakob Wörner[2] — [1]GAP-Biophotonics, Université de Genéve, Geneva, Switzerland — [2]Laboratory for Physical Chemistry, ETH Zürich, Zürich, Switzerland — [3]Institute of Chemical Sciences and Engineering, Lausanne, Switzerland

We demonstrate time–resolved soft–X–ray absorption spectroscopy of liquid samples at K edges of carbon, nitrogen and titanium L2,3 edge using a sub–um liquid jet to study dynamics in aqueous solutions and nanoparticles.

CJ-2: Mode-locked Fiber Lasers above 2 Micron

Chair: Sobon Grzegorz, Wroclaw University of Technology, Poland

Time: Tuesday, 18:30–20:00 Location: TRACK 4

Oral CJ-2.1 18:30 TRACK 4

All-fiber format source of 50 nJ 9 cycle pulses at 2.95 μm — •Idris Tiliouine, Geoffroy Granger, Hugo Delahaye, Yann Leventoux, Vincent Couderc, and Sébastien Février — Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France

We demonstrate that picosecond pulses at 2 μm from a MHz repetition rate fiber laser can trigger the formation of frequency-shifted solitons up to 2.95 μm with 50 nJ energy and 86 fs duration pulse.

Oral CJ-2.2 18:45 TRACK 4

Passively mode-locked 2.8 μm polarization maintaining fiber laser — •Alexandre Kouta[1], Thibaud Berthelot[2], Rezki Becheker[1], Solenn Cozic[2], Saïd Idlahcen[1], Thomas Godin[1], Patrice Camy[3], Samuel Poulain[2], and Ammar Hideur[1] — [1]CORIA - CNRS - Université de Rouen Normandie - INSA Rouen, Rouen, France — [2]Le Verre Fluoré, Bruz, France — [3]CIMAP, ENSICAEN-CNRS-CEA-Université Caen Normandie, Caen, France

We report on the first demonstration of a passively mode-locked oscillator featuring a polarization maintaining erbium-doped ZBLAN fiber and generating a highly stable ultrashort pulses with 12 ps duration at a 28.8 MHz repetition rate.

Oral CJ-2.3 19:00 TRACK 4

Tuneable Self-Mode-Locking in a nJ- and fs-class Thulium-doped All-Fibre Laser — •Dennis Kirsch and Maria Chernysheva — Leibniz Institute of Photonic Technology, Jena, Germany

The capability of filter-less tuneability in a self-mode-locked oscillator is explored. The laser accesses a wavelength span of 1873-1962 nm with up to 68 mW output, 350 fs pulse duration and 44 MHz repetition rate.

Oral CJ-2.4 19:15 TRACK 4

Hybrid Mode-locking in a Thulium-doped Fiber Mamyshev Osillator — •Benedikt Schuhbauer[1], Veronika Adolfs[1], Paul Repgen[1], Moritz Hinkelmann[1,2], Andreas Wienke[1], Jörg Neumann[1,2], and Dietmar Kracht[1,2] — [1]Laser Zentrum Hannover e.V., Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany

We present the characteristics of a self-starting hybrid mode-locked Mamyshev oscillator. It emitted a pulse train at 16.55 MHz with a pulse energy of 1.6 nJ. The chirped pulses could be compressed to 295 fs.

Oral CJ-2.5 19:30 TRACK 4

2 μm mode-locked fiber laser enabled by NPR in a chalcogenide taper — •Imtiaz Alamgir and Martin Rochette — McGill University, Montreal, Canada

We demonstrate the first thulium-doped mode-locked fiber laser based on nonlinear polarization rotation in a chalcogenide taper. The resulting laser is tunable and operates in both a continuous-wave mode-locked or a Q-switch mode-locked regime.

Oral CJ-2.6 19:45 TRACK 4

Dumbbell-shaped Mode-locked Ho3+ - doped Fiber Laser — •Serafima A. Filatova[1], Vladimir A. Kamynin[1], Yuriy G. Gladush[2], Eldar M. Khabushev[2], Dmitry V. Krasnikov[2], Albert G. Nasibulin[2,3], and Vladimir B. Tsvetkov[1] — [1]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [2]Skolkovo Institute of Science and Technology, Moscow, Russia — [3]Aalto University, Espoo, Finland

We demonstrate a self-starting mode-locked holmium-doped fiber laser with the simple dumbbell-shaped cavity utilizing a polymer-free SWCNT. The effect of SWCNT layers number on the generation modes, stability, and self-starting was studied.

CA-4: Novel Laser Concepts

Chair: Jennifer Hastie, University of Strathclyde, Glasgow, United Kingdom

Time: Tuesday, 18:30–20:00 Location: TRACK 5

Invited CA-4.1 18:30 TRACK 5

The Game of Light & Heat: Cryogenic Optical Refrigeration and Athermal Lasers — •Mansoor Sheik-Bahae[1], Jackson Kock[1], Alexander Albrecht[1], Azzurra Volpi[1], Saeid Rostami[1], Mostafa Peysokhan[1], Richard Epstein[1], and Markus Hehlen[2] — [1]University of New Mexico , Albuquerque, NM, USA — [2]Los Alamos National Laboratory , Los Alamos, NM, USA

Optical refrigeration has shown record cooling of Yb:YLF crystals to <90K, and cooling of a payload (IR sensor) to 130K. In parallel, exploiting this concept for developing lasers without internal heat generation has been advancing.

Oral CA-4.2 19:00 TRACK 5

Temperature-dependent spectroscopy of Yb:YLF and prospects for laser cooling — •Stefan Püschel, Sascha Kalusniak, Christian Kränkel, and Hiroki Tanaka — Leibniz-Institut für Kristallzüchtung, Berlin, Germany

We present temperature-dependent spectroscopy and lifetime measurements of Yb:YLF with a setup suppressing reabsorption in a range between 17 K to 440 K. This enables to re-evaluate the potential of Yb:YLF for laser cooling.

Oral CA-4.3 19:15 TRACK 5

100 fs LED-pumped Cr:LiSAF regenerative amplifier — •Hussein Taleb, Pierre Pichon, Frédéric Druon, François Balembois, and Patrick Georges — Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, Palaiseau, France

We demonstrate the first LED-pumped femtosecond Cr:LiSAF regenerative amplifier operating at a 10 Hz repetition rate. After recompression, we obtain 100 fs pulses with 0.3 mJ pulse energy at 835 nm.

Oral CA-4.4 19:30 TRACK 5

Free-Space Intra-Cavity Dark Pulse Generation — •Martin Brunzell, Max Widarsson, Fredrik Laurell, and Valdas Pasiskevicius — Royal Institute of Technology, Stockholm, Sweden

First demonstration of free-space intra-cavity dark pulse generation through synchronized sum frequency generation between mode-locked and Nd:YVO4 laser. Cross-correlation shows dark pulses at 1064nm with sub-picosecond widths and 80% modulation depth at 150mW output.

Oral CA-4.5 19:45 TRACK 5

Metasurface Dichroic Mirrors: Application to Low Quantum Defect Lasers — Kaloyan Georgiev[1], Khosro Kamali[2], Lei Xu[2,3], Mohsen Rahmani[2,3], Andrey Miroshnichenko[4], Dragomir Neshev[2,5], and •Ivan Buchvarov[1,5] — [1]Physics Department, Sofia University, Bulgaria , Sofia , Bulgaria — [2]ARC Centre of Excellence TMOS, Research School of Physics, Australian National University, Canberra, Australia — [3]Advanced Optics and Photonics Laboratory, Department of Engineering, Nottingham Trent University, Nottingham, United Kingdom — [4]School of Engineering and Information Technology, University of New South Wales, Canberra, Australia — [5]John Atanasoff Center for Bio and Nano Photonics (JAC BNP), Sofia, Bulgaria

We demonstrate the design and implementation of optical metasurface mirror with a steep spectral change of its reflection. Using it as a resonator pump mirror of an Yb-laser, stable operation is obtained without its damage.

CD-5: Supercontinuum Generation

Chair: Hilton Barbosa de Aguiar, École Normale Supérieure, Paris, France

Time: Tuesday, 18:30–20:00 Location: TRACK 6

Oral CD-5.1 18:30 TRACK 6

Generation of an ultra-flat, low-noise and linearly polarized fiber supercontinuum covering 670 nm-1390 nm — •Etienne Genier[1,2], Sachat Grelet[1], Rasmus D. Engelsholm[1], Patrick Bowen[1], Peter M. Moselund[1], Ole Bang[3], John M. Dudley[2], and Thibaut Sylvestre[2] — [1]NKT Photonics , Birkerød, Denmark — [2]FEMTO-ST, Besançon, France — [3]DTU Fotonik, Lyngby, Denmark

We report an ultra-flat octave-spanning (670-1390 nm) coherent supercontinuum using a femtosecond-pumped all-normal dispersion polarization-maintaining fiber with excellent noise (RIN<0.54%) and polarization properties (PER>17 dB).

Oral CD-5.2 18:45 TRACK 6

Temporal fine structure of all-normal dispersion fiber supercontinuum — Anupamaa Rampur[1], Dirk-Mathys Spangenberg[1], Grzegorz Stępniewski[2,3], Dominik Dobrakowski[2], Karol Tarnowski[4], Karolina Stefańska[4], Adam Paździor[5], Paweł Mergo[5], Tadeusz Martynkien[4], Thomas Feurer[1], •Mariusz Klimczak[2], and Alexander Heidt[1] — [1]Institute of Applied Physics, University of Bern, Bern, Switzerland — [2]Faculty of Physics, University of Warsaw, Warsaw, Poland — [3]Łukasiewicz Research Network - Institute of Microelectronics and Photonics, Warsaw, Poland — [4]Department of Optics and Photonics, Wroclaw University of Science and Technology, Wroclaw, Poland — [5]Laboratory of Optical Fiber Technology, Maria Curie-Sklodowska University, Lublin, Poland

Experimental characterization of spectro-temporal structure of octave-spanning, coherent fiber supercontinuum pulses is performed and full-field information is retrieved using time-domain ptychography. Fast femtosecond oscillations are observed and traced back to imperfections of the pump pulses.

Oral CD-5.3 19:00 TRACK 6

Noise Fingerprints of Fiber Supercontinuum Sources — •Dirk-Mathys Spangenberg[1], Benoît Sierro[1], Anupamaa Rampur[1], Pascal Hänzi[1], Alexander Hartung[2], Pawel Mergo[3], Karol Tarnowski[3], Tadeusz Martynkien[3], Mariusz Klimczak[4], and Alexander Heidt[1] — [1]Institute of Applied Physics, University of Bern, Bern, Switzerland — [2]Leibniz-Institute of Photonic Technology, Jena, Germany — [3]Wroclaw University of Science and Technology, Wroclaw, Poland — [4]Faculty of Physics, University of Warsaw, Warsaw, Poland

We present a novel technique for measuring unique "noise fingerprints" of fiber supercontinuum (SC) sources, revealing a strong dependence of SC relative intensity noise not only on the dispersion of the fiber, but also on its cross-sectional geometry.

Oral CD-5.4 19:15 TRACK 6

All-Optical Switching of Supercontinuum Spectra — •Oliver Melchert[1,2,3], Ayhan Tajalli[1,2], Alexander Pape[2], Rostislav Arkhipov[4], Stephanie Willms[1,2], Ihar Babushkin[1,2], Dmitry Skryabin[5], Günter Steinmeyer[6,7], Uwe Morgner[1,2,3], and Ayhan Demircan[1,2,3] — [1]Institute of Quantum Optics, Leibniz University Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation Across Disciplines), Hannover, Germany — [3]Hannover Centre for Optical Technologies, Hannover, Germany — [4]St. Petersburg State University, St. Petersburg, Russia — [5]Department of Physics, University of Bath, Bath, United Kingdom — [6]Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany — [7]Max Born Institute, Berlin, Germany

We discuss all-optical switching of parts of soliton fission induced supercontinuum spectra using a dispersive wave, enabled by a nonlinear interaction mechanism. We achieve ultrafast switching times, high contrast and satisfy the fan-out criterion.

Oral CD-5.5 19:30 TRACK 6

Transient Grating Single-shot Supercontinuum Spectral Interferometry (TG-SSSI) — •Scott W. Hancock, Sina Zahedpour, and Howard M. Milchberg — Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, USA

We present transient grating single-shot supercontinuum spectral interferometry, a technique for the single-shot measurement of spatiotemporal (1D space + time) amplitude and phase of an ultrashort laser pulse.

Oral CD-5.6 19:45 TRACK 6

UV Extension of Supercontinuum via Tapered Single-ring PCF — •Mallika Irene Suresh[1], Jonas Hammer[1], Nicolas Y. Joly[1,2], Philip St.J. Russell[1,2], and Francesco Tani[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Friedrich-Alexander-Universität, Erlangen, Germany

Tapered Kr-filled single-ring photonic crystal fibre, pumped by 220 fs 7.8 μJ pulses at 1030 nm, is used to generate a broadband supercontinuum with spectral power density 0.18 mW/nm between 200 and 350 nm.

CE-4: Luminescent Materials

Chair: Fiorenzo Vetrone, INRS, Montreal, Montreal, Canada

Time: Tuesday, 18:30–20:00 Location: TRACK 7

Invited CE-4.1 18:30 TRACK 7

Compact Quantum Dots Photoligated with Multifunctional Zwitterionic Coating for Immunofluorescence and Imaging — •Hedi Mattoussi — Florida State University, Department of Chemistry and Biochemistry, Tallahassee, FL 32306, USA

Highly fluorescent quantum dots (QDs) have been photoligated with multifunctional hydrophilic ligands that are compact and compatible with strain-promoted click conjugation. These QDs were then used as effective probes for immunofluorescence and in-vivo imaging.

Oral CE-4.2 19:00 TRACK 7

New laser crystals based on CaF2:Nd with double buffer ions for high energy lasers applications — •Cesare Meroni[1], Alain Braud[1], Jean-Louis Doualan[1], Cedric Maunier[2], Denis Penninckx[2], and Patrice Camy[1] — [1]Centre de recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen, 6 Blvd Maréchal Juin, Caen, France — [2]CEA CESTA, 15 avenue des Sablières, CS 60001, Le Barp Cedex, France

The co-doping of CaF2:Nd3+ with different buffer ions enables a fine tailoring of spectroscopic properties making this family of material promising for large-scale high peak power diode-pumped amplifiers.

Oral CE-4.3 19:15 TRACK 7

Growth and Polarized Spectroscopy of Red-Emitting Monoclinic Eu:CsGd(MoO4)2 Crystal with a Layered Structure — •Anna Volokitina[1,2], Pavel Loiko[3], Anatoly Pavlyuk[4], Sami Slimi[1], Rosa Maria Solé[1], Magdalena Aguiló[1], Francesc Díaz[1], and Xavier Mateos[1] — [1]Universitat Rovira i Virgili (URV), Tarragona, Spain — [2]ITMO University, St. Petersburg, Russia — [3]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen , France — [4]A.V. Nikolaev Institute of Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

17 at.% Eu:CsGd(MoO4)2 double molybdate crystal is grown from the flux. It is monoclinic, possesses a layered structure and exhibits perfect cleavage. An extremely strong polarization-anisotropy of spectroscopic properties of this red-emitting material is revealed.

Oral CE-4.4 19:30 TRACK 7

Strategies for charging and discharging phosphors with persistent luminescence. — •Teresa Delgado[1], Victor Castaing[1], Daniel Rytz[2], Emmanuel Véron[3], Mathieu Allix[3], and Bruno Viana[1] — [1]PSL University, Chimie ParisTech, IRCP-CNRS, Paris, France — [2]BREVALOR Sarl, Les Sciernes-d'Albeuve, Switzerland — [3]CNRS, CEMHTI UPR, Univ. Orléans, Orléans, France

The persistent luminescence of afterglow materials such as aluminates and garnets in the shape of transparent ceramics and crystals is optimized thanks to volumetric effect and the election of the ideal charging source.

Oral CE-4.5 19:45 TRACK 7

Transparent Gahnite Ceramics Cr3+:ZnAl2O4 – Novel Red-Emitting Material — •Liza Basyrova[1], Stanislav Balabanov[2], Alexander Belyaev[2], Ivan Mukhin[3], Ivan Kuznetsov[3], Jean-Louis Doualan[1], Patrice Camy[1], and Pavel Loiko[1] — [1]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France — [2]G.G. Devyatykh Institute of Chemistry of High-Purity Substances, RAS, Nizhny Novgorod, Russia — [3]Institute of Applied Physics of the Russian Academy of Science, Nizhny Novgorod, Russia

Transparent gahnite ceramics 1 at.% Cr:ZnAl2O4 are fabricated by hot pressing at 1520 °C / 40 MPa. Chromium ions Cr3+ reside in octahedral sites exhibiting intense broadband red luminescence with a lifetime of 2.14 ms.

EB-5: Long-Range Distribution of Entanglement I

Chair: Thomas Jennewein, University of Waterloo, Waterloo, Canada

Time: Tuesday, 18:30–20:00 Location: TRACK 8

Invited EB-5.1 18:30 TRACK 8

Efficient entanglement transfer between light and cold-atom quantum memories — •Felix Hoffet, Mingtao Cao, Shuwei Qiu, Alexandra S. Sheremet, Hadriel Mamann, Thomas Nieddu, and Julien Laurat — Sorbonne Universités, Laboratoire Kastler Brossel, Paris, France

Highly-efficient entanglement storage in quantum memories is a critical requirement for quantum networks. We present an experiment where we stored single-photon entanglement into two atomic-ensemble based quantum memories with an overall efficiency of 87%.

Oral EB-5.2 19:00 TRACK 8

Event-Ready Entanglement of Distant Atoms Distributed at Telecom Wavelength — •Tim van Leent[1,2], Florian Fertig[1,2], Matthias Bock[3], Robert Garthoff[1,2], Yiru Zhou[1,2], Sebastian Eppelt[1,2], Wei Zhang[1,2], Christoph Becher[3], and Harald Weinfurter[1,2,4] — [1]Fakultät für Physik, Ludwig-Maximilians-Universität, München, Germany — [2]Munich Center for Quantum Science and Technology (MCQST), München, Germany — [3]Fachrichtung Physik, Universität des Saarlandes, Saarbrücken, Germany — [4]Max-Planck-Institut für Quantenoptik, Garching, Germany

We present results demonstrating heralded entanglement between two distant Rubidium 87 atoms employing fiber links up to 22 km. To overcome attenuation loss in the fibers we use polarization-preserving quantum frequency conversion to telecom wavelength.

Oral EB-5.3 19:15 TRACK 8

Multimode quantum networking with trapped ions — •Victor Krutyanskiy[1,2], Vojtech Krcmarsky[1,2], Marco Canteri[1,2], Martin Meraner[1,2], Josef Schupp[1,2], and Ben Lanyon[1,2] — [1]Institute for Quantum Optics and Quantum Information of Austrian Academy of Sciences, Innsbruck, Austria — [2]University of Innsbruck, Innsbruck, Austria

We demonstrate the production of trains of telecom photons, each maximally entangled with a different matter-qubit in a quantum register, and their use to distribute light-matter entanglement over a record 100 km of optical fiber.

Oral EB-5.4 19:30 TRACK 8

Telecom-Heralded Entanglement Distribution Between Remote Multimode Solid-State Quantum Memories — •Dario Lago-Rivera[1], Samuele Grandi[1], Jelena V. Rakonjac[1], Alessandro Seri[1], and Hugues de Riedmatten[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [2]ICREA-Institucio Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We demonstrate entanglement between two quantum nodes. The entanglement is generated by parametric down conversion, heralded by telecom photons and stored in multimode rare-earth based quantum memories. The memories share a delocalized excitation.

Oral EB-5.5 19:45 TRACK 8

A single ion and two photons: A programmable three-qubit interface — •Omar Elshehy, Martin Steinel , Stephan Kucera, Matthias Kreis, and Jürgen Eschner — Universität des Saarlandes, Saarbrücken, Germany

We demonstrate a three-qubit protocol based on the sequential heralded absorption of two photons by a single 40Ca+ ion. The programmable protocol provides quantum repeater functionality or serves as a single-ion quantum memory.

EC-3: Bound States and High-order Topology

Chair: Hannah Price, University of Birmingham, Birmingham, United Kingdom

Time: Tuesday, 18:30–20:00 Location: TRACK 9

Invited EC-3.1 18:30 TRACK 9

Using symmetry bandgaps to create a line of bound states in the continuum in 3D photonic crystals — Alexander Cerjan[1], •Christina Jörg[1], Wladimir A. Benalcazar[1], Sachin Vaidya[1], Chia Wei Hsu[2], Georg von Freymann[3], and Mikael C. Rechtsman[1] — [1]Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802, USA — [2]Ming Hsieh Department of Electrical Engineering, University of Southern California, Los Angeles, California 90089, USA — [3]Physics Department and Research Center OPTIMAS, University of Kaiserslautern, 67663 Kaiserslautern, Germany

We show that photonic-crystal environments can create symmetry-specific bandgaps that host symmetry-protected bound states in the continuum along a complete line in the Brillouin zone, which we prove to be impossible in homogeneous environments.

Oral EC-3.2 19:00 TRACK 9

Second-order topological modes in all-dielectric systems — •Jan Košata and Oded Zilberberg — ETH Zurich, Zurich, Switzerland

We introduce a scheme to create 0D topological modes in patterned all-dielectric 2D metamaterials, presenting analytical and numerical results and generalizing to a broad range of lattice structures.

Oral EC-3.3 19:15 TRACK 9

Non-Abelian Bloch oscillations in higher-order topological insulators — •Marco Di Liberto — Institute for Quantum Optics and Quantum Information, Innsbruck, Austria

In this work, we show that higher-order topological insulators host peculiar non-Abelian Bloch oscillations with multiplied period, where the inter-band dynamics occurs in sync with with the Hall displacement of the wavepacket.

Oral EC-3.4 19:30 TRACK 9

Realization of photonic square-root higher-order topological insulators — •Wenchao Yan[1], Shiqi Xia[1], Liqin Tang[1], Daohong Song[1], Jingjun Xu[1], and Zhigang Chen[1,2] — [1]The MOE Key Laboratory of Weak-Light Nonlinear Photonics, TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China — [2]Department of Physics and Astronomy, San Francisco State University, San Francisco, California, USA

We experimentally demonstrate the square-root higher-order topological insulators, unveiling two kinds of corner states that reside in different band gaps of a photonic super-honeycomb lattice established with photorefractive cw-laser-writing technique.

Oral EC-3.5 19:45 TRACK 9

Topological Corner State Laser in Kagome Waveguide Arrays — H. Zhong[1], Y. V. Kartashov[2], A. Szameit[3], Y. D. Li[1], C. L. Liu[1], and •Y. Q. Zhang[1] — [1]Key Laboratory for Physical Electronics and Devices of the Ministry of Education & Shaanxi Key Lab of Information Photonic Technique, School of Electronic and Information Engineering, Xi'an Jiaotong University, Xi'an, China — [2]Institute of Spectroscopy, Russian Academy of Sciences, Troitsk, Moscow, Russia — [3]Institute for Physics, University of Rostock, Rostock, Germany

We predict that stable lasing in zero-dimensional corner states may occur in a second-order photonic topological insulator based on Kagome waveguide array with a rhombic configuration, under the balance between diffraction, focusing nonlinearity, uniform losses, two-photon absorption, and gain.

CF-3: Nonlinear Pulse Propagation

Chair: Caterina Vozzi, Politecnico di Milano, Milano, Italy

Time: Tuesday, 18:30–20:00 Location: TRACK 10

Oral CF-3.1 18:30 TRACK 10

Guiding of Laser Pulses at the Theoretical Limit – 97% Throughput Hollow-Core Fibers — Young-Gyun Jeong[1], Riccardo Piccoli[1], Andrea Rovere[1], Luca Zanotto[1], Gabriel Tempea[2], Derrek Wilson[1,2], Maksym Ivanov[1,2], Alicia Ramirez[2], Roberto Morandotti[1,3], François Légaré[1], Luca Razzari[1], and •Bruno E. Schmidt[2] — [1]INRS - EMT, Varennes, Canada — [2]few-cycle Inc., Varennes, Canada — [3]IFFS – UESTC, Chengdu, China

We describe a compact, 1-m-long, hollow-core fiber (HCF) with 97.4% transmission. 1mJ, 170fs pulses are compressed to 25fs with 92% total efficiency, energy stability of 0.6% RMS and an M2 parameter of about 1.05.

Oral CF-3.2 18:45 TRACK 10

High-energy multidimensional solitary states in hollow-core fibres — •Guangyu Fan[1], Reza Safaei[1], Ojoon Kwon[1], Katherine Légaré[1], Philippe Lassonde[1], Bruno Schmidt[2], Heide Ibrahim[1], and François Légaré[1] — [1]Institut National de la Recherche Scientifique, Centre Énergie Matériaux et Télécommunications, Montreal, Canada — [2]few-cycle. Inc., Montreal, Canada

We report the first observation of the formation of multidimensional solitary states in a gas-filled hollow-core fibre, presenting a route toward a new class of compact, tunable and high-energy spatiotemporally engineered light sources based on picosecond ytterbium technology.

Oral CF-3.3 19:00 TRACK 10

Raman conversion in a multipass cell — •Nour Daher[1], Xavier Délen[1], Florent Guichard[2], Marc Hanna[1], and Patrick Georges[1] — [1]Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, 91127, Palaiseau, France — [2]Amplitude Laser, 11 Avenue de Canteranne, Cité de la Photonique, 33600 Pessac, France

We demonstrate Raman frequency conversion of stretched femtosecond pulses in a KGW crystal included in a multipass cell. The generation of 1st and 2nd Stokes is obtained with ~41% and ~25% conversion efficiencies, respectively.

Oral CF-3.4 19:15 TRACK 10

Octave-spanning infrared supercontinuum generation in a graded-index multimode Lead-Bismuth-Gallate fiber — •Zahra Eslami[1], Adam Filipkowski[2,3], Dariusz Pysz[2], Mariusz Klimczak[3], Ryszard Buczynski[2,3], and Goery Genty[1] — [1]Photonics Laboratory, Tampere University, Tampere, Finland — [2]Łukasiewicz Research Network – Institute of Microelectronics and Photonics, Warsaw, Poland — [3]Faculty of Physics, University of Warsaw, Warsaw, Poland

We demonstrate supercontinuum generation in the infrared from 1000 nm to 2800 nm in a lead-bismuth-gallate multimode graded-index fiber with near single-mode characteristics beam profile. Our results open the route towards high-power mid-infrared supercontinuum sources.

Invited CF-3.5 19:30 TRACK 10

Laser lightning rod and artificial fog dissipation — •Jean-Pierre Wolf — University of Geneva, Geneva, Switzerland

We present a unique TW-class ultrashort laser with kW average power. This laser is used for triggering and guiding upward flashing lightnings and for opening clear channels in fog for free space optical (FSO) communications.

CH-5: Imaging in Scattering Media

Chair: Adrian Podoleanu, University of Kent, Canterbury, United Kingdom

Time: Tuesday, 18:30–20:00 Location: TRACK 11

Invited CH-5.1 18:30 TRACK 11

Supercontinuum based mid-infrared OCT, spectroscopy, and hyperspectral imaging — Christian R. Petersen[1,3], Niels M. Israelsen[1,3], Getinet Woyessa[1], Kyei Kwarkye[1], Rasmus E. Hansen[1], Christos Markos[1,3], Amir Khodabakhsh[4], Frans J.M. Harren[4], Peter Rodrigo[2], Peter Tidemand-Lichtenberg[2], Christian Pedersen[2], and •Ole Bang[1,3] — [1]DTU Fotonik, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark — [2]DTU Fotonik, Technical University of Denmark, 4000 Roskilde, Denmark — [3]NORBLIS IVS, 2830 Virum, Denmark — [4]Trace Gas Research Group, IMM, Radboud University, Nijmegen, Netherlands

We present the latest result on high average power MHz mid-IR supercontinuum lasers and their application in hyper-spectral imaging, real-time OCT, and trace gas monitoring.

Oral CH-5.2 19:00 TRACK 11

Ptychographic optical coherence tomography — •Mengqi Du[1,2], Lars Loetgering[1,2], Kjeld S.E. Eikema[1,2], and Stefan Witte[1,2] — [1]ARCNL, Amsterdam, Netherlands — [2]Vrije Universiteit Amsterdam, Amsterdam, Netherlands

A new, high-resolution, 3D computational imaging method, termed ptychographic optical coherence tomography (POCT), is presented. We demonstrate the capabilities of POCT by imaging an axially discrete nano-lithographic structure and an axially continuous mouse brain sample.

Oral CH-5.3 19:15 TRACK 11

Enhanced transparency in strongly scattering media — •Alfredo Rates[1], Allard P. Mosk[2], Ad Lagendijk[1], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Debye Institute for NanoMaterials Science and Center for Extreme Matter and Emergent Phenomena, Utrecht University, Utrecht, Netherlands

Based on the Mutual Extinction and Transparency effect, we control the total extinction of a highly scattering soot sample using two beams and controlling their relative phase and angle.

Oral CH-5.4 19:30 TRACK 11

Optical Coherence Microscopy for Integrated Photonics Devices Imaging — •Maxim A. Sirotin[1], Maria N. Romodina[1], Evgeny V. Lyubin[1], Irina V. Soboleva[1,2], Vitalina V. Vigdorchik[1], Kirill R. Safronov[1], Daniil V. Akhremenkov[1], Vladimir O. Bessonov[1,2], and Andrey A. Fedyanin[1] — [1]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia — [2]Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Moscow, Russia

We report on the development of a method for integrated photonics devices imaging based on phase-sensitive optical coherence microscopy. This method makes it possible to study the internal structure of devices and allows flaw detection.

Oral CH-5.5 19:45 TRACK 11

Deep learning based direct aberration phase retrieval in stimulated emission depletion (STED) microscopy — •Yangyundou Wang[1], Yiming Li[2], Chuanfei Hu[2], Hui Yang[2], and Min Gu[1] — [1]Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China — [2]School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China

We demonstrate a new and accurate method for the direct correction of phase aberration induced by the refractive index mismatch of specimen or systematic aberration in a stimulated emission depletion (STED) microscope using convolutional neural networks.

CC-3: High Power THz Sources

Chair: Dmitry Turchinovich, University of Bielefeld, Bielefed, Germany

Time: Tuesday, 18:30–20:00 Location: TRACK 12

Oral CC-3.1 18:30 TRACK 12

High Power THz Generation Using Tilted Pulse Fronts with Low Pump Pulse Energies — •Frank Wulf, Tim Vogel, Samira Mansourzadeh, Martin Hoffmann, and Clara Saraceno — Ruhr-University Bochum, Bochum, Germany

We investigate THz generation using tilted pulse fronts with high power, high repetition rate driving lasers. It is shown that small beam sizes limit the maximum conversion efficiency due to spatial walk-off.

Oral CC-3.2 18:45 TRACK 12

Demonstration of Imaging-Free Terahertz Generation Setup Using Segmented Tilted-Pulse-Front Excitation — •Gergő Krizsán[1,2], Gyula Polónyi[2,3], Tobias Kroh[4,5], György Tóth[1], Zoltán Tibai[1], Nicholas H. Matlis[4], Franz X. Kärtner[4,5], and János Hebling[1,2,3] — [1]Institute of Physics, University of Pécs, Pécs, Hungary — [2]Szentágothai Research Centre, University of Pécs, Pécs, Hungary — [3]MTA-PTE High-Field Terahertz Research Group, Pécs, Hungary — [4]Center for Free-Electron Laser Science, Desy, Hamburg, Germany — [5]The Hamburg Centre for Ultrafast Imaging, Univesity of Hamburg, Hamburg, Germany

Generation of single-cycle THz pulses with more than 40 μJ energy at room temperature were demonstrated with an imaging-free, scalable terahertz pulse source.

Oral CC-3.3 19:00 TRACK 12

High efficiency, multicycle terahertz generation in periodically poled lithium niobate using a two-line laser — •Halil Olgun — Center for Free-Electron Laser Science , Hamburg, Germany

Using a custom, home-built, two-line laser source, record level optical-to-multicycle terahertz efficiencies of 0.49% at 290 GHz and 0.89% at 530 GHz were demonstrated in MgO doped PPLN crystals.

Oral CC-3.4 19:15 TRACK 12

High-Power Broadband THz Source in Organic Crystal BNA at MHz Repetition Rates — •Samira Mansourzadeh[1], Tim Vogel[1], Mostafa Shalaby[2], Frank Wulf[1], and Clara. J Saraceno[1] — [1]Ruhr Universität Bochum, Bochum, Germany — [2]Swiss Terahertz Research-Zurich , Zurich, Switzerland

We investigate THz average power scaling at MHz repetition rate in the organic crystal BNA for the first time, reaching an average power of 490 μW at 10% duty cycle with conversion efficiency of 5×10-4.

Oral CC-3.5 19:30 TRACK 12

Powerful Broadband Intra-Oscillator THz Generation Inside a Kerr-Lens Mode-Locked Diode-Pumped Laser Cavity — •Marin Hamrouni , Jakub Drs, Julian Fischer, Kenichi Komagata, Norbert Modsching , Valentin J. Wittwer , François Labaye , and Thomas Südmeyer — Laboratoire Temps-Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Neuchâtel, Switzerland

We exploit the intracavity enhanced performance of an ultrafast bulk oscillator to generate 150-μW of THz average power in 5-THz spectral bandwidth requiring only 7-W of diode-pump power.

Oral CC-3.6 19:45 TRACK 12

Two-color plasma THz transients at 400 kHz repetition rate — •Denizhan K. Kesim, Celia Millon, Alan Omar, Tim Vogel, Samira Mansourzadeh, Frank Wulf, and Clara J. Saraceno — Ruhr Universität Bochum, Bochum, Germany

We demonstrate broadband THz generation using 36 μJ, 27 fs pulses via two-color air plasma at 400 kHz, the highest repetition rate reported. Acquired THz transients spanning 15 THz which was limited by detection.

CD-P: CD Poster Session

Time: Tuesday, 13:30–14:30 Location: TRACK 1

CD-P.1 13:30 TRACK 1

Chiral high-harmonic spectroscopy in solids by polarization control of the driving strong field — •Tobias Heinrich[1], Marco Taucer[2], Ofer Kfir[1,3], Paul B. Corkum[2], André Staudte[2], Claus Ropers[1,3], and Murat Sivis[1,3] — [1]4th Physical Institute – Solids and Nanostructures, University of Göttingen, Göttingen, Germany — [2]Joint Attosecond Science Laboratory, National Research Council of Canada and University of Ottawa, Ottawa, Canada — [3]Max Planck Institute for Biophysical Chemistry, Göttingen, Germany

We demonstrate circularly polarized high harmonic generation in solids by using bi-chromatic three-fold driving fields and utilize the chiral sensitivity to investigate structural helicity of quartz and spontaneous chiral symmetry breaking at magnesium oxide surfaces

CD-P.2 13:30 TRACK 1

High repetition rate green-pumped supercontinuum generation in calcium fluoride — •Vaida Marčiulionytė, Vytautas Jukna, Gintaras Tamošauskas, and Audrius Dubietis — Laser Research Center, Vilnius University, Vilnius, Lithuania

We demonstrate that loose focusing of the pump beam into a long (25 mm) CaF2 slab produces durable ultraviolet supercontinuum generation without optical degradation of untranslated crystal at a 10 kHz repetition rate.

CD-P.3 13:30 TRACK 1

Picosecond VIS, UV and Deep UV Beams Generated at 100 kHz Diode-Pumped Yb:YAG Thin Disk Laser System — •Hana Turcicova[1], Ondrej Novak[1], Jiri Muzik[1,2], Denisa Stepankova[1,2], Martin Smrz[1], and Tomas Mocek[1] — [1]HiLASE Centre, Inst. of Physics, CAS, Dolni Brezany, Czech Republic — [2]Faculty of Nuclear Sciences and Physical Engineering, CTU, Prague, Czech Republic

Generation of 1st up to 5th harmonic frequencies at 100 kHz picosecond Yb:YAG thin disk diode pumped laser is reported, based on SHG and SFG processes. Application potential of the harmonics is demonstrated.

CD-P.4 13:30 TRACK 1

High-order breathing behaviour of solitons in a mode-locked laser — •Xueming Liu[1,2,3] and Yi Yang[1] — [1]College of Optical Science and Engineering, Zhejiang University, Hangzhou, China — [2]Nanjing University of Information Science & Technology, Nanjing, China — [3]Nanjing University of Aeronautics and Astronautics, Nanjing, China

We have experimentally revealed the superposition state of breathing soliton in a mode-locked laser, showing that there exist several breathing periods simultaneously for breathing soliton and breathing period is quite sensitive to the pump power.

CD-P.5 13:30 TRACK 1

Temperature noncritical Pockels cell based on a single KTP crystal — Sergey Gagarskiy[1], Sergey Grechin[2], •Petr Druzhinin[1], Andrey Sergeev[1], Yana Fomicheva[1], Vladimir Rusov[3], Nina Maklakova[4], and Alexander Yurkin[4] — [1]ITMO University, Sankt-Peterburg, Russia — [2]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [3]Vavilov State Optical Institute, Saint Petersburg, Russia — [4]Siberian Monocrystal-Eksma, Novosibirsk, Russia

The temperature noncritical cut of KTP crystal for electro-optic Q-switch application is studied. Low temperature sensitivity allows using of single crystal Pockels cell scheme. Measured temperature range with contrast drop less than 10% was 10°C.

CD-P.6 13:30 TRACK 1

Integrated phononic-photonic circuits on GaAs as a platform for microwave to optical signal transduction — •Ankur Khurana[1,2], Pisu Jiang[1], and Krishna C. Balram[1,3] — [1]Quantum Engineering Technology Labs, University of Bristol, Bristol BS8 1FD, United Kingdom — [2]School of Physics, H.H. Wills Physics Laboratory, University of Bristol, Bristol BS8 1FD, United Kingdom — [3]Department of Electrical and Electronics Engineering, University of Bristol, Woodland Road, Bristol BS8 1UB, United Kingdom

We demonstrate an acousto-optic modulator on a suspended GaAs platform for efficient microwave-to-optical transduction. Owing to high refractive index and photoelastic coefficients, GaAs offers strong optomechanical coupling to achieve a $V\pi L$ of 0.22V.cm, even for relatively lower optical quality factors.

CD-P.7 13:30 TRACK 1

In vivo zebrafish embryo heart using a new fast multiphoton microscope — •Dobryna Zalvidea[1], Yannis Lazis[2], Xavier Trepat[1], Angel Raya[2], and Elena Rebollo[3] — [1]Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain — [2]Center of Regenerative Medicine in Barcelona (CRMB), Barcelona, Spain — [3]Molecular Biology Institute of Barcelona (IBMB), Barcelona, Spain

We have designed and built a fast multiphoton microscope that allowed for deep volumetric imaging zebrafish embryo heart with a speed of 524x524x100 μm3 per second.

CD-P.8 13:30 TRACK 1

Scalable Integrated Waveguide with CVD-Grown MoS2 and WS2 Monolayers on Exposed-Core Fibers — •Gia Quyet Ngo[1], Antony George[2], Alessandro Tuniz[3], Emad Najafidehaghani[2], Ziyang Gan[2], Tobias Bucher[1], Heiko Knopf[1,4,5], Sina Saravi[1], Tilman Lühder[6], Stephen Warren-Smith[7], Heike Ebendorff-Heidepriem[7], Andrey Turchanin[2], Markus Schmidt[6], and Falk Eilenberger[1,4,5] — [1]Institute of Applied Physics, Friedrich Schiller University, Albert-Einstein-Str. 15, 07745 Jena, Germany — [2]Institute of Physical Chemistry, Friedrich Schiller University, Lessingstrasse 10, 07745 Jena, Germany — [3]University of Sydney, School of Physics, Physics Road, Camperdown NSW 2006, Australia — [4]Fraunhofer-Institute for Applied Optics and Precision Engineering IOF, Albert-Einstein-Str. 7, 07745 Jena, Germany — [5]Max Planck School of Photonics, 07745 Jena, Germany — [6]Leibniz Institute for Photonic Technology IPHT, Albert-Einstein-Str. 13, 07745 Jena, Germany — [7]Institute for Photonics and Advanced Sensing, University of Adelaide, Adelaide SA 5005, Australia

We introduce scalable integrated waveguides, where MoS2 and WS2 crystals are directly grown on the core of microstructured exposed-core fibers (ECFs) and demonstrate enhanced second-harmonic generation, third-harmonic generation, in-fiber exciton excitation, and photoluminescence collection.

CD-P.9 13:30 TRACK 1

Chip-Scale Beta-Barium Borate Platform for Near-Infrared to Deep-Ultraviolet Nonlinear Integrated Photonics — •Mohamed Sabry Mohamed and Siamak Forouhar — Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

We present a novel chip-scale platform based on beta-barium borate nonlinear crystal-on-insulator, which provides an extended multi-octave spanning spectrum for nonlinear optical processes in integrated photonic circuits, from the near-infrared to the deep-ultraviolet range.

CD-P.10 13:30 TRACK 1

Frequency comb generation based on optical parametric oscillation with second-order nonlinear materials — •Nicolas Amiune[1], Karsten Buse[1,2], and Ingo Breunig[1,2] — [1]Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg, Germany — [2]Fraunhofer Institute for Physical Measurement Techniques IPM, Freiburg, Germany

We investigate $\chi^{(2)}$ mid-infrared frequency comb generation based on degenerate optical parametric oscillation in a mm-sized cadmium silicon phosphide ($CdSiP_2$) whispering-gallery resonator. First observations of sidebands due to internally pumped second harmonic generation are presented.

CD-P.11 13:30 TRACK 1

Heterogeneous silicon nitride waveguide integrated with few-layer WS_2 for on-chip nonlinear optics — Yuchen Wang[1], •Vincent Pelgrin[1,2], Samuel Gyger[3], Christian Lafforgue[2], Val Zwiller[3], Klaus D. Jöns[3,4], Eric Cassan[2], and Zhipei Sun[1,5] — [1]Department of Electronics and Nanoengineering, Aalto University, Aalto, Finland — [2]Universite' Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [3]Department of Applied Physics, KTH Royal Institute of Technology, Stockholm, Sweden — [4]Department of Physics, Paderborn University,, Paderborn, Germany — [5]QTF Centre of Excellence, Department of Applied Physics, Aalto University, Aalto, Finland

We report on the experimental investigation and the numerical modelling of nonlinear pulse propagation in a heterogeneous silicon nitride channel waveguide with the integration of a few-layer WS_2 flake significantly increasing the effective nonlinearity.

CD-P.12 13:30 TRACK 1

Photorefractive induced slowdown of nanosecond light pulses in the nanosecond regime — •Nacera Bouldja[1,2], Alexander Grabar[3], Marc Sciamanna[1,2], and Delphine Wolfersberger[1,2] — [1]Chaire Photonique, LMOPS, CentraleSupélec,, Metz, France — [2]Université de Lorraine, LMOPS, CentraleSupélec,, Metz, France — [3]Institute of Solid State Physics and Chemistry, Uzhhorod National University, Uzhhorod, Ukraine

We theoretically and experimentally demonstrate for the first time the possibility to slowdown nanosecond light pulses in a photorefractive crystal at room temperature.

CD-P.13 13:30 TRACK 1

Dispersion engineered sum-frequency generation in a periodically poled thin-film $LiNbO_3$ nanowaveguide — •Pawan Kumar, Mohammadreza Younesi, Sina Saravi, Thomas Pertsch, and Frank Setzpfandt — Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany

We experimentally demonstrate group index matched type-II sum frequency generation in a periodically poled thin film $LiNbO_3$ nanowaveguide through careful design of the waveguide dimensions to control the dispersion properties of its guided modes.

CD-P.14 13:30 TRACK 1

Conical Third Harmonic Generation from Volume Nanogratings Induced by Filamentation of Femtosecond Pulses in Transparent Bulk Materials — •Robertas Grigutis[1], Vytautas Jukna[1], Marius Navickas[1], Gintaras Tamošauskas[1], Kęstutis Staliūnas[1,2], and Audrius Dubietis[1] — [1]Laser Research Center, Vilnius University, Vilnius, Lithuania — [2]Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We demonstrate that filamentation of femtosecond laser pulses at high repetition rate inscribes a nanograting in the volume of transparent material, that has a certain spectrum of periods to phase match conical third harmonic generation.

CD-P.15 13:30 TRACK 1

Kerr beam self-cleaning and supercontinuum generation in a graded-index few-mode photonic crystal fiber — •Fathima Shabana M.A[1,2], Vincent Tombelaine[2], Guillaume Huss[2], Amar Nath Ghosh[3], Thibaut Sylvestre[3], Jean-Louis Auguste[1], Marc Fabert[1], Alessandro Tonello[1], Vincent Couderc[1], François Reynaud[1], and Philippe Leproux[1] — [1]XLIM - Université de Limoges, Limoges, France — [2]LEUKOS, Limoges, France — [3]FEMTO-ST - Université Bourgogne Franche-Comté, Besançon, France

We introduce the observation of Kerr-induced beam self-cleaning (KBSC) and supercontinuum generation in a few-mode photonic crystal fiber with a graded-index germanium-doped core. The very weak peak power threshold of KBSC process is highlighted.

CD-P.16 13:30 TRACK 1

Performance of silicon OPUFs under variable input losses — •Juan Esteban Villegas[1,2], Bruna Paredes[1], and Mahmoud Rasras[1] — [1]New York University-Tandon School of Engineering, Brooklyn, USA — [2]New York University Abu Dhabi, Abu Dhabi, United Arab Emirates

Study of the power stability of integrated silicon optical physical unclonable functions as hardware primitives of modern secure systems.

CD-P.17 13:30 TRACK 1

A multi-channel pump-probe system for trARPES experiments — •Torsten Golz, Gregor Indorf, Jan Heye Buss, Mihail Petev, Sebastian Starosielec, Michael Schulz, and Robert Riedel — Class 5 Photonics GmbH, Hamburg, Germany

Here we present an optical parametric chirped pulse amplifier (OPCPA) multi-channel pump-probe laser systems providing pulses spanning from the XUV up to the THz range with a repetition rate of 100 kHz.

CD-P.18 13:30 TRACK 1

All-fibered high-quality 28-GHz to 112 GHz pulse sources based on nonlinear compression of optical temporal besselons — •Anastasiia Sheveleva and Christophe Finot — Laboratoire Interdisciplinaire CARNOT de Bourgogne, DIJON, France

With a setup based on temporal and spectral processing we generate high quality pulse trains at high repetition rates (up to 112 GHz). Nonlinear propagation further compresses the pulses to subpicosecond durations.

CD-P.19 13:30 TRACK 1

Ultrafast All-Optical Two-Colour Switching in Asymmetric Dual-Core Fibre — •Mattia Longobucco[1,2], Ignas Astrauskas[3], Audrius Pugžlys[3], Dariusz Pysz[1], František Uherek[4], Andrius Baltuška[3], Ryszard Buczyński[1,2], and Ignác Bugár[1,4] — [1]Department of Glass, Łukasiewicz - Institute of Microelectronics & Photonics, Wólczyńska 133, 01-919 Warsaw, Poland — [2]Department of Photonics, Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland — [3]Photonics Institute, TU Wien, Gußhausstraße 27-387, 1040 Vienna, Austria — [4]International Laser Centre, Ilkovičova 3, 841 04 Bratislava, Slovakia

We present a two-colour control (1030 nm) – signal (1560 nm) pulse switching approach, using a highly nonlinear, fabricated in-house all-solid dual-core optical fibre with high contrast of refractive index and slight structual dual-core asymmetry.

CD-P.20 13:30 TRACK 1

Electric Field Measurements in Plasmas with E-FISH Using Focused Gaussian Beams — •Tat Loon Chng[1], Svetlana Starikovskaia[1], and Marie-Claire Schanne-Klein[2] — [1]Laboratoire de Physique des Plasmas, École Polytechnique, Palaiseau, France — [2]Laboratoire d'Optique et Biosciences, École Polytechnique, Palaiseau, France

We present a new theoretical and experimental analysis of electric field measurements in non-equilibrium plasmas using the E-FISH method, and show that the use of focused laser beams strongly affects the signal generation.

CD-P.21 13:30 TRACK 1

Experimental investigation of the saturated regime of short pulse amplification in counter-pumped Raman amplifiers — •Guillaume Vanderhaegen, Pascal Szriftgiser, Matteo Conforti, Alexandre Kudlinski, and Arnaud Mussot — University of Lille, CNRS, UMR 8523 - PhLAM - Physique des Lasers Atomes et Molécules, Lille, France

We report an experimental study of the influence of the pulses width on a counter-propagating Raman pump. Transient and saturation effects and high signal powers are highlighted.

CD-P.22 13:30 TRACK 1

Dual-pump Optical Parametric Oscillation in a 4H-SiC-on-insulator Microring Resonator — •Xiaodong Shi[1], Weichen Fan[1], Ailun Yi[2], Xin Ou[2], Karsten Rottwitt[1], and Haiyan Ou[1] — [1]DTU Fotonik, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]State Key Laboratory of Functional Materials for Informatics, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, Shanghai, China

We experimentally observe on-chip Kerr-nonlinearity based dual-pump optical parametric oscillation in a 4H-SiC-on-insolator microring resonator. The demonstration indicates SiC is a potential material for the frequency comb generation.

CD-P.23 13:30 TRACK 1

Impact of Signal Waveform on the Accuracy of the Perturbation Methods for Compensation of Fiber Nonlinearity — •Sergey V. Suchkov[1], Alexey A. Reduk[1,2], and Sergei K. Turitsyn[1,3] — [1]Novosibirsk State University, Novosibirsk, Russia — [2] Federal Research Center for Information and Computational Technologies, Novosibirsk, Russia — [3]Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom

We examine the impact of a carrier pulse shape on the accuracy of the perturbation theory of fiber channels. We demonstrate that temporally compact carrier pulses can be more efficient than conventional waveforms.

CD-P.24 13:30 TRACK 1

Single pass second harmonic generation of 17 W at 532 nm and high resolution relative-intensity-noise transfer study. — •Clément Dixneuf[1,2], Germain Guiraud[2], Hanyu Ye[1], Yves-Vincent Bardin[2], Mathieu Goeppner[2], Giorgio Santarelli[1], and Nicholas Traynor[2] — [1]LP2N, IOGS, CNRS and Université de Bordeaux, Talence, France — [2]Azurlight Systems, Pessac, France

A complete characterization of the RIN transfer between fundamental and second harmonic is presented for the first time in our knowledge with a highly resolved method for a high output power of 17W at 532nm.

CD-P.25 13:30 TRACK 1

Electric Field Induced Second Harmonic Generation In Silicon Waveguides: the role of the disorder — •Riccardo Franchi[1], Chiara Vecchi[1], Mher Ghulinyan[2], and Lorenzo Pavesi[1] — [1]Nanoscience Laboratory, Department of Physics, University of Trento, Trento, Italy — [2]Sensors and Devices, Fondazione Bruno Kessler, Trento, Italy

We demonstrate an improvement of the electric-field induced second-harmonic generation in an interdigitated poled silicon waveguide. Moreover, we study the role of the waveguide width fluctuations in widening of the generation bandwidth.

CD-P.26 13:30 TRACK 1

Fabrication of Large Aperture PPRKTP with Short Period (3.43 μm) Using Coercive Field Engineering — •Cherrie S.J. Lee, Andrius Zukauskas, and Carlota Canalias — KTH Royal Institute of Technology, Stockholm, Sweden

We demonstrate high-quality periodic poling of a 3-mm thick RKTP crystal with period of 3.43 μm using coercive field engineering. The PPRKTP shows a normalized conversion efficiency of 1.4 %/Wcm for SHG at 405 nm.

CD-P.27 13:30 TRACK 1

Pure Nonlinear Optical Response in Plasmonic Nanoantennas — •Avi Niv — Ben-Gurion University of The Negev, Sde Boker, Israel

We use a deep subwavelength-sized plasmonic heterodimer to explore a new source of optical nonlinearity. We present SHG from this source and discuss its efficiency, 3ed-order processes, higher harmonics generation, optical-rectification, and chaos.

CD-P.28 13:30 TRACK 1

TI-REX: A Tunable Infrared laser for Experiments in nanolithography — •Zeudi Mazzotta[1,2], Jan Mathjissen[1,2], Kjeld Eikema[1,2], Oscar Versolato[1,2], and Stefan Witte[1,2] — [1]Advanced Research Center for Nanolithography, Amsterdam, Netherlands — [2]LaserLaB, Department of Physics and Astronomy, Vrije Universiteit, Amsterdam, Netherlands

TI-REX is a nanosecond mid-IR light source, with spectral tunability from 1.45 to 4.5μm, pulse energy up to 100mJ, and accurate temporal pulse shape control, and a great future tool for plasma-based extreme-ultraviolet generation studies.

CD-P.29 13:30 TRACK 1

Quasi-Phase Matching and Crystal Segmentation for Robust Optical Parametric Amplification — •Mouhamad Al-Mahmoud[1], Virginie Coda[2], Andon Rangelov[1], and Germano Montemezzani[2] — [1]Department of Theoretical Physics, Sofia University, Sofia, Bulgaria — [2]Université de Lorraine, CentraleSupélec, LMOPS,, Metz, France

Combination of quasi-phase-matching with segmentation of the nonlinear crystal dramatically increases the robustness of frequency conversion processes with respect to changes of wavelengths, temperature or pump power, as illustrated for Optical Parametric Amplification.

CD-P.30 13:30 TRACK 1

Enhancing the brightness of luminescent concentrators by one order of magnitude using light recycling — •Pierre Pichon[1], Maxime Nourry-Martin[1,2], Frederic Druon[1], Stephane Darbon[2], Patrick Georges[1], and François Balembois[1] — [1]Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, 91127, Palaiseau, France — [2]CEA, DAM, DIF, F-91297, Arpajon, France

This work shows how to enhance by one order of magnitude the brightness of LED-pumped luminescent concentrators. This results in a system counting among the brightest incoherent light sources emitting 2kW/cm^2/sr (63W from 1mm^2).

CD-P.31 13:30 TRACK 1

Improvement of Multiple-plate GaAs Stacks for Mid-infrared Quasi-phase-matching Wavelength-conversion Devices Fabricated with Room-temperature Bonding — •Ichiro Shoji, Rika Tanimoto, and Yuki Takahashi — Chuo University, Tokyo, Japan

We achieved high transmittance over the whole aperture of a 25-plate GaAs stack for quasi-phase-matched mid-IR wavelength-conversion. This was accomplished by improved fabrication process using the room-temperature bonding.

CD-P.32 13:30 TRACK 1

PP-crystals Lengths Optimization to Improve the Efficiency of Two-Cascade Nearly-Degenerate DFG of 3μm Radiation from Fiber NIR Lasers — •Igor Larionov, Alexander Gulyashko, and Valentin Tyrtyshnyy — NTO "IRE-Polus", Fryazino, Russia

PP-crystals lengths optimization leads to 40% efficiency of the single-pass parametric down-conversion of two fiber lasers radiation to mid-IR range in experiment. The theoretical model gives the dependence between PP-crystals lengths and pump beam parameters.

CD-P.33 13:30 TRACK 1

Manufacturing and characterization of frequency tripling mirrors — •Sebastian Balendat — Laser Zentrum Hannover e. V., Hannover, Germany

We raised our layer thickness precision for an IBS process to produce THG mirrors by combining a high-resolution BBM including a multiplexer and establishing coating routines. Additionally the influence of the laser bandwidth is investigated.

CD-P.34 13:30 TRACK 1

Multi-ordered IR Raman from KTiOPO4 in the nanosecond regime — •Kjell Martin Mølster, Robert Lindberg, and Fredrik Laurell — Department of Applied Physics, Royal Institute of Technology, KTH, Stockholm, Sweden

We report 55% pump depletion into multi-ordered Raman generation in y-cut KTiOPO4 by stimulated polariton scattering. The output spectrum consists of combs separated by 8 and 20 THz, spanning 1095 nm to 1736 nm.

CD-P.35 13:30 TRACK 1

Toward industrial and fibered non-linear sum frequency generation devices — •Alexis Mehlman[1,2], David Holleville[1], Michel Lours[1], Sébastien Bise[1], Ouali Acef[1], Aurélien Boutin[2], Karine Lepage[2], and Ludovic Fulop[2] — [1]LNE-SYRTE, Paris, France — [2]Kylia, Paris, France

We report on the development of an all-fibered sum frequency generation device using a PPLN crystal. A 5-5.5%/(W*cm) conversion efficiency and an 80% coupling efficiency were reached, with a peak-to-peak residual power fluctuations under 2%.

CD-P.36 13:30 TRACK 1

Complex Optical Waveguiding Structures Induced By Bessel Beams — •Yue Chai[1,2], Nicolas Marsal[1,2], and Delphine Wolfersberger[1,2] — [1]Université de Lorraine, CentraleSupélec, LMOPS, F-57000 Metz, France — [2]Chair in Photonics, CentraleSupélec, LMOPS, F-57000 Metz, France

We numerically study interactions of Bessel beams in a photorefractive medium. Playing with nonlinearity, complex multi-channels structures can be induced by single or two counter-propagating Bessel beams. These results provide a prospect for all-optical interconnects.

CD-P.37 13:30 TRACK 1

Mode selective photon addition to a multimode quantum field using SPDC process — •Srinivasan Kaali[1], Ganael Roeland[1], Victor Roman-Rodriguez[2], Nicolas Treps[1], Valentina Parigi[1], and Mattia Walschaers[1] — [1]Laboratoire Kastler Brossel, Sorbonne Universite, CNRS, ENS-PSL Université, College de France, 4 place Jussieu, F-75252, Paris, France — [2]Sorbonne Universite, CNRS, LIP6, 4 place Jussieu, F-75005, Paris, France

We propose a theoretical scheme to generate non-gaussian quantum states by the mode selective photon addition to a multimode Gaussian state. This can be implemented via the Spontaneous Parametric down-conversion process in nonlinear bulk crystals.

CD-P.38 13:30 TRACK 1

QPM-LN-Based 40GHz to 40GHz Switch Using Cascaded Nonlinearities — •Yutaka Fukuchi, Genki Abe, and Kazumasa Kawanaka — Tokyo University of Science, Tokyo, Japan

Characteristics of an all-optical switch employing a 3-cm-long QPM-LN are investigated through switching experiments considering the temporal widths of the input clock and signal pulses. Stable and efficient 40GHz to 40GHz operation is successfully demonstrated.

CD-P.39 13:30 TRACK 1

Novel features of white light emission observed in transparent Cr-doped YAG ceramics — •Mykhailo Chaika, Taras Hanulia, Robert Tomala, and Wieslaw Strek — Institute of Low Temperature and Structure Research, Wroclaw, Poland

Laser-induced white light emission was observed from transparent Cr:YAG ceramics on the surface of the sample and is not observed in volume. This phenomenon was discussed in terms of inter-valence charge transfer mechanism.

CD-P.40 13:30 TRACK 1

Self-referenced multiplex CARS imaging with picosecond pulse generated supercontinuum by using second and third order nonlinearities — •Sahar Wehbi[1,2], Tigran Mansuryan[1], Marc Fabert[1], Alessandro Tonello[1], Katarzyna Krupa[3], Stefan Wabnitz[4], Sébastien Vergnole[2], and Vincent Couderc[1] — [1]University of Limoges-XLIM, Limoges, France — [2]ALPhANOV Optics & Lasers Technology Center, Bordeaux, France — [3]Institute of Physical Chemistry, Warsaw, Poland — [4]DIET, Rome, Italy

We developed a self-referenced multiplex CARS imaging system, operating in the picosecond domain. The large band Stokes wave is generated either in X(2)-X(3) crystals, or in multimode optical fiber under the Kerr self-cleaning process.

CD-P.41 13:30 TRACK 1

Surface dominance in high harmonic generation in AlN thin film — •Jozsef Seres[1], Enikoe Seres[1], Carles Serrat[2], and Thorsten Schumm[1] — [1]Atominstitut - E141, Technische Universität Wien, Vienna, Austria — [2]Universitat Politècnica de Catalunya, Departament de Física, Terrassa, Spain

Based on the measurement of beam propagation and spectral characteristics, we conclude that high order harmonics in AlN thin film are generated on the surface of the film. Time-dependent density-functional simulations corroborate the experimental results.

CD-P.42 13:30 TRACK 1

Enhanced Supercontinuum Generation in the Mid-IR using Graphene Covered SiGe waveguides — •Pierre Demongodin[1], Rémi Armand[1], Milan Sinobad[1], Alberto Della Torre[1], Jean-Michel Hartmann[2], Vincent Reboud[2], Jean-Marc Fedeli[2], Christian Grillet[1], and Christelle Monat[1] — [1]Institut des Nanotechnologies de Lyon, Ecully, France — [2]CEA-LETI, Grenoble, France

We experimentally demonstrate that hybrid graphene/ SiGe waveguides could effectively enhance the mid-infrared supercontinuum bandwidth. Through impacting the supercontinuum dynamics, graphene could provide unique opportunities to control the supercontinuum performance of mid-IR chip-based devices.

ED-P: ED Poster Session

Time: Tuesday, 13:30–14:30 Location: TRACK 2

ED-P.1 13:30 TRACK 2

Cavity ring-down Fourier transform spectroscopy based on a near infrared optical frequency comb — •Romain Dubroeucq[1], Aleksander Głuszek[2], Grzegorz Soboń[2], and Lucile Rutkowski[1] — [1]Univ Rennes, CNRS, IPR (Institut de Physique de Rennes) - UMR 6251, Rennes, France — [2]Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wroclaw, Poland

We perform cavity ring-down spectroscopy based on a near-infrared frequency comb source and retrieve the multiplex decays using a time-resolved fast-scanning Fourier transform spectrometer.

ED-P.2 13:30 TRACK 2

Simple method of carrier-envelope-offset locking with f-3f self-referencing solely by a dispersion-controlled silicon-nitride waveguide — •Atsushi Ishizawa[1], Kota Kawashima[1,2], Rai Kou[3], Xuejun Xu[1], Tai Tsuchizawa[4], Takuma Aihara[4], Koki Yoshida[1,2], Tadashi Nishikawa[2], Kenichi Hitachi[1], Guangwei Cong[3], Noritsugu Yamamoto[3], Koji Yamada[3], and Katsuya Oguri[1] — [1]NTT Basic Research Laboratories, Atsugi-shi, Japan — [2]Tokyo Denki University, Adachi-ku, Japan — [3]Platform Photonics Research Center, AIST, Tsukuba, Japan — [4]NTT Device Technology Laboratories, Atsugi-shi, Japan

We demonstrate a very simple and robust method of carrier-envelope-offset locking with f-3f self-referencing trough third-harmonic light and a 2.5-octave-wide supercontinuum spectrum (400-2500 nm at -45 dB level) solely by a dispersion-controlled 5-mm-long silicon-nitride waveguide.

ED-P.3 13:30 TRACK 2

Shifted Wave Interference Fourier Transform Spectroscopy of THz Quantum Cascade Laser Frequency Combs operating above 70 K — •Andres Forrer[1], Sara Cibella[2], Guido Torrioli[2], Mattias Beck[1], Jérôme Faist[1], and Giacomo Scalari[1] — [1]ETH Zürich, Zürich, Switzerland — [2]CNR-Istituto di Fotonica e Nanotecnologie, Rome, Italy

We investigate the coherence and phases of THz Quantum Cascade Laser frequency combs by Shifted Wave Interference Fourier Transform spectroscopy. The result indicates FM modulated emission and shows different phase relations compared to mid-IR QCLs.

ED-P.4 13:30 TRACK 2

The Schawlow–Townes limit in frequency comb metrology — •Günter Steinmeyer — Max-Born-Institut, Berlin, Germany — Humboldt-Universität, Berlin, Germany

Frequency-comb based metrology has seen a dramatic increase of precision in the recent decades. Schawlow-Townes noise imposes a previously unrecognized limitation that is expected to limit further progress at the sub-10^{-20} fractional uncertainty level.

ED-P.5 13:30 TRACK 2

Stability frequency transfer demonstration at 10-13 level of a semiconductor based Frequency Comb via electrical and optical injection locking — Karim Manamanni, Tatiana Steshchenko, •Vincent Roncin, and Frédéric Du-Burck — Laboratoire de Physique des Lasers UMR CNRS 7538, Université Sorbonne Paris Nord, Villetaneuse, France

Fundamental physics, spectroscopy or quantum systems need compact and transportable frequency references with metrological stability performances. We report, the frequency stabilization of a 1.55μm Quantum-dot Fabry-Perot diode with a relative stability at 10-13 level.

ED-P.6 13:30 TRACK 2

High-resolution spectroscopy of molecular iodine using a narrow-linewidth laser at telecom wavelength — •Kohei Ikeda, Rei Kato, Yuma Goji, Daisuke Akamatsu, and Feng-Lei Hong — Department of Physics, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan

The absolute frequency and hyperfine structure of the P(57)45-0, P(91)48-0, R(73)46-0 transitions of molecular iodine at 514.1 nm were measured. Hyperfine constants were calculated by fitting the measured hyperfine splitting to a four-term Hamiltonian.

ED-P.7 13:30 TRACK 2

High-Quality Level-Crossing Resonances in Cesium Vapor Cells for Applications in Atomic Magnetometry — •Denis Brazhnikov[1,2], Stepan Ignatovich[1], Vladislav Vishnyakov[1], Irina Mesenzova[1], and Andrei Goncharov[1,2,3] — [1]Institute of Laser Physics SB RAS, Novosibirsk, Russia — [2]Novosibirsk State University, Novosibirsk, Russia — [3]Novosibirsk State Technical University, Novosibirsk, Russia

We propose novel schemes for observing the high-quality zero-field level-crossing resonances that noticeably expand the capabilities of standard schemes. The experiments were performed with cesium buffered vapor cells. Possible applications to atomic magnetometry are discussed.

JSI-2: Phononic Crystals and Acoustic Metamaterials

Chair: Roberto Li Voti, Sapienza Università di Roma, Rome, Italy

Time: Wednesday, 8:30–10:00 Location: TRACK 1

Invited JSI-2.1 8:30 TRACK 1

Perfect-bandgap tapered nanophononic metamaterial beam for thermal insulation — •Oliver Wright — Division of Applied Physics, Faculty of Engineering, Hokkaido University, Sapporo, Japan

Acoustic metamaterials can be tailored to efficiently block phonon propagation. We present the use of tapered meta-beam structures consisting of five unit cells of slowly varying size that extend the phonon propagation frequency gap significantly.

Invited JSI-2.2 9:00 TRACK 1

Heat and hypersound management in 2D phononic crystals — •Bartlomiej Graczykowski — Adam Mickiewicz University, Poznan, Poland

The presentation is devoted to experimental studies on the propagation of GHz-THz in nanostructured materials. In particular, such topics as hypersonic phononic crystals, thermal rectification, photoactuation, and elastic size effect will be discussed.

Oral JSI-2.3 9:30 TRACK 1

Acoustic Phonon Localization in One-dimensional Quasiperiodic Structures — •Priya Priya, Edson R. Cardozo de Oliveira, Anne Rodriguez, and Norberto Daniel Lanzillotti-Kimura — Centre de Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, Palaiseau, France

We theoretically demonstrate the localization of acoustic phonons in the range of 20-100 GHz in one- dimensional complex quasiperiodic systems composed of AlGaAs/GaAs heterostructures.

Oral JSI-2.4 9:45 TRACK 1

Observation of an accidental bound state in the continuum in a chain of dielectric disks — Mikhail Sidorenko[1], Olga Sergaeva[1], •Zarina Sadrieva[1], Charles Roques-Carmes[2], Pavel Muraev[3,4], Dmitrii Maksimov[3,4], and Andrey Bogdanov[1] — [1]Department of Physics and Engineering, ITMO University, St. Petersburg, Russia — [2]Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, USA — [3]Kirensky Institute of Physics, Federal Research Center KSC SB RAS, Krasnoyarsk, Russia — [4]Siberian Federal University, Krasnoyarsk, Russia

We experimentally analyze for the first time an off-Γ BIC in a one-dimensional periodic chain of disks and demonstrate its transformation to a resonant state with the decrease of the chain's length.

CA-5: Mid-infrared Lasers

Chair: Xavier Mateos, Universitat Rovira i Virgili, Tarragona, Spain

Time: Wednesday, 8:30–10:00 Location: TRACK 2

Oral CA-5.1 8:30 TRACK 2

1-Watt SESAM-Modelocked fs-Cr:ZnS Oscillator at 2.4 μm — •Ajanta Barh, B. Ozgur Alaydin, Jonas Heidrich, Marco Gaulke, Matthias Golling, Christopher R. Phillips, and Ursula Keller — ETH Zurich, Zürich, Switzerland

We present a novel GaSb-based SESAM to modelock 2.4-μm Cr:ZnS oscillators, producing 120 fs transform limited pulses at average output power of 1 W from a 250 MHz cavity, scalable to 0.5 GHz.

Oral CA-5.2 8:45 TRACK 2

Sub-9 Optical-cycle Kerr-lens Mode-locked Combined Gain Media Laser Based on Tm-doped Sesquioxide — •Anna Suzuki[1], Christian Kränkel[2], and Masaki Tokurakawa[1] — [1]Institute for Laser Science, University of Electro-Communications, Chofu, Japan — [2]Zentrum für Lasermaterialien, Leibniz-Institut für Kristallzüchtung, Berlin, Germany

We report on the Kerr-lens mode-locked combined gain media laser based on Tm:Lu2O3 and Tm:Sc2O3 at 2.1 μm. Pulses as short as 60 fs with an average power of 52 mW were obtained.

Oral CA-5.3 9:00 TRACK 2

Mid-Infrared Laser Emissions of Tm^{3+}-doped Garnets: The Case Study of Disordered Tm:CNGG Crystal — •Lauren Guillemot[1], Pavel Loiko[1], Zhongben Pan[2], Jean-Louis Doualan[1], Alain Braud[1], and Patrice Camy[1] — [1]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France — [2]Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, China

Mid-infrared laser emissions from disordered Tm:CNGG garnet crystal are studied and assigned to vibronic processes and $^3H_4 \rightarrow ^3H_5$ electronic transition. A Tm:CNGG laser generated 548 mW at 2.13 & 2.33μm with a slope efficiency of 58.2%.

Oral CA-5.4 9:15 TRACK 2

Passively Q-switched Diode-Pumped Thulium Laser at 2305 nm — Esrom Kifle[1], •Pavel Loiko[1], Lauren Guillemot[1], Jean-Louis Doualan[1], Florent Starecki[1], Alain Braud[1], Ammar Hideur[2], and Patrice Camy[1] — [1]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France — [2]CORIA UMR6614, CNRS-INSA-Université de Rouen, Normandie Université, Saint Etienne du Rouvray, France

A diode-pumped mid-infrared Tm:LiYF4 laser operating on the 3H4→3H5 transition is passively Q-switched by Cr2+:ZnSe. The laser generates 357 mW at 2304.6 nm and the best pulse characteristics (duration/energy) are 870 ns/4.4 μJ.

Oral CA-5.5 9:30 TRACK 2

Efficient Laser Operation of Transparent "Mixed" 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 μm — •Liza Basyrova[1], Pavel Loiko[1], Wei Jing[2], Yicheng Wang[3], Hui Huang[2], Magdalena Aguiló[4], Francesc Díaz[4], Elena Dunina[5], Alexey Kornienko[5], Uwe Griebner[3], Valentin Petrov[3], Xavier Mateos[4], Bruno Viana[6], and Patrice Camy[1] — [1]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France — [2]Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, China — [3]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [4]Universitat Rovira i Virgili (URV), FiCMA-FiCNA-EMaS, Tarragona, Spain — [5]Vitebsk State Technological University, Vitebsk, Belarus — [6]Chimie ParisTech, PSL University, CNRS, Institut de Recherche de Chimie Paris, Paris, France

Transparent "mixed" sesquioxide ceramic 7 at.% Er:(Lu,Sc)2O3 is synthesized by HIPing at 1750 °C/200 MPa and its spectroscopy is studied. The ceramic laser generates 342 mW at 2.71&2.85 μm with a slope efficiency of 41.7%.

Oral CA-5.6 9:45 TRACK 2

High-Energy, Widely Tunable and Efficient Mid-Infrared Lasers Based on Single-Crystal Fe:CdTe — Mikhail P. Frolov[1], Yuri V. Korostelin[1], Vladimir I. Kozlovsky[1], Stanislav O. Leonov[1,2], •Peter Fjodorow[3], and Yan K. Skasyrsky[1] — [1]P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia — [2]Bauman Moscow State Technical University, Moscow, Russia — [3]Institute for Combustion and Gas Dynamics – Reactive Fluids, University of Duisburg-Essen, Duisburg, Germany

We present our recent results obtained with single-crystal Fe:CdTe lasers. In particular, different pumping schemes and operation temperatures are investigated. The developed laser systems are characterized regarding efficiency, output energy and tunability.

CB-3: Technologies for LIDAR Applications

Chair: James Lott, TU Berlin, Berlin, Germany

Time: Wednesday, 8:30–10:00 Location: TRACK 3

Oral CB-3.1 8:30 TRACK 3

Experimental investigation of nanosecond pulsed tapered-waveguide lasers obtaining extremely high brightness values — •Heike Christopher, Anissa Zeghuzi, Andreas Klehr, Jan-Philipp Koester, Hans Wenzel, and Andrea Knigge — Ferdinand-Braun-Institut gGmbH, Berlin, Germany

The influence of the lateral index guiding trench width is studied experimentally to obtain an excellent brightness value of 27.4 W/mm/mrad at >18 W output power under 3.3 ns long pulse operation from tapered-waveguide lasers.

Oral CB-3.2 8:45 TRACK 3

Low-noise, Frequency-agile, Hybrid Integrated Laser for LiDAR — •Grigory Lihachev[1], Johann Riemensberger[1], Wenle Weng[1], Junqiu Liu[1], Hao Tian[2], Anat Siddharth[1], Rui N. Wang[1], Viacheslav Snigirev[1], Jijun He[1], Sunil Bhave[2], and Tobias Kippenberg[1] — [1]Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland — [2]OxideMEMS Lab, Purdue University, West Lafayette, USA

We demonstrate a hybrid integrated laser with intrinsic linewidth of 40 Hz, 1.5 GHz tuning range, 1 MHz actuation bandwidth attained by a DFB laser self-injection locking to a Si3N4 microresonator with integrated AlN piezoactuator.

Invited CB-3.3 9:00 TRACK 3

High-power VCSEL beam scanners for 3D sensing — •Fumio Koyama — Tokyo Institute of Technology, Yokohama, Japan

The device concept and experiments for high-power VCSEL beam-scanners will be presented for 3D sensing. We demonstrate a VCSEL beam-scanner, which offers watt-class high power operations and high-resolution non-mechanical beam steering functions.

Oral CB-3.4 9:30 TRACK 3

Analysis of the phase-locking dynamics of a III-V-on-silicon frequency comb laser — •Alexis Verschelde[1], Kasper Van Gasse[2], Bart Kuyken[2], Massimo Giudici[1], Guillaume Huyet[1], and Mathias Marconi[1] — [1]Institut de Physique de Nice, Nice, France — [2]Ghent University - IMEC, Ghent, Belgium

We analyze the phase-locking of a III-V-on-silicon frequency comb laser with a stepped-heterodyne technique. We measure the modal phase dispersion and reconstruct the pulse envelope as a function of the saturable absorber bias voltage.

Oral CB-3.5 9:45 TRACK 3

Broadband optical frequency comb generation using hybrid integrated InP-Si3N4 diode lasers — •H.M.J. Bastiaens[1], G. Neijts[1], A. Memon[1], Y. Fan[1], J. Mak[1], D. Geskus[2], M. Hoekman[2], V. Moskalenko[3], E.A.J.M. Bente[3], and K.-J. Boller[1] — [1]Laser Physics and Nonlinear Optics, Department for Science and Technology, University of Twente, Enschede, Netherlands — [2]LioniX International BV, Enschede, Netherlands — [3]Photonic Integration Group, Electrical Engineering Department, Eindhoven University of Technology, Eindhoven, Netherlands

Using hybrid integration of long, low-loss Si3N4 waveguide circuits with InP semiconductor amplifiers, we demonstrate on-chip frequency comb generation. The comb densely covers a 25-nm broad spectrum with more than 1600 comblines at 2-GHz spacing.

CC-4: Novel Approach THz Sources

Chair: Juliette Mangeney, LPENS/CNRS, Paris, France

Time: Wednesday, 8:30–10:00 Location: TRACK 4

Oral CC-4.1 8:30 TRACK 4

Corrugated graphene for synchrotron-like coherent THz emission — •Romaine Kerjouan[1], Elisa Riccardi[1], Pan Hui Huang[1], Michael Rosticher[1], Aurélie Pierret[1], Jerome Tignon[1], Sukhdeep Dhillon[1], Marie-Blandine Martin[2], Bruno Dlubak[3], Pierre Seneor[3], Daniel Dolfi[2], Kenji Watanabe[4], Takashi Taniguchi[4], Robson Ferreira[1], and Juliette Mangeney[1] — [1]Laboratoire de Physique de l'Ecole normale supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France — [2]Thales Research and Technology, Palaiseau, France — [3]Unité Mixte de Physique, CNRS-Thales, Université Paris-Saclay, Palaiseau, France — [4]National Institute for Materials Science, Tsukuba, Japan

We investigate corrugated graphene based devices and show their potential to generate synchrotron-like radiation tunable in the THz spectral range. Transport measurements at 4 K and Raman characterization of these devices show unique interesting features.

Oral CC-4.2 8:45 TRACK 4

Terahertz Sources Based on Time-Dependent Metasurfaces — •Jacob Tunesi[1], Luke Peters[1], Juan Sebastian Totero Gongora[1], Luana Olivieri[1], Andrea Fratalocchi[2], Alessia Pasquazi[1], and Marco Peccianti[1] — [1]Emergent Photonics Lab (EPic), Dept. of Physics and Astronomy, University of Sussex, Falmer, United Kingdom — [2]PRIMALIGHT, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

We demonstrate a time-dependent random metasurface exhibiting sub-cycle phase dynamics when coupled with a photoexcited electromagnetic source. The ultrafast photoexcitation of nanostructured Silicon acts as a temporal discontinuity, modifying the nonlinearity responsible for terahertz emission.

Oral CC-4.3 9:00 TRACK 4

Large HgTe nanocrystals for THz technology — •Thibault Apretna[1], Sylvain Massabeau[1], Charlie Gréboval[2], Nicolas Goubet[2], Sukhdeep Dhillon[1], Robson Ferreira[1], Emmanuel Lhuillier[2], and Juliette Mangeney[1] — [1]Laboratoire de Physique de l'Ecole Normale Supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France — [2]Sorbonne Université, CNRS, Institut des NanoSciences de Paris, Paris, France

Large HgTe nanocrystals (~100nm) grown by colloidal synthesis show attractive properties for the development of advanced THz optoelectronic devices as they exhibit strong absorption in the THz range and hot carrier lifetimes of few picoseconds.

Oral CC-4.4 9:15 TRACK 4

Robust Self-Referenced Generator of Programmable Multi-Millijoule THz-Rate Bursts — •Vinzenz Stummer[1], Tobias Flöry[1], Edgar Kaksis[1], Audrius Pugzlys[1,2], and Andrius Baltuska[1,2] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Center for Physical Sciences & Technology, Vilnius, Lithuania

We demonstrate a technique for the programmable generation and multi-millijoule amplification of ultrashort pulse bursts, which can be applied to any master-oscillator regenerative-amplifier system with very low implementation complexity and high stability in burst performance.

Oral CC-4.5 9:30 TRACK 4

Terahertz generation using a ZnGeP2 photoconductive antenna — •Vladislava Bulgakova[1], Pavel Chizhov[1], Aleksandr Ushakov[1], Nikolay Yudin[2,3,4], Mikhail Zinovev[2,3,4], Sergey Podzyvalov[2,3,4], Timophey Dolmatov[1], Vladimir Bukin[1], and Sergey Garnov[1] — [1]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [2]National Research Tomsk State University, Tomsk, Russia — [3]V. E. Zuev Institute of atmospheric optics SB RAS, Tomsk, Russia — [4]LLC "Laboratory of Optical Crystals", Tomsk, Russia

The paper discusses the generation of terahertz radiation using the ZnGeP2 photoconductive antennas. The THz waveform was obtained. The antenna's terahertz energy dependence versus optical energy was measured. The ZnGeP2 and CVD-ZnSe antennas were compared.

Oral CC-4.6 9:45 TRACK 4

Generation of radially- and azimuthally-polarized terahertz cylindrical vector beams from spintronic terahertz emitter — •Hiroaki Niwa[1], Naotaka Yoshikawa[1], Masashi Kawaguchi[1], Masamitsu Hayashi[1], and Ryo Shimano[1,2] — [1]Department of Physics, University of Tokyo, Hongo, Tokyo, Japan — [2]Cryogenic Research Center, University of Tokyo, Yayoi, Tokyo, Japan

We demonstrate the generation of radial and azimuthal terahertz pulses using a spintronic terahertz emitter. Combining the external magnetic-field tuning and mode conversion, our method enables convenient access toward the terahertz cylindrical vector beams.

CE-5: Micro and Nanostructures

Chair: Daniel Milanese, University of Parma, Parma, Italy

Time: Wednesday, 8:30–10:00 Location: TRACK 5

Oral CE-5.1 8:30 TRACK 5

Fabrication of Microstructured Optical Fiber (MOF) segments by two-photon lithography 3D printing — andrea bertoncini and •carlo liberale — King Abdullah University of Science and Technology, Thuwal, saudi arabia

Here we show the drawing-less fabrication of microstructured optical fibers (MOFs) segments by high-resolution 3D printing (two-photon lithography) and their combination to realize complex photonic devices integrated on optical fibers.

Oral CE-5.2 8:45 TRACK 5

Nanoimprint Lithography for the Replication of Optical Microstructures on Azopolymer Thin Films — •Jonas Strobelt[1], Daniel Stolz[1], Maximilian Leven[1], Luke Kurlandski[2], and David J. McGee[2] — [1]Beuth Hochschule für Technik Berlin, Berlin, Germany — [2]The College of New Jersey, Ewing, USA

A new process for the replication of optical microstructures is reported. It combines microstructure fabrication on azopolymer films with nanoimprint lithography. Comparisons of the original microstructure and the final replica show excellent reproduction fidelity.

Oral CE-5.3 9:00 TRACK 5

Nanopatterning of Phase-Change Material Thin Films for Tunable Photonics — •Laric Bobzien[1], Ann-Katrin U. Michel[1], Nolan Lassaline[1], Carin R. Lightner[1], Alexander C. Hernandez Oendra[1], Sebastian Meyer[2], Iason Giannopoulos[3], Abu Sebastian[3], Samuel Bisig[4], Dmitry N. Chigrin[2], and David J. Norris[1] — [1]Optical Materials Engineering Laboratory, Department of Mechanical and Process Engineering, Zurich, Switzerland — [2]DWI Leibniz Institute for Interactive Materials, Aachen, Germany — [3]IBM Research-Zurich, Rüschlikon, Zurich, Switzerland — [4]Heidelberg Instruments Nano, Zurich, Switzerland

Tunable nanooptics enabled by phase-change materials (PCMs) have sparked tremendous research interest due to the PCMs reversibly switchable refractive index. We report sub-diffraction limited tip-induced switching of PCMs with feature sizes down to 100 nm.

Oral CE-5.4 9:15 TRACK 5

Nanogeometry-Induced Spectral Modification of self-Assembled Low-Dimensional WS2 Structures — •Irina Komen, Sabrya Van Heijst, Sonia Conesa-Boj, and Kobus Kuipers — Delft University of Technology, Delft, Netherlands

We characterize the optical (Raman) response of CVD-grown WS2 pyramids and nanoflowers. Studying the dependence of the Raman features on position, temperature and polarization, we find how the geometry of the nanostructures induces spectral modifications.

Oral CE-5.5 9:30 TRACK 5

Sculptured thin film based all-silica mirrors for high power lasers — •Tomas Tolenis, Lukas Ramalis, Rytis Buzelis, and Lina Grineviciute — Center for Physical Sciences and Technology, Vilnius, Lithuania

All-silica based high reflectance mirrors and zero angle polarizers are presented. LIDT values reach more than 60 J/cm2 at the wavelength of 35 nm in ns regime.

Oral CE-5.6 9:45 TRACK 5

Ultrabroadband Moth-Eye Antireflection Structures on GaSe Produced by Focused-Ion Beam Milling — •Philipp Sulzer, Matthias Hagner, Andreas Liehl, Moritz Cimander, Hannes Kempf, Annika Bitzer, Alexa Herter, and Alfred Leitenstorfer — Department of Physics and Center for Applied Photonics, University of Konstanz, Konstanz, Germany

Moth-eye structures are fabricated on GaSe by focused-ion beam milling, suppressing reflections of mid-infrared radiation. Their performance is characterized via electro-optic sampling, yielding reflectivites below one percent over a range of multiple octaves.

CF-4: Ultrafast Lasers

Chair: Jean-Pierre Wolf, University of Geneva, Geneva, Switzerland

Time: Wednesday, 8:30–10:00 Location: TRACK 6

Oral CF-4.1 8:30 TRACK 6

100 MW Thin-Disk Oscillator — •Semyon Goncharov, Kilian Fritsch, and Oleg Pronin — Helmut-Schmidt University, Hamburg, Germany

Highest peak power femtosecond oscillator delivering 100 MW, 140-fs pulses with 14 μJ energy is demonstrated.

Oral CF-4.2 8:45 TRACK 6

Tunable Thermal Lensing Enabled by Silicate Bonding of Sapphire to SESAMs: Novel Devices for High-Power Lasers — •Lukas Lang[1], Francesco Saltarelli[1], Gregoire Lacaille[2], Sheila Rowan[2], James Hough[2], Ivan J. Graumann[1], Christopher R. Phillips[1], and Ursula Keller[1] — [1]ETH Zürich - Institute of Quantum Electronics, Zurich, Switzerland — [2]University of Glasgow - Institute for Gravitational Research, Glasgow, United Kingdom

We demonstrate a new type of high-power-compatible SESAM with adjustable thermal lens by silicate-bonding sapphire to the SESAM. We modelock a high-power thin-disk-laser, achieving 233-W average-power, a 70-W-improvement over state-of-the-art SESAMs in the same laser.

Oral CF-4.3 9:00 TRACK 6

Recent Progress and Perspectives of Intra-Oscillator High Harmonic Generation Using Thin-Disk Lasers — •Julian Fischer, Jakub Drs, Francois Labaye, Norbert Modsching, Valentin J. Wittwer, and Thomas Südmeyer — Laboratoire Temps-Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Neuchatel, Switzerland

We discuss recent developments and the state-of-the-art of high harmonic generation inside thin-disk laser oscillators and their potential for further scaling of the XUV performance.

Oral CF-4.4 9:15 TRACK 6

Highly stable thin-disk multipass amplifier delivering 1kW of average output power with excellent beam quality — •Florian Bienert[1], André Loescher[1], Christoph Röcker[1], Martin Gorjan[2], Jürg Aus-der-Au[2], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge (IFSW) Universität Stuttgart, Stuttgart, Germany — [2]MKS/Spectra-Physics Rankweil, Rankweil, Austria

We present a CPA-free thin-disk multipass amplifier delivering a 1MHz pulse train with a pulse duration of 340 fs at an output power of 1033 W and an excellent beam quality of M2x=1.16 and M2y=1.18.

Oral CF-4.5 9:30 TRACK 6

Cryogenic Yb:YLF lasers mode-locked with saturable Bragg reflectors — •Umit Demirbas[1,3], Jelto Thesinga[1], Martin Kellert[1], Simon Reuter[1], Franz X. Kärtner[1,2], and Mikhail Pergament[1] — [1]Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607, Hamburg, Germany — [2]Physis Department and The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, Hamburg, Germany — [3]Laser Technology Laboratory, Antalya Bilim University, 07190 Dosemealti, Antalya, Turkey

We report a SBR mode-locked cryogenic Yb:YLF laser generating sub-5-ps pulses with 28-W average power around 1017 nm and 105-ps pulses with 40-W average power around 995 nm, by employing E//a and E//c axes, respectively.

Oral CF-4.6 9:45 TRACK 6

Design of a Passively Mode-locked Microlaser with an Er-doped Microcavity and Carbon Nanotubes — •Riku Imamura[1], Ayata Nakashima[1], Keigo Nagashima[1], Tomoki S. L. Prugger Suzuki[1], Rammaru Ishida[1], Shun Fujii[1,2], and Takasumi Tanabe[1] — [1]Department of Electronics and Electrical Engineering, Faculty of Science and Technology, Keio University, Yokohama, Japan — [2]Quantum Optoelectronics Research Team, RIKEN Center for Advanced Photonics, Saitama, Japan

In this work, we report on a numerical investigation that clarified the optimum design parameters to achieve passive ML with a toroidal WGM microlaser.

EG-2: Coupling at the Nanoscale 1

Chair: Igor Aharanovich, University of Technology Sydney, Sydney, Australia

Time: Wednesday, 8:30–10:00 Location: TRACK 7

Oral EG-2.1 8:30 TRACK 7

Coupling A Single Molecule To An Interrupted Nanophotonic Waveguide — •Ross C. Schofield[1], Sebastien Boissier[1], Lin Jin[2], Anna Ovvyan[2], Salahuddin Nur[1], Frank H. L. Koppens[3], Costanza Toninelli[4], Wolfram H. P. Pernice[2], Kyle D. Major[1], E. A. Hinds[1], and Alex S. Clark[1] — [1]Imperial College London, London, United Kingdom — [2]Universität Münster, Münster, Germany — [3]ICFO, Barcelona, Spain — [4]LENS and CNR-INO, Florence, Italy

We demonstrate coherent coupling of a molecular single photon emitter to an interrupted nanophotonic waveguide and develop a method for calculating coupling efficiency, applicable to many nanophotonic structures that cannot be decomposed into well-defined modes.

Oral EG-2.2 8:45 TRACK 7

3 Ways to View the Local Density of Optical States — William Barnes[1,2], Simon Horsley[1], and •Willem Vos[2] — [1]Department of Physics and Astronomy, University of Exeter, Stocker Road, Exeter, EX4 4QL, United Kingdom — [2]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, 7500 AE Enschede, Netherlands

We theoretical analyze the fundamentals of the local density of states that is central to emission control, antennae, energy transfer. We discuss the equivalence of 3 completely different viewpoints from quantum optics, nanophotonics, electrical engineering.

Oral EG-2.3 9:00 TRACK 7

A scanning planar Yagi-Uda antenna for fluorescence detection — •Navid Soltani[1,4], Elham Rabbany Esfahany[1,4], Gregor Schulte[2,4], Sergey I. Druzhinin[2,4], Julian Müller[3,4], Benjamin Butz[3,4], Holger Schönherr[2,4], Nemanja Markešević[1,5], and Mario Agio[1,4,6] — [1]Laboratory of Nano-Optics, University of Siegen, Siegen, Germany — [2]Physical Chemistry I, University of Siegen, Siegen, Germany — [3]Institute of Materials Engineering, University of Siegen, Siegen, Germany — [4]Center for Micro- and Nanochemistry and Engineering (Cμ), University of Siegen, Siegen, Germany — [5]Nanoscience Center, University of Jyväskylä, Jyväskylä, Finland — [6]National Institute of Optics (INO), National Research Council (CNR), Florence, Italy

We introduce a scanning planar Yagi-Uda antenna to improve fluorescence detection. Dyes labeling double-stranded DNA molecules immobilized in the antenna exhibit directional emission. The method is thus suitable for sensing biomolecules with low-NA optics

Oral EG-2.4 9:15 TRACK 7

Circular Bragg grating resonators for optical read-out of NV centres in nanodiamonds encapsulated in silicon nitride — •Jorge Monroy Ruz[1,2], Cecile Skoryna Kline[1,2], Joe Smith[2], John Rarity[2], and Krishna C. Balram[2] — [1]Quantum Engineering Centre for Doctoral Training, HH Wills Physics Laboratory, University of Bristol, Bristol, United Kingdom — [2]Quantum Engineering Technology Labs, Department of Electrical and Electronic Engineering, Universtiy of Bristol, Bristol, United Kingdom

We present the fabrication of circular Bragg grating resonators on silicon nitride to increase the collection efficiency of NV centre in encapsulated nanodiamonds.

Oral EG-2.5 9:30 TRACK 7

Nanophotonic Structures for Cavity Optomechanics — Jamie M. Fitzgerald, Sushanth Kini Manjeshwar, Witlef Wieczorek, and •Philippe Tassin — Chalmers University of Technology, Göteborg, Sweden

We show that techniques and structures from nanophotonics, such as photonic crystal membranes and bound states in the continuum, can be used to access entirely new regimes in cavity optomechanics.

Oral EG-2.6 9:45 TRACK 7

Fano lineshapes and mode splittings: Can they be artificially generated orobscured by the numerical aperture? — •Zhoumuyan Geng, Johanna Theenhaus, Biplab K. Patra, Jian-Yao Zheng, Joris Busink, Erik C. Garnett, and Said Rahimzadeh Kalaleh Rodriguez — Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

We demonstrate experimentally and theoretically how a moderate numerical aperture of the measurement setup can artificially generate Fano resonances and Rabi splittings, and conclude with general guidelines to avoid pitfalls in studying such optical systems.

EC-4: Band Topology - II

Chair: Alberto Amo, CNRS, Lille, France

Time: Wednesday, 8:30–10:00 Location: TRACK 8

Oral EC-4.1 8:30 TRACK 8

Non-abelian holonomies in a generalized Lieb lattice. — Valentina Brosco[1], •Laura Pilozzi[1], Rosario Fazio[2,3], and Claudio Conti[1,4] — [1]Institute for Complex Systems, National Research Council (ISC-CNR), Via dei Taurini 19, 00185 Rome, Italy — [2]The Abdus Salam International Centre for Theoretical Physics, Strada Costiera 11, I-34151 Trieste, Italy — [3]Dipartimento di Fisica, Università di Napoli Federico II, Monte S. Angelo, I-80126 Napoli, Italy — [4]Department of Physics, University Sapienza, Piazzale Aldo Moro 5, 00185 Rome, Italy

We design modulated photonic waveguide arrays for the generation and detection of non-abelian gauge fields. Exploiting the Thouless pumping we show that photon beam displacement quantization can be traced back to the existence of non-Abelian topological invariants.

Oral EC-4.2 8:45 TRACK 8

Topological Anderson Localization Transition in Time-Multiplexed Quantum Walks — •Syamsundar De[1], Dmitry Bagrets[2], Kun W. Kim[2], Sonja Barkhofen[1], Jan Sperling[1], Benjamin Brecht[1], Alexander Altland[2], Tobias Micklitz[3], and Christine Silberhorn[1] — [1]Paderborn University, Paderborn, Germany — [2]Universität zu Köln, Köln, Germany — [3]Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil

The experimental feasibility of topological Anderson localization transitions is studied. We put forward time-multiplexed quantum walks with tunable coin operations for realizing the targeted effect arising from the interplay between disorder and topology.

Oral EC-4.3 9:00 TRACK 8

Probing the Floquet bulk winding number through Bloch sub-oscillations — •Lavi Kumar Upreti[1], Clement Evain[2], Stephane Randoux[2], Pierre Suret[2], Alberto Amo[2], and Pierre Delplace[1] — [1]Univ. Lyon, ENS de Lyon, Univ Claude Bernard, CNRS, Laboratoire de Physique, Lyon, France — [2]Univ. Lille, CNRS, Physique des Lasers Atomes et Molecules, Lille, France

We report a new family of Bloch oscillations in quantum walks. The number of turning points distinguishes these oscillations within one Bloch period. The topological winding number governs them, and this can be probed in a photonic setup.

Oral EC-4.4 9:15 TRACK 8

Topological Characterization of Photonic Crystals — •María Blanco de Paz[1], Hadiseh Alaeian[2], Maia G. Vergniory[1,3], Barry Bradlyn[4], Geza Giedke[1,3], Dario Bercioux[1,3], and Aitzol García-Etxarri[1,3] — [1]Donostia International Physics Center, San Sebastian, Spain — [2]Electrical and Computer Engineering Physics and Astronomy, Purdue University, W. Lafayette, USA — [3]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain — [4]Department of Physics and Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign, Urbana, USA

We combine the theory of Topological Quantum Chemistry and Wilson loops calculations to characterize the topology of 2D photonic crystals. Including LDOS information in the analysis provides meaningful insights on the topological states of light.

Oral EC-4.5 9:30 TRACK 8

Breakdown of Spin-to-Helicity Locking in Symmetry-Protected Topological Photonic Crystal Edge States — •Thomas Bauer[1], Sonakshi Arora[1], René Barczyk[2], Ewold Verhagen[2], and Kobus Kuipers[1] — [1]Kavli Institute of Nanoscience Delft, Delft University of Technology, Delft, Netherlands — [2]Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

We experimentally reveal the influence of higher-order Bloch harmonics in edge states of topological photonic crystals emulating the quantum spin Hall effect, leading to a breakdown of the coupling between their local spin and helicity.

Oral EC-4.6 9:45 TRACK 8

Topological photonics: Mistaken paradigms and new opportunities — •Aitzol Garcia-Etxarri[1,2], Maria Blanco de Paz[1], Chiara Devescovi[1], Barry Bradlyn[3], Maia Garcia Vergniory[1,2], Dario Bercioux[1,2], Matt Proctor[4], and Paloma Arroyo Huidobro[5] — [1]Donostia International Physics Center, San Sebastian, Spain — [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain — [3]Department of Physics and Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign, Urbana, USA — [4]Department of Mathematics, Imperial College London , London, United Kingdom — [5]Instituto de Telecomunicações, Instituto Superior Tecnico-University of Lisbon,, Lisbon, Portugal

We apply "Topological Quantum Chemistry" to photonic crystals. Through this method, we found the first instance of bosonic fragile topology as well as higher-order photonic Photonic TIs and novel 3D photonic topological effects.

CI-2: Digital Signal Processing

Chair: Darko Zibar, DTU Fotonik, Kgs. Lyngby, Denmark

Time: Wednesday, 8:30–10:00 Location: TRACK 9

Invited CI-2.1 8:30 TRACK 9

Towards 50G/100G Passive Optical Networks with Digital Equalisation and Coherent Detection — •Robert Killey — University College London, London, United Kingdom

Recent advances in the development of low-complexity coherent transceiver technology for passive optical networks are reviewed. These include reducing optical network unit complexity, increasing laser phase noise tolerance and implementing effective machine-learning based equalisation.

Oral CI-2.2 9:00 TRACK 9

Experimental demonstration of 100 Gb/s 50Km Downstream Using PolMux MultiCAP OSSB Transmission and Heterodyne Reception based on 10G Electronics for Passive Optical Networks — •Miguel Barrio[1], David Izquierdo[2,1], Josep Cerda[3], Samael Sarmiento[4], Jose Antonio Altabas[5], Jose Antonio Lazaro[3], and Ignacio Garces[1] — [1]I3A, University of Zaragoza, Zaragoza, Spain — [2]Centro Universitario de la Defensa, Zaragoza, Spain — [3]Universitat Politècnica de Catalunya, Barcelona, Spain — [4]ICFO, Castelldefels, Spain — [5]Bifrost Communications, Kgs Lyngby, Denmark

We present a 100Gb/s downstream PON link based on a PolMux, multi-CAP OSSB modulation signal received by a coherent receiver. 50km transmission is achieved using 10G electronic and photonic devices with a sensitivity of -20dBm.

Oral CI-2.3 9:15 TRACK 9

An analysis of linear digital equalization in 50Gbit/s HS-PONs to compensate the combined effect of chirp and chromatic dispersion — •Flávio A. Nogueira Sampaio[1], Erwan Pincemin[1], Naveena Genay[1], Luiz Anet Neto[2], Raphaël Le Bidan[2], and Yves Jaouen[3] — [1]Orange Labs, Lannion, France — [2]IMT Atlantique, Plouzané, France — [3]Telecom Paris, Palaiseau, France

We study the impacts of frequency chirp and chromatic dispersion (CD) in 50Gbit/s Non-Return-to-Zero (NRZ) transmissions in an Intensity Modulation and Direct Detection (IM/DD) channel with a Minimum-Mean-Square Error Equalizer (MMSE-LE) at reception.

Oral CI-2.4 9:30 TRACK 9

Estimation for IQ skew of A Transmitter in Digital Coherent Communication Systems — •Naoki Tsuchida, Takuma Kuno, Yojiro Mori, and Hiroshi Hasegawa — Nagoya University, Nagoya, Japan

This paper presents a novel method for estimating transmitter IQ skew in digital coherent communication systems. Numerical simulations confirm that its estimation error is less than 0.04 ps even if other IQ impairments are present.

Oral CI-2.5 9:45 TRACK 9

A Novel Sixth-Order Algorithm for the Direct Zakharov-Shabat Problem — Sergey Medvedev[1,2], •Irina Vaseva[1,2], Igor Chekhovskoy[1,2], and Mikhail Fedoruk[1,2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Federal Research Center for Information and Computational Technologies, Novosibirsk, Russia

We propose a novel sixth-order conservative scheme based on Magnus expansion and Padé approximation for the numerical implementation of the nonlinear Fourier transform. The scheme allows the use of fast algorithms with low computational complexity.

CJ-3: Multimode Nonlinear Fiber Optics and SC Generation

Chair: William Wadsworth, University of Bath, Bath, United Kingdom

Time: Wednesday, 8:30–10:00 Location: TRACK 10

Invited CJ-3.1 8:30 TRACK 10

Latest experimental advances in nonlinear multimode fiber optics — Yann Leventoux[1], Marc Fabert[1], Maria Sapantan[1], •Katarzyna Krupa[2], Alessandro Tonello[1], Geoffroy Granger[1], Sebastien Fevrier[1], Tigran Mansuryan[1], Alioune Niang[3], Benjamin Wetzel[1], Guy Millot[4,5], Stefan Wabnitz[6,7], and Vincent Couderc[1] — [1]Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France — [2]Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland — [3]Dipartimento di Ingegneria dell'Informazione, Università degli Studi di

We present our recent results in multimode nonlinear fiber optics, including coherent combining of self-cleaned beams, and development of new SW/MID-IR laser sources. Novel 3D beam diagnostics will be also discussed.

Oral CJ-3.2 9:00 TRACK 10

0.75-6 μm supercontinuum generation using spatiotemporal nonlinear dynamics in graded index multimode fiber — •Yann Leventoux[1], Geoffroy Granger[1], Tigran Mansuryan[1], Marc Fabert[1], Katarzyna Krupa[2], Alessandro Tonello[1], Stefan Wabnitz[3], Vincent Couderc[1], and Sébastien Février[1] — [1]Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France — [2]Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland — [3]DIET, Sapienza University of Rome, Rome, Italy

We demonstrate that the interplay between the nonlinear processes in graded index multimode fibers can be controlled in order to seed a three octave spanning supercontinuum ranging from 0.75 to 6 μm.

Oral CJ-3.3 9:15 TRACK 10

Octave-spanning Infrared Supercontinuum Generation in a Graded-Index Multimode tellurite Fiber — •Ekaterina Krutova[1], Zahra Eslami[1], Tanvi Karpate[2,3], Mariusz Klimczak[3], Ryszard Buczynski[2,3], and Goery Genty[1] — [1]Photonics Laboratory, Tampere University, Tampere, Finland — [2]Łukasiewicz Research Network – Institute of Microelectronics and Photonics, Warsaw, Poland — [3]Faculty of Physics, University of Warsaw, Warsaw, Poland

We demonstrate for the first time octave-spanning supercontinuum generation from 1000 nm to 3000 nm in a tellurite multimode graded-index fiber. Our results could pave the way to high-power supercontinuum light sources in the mid-infrared.

Oral CJ-3.4 9:30 TRACK 10

Spatial self-beam cleaning in spatiotemporally mode-locked fiber lasers — •Ugur Tegin[1,2], Babak Rahmani[1], Eirini Kakkava[2], Demetri Psaltis[2], and Christophe Moser[1] — [1]Laboratory of Applied Photonics Devices, Ecole federale polytechnique de Lausanne, Lausanne, Switzerland — [2]Optics Laboratory, Ecole federale polytechnique de Lausanne, Lausanne, Switzerland

A novel technique by controlling spatiotemporal nonlinearities to achieve spatial self-beam cleaning in mode-locked lasers is presented. Multimode fiber oscillator with single-mode beam, 24 nJ and sub-100 fs pulses is demonstrated.

Oral CJ-3.5 9:45 TRACK 10

Multi-octave coherent supercontinuum generation under anomalousdispersion regime in a ZBLAN-based master oscillator fiber amplifier — •Seyed Ali Rezvani[1], Kazuhiko Ogawa[2], and Takao Fuji[1] — [1]Toyota Technological Institute, Nagoya, Japan — [2]FiberLabs Inc., Saitama, Japan

A fully stable polarized supercontinuum spanning from 0.35-4.5 μm is generated under anomalous dispersion in polarization-maintaining ZBLAN fiber using pulses at the vicinity of 2 μm from a master oscillator fiber amplifier

CD-6: Quantum Technologies

Chair: Dragomir Neshev, Australian National University, Canberra, Australia

Time: Wednesday, 8:30–10:00 Location: TRACK 11

Oral CD-6.1 8:30 TRACK 11

General measurement technique of the ratio between chromatic dispersion and the nonlinear coefficient — •David Castelló-Lurbe[1], Antonio Carrascosa[2,3], Enrique Silvestre[2,4], Antonio Díez[2,3], Jürgen Van Erps[1], Nathalie Vermeulen[1], and Miguel V. Andrés[2,3] — [1]Brussels Photonics, Department of Applied Physics and Photonics, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Belgium — [2]Institut Universitari de Ciències dels Materials, Universitat de València, Catedrático Agustín Escardino 9, 46980 Paterna, Spain — [3]Departament de Física Aplicada i Electromagnetisme, Universitat de València, Dr. Moliner 50, 46100 Burjassot, Spain — [4]Departament d'Òptica, Universitat de València, Dr. Moliner 50, 46100 Burjassot, Spain

A novel approach to determine directly the ratio between chromatic dispersion and the nonlinear coefficient in any guiding medium is presented and demonstrated in polarization-maintaining and single-mode fibers with normal and anomalous dispersion.

Oral CD-6.2 8:45 TRACK 11

Analysis of laser-inscription of waveguides in bulk Silicon via ultrashort pulses — •Alessandro Alberucci[1], Namig Alasgarzade[1], Markus Blothe[1], Maxime Chambonneau[1], Chandroth P Jisha[1], and Stefan Nolte[1,2] — [1]Friedrich-Schiller University Jena, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

The process of writing Silicon waveguides using ultrashort lasers is investigated. After addressing the nonlinear propagation of the writing pulse analytically and numerically, we characterize the index profile of the written waveguides using transversally-shifted inputs.

Oral CD-6.3 9:00 TRACK 11

High performance Kerr effect in hybrid 2D material-SiN waveguide platform — •Vincent Pelgrin[1,2], Yuchen Wang[2], Jonathan Peltier[1], Carlos Alonso-Ramos[1], Laurent Vivien[1], Zhipei Sun[2,3], and Eric Cassan[1] — [1]Université Paris Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]Department of Electronics and Nanoengineering, Aalto University, Aalto, Finland — [3]QTF Centre of Excellence, Department of Applied Physics, Aalto University, Aalto, Finland

Hybridization of 2D highly nonlinear materials with the silicon platform introduce a boosting of nonlinear effects while remaining TPA free at telecom wavelength. With optimization of the structures, nonlinear performance almost compares to SOI waveguides.

Oral CD-6.4 9:15 TRACK 11

Stimulated Brillouin scattering of helical Bloch modes in chiral three-core photonic crystal fibre — •Xinglin Zeng[1], Wenbin He[1], Jiapeng Huang[1], Paul Roth[1,2], Gordon K. L. Wong[1], Michael H. Frosz[1], Birgit Stiller[1,2], and Philip St. J. Russell[1,2] — [1]Max-Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

We report stimulated Brillouin scattering of helical Bloch modes in chiral photonic crystal fibre with a three-fold rotationally symmetric core. Conservation of azimuthal order, not topological charge, plays a crucial role in the scattering process.

Oral CD-6.5 9:30 TRACK 11

Optical parametric oscillator based on silicon nitride waveguides — •Niklas M. Lüpken[1], David Becker[1], Thomas Würthwein[1], Klaus-J. Boller[2,1], and Carsten Fallnich[1,2,3] — [1]Institute of Applied Physics, University of Münster, Münster, Germany — [2]MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [3]Cells in Motion Interfaculty Centre, University of Münster, Münster, Germany

We present waveguide-based optical parametric oscillation in silicon nitride with the potential of full integration. The tunable light source paves the path towards integrated CARS measurements or mid-infrared absorption spectroscopy.

Oral CD-6.6 9:45 TRACK 11

Difference-frequency generation in silicon nitride waveguides based on all-optical poling — •Boris Zabelich, Ezgi Sahin, Ozan Yakar, Edgars Nitiss, and Camille-Sophie Brès — Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

We demonstrate difference-frequency generation in silicon nitride waveguide leveraging all-optical poling. Appropriate dispersion engineering can shift the nonlinear frequency conversion towards the middle-infrared based on a grating inscribed with telecommunication signals.

SH-12: Short Course 12: Finite Element Modelling Methods for Photonics

Time: Wednesday, 8:30–12:00 Location: TRACK 12

Short Course SH-12.1 8:30 TRACK 12

Finite Element Modelling methods for Photonics and Optics — •Arti Agrawal — UTS, Sydney, Australia

This short course starts with Maxwell's equations and explains the basic principles of numerical modelling and the key assumptions involved.

Break.

Short Course 12 continued.

CJ-4: Mode-locked Fiber Lasers

Chair: Sobon Grzegorz, Wroclaw University of Technology, Wroclaw, Poland

Time: Wednesday, 11:00–12:30 Location: TRACK 1

Oral CJ-4.1 11:00 TRACK 1

Multipulse and Molecule states in a broadband Mamyshev oscillator around 1550 nm — •Coraline Lapre[1], Cyril Billet[1], Fanchao Meng[1], Mehdi Mabed[1], Christophe Finot[2], Lauri Salmela[3], Goery Genty[3], and John Dudley[1] — [1]Institut FEMTO-ST, Université Bourgogne Franche-Comté CNRS UMR 6174, Besançon, France, Besançon, France — [2]Laboratoire Interdisciplinaire Carnot de Bourgogne, Université Bourgogne Franche-Comté CNRS UMR 6303, Dijon, France, Dijon, France — [3]Photonics Laboratory, Tampere University, Tampere, FI-33104, Finland , Tampere, Finland

Frequency resolved optical gating and dispersive Fourier transform measurements provide new insights into stable and unstable dynamics in a fibre Mamyshev oscillator generating 100 nm bandwidth pulses around 1550 nm.

Oral CJ-4.2 11:15 TRACK 1

Autosetting Mode-locked Laser with Genetic Algorithm Optimization and Advanced Intracavity Controls — •Jérémie Girardot, Franck Billard, Aurélien Coillet, Malik Nafa, Edouard Hertz, and Philippe Grelu — Laboratoire ICB UMR 6303 CNRS, Photonics Dpt, Université Bourgogne—Franche-Comté, Dijon, France

We present a smart ultrafast fiber laser with interfaced intracavity controls applying on both nonlinear and spectral transfer functions. After running an evolutionary algorithm, the self-starting pulsed output optimizes various user-defined merit functions.

Oral CJ-4.3 11:30 TRACK 1

Deep reinforcement learning algorithm for self-tuning 8-figure fiber laser — •Alexey Kokhanovskiy[1], Evgeny Kuprikov[1], Kirill Serebrennikov[1], and Sergey Turitsyn[1,2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Aston Institute of Photonic Technologies, Birmingham, United Kingdom

We demonstrate the performance of Q-learning algorithm for searching stable dissipative soliton generation inside 8-figure fiber laser via tuneable spectral filtration.

Oral CJ-4.4 11:45 TRACK 1

Generation of ~625nJ Pulses from a Mamyshev Oscillator with a few-mode LMA Yb-doped Fiber — •Di Lin[1], Duanyang Xu[1], Jing He[2], Yutong Feng[1], Zhenqi Ren[1], and David J. Richardson[1] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]Cambridge Graphene Centre, University of Cambridge, Cambridge, United Kingdom

We demonstrate a Maymshev oscillator based on a 25μm core diameter Yb-doped fiber. The oscillator generates pulses with an energy of 625nJ that can be compressed to ~44 fs with a peak power of ~5.6MW.

Invited CJ-4.5 12:00 TRACK 1

Revealing the soliton buildup dynamics in mode-locked fiber lasers — •Xueming Liu[1,2,3] and Lin Huang[1] — [1]College of Optical Science and Engineering, Zhejiang University, Hangzhou, China — [2]Nanjing University of Information Science & Technology, Nanjing, China — [3]College of Astronautics, Nanjing University of Aeronautics and Astronautics, Nanjing, China

We discuss real-time dynamics of soliton evolution in mode-locked fiber lasers, including the entire buildup dynamics of soliton, soliton molecule, harmonic mode-locking based on TS-DFT technique, and the temporal evolution using time-lens technique.

CH-6: On-chip Solutions for Optical Sensing

Chair: Robert Halir, University of Málaga, BIONAND - Centro Andaluz de Nanomedicina y Biotecnología, Málaga, Spain

Time: Wednesday, 11:00–12:30 Location: TRACK 2

Oral CH-6.1 11:00 TRACK 2

Investigations of Protein-Ligand Reaction Kinetics by Transistor-Microfluidic Integrated Sensors — •Keng-Yi Tsai[1], Ya-Chu Lee[2], Chun-Ho Chou[3], and Jian-Jang Huang[4] — [1] Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei , Taiwan — [2] Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei, Taiwan — [3] Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei, Taiwan — [4] Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei, Taiwan

In this work, the IGZO-TFT (thin-film transistor) biosensor integrated with a tailored microfluidic chip was developed to explore binding kinetics of protein-ligand biochemical interactions in the real-time manner.

Oral CH-6.2 11:15 TRACK 2

Tantalum Pentoxide Slot Waveguides for Waveguide Enhanced Raman Spectroscopy — •Zuyang Liu[1,2], Qiancheng Zhao[3], Peixin Shi[1,2], Bill Mitchell[4], Haolan Zhao[1,2], Nicolas Le Thomas[1,2], Daniel Blumenthal[3], and Roel Baets[1,2] — [1]Photonics Research Group, Ghent University-IMEC, Gent, Belgium — [2]Center for Nano- and Biophotonics, Ghent University, Gent, Belgium — [3]Department of Electrical and Computer Engineering, University of California, Santa Barbara, Santa Barbara, USA — [4]UCSB Nanofabrication Facility, University of California, Santa Barbara, Santa Barbara, USA

We demonstrate a waveguide-enhanced Raman sensor utilizing tantalum pentoxide slot waveguides. The high index contrast and optimized waveguide geometry improve the signal intensity by 4x compared to a conventional silicon nitride slot waveguide.

Oral CH-6.3 11:30 TRACK 2

Spectroscopic Gas Detection Using Thin-film Mesoporous Waveguides — •Anurup Datta, Sebastián Alberti, Marek Vlk, and Jana Jágerská — UiT The Arctic University of Norway, Tromsø, Norway

Chip-integrated waveguides for gas sensing have inadequate evanescent field interaction. A thin-film mesoporous waveguide has enhanced sensitivity through gas interaction with the field inside the waveguide-core, demonstrated through spectroscopic detection of acetylene at 1520 nm.

Oral CH-6.4 11:45 TRACK 2

Multicolor hologram based on plasmonic nanohole arrays and detour phase: design and simulation — •Seyed Saleh Mousavi Khaleghi[1], Dandan Wen[1], Jasper Cadusch[1], and Kenneth B. Crozier[1,2,3] — [1]Department of Electrical and Electronic Engineering, University of Melbourne, Victoria 3010, Australia — [2]School of Physics, University of Melbourne, Victoria 3010, Australia — [3]ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Victoria, Australia

We design nanohole arrays that serve as color filters with high transmission and low cross-talk. We design two multicolor holograms based on these and simulate their performance, demonstrating good fidelity to the desired holographic images.

Oral CH-6.5 12:00 TRACK 2

Mach-Zehnder interferometer assisted ring resonator configuration for refractive index sensing — •Mukesh Yadav and Astrid Aksnes — Norwegian University of Science and Technology, Trondheim, Norway

Four-fold enhancement in the dynamic range of a ring resonator sensor is presented. The Mach-Zehnder interferometer assisted ring resonator configuration is utilized to achieve this enhanced dynamic range, which is independent of the Q-factor.

Oral CH-6.6 12:15 TRACK 2

Integrated Multispectral Scanner for Chlorophyll Monitoring — •Pierre Maidment[1], Muhammad N. Malik[2], Antonella Bogoni[2], Charalambos Klitis[1], and Marc Sorel[1,2] — [1]James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom — [2]Sant'Anna School of Advanced Studies, Pisa, Italy

Active multispectral sensors are an effective technology for biological monitoring. A triple-wavelength scanning system with compact semiconductor lasers to probe chlorophyll is demonstrated. The system architecture has been translated into a compact silicon photonic chip.

CF-5: Ultrashort Pulses in the mid-IR

Chair: Rupert Huber, University of Regensburg, Regensburg, Germany

Time: Wednesday, 11:00–12:30 Location: TRACK 3

Invited CF-5.1 11:00 TRACK 3

High-Brightness Seven-Octave Light Source — Ugaitz Elu[1], Luke Maidment[1], •Lenard Vamos[1], Francesco Tani[2], David Novoa[2], Michael H. Frosz[2], Valeriy Badikov[3], Dmitrii Badikov[3], Valentin Petrov[4], Philip St. J. Russell[2,5], and Jens Biegert[1,6] — [1]ICFO– Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Barcelona, Spain — [2]Max-Planck Institute for Science of Light, Erlangen, Germany — [3]High Technologies Laboratory, Kuban State University, Krasnodar, Russia — [4]Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy, Berlin, Germany — [5]Department of Physics, Friedrich-Alexander-Universität,, Erlangen, Germany — [6]ICREA, Barcelona, Spain

We present a high brightness source combining soliton self-compression and intra-pulse difference frequency generation which spans seven optical octaves (UV to THz) with stable carrier-envelope phase.

Oral CF-5.2 11:30 TRACK 3

Generation of sub-half-cycle 10 μm pulses using four-wave mixing through two-color filamentation — Wei-Hong Huang[1,2], Yue Zhao[1], Shota Kusama[1], Chih-Wei Luo[2], and •Takao Fuji[1] — [1]Toyota Technological Institute, Nagoya, Japan — [2]National Chiao Tung University, Hsinchu, Taiwan

We have experimentally demonstrated the generation of sub-half-cycle pulses at 10 μm through filamentation in nitrogen. The absolute value of the CEP was consistent with a simple four-wave difference frequency generation model.

Oral CF-5.3 11:45 TRACK 3

OPCPA Front-End based on a Cr:ZnS Laser for Femtosecond Pulse Generation in the Mid-Infrared — •Pia Fuertjes, Lorenz von Grafenstein, Chao Mei, Uwe Griebner, and Thomas Elsaesser — Max Born Institute, Berlin, Germany

A novel front-end for mid-IR OPCPAs based on a fs Cr:ZnS laser is presented. The 2-μm pumped 1 kHz OPCPA delivers >400 μJ idler pulses tunable between 5.4 – 6.8 μm with sub-150 fs duration.

Oral CF-5.4 12:00 TRACK 3

Carrier-envelope phase characterization using harmonic spectral interference in mid-infrared laser filament in argon — •Pavel Polynkin[1], Claudia Gollner[2], Valentina Shumakova[2], Jacob Barker[1], Audrius Pugzlys[2], and Andrius Baltuska[2] — [1]College of Optical Sciences, University of Arizona, Tucson, USA — [2]Photonics Institute, Vienna University of Technology, Vienna, Austria

We quantify the carrier-envelope phase of an ultrafast mid-infrared laser source at 3.9um by measuring the phase of the spectral interference between adjacent odd harmonics generated by this laser on its filamentation in argon gas.

Oral CF-5.5 12:15 TRACK 3

Ultrafast, High-flux hard X-ray Source driven by a Few-cycle 5 μm OPCPA — •Lorenz von Grafenstein, Azize Koç, Christoph Hauf, Michael Woerner, Martin Bock, Esmerando Escoto, Uwe Griebner, and Thomas Elsaesser — Max Born Institute, Berlin, Germany

A novel table-top hard X-ray source at 8 keV driven by few-cycle 5-μm laser pulses with 3.0 mJ energy provide a total number of 1.5×109 Cu-Kα photons per pulse at 1 kHz repetition rate.

CM-2: Semiconductor Processing

Chair: Ya Cheng, Shanghai Institute of Optics and Fine Mechanics, China

Time: Wednesday, 11:00–12:30 Location: TRACK 4

Oral CM-2.1 11:00 TRACK 4

Monitoring Ultrafast Laser Micro-Excitation and Modification Deep inside GaAs — •Andong Wang, Amlan Das, Jörg Hermann, and David Grojo — Aix-Marseille Université, CNRS, LP3, UMR7341, Marseille, France

We measure laser-induced microscale carrier excitation inside GaAs by monitoring the fluorescence. Results reveal the requirements existing on the pulse energy, duration, and focusing numerical aperture to obtain modification deep inside GaAs.

Oral CM-2.2 11:15 TRACK 4

Deep surface amorphization in silicon induced by spectrally-tuned ultrashort laser pulses — Mario Garcia-Lechuga[1], Noemi Casquero[2], Andong Wang[3], David Grojo[3], and •Jan Siegel[2] — [1]Departamento de Física Aplicada, Universidad Autónoma de Madrid, Madrid, Spain — [2]Laser Processing Group, Instituto de Óptica, IO-CSIC, Madrid, Spain — [3]Aix-Marseille University, CNRS, LP3 UMR 7341, Marseille, France

Deep surface amorphization in silicon for telecom waveguide writing applications is achieved by tuning the femtosecond laser writing wavelength from 515nm-4000nm. Amorphous layers of 128 nm can be achieved, much exceeding the current 70 nm-limit.

Oral CM-2.3 11:30 TRACK 4

Laying the foundations of ultrafast stealth dicing of silicon with picosecond laser pulses at 2-μm wavelength — •Markus Blothe[1], Maxime Chambonneau[1], Tobias Heuermann[1,2], Martin Gebhardt[1,2], Jens Limpert[1,2,3], and Stefan Nolte[1,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745, Jena, Germany — [2]Helmholtz Institute Jena, Fröbelstieg 3, 07743, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745, Jena, Germany

Transversally elongated modifications were induced into the bulk of silicon with 2-μm picosecond laser pulses. The modified samples showed a reduced breaking strength and may serve in future for dicing applications.

Oral CM-2.4 11:45 TRACK 4

Pulse Duration and Temporal Contrast as Critical Parameters for Internal Structuring of Silicon — •Amlan Das, Andong Wang, Olivier Utéza, and David Grojo — Aix-Marseille Université, CNRS, LP3, F-13288, Marseille, France

By synchronizing 1550-nm pulses of durations from 190 fs to 5 ns, we investigate the key dynamical aspects of interactions to achieve 3D laser writing inside silicon.

Oral CM-2.5 12:00 TRACK 4

3D Laser Structured Mirror-Waveguide Circuits: a New Optical PCB Platform for Silicon Photonics — •Amir Rahimnouri, Gligor Djogo, and Peter Herman — University of Toronto, Toronto, Canada

Femtosecond laser glass processing of micro-void mirror disks and waveguides inside of fused silica facilitated high-density bending of 3D waveguide circuits for efficient optical routing and vertical light coupling into silicon photonic chips.

Oral CM-2.6 12:15 TRACK 4

Laser nanofabrication deep inside silicon wafers — Rana Asgari Sabet[1,2], Aqiq Ishraq[1,2], and •Onur Tokel[1,2] — [1]Bilkent University, Department of Physics, Ankara, Turkey — [2]National Nanotechnology Research Center, Turkey, Ankara, Turkey

Here, we introduce the first controlled nano-fabrication capability in the bulk of silicon wafers. We exploit smart use of structured beams and demonstrate "in-chip" nano-structuring with features lower than 250 nm.

CB-4: Quantum Cascade Lasers

Chair: Dmitri Boiko, CSEM, Neuchâtel, Switzerland

Time: Wednesday, 11:00–12:30 Location: TRACK 5

Oral CB-4.1 11:00 TRACK 5

Actively mode-locked pulses from a mid-IR quantum cascade laser — •Johannes Hillbrand[1,2], Nikola Opačak[1], Marco Piccardo[2], Harald Schneider[3], Gottfried Strasser[1], Federico Capasso[2], and Benedikt Schwarz[1,2] — [1]Institute of Solid State Electronics, TU Wien, Vienna, Austria — [2]Harvard John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, USA — [3]Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

The ultrafast carrier transport in mid-infrared quantum cascade lasers (QCLs) has long been considered an insurmountable obstacle for the generation of short pulses. Here, we report on transformation-limited picosecond pulses from a high-performance mid-IR QCL.

Oral CB-4.2 11:15 TRACK 5

Ultra-low Threshold Quantum Cascade Laser — •Zhixin Wang, Filippos Kapsalidis, Ruijun Wang, Mattias Beck, Giacomo Scalari, and Jérôme Faist — ETH Zürich, Zürich, Switzerland

We present a quantum cascade laser operating at 4.3 μm wavelength and exhibiting a threshold current of only 11.0 mA while generating a single-mode maximum power of 0.23 mW at -20 °C in continuous-wave operation.

Oral CB-4.3 11:30 TRACK 5

Mid-Infrared Quantum Cascade Lasers with 9 Stages for Regrowth-Free Low Voltage Continuous Wave Operation — •Dominik Burghart, Wolfhard Oberhausen, Kevin Zhang, Alexander Gardanow, Jonas Krakofsky, Gerhard Boehm, and Mikhail A. Belkin — Walter Schottky Institut and Department of Electrical and Computer Engineering, Technische Universität München, Garching, Germany

We report room temperature continuous-wave operation of quantum cascade lasers at 7μm with only 9 active regions and operating voltage below 5V compatible with standard laser diode drivers, while not requiring regrowth or epidise-down mounting.

Oral CB-4.4 11:45 TRACK 5

Frequency Control of a Mid-Infrared Quantum Cascade Laser Frequency Comb by Near-Infrared Light Injection and Intensity Modulation — •Kenichi Komagata[1], Atif Shehzad[1], Marin Hamrouni[1], Renaud Matthey[1], Filippos Kapsalidis[2], Pierre Jouy[3], Mattias Beck[2], Valentin J. Wittwer[1], Andreas Hugi[3], Thomas Südmeyer[1], and Stephane Schilt[1] — [1]Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, CH-2000 Neuchâtel, Switzerland — [2]Institute for Quantum Electronics, ETH Zurich, CH-8093 Zurich, Switzerland — [3]IRsweep AG, Laubisrütistrasse 44, CH-8712 Stäfa, Switzerland

We study the response of a mid-infrared quantum cascade laser frequency comb to optical injection of intensity-modulated near-infrared light. We demonstrate MHz actuation bandwidth of the comb properties necessary for tightly-locking a dual comb spectrometer.

Oral CB-4.5 12:00 TRACK 5

Heating Dynamics of Pulse-Pumped Quantum-Cascade Lasers — Vladislav Dudelev[1], Dmitriy Mikhailov[1], Dmitriy Chistyakov[1], Andrey Babichev[2], Valentin Mylnikov[1], Andrey Gladyshev[2], Sergey Losev[1], Innokentiy Novikov[2], Andrey Lyutetskiy[1], Sergey Slipchenko[1], Nikita Pikhtin[1], Leonid Karachinsky[2], Anton Egorov[3], and •Grigorii Sokolovskii[1] — [1]Ioffe Institute, Saint-Petersburg, Russia — [2]Connector Optics LLC, Saint-Petersburg, Russia — [3]ITMO University, Saint-Petersburg, Russia

We report on the temperature dynamics measurements of pulse-pumped quantum-cascade lasers with μm-scale spatial and sub-ns temporal resolution allowing for detection of mK/ns heating rates inside the active region

Oral CB-4.6 12:15 TRACK 5

Linewidth Enhancement Factor of Mid-IR Quantum Cascade Lasers — •Mathieu Bertrand, Martin Franckié, Andres Forrer, Filippos Kapsalidis, Mattias Beck, and Jérôme Faist — Institute for Quantum Electronics, ETH Zürich, Zürich, Switzerland

We present measurements of the linewidth enhancement factor of Mid-IR Quantum Cascade Lasers using a coherent beatnote spectroscopy technique. We provide also theoretical predictions to explain the experimentally observed devices' behavior.

EG-3: Coupling at the Nanoscale 2

Chair: Claus Ropers, Georg-August University & Max Planck Institute for Biophysical Chemistry, Göttingen, Germany

Time: Wednesday, 11:00–12:30 Location: TRACK 6

Oral EG-3.1 11:00 TRACK 6

Breakdown of polaritons in ultrastrongly coupled nanophotonic systems — •Shima Rajabali[1], Erika Cortese[2], Mattias Beck[1], Simone De Liberato[2], Jérôme Faist[1], and Giacomo Scalari[1] — [1]Quantum Optoelectronics Group, Institute of Quantum Electronics, ETH Zürich, Zürich, Switzerland — [2]School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom

We theoretically and experimentally show a physical limit for the confinement of electromagnetic field which can ultimately limit the light-matter coupling enhancement in an ultra-strong coupling regime due to the excitement of high momentum propagating matter resonances.

Oral EG-3.2 11:15 TRACK 6

Dual-Tone Raman Study of Optical Picocavities — •Sachin Verlekar, Aqeel Ahmed, Wen Chen, and Christophe Galland — École polytechnique fédérale de Lausanne, Lausanne, Switzerland

Nanoparticle-on-mirror (NPoM) nanocavities are studied under dual-tone laser excitation. We leverage the multimode nature of these structures to probe the generation mechanism of plasmonic picocavities.

Oral EG-3.3 11:30 TRACK 6

Maximal coupling of light into 2D polaritons — •Eduardo J. C. Dias[1] and Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We quantify the coupling strength between light and 2D polaritons in thin films, using point and line scatterers, and find universal constraints that limit its fundamental maximum allowed values.

Oral EG-3.4 11:45 TRACK 6

Cavities with Giant Brownian Fluctuations — •Mark Douvidzon[1], Udvas Chattopadhyay[2], Yidong Chong[2], and Tal Carmon[3] — [1]Technion, Israel Institute of Technology, Technion City, Israel — [2]Nanyang Technological University, Singapore, Singapore — [3]Tel Aviv University, Tel Aviv, Israel

We report on the softest optical micro resonator at room conditions. We operate a submerged micro-drop near the Winsor III phase and measure a Q=10^5, capillary amplitude and frequency of 6 nm and 155 Hz

Oral EG-3.5 12:00 TRACK 6

Metal-molecule charge transfer through Fermi level equilibration in plasmonic systems — •Andrei Stefancu[1], Seunghoon Lee[2], Zhu Li[3], Min Liu[3], Raluca Ciceo-Lucacel[1], Nicolae Leopold[1], and Emiliano Cortes[2] — [1]Babes-Bolyai University, Cluj-Napoca, Romania — [2]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, Munich, Germany — [3]State Key Laboratory of Powder Metallurgy, School of Physical and Electronics, Central South University, Changsha, China

In this study we highlight, and monitor by SERS, a new metal-molecule charge transfer pathway, complementary to photoexcitation or plasmon assisted charge carrier production, through Fermi level equilibration of plasmonic materials and adsorbed molecules.

Oral EG-3.6 12:15 TRACK 6

Nano-IR study of light-matter interaction between intersubband transitions in quantum wells and patch antenna resonators by polymer expansion — •Mario Malerba[1], Leonetta Baldassarre[2], Raymond Gillibert[2], Valeria Giliberti[3], Simone Sotgiu[2], Michele Ortolani[2,3], and Raffaele Colombelli[1] — [1]C2N, Université de Paris Saclay, Palaiseau, France — [2]Dipartimento di Fisica, Università La Sapienza, Roma, Italy — [3]Center for Life Nanoscience, Istituto Italiano diTecnologia, Roma, Italy

By inserting a layer of polyethylene inside a metal-heterostructure-metal optical cavity resonator and shining mid-IR light, we detect strong coupling of light/matter interactions and map EM fields from a single patch nanoantenna as polymer expansion.

CE-6: Materials for Waveguides and Resonators

Chair: Daniel Milanese, University of Parma, Parma, Italy

Time: Wednesday, 11:00–12:30 Location: TRACK 7

Oral CE-6.1 11:00 TRACK 7

Photonic Transformers — •Mark Douvidzon[1], Shai Maayani[1], Harel Nagar[2], Tamir Admon[2], Vladimir Shuvayev[3], Lan Yang[4], Lev Deych[3], Yael Roichman[2], and Tal Carmon[2] — [1]Technion, Haife, Israel — [2]Tel Aviv University, Tel Aviv, Israel — [3]Queems College of Cuny, New York, USA — [4]Washington University in St. Louis, St. Louis, Missouri, USA

We report on transformable micro-photonic devices that change their functionality while operating. Assisted by holographic-tweezers, we gradually deform the shape of a droplet whispering-gallery cavity and split a resonant mode to a 10-GHz separated doublet.

Oral CE-6.2 11:15 TRACK 7

Fabry-Pérot Based Temporal Standard at 8.5 μm for Electro-Optic Delay Tracking — •Tatiana Amotchkina[1], Michael Trubetskov[1], Alexander Weigel[1,2,3], Daniel Hahner[2], Syed Ali Hussain[2,3], Philip Jacob[1,2], Ioachim Pupeza[1,2], and Vladimir Pervak[2] — [1]Max-Planck-Institut für Quantenoptik, Garching, Germany — [2]Ludwig-Maximilian-Universität München, Garching, Germany — [3]Molekuláris- Ujjlenyomat Kutató Közhasznú Nonprofit Kft., Budapest, Hungary

We demonstrate the elongation of a few-cycle mid-infrared pulse via a Fabry-Pérot type optical filter, providing a monochromatic mid-infrared waveform for electro-optic delay tracking, which is robust against variations of the initial mid-infrared pulse.

Oral CE-6.3 11:30 TRACK 7

Optical birefringence in strain tuneable silk fibroin whispering gallery mode cavities — •Nikolaos Korakas[1,2], Davide Vurro[4], Odysseas Tsilipakos[1], Annamaria Cucinotta[3], Stefano Selleri[3], Salvatore Iannotta[4], and Stavros Pissadakis[1] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece — [2]Department of Materials Science & Technology, University of Crete, Heraklion, Greece — [3]Department of Engineering and Architecture, University of Parma, Parma, Italy — [4]Institute of Materials for Electronics and Magnetism (IMEM), CNR, Parma, Italy

Whispering gallery modes resonation at the 1.5μm spectral band is used for the investigation of the light-localization and photo-elastic properties of cylindrically shaped silk fibroin cavities, in the Silk I and II structures.

Oral CE-6.4 11:45 TRACK 7

New strategies to shorten the time response of thermo-optic switches in a glass chip — •Petra Paiè [1], Matteo Calvarese[1,2], Francesco Ceccarelli [1], Federico Sala[1,2], Andrea Bassi[1,2], Roberto Osellame[1,2], and Francesca Bragheri[1] — [1]Istituto di Fotonica e Nanotecnologie, IFN-CNR, Milano, Italy — [2]Dipartimento di Fisica, Politecnico di Milano, Milano , Italy

In this work we present the design, fabrication and characterization of a fast thermo-optical switch. By layout optimization, surface laser microstructuring and driving voltage tuning, we prove a switching time of less than 100 μs.

Oral CE-6.5 12:00 TRACK 7

Whispering gallery mode resonances in thermally poled borosilicate glass optical microcavities — •Nikolaos Korakas[1,2], Vassilis Tsafas[1,3], George Filippidis[1], Bruno Moog[4], Chris Craig[4], Daniel W. Hewak[4], Michalis N. Zervas[4], and Stavros Pissadakis[1] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece — [2]Department of Materials Science & Technology, University of Crete, Heraklion, Greece — [3]Department of Physics, University of Crete, Heraklion, Greece — [4]Optoelectronics Research Centre (ORC), University of Southampton, Southampton, United Kingdom

Whispering gallery mode resonances are investigated in thermally poled, borosilicate glass, cylindrical cavities. Experimental results reveal the role of poling losses in the selective suppression of spectral resonances upon their radial order and polarization state.

Oral CE-6.6 12:15 TRACK 7

Self-Written Waveguides as Low-Loss Interconnects and Temperature Sensor — •Axel Günther[1,3], Roopanshu Garg[2], Lei Zheng[2,3], Bernhard Roth[2,3], and Wolfgang Kowalsky[1,3] — [1]Institute of High Frequency Technology, Braunschweig, Germany — [2]Hannover Centre for Optical Technologies, Hannover, Germany — [3]Cluster of Excellence PhoenixD, Hannover, Germany

Self-written waveguides represent a promising class of optical interconnects. They enable a rigid connection and minimize coupling losses between different optical elements. Furthermore, their characteristics enable a usage as thermal sensing element simultaneously.

EA-3: Quantum Optomechanics and Detectors

Chair: Lukas Slodicka, Palacky University of Olomouc, Olomouc, Czech Republic

Time: Wednesday, 11:00–12:30 Location: TRACK 8

Oral EA-3.1 11:00 TRACK 8

Bell Correlations Between Light and Vibrations at Ambient Conditions — •Santiago Tarrago Velez[1], Vivishek Sudhir[2,3], Nicolas Sangouard[4], and Christophe Galland[1] — [1]Institue of Physics, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — [2]LIGO Laboratory, Massachusetts Institute of Technology, Cambridge, USA — [3]Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, USA — [4]Departement Physik, Universität Basel, Klingelbergstrasse, Basel, Switzerland

In this talk we present a new scheme leveraging Spontaneous Raman Spectroscopy and Time Resolved Single Photon Counting in order to produce Bell correlations between light and vibrations at ambient conditions.

Oral EA-3.2 11:15 TRACK 8

Detection of a Levitated Nanoparticle's Position via Self-Homodyne — •Dmitry S. Bykov[1], Lorenzo Dania[1], Katharina Heidegger[1], Giovanni Cerchiari[1], Rainer Blatt[1,2], and Tracy E. Northup[1] — [1]Institut für Experimentalphysik, Universität Innsbruck, Technikerstrasse 25, Innsbruck, Austria — [2]Institut für Quantenoptik und Quanteninformation, Österreichische Akademie der Wissenschaften, Technikerstrasse 21a, Innsbruck, Austria

We demonstrate a technique to increase the efficiency with which the position of a levitated nanoparticle is detected. The method is based on self-homodyne of scattered light and theoretically can reach the Heisenberg limit.

Oral EA-3.3 11:30 TRACK 8

A High Cooperativity Silicon Nitride Optomechanical Transducer — •Mohammad J. Bereyhi, Amirali Arabmoheghi, Nils J. Engelsen, and Tobias J. Kippenberg — Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

We report the design, fabrication, and characterization of a monolithic nano-optomechanical silicon nitride transducer. Our system features a 1D photonic crystal cavity (Q ≈ 10^5) integrated with a high-Q (Q > 10^6) nanobeam with optomechanical cooperativity exceeding 10^3.

Oral EA-3.4 11:45 TRACK 8
Integrated free-space optomechanics with AlGaAs heterostructures — •Anastasiia Glushkova[1], Sushanth Kini Manjeshwar[1], Jamie M. Fitzgerald[2], Shu Min Wang[1], Philippe Tassin[2], and Witlef Wieczorek[2] — [1]Department of Microtechnology and Nanoscience, Chalmers University of Technology, Göteborg, Sweden — [2]Department of Physics, Chalmers University of Technology, Göteborg, Sweden
We fabricated and characterized suspended bi-layered photonic crystal slabs in AlGaAs heterostructures. Our approach allows to create integrated, closely spaced membranes, which can exhibit photonic bound states in the continuum to increase light-matter interaction.

Oral EA-3.5 12:00 TRACK 8
How to observe single photons at 200 000 camera frames per second? — •Michał Lipka[1] and Michał Parniak[1,2] — [1]Centre for Quantum Optical Technologies, Centre of New Technologies, University of Warsaw, Warsaw, Poland — [2]Niels Bohr Institute, University of Copanhagen, Copenhagen, Denmark
Quantum technologies often benefit from spatially-resolved single-photon detection and adaptive real-time measurements. We present an order of magnitude faster camera localizing single-photons in real-time (a few us), and demonstrate it for twin-photons correlation measurements.

Oral EA-3.6 12:15 TRACK 8
Tomography of a Feedback Measurement with Photon Detection — •Shuro Izumi, Jonas S. Neergaard-Nielsen, and Ulrik L. Andersen — Center for Macroscopic Quantum States (bigQ), Department of Physics, Technical University of Denmark, Kongens Lyngby, Denmark
We experimentally develop a measurement consisting of real-time feedbak controlled displacement combined with photon detector for the discrimination of the superpositions of the vacuum and single photon state, and characterize it via quantum detector tomography.

EF-3: 2D Transverse Dynamics and Quantum Effects

Chair: Kestutis Staliunas, ICREA, Barcelona, Spain

Time: Wednesday, 11:00–12:30 Location: TRACK 9

Oral EF-3.1 11:00 TRACK 9
Penrose wave amplification in superfluids of light — •Maria Chiara Braidotti[1], Radivoje Prizia[1,2], Ewan M. Wright[3], and Daniele Faccio[1] — [1]School of Physics and Astronomy, University of Glasgow, G12 8QQ, Glasgow, United Kingdom — [2]Institute of Photonics and Quantum Sciences, Herriot-Watt University, EH14 4AS, Edinburgh, United Kingdom — [3]Wyant College of Optical Sciences, University of Arizona, Arizona 85721, Tucson, USA
Fluids of light in defocusing media can be used to mimic curved spacetimes. We present the first experimental measurement of Penrose superradiance, i.e. the amplification of waves from a vortex spacetime, in a photonic superfluid.

Oral EF-3.2 11:15 TRACK 9
Can some semiconductor lasers operate as Bose Einstein condensates? — •Stéphane Barland[1], Pierre Azam[1], Gian Luca Lippi[1], Robert Nyman[2], and Robin Kaiser[1] — [1]Université Côte d'Azur, Institut de Physique de Nice, Valbonne, France — [2]Physics Department, Imperial College , London, United Kingdom
Lasers are known as out of equilibrium light emitting devices. Yet we observe signatures of photon thermalization and Bose Einstein condensation of photons (thermal equilibrium processes) in a Vertical Cavity Surface Emitting Laser.

Oral EF-3.3 11:30 TRACK 9
Filamentation and beam-reshaping in a 2D quadratic nonlinear medium — •Raphaël Jauberteau[1,2], Sahar Wehbi[1,3], Tigran Mansuryan[1], Katarzyna Krupa[4], Fabio Baronio[2], Benjamin Wetzel[1], Alejandro B. Aceves[5], Alessandro Tonello[1], Stefan Wabnitz[6], and Vincent Courderc[1] — [1]Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France — [2]Università di Brescia, Brescia, Italy — [3]ALPhANOV, Optics & Lasers Technology Center, Institut d'optique d'Aquitaine, Talence, France — [4]Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland — [5]Department of Mathematics, Southern Methodist University, Dallas, USA — [6]Dipartimento di Ingegneria dell'Informazione, Elettronica e Telecomunicazioni, Sapienza University, Rome, Italy
We reported the spatial filamentation, followed by the recovery of a bell-shaped beam for the second harmonic wave in a quadratic crystal. Such behavior is accompanied by spectral broadening covering the entire visible spectrum.

Oral EF-3.4 11:45 TRACK 9
Two-Photon Pumped Polariton Condensation — •Nadav Landau[1], Dmitry Panna[1], Sarit Feldman[1], Ronen Jacovi[1], Sebastian Brodbeck[2], Christian Schneider[2], Sven Höfling[2], and Alex Hayat[1] — [1]Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel — [2]Technische Physik and Wilhelm-Conrad-Röntgen-Research Center for Complex Material Systems, Universität Würzburg, Würzburg, Germany
We report the first observation of two-photon excitation of a polariton condensate, demonstrated by angle- and time-resolved photoluminescence in a GaAs-based microcavity. Our results pave the way towards realization of a polariton-based THz laser source.

Oral EF-3.5 12:00 TRACK 9
Photon-photon polaritons in chi-2 microresonators — •Dmitry Skryabin, Vlad Pankratov, Alberto Villois, and Danila Puzyrev — University of Bath, Bath, United Kingdom
We present a concept of new quasi-particles - photon-photon polaritons - and demonstrate how the polaritonic resonance splitting, avoided crossings, and Rabi dynamics can be observed in chi-2 ring microresonators using the pump-probe arrangement.

Oral EF-3.6 12:15 TRACK 9
Pattern formation in colloids driven by optical single feedback. — •Valeriia Bobkova, Alexander Goenner, and Cornelia Denz — University of Muenster, Muenster, Germany
We investigate the nonlinear dynamics of self-organization in a colloidal suspension driven by an optical single feedback system. Pattern formation is obtained as a result of an interplay of stochastic processes in colloids and optomechanical forces action.

CA-6: High-Power Yb-lasers

Chair: Clara Saraceno, Ruhr University Bochum, Bochum Germany

Time: Wednesday, 11:00–12:30 Location: TRACK 10

Invited CA-6.1 11:00 TRACK 10
Broadband Ytterbium fiber CPA-system delivering 120fs, 10 mJ pulses at 1 kW average power — •Joachim Buldt[1], Henning Stark[1], Michael Müller[1], Arno Klenke[1,2], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Jena, Germany — [2]Helmholtz-Institute, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany
We present on a fiber CPA-system based on coherent combining which exploits the gain-bandwidth of Ytterbium through aggressive but elaborate spectral shaping and delivers 120 fs, 10 mJ pulses at 1 kW average power.

Oral CA-6.2 11:30 TRACK 10
Towards the Multi-kW Ultrafast Green Thin-Disk Laser — •Christoph Röcker[1], André Loescher[1], Florian Bienert[1], Philippe Villeval[2], Dominique Lupinski[2], Dominik Bauer[3], Alexander Killi[3], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge (IFSW), Stuttgart, Germany — [2]Cristal Laser, Messein, France — [3]Trumpf Laser GmbH, Schramberg, Germany

We present an ultrafast green laser with near-diffraction-limited beam quality delivering more than 1.4 kW of average power. It is based on second harmonic generation of a Yb:YAG thin-disk multipass amplifier in LBO.

Oral CA-6.3 11:45 TRACK 10

Thin-disk multipass amplifier for kilowatt-class ultrafast lasers above 100 mJ — •Johanna Dominik[1], Michael Scharun[1], Michael Rampp[2], Benjamin Dannecker[1], Dominik Bauer[1], Thomas Metzger[2], Alexander Killi[1], and Thomas Dekorsy[3] — [1]TRUMPF Laser GmbH, Schramberg, Germany — [2]TRUMPF Scientific Lasers GmbH + Co. KG, Unterföhring, Germany — [3]German Aerospace Center (DLR), Institute of Technical Physics and Stuttgart University, Stuttgart, Germany

We report on an industrially stable thin-disk multipass amplifier capable of delivering diffraction-limited beam quality, multi-kilowatt average power and pulse energies above 100 mJ.

Oral CA-6.4 12:00 TRACK 10

kW-class ceramic Yb:Lu2O3 thin disk laser — •Stefan Esser[1], Xiaodong Xu[2], Jian Zhang[3], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge, University of Stuttgart, Stuttgart, Germany — [2]Jiangsu Key Laboratory of Advanced Laser Materials and Devices, School of Physics and Electronic Engineering, Jiangsu Normal University, Xuzhou, China — [3]Key Laboratory of Transparent and Opto-functional Inorganic Materials, Shanghai Institute of Ceramics, Chinese Academy of Science, Shanghai, China

We report on a ceramic Yb:Lu2O3 thin-disk laser delivering a continuous-wave output power of 1190W in mutlimode operation with an optical efficiency of 64%. In fundamental mode operation 360W of output power were achieved.

Oral CA-6.5 12:15 TRACK 10

Efficient diode-pumped crygenic Yb:YLF laser with 500 W cw output power from a single rod — •Martin Kellert[1], Umit Demirbas[1,3], Jelto Thesinga[1], Simon Reuter[1], Franz X. Kärtner[1,2], and Mikhail Pergament[1] — [1]Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Physics Department, University of Hamburg, Hamburg, Germany — [3]Laser Technology Laboratory, Department of Electrical and Electronics Engineering, Antalya Bilim University, Antalya, Turkey

We present >500W cw output power from cryogenically cooled Yb:YLF laser in rod geometry by employing E//c axis for lasing. A wavelength shift from 995nm to 1019nm is observed and underlying physical mechanisms are discussed.

EB-6: Long-Range Distribution of Entanglement II

Chair: Jürgen Eschner, University of Saarland, Germany

Time: Wednesday, 11:00–12:30 Location: TRACK 11

Oral EB-6.1 11:00 TRACK 11

Long-Distance Entanglement Distribution for Trapped-Ion based Quantum Networks — •Tobias Bauer[1], Jan Arenskötter[1], Matthias Bock[1,2], Stephan Kucera[1], Jürgen Eschner[1], and Christoph Becher[1] — [1] Universität des Saarlandes, Fakultät NT, FR Physik, 66123 Saarbrücken, Germany — [2]Österreichischen Akademie der Wissenschaften, Institut für Quantenoptik und Quanteninformation, 6020 Innsbruck, Austria

We present an experiment towards trapped-ion based quantum networks where we demonstrate high-fidelity entaglement distribution over up to 40 km of fiber using a SPDC-source and polarization-preserving frequency conversion to the telecom C-band.

Oral EB-6.2 11:15 TRACK 11

Hybrid Teleportation Protocols for Heterogeneous Quantum Networks — •Tom Darras[1], Adrien Cavaillès[1], Hanna Le Jeannic[2], Huazhuo Dong[1], Beate Asenbeck[1], Giovanni Guccione[1], and Julien Laurat[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL Université, Collège de France, Paris, France — [2]Laboratoire Photonique Numérique et Nanoscience, Universit'e de Bordeaux, Institut d'Optique, CNRS, UMR 5298, Bordeaux, France

Based on hybrid entanglement between discrete- and continuous-variable optical qubits, we report an entanglement swapping protocol that enables the connection of nodes relying on different encodings of quantum information in a heterogeneous quantum network.

Oral EB-6.3 11:30 TRACK 11

How to send entangled photons across hundreds of km? A multimode platform for near-term quantum repeaters — •Michał Lipka[1,2], Mateusz Mazelanik[1,2], Adam Leszczyński[1,2], Wojciech Wasilewski[1], and Michał Parniak[1,3] — [1]Centre for Quantum Optical Technologies, Centre of New Technologies, University of Warsaw, Warsaw, Poland — [2]Faculty of Physics, University of Warsaw, Warsaw, Poland — [3]Niels Bohr Institute, University of Copanhagen, Copenhagen, Denmark

Quantum-entangled pairs of photons find broad applications, yet require feasible quantum repeaters to be distributed on inter-city distances. We present an experimental platform for Bell-state generation across 500 modes and analyze its performance as a wavevector-multiplexed quantum repeater.

Oral EB-6.4 11:45 TRACK 11

Optical Fiber Transmission of Squeezed States of Light and Homodyne Detection with a Real-time True Local Oscillator — •Iyad Suleiman, Jens Arnbak, Xueshi Guo, Jonas Neergaard-Nielsen, Tobias Gehring, and Ulrik Lund Andersen — Denmark Technical University, Kongens Lyngby (Copenhagen), Denmark

We demonstrate transmission and homodyne detection of 1550 nm squeezed light through up to 10 km single-mode fiber with a real-time independent local oscillator, measuring up to 3.6 dB of squeezing below vacuum noise.

Oral EB-6.5 12:00 TRACK 11

Spectral Hong-Ou-Mandel Interference Between Independently Generated Single Photons for Scalable Frequency-Domain Quantum Processing — •Anahita Khodadad Kashi[1,2] and Michael Kues[1,2] — [1]Institue of Photonics, Leibniz University, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany

Via a reconfigurable photonic frequency circuit, we show spectral bosonic and fermionic Houng-Ou-Mandel interference between independently created pure single photons, demonstrating photon number scalability and versatility of the frequency processing approach.

Oral EB-6.6 12:15 TRACK 11

Experimental demonstration of robust quantum steering — •Sabine Wollmann[1], Roope Uola[2], and Ana Costa[3] — [1]University of Bristol, Bristol, United Kingdom — [2]University of Geneva, Geneva, Switzerland — [3]Federal University of Parana, Curitiba, Brazil

We demonstrate quantum steering based on generalised entropies and criteria with minimal assumptions based on the so-called dimension-bounded steering. Further, we investigate their robustness against experimental imperfections such as misalignment in the shared measurement reference-frame.

SP-2: Hot Topics: What's Next in Integrated Frequency Combs

Time: Wednesday, 13:30–14:30 Location: TRACK 1

This session will showcase a 1-hour virtual panel discussion organized by OSA's Integrated Photonics Technical Group

CH-7: Microscopy and Imaging Sensors

Chair: Crina Cojocaru, University of Catalonia, Terrassa, Spain

Time: Wednesday, 14:30–16:00 Location: TRACK 1

Invited CH-7.1 14:30 TRACK 1
Photonic Antennas for Ultra-sensitive Biosensing and Bioimaging — Pamina Winkler[1], Maria Sanz-Paz[1], Ediz Herkert[1], and •Maria Garcia-Parajo[1,2] — [1]ICFO-Institute of Photonic Sciences, Barcelona, Spain — [2]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain
Photonic antennas are metallic nanostructures that enhance and confine light into nanometer dimensions. I will discuss various antenna geometries and their suitability for monitoring nanoscale dynamic processes in living cells with single molecule detection sensitivity.

Oral CH-7.2 15:00 TRACK 1
Sub-Nyquist label-free fiber-based ghost imaging — •Ksenia Abrashitova[1] and Lyubov Amitonova[1,2] — [1]ARCNL, Amsterdam, Netherlands — [2]Vrije Universiteit Amsterdam, Amsterdam, Netherlands
The diffraction limit restricts the amount of information that can be captured with a standard optical system. Here we demonstrate label-free fiber-based computational ghost imaging that overcomes the Nyquist and Abbe limits.

Oral CH-7.3 15:15 TRACK 1
Subwavelength Video-Rate Terahertz Carrier Microscopy — •Robyn Tucker, Luke Peters, Juan S Totero Gongora, Jacob Tunesi, Maxwell Rowley, Alessia Pasquazi, and Marco Peccianti — Emergent Photonics Lab, University of Sussex, Brighton, United Kingdom
We demonstrate a microscopy approach for high-frame-rate imaging of carrier dynamics in targets. A parallel large-area optical pump terahertz probe provides near-field resolution and enables the investigation of responses under arbitrary photo-excitation textures.

Oral CH-7.4 15:30 TRACK 1
Scattering field imaging along an optical waveguide in operando — •Yosri Haddad, Jacques Chrétien, Samuel Margueron, Jean-Charles Beugnot, and Gil Fanjoux — FEMTO-ST institut, BESANCON, France
We present a non-destructive and non-invasive imaging spectroscopic technique with a high spatial and spectral resolution based on the detection of the Rayleigh scattering field radiated out of an optical waveguide in operation.

Oral CH-7.5 15:45 TRACK 1
Interferometric phase retrieval in optical transient detection — •Adolfo Esteban-Martín, Javier García-Monreal, Fernando Silva, and Germán J. de Valcárcel — Departament d'Òptica i Optometria i Ciències de la Visió, Universitat de València, Burjassot (València), Spain
We report a nonlinear-crystal-based transient detection imaging system with off-axis digital holographic Fourier filtering for complex-field retrieval of a dynamic scene while suppressing stationary background and remarkable ability of to detect phase-sign changes.

CF-6: Ultrafast Mid-IR Sources

Chair: Takao Fuji, Toyota Technological Institute, Nagoya, Japan

Time: Wednesday, 14:30–16:00 Location: TRACK 2

Oral CF-6.1 14:30 TRACK 2
Milliwatt-Level Multi-Octave Mid-Infrared Generation by a Diode-Pumped Cr:ZnS Oscillator — •Nathalie Nagl[1], Vladimir Pervak[1], Ferenc Krausz[1,2], and Ka Fai Mak[2] — [1]Ludwig-Maximilians-Universität München, Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Garching, Germany
We report the generation of a multi-octave-spanning coherent mid-infrared light via intra-pulse difference-frequency generation driven directly by a diode-pumped high-peak-power and low-noise Cr:ZnS oscillator, providing over 75 mW of average power between 2.8-14 μm.

Oral CF-6.2 14:45 TRACK 2
Kerr-lens modelocked Cr:ZnS oscillator for spectroscopy and microscopy applications — •Johann Gabriel Meyer and Oleg Pronin — Helmut-Schmidt-Universität, Hamburg, Germany
We report a broadband Kerr-lens modelocked Cr:ZnS oscillator emitting 39 fs pulses with a peak power of 360 kW. It represents a promising source for unique spectroscopic applications in the molecular fingerprint region.

Oral CF-6.3 15:00 TRACK 2
Yb-laser-based sub-60fs Mid-Infrared Source Tunable from 2.5μm to 10μm — •Rimantas Budriūnas[1,2], Karolis Jurkus[1], and Arūnas Varanavičius[2] — [1]Light Conversion, Ltd, Vilnius, Lithuania — [2]Vilnius University Laser Research Centre, Vilnius, Lithuania
Dual optical parametric amplifier setup capable of generating broadband few-cycle pulses tunable throughout 2.5μm-10μm is presented. Output power >1.5 W at 3μm and >450mW at 10μm is achieved using an 80W pump laser.

Oral CF-6.4 15:15 TRACK 2
Broadband Pulse Generation at Infrared Frequencies Based on a multi-kHz Ytterbium Amplifier — •Kilian Keller[1], Arne Budweg[2], Jonas Allerbeck[1,2], and Daniele Brida[1,2] — [1] Université du Luxembourg, Luxembourg, Luxembourg — [2] University of Konstanz, Konstanz, Germany
Two-stage optical parametric amplification enables the generation of sub-20 fs pulses at near- to mid-infrared frequencies, spanning from 1.5 to 2.5 μm (120 – 200 THz) and tunable up to 5 μm (60 THz).

Oral CF-6.5 15:30 TRACK 2
Electro-Optic Sampling with Percent-Level Detection Efficiency — •Christina Hofer[1,2], Daniel Gerz[1,2], Martin Gebhardt[3,4], Tobias Heuermann[3,4], Thomas P. Butler[2], Christian Gaida[5], Jens Limpert[3,4,5], Ferenc Krausz[1,2], and Ioachim Pupeza[1,2] — [1]Ludwig Maximilians University Munich, Garching, Germany — [2]Max Planck Institute of Quantum Optics, Garching, Germany — [3]Institute of Applied Physics, Abbe Centre of Photonics, Friedrich-Schiller Univ. Jena, Jena, Germany — [4]Helmholtz-Institute Jena, Jena, Germany — [5]Active Fiber Systems GmbH, Jena, Germany
Employing a high-power, 2-μm laser source, we demonstrate detection of octave-spanning mid-infrared waveforms via electro-optic sampling, reaching percent-level detection efficiencies and an intensity dynamic range that surpasses 14 orders of magnitude at 9 μm.

Oral CF-6.6 15:45 TRACK 2
Shaping and Phase Characterization of Ultrashort Pulses in the Mid-Infrared by AOM Shaper-Based D-Scan — •Florian Nicolai[1], Niklas Müller[1], Cristian Manzoni[2], Giulio Cerullo[2], and Tiago Buckup[1] — [1]Physikalisch-Chemisches Institut, Universität Heidelberg, Heidelberg, Germany — [2]IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milano, Italy
An AOM-shaper based dispersion scan setup for characterization of mid-infrared pulses is implemented. Flexible shaping and phase characterization for several phases as well as pulse compression down to 45 fs FWHM autocorrelation are demonstrated.

CM-3: Temporal and Spatial Beam Shaping for Laser Processing Part 1

Chair: Francois Courvoiser, University of Franche-Comté, Besançon, France

Time: Wednesday, 14:30–16:00 Location: TRACK 3

Oral CM-3.1 14:30 TRACK 3
On-The-Fly Laser Beam Shaping With Acousto-Optofluidics — •Marti Duocastella[1,2], Alessandro Zunino[2,3], and Salvatore Surdo[2] — [1]Universitat de Barcelona, Barcelona, Spain — [2]Istituto Italiano di Tecnologia, Genoa, Italy — [3]University of Genoa, Genoa, Italy
We present a new system for on-demand beam shaping based on cascading two acousto-optofluidic cavities. By implementing it in a laser writing workstation,

we demonstrate high-throughput material processing with multiple Bessel, annular and Gaussian beams.

Oral CM-3.2 14:45 TRACK 3
Field enhancement on nano-structures inside dielectrics — •Kazem Ardaneh, Remo Giust, and Francois Courvoisier — FEMTO-ST Institute, Univ. Bourgogne Franche-Comte, UMR CNRS 6174, 15B avenue des Montboucons, Besancon, France
Femtosecond Bessel pulses create nano-plasma rods inside the bulk of dielectrics. We have investigated, by performing Particle-In-Cell simulations, surface waves, field enhancement and heating on these structures, depending on the plasma profile.

Oral CM-3.3 15:00 TRACK 3
Excitation of Orbital Angular Momentum Modes in Helical Bragg Waveguide Inscribed by Femtosecond Laser Beam in YAG Crystal — •Andrey Okhrimchuk[1,2], Vladislav Likhov[1,2], Sergei Vasiliev[1], and Andrey Pryamikov[1] — [1]Prokhorov General Physics Institute of Russian Academy of Sciences, Moscow, Russia — [2]Mendeleev University of Chemical Technology of Russia, Moscow, Russia
A few mode waveguide with the depressed cladding in the form of helix was inscribed in YAG:Nd crystal. Conversion of Gaussian beam into modes with orbital angular momentum is experimentally demonstrated at Bragg resonance.

Oral CM-3.4 15:15 TRACK 3
Optical Properties of Nanogratings Inscribed with Conical Phase Fronts — •Kim Lammers[1], Ehsan Alimohammadian[2], Alessandro Alberucci[1], Gligor Djogo[2], Stefan Nolte[1,3], and Peter R. Herman[2] — [1]Institute of Applied Physics, Abbe School of Photonics, Friedrich Schiller University Jena, Jena, Germany — [2]Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany
We present a novel degree of freedom by which the properties of nanogratings can be altered: the conical phase front of the inscription beam. We will discuss its influence on the optical properties of nanogratings.

Oral CM-3.5 15:30 TRACK 3
Laser-fabrication of arrays of channels with subwavelength diameter and micrometric depth at the surface of glass — •Nicolas Sanner[1], Xin Liu[1,2], David Grojo[1], and Olivier Utéza[1] — [1]Aix Marseille Univ., CNRS, LP3 UMR 7341, Marseille, France — [2]State Key Laboratory of Transient Optics and Photonics, Xi'an Institute of Optics and Precision Mechanics of CAS, Xi'an, China
Using customized micro-Bessel beams of reduced length, we demonstrate the fabrication of arrays of submicrometer-diameter channels by laser ablation (pitch=1.5 μm, depth=5 μm). Influence of crosstalk between channels on the laser writing process is discussed.

Oral CM-3.6 15:45 TRACK 3
Dynamic higher order Bessel beam mixing – the formation of an optical drill — •Gabrielius Kontenis[1,2], Darius Gailevičius[1,2], and Kęstutis Staliūnas[1,3,4] — [1]Vilnius University, Faculty of Physics, Laser Research Center, Vilnius, Lithuania — [2]Femtika LTD, Vilnius, Lithuania — [3]ICREA, Barcelona, Spain — [4]UPC, Dep. de Fisica, Terrassa (Barcelona), Spain
We demonstrate the formation of an optical drill by superposition of two higher order Bessel beams of different helicities. We dynamically form and mix the Bessel beams by application of a programmable Spatial Light Modulator.

CB-5: Mid-infrared Semiconductor Lasers

Chair: Mikhail Belkin, Walter Schottky Institute, Garching, Germany

Time: Wednesday, 14:30–16:00 Location: TRACK 4

Invited CB-5.1 14:30 TRACK 4
Mid-IR lasers epitaxially integrated on on-axis Silicon — •Eric Tournié, Marta Rio Calvo, Laura Monge Bartolome, Zeineb Loghmari, Roland Teissier, Alexei N. Baranov, Laurent Cerutti, and Jean-Baptiste Rodriguez — IES, Univ. Montpellier, CNRS, Montpellier, France
We review our recent results on GaSb-based laser diodes (LDs) and InAs/AlSb quantum-cascade lasers (QCLs), grown on on-axis (001) Si substrates by molecular-beam epitaxy, and covering emission wavelengths from 2 to 10 μm.

Oral CB-5.2 15:00 TRACK 4
Precise mid-infrared characterization of InGaSb/GaSb SESAMs — •Jonas Heidrich, Marco Gaulke, B. Ozgur Alaydin, Matthias Golling, Ajanta Barh, and Ursula Keller — ETH Zürich, Institute for Quantum Electronics, Ultrafast Laser Physics, Zürich, Switzerland
We present high-precision (<0.04%) nonlinear reflectivity and pump-probe setups to characterize mid-infrared InGaSb/GaSb quantum-well-based SESAMs at 2.05 μm. The SESAMs show modulation depths between 1-2.4%, low saturation fluences, low non-saturable losses and fast recovery times.

Oral CB-5.3 15:15 TRACK 4
Auger Recombination in Mid-Infrared Quantum Well Lasers — •Timothy Eales[1], Igor Marko[1], Alf Adams[1], Alexander Andrejew[2], Kristijonas Vizbaras[2,3], and Stephen Sweeney[1] — [1]Advanced Technology Institute, University of Surrey, Guildford, United Kingdom — [2]Walter Schottky Institut, Technische Universität München, Garching, Germany — [3]Brolis Semiconductors UAB, Vilnius, Lithuania
Auger recombination is significant in near- and mid-infrared emitters. The quantum well geometry permits two fundamentally different Auger transitions. Our analysis demonstrates that the temperature dependence can be explained by a thermally activated Auger process.

Oral CB-5.4 15:30 TRACK 4
Gain characterization of 2-μm GaSb VECSELs — •Marco Gaulke, Jonas Heidrich, B. Özgür Alaydin, Matthias Golling, Ajanta Barh, and Ursula Keller — Institute for Quantum Electronics, ETH, Zurich, Switzerland
We present spectral gain and gain saturation measurements for mid-infrared GaSb-based VECSEL gain chips. Small-signal-gain up to 5 % and saturation-fluences of 4 μJ/cm^2 were measured for a commercial 2-μm VECSEL.

Oral CB-5.5 15:45 TRACK 4
Toward mid-infrared laser diodes on Silicon photonic integrated circuits — •Laura Monge Bartolome, Marta Rio Calvo, Michaël Bahriz, Jean-Baptiste Rodriguez, Laurent Cerutti , and Eric Tournié — Institut d'Electronique et des Systèmes, Montpellier, France
Monolithic integration of mid-IR LDs on PICs requires direct epitaxy on on-axis Si substrates and fabrication of cleavage-free cavities. We report on both goals: the first etched-facets GaSb-based lasers grown on on-axis operating in CW-RT.

EG-4: Nonlinear and Ultrafast Nano-optics

Chair: Walter Pfeiffer, Universität Bielefeld, Bielefeld, Germany

Time: Wednesday, 14:30–16:00 Location: TRACK 5

Oral EG-4.1 14:30 TRACK 5
Extremely Non-adiabatic Switch-off of Deep-strong Light-Matter Coupling — •Joshua Mornhinweg[1], Maike Halbhuber[1], Viola Zeller[1], Cristiano Ciuti[2], Dominique Bougeard[1], Rupert Huber[1], and Christoph Lange[1,3] — [1]Department of Physics, University of Regensburg, Regensburg, Germany — [2]Université de Paris, Laboratoire Matériaux et Phénomènes Quantiques, CNRS, Paris, France — [3]3Department of Physics, TU Dortmund University, Dortmund, Germany
We deactivate deep-strong light-matter coupling extremely non-adiabatically. The switch-off is characterized by pronounced subcycle polarization oscillations more than an order of magnitude faster than the optical cycle duration, as verified by our quantum model.

Oral EG-4.2 14:45 TRACK 5

Observation of modal interferences in plasmonic nano-resonators by ultrafast transmission electron microscopy — •Hugo Lourenço-Martins[1,2], Andre Geese[2], Armin Feist[2], Murat Sivis[1,2], Jonah Schrauder[2], and Claus Ropers[1,2] — [1]Max Plank Institute for Biophysical Chemistry, Göttingen, Germany — [2]IV. Physical Institute, University of Göttingen, Göttingen, Germany

In this talk, we will demonstrate that an ultrafast transmission electron microscope can be used to quantively analyse the modes population and dephasing of plasmonic excitations in a single resonator at the nano-scale.

Oral EG-4.3 15:00 TRACK 5

Broadband Four-Wave Mixing Enhancement in 2D Transition-Metal Dichalcogenides Using Plasmonic Structures — •Yunyun Dai[1], Yadong Wang[1], Susobhan Das[1], Hui Xue[1], Mohsen Ahmadi[1], Shisheng Li[2], and Zhipei Sun[1] — [1]Department of Electronics and Nanoengineering, Aalto University, Espoo, Finland — [2]International Center for Young Scientists (ICYS), National Institute for Materials Science (NIMS), Tsukuba, Japan

The significantly enhanced four-wave mixing is achieved in a broadband range in 2D transition-metal dichalcogenides using plasmonic structures. This enhancement is attributed to the plasmon-induced strongly confined electric field, promising for 2D nonlinear optical applications.

Oral EG-4.4 15:15 TRACK 5

Second Harmonic Generation in monolayer WS2 with double resonant Bragg-Cavities — •Heiko Knopf[1,2,3], Mathias Zilk[1], Simon Bernet[1,2], Gia Quyet Ngo[1], Fatemeh Alsadat Abtahi[1], Antony George[4], Emad Najafidehaghani[4], Ziyang Gan[4], Maximilian Weissflog[1,3], Tobias Vogl[4], Andrey Turchanin[4], Ulrike Schulz[2], Sven Schröder[2], and Falk Eilenberger[1,2,3] — [1]Institute of Applied Physics, Friedrich-Schiller-University, Jena, Germany — [2]Fraunhofer Institute of Applied Optics and Precision Engineering IOF, Jena, Germany — [3]Max Planck School of Photonics, Jena, Germany — [4]Institute of Physical Chemistry, Friedrich Schiller University, Jena, Germany

We show enhanced nonlinear frequency generation in 2D-materials using monolithic dielectric Bragg mirror based resonators with high Q-factors at the pump and second harmonic wavelength. We report on fabrication and measured energy- and polarization dependencies.

Oral EG-4.5 15:30 TRACK 5

Ultrafast dynamics of heat in metals — Alexander Block[1] and •Yonatan Sivan[2] — [1]ICN2, Catalan Institute of Nanoscience and Nanotechnology, Barcelona, Spain — [2]Ben-Gurion University, Beer-Sheva, Israel

We provide a thorough theoretical description and experimental observation of femtosecond-scale heat diffusion in a metal film. Various unexpected phenomena such as the cooling and refocusing of the electron heat spot are analyzed and explained.

Oral EG-4.6 15:45 TRACK 5

Describing SPDC at the Nanoscale: A Quasinormal Mode Approach — •Maximilian A. Weissflog[1,2], Sina Saravi[1], Carlo Gigli[3], Giuseppe Marino[3], Adrien Borne[3], Giuseppe Leo[3], Thomas Pertsch[1,4], and Frank Setzpfandt[1] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany — [2]Max Planck School of Photonics, Jena, Germany — [3]Matériaux et Phénomènes Quantiques, Université de Paris and CNRS, Paris, France — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We describe Spontaneous Parametric Downconversion in dielectric nanoresonators based on their quasinormal modes. By revealing the governing modal interactions, our approach provides a capable tool for designing nanoscale photon-pair sources with tailored emission properties.

CE-7: Integrated Optoelectronic Devices

Chair: Roel Baets, Ghent University - IMEC, Ghent, Belgium

Time: Wednesday, 14:30–16:00 Location: TRACK 6

Oral CE-7.1 14:30 TRACK 6

Coupling of a 2D Heterostructure to a Photonic Polymer Waveguide via Mode-center Encapsulation — •Angelina Frank[1], Justin Zhou[2], James A. Grieve[1,5], José Viana-Gomez[6], Ivan Verzhbitskiy[2], Alexander Ling[1,2], and Goki Eda[2,3,4] — [1]Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore — [2]Department of Physics, National University of Singapore, Singapore, Singapore — [3]Centre for Advanced 2D Materials, National University of Singapore, Singapore, Singapore — [4]Department of Chemistry, National University of Singapore, Singapore, Singapore — [5]Quantum Research Centre, Technology Innovation Institute, Abu Dhabi, Abu Dhabi — [6]Departamento de Física, Centro de Física, Braga, Portugal

We demonstrate the integration of a 2D heterostructure into the photonic mode-center of an elastomer ridge waveguide. The established geometry enhances mode-coupling by more than two orders of magnitude compared to surface placement.

Oral CE-7.2 14:45 TRACK 6

Focused-ion-beam Implantation of Luminescence Centers in Gallium Nitride in Optical Telecom Frequency Band — •Jin-Kyu So[1], Cesare Soci[1], Weibo Gao[1], and Nikolay I. Zheludev[1,2] — [1]Nanyanag Technological University, Singapore, Singapore — [2]University of Southampton, Southampton, United Kingdom

We report on-demand and site-specific creation of near-infrared color centers in GaN films by Ga+ implantation where the luminescence is attributed to optical transitions of neutral gallium atoms originating from implanted Ga+ ions.

Oral CE-7.3 15:00 TRACK 6

Charge Carrier Density Determination Via Magneto-Electroluminescence Spectroscopy in Resonant Tunneling Diodes — •Edson Rafael Cardozo de Oliveira[1,2], Andrea Naranjo[1], Andreas Pfenning[3], Victor Lopez-Richard[1], Gilmar Eugenio Marques[1], Lukas Worschech[3], Fabian Hartmann[3], Sven Höfling[3], and Marcio Daldin Teodoro[1] — [1]Departamento de Física, Universidade Federal de São Carlos, São Carlos, Brazil — [2]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [3]Technische Physik, Physikalisches Institut and Röntgen Center for Complex Material Systems (RCCM), Universität Würzburg, Würzburg, Germany

Optoelectronic properties of purely n-doped resonant tunneling diodes (RTDs) are studied through magnetotransport and magneto-electroluminescence. We take advantage of the RTDs electroluminescence to investigate the charge carrier dynamics and accumulation, complementing traditional transport measurements.

Oral CE-7.4 15:15 TRACK 6

Integration of a perovskite-based amplifier and photodetector system in rigid and solid substrates — •Isaac Suárez — Escuela Técnica Superior de Ingeniería, Avenida de la Universidad s/n, Burjassot, Spain

CH3NH3PbI3 perovskite thin films were integrated in polymer waveguides to construct an amplifier-photodetector system. The device is integrated in both rigid and flexible substrates and demonstrates, experimental and theoretically, ASE and photocurrent under light illumination.

Oral CE-7.5 15:30 TRACK 6

Strain-induced optoelectronic tunability of fiber grown 2D transition metal di-chalcogenides — •Avi Niv[2] and Assaf Ya'akobovitz[1] — [1]Ben-Gurion University of The Negev, Beer-Sheva, Israel — [2]Ben-Gurion University of The Negev, Sde-Boqer, Israel

The bandgap of sheared MoS2 is shown to blueshift, while a redshift is predicted. Further investigation points to the intricate interplay of the electronic bandgap and tightly bound quasi-particles in the form of trions and excitons.

Oral CE-7.6 15:45 TRACK 6

Temperature Dynamics in Silicon Core Fibers during CO_2-Laser Processing — •Korbinian Mühlberger, Clarissa M. Harvey, and Michael Fokine — Department of Applied Physics, KTH Royal Institute of Technology, Stockholm, Sweden

The as-drawn optical quality of silicon core optical fibers can be improved by CO_2-laser post-processing. Critical temperature dynamics in the fiber during laser processing are studied, in-situ and non-contact, using an interferometric technique.

EA-4: Cavity-QED and Cold Gases

Chair: Sebastian Blatt, MPQ Garching, Germany

Time: Wednesday, 14:30–16:00 Location: TRACK 7

Invited EA-4.1 14:30 TRACK 7

Creating optical lattices with sound using confocal cavity QED — •Benjamin Lev[1], Yudan Guo[1], and Jonathan Keeling[2] — [1]Stanford University, Stanford, USA — [2]University of St. Andrews, St. Andrews, United Kingdom

We present an experiment that creates an optical lattice with sound, adding a new tool to the toolbox of quantum simulation. We measure the continuous dispersion relation of the phonons.

Oral EA-4.2 15:00 TRACK 7

Structural phase transitions in cold atoms mediated by optical feedback — •Giuseppe Baio, Gordon R. M. Robb, Alison M. Yao, Gian-Luca Oppo, and Thorsten Ackemann — Department of Physics, University of Strathclyde, Glasgow, United Kingdom

We present novel structural transitions between hexagon, stripe, honeycomb phases in cold atomic clouds, where effective interactions are mediated by a retro-reflected driving beam. Nontrivial recovery of inversion symmetry due to atomic transport is demonstrated.

Oral EA-4.3 15:15 TRACK 7

Atom femto trap: the first experimental realization and its spectroscopic perspectives — Anton Afanasiev[1,2], Anna Kortel[1,2], Anastasia Mashko[1,2], Pavel Melentiev[1,2], and •Victor Balykin[1,2] — [1]Institute of Spectroscopy Russian Academy of Sciences, Moscow, Troitsk, Russia — [2]National Research University Higher School of Economics, Moscow, Russia

We show the first experimental trapping of atoms with femtosecond laser radiation. We investigated the lifetime and spectral properties of localized atoms. Such localization can be realized without ac Stark shift of atom's spectral line.

Oral EA-4.4 15:30 TRACK 7

Wave-packet dynamic in a SU(2) non-Abelian Gauge field — Mehedi Hasan[1,2], Chetan Madasu[1,2], Ketan Rathod[2,3], Chang Chi Kwong[1,2], Christian Miniatura[1,2,3], Frederic Chevy[4], and •David Wilkowski[1,2,3] — [1]Nanyang Quantum Hub, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore — [2]MajuLab, International Joint Research Unit UMI 3654, CNRS, Université Côte d'Azur, Sorbonne Université, National University of Singapore, Nanyang Technological University, Singapore, Singapore — [3]Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore — [4]. Laboratoire Kastler Brossel, ENS-PSL Université, CNRS, Sorbonne Université, College de France, Paris, France

We present wave-packet dynamic in a synthetic non-Abelian gauge field using an ultracold Fermionic gas. Here, anisotropic Zitterbewegung-like oscillation are observed in two-dimensional plane. Applications to quantum information and atomtronics are discussed.

Oral EA-4.5 15:45 TRACK 7

Electric field correlation measurements on the electromagnetic groundstate in the non-local regime — •Francesca Fabiana Settembrini[1], Alexa Herter[1], Ileana-Cristina Benea-Chelmus[2], Frieder Lindel[3], Giacomo Scalari[1], and Jerome Faist[1] — [1]ETH Zürich, Institute for Quantum Optoelectronics, Zürich, Switzerland — [2]Harvard University, John A. Paulson School of Engineering, Cambridge, USA — [3]Albert-Ludwigs-Universität Freiburg, Physikalisches Institut, Freiburg, Germany

We present temporal and spatial electric field correlation measurements performed on the electromagnetic ground state at terahertz frequencies in the non-local regime. We investigate the scaling of these correlations with the sampled space-time volume.

EF-4: Nonlinear Regimes in Optical Fibers

Chair: Stephane Barland, Institut de Physique de Nice, Nice, France

Time: Wednesday, 14:30–16:00 Location: TRACK 8

Oral EF-4.1 14:30 TRACK 8

Loss induced multiple symmetry breakings in the Fermi Pasta Ulam recurrence process — •Guillaume Vanderhaegen[1], Pascal Szriftgiser[1], Matteo Conforti[1], Alexandre Kudlinski[1], Stefano Trillo[2], and Arnaud Mussot[1] — [1]University of Lille, CNRS, UMR 8523 - PhLAM - Physique des Lasers Atomes et Molécules, Lille, France — [2]Department of Engineering, University of Ferrara, Ferrara, Italy

We report a complete experimental description of the optical fiber losses effect in the Fermi Pasta Ulam recurrence process. The tuning of those losses highlights multiple critical values for which symmetry breakings occur.

Oral EF-4.2 14:45 TRACK 8

Spatio-temporal observation of higher-order modulation instability in a recirculating fiber loop — •François Copie, Pierre Suret, and Stéphane Randoux — Univ. Lille - PhLAM - Physique des Lasers Atomes et Molécules, Lille, France

We report new observations regarding higher-order modulation instability in a fiber optics experiment. Single-shot space-time recordings reveal the deterministic pulse-splitting dynamics as well as an interplay with spontaneous MI mediated by the pump-signal frequency detuning.

Oral EF-4.3 15:00 TRACK 8

Effect of synchronization mismatch on modulation instability in passive fiber-ring cavity — •Stefano Negrini, François Copie, Saliya Coulibaly, Matteo Conforti, Alexandre Kudlinski, and Arnaud Mussot — University of Lille, Villeneuve-d'Ascq, France

We experimentally, numerically and theoretically investigate the impact of synchronization mismatch on modulation instability in passive fiber-ring cavities. We demonstrate that the sidebands position and shape depends on this parameter.

Oral EF-4.4 15:15 TRACK 8

Spatiotemporal Soliton Attractor in Multimode Graded-index Fibers — •Mario Ferraro[1], Mario Zitelli[1], Fabio Mangini[2], and Stefan Wabnitz[1] — [1]Department of Information Engineering, Electronics and Telecommunications (DIET), Sapienza University of Rome, Rome, Italy — [2]Department of Information Engineering (DII), University of Brescia, Brescia, Italy

Experimental evidence of spatiotemporal femtosecond soliton propagation over long spans of parabolic graded-index (GRIN) fibers, supported by numerical simulations, reveals that initial multimode soliton pulses naturally and irreversibly evolve into a singlemode soliton.

Oral EF-4.5 15:30 TRACK 8

Multicore fibers: a novel platform for a robust and reconfigurable self-organisation of light — Saurabh Jain[1], Kunhao Ji[1], Jayantha Sahu[1], David J. Richardson[1], Julien Fatome[2], Stefan Wabnitz[3], and •Massimiliano Guasoni[1] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS, University of Bourgogne-Franche-Comte, Dijon, France — [3]Department of Information Engineering, Electronics and Telecommunications (DIET), Sapienza University, Rome, Italy

Multicore fibers offer many degrees of freedom with respect to the single-core counterpart. This paves the way to a plethora of unexplored types of self-organization disclosing novel opportunities for high-power lasers and optical communications

We report the observation and the thermodynamic characterization of light condensation in multimode fibers: below a critical value of the kinetic energy, the fundamental mode gets macroscopic populated, in agreement with the equilibrium theory.

Oral EF-4.6 15:45 TRACK 8

Condensation of optical waves in multimode fibers: observation and thermodynamic characterization — •Kilian Baudin[1], Adrien Fusaro[1], Josselin Garnier[2], Katarzyna Krupa[3], Nicolas Berti[1], Claire Michel[4], Iacopo Carusotto[5], Sergio Ricca[6], Guy Millot[1], and Antonio Picozzi[1] — [1]Université de Bourgogne , Dijon, France — [2]Ecole Polytechnique, Palaiseau, France — [3]Institute of Physical Chemistry Polish Academy of Sciences, Varsovia, Poland — [4]Université Côte d'Azur, Nice, France — [5]Università di Trento, Povo, Italy — [6]University of Adolfo Ibáñez, Santiago, Chile

CA-7: Ultrafast Lasers

Chair: Nicolai Tolstik, NTNU Norwegian University of Science and Technology, Trondheim, Norway

Time: Wednesday, 14:30–16:00 Location: TRACK 9

Oral CA-7.1 14:30 TRACK 9

69-W Sub-100-fs Yb:YAG Thin-Disk Laser Oscillator — •Jakub Drs, Julian Fischer, Norbert Modsching, François Labaye, Valentin J. Wittwer, and Thomas Südmeyer — Laboratoire Temps-Fréquence, Université de Neuchâtel, Avenue de Bellevaux 51, Neuchâtel, Switzerland

We demonstrate a Kerr-lens mode-locked thin-disk laser oscillator generating 69-W 84-fs pulses at 17.3-MHz repetition rate. This corresponds to the highest average power of any sub-100-fs laser oscillator.

Oral CA-7.2 14:45 TRACK 9

SESAM mode-locked Yb:YAB thin-disk oscillator delivering an average output power of 19 W — •Frieder Beirow[1], Benjamin Dannecker[1], Birgit Weichelt[1], Daniel Rytz[2], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Stuttgart, Germany — [2]Electro-Optics Technology GmbH (EOT), Idar-Oberstein, Germany

We present first modelocking experiments of Yb:YAB in thin-disk configuration. In multimode operation an output power of 155 W was achieved. In mode-locked operation, 19.2 W at a pulse duration of 462 fs was obtained.

Oral CA-7.3 15:00 TRACK 9

Efficient Yb-doped laser oscillator delivering 729 mW in 22-fs pulses — •François Labaye[1], Valentin J. Wittwer[1], Marin Hamrouni[1], Norbert Modsching[1], Eric Cormier[2,3], and Thomas Südmeyer[1] — [1]Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, Neuchâtel, Switzerland — [2]Laboratoire Photonique, Numérique et Nanosciences, UMR 5298, CNRS-IOGS-Université Bordeaux, Talence, France — [3]Institut Universitaire de France (IUF), Paris, France

A cross-pumping approach for BULK laser oscillators enables overcoming previous bandwidth limitations. Applied to a Kerr-lens mode-locked Yb:CALGO laser enable to generate 22 fs pulses with an average power of 729 mW and 25% optical-to-optical efficiency.

Oral CA-7.4 15:15 TRACK 9

High-Peak Power Single-Cavity Dual-Comb Solid-State Laser with 100-fs Pulse Duration — •Justinas Pupeikis, Benjamin Willenberg, Carolin Bauer, Christopher Phillips, and Ursula Keller — Department of Physics, Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland

We demonstrate a 230-kW peak power Yb:CaF2 dual-comb oscillator with 100-fs pulse duration from both combs simultaneously. The common-path polarization-multiplexed cavity delivers two combs at 80-MHz repetition rate with 208 Hz tunable repetition rate difference.

Oral CA-7.5 15:30 TRACK 9

Dual-comb mode-locked laser simultaneously operating in two different dispersion regimes — •Maciej Kowalczyk[1], Xuzhao Zhang[2,3], Valentin Petrov[4], Zhengping Wang[2], and Jarosław Sotor[1] — [1]Laser & Fiber Electronics Group, Faculty of Electronics, Wroclaw University of Science and Technology, Wrocław, Poland — [2]State Key Laboratory of Crystal Materials, Shandong University, Jinan, China — [3]Center of Nanoelectronics, School of Microelectronics, Shandong University, Jinan, China — [4]Max Born Institute for Nonlinear Optics and Ultrafast Spectroscopy, Berlin, Germany

We present a single-cavity dual-comb mode-locked oscillator based on intrinsic polarization-multiplexing in a birefringent Yb:CNGS gain medium. The laser simultaneously generates two pulse trains in a conservative (117 fs) and chirped (2.36 ps) soliton regimes.

Oral CA-7.6 15:45 TRACK 9

Multi-GHz repetition rate, deep ultraviolet femtosecond source operating in the burst mode — •Hanyu Ye[1], Lilia Pontagnier[1], Clément Dixneuf[1,2], Giorgio Santarelli[1], and Eric Cormier[1,3] — [1]Laboratoire Photonique Numérique et Nanosciences (LP2N), Talence, France — [2]Azurlight Systems, Pessac, France — [3]Institut Universitaire de France (IUF), Paris, France

we present a multi-GHz repetition rate, femtosecond deep UV source in the burst mode based on FHG of an EO comb, promising for the application of driving multi-bunch X-band photoinjectors.

EB-7: Quantum Imaging and Interference

Chair: Martin Ringbauer, University of Innsbruck, Austria

Time: Wednesday, 14:30–16:00 Location: TRACK 10

Oral EB-7.1 14:30 TRACK 10

High-dimensional quantum operations using structured photons — Markus Hiekkamäki, Shashi Prabhakar, and •Robert Fickler — Tampere University, Tampere, Finland

We demonstrate a flexible scheme to perform a broad range of high-dimensional quantum gates using structured photons. We use this technique to investigate two-photon interference effects using multiple spatial modes along a single beam-path.

Oral EB-7.2 14:45 TRACK 10

A Controllable Source of High-dimensional Entagled Photon Pairs — •Jano Gil-Lopez, Vahid Ansari, Christine Silberhorn, and Benjamin Brecht — ntegrated Quantum Optics Group, Institute for Photonic Quantum Systems (PhoQS), Paderborn, Germany

We present a highly controllable source of maximally entangled high-dimensional photon pairs. Combining dispersion engineering of the PDC process and spectral shaping of the pump, up to six-dimensional states with user chosen dimension are generated.

Oral EB-7.3 15:00 TRACK 10

Ghost Imaging Exchange-Free — •Jonte Hance and John Rarity — Quantum Engineering Technology Laboratory, Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom

We have developed a protocol for ghost imaging that is always counterfactual - while imaging an object, no light interacts with it. This provides both better visibility/SNR and less absorbed intensity than ghost imaging.

Oral EB-7.4 15:15 TRACK 10

Hong-Ou-Mandel-Enabled Quantum Imaging — Bienvenu Ndagano, Hugo Defienne, •Ashley Lyons, and Daniele Faccio — School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom

Here we exploit the mapping between the number of coincidence events and the temporal delay between two photons in HOM interference to demonstrate full HOM imaging directly on a camera.

Oral EB-7.5 15:30 TRACK 10

Experimental Higher-Order Interference in Quantum Mechanics Induced by Optical Nonlinearities — Peter Namdar[1], Irati Alonso Calafell[1], Alessandro Trenti[1], Milan Radonjic[2], Borivoje Dakic[1,3], Philip Walther[1], and •Lee Rozema[1] — [1]Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Boltzmanngasse 5, Vienna, Austria — [2]Scientific Computing Laboratory, Center for the Study of Complex Systems, Institute of Physics, University of Belgrade, Belgrade, Serbia — [3]Institute for Quantum Optics & Quantum Information (IQOQI), Austrian Academy of Sciences, Boltzmanngasse, Vienna, Austria

It has been proven theoretically and confirmed experimentally that quantum mechanics exhibits only second-order interference. However, this makes several implicit assumptions. Here we highlight these assumptions experimentally, showing that optical nonlinearities can induce higher-order interference.

Oral EB-7.6 15:45 TRACK 10

Anyonic two-photon statistics and hybrid entanglement with a semiconductor chip — •Florent Baboux[1], Saverio Francesconi[1], Arnault Raymond[1], Nicolas Fabre[1], Aristide Lemaître[2], Pérola Milman[1], Maria I. Amanti[1], and Sara Ducci[1] — [1]Université de Paris/CNRS - MPQ, Paris, France — [2]CNRS/Université Paris Saclay - C2N, Palaiseau, France

We employ SPDC in an AlGaAs chip to engineer the wavefunction and exchange statistics of photon pairs directly at the generation stage. We simulate fermions, anyons, and generate hybrid frequency-polarization entangled states for applications in quantum information.

EI-3: Graphene Heterolayers

Chair: Vasili Perebeinos, University at Buffalo, Buffalo, USA

Time: Wednesday, 14:30–16:00 Location: TRACK 11

Oral EI-3.1 14:30 TRACK 11

Optoelectronic read-out of local current-induced spin polarization in gated graphene/WTe_2 heterostructures — •Christoph Kastl — Walter Schottky Institut and Physics Department, Technical University of Munich, Garching, Germany — – Munich Center for Quantum Science and Technology (MCQST), Munich, Germany

We utilize an optoelectronic detection scheme based on magneto-optical Kerr microscopy to resolve large spin polarizations in graphene/WTe_2 heterostructures. The current-induced spin-orientation is driven by interlayer coupling and Berry curvature in the WTe_2.

Oral EI-3.2 14:45 TRACK 11

Graphene/Bi2Se3Heterojunction Phototransistor Using PhotogatingEffect Modulated by Tunable Tunneling Resistance — •Hoon Hahn Yoon[1,2], Faisal Ahmed[1], Yunyun Dai[1,2], Henry A. Fernandez[1,2], Xiaoqui Cui[1,2], Xueyin Bai[1,2], Diao Li[1,2], Mingde Du[1,2], Harri Lipsanen[1], and Zhipei Sun[1,2] — [1]Department of Electronics and Nanoengineering, Aalto University, Fi-00076 Aalto, Finland — [2]Finnish Centre of Excellence in Quantum Technology, Department of Applied Physics, Fi-00076 Aalto, Finland

A Dirac-source field-effect transistor combined based on a lateral heterochannel and a vertical tunnel junction has been realized, enabling us to explore photogating effect modulated by tunable tunneling resistance for high-performance light detection.

Oral EI-3.3 15:00 TRACK 11

Photoinduced Intersubband Absorption and Enhanced Photobleaching in Twisted Bilayer Graphene — •Eva A. A. Pogna[1], Xianchong Miao[2], Driele von Dreifus[3], Thonimar V. Alencar[4], Marcus V. O. Moutinho[5], Pedro Venezuela[6], Po-Wen Chiu[7], Cristian Manzoni[8], Giulio Cerullo[8], Minbiao Ji[2], and Ana M. de Paula[3] — [1]Istituto di Nanoscienze CNR-NANO, Lab. NEST, Pisa, Italy — [2]Laboratory of Surface Physics and Department of Physics, Fudan University, Shanghai, China — [3]Departamento de Física, Universidade Federal de Minas Gerais, Belo Horizonte-MG, Brazil — [4]Departamento de Física, Universidade Federal de Ouro Preto, Ouro Preto-MG, Brazil — [5]Núcleo Multidisciplinar de Pesquisas em Computação - NUMPEX-COMP, Campus Duque de Caxias, Universidade Federal do Rio de Janeiro, Duque de Caxias, Rio de Janeiro, Brazil — [6]Instituto de Física, Universidade Federal Fluminense, UFF, Niterói, Rio de Janeiro, Brazil — [7]Dep. of Electrical Engineering, National Tsing Hua University, Hsinchu, Taiwan — [8]IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milano, Italy

High-sensitivity femtosecond microscopy with broad spectral coverage reveals photoinduced intersubband absorption and enhanced photobleaching bands in twisted bilayer graphene endowed with picosecond relaxation time and twist angle-tunable energy position.

Oral EI-3.4 15:15 TRACK 11

Hybrid Graphene-WS2 Mach-Zehnder modulator on passive silicon waveguide — •ChengHan Wu[1,2], Steven Brems[1], Inge Asselberghs[1], Cedric Huyghebaert[1], Vito Sorianello[3], Marco Romagnoli[3], Joris Van Campenhout[1], Dries Van Thourhout[2], and Marianna Pantouvaki[1] — [1]imec, Leuven, Belgium — [2]Ghent University-imec, Department of information Technology, Gent, Belgium — [3]Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), Pisa, Italy

In this work, we integrate an graphene-oxide-WS2 stack on silicon passive waveguide. The Loss and electro-optical effects are both characterized with Mach-Zehnder interferometer.

Oral EI-3.5 15:30 TRACK 11

Anisotropic Terahertz Pump-Probe Response of Bilayer Graphene — •Angelika Seidl[1,2], Roozbeh Anvari[3], Marc M. Dignam[3], Peter Richter[4], Thomas Seyller[4], Harald Schneider[1], Manfred Helm[1,2], and Stephan Winnerl[1] — [1]Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]Institute for Applied Physics, Technische Universität Dresden, Dresden, Germany — [3]Department of Physics, Engineering Physics & Astronomy, Queen's University, Kingston, Canada — [4]Institute of Physics, Technical University Chemnitz, Chemnitz, Germany

We studied the pump-induced anisotropy of the intraband excitation in bilayer graphene in degenerate terahertz pump-probe experiments. The differential transmission signal increases approximately linearly with the excitation field, in qualitative agreement with our microscopic model.

Oral EI-3.6 15:45 TRACK 11

Plasmons in graphene nanoribbons: a platform for nonlinear optics — •Alvaro Rodríguez[1], Javier García de Abajo[1,2], and Joel Cox[3,4] — [1]ICFO - The institute of Photonic Sciences, Castelldefels, Spain — [2]ICREA – Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys 23, 08010 Barcelona, Spain, Barcelona, Spain — [3]Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — [4]Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark

We excite propagating plasmons in 1-D graphene nanoribbons and study them through rigorous quantum-mechanical simulations that account for nonlocal, quantum finite-size, and edge-termination effects in both linear and nonlinear optical response.

EJ-3: Tailored Light

Chair: Julien Javaloyes, University of the Balearic Islands, Palma, Spain

Time: Wednesday, 14:30–16:00 Location: TRACK 12

Oral EJ-3.1 14:30 TRACK 12

Conical refraction with generalized Bessel-Gaussian beams — •Valentin Yu. Mylnikov[1], Edik U. Rafailov[2], and Grigorii S. Sokolovskii[1] — [1]Ioffe Institute, St. Petersburg, Russia — [2]Aston University, Birmingham, United Kingdom

We investigate conical refraction of the linearly polarized generalized Bessel-Gaussian beam and demonstrate drastic changes in the focal intensity patterns for different beam parameters, including multi-ring Lloyd's distributions and inversion of orientation of associated half-rings.

Oral EJ-3.2 14:45 TRACK 12

Complexly Shaped Vector Beams via Conical Diffraction Cascade — •Muhammad Waqar Iqbal, Nicolas Marsal, and Germano Montemezzani — Université de Lorraine, CentraleSupélec, LMOPS, Metz, France

Modeling of a two-crystals conical diffraction cascade with intermediate transformation in wave-vector space predicts the formation of highly complex shaped vector beams that lose the usual radial circular symmetry. The theoretical findings are confirmed experimentally.

Oral EJ-3.3 15:00 TRACK 12

Local tailoring of light in inhomogeneous scattering media — •Ivor Kresic[1], Konstantinos G. Makris[2,3], and Stefan Rotter[1] — [1]Institute for Theoretical Physics, Vienna University of Technology (TU Wien), Vienna, Austria — [2]ITCP-Physics Department, University of Crete, Heraklion, Greece — [3]Institute of Electronic Structure and Lasers (IESL), Foundation for Research and Technology - Hellas, Heraklion, Greece

We present a framework to modify a pre-existing dielectric structure such that it confines light following a desired intensity distribution. The local index tuning required leaves the initial and the modified structure uni-directionally indistinguishable.

Oral EJ-3.4 15:15 TRACK 12

Optimal Design of Arrays of Nonlinear Nanoantennas — Marco Gandolfi[1], Costantino De Angelis[1], and •Massimiliano Guasoni[2] — [1]CNR-INO and Department of Information Engineering, University of Brescia, Brescia, Italy — [2]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

We develop a theoretical model that provides relatively simple semi-analytical formulas to describe the near and the far-field scattered from an array of nonlinear nanoantennas. This substantially simplifies the inverse design.

Oral EJ-3.5 15:30 TRACK 12

Silent White Light: Intensity Noise Suppression in Superluminescent Diodes — •Kai Niklas Hansmann, Wolfgang Elsäßer, and Reinhold Walser — Technische Universität Darmstadt, Institut für Angewandte Physik, Darmstadt, Germany

Temperature dependent suppression of intensity fluctuations in semiconductor light sources are explained via the interaction between a statistically distributed classical electric field and a pumped atomic three-level-system with varying pumping rate.

Oral EJ-3.6 15:45 TRACK 12

Optical waveguides based upon a gauge field — •Alessandro Alberucci[1], Chandroth P Jisha[1], and Stefan Nolte[1,2] — [1]Friedrich-Schiller University Jena, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We discuss light waveguiding due to a synthetic gauge field. Our proposal relies on longitudinally periodic structures, where the gauge field corresponds to a point-wise shift of the longitudinal index modulation.

SH-1: Short Course 1: Ultrashort Pulse Characterization

Time: Wednesday, 16:30–20:00 Location: TRACK 1

Short Course SH-1.1 16:30 TRACK 1

Ultrashort Pulse Characterization — •Aktürk Selçuk — Bruker Nano Surfaces, Madison, USA

In this course, we will review physics of ultrashort laser pulses and fundamental principles of ultrashort pulse characterization, describe details of commonly used charachterization methods, and discuss important recent developments.

Break

Short course 1 continued.

SH-2: Short Course 2: High-power Fiber Lasers

Time: Wednesday, 16:30–20:00 Location: TRACK 2

Short Course SH-2.1 16:30 TRACK 2

not yet filled — •Andy Clarkson — , ,

not yet filled

Break

Short course 2 continued.

SH-3: Short Course 3: Optical Parametric Oscillators

Time: Wednesday, 16:30–20:00 Location: TRACK 3

Short Course SH-3.1 16:30 TRACK 3

not yet filled — •Majid Ebrahim-Zadeh — , ,

not yet filled

Break

Short course 3 continued.

SH-4: Short Course 4: Laser Beam Analysis, Propagation, and Spatial Shaping Techniques

Time: Wednesday, 16:30–20:00 Location: TRACK 4

Short Course SH-4.1 16:30 TRACK 4

Laser Beam Analysis, Propagation, and Spatial Shaping Techniques — •James Leger — University of Minnesota, Minneapolis, USA

This short course describes both the mathematical and practical aspects of the propagation, control, and measurement of laser light. Applications to optical vortex beams, spatial beam shaping, and optimal light concentration are considered.

Break

Short course 4 continued.

SH-5: Short Course 5: Practical Quantum Optics

Time: Wednesday, 16:30–20:00 Location: TRACK 5

Short Course SH-5.1 16:30 TRACK 5
not yet filled — •Gerd Leuchs — , ,
not yet filled

Break

Short course 5 continued

SH-6: Short Course 6: Mid-infrared Semiconductor Lasers

Time: Wednesday, 16:30–20:00 Location: TRACK 6

Short Course SH-6.1 16:30 TRACK 6
not yet filled — •Jérôme Faist — , ,
not yet filled

Break

Short course 6 continued.

SH-7: Short Course 7: THz Measurements and their Applications

Time: Wednesday, 16:30–20:00 Location: TRACK 7

Short Course SH-7.1 16:30 TRACK 7
Terahertz Measurements and their Applications — •Daniel Mittleman — Brown University, Providence, Rhode Island , USA
This short course discusses several techniques for performing measurements in the terahertz (THz) region of the electromagnetic spectrum, along with an overview of the properties of materials and examples of some prominent applications.

Break

Short Course 7 continued.

SH-8: Short Course 8: Nonlinear Crystal Optics

Time: Wednesday, 16:30–20:00 Location: TRACK 8

Short Course SH-8.1 16:30 TRACK 8
Non Linear Crystal Optics — •Benoit Boulanger — University Grenoble-Alpes, Institut Néel-CNRS, Grenoble, France
This lecture focuses on fundamental crystal parametric optics that is one of the most fascinating field of nonlinear optics involving corpuscular and wave aspects of light and leading to optical frequency synthesis and mixing.

Break

Short Course 8 continued.

SH-9: Short Course 9: Frequency Combs Principles and Applications

Time: Wednesday, 16:30–20:00 Location: TRACK 9

Short Course SH-9.1 16:30 TRACK 9
Frequency Combs and Applications — •Thomas Udem — Max-Planck Institut of Quantum Optics, Garching, Germany
I will discuss the frequency comb principles in detail and present various applications.

Break

Short Course 9 continued.

SH-10: Short Course 10: Silicon Photonics

Time: Wednesday, 16:30–20:00 Location: TRACK 10

Short Course SH-10.1 16:30 TRACK 10
Silicon Photonics (Short Course) — •Dries Van Thourhout — Ghent University - imec, Gent, Belgium
This course discusses both fundamentals and applications of silicon photonics. Following a discussion on the design and performance of basic building blocks, more advanced circuits, integration with electronics and different application areas will be covered.

Break

Short Course 10 continued.

SH-11: Short Course 11: Optics in Graphene and other 2D Materials

Time: Wednesday, 16:30–20:00 Location: TRACK 11

Short Course SH-11.1 16:30 TRACK 11
not yet filled — •Coskun Kocabas — , ,
not yet filled

Break

Short Course 11 continued.

CC-P: CC Poster Session

Time: Wednesday, 10:00–11:00 Location: TRACK 1

CC-P.1 10:00 TRACK 1

Deterministic spatiotemporal focusing of terahertz waves through scattering media — •Vivek Kumar, Vittorio Cecconi, Alessia Pasquazi, Juan Gongora, and Marco Peccianti — University of Sussex, Falmer, United Kingdom

we theoretically demonstrate spatiotemporal refocusing of THz waves following a direct measurement of the transfer matrix of the scattering medium. Our approach combines the advantages offered by field-sensitive detection with the nonlinear wavefront shaping of THz waves.

CC-P.2 10:00 TRACK 1

Low Noise Terahertz Photodetectors in the 0.6-2.8 THz Range based on Quantum Dot Single Electron Transistors — •Mahdi Asgari[1], Leonardo Viti[1], Dominique Coquillat[2], Valentina Zannier[1], Lucia Sorba[1], and Miriam Serena Vitiello[1] — [1]CNR Nano-Institute and Scuola Normale Superiore, Pisa, Italy — [2]Laboratoire Charles Coulomb, Campus du Triolet, Université Montpellier, Montpellier, France

In this work, we describe that quantum dot single electron transistors based on InAs/InAs0.3P0.7 heterostructured nanowires and planar on-chip nanoantennas, behave as highly sensitive quantum detector at 0.6-2.8 THz range.

CC-P.3 10:00 TRACK 1

A Broadband Suspended Hollow Vivaldi Antenna for THz Quantum Cascade Lasers — •Urban Senica, Mattias Beck, Jérôme Faist, and Giacomo Scalari — ETH Zurich, Zurich, Switzerland

We present a broadband (1.5-4.5 THz) suspended hollow Vivaldi antenna. When mounted on a broadband THz Quantum Cascade Laser with emission spanning more than 1 THz, the far-field has a FWHM beam width of ($5^\circ \times 9^\circ$).

CC-P.4 10:00 TRACK 1

Towards efficient broadband difference frequency mixing and terahertz generation in metallic nanostructures — •Ihar Babushkin[1], Ayhan Demircan[1], Uwe Morgner[1], Joachim Herrman[2], and Anton Husakou[2] — [1]Institute of Quantum Optics, Leibniz University, Welfengarten 1, 30167, Hannover, Germany — [2]Max Born Institute, Max Born Str. 2a, 12489, Berlin, Germany

We show that resonances, resulting from the confinement of electrons in metallic nanostructures lead to strong nonlinearities at low frequencies. They can be used for effective low-harmonic (for instance THz or MIR) generation.

CC-P.5 10:00 TRACK 1

Comparative Study on efficient THz Generation in the organic Crystal DAST driven by mid-IR Pulses — Claudia Gollner[1], •Rokas Jutas[1], Mostafa Shalaby[2,3], Corinne Brodeur[2], Ignas Astrauskas[1], Andrius Baltuska[1,4], and Audrius Pugzlys[1,4] — [1] TU Wien, Photonics Institute, Vienna, Austria — [2]Swiss Terahertz Research-Zurich, Zurich, Switzerland — [3]Key Lab of Terahertz Optoelectronics, Beijing, China — [4]Center for Physical Sciences & Technology, Vilnius, Lithuania

We report on unprecedentedly high THz generation efficiencies approaching 6% by optical rectification of 2 micrometer pulses in the organic crystal DAST, and investigate an underlying interplay between the wavelength and intensity of the driving pulses.

CC-P.6 10:00 TRACK 1

withdrawn

CC-P.7 10:00 TRACK 1

Giant Controllable Gigahertz to Terahertz Harmonic Generation in Semiconductor Superlattices — •Mauro Fernandes Pereira[1], Vladimir Anfertev[2], Apostolos Apostolakis[3], Yuliia Shevchenko[3], and Vladimir Vaks[2] — [1]Department of Physics, Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates — [2]Institute for Physics of Microstructures, Russian Academy of Sciences, GSP-105, Nizhny Novgorod, Russia — [3]Institute of Physics, Czech Academy of Sciences, Prague, Czech Republic

Giant control of GHz-THz nonlinear harmonic generation in semiconductor superlattices is delivered by a combination of structural design and externally applied static bias. Our nonequlibrium manybody simulations and experimental data are in excellent agreement.

CC-P.8 10:00 TRACK 1

Bursting and excitability in neuromorphic resonant tunneling diodes — •Ignacio Ortega-Piwonka[1,2], Oreste Piro[1], Bruno Romeira[3], Jose Figueiredo[4], and Julien Javaloyes[1,2] — [1]Departament de Física, Universitat de les Illes Balears, Palma de Mallorca, Spain — [2]Institute of Applied Computing and Community Code (IAC-3), Palma de Mallorca, Spain — [3]Ultrafast, Bio and Nanophotonics, International Iberian Nanotechnology Laboratory (INL), Braga, Portugal — [4]Centra-Ciências and Departamento de Física, Faculda de de Ciências, Universidade de Lisboa, Lisboa, Portugal

Resonant tunneling diodes can operate as excitable devices, with potential applications in spike signaling and neural networks. In this study, an RTD connected to DC voltage is modeled and characterized in terms of its parameters.

CC-P.9 10:00 TRACK 1

High-quality 3D printed THz waveguides with optimized processing parameters for COC filaments — •Elena Mavrona, Jil Graf, Erwin Hack, and Peter Zolliker — Empa, Dübendorf, Switzerland

New low-cost optical devices can be manufactured with 3D printing while using THz transparent materials. We present the 3D printing of high-quality THz waveguides while optimizing the 3D printing parameters of cyclic olefin copolymer (Topas).

CC-P.10 10:00 TRACK 1

The Role of Gas Dynamics on Laser Filamentation THz Sources Operating at High Repetition Rates — •Christina Lanara[1,2], Anastasios D. Koulouklidis[1], Christina Daskalaki[1], Vladimir Yu. Fedorov[3,4], and Stelios Tzortzakis[1,2,3] — [1]Institute of Electronic Structure and Laser (IESL), Heraklion, Greece — [2]Department of Materials Science and Technology, University of Crete, Heraklion, Greece — [3]Texas A&M University at Qatar, Doha, Qatar — [4]P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia

We report on the impact of laser pulse repetition rate on two-color filamentation based terahertz sources. A 50% decrease on the terahertz energy is observed when the repetition rate increases from 0.6 to 6 kHz.

CC-P.11 10:00 TRACK 1

Experimental exploration of longitudinal modes in spherical shells at 220 GHz – 330 GHz: applications to corneal sensing — •Faezeh Zarrinkhat[1,2], Joel Lamberg[2], Mariangela Baggio[2], Aleksi Tamminen[2], Juha Ala-Laurinaho[2], Elsayed E. M. Khaled[3,4], Juan Manuel Rius[1], Jordi Romeu Robert[1], and Zachary Taylor[2] — [1]CommSensLab, Technical University of Catalonia/UPC, Barcelona, Spain — [2]Department of Electronics and Nanoengineering, Aalto University, MilliLab, Espoo, Finland — [3]Department of Electrical Engineering, Assiut University, Assiut, Egypt — [4]High Institute of Engineering and Technology, Sohage, Egypt

Agreement between the reflectivity of a spherical shell and equivalent planar structure is demonstrated at 220-330 GHz. The Gaussian-beam illumination on spherical surfaces results in a non-trivial alignment to achieve broadband THz sensing of corneal tissue.

CC-P.12 10:00 TRACK 1

High-resolution molecular spectroscopy in micrometric thin cells — Joao Carlos de Aquino Carvalho, Junior Lukusa Mudiayi, Pablo Resendiz-Vasquez, Benoit Darquié, Daniel Bloch, Isabelle Maurin, and •Athanasios Laliotis — Laboratoire de Physique des Lasers, UMR7538 CNRS, Université Sorbonne Paris Nord, Villetaneuse, France

We present linear sub-Doppler rovibrational spectroscopy of molecular gases confined in a thin cell of micrometric thickness. These experiments pave the way towards compact frequency references and spectroscopic measurements of the Casimir-Polder interaction with molecules.

CC-P.13 10:00 TRACK 1

Monte Carlo Modeling of a Short Wavelength Strain Compensated Quantum Cascade Detector — •Johannes Popp[1], Michael Haider[1], Martin Franckié[2], Jérôme Faist[2], and Christian Jirauschek[1] — [1]Technical University of Munich, Munich, Germany — [2]ETH Zurich, Zurich, Switzerland

We present simulation results of a short wavelength strain compensated quantum cascade detector based on an ensemble Monte Carlo approach. The modeled detectivity of 5.06×10^7 Jones at 300 K shows good agreement with the experimental value.

CC-P.14 10:00 TRACK 1

Nonlinear Generation of THz Vortex Beams with Tunable Orbital Angular Momentum in Si Microdisks — •Hailong Pi, Fei He, Jize Yan, and Xu Fang — School of Electronics and Computer Science, University of Southampton, Southampton, United Kingdom

We demonstrate waveguide-coupled microdisks that emit THz light with tunable orbital angular momentum. The topological charge of the THz light can be tuned by changing the driving infrared wavelengths in the difference-frequency generation process.

CC-P.15 10:00 TRACK 1

Terahertz pulse generation in ZnTe crystal pumped around the bandgap — •Dongwei Zhai, Emilie Herault, Frederic Garet, and Jean-Louis Coutaz — IMEP-LAHC, Le Bourget du lac, France

We generate THz waveforms in ZnTe by optical rectification of femtosecond laser pulses whose photon energy is tuned from1.55 to 2.56 eV. We observed a peak of the THz signal at the ZnTe bandgap energy.

CC-P.16 10:00 TRACK 1

Investigation of optimal THz band for corneal water content quantification — •Mariangela Baggio[1], Aleksi Tamminen[1], Semyon Presnyakov[2], Natalya P. Kravchenko[2], Irina I. Nefedova[1], Juha Ala-Laurinaho[1], Elliott Brown[3], Sophie Deng[4], Vincent Wallace[5], and Zachary D. Taylor[5] — [1]Aalto University, Espoo, Finland — [2]HSE University, Moscow, Russia — [3]Wright State University, Dayton, USA — [4]University of California, Los Angeles, USA — [5]University of Western Australia, Perth, Australia

Low terahertz frequency reflectometry is a promising technique for human cornea sensing. In particular, two waveguide bands (WR 5.1 and WR 2.2) are compared in terms of sensitivity to corneal water content and thickness variations.

CF-P: CF Poster Session

Time: Wednesday, 10:00–11:00 Location: TRACK 2

CF-P.1 10:00 TRACK 2

Ultrafast nonlinear spectroscopy of nematic liquid crystals via transient frequency-shear detection — Elizaveta Neradovskaia, Gilles Cheriaux, Cyrille Claudet, and •Aurelie Jullien — Université Côte d'Azur, CNRS, Institut de Physique de Nice, Valbonne, France

We report a novel time-resolved ultrafast spectroscopy setup to investigate third-order nonlinear dynamics, through transient Kerr-induced carrier-frequency shift measurement. The method is applied to ultrafast spectroscopy of orientated nematic liquid crystals.

CF-P.2 10:00 TRACK 2

Octave-Spanning Mid-Infrared Passive Optical Resonator — •Ernst Fill[1,2], Ann-Kathrin Raab[1,2], Maximilian Högner[2], Philipp Sulzer[1,2,3,4], Daniel Gerz[1,2], Lukas Fürst[1,2], and Ioachim Pupeza[1,2] — [1]Ludwig-Maximilians-Universität, Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Garching, Germany — [3]Department of Physics and Astronomy, Vancouver, Canada — [4]Quantum Matter Institute, Vancouver, Canada

35-word abstract: We demonstrate an ultrabroadband passive optical resonator to which the seeding laser is coupled through a wedged diamond plate. Using gold mirrors, frequency combs in the near-IR and the mid-IR regions are simultaneously resonantly enhanced.

CF-P.3 10:00 TRACK 2

supercontinuum generation in a nitrogen filled multipass cell — •Ammar Bin Wahid, Victor Hariton, Kilian Fritsch, and Oleg Pronin — helmut-schmidt universität, hamburg, Germany

we perform efficient supercontinuum generation in a multipass cell taking advantage of the Raman nonlinearity of nitrogen gas for 25 μJ and 230 fs pulses.

CF-P.4 10:00 TRACK 2

Lorentzian autocorrelation of mid-infrared pulses from water vapor absorption — •Lenard Vamos[1], Christian Hensel[1], Luke Maidment[1], Igor Tyulnev[1], Ugaitz Elu[1], Daniel Sanchez[1], Michael Enders[1], and Jens Biegert[1,2] — [1]ICFO - Institut de Ciencies Fotoniques, Castelldefels, Barcelona, Spain — [2]ICREA, Castelldefels, Barcelona, Spain

Propagation of ultrashort mid-infrared laser pulses was simulated to validate the Lorentzian shape in intensity autocorrelation measurements due to linear absorption and dispersion in moist air.

CF-P.5 10:00 TRACK 2

Two-dimensional spectral shearing interferometry designed for mode-locked Cr:ZnS lasers — •Tobias Kugel[1,2], Daiki Okazaki[1], Ko Arai[1], and Satoshi Ashihara[1] — [1]Institute of Industrial Science, University of Tokyo, Tokyo, Japan — [2]Institute of Experimental Physics, Graz University of Technology, Graz, Austria

We present Cr:ZnS laser pulse characterization by two-dimensional spectral shearing interferometry. It enables the direct spectral phase measurement of mid-infrared pulses with energies as low as 2 nJ.

CF-P.6 10:00 TRACK 2

Generation of optical vortices with diverse topological charge via angular momentum transfer — •Ignacio Lopez-Quintas[1], Warein Holgado[1], Rokas Drevinskas[2], Peter G. Kazansky[2], Íñigo J. Sola[1], and Benjamín Alonso[1] — [1]Grupo de Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, University of Salamanca, 37008, Salamanca, Spain — [2]Optoelectronics Research Centre, University of Southampton, SO17 1BJ, Southampton, United Kingdom

We propose an in-line method to produce collinear optical vortices with different topological charges based on the interaction between radially or azimuthally varying linear polarization fields with the spin and orbital angular momenta of light.

CF-P.7 10:00 TRACK 2

Self-started figure-8 mode-locked fiber laser for space borne optical frequency comb — •Yuichi Takeuchi, Ryota Saito, Shun Endo, Taishu Kurihara, and Mitsuru Musha — Institute for Laser science,Univ. of Electro-communications, Chofu, Japan

We have developed an all-PM figure-8 mode-locked laser for optical-based high-precision microwave generation in space. Our mode-locked laser has obtained the optical spectrum of 45.1 nm and observed self-starting of mode-locking without active trigger.

CF-P.8 10:00 TRACK 2

Towards 1 J-level multipass spectral broadening. — •Victor Hariton[1,2], Kilian Fristch[1], Gonçalo Figueira[2], and Oleg Pronin[1] — [1]Helmut-Schmidt-University, Hamburg, Germany — [2]Instituto Superior Técnico, Lisboa, Portugal

We propose a novel multi-pass spectral broadening concept based on a concave-convex arrangement with scaling potential up to 1-J energy and TW peak-power. In a proof-of-principle experiment, efficient and homogeneous compression of pulses is achieved.

CF-P.9 10:00 TRACK 2

Neodymium-doped polarization maintaining all-fiber laser with dissipative soliton resonance mode-locking at 905 nm — •Aram A. Mkrtchyan[1], Yuriy Gladush[1], Mikhail Melkumov[2], Aleksandr Khegai[2], Kirill Sitnik[1], Pavlos G. Lagoudakis[1], and Albert G. Nasibulin[1,3] — [1]Skolkovo Institute of Science and Technology, Moscow, Russia — [2]Prokhorov General Physics Institute of the Russian Academy of Sciences, Dianov Fiber Optics Research Center, Moscow, Russia — [3]Aalto University, Department of Chemistry and Materials Science, Espoo, Finland

Here we demonstrate all-fiber polarization-maintaining mode-locked rectangular shape pulse laser operating at 905 nm wavelength in NALM scheme. Numerical simulation showed perfect correspondence of obtained pulses to dissipative soliton resonance regime.

CF-P.10 10:00 TRACK 2

Femtosecond OPO employing Brewster angle prism retroreflectors — •Diana E. Hunter and Richard A. McCracken — Heriot-Watt University, Edinburgh, United Kingdom

We demonstrate a low-cost OPO in which dielectric mirrors are replaced by Brewster angle prism retroreflectors (Pellin-Broca prisms). Exploiting total internal reflection, these prisms form a high-finesse cavity supporting femtosecond pulses tuneable across 1100-1400nm.

CF-P.11 10:00 TRACK 2

Multi-color FROG with a Single Monolayer of WS_2 — •Marc Noordam[1], Javier Hernandez-Rueda[1,2], and Kobus Kuipers[1] — [1]Kavli Institute of Nanoscience, Delft, Netherlands — [2]Advanced Research Center for Nanolithography (ARCNL), Amsterdam, Netherlands

We simultaneously characterize two different colour ultrafast laser pulses by exploiting the high nonlinear response of monolayer of WS_2 and concurrently measuring the nondegenerate FROG traces of the sum-frequency and four-wave mixing nonlinear processes.

CF-P.12 10:00 TRACK 2

Tunable femtosecond optical parametric amplifier pumped by 1 kHz ultrafast thin-disk laser pulses for coherent anti-Stokes Raman scattering — •Xiaodong Zhao[1], Matthias Baudisch[2], Marcus Beutler[2], Thomas Gabler[1], Stefan Nolte[1,3], and Roland Ackermann[1] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller Universität Jena, Jena, Germany — [2]APE Angewandte Physik & Elektronik GmbH, Berlin, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena, Germany

A tunable optical parametric amplifier pumped by thin-disk laser pulses provides a maximum pulse energy of ~200 μJ, at 700-900 nm and a pulse duration of ~1 ps for fs-CARS system in high pressure gases.

CF-P.13 10:00 TRACK 2

Harnessing Amplitude and Phase Spectral Correlations to Recover the Dynamics of Optical Frequency Combs — •Matthieu Ansquer[1], Valérian Thiel[2], Syamsundar De[3], Bérangère Argence[1], Fabien Bretenaker[4], and Nicolas Treps[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, ENS-Université PSL, CNRS, Collège de France, Paris, France — [2]Department of Physics and Oregon Center for Optical, Molecular, and Quantum Science, University of Oregon, Eugene, USA — [3]Integrated Quantum Optics Group, Applied Physics, Paderborn University, Paderborn, Germany — [4]Université Paris-Saclay, CNRS, ENS Paris-Saclay, CentraleSupélec, LuMIn, Gif-sur-Yvette, France

The intensity, carrier envelope offset, repetition rate and central wavelength noises of a frequency comb are extracted from spectral covariance matrices. Intensity related dynamics is investigated from amplitude-phase correlations and compared to a simple model.

CF-P.14 10:00 TRACK 2

High resolution spectrally resolved interferometry in the mid-IR — •Mate Kurucz[1,2], Roland Flender[1], Timea Grosz[1], Adam Borzsonyi[1,2], Ugnius Gimzevskis[3], Arturas Samalius[3], Dominik Hoff[4], and Balint Kiss[1] — [1]ELI-ALPS, ELI-HU Non-Profit Ltd, Szeged, Hungary — [2]University of Szeged, Szeged, Hungary — [3]OPTOMAN, Vilnius, Lithuania — [4]Single cycle instruments, Jena, Germany

Spectrally resolved interferometric techniques combined with nonlinear processes are presented, aiming for high accuracy phase measurement in the MIR. Using these methods spectral phase can be determined at two spectral bands from a single interferogram.

CF-P.15 10:00 TRACK 2

Kilowatt-average-power compression of millijoule pulses in a gas-filled multi-pass cell. — •Christian Grebing[1,2], Michael Müller[1], Joachim Buldt[1], Henning Stark[1], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany — [3]Helmholtz-Institute Jena, Jena, Germany

We demonstrate the generation of 1-mJ, 31-fs pulses with an average power of 1 kW by close-to lossless post-compression of 200-fs pulses from a high-power Yb:fiber laser system in an argon-filled Herriott-type multi-pass cell.

CF-P.16 10:00 TRACK 2

85 fs Yb:YAG bulk oscillator with separated Kerr-lens and gain media — •Mohsen Khalili Kelaki, Johann Gabriel Meyer, and Oleg Pronin — Helmut-Schmidt-Universität, Hamburg, Germany

We present peak power scaling of a Kerr-lens modelocked Yb:YAG bulk oscillator. By lowering the repetition rate and controlling the Kerr-lens in a separate medium a peak power increase from 68 to 136 kW was achieved.

CF-P.17 10:00 TRACK 2

Regenerative shaping of ultrashort light pulses — •Kęstutis Regelskis, Gustas Liaugminas, Giedrius Dubosas, and Julijanas Želudevičius — Center for Physical Sciences & Technology, Vilnius, Lithuania

We present a regenerative ultrashort light pulse shaper based on double-stage Mamyshev regenerators connected in closed loop with electrically-controlled acousto-optic switcher. This scheme enables the formation of high quality ultrashort light pulses.

CF-P.18 10:00 TRACK 2

Second-harmonic generation by diamond color centers — •Aizitiaili Abulikemu[1], Yuta Kainuma[2], Toshu An[2], and Muneaki Hase[1] — [1]Department of Applied Physics, University of Tsukuba, Tsukuba, Japan — [2]School of Materials Science, Japan Advanced Institute of Science and Technology, Nomi, Japan

In this presentation, we report the observation of second-harmonic generation (SHG) from diamond crystals, whose inversion symmetry is broken by the nitrogen-vacancy (NV) center. Furthermore, we have investigated the tunability of wavelength for the SHG output.

CF-P.19 10:00 TRACK 2

Non-instantaneous Third-order Polarization in Gases at Low Intensities — •Anton Husakou[1], Felipe Morales[1], Maria Richter[1], and Vladimir Olvo[2] — [1]Max Born Institute, Max Born Str. 2a, 12489, Berlin, Germany — [2]Department of Physics, Voronezh State University, Universitetskaya Ploshchad', 1, 394036, Voronezh, Russia

Using first-principle simulations we show that, contrary to common belief, nonlinear polarization cannot be described by an instantaneous function of the electric field even at low intensities and far from resonances.

CE-P: CE Poster Session

Time: Wednesday, 10:00–11:00 Location: TRACK 3

CE-P.1 10:00 TRACK 3

Harnessing surface effects on exitonic absorptions in EuOx nanocomposite films for photonics — •Antonio Mariscal-Jiménez[1,2], Iván Camps[1,3], and Rosalía Serna[1] — [1]Laser Processing Group, Instituto de Optica, IO-CSIC, Madrid, Spain — [2]Departamento de Tecnologías de la Información, Escuela Politécnica Superior, Universidad CEU-San Pablo, CEU Universities, Madrid, Spain — [3]Universidad Nacional Autónoma de México, Instituto de Ciencias Físicas, Cuernavaca, México

We present a breakthrough in the understanding of the photonic potential of EuOx films grown by pulsed laser deposition. The results show how we can control the excitonic tweaking modifying the complex dielectric function.

CE-P.2 10:00 TRACK 3

Analysis and Assessment of Tube Thickness Variation Effect in Hollow-Core Inhibited Coupling Tube Lattice Fibers — •Federico Melli[1], Fabio Giovanardi[2], Lorenzo Rosa[1], Fetah Benabid[3], and Luca Vincetti[1] — [1]Department of Engineering “Enzo Ferrari”, University of Modena and Reggio Emilia, Modena, Italy — [2]Department of Engineering and Architecture, University of Parma, Parma, Italy — [3]GPPMM Group, XLIM Institute, CNRS UMR 7252, University of Limoges, Limoges, France

The effects of geometrical imperfections in Inhibited Coupling Tube Lattice Fibers are investigated. The impact of incremental variations of the tube thickness approaching their apex is analyzed and modeled in terms of cladding mode coupling.

CE-P.3 10:00 TRACK 3

Raman Spectroscopy of gallium phosphide nanowires under 5% elastic strain — •Vladislav Sharov[1,2], Prokhor Alekseev[2], Vladimir Fedorov[1], and Ivan Mukhin[1] — [1]Saint-Petersburg Academic University, Saint-Petersburg, Russia — [2]Ioffe Institute, Saint-Petersburg, Russia

Polarized Raman spectra of highly-strained gallium phosphide NWs were obtained and analyzed. Strain effects such as shifting, splitting and broadening of certain Raman modes were discussed via deformation potential theory and Mie theory.

CE-P.4 10:00 TRACK 3

Development of a New Sintering Technique for Fabricating High-Quality Nd3+- and Yb3+-doped Y2O3 Transparent Ceramics — •George Stanciu, Flavius Voicu, Catalina-Alice Brandus, Elena-Cristina Tihon, Stefania Hau, Cristina Gheorghe, Gabriela Croitoru, and Lucian Gheorghe — National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Magurele, Romania

A multi-step sintering method was used to fabricate high-quality Nd:Y2O3 and Yb:Y2O3 transparent ceramic laser media. Structural and morphological characteristics, the spectroscopic properties, and laser emission performances of the obtained ceramics were investigated.

CE-P.5 10:00 TRACK 3

Zinc Oxide Optical Ceramic Codoped with Er3+ and Yb3+ Ions — Elena Gorohova[1], Ivan Venevtsev[2], Sergey Eron'ko[1], •Liza Basyrova[3], Irina Alekseeva[1], Aleksander Khubetsov[1], Olga Dymshits[1], Aleksandr Zhilin[1], and Pavel Loiko[3] — [1]S.I. Vavilov State Optical Institute, St. Petersburg, Russia — [2]Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia — [3]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France

Zinc oxide optical ceramics codoped with Er3+ and Yb3+ ions is fabricated by uniaxial hot pressing at 1180 °C. The structure of ceramic (hexagonal, wurtzite-type) and its spectroscopic properties are studied evidencing the ZnO→RE3+ energy-transfer.

CE-P.6 10:00 TRACK 3

Red-Emitting Manganese Doped MgAl2O4 Ceramic Spinels Studied by Time- and Temperature-Resolved Luminescence Spectroscopy — Nicholas Khaidukov[1], Angela Pirri[2], Maria Brekhovskikh[1], Guido Toci[3], Matteo Vannini[3], Barbara Patrizi[3], and •Vladimir Makhov[4] — [1]N. S. Kurnakov Institute of General and Inorganic Chemistry, Moscow, Russia — [2]Istituto di Fisica Applicata "N. Carrara", Consiglio Nazionale delle Ricerche, Florence, Italy — [3]Istituto Nazionale di Ottica, Consiglio Nazionale delle Ricerche, Florence, Italy — [4]P. N. Lebedev Physical Institute, Moscow, Russia

Ceramic samples of MgAl2O4 spinel doped exclusively with tetravalent manganese ions, Mn4+, have been prepared as red-emitting (651 nm) phosphors and studied using time-resolved luminescence spectroscopy technique in the temperature range of 10 – 290 K

CE-P.7 10:00 TRACK 3

Hollow Antiresonant Optical Fiber Modified with Thin Films Containing Highly-Luminescent Gd2O3:Nd3+ Nanophosphors — •Vladimir Demidov[1,2], Aleksandra Matrosova[1,2,3], Sergey Evstropiev[1,2,3,4], Natalia Kuzmenko[3], Vladimir Aseev[3], Nikolay Nikonorov[3], and Konstantin Dukelskii[1,3,5] — [1]R&P Association Vavilov State Optical Institute, St. Petersburg, Russia — [2]Bauman Moscow State Technical University, Moscow, Russia — [3]ITMO University, St. Petersburg, Russia — [4]Saint-Petersburg State Institute of Technology, St. Petersburg, Russia — [5]The Bonch-Bruevich St.-Petersburg State University of Telecommunications, St. Petersburg, Russia

Cubic Gd2O3 crystals were applied for the modification of a silica hollow-core antiresonant fiber with thin films based on highly-luminescent Gd2O3:Nd3+ nanophosphors synthesized by the polymer-salt method which allows non-CVD formation of active silica layers

CE-P.8 10:00 TRACK 3

Deep-red activated persistent luminescence nanoparticles via upconversion — Luidgi Giordano[1,2], Lucas Carvalho Veloso Rodrigues[1], and •Bruno Viana[2] — [1]Department of Fundamental Chemistry, Institute of Chemistry, University of São Paulo, São Paulo, Brazil — [2]IRCP, CNRS, Chimie Paristech, PSL University , Paris, France

This work proposes to combine upconverting nanoparticles and persistent luminescent nanoparticles by dry impregnation. The assemblies present persistent luminescence under excitation in the first biological window at 980 nm opening the path to bioimaging applications.

CE-P.9 10:00 TRACK 3

Near and Mid Infrared spectroscopy of Nd3+:YLF crystal — •Giorgio Turri[1], Scott Webster[2], Michael Bass[2], and Alessandra Toncelli[3,4] — [1]Full Sail University, Winter Springs, FL, USA — [2]CREOL, the College of Optics and Photonics, Orlando,FL, USA — [3]Universita di Pisa, Pisa, Italy — [4]Italian National Research Council, Pisa, Italy

We present an extensive experimental investigation of the spectroscopic properties of Nd:YLF crystal, from the near infrared to the crystal thermal emission around 5 mm wavelength, over a broad range of temperatures.

CE-P.10 10:00 TRACK 3

Fano Resonances in Corrugated Ring coupled Bragg Waveguide System — •Pravin Rawat, Viphretuo Mere, and Shankar Kumar Selvaraja — Indian Institute of Science , Bengaluru, India

We experimentally demonstrate the Fano resonance in a corrugated ring coupled to a corrugated bus waveguide system and report that it is strongly dependent upon the coupling gap between ring and waveguide.

CE-P.11 10:00 TRACK 3

Production of Biaxial Polarization-Maintaining Optical Fiber with Panda-Type and Elliptical-Core Geometry — •Ali Karatutlu, Elif Yapar Yıldırım, Esra Kendir, and Bülend Ortaç — Bilkent University UNAM - Institute of Materials Science and Nanotechnology, Ankara, Turkey

This work demonstrates two-axes high polarization extinction ratio over 30 dB within operation temperatures from -60 °C to +85 °C using a novel geometry combined with Panda-type and elliptical-core PM fiber designs.

CE-P.12 10:00 TRACK 3

Two-photon Absorption in $Ca_3(VO_4)_2$ Crystal — Dmitry S. Chunaev, Elizaveta E. Dunaeva, Sergey B. Kravtsov, Irina S. Voronina, and •Petr G. Zverev — Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia

Two-photon absorption coefficient in calcium orthovanadate under irradiation with trains of 25-ps laser pulses at the wavelength of 523.5 nm was measured to be 0.25 cm/GW.

CE-P.13 10:00 TRACK 3

Insight into the performance of mode-locking with heating SWNT composites — •Cuihong Jin and Xueming Liu — State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China

For the first time, we have studied on the performance of SWNT-based SA composites under different temperatures which is expected to provide a reference to research on high thermal endurance property SA in fiber lasers.

CE-P.14 10:00 TRACK 3

Large-scale, high-resolution, wide-gamut structural coloration of flexible substrate — •Ning Li and Andrea Fratalocchi — King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

We propose a low-cost structural color technique based on self-assembly that exploits the interaction of scattering and resonances of complex hierarchical nanostructures. It realizes full color gamut, 127000 DPI resolution, large-scale printing (4-inch) simultaneously.

JSII-P: JSII Poster Session

Time: Wednesday, 10:00–11:00 Location: TRACK 4

JSII-P.1 10:00 TRACK 4

THz-Pump/SC-Probe Spectroscopy and the Non-resonant Dynamic Stark Effect of Molecules — •Bong Joo Kang[1], Egmont J. Rohwer[1], Michele Cascella[2], Shi-Xia Liu[3], Robert J. Stanley[4], and Thomas Feurer[1] — [1]Institute of Applied Physics, University of Bern, 3012 Bern, Switzerland — [2]Department of Chemistry and Hylleraas Centre for Quantum Molecular Sciences, University of Oslo, N-0315 Oslo, Norway — [3]Department of Chemistry and Biochemistry, University of Bern, 3012 Bern, Switzerland — [4]Department of Chemistry, Temple University, Philadelphia, Pennsylvania 19122, USA

We demonstrate THz Stark spectroscopy of solvated molecules using intense single-cycle THz pulses, thereby overcoming limitations of traditional Stark spectroscopy: No sample freezing, peak fields beyond the dielectric breakdown in conventional experiments and arbitrary polarization.

EC-P: EC Poster Session

Time: Wednesday, 13:30–14:30 Location: TRACK 1

EC-P.1 13:30 TRACK 1

First observation of a fractal topological insulator — •Tobias Biesenthal[1], Lukas Maczewsky[1], Zhaoju Yang[2], Mark Kremer[1], Matthias Heinrich[1], Mordechai Segev[2], and Alexander Szameit[1] — [1]Institut für Physik, Universität Rostock, 18059 Rostock, Germany — [2]Physics Department and Solid State Institute, Technion-Israel Institute of Technology, Haifa 32000, Israel

We experimentally demonstrate the first fractal topological insulator. We show the existence of topological protected edge states despite the absence of any bulk: every site in our structure is on an edge, external or internal.

EC-P.2 13:30 TRACK 1

Observation of a higher-order topological bound state in the continuum — •Alexander Cerjan, Marius Jürgensen, Wladimir A. Benalcazar, Sebabrata Mukherjee, and Mikael C. Rechtsman — Pennsylvania State University, University Park, USA

We experimentally demonstrate that the topological corner-localized modes of higher-order topological systems can be symmetry protected bound states in the continuum using a two-dimensional waveguide array.

EC-P.3 13:30 TRACK 1

Unidirectional Soliton-like Edge States in Floquet Topological Insulators — •Sebabrata Mukherjee and Mikael Rechtsman — The Pennsylvania State University, University Park, USA

We present the first realization of soliton-like unidirectional edge states on photonic Floquet topological insulators. These nonlinear states radiate power at a finite rate because of the discreteness and intrinsic gaplessness of the system.

EC-P.4 13:30 TRACK 1

Observation of charge-2 Weyl point splitting in a 3D photonic crystal — Christina Jörg[1,2], •Sachin Vaidya[1], Jiho Noh[1], Alexander Cerjan[1], Shyam Augustine[2], Georg von Freymann[2,3], and Mikael C. Rechtsman[2,3] — [1]Department of Physics, The Pennsylvania State University, University Park, PA 16802, USA — [2]Physics Department and Research Center OPTIMAS, Technische Universität Kaiserslautern, 67663 Kaiserslautern, Germany — [3]Fraunhofer Institute for Industrial Mathematics ITWM, 67663 Kaiserslautern, Germany

We experimentally demonstrate the splitting of a charge-2 Weyl point into two charge-1 Weyl points in a low-index-contrast 3D photonic crystal fabricated by two-photon polymerization and characterized using Fourier transform infrared (FTIR) spectroscopy.

EC-P.5 13:30 TRACK 1

Measurement of the Band Dispersions of a Floquet-Bloch Lattice Realised with Coupled Fiber Rigns — •Corentin Lechevalier, Clément Evain, Pierre Suret, François Copie, Alberto Amo, and Stéphane Randoux — Université de Lille, CNRS, UMR 8523-PhLAM-Physique des Lasers Atomes et Molécules, F-5900 Lille, France

We report the single-shot measurement of the dispersive band structure in a Floquet-Bloch photonic lattice realized with a double fibre loop system. This open the door to the full experimental characterization of Floquet-lattice systems.

EC-P.6 13:30 TRACK 1

Two-Dimensional PT-Symmetric Floquet Topological Insulator — •Alexander Fritzsche[1,2], Mark Kremer[2], Lukas Maczewsky[2], Yogesh Joglekar[3], Matthias Heinrich[2], Ronny Thomale[1], and Alexander Szameit[2] — [1]Institute for Theoretical Physics and Astrophysics, Julius-Maximilans University of Würzburg, Würzburg, Germany — [2]Universität Rostock, Institute of physics, Rostock, Germany — [3]Department of Physics, Indiana University-Purdue University Indianapolis (IUPUI), Indianapolis, USA

We present a theoretical proposal for a two-dimensional PT-symmetric topological insulator (TI) that supports two counter-propagating topologically protected boundary states and discuss ongoing experiments to confirm the theoretical predictions.

EC-P.7 13:30 TRACK 1

Topological confinement of light in photonic crystal nanocavites — •René Barczyk[1], Nikhil Parappurath[1], Sonakshi Arora[2], Thomas Bauer[2], Filippo Alpeggiani[2], Kobus Kuipers[2], and Ewold Verhagen[1] — [1]Center for Nanophotonics, AMOLF, Amsterdam, Netherlands — [2]Kavli Institute of Nanoscience, Delft University of Technology, Delft, Netherlands

We employ far-field Fourier spectroscopy to characterize the confinement of light at telecom frequencies in topological photonic crystal ring cavities and cavity-waveguide couplers. We explore the hallmarks of topological protection, quantifying dispersion, loss, and coupling.

EC-P.8 13:30 TRACK 1

Direct visualization of on-chip THz topological states — •Jiayi Wang[1], Ride Wang[2], Xinzheng Zhang[1], Qiang Wu[1], Daohong Song[1], Jingjun Xu[1], and Zhigang Chen[1] — [1]The MOE Key Laboratory of Weak-Light Nonlinear Photonics, TEDA Institute of Applied Physics and School of Physics, Nankai University, Tianjin, China — [2]Innovation Laboratory of Terahertz Biophysics, National Innovation Institute of Defense Technology, Beijing, China

We demonstrate nonlinear generation of terahertz topological edge states in an SSH lattice engineered on a LiNbO3 chip, manifested directly in the bandgap from the dispersion relation and further verified by the characteristic electric field distribution.

EC-P.9 13:30 TRACK 1

A Topological Phase Transition in Random Photonic Multilayer Structures — •David Whittaker — Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom

A mapping between photonic multilayers and chiral tight-binding models shows that a topological phase transition can be observed by measuring transmission through randomly layered structures. This is verified experimentally using analogous transmission line structures.

EC-P.10 13:30 TRACK 1

Direct quantification of robustness in topologically-protected photonic edge states at telecom wavelengths — •Sonakshi Arora[1], Thomas Bauer[1], René Barczyk[2], Ewold Verhagen[2], and L. Kuipers[1] — [1]Delft University of Technology, Delft, Netherlands — [2]AMOLF, Amsterdam, Netherlands

We experimentally quantify the back-scattering contribution of the edge states in topological photonic crystals emulating the quantum valley Hall effect. Measuring the vectorial near field reveals two orders of magnitude higher robustness compared to a conventional waveguide.

EC-P.11 13:30 TRACK 1

Chiral anomaly on the surface of a 3D Chern photonic crystal — •Chiara Devescovi[1], Mikel García Díez[2], Inigo Robredo Magro[1], Juan Luis Mañes[2], Maia García Vergniory[1,3], and Aitzol García Etxarri[1,3] — [1]Donostia International Physics Center (DIPC), Donostia-San Sebastian, Spain — [2]University of the Basque Country (UPV-EHU), Bilbao, Spain — [3]Basque Foundation for Science (IKERBASQUE), Bilbao, Spain

We analyze chiral anomalous surface states and disjoint Fermi loops of a 3D Chern photonic crystal, designed to preserve spatially isotropy and minimize required bias magnetization.

EC-P.12 13:30 TRACK 1

Quantifying the robustness of light transport in topological photonic waveguides — Guillermo Arregui[1], Jordi Gomis-Bresco[1], Clivia Marfa Sotomayor-Torres[1,2], and •Pedro David García[1] — [1]ICN2 - Instituto Catalán de Nanociencia y Nanotecnología, Bellaterra, Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avancats, Barcelona, Spain

Topological photonics has triggered so much attention due to its potential to engineer topological edge states robust against imperfection. Here, we analyze and quantify this claimed protection of topological transport compared to standard photonic transport.

EC-P.13 13:30 TRACK 1

Free space topological surface states at the surface of uncorrugated finite gyrotropic photonic crystals — •Anna Tasolamprou[1], Maria Kafesaki[1], Costas Soukoulis[1], Eleftherios Economou[1], and Thomas Koschny[2] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, N. Plastira 100, Heraklion, Greece — [2]Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011, USA, Ames, USA

We present a photonic crystal that sustains topological surface states at the free space interface. Band structure and direct scattering simulations demonstrate the topological surface mode unidirectionalilty and immunity to defects and back-scattering.

EC-P.14 13:30 TRACK 1

Second harmonic generation of spatiotemporal optical vortices (STOVs) and conservation of orbital angular momentum — •Sina Zahedpour Anaraki, Scott W. Hancock, and Howard M. Milchberg — University of Maryland, College Park, USA

We generate the second harmonic of pulses containing spatio-temporal optical vortices (STOVs) and directly measure their amplitude and phase in space and time. We demonstrate conservation of orbital angular momentum of STOVs under SHG.

EC-P.15 13:30 TRACK 1

Topological nanophotonics with time-reversal-invariant plasmonic lattices — •Paloma A. Huidobro — Instituto de Telecomunicacoes, IST-University of Lisbon, Lisbon, Portugal

Plasmonic lattices allow to realise time-reversal invariant topological phases for subwavelength-confined light. Retarded and radiative interactions are ubiquitous in nanophotonics, and their effect in the topological properties of edge and corner modes will be discussed.

EC-P.16 13:30 TRACK 1

Cavityless Lasing in Planar Topological Structure — •Alexander Palatnik, Markas Sudzius, Stefan Meister, and Karl Leo — Dresden Integrated Center for Applied Physics and Photonic Materials, Technische Universität Dresden, Dresden, Germany

We report a one-dimensional (1D) planar topological laser based on a topological interface state formed by two 1D photonic crystals. The crystals have different band topology leading to formation of an interface state.

EC-P.17 13:30 TRACK 1

Investigation of a negative next-nearest-neighbor-coupling in evanescently coupled dielectric waveguides — •Julian Schulz[1], Christina Jörg[1,2], and Georg von Freymann[1,3] — [1]Physics Department and Research Center OPTIMAS, TU Kaiserslautern, Kaiserslautern, Germany — [2]Department of Physics, The Pennsylvania State University, Pennsylvania , USA — [3]Fraunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern, Germany

We experimentally demonstrate a negative NNN-coupling constant, arising naturally in a dielectric waveguide structure, fabricated by direct-laser-writing, and show how we can tune between positive and negative ratios for NN and NNN coupling

EC-P.18 13:30 TRACK 1

Bound States in the Continuum and Unidirectional Guided Resonances in Anisotropic Structures with Multiple Radiation Channels — •Samyobrata Mukherjee[1], Jordi Gomis-Bresco[1], David Artigas[1,2], and Lluis Torner[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [2]Department of Signal Theory and Communications, Universitat Politecnica de Catalunya, Barcelona, Spain

Anisotropic antiguiding structures with two distinct radiation channels support solitary bound states in the continuum. This system can also be tuned to radiate in only one radiation channel, forming unidirectional guided resonances.

EC-P.19 13:30 TRACK 1

Spontaneously Appearing Polarization Singularities in Vertical-Cavity Lasers with Feedback — •Thorsten Ackemann[1] and Thierry Guillet[2] — [1] SUPA and Department of Physics, University of Strathclyde, Glasgow, United Kingdom — [2]Laboratoire Charles Coulomb (L2C), Univ. Montpellier, CNRS, Montpellier, France

We study the stability of nonlinear vector vortex beams in a vertical-cavity semiconductor laser against perturbations of the cylindrical symmetry. Different states arise depending on the interaction of a half-wave plate with the residual intrinsic anisotropies.

EC-P.20 13:30 TRACK 1

Three-dimensional fully-structured light by counter-propagation of self-similar beams — •Eric Asché, Ramon Droop, Eileen Otte, and Cornelia Denz — Institute of Applied Physics, University of Münster , Münster, Germany

We fully-structure light in amplitude, phase, and polarization in its transverse and longitudinal extent by counter-propagation of self-similar beams. Spiraling intensity as well as polarization distributions are sculpted upon propagation, as evinced by artificial counter-propagation.

EC-P.21 13:30 TRACK 1

Light Spin-Orbit Coupling in High-Order Harmonic Generation via Graphene's Band Anisotropy — •Ana García-Cabrera, Roberto Boyero-García, Óscar Zurrón-Cifuentes, Luis Plaja, and Carlos Hernández-García — Grupo de Investigación en Aplicaciones del Láser y Fotónica, Universidad de Salamanca, Salamanca, Spain

We unveil a novel spin-orbit coupling in high-order harmonic generation driven by a vector beam in single layer graphene. Our simulations show spin-to-orbital angular momentum conversion due to the graphene's band anisotropy.

EC-P.22 13:30 TRACK 1

Topological edge transport in a Lieb-like photonic lattice — •Jan Jasper Wichmann, Haissam Hanafi, Jean-Philippe Lang, and Cornelia Denz — Institute of Applied Physics and Center for Nonlinear Science, 48149 Münster, Germany

We report on topologically protected edge states in a four-band Lieb-like photonic lattice of evanescently coupled helical waveguides. Our results demonstrate adjustable group velocities depending on the driving potential and the selected edge termination.

EC-P.23 13:30 TRACK 1

Robustness of the topological interface state in a 1D photonic crystal resonator with an air-gap — •Seonyeong Kim[1,2], Hee Jin Choi[1], Markus Scherrer[3], Kirsten Moselund[3], and Chang-Won Lee[1] — [1]Institute of Advanced Optics and Photonics, Hanbat National University, Daejeon, South Korea — [2]Department of Physics, Sejong University, Seoul, South Korea — [3]IBM Research , Rüschlikon, Switzerland

We verify the effect of air-gap on the topological interface states between two photonic crystals with distinct Zak phases of π based on a one-dimensional system, resulting in the shift of topological modes.

EC-P.24 13:30 TRACK 1

Resonant Coupling between Orbital-Angular-Momentum Modes in Femtosecond Laser Written Helical Bragg Waveguides — •Andrey Pryamikov[1], Sergei Vasiliev[1], Vladislav Likhov[1,2], and Andrey Okhrimchuk[1,2] — [1]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [2]Mendeleev University of Chemical Technology of Russia, Moscow, Russia

In this work we investigate optical properties of a new type of micro – structured waveguide called helical Bragg waveguide. The resonant coupling between OAM modes of the waveguide has been studied theoretically and experimentally.

EH-P: EH Poster Session

Time: Wednesday, 13:30–14:30 Location: TRACK 2

EH-P.1 13:30 TRACK 2

Ultrafast Thermal Manipulation of Plasmons in Atomically Thin Films — •Eduardo J. C. Dias[1], Renwen Yu[1], and Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We demonstrate the ability of graphene and thin metal films to undergo ultrafast photothermal optical modulation under pump-probe conditions, with depths as large as >70% over a wide spectral range.

EH-P.2 13:30 TRACK 2

SHG behaviors due to coupled plasmon mode in Au nanorod trimer — •Atsushi Sugita, Shunnma Oh, and Yohsei Nakatsuka — Shizuoka University, Hamamatsu, Japan

We present SHG behaviors in dolmen-type Au nanorod (AuNR) trimer. SHG intensity from trimer was 20 times higher than that from referential monomeric AuNR. Efficient SHG conversions resulted from coupled plasmons in noncentrosymmetrically arranged AuNR's.

EH-P.3 13:30 TRACK 2

Rich Broadband Chiral Behavior in Low-cost Plasmonic Nanostructures — •Emilija Petronijevic[1], Alessandro Belardini[1], Grigore Leahu[1], Tiziana Cesca[2], Carlo Scian[2], Giovanni Mattei[2], and Concita Sibilia[1] — [1]University of Rome La Sapienza, Rome, Italy — [2]University of Padova, Padova, Italy

We demonstrate broadband chiral behaviour of plasmonic metasurfaces fabricated by low-cost nanopshere lithography. Experimental and numerical analysis reveals rich resonant features, tuneable by wavelength and incident angle, interesting for chiral sensing and chiral nanoscale sources.

EH-P.4 13:30 TRACK 2

Formation of plasmonic metasurfaces using spatial light modulator — Mohammad Bitarafan, •Shambhavee Annurakshita, Juha Toivonen, and Godofredo Bautista — Tampere University, Tampere, Finland

We demonstrate a high-speed optical technique to fabricate plasmonic metasurfaces with a complex distribution of meta-atoms in a polymer film using spatial light modulator.

EH-P.5 13:30 TRACK 2

Low loss dielectric loaded plasmonic waveguides for sensing applications above nine microns — •Mauro David[1], Alicja Dabrowska[2], Masiar Sistani[1], Erik Hinkelmann[3], Ismail Cem Doganlar[1], Benedikt Schwarz[1], Hermann Detz[1,3], Walter Michael Weber[1], Bernhard Lendl[2], Gottfried Strasser[1], and Borislav Hinkov[1] — [1]Institute of Solid State Electronics and Center for Micro- and Nanostructures, Vienna, Austria — [2]Institute of Chemical Technologies and Analytics, Vienna, Austria — [3]Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic

Undoped germanium is investigated as dielectric material for long-wave infrared plasmonics. Basic plasmonic properties are calculated and fabricated samples are characterized experimentally. The typical attenuation is found to be around 12 dB/mm.

EH-P.6 13:30 TRACK 2

Bismuth-based gap-plasmon metasurfaces for visible photonics with volatile tuning potential — •Carlota Ruiz de Galarreta[1,2], Eva Nieto-Pinero[1], Marina Garcia-Pardo[1], C. David Wright[2], Rosalia Serna[1], and Johann Toudert[1] — [1]Laser Processing Group, Instituto de Optica, Madrid, Spain — [2]College of Engineering Mathematics and Physical Sciences, University of Exeter, Exeter, United Kingdom

We report the use of bismuth as an excellent plasmonic metal for the design of gap plasmon absorbing metasurfaces operating at visible wavelengths, towards the development of highly efficient, and high purity, and potentially active structural colour generators.

EH-P.7 13:30 TRACK 2

Investigation of the optical properties of Al-doped Ag Layers — Elisabeth Mariegaard, Ida Skøt Støvring, Andrei Lavrinenko, and •Radu Malureanu — Technical University of Denmark, DTU Fotonik, Kgs Lyngby, Denmark

In this article we show that, although the Al-doped Ag ultrathin layers are morphologically stable, their collision energy is about 3 times higher than the one of Ag, making them unsuitable for many plasmonic applications.

EH-P.8 13:30 TRACK 2

enhancing photocatalytic efficiency through plasmonic nanoparticles with Au–TiO2 based nanostructures. — •Ana Sousa-castillo[1,2], Andrea Mariño-lópez[2], Yoel Negrín-Montecelo[2], Miguel Comesaña-Hermo[3], Stefan Krühler[1], Leonardo de S. Menezes[1], Stefan A. Maier[1,4], Miguel A. Correa-Duarte[2], and Emiliano Cortés[1] — [1]chair in hybrid nanosystems, nanoinstitutmünchen, fakultät für physik, ludwig maximilians-universität münchen, münchen, Germany — [2]CINBIO, universidade de vigo, Vigv, Spain — [3]université de paris, ITODYS, CNRS, UMR , paris, France — [4]experimental solidstate physics group, department of physics, imperial collegelondon, london, United Kingdom

in this work, we have focused on the role of the amount and composition of plasmonic nanoparticles for their photosensitizing capabilities. The mechanism has been studied in photodriven processes by ultrafast transient spectroscopies.

EH-P.9 13:30 TRACK 2

Using cryogenic temperatures and crystalline gold platelets to dramatically reduce the optical losses observed in the coupling between a metallic film and an individual colloidal CdSe/CdS nanocrystals — Antoine Coste[1], Laureen Moreaud[2], Gérard Colas des Francs[3], Stéphanie Buil[1], Xavier Quélin[1], Erik Dujardin[2], and •Jean-Pierre Hermier[1] — [1]Université Paris-Saclay, UVSQ, CNRS, GEMaC, Versailles, France — [2]CEMES/CNRS UPR 8011, Toulouse, France — [3]Laboratoire Interdisciplinaire Carnot de Bourgogne (ICB), UMR 6303 CNRS, Université Bourgogne Franche-Comté, Dijon, France

In this paper, we show the strong decrease of optical losses for the fluoresence of individual colloidal nanocrystals by a crystalline gold film and operating at 4K.

EI-P: EI Poster Session

Time: Wednesday, 13:30–14:30 Location: TRACK 3

EI-P.1 13:30 TRACK 3

Dark Exciton Formation and Relaxation Dynamics in Monolayer WSe_2 — •Satoshi Kusaba[1], Kenji Watanabe[2], Takashi Taniguchi[2], Kazuhiro Yanagi[3], and Koichiro Tanaka[1,4] — [1]Department of Physics, Kyoto University, Sakyo-ku, Kyoto, Japan — [2]National Institute for Materials Science, Tsukuba, Ibaraki, Japan — [3]Department of Physics, Tokyo Metropolitan University, Hachioji, Tokyo, Japan — [4]Institute for Integrated Cell-Material Sciences, Sakyo-ku, Kyoto, Japan

We investigated dark exciton formation and relaxation dynamics in hBN-encapsulated high-quality monolayer WSe_2 by time-resolved photoluminescence spectroscopy. Finite rise time of dark exciton time profile reflects the thermal decay process of the hot dark excitons.

EI-P.2 13:30 TRACK 3

Wafer-scale epitaxial MoSe2on epitaxial hBN: a combination of MBE and-MOVPE — •Katarzyna Ludwiczak, Aleksandra Dąbrowska, Wojciech Pacuski, Johannes Binder, Rafał Bożek, Mateusz Tokarczyk, Grzegorz Kowalski, Roman Stępniewski, and Andrzej Wysmołek — Faculty of Physics, University of Warsaw, Warsaw, Poland

We present an unique method to obtain wafer-scale, ultrathin layers of molybdenum diselenide. Material is grown by two epitaxial techniques: MOVPE and MBE and manifest excellent optical quality.

EI-P.3 13:30 TRACK 3

Excitons in Lead-Halide Perovskite Nanocrystals from Tight-Binding GW/BSE Approach — •Giulia Biffi[1,2], Yeongsu Cho[3], Roman Krahne[1], and Timothy C. Berkelbach[3,4] — [1]Istituto Italiano di Tecnologia, Genova, Italy — [2]Università degli studi di Genova, Genova, Italy — [3]Columbia University, New York, USA — [4]Flatiron Institute, New York, USA

Test showing the dependence of the excitonic energy on the number of transitions per unit cell included in the Bethe-Salpeter matrix

EI-P.4 13:30 TRACK 3

Macroscopic Signatures of the Non-Perturbative Response of Single Layer Graphene to Intense Laser Fields — •Roberto Boyero-García, Óscar Zurrón-Cifuentes, Ana García-Cabrera, Carlos Hernández-García, and Luis Plaja — Grupo de Investigación en Aplicaciones de Láser y Fotónica, departamento de Física Aplicada, Universidad de Salamanca, Salamanca, Spain

We explore the electronic dynamics of graphene subjected to an intense laser through high-order harmonic generation. Our results reveal that the macroscopic emission presents an unequivocal signature of the non-perturbative response of graphene.

EI-P.5 13:30 TRACK 3

Epitaxial growth of $CH(NH_2)_2PbI_3$ thin films on $CH_3NH_3PbBr_3$ single crystal substrates by vapor phase deposition — •Zihao Liu[1], Tomonori Matsushita[2], Masato Sotome[1,2], and Takashi Kondo[1,2] — [1]Department of Materials Engineering, The University of Tokyo, Tokyo, Japan — [2]Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan

By partially limiting the halide ion inter-diffusion, we have achieved the epitaxial growth of I-rich perovskite thin films on the $CH_3NH_3PbBr_3$ single crystal substrates using vapor phase deposition.

EI-P.6 13:30 TRACK 3

Optimum absorption of MoS2 monolayer using Cavity Resonator Integrated Filtering — •Jean-Baptiste Dory[1,2], Olivier Gauthier-Lafaye[2], Stéphane Calvez[2], and Adnen Mlayah[1,2] — [1]CEMES-CNRS, Université de Toulouse, Toulouse, France — [2]LAAS-CNRS, Université de Toulouse, Toulouse, France

This work explores the numerical conception and the fabrication of devices combining MoS2 monolayer and photonic structures. The reported hybrid device shows an optimal optical response to study the photoluminescence of the integrated MoS2 monolayer.

EI-P.7 13:30 TRACK 3

Nonlocal Ultra-Strong Coupling Using Graphene Plasmons — •Yaniv Kurman and Ido Kaminer — Technion, Israel Institute of Technology, Haifa, Israel

We show that when stating a semiconductor between graphene and metal, the graphene plasmons vacuum fluctuations couple nonlocally a single semiconductor electron to all available valence states, reaching ultra-strong coupling and a 100meV bandgap shift.

JSI-P: JSI Poster Session

Time: Wednesday, 13:30–14:30 Location: TRACK 4

JSI-P.1 13:30 TRACK 4

Generalized law of heat conduction including the intrinsic coherence of thermal phonons — •Zhongwei Zhang[1], Yangyu Guo[1], Masahiro Nomura[1], Jie Chen[2], and Sebastian Volz[1] — [1]The University of Tokyo, Tokyo, Japan — [2]Tongji University, Shanghai, China

We propose a formalism supported by theoretical arguments and direct atomic simulations, which takes into account both the conventional phonon gas model and the internal wave nature of thermal phonons.

JSI-P.2 13:30 TRACK 4

Radiative sky cooling of silicon solar cells: investigation of photonic pathways through coupled optical-electrical-thermal modelling — •Jérémy Dumoulin[1], Emmanuel Drouard[2], and Mohamed Amara[1] — [1]INL UMR5270, Univ. Lyon, INSA-Lyon, CNRS, Villeurbanne, France — [2]INL UMR5270, Univ. Lyon, Ecole Centrale de Lyon, Ecully, France

Radiative sky cooling is a promising method to efficiently cool silicon solar cells. We aim to develop a coupled optical-electrical-thermal model in order to study various photonic pathways to enhance radiative sky cooling.

JSI-P.3 13:30 TRACK 4

Designing Mesoporous Acoustic Cavities for Opto-Phononic Sensing in the Gigahertz Range — •Edson Rafael Cardozo de Oliveira[1], Martin Esmann[1], Nicolas L. Abdala[2], Maria C. Fuertes[3], Paula C. Angelomé[3], Omar Ortiz[1], Axel Bruchhausen[4], Hernan Pastoriza[4], Bernard Perrin[5], Galo J. A. A. Soler-Illia[2], and Norberto Daniel Lanzillotti-Kimura[1] — [1]Centre National de Recherche Scientifique, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]Instituto de NanoSistemas – Universidad Nacional de San Martín-CONICET, Buenos Aires, Argentina — [3]Gerencia Química & Instituto de Nanociencia y Nanotecnología, Centro Atómico Constituyentes, CNEA-CONICET, Buenos Aires, Argentina — [4]Centro Atómico Bariloche & Instituto de Nanociencia y Nanotecnología, CNEA-CONICET, Rio Negro, Argentina — [5]Sorbonne Université, CNRS, Institut des NanoSciences de Paris, Paris, France

Multilayered nanoacoustic resonators based on mesoporous oxide thin-films showing acoustic resonances in the 5-100 GHz range are presented, with experimental results and simulations. Finally, we propose new complex mesoporous systems with potential for nanoacoustic sensors.

JSI-P.4 13:30 TRACK 4

Angular filtering for Brillouin spectroscopy in the 20-300 GHz range — •Anne Rodriguez, Priya Priya, Pascale Senellart, Carmen Gomez-Carbonell, Aristide Lemaître, Martin Esmann, and Norberto Daniel Lanzillotti-Kimura — Centre de nanosciences et de nanotechnologies, Palaiseau, France

We present a versatile custom-built Brillouin spectroscopy setup to probe acoustic phonons in the 20 to 300 GHz range of tunable optophononic cavities with high spectral resolution at broadband acoustical and optical frequencies.

JSI-P.5 13:30 TRACK 4

Engineering Low-Loss Silicon Quantum Photonics in the Mid-Infrared — •Dominic A. Sulway[1,2], Lawrence M. Rosenfeld[2], Yuya Yonezu[3], Quinn M. B. Palmer[1,2], Pisu Jiang[2], Takao Aoki[3], John G. Rarity[2], and Joshua W. Silverstone[2] — [1]Quantum Engineering Centre for Doctoral Training, University of Bristol, Bristol, United Kingdom — [2]Quantum Engineering Technology Labs, University of Bristol, Bristol, United Kingdom — [3]Department of Applied Physics, Waseda University, Tokyo, Japan

To achieve low-loss silicon quantum photonics, we demonstrate a two-photon-absorption reduced single-photon source, and a high-performance fiber-to-chip coupler, both operating in the mid-infrared on the 220-nm silicon platform.

JSI-P.6 13:30 TRACK 4

Spike propagation in a nanolaser-based optoelectronic neuron — •Ignacio Ortega-Piwonka[1,2], Oreste Piro[1], Jose Figueiredo[3], Bruno Romeira[4], and Julien Javaloyes[1,2] — [1]Departament de Física, Universitat de les Illes Balears, Palma de Mallorca, Spain — [2]Institute of Applied Computing and Community Code (IAC-3), Palma de Mallorca, Spain — [3]Centra-Ciências and Departamento de Física, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal — [4]Ultrafast, Bio and Nanophotonics, International Iberian Nanotechnology Laboratory (INL), Braga, Portugal

An optoelectronic, neuromorphic circuit consisting of a resonant tunneling diode and a nanolaser is demonstrated as an excitable pulse generator. The optical pulses are quantitatively characterized. Next, two units are integrated to propagate pulses.

JSI-3: Nanophononic and Optomechanical Systems. Radiative Heat Transfer Thermal Rectification.

Chair: Roberto Li Voti, Sapienza Università di Roma, Rome, Italy

Time: Thursday, 8:30–10:00 Location: TRACK 1

Oral JSI-3.1 8:30 TRACK 1

Towards Integrated Nanoacoustics: Fiber-integrated Microcavities for Efficient Generation of Coherent Acoustic Phonons in the 20 GHz Range — Omar Ortiz[1], Florian Pastier[2], Anne Rodriguez[1], Priya Priya[1], Aristide Lemaitre[1], Carmen Gomez Carbonell[1], Isabelle Sagnes[1], Abdelmounaim Harouri[1], Pascale Senellart[1], Valerian Giesz[2], Martin Esmann[1], and •Daniel Lanzillotti-Kimura[1] — [1]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies (C2N), Palaiseau, France — [2]Quandela SAS, Palaiseau, France

We integrate opto-phononic resonators working at ~20 GHz to single-mode fibers lifting the need for focusing optics to excite and detect coherent acoustic phonons in a pump-probe scheme.

Oral JSI-3.2 8:45 TRACK 1

Experimental Optimization of the Thermal Rectification of a Far-Field Diode Based on VO2 — •Jose Ordonez-Miranda[1], Ivan Forero-Sandoval[2], Frédéric F. Dumas-Bouchiat[3], Corinne Champeaux[3], and Juan Jose Alvarado-Gil[4] — [1]LIMMS, CNRS-IIS UMI 2820, The University of Tokyo, 153-8505, Tokyo, Japan — [2]Institut Pprime, CNRS, Université de Poitiers, ISAE-ENSMA, F-86962 , Futuroscope Chasseneuil, France — [3]Université de Limoges, CNRS, IRCER, UMR 7315, F-87000, Limoges, France — [4]Applied Physics Department, CINVESTAV-IPN Mérida, C.P. 97310, Mérida, Yucatán, Mexico

An optimum rectification factor of 61% is experimentally observed for far-field thermal diode made up of a VO2 film placed in vacuum and in front of a heat fluxmeter.

Oral JSI-3.3 9:00 TRACK 1

Dynamically Tuned Infrared Emission using VO2 Thin Films. — •Maria Cristina Larciprete[1], Marco Centini[1], Stefano Paoloni[2], Ilaria Fratoddi[3], Sina A. Dereshgi[4], Kechao Tang[5], Junqiao Wu[6], and Koray Aydin[4] — [1]Dipartimento di Scienze di Base ed Applicate per l'Ingegneria, Sapienza Università di Roma, Italy, Roma, Italy — [2]Dipartimento di Ingegneria Industriale, Università degli Studi di Roma Tor Vergata, Roma, Italy — [3]Dipartimento di Chimica, Sapienza Università di Roma, Roma, Italy — [4]Department of Electrical and Computer Engineering, Northwestern University, Evanston (Illinois), USA — [5]Department of Materials Science and Engineering, University of California, Berkeley (California), USA — [6]Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley (California), USA

We investigated the infrared emission of VO2 during phase transition and demonstrate that VO2 thin films are promising candidates for tuning and controlling the thermal radiation of an underlying hot body with different emissivity features.

Oral JSI-3.4 9:15 TRACK 1

Highly efficient thermionic cooling nano-device: the quantum cascade cooler — •Marc Bescond[1,2] and Kazuhiko Hirakawa[1,2] — [1]LIMMS-CNRS, Tokyo, Japan — [2]Institute of Industrial Science and INQIE, University of Tokyo, Tokyo, Japan

We propose a novel semiconductor heterostructure cooling device, identified as "quantum cascade cooler" (QCC). Its concept is based on successive resonant tunneling and thermionic emission processes through a series of quantum wells.

Oral JSI-3.5 9:30 TRACK 1

Synthetic Magnetic Fields and Non-Hermitian Dynamics for Phonons in a Nano-Optomechanical System — •Jesse J. Slim, Javier del Pino, John P. Mathew, and Ewold Verhagen — AMOLF, Amsterdam, Netherlands

We establish synthetic magnetic fields and parametric amplification for nanomechanical transport by modulating optomechanical interactions. We show that the controlled breaking of time-reversal symmetry and non-Hermitian dynamics lead to chiral propagation and directional amplification.

Oral JSI-3.6 9:45 TRACK 1

Ultra-thin and high selective emission with additional lossless layer — •Do Hyeon Kim[1], Gil Ju Lee[1], Se-Yeon Heo[1], Soomin Son[2], Kyeong Muk Kang[1], Heon Lee[2], and Young Min Song[1] — [1]Gwangju Institute of Science and Technology, Gwangju, South Korea — [2]Korea University, Seoul, South Korea

This article introduces an ultra-thin and near-unity selective emitter within long wave infrared region, which can be fabricated in simple and affordable process.

CG-5: Symmetries in Ultrafast Science

Chair: Carla Figueira de Morisson Faria, University College London, London, United Kingdom

Time: Thursday, 8:30–10:00 Location: TRACK 2

Invited CG-5.1 8:30 TRACK 2

Attosecond Dual Nature of Core Excitons — •Matteo Lucchini[1,2], Shunsuke A. Sato[3,4], Giacinto D. Lucarelli[1,2], Bruno Moio[1,2], Giacomo Inzani[1], Rocío Borrego-Varillas[2], Fabio Frassetto[5], Luca Poletto[5], Hannes Huebener[3], Umberto De Giovannini[3], Angel Rubio[3], and Mauro Nisoli[1,2] — [1]Department of Physics, Politecnico di Milano, Milano, Italy — [2]Institute for Photonics and Nanotechnologies, IFN-CNR, Milano, Italy — [3]Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — [4]Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan — [5]Institute for Photonics and Nanotechnologies, IFN-CNR, Padova, Italy

Ultrafast core-exciton dynamics was measured in MgF_2 by attosecond transient-reflection spectroscopy. We found that the atomic nature of excitons dominates the few-femtosecond response, while their solid-state nature dictates the attosecond timing of the system.

Oral CG-5.2 9:00 TRACK 2

Observation of Rotational Doppler Shift for Harmonic Generation in Solids — •Wataru Komatsubara, Kuniaki Konishi, Junji Yumoto, and Makoto Kuwata-Gonokami — The University of Tokyo, Tokyo, Japan

Spin angular momentum exchange of harmonic generation in solids can be observed by the Rotational Doppler Shift (RDS). Here, we generate harmonics from the crystal with no rotational symmetry and observe the two different RDS.

Oral CG-5.3 9:15 TRACK 2

Rotational Quantum Beat Lasing without Inversion — •Maria Richter[1], Marianna Lytova[2,3], Felipe Morales[1], Stefan Haessler[4], Olga Smirnova[1], Michael Spanner[2,3], and Misha Ivanov[1] — [1]Max-Born-Institute, Berlin, Germany — [2]Department of Physics, University of Ottawa, Ottawa, Canada — [3]National Research Council of Canada, Ottawa, Canada — [4]Laboratoire d'Optique Appliquée, CNRS, École Polytechnique, ENSTA Paris, Institut Polytechnique de Paris, Palaiseau, France

We show that lasing without inversion arises naturally during propagation of intense femtosecond laser pulses in air. It is triggered by the combination of molecular ionization and molecular alignment, both unavoidable in intense light fields.

Oral CG-5.4 9:30 TRACK 2

Extreme-Ultraviolet Vortices of very high Topological Charge — •Alok Kumar Pandey[1], Alba de las Heras[2], Julio San Román[2], Luis Plaja[2], Elsa Baynard[1], Guillaume Dovillaire[3], Moana Pittman[1], Sophie Kazamias[1], Olivier Guilbaud[1], and Carlos Hernández-García[1] — [1]Laboratoire Irène Joliot-Curie, Université Paris-Saclay, UMR CNRS, Rue Ampère, Bâtiment 200, F-91898, Orsay, France — [2]Grupo de Investigación en Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, Universidad de Salamanca, E-37008 , Salamanca, Spain — [3]Imagine Optic, 18, rue Charles de Gaulle, Orsay, France

We report the generation, and intensity, wavefront, modal content characterization of optical vortices with topological charges as high as 100 in the extreme-ultraviolet spectral range. Furthermore, we complement the experimental observations with advanced simulations.

Oral CG-5.5 9:45 TRACK 2

Ellipticity dependent excitation and high harmonic generation from intense mid-IR laser pulses in ZnO — •Paul Herrmann[1], Richard Hollinger[1,2], Viacheslav Korolev[1], Maximilian Zapf[3], Valentina Shumakova[4], Robert Röder[3], Ingo Uschmann[1], Audrius Pugžlys[4], Andrius Baltuška[4], Michael Zürch[1,5,6,7], Carsten Ronning[3,8], Christian Spielmann[1,2,8], and Daniil Kartashov[1,8] — [1]Institute of Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Jena, Germany — [2]Helmholtz Institute Jena, Jena, Germany — [3]Institute for Solid State Physics, Friedrich-Schiller-University Jena, Jena, Germany — [4]Institute for Photonics, Technical University Vienna, Vienna, Austria — [5]Fritz Haber Institute, Berlin, Germany — [6]Department of Chemistry, University of California Berkeley, Berkeley, USA — [7]Lawrence Berkeley National Laboratory, Materials Sciences Division, Berkeley, USA — [8]Abbe Center of Photonics, Friedrich Schiller University, Jena, Jena, Germany

We experimentally investigated the ellipticity dependence of high harmonic generation (HHG) in ZnO as a function of the driving wavelength. The results reveal a different behaviour of the below and above band gap orders.

CH-8: Spectroscopy at the Molecular Level

Chair: Martina Gerken, Christian-Albrechts-Universität, Kiel, Germany

Time: Thursday, 8:30–10:00 Location: TRACK 3

Invited CH-8.1 8:30 TRACK 3

Mid-IR Laser Spectroscopy for Protein Analysis in Aqueous Solution — •Bernhard Lendl, Christopher K. Akhgar, Alicja Dabrowska, Stephan Freitag, Daniel-Ralph Hermann, Georg Ramer, and Andreas Schwaighofer — Institute of Chemical Technologies and Analytics, Technische Universität Wien, Vienna, Austria

Advanced sensing schemes for the analysis of proteins in aqueous solutions using broadly tunable mid-IR external-cavity quantum cascade lasers and their application in life sciences and down stream bio-process monitoring will be discussed.

Oral CH-8.2 9:00 TRACK 3

Mid-infrared gas sensor based on hybrid graphene nanostructures and ultrathin gas-adsorbing polymer — •Nestor Jr. Bareza[1], Bruno Paulillo[1], Kavitha Gopalan[1], Rose Alani[1], and Valerio Pruneri[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain — [2]ICREA-Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys, 23, 08010 , Barcelona, Spain

Here, we present a novel gas sensing scheme in mid-infrared plasmonic detection based on a hybrid combination of graphene nanostructures and gas-adsorbing polymer. The plasmonic resonance is tuned with varying gas concentrations via reversible chemical doping of graphene.

Oral CH-8.3 9:15 TRACK 3

Generating, probing and utilising photo-induced surface oxygen vacancies for trace molecular detection — •Daniel Glass[1,2], Emiliano Cortes[1,3], Raul Quesada-Cabrera[2], Ivan P. Parkin[2], and Stefan A. Maier[1,3] — [1]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom — [2]Department of Chemistry, University College London, London, United Kingdom — [3]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Ludwig-Maximilians-Universität, Muchen, Germany

Defects can strongly affect properties of metal-oxide semiconductors (MOS). Using UVC irradiation, surface vacancies can be induced in MOS. Here, we generate, probe and utilise these defects using Raman spectroscopy for trace molecular detection applications.

Oral CH-8.4 9:30 TRACK 3

Single-molecule Lifetime Imaging of the Local Density of States of Plasmonic and Dielectric Nanostructures — •Valentina Krachmalnicoff[1], R. Margoth Cordova-Castro[1], Bart van Dam[1], Guillaume Blanquer[1], Angelo Gulinatti[2], Giulia Acconcia[2], Yannick De Wilde[1], and Ignacio Izeddin[1] — [1]Institut Langevin - ESPCI Paris, Paris, France — [2]Politecnico di Milano, Milano, Italy

We show that single-molecule localization lifetime microscopy enables Local-Density-of-States measurement close to a plasmonic nanostructure. We demonstrate how to circumvent the plasmonic mirage effect and reconstruct the real position of detected events in three dimensions.

Oral CH-8.5 9:45 TRACK 3

Power-dependent optoplasmonic sensing of single-molecules of enzymes — •Nikita Toropov, Sivaraman Subramanian, and Frank Vollmer — University of Exeter, Exeter, United Kingdom

Optoplasmonic sensors for single-enzyme detection are presented. Dependence of their characteristics (wavelength shifts, broadening of resonances, frequency of binding events) on the power of lasers used to excite resonances is discussed.

CB-6: Integration on Silicon

Chair: Sylvie Menezo, Scintil Photonics, Lyon, France

Time: Thursday, 8:30–10:00 Location: TRACK 4

Invited CB-6.1 8:30 TRACK 4

III-V components on a SOI platform by selective MOVPE without buffer layers for Si photonic integrated circuits — •Key May Lau, Ying Xue, Zhao Yan, Liying Lin, and Yu Han — Hong Kong University of Science & Technology, Clear Water Bay, Hong Kong

III-V micro-lasers and p-i-n photodetectors selectively grown on (001) silicon-on-insulator (SOI) wafers will be described. Lateral growth of III-V from the patterned silicon device layer is dislocation free and can be used for high-performance devices.

Oral CB-6.2 9:00 TRACK 4

InGaAs Nano-ridge Laser Emitting in the Telecom O-band Monolithically Grown on a 300 mm Si Wafer — •Davide Colucci[1,2], Yuting Shi[1], Marina Baryshnikova[2], Yves Mols[2], Muhammad Muneeb[1], Yannick De Koninck[2], Marianna Pantouvaki[2], Joris Van Campenhout[2], Bernardette Kunert[2], and Dries Van Thourhout[1] — [1]Ghent University, Ghent, Belgium — [2]IMEC, Leuven , Belgium

Nano-ridge engineering is a novel approach for the monolithic integration of active components on the Silicon Photonics platform. By demonstrating lasing from a InGaAs nano-ridge we further extend its reach to telecom applications.

Oral CB-6.3 9:15 TRACK 4

Hybrid-integrated extended cavity mode-locked laser using SiN and a generic III/V platform — •Ewoud Vissers[1,2], Stijn Poelman[1,2], Kasper Van Gasse[1,2], and Bart Kuyken[1,2] — [1]Photonics Research Group, Department of Information Technology, Ghent University IMEC, Ghent, Belgium — [2]Center for Nano- and Biophotonics (NB-Photonics), Ghent University, Ghent, Belgium

A hybrid integrated mode-locked laser made using a SiN extended cavity coupled to a generic III/V platform gain section is demonstrated. The RF linewidth is 31 Hz, which is lower than monolithic integrated lasers.

Oral CB-6.4 9:30 TRACK 4

Carrier recombination and temperature-dependence of GaInSb quantum well lasers for silicon photonics applications — •Christopher R Fitch[1], Graham W Read[1], Igor P Marko[1], Dominic A Duffy[1], Laurent Cerutti[2], Jean-Baptiste Rodriguez[2], Eric Tournié[2], and Stephen J Sweeney[1] — [1]Advanced Technology Institute and Department of Physics, University of Surrey, Guildford, United Kingdom — [2]IES, Université de Montpellier, CNRS, Montpellier, France

GaInSb based QW lasers show great potential for on-silicon telecoms applications at 1.55 μm. Low temperature and high hydrostatic pressure techniques show that device performance is limited by carrier leakage with further potential for optimisation.

Oral CB-6.5 9:45 TRACK 4

Dynamics of epitaxial quantum dot laser on silicon subject to chip-scale back-reflection for isolator-free photonics integrated circuits — •Bozhang Dong[1], Jun-Da Chen[2], Justin Norman[3], John Bowers[3], Fan-Yi Lin[2], and Frédéric Grillot[1,4] — [1]Télécom Paris, Palaiseau, France — [2]National Tsing Hua University, Hsinchu, Taiwan — [3]University of California, Santa Barbara, Santa Barbara, USA — [4]University of New-Mexico, Albuquerque, USA

This paper reports on a study on the pulsation dynamics of a 1.3 μm Si-based epitaxial quantum dot laser under strong chip-scale optical feedback. These results are paramount for photonics integration applications.

CA-8: Laser Beam Control

Chair: Takunori Taira, Riken Spring-8, Saitama, Japan

Time: Thursday, 8:30–10:00 Location: TRACK 5

Oral CA-8.1 8:30 TRACK 5

>30 W Vortex Laser Using Vortex Output Coupler — •Jan W T Geberbauer, William R Kerridge-Johns, and Michael J Damzen — Imperial College London, London, United Kingdom

We demonstrate record 31W vortex (LG0±1) laser in CW and up to 500kHz Q-switching (21.1ns, 304μJ), using modified Sagnac interferometric output coupler. The vortex has 96% modal purity with switchable handedness for high-power applications.

Oral CA-8.2 8:45 TRACK 5

Thin-disk multi-pass amplifier delivering azimuthally polarized ultra-short pulses with an average power of 1.74 kW — •André Loescher, Christoph Röcker, Thomas Graf, and Marwan Abdou Ahmed — Institut für Strahlwerkzeuge, University of Stuttgart, Pfaffenwaldring 43, 70569 Stuttgart, Germany

We present our latest achievements on the amplification of ultrafast beams with radial/azimuthal polarization using a thin-disk multipass amplifier. Up to 1.74 kW of average output power could be extracted at 300 kHz repetition rate.

Oral CA-8.3 9:00 TRACK 5

Generation of a Radially Polarised Beam in a Solid-State Laser Using an Intracavity Spatially Variant Waveplate — Thomas Jefferson-Brain, Yuhao Lei, Peter Kazansky, and •William Clarkson — University of Southampton, Southampton, United Kingdom

Direct excitation of a radially polarized mode from an end-pumped Nd:YVO4 laser using an intracavity spatially variant waveplate is reported. The laser yielded a radially polarized output of 1.3W with a 35:1 polarization extinction ratio.

Oral CA-8.4 9:15 TRACK 5

Geometrical Laguerre-Gaussian mode generation from an off-axis pumped Nd:GdVO4 degenerate laser — •Yuanyuan Ma[1], Andrew J Lee[2], Helen M Pask[2], Katsuhiko Miyamoto[1,3], and Takashige Omatsu[1,3] — [1]Chiba University, Chiba, Japan — [2]MQ Photonics Research Centre, Macquarie University, Sydney, Australia — [3]Molecular Chirality Research Center, Chiba, Japan

We have demonstrated the first demonstration of geometrical Laguerre-Gaussian modes laser operation in an annular beam pumped Nd:GdVO4 laser with an off-axis degenerate cavity configuration.

Oral CA-8.5 9:30 TRACK 5

Radially polarized solid-state Raman laser — •Yoshihiro Nishigata[1], Shun Sasaki[1], Katsuhiko Miyamoto[1,2], and Takashige Omatsu[1,2] — [1]Chiba University, Chiba, Japan — [2]Molecular Chirality Research Center, Chiba, Japan

we demonstrate the generation of radially polarized Stokes beams from a solid-state Ba(NO3)2 Raman laser pumped by vector vortex light.In our setup, the 1st, 2nd and 3rd Stokes outputs were ganarated as vector vortex mode.

Oral CA-8.6 9:45 TRACK 5

Experimental and numerical studies of thermal lensing and gain guiding effects in a high-power ZGP OPO — •Marcin Piotrowski[1], Manuel A. Medina[1,2], Martin Schellhorn[1], Christian Mueller[1], Gerhard Spindler[3], and Anne Hildenbrand- Dhollande[1] — [1]French-German Research Institute of Saint-Louis (ISL), Saint-Louis, France — [2]Aix-Marseille University, Marseille, France — [3]Untere Gaisäckerstr, 10, Waldshut-Tiengen, Germany

We investigate the influence of thermal effects on beam quality in high-power OPOs with ZnGeP2 nonlinear optical crystals. Our setup yields more than 30 W of output power in 3-5 μm region with M2>2.

CM-4: Surface Engineering and Functionalisation

Chair: Gert-Willlem Romer, University of Twente, Twente, Netherlands

Time: Thursday, 8:30–10:00 Location: TRACK 6

Invited CM-4.1 8:30 TRACK 6

Optical FIB: Far-fieldfabrication with real-nanoscale spatial resolution in any solid materials — Zhen-Ze Li[1], Lei Wang[1], Qi-Dai Chen[1], and •Hong-Bo Sun[1,2] — [1]Jilin University, Changchun, China — [2]Tsinghua University, Beijing, China

we report an optical far-field-induced near-field breakdown technology as is abbreviated as optical FIB. It in principle can be applied to any solid materials to reach 10-nm spatial resolution in femtosecond laser direct writing.

Oral CM-4.2 9:00 TRACK 6

Observation of Surface Plasmon Polaritons excited on Si Transiently Metalized with An Intense Femtosecond Laser pulse — •Yuto Iida, Mika Tateda, and Godai Miyaji — Tokyo University of Agriculture and Technology, 2-24-16 Nakacho, Kognei, Tokyo 184-8588, Japan

We report on first observation of surface plasmon polaritons excited on Si transiently metalized with an intense femtosecond laser pulse. We found their characteristic properties can be controlled by a time delay of double pulses.

Oral CM-4.3 9:15 TRACK 6

All Optical Holographic Encryption in Reduced Graphene Oxide Based on Laser Direct Writing — •Yibo Dong, Xinyuan Fang, Dajun Lin, Xiaoguang Ma, Xi Chen, and Min Gu — Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China

A holographic encryption method in reduced graphene oxide (rGO) is introduced. Through laser direct writing, the information in the rGO hologram can be transformed, so as to achieve the effect of encryption of important information.

Oral CM-4.4 9:30 TRACK 6

Changes in the Intensity Distribution of the Laser Pulse due to Non-linear Optical Interaction with Air and Its Effects on Laser Ablation — •Ryohei Yamada, Wataru Komatsubara, Haruyuki Sakurai, Kuniaki Konishi, Norikatsu Mio, Junji Yumoto, and Makoto Kuwata-Gonokami — The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 1130033, Japan

We numerically calculated the non-linear propagation of a gaussian beam. We demonstrated the calculated modulation of the laser beam profile due to non-linear optical effects can be useful in predicting its effects on laser ablation.

Oral CM-4.5 9:45 TRACK 6

Azo-polymer spiral surface relief formation with rotating Hermite-Gaussian beams — Arata Tomita[1], •Adam Vallés[1,2], Katsuhiko Miyamoto[1,2], and Takashige Omatsu[1,2] — [1]Graduate School of Science and Engineering, Chiba University, Chiba, Japan — [2]Molecular Chirality Research Center, Chiba University, Chiba, Japan

We present the formation of spiral surface relief of azo-polymers by the irradiation of a rotating Hermite-Gaussian two-petal beam with zero orbital angular momentum.

CK-4: Silicon Photonics

Chair: Max Yann, KTH - Royal Institute of Technology, Stockholm, Sweden

Time: Thursday, 8:30–10:00 Location: TRACK 7

Invited CK-4.1 8:30 TRACK 7

Multimode Silicon Photonics — •Daoxin Dai — Zhejiang University, Hangzhou, China

A review is given for multimode silicon photonics, including multimode silicon photonic devices for MDM systems, silicon photonic devices assisted by higher-order modes, and high-performance photonic devices with the fundamental mode only in multimode waveguides.

Oral CK-4.2 9:00 TRACK 7

InGaAs microdisk cavities monolithically integrated on Si with room temperature emission at 1530 nm — •Preksha Tiwari, Anna Fischer, Svenja Mauthe, Enrico Brugnolotto, Noelia Vico Triviño, Marilyne Sousa, Daniele Caimi, Heinz Schmid, and Kirsten Emilie Moselund — IBM Research Europe, Rueschlikon, Switzerland

We present monolithically integrated InGaAs cavities on Si by template-assisted-selective-epitaxy with evidence of room-temperature lasing at 1530nm, and compare them with previously demonstrated InP-on-Si lasers. This allows for integrated InP/InGaAs QWs for increased carrier confinement.

Oral CK-4.3 9:15 TRACK 7

Heterogeneous Integration of Uni-Travelling-Carrier Photodiodes using Micro-Transfer-Printing on a Silicon-Nitride Platform — •Dennis Maes[1,2], Gunther Roelkens[1], Mohammed Zaknoune[2], Camiel Op de Beeck[1], Stijn Poelman[1], Maximilien Billet[1], Muhammad Muneeb[1], Sam Lemey[1], Emilien Peytavit[2], and Bart Kuyken[1] — [1]Department of Information Technology (INTEC), Ghent University — imec, Ghent, Belgium — [2]Institute of Electronics, Microelectronics and Nanotechnology (IEMN), Université de Lille, Lille, France

Uni-travelling-carrier photodiodes (UTC PDs) are heterogeneously integrated on a silicon-nitride (SiN) platform using micro-transfer-printing (μTP). These waveguide-coupled photodiodes feature a high responsivity for a very small footprint and promise high-speed operation into the THz domain.

Oral CK-4.4 9:30 TRACK 7

Exploration of the optical behavior of phase-change materials integrated in silicon photonics platforms — •Clément Zrounba[1], Sébastien Cueff[1], Sébastien Le Beux[2], Ian O'Connor[1], and Fabio Pavanello[1] — [1]Lyon Institute of Nanotechnologies, Écully, France — [2]Concordia University, Montréal, Canada

We demonstrate that, contrary to common assumptions, the absorption profile within waveguide-integrated phase-change material devices may not be exponential and that a non-negligible power fraction may be lost rather than absorbed.

Oral CK-4.5 9:45 TRACK 7

Cavity modulator assisted nonreciprocal light transmission on Silicon — •Awanish Pandey[1], Sarvagya Dwivedi[2], and Dries Van Thourhout[1] — [1]Ghent University-imec, Ghent, Belgium — [2]imec, Leuven, Belgium

We experimentally demonstrate optical non-reciprocal transmission in a compact cascaded microcavity modulator, achieving a 16dB extinction ratio between forward and backward propagating waves. Variation as a function of drive power is also reported.

EE-2: HHG in Condensed Matter

Chair: Paolo Carpeggiani, Technische Universität Wien, Vienna, Austria

Time: Thursday, 8:30–10:00 Location: TRACK 8

Oral EE-2.1 8:30 TRACK 8

High-harmonic generation in monolayer WSe_2 under photo-carrier doping — •Kohei Nagai[1], Kento Uchida[1], Satoshi Kusaba[1], Takahiko Endo[2], Yasumitsu Miyata[2], and Koichiro Tanaka[1,3] — [1] Department of Physics, Kyoto University, Sakyo-ku, Kyoto, Japan — [2] Department of Physics, Tokyo Metropolitan University, Hachioji, Tokyo, Japan — [3]Institute for Integrated Cell-Material Sciences, Kyoto University, Sakyo-ku, Kyoto, Japan

We experimentally confirmed the main high-harmonic generation mechanism in monolayer WSe_2 by using photo-carrier doping effect. The ratio of the interband to intraband contribution is suggested to switch around the absorption edge of the monolayer.

Oral EE-2.2 8:45 TRACK 8

Low-Divergence, Soft X-Ray Harmonic Combs with Tunable Line Spacing from Necklace-Structured Driving Lasers — Laura Rego[1], Nathan J. Brooks[2], Quynh L. D. Nguyen[2], Julio San Román[1], Iona Binnie[2], Luis Plaja[1], Henry C. Kapteyn[2], Margaret M. Murnane[2], and •Carlos Hernández-García[1] — [1]Universidad de Salamanca, Salamanca, Spain — [2]University of Colorado, Boulder, USA

Necklace-structured high-harmonic generation is theoretically and experimentally implemented to produce high-frequency harmonic combs with tunable frequency content, up to the soft x-rays. Remarkably, the emitted harmonics present extremely low divergence, which further decreases with frequency

Invited EE-2.3 9:00 TRACK 8

High energy high harmonic generation (HHG) in liquids — Sebastian Jarosch, Oliver Alexander, Timur Avni, Jonathan Barnard, Clement Ferchaud, Esben Larson, •Mary Matthews, and Jon Marangos — Imperial College London, London, United Kingdom

We present carrier-envelope-phase (CEP) dependent extreme-ultraviolet (XUV) harmonic emission from isopropanol which extends to 50eV with emission features supporting a recombination mechanism. The emission is damped by scattering of the driven electron from neighbouring molecules.

Oral EE-2.4 9:30 TRACK 8

Transition dipole moment structure revealed by high harmonic generation spectroscopy in thin layer black phosphorus — •Kento Uchida[1], Vivek Pareek[2], Kohei Nagai[1], Keshav Dani[2], and Koichiro Tanaka[1] — [1]Kyoto University, Kyoto, Japan — [2]Okinawa Institute of Science and Technology Graduate University, Okinawa, Japan

We observed high harmonic generation in thin layer black phosphorus. By measuring crystal orientation dependence with the resonant excitation condition, we succeeded in reconstructing the transition dipole moment structure in two-dimensional momentum space.

Oral EE-2.5 9:45 TRACK 8

Ultrafast Single-Photon Detection based on Optical Kerr Gates — •Assegid M. Flatae[1], Abdul-Hamid Fattah[1], Amr Farrag[1], and Mario Agio[1,2] — [1]University of Siegen, Laboratory of Nano-Optics and Cμ, Siegen, Germany — [2]National Institute of Optics (INO), National Research Council (CNR), Florence, Italy

Ultrafast single-photon detection at gigahertz rates based on optical Kerr gates under focused illumination is theoretically demonstrated. The technique provides sub-picosecond time resolution, while keeping a gate efficiency at around 85%.

EF-5: Micro-combs in Microresonators

Chair: Miro Erkintalo, The Auckland University, Auckland, Australia

Time: Thursday, 8:30–10:00 Location: TRACK 9

Oral EF-5.1 8:30 TRACK 9

Bidirectional initiation of dissipative solitons in photonic molecules — •Óskar B. Helgason, Zhichao Ye, Jochen Schröder, and Victor Torres-Company — Chalmers University of Technology, Gothenburg, Sweden

We demonstrate the initiation of dissipative solitons in linearly coupled microresonators using a continuous wave laser by tuning into resonance from either the blue side or the red side.

Oral EF-5.2 8:45 TRACK 9

A Kerr Oscillator based on Counterpropagating Light in a Microresonator — •Michael T. M. Woodley[1,2,3], Lewis Hill[1,4], Leonardo Del Bino[1,2,5], Gian-Luca Oppo[4], and Pascal Del'Haye[5,6] — [1]National Physical Laboratory, Teddington, United Kingdom — [2]SUPA and Department of Physics, Heriot-Watt University, Edinburgh, United Kingdom — [3]Department of Physics, Blackett Laboratory, Imperial College London, London, United Kingdom — [4]SUPA and Department of Physics, University of Strathclyde, Glasgow, United Kingdom — [5]Max Planck Institute for the Science of Light, Erlangen, Germany — [6]Department of Physics, Friedrich Alexander University Erlangen-Nuremberg, Erlangen, Germany

We present experimental and theoretical self-switching behaviours in counter-propagating light in a Kerr microresonator, due to symmetry restoration on average. These results pave the way for chip-integrated all-optical generation of waveforms, encoding, and cryptographic applications.

Invited EF-5.3 9:00 TRACK 9

Lithium-Niobate-Based Frequency Combs — •Mengjie Yu — John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, USA

We discuss the recent development of electro-optic and Kerr frequency combs, powered by integrated lithium niobate photonics. Specifically, I will cover the generation, control and dynamics of microcombs in modulator-based, single- and coupled-cavity based geometries.

Oral EF-5.4 9:30 TRACK 9

Features of spontaneous symmetry breaking of dissipative cavity solitons in passive Kerr resonators — •Gang Xu[1], Alexander Nielsen[1], Bruno Garbin[1,2], Lewis Hill[3], Gian-Luca Oppo[3], Julien Fatome[1,4], Stuart Murdoch[1], Stéphane Coen[1], and Miro Erkintalo[1] — [1]The University of Auckland, Auckland, New Zealand — [2]Université Paris-Saclay, Palaiseau, France — [3]University of Strathclyde, Glasgow, United Kingdom — [4]Laboratoire Interdisciplinaire Carnot de Bourgogne, Dijon, France

We report on theoretical and experimental investigations of spontaneous polarization symmetry breaking of temporal cavity solitons. Our findings represent the first observation of these dynamics for dissipative solitons in any two-component physical system.

Oral EF-5.5 9:45 TRACK 9

Self-Stabilized Soliton Generation in a Microresonator Through Mode-Pulled Brillouin Lasing — •In Hwan Do[1], Dohyeong Kim[2], Dongin Jeong[1], Daewon Suk[1], Dohyeon Kwon[3], Jungwon Kim[3], Jae Hoon Lee[4], and Hansuek Lee[1,2] — [1]Graduated School of Nanoscience and Technology, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea — [2]Department of Physics, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea — [3]School of Mechanical and Aerospace Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea — [4]Korea Research Institute of Standards and Science (KRISS), Daejeon, South Korea

Here generating and self-stabilizing mechanism of Brillouin assisted soliton and its long-term stability is illustrated. The single-soliton pulses are sustained over several days with a phase noise of –137dBc/Hz at 100kHz without any feedback systems.

EH-4: Plasmonics for Enhanced Light-Matter Interaction

Chair: Andrei Lavrinenko, Technical University of Denmark, Copenhagen, Denmark

Time: Thursday, 8:30–10:00 Location: TRACK 10

Oral EH-4.1 8:30 TRACK 10

Material-Insensitive Optical Response From Disordered Plasmonic Nanostructures — •Changxu Liu[1], Peng Mao[2], Yubiao Niu[3], Yuyuan Qin[4], Fengqi Song[4], Min Han[4], Richard Palmer[3], Shuang Zhang[2,5,6], and Stefan Maier[1,7] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig Maximilians University of Munich, Munich, Germany — [2]School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom — [3]College of Engineering, Bay Campus, Swansea University, Swansea, United Kingdom — [4]College of Engineering and Applied Sciences, Nanjing University, 210093 Nanjing, China, Nanjing, China — [5]Department of Physics, University of Hong Kong, Hong Kong, China, Hong Kong, China — [6]Department of Electrical & Electronic Engineering, University of Hong Kong, Hong Kong, China, Hong Kong, China — [7]Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom, London, United Kingdom

Due to unique dielectric functions, the optical response of materials varies. We demonstrate that the disorder dramatically reduces the material dependence in optical response, produce identical colour for plasmonic nanostructures composed of different metals.

Oral EH-4.2 8:45 TRACK 10

Plasmon-Induced Trap State Emission Excited by Two-Photon Absorption — •Oluwafemi Ojambati — Cavendish Laboratory, Department of Physics, JJ Thompson Avenue, University of Cambridge, Cambridge, United Kingdom

We demonstrate that a plasmonic nanocavity enhances two-photon excited photoluminescence by 106 - 108 and this efficient nonlinear interaction elicits new trap states emission in single quantum dots while suppressing band-edge emission.

Oral EH-4.3 9:00 TRACK 10
Energy-resolved few-cycle nanoplasmonic photoemission dynamics — •Péter Sándor[1], Béla Lovász[1], Zsuzsanna Pápa[1], Balázs Bánhegyi[1], Péter Rácz[1], Christine Prietl[2], Joachim R. Krenn[2], and Péter Dombi[1] — [1]Wigner Research Centre for Physics, Budapest, Hungary — [2]Institut für Physik, Karl-Franzens-Universität, Graz, Austria
Energy-selective and time-resolved photoemission from nanoparticles of various geometries enables localized characterization of few-cycle plasmon transients.

Oral EH-4.4 9:15 TRACK 10
Mechanisms of Spontaneous Emission Rate Enhancement in Metal-Insulator-Metal Cavities — •Dipa Ghindani, Alireza Rahimi Rashed, and Humeyra Caglayan — Tampere University, Tampere, Finland
Tailoring the emission and radiation properties of an emitter is of fundamental importance for emerging photonic applications. We demonstrate 260-folds of photoluminescence enhancement along with tunable lifetime of fluorescent dye by integrating with MIM nanocavity

Oral EH-4.5 9:30 TRACK 10
Near-field and far-field studies of single and double sub-wavelength sized infrared plasmonic nano-antennas — Loubnan Abou Hamdan[1], Loubnan Abou Hamdan[2], Valentina Krachmalnicoff[1], Riad Haidar[2], Patrick Bouchon[2], and •Yannick De Wilde[1] — [1]ESPCI Paris, Université PSL, CNRS, Institut Langevin, Paris, France — [2]DOTA, ONERA, Université Paris-Saclay, Palaiseau, France
The thermal radiation from single or double metal-insulator-metal nanoantennas is measured. The fundamental spatial mode can be excited at different wavelengths on single MIMs, and we observe the simultaneous thermal excitation of various hybrid modes on double MIMs.

Oral EH-4.6 9:45 TRACK 10
Sensitive Determination of the Size and Dielectric Function of Plasmonic Nanoparticles using the Extinction-to-Absorption Ratio — •Aleksa Djorović[1], Steven J. Oldenburg[2], Johan Grand[1,3], and Eric C. Le Ru[1] — [1]The MacDiarmid Institute for Advanced Materials and Nanotechnology, School of Chemical and Physical Sciences, Victoria University of Wellington, Wellington, New Zealand — [2]nanoComposix, San Diego, USA — [3]Université de Paris, Paris, France
We propose and demonstrate a method to significantly improve the accuracy of routine plasmonic nanoparticle size characterization by measuring the absorption-to-extinction ratio compared to the standard and widespread UV-Vis extinction method.

CE-8: Materials and Fabrication of Specialty Optical Fibers

Chair: Natalie Wheeler, University of Southampton, Southampton, United Kingdom

Time: Thursday, 8:30–10:00 Location: TRACK 11

Oral CE-8.1 8:30 TRACK 11
Thermal Stability of Type II Modifications by IR Femtosecond Laser in Highly-Doped Aluminosilicate Glass Optical Fibers — •Yitao Wang[1], Maxime Cavillon[1], John Ballato[2], Tino Elsmann[3], Manfred Rothhardt[3], Bertrand Poumellec[1], and Matthieu Lancry[1] — [1]Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), Université Paris Saclay, C.N.R.S, Orsay, France — [2]Center of Optical Materials Science and Engineering Technologies (COMSET), Clemson University, Clemson, USA — [3]Leibniz Institute of Photonic Technology, Albert-Einstein-Str, Jena, Germany
Type II modifications are inscribed into aluminosilicate optical fibers using a femtosecond laser, and their thermal stability is investigated through isochronal annealing experiments. Results suggest improved thermal stability relative to conventional silica fibers.

Oral CE-8.2 8:45 TRACK 11
Silicate glass composite fibers with nanodiamonds-embedded core — •Adam Filipkowski[1,2], Mariusz Mrózek[3], Grzegorz Stępniewski[1,2], Mateusz Ficek[4], Tanvi Karpate[1], Maciej Głowacki[4], Adam Wojciechowski[3], Mariusz Klimczak[1], Robert Bogdanowicz[4], Wojciech Gawlik[3], and Ryszard Buczyński[1,2] — [1]Faculty of Physics, University of Warsaw, Warsaw, Poland — [2]Łukasiewicz Research Network - Institute of Microelectronics and Photonics, Warsaw, Poland — [3]Institute of Physics, Jagiellonian University, Kraków, Poland — [4]Faculty of Electronics, Telecommunications and Informatics, Gdańsk University of Technology, Gdańsk, Poland
We report nanodiamond-embedded core optical fibers drawn from silicate glass canes and tubes. Two techniques of ND nanofilm deposition are compared and presence of NDs in a free-form core is confirmed with photoluminescence imaging.

Oral CE-8.3 9:00 TRACK 11
High-temperature polymer multimaterial fibers — •Parisah Akrami[1], Abubakar I. Adamu[1], Getinet Woyessa[1], Henrik K. Rasmussen[2,3], Ole Bang[1,4], and Christos Markos[1] — [1]DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark — [2]DTU Mekanik, Department of Mechanical Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark — [3]University College Absalon, Centre for Engineering and Science, 4400 Kalundborg, Denmark — [4]SHUTE Sensing Solutions A/S, 3490 Kvistgård, Denmark
The fabrication of a heat-resistant multimaterial polymer optical fiber withstanding temperatures up to 180 degrees consisting of two different grades of the cycloolefin polymer Zeonex and high-performance thermoplastic PSU developed using a co-extrusion method

Oral CE-8.4 9:15 TRACK 11
Nanocrystal-doped fibres using glass powder doping – towards new laser transitions in fibre lasers — •Matthias Jäger[1], Martin Lorenz[1], Robert Müller[1], Jens Kobelke[1], Katrin Wondraczek[1], Rafael Valiente[2], Andrea Diego-Rucabado[2], Israel Cano[2], Fernando Aguado[2], Jürgen Gluch[3], Isabel Kinski[4], Dominik Dorosz[5], and Marian Kochanowicz[6] — [1]Leibniz Institute of Photonic Technology, Jena, Germany — [2]University of Cantabria, Santander, Spain — [3]Fraunhofer Institute of Ceramic Technologies and Systems, Dresden, Germany — [4]Fraunhofer Institute of Ceramic Technologies and Systems, Hermsdorf, Germany — [5]AGH University of Science and Technology, Krakow, Poland — [6]Bialystok University of Technology, Bialystok, Poland
We investigate the introduction of laser-active nanocrystals (Ti:sapphire and Pr:yttria) into optical fibres using glass powder doping. The survival of crystalline material during fibre drawing is confirmed by fluorescence and nanostructure analysis.

Invited CE-8.5 9:30 TRACK 11
Novel concepts for fabrication and applications of fibers using high-index heavy metal oxide glasses — •Heike Ebendorff-Heidepriem — Institute for Photonics and Advanced Sensing, The University of Adelaide, Adelaide, Australia — ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP), Adelaide, Australia
This talk will review our recent advances in the fabrication of heavy metal oxide glass fibers and waveguides and our recent research on using these fibers to demonstrate new lasing, imaging, sensing and mode propagation concepts.

EG-5: Light-driven Phenomena at the Nanoscale

Chair: Niek van Hulst, ICFO - The Institute of Photonic Sciences, Castelldefels, Spain

Time: Thursday, 8:30–10:00 Location: TRACK 12

Invited EG-5.1 8:30 TRACK 12

Atomic-scale, light-driven dynamics of plasmonic nanojunctions — Wen Chen[1], Philippe Roelli[1], Aqeel Ahmed[1], Sachin Verlekar[1], Huatian Hu[2], Karla Banjac[1], Magali Lingenfelder[1], Giulia Tagliabue[1], and •Christophe Galland[1] — [1]Ecole Polytechnique Fédérale Lausanne (EPFL), Lausanne, Switzerland — [2]The Institute for Advanced Studies, Wuhan University, Wuhan, China

We report the observation of quantum-confined emitters forming inside gold plasmonic nanojunctions under green light excitation. We propose that non-thermal photo-excited carriers are causing atomic reconfiguration near the gold surface.

Oral EG-5.2 9:00 TRACK 12

Optical trapping and self-assembly of particle clusters using on-chip plasmonic nanotweezers — Christophe Pin[1,2,3], Giovanni Magno[4,5], Aurore Ecarnot[4], Emmanuel Picard[2], Emmanuel Hadji[2], Vy Yam[4], Frédérique de Fornel[1], Béatrice Dagens[4], and •Benoît Cluzel[1] — [1]ICB, Université Bourgogne Franche-Comté, Dijon, France — [2]CEA Grenoble, Université Grenoble Alpes, Grenoble, France — [3]RIES, Hokkaido University, Sapporo, Japan — [4]C2N, Université Paris-Saclay, Palaiseau, France — [5]DEI, Politecnico di Bari, Bari, Italy

Single beads and self-assembled bead clusters are trapped using a periodic chain of gold nanorods on a photonic silicon waveguide. The trapping efficiency, orientation, compactness, and stability of the observed cluster configurations are statistically analysed.

Oral EG-5.3 9:15 TRACK 12

Optical Suppression of Energy Barriers in Single Molecule-Metal Binding — •Qianqi Lin[1], Shu Hu[1], Tamás Földes[2,3], Junyang Huang[1], Demelza Wright[1], Jack Griffiths[1], Bart de Nijs[1], Edina Rosta[2,3], and Jeremy J. Baumberg[2,3] — [1]Nanophotonics Centre, Department of Physics, Cavendish Laboratory, University of Cambridge, Cambridge, CB3 0HE, United Kingdom — [2]Department of Chemistry, King's College London, 7 Trinity Street, London, SE1 1DB, United Kingdom — [3]Department of Physics and Astronomy, University College London, London, WC1E 6BT, United Kingdom

Molecule-metal transient bonds underpin catalysis. Here we confine light to atomic scales for single-molecule probes utilising surface-enhanced Raman scattering. Our analysis of >800,000 spectra shows light-induced local polarization reduces energy barriers for molecule-metal bindings.

Oral EG-5.4 9:30 TRACK 12

Thermal effects - an alternative mechanism for plasmon-assisted photocatalysis — Yonatan Dubi[1], Joshua H. Baraban[1], •Ieng Wai Un[2], and Yonatan Sivan[2] — [1]Department of Chemistry, Ben Gurion University, Beer Sheva, Israel — [2]School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

We show that the claims in some of the most famous papers on the topic of plasmon-assisted photocatalysis are extremely unlikely to be correct and that the faster reactions are likely the result of heating.

Oral EG-5.5 9:45 TRACK 12

Super-Resolution Mapping of Light-Driven Reactions on Metal Nanostructures — •Simone Ezendam[1], Julian Gargiulo[1], Ana Sousa-Castillo[1,2], Lin Nan[1], Maximilian Maier[1], Stefan A. Maier[1,3], and Emiliano Cortés[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitut, Fakultät für Physik, Ludwig Maximilians-Universität München, München, Germany — [2]CINBIO, Universidade de Vigo, Vigo, Spain — [3]Experimental Solid State Physics Group, Department of Physics, Imperial College London, London, United Kingdom

In this work, we investigate how both the wavelength and polarization of light allow the selection of different mechanisms for catalysis by mapping the reaction sites on individual nanoantennas.

CA-9: Laser Materials

Chair: Thomas Mocek, HiLASE Center of Excellence, Dolní Břežany, Czech Republic

Time: Thursday, 11:00–12:30 Location: TRACK 1

Oral CA-9.1 11:00 TRACK 1

OFZ-growth of Yb:(Sc,Y)$_2$O$_3$ for 1 μm lasers — •Anastasia Uvarova, Sascha Kalusniak, Christo Guguschev, and Christian Kränkel — Leibniz-Institut für Kristallzüchtung (IKZ), Berlin, Germany

We report on the growth of Yb:(Sc,Y)$_2$O$_3$ by the optical floating zone method. The up to 8 cm long, few-mm thick single crystals exhibit broad spectra and a relatively high thermal conductivity.

Oral CA-9.2 11:15 TRACK 1

Sub-50-fs Kerr-lens mode-locked Yb:GdYCOB laser — Huangjun Zeng[1], Zhanglang Lin[1], Haifeng Lin[1], Lizhen Zhang[1], Zhoubin Lin[1], Ge Zhang[1], Valentin Petrov[2], Li Wang[2], and •Weidong Chen[1] — [1]Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, China — [2]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

We report on the first sub-50-fs Kerr-lens mode-locked solid-state laser using mixed Yb:GdYCOB crystal as a gain medium, to generate pulses as short as 43 fs at 1036.5 nm with a repetition rate of ~70 MHz.

Oral CA-9.3 11:30 TRACK 1

Nanosecond Compact Eye-Safe Erbium Lasers with 190 kW Peak Power — Vladimir Vitkin[1], Anton Polishchuk[1], Daria Zavirukha[1], Valeria Kurikova[1], Olga Dymshits[2], Irina Alekseeva[2], Svetlana Zapalova[2], Aleksander Zhilin[2], and •Pavel Loiko[3] — [1]ITMO University, Saint Petersburg, Russia — [2]NITIOM Vavilov State Optical Institute, Saint Petersburg, Russia — [3]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France

Compact diode-side-pumped eye-safe Er,Yb:glass laser is passively Q-switched by transparent glass-ceramics containing Co:Mg(Al,Ga)2O4 and γ-Co:Ga2O3 spinel nanophases. The laser generates 1.39 mJ/7.2 ns pulses (energy/duration) at 1535 nm in the fundamental transverse mode.

Oral CA-9.4 11:45 TRACK 1

Growth, Spectroscopy and Laser Operation of Tm3+, Li+-Codoped Ca3Ta1.5Ga3.5O12-Type Disordered Garnet Crystal — •Adrian Alles[1,2], Zhongben Pan[3,4], Josep M. Serres[1,2], Pavel Loiko[5], Kaiyang Tang[3], Shawuti Yingming[3], Yicheng Wang[4], Yongguang Zhao[4,6], Elena Dunina[7], Alexey Kornienko[7], Patrice Camy[5], Weidong Chen[4,8], Li Wang[4], Uwe Griebner[4], Valentin Petrov[4], Rosa M. Solé[1], Magdalena Aguiló[1], Francesc Díaz[1], and Xavier Mateos[1,9] — [1]Universitat Rovira i Virgili (URV), Tarragona, Spain — [2]Eurecat, Centre Tecnològic de Catalunya, Advanced Manufacturing Systems Unit (AMS), Tarragona, Spain — [3]Institute of Chemical Materials, Mianyang, China — [4]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [5]CIMAP, UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France — [6]Jiangsu Key Laboratory of Advanced Laser Materials and Devices, Xuzhou, China — [7]Vitebsk State Technological University, Vitebsk, Belarus — [8]Key Laboratory of Optoelectronic Materials Chemistry and Physics, Fujian, China — [9]Serra Húnter Fellow, Tarragona, Spain

Tm3+,Li+-codoped Ca3Ta1.5Ga3.5O12-type (Tm:CLTGG) disordered garnet is grown by the Czochralski method. Its structure, spectroscopic and laser properties are studied. A diode-pumped Tm:CLTGG laser generates 1.08 W at ~2.0 μm with a slope efficiency of 23.8%.

Oral CA-9.5 12:00 TRACK 1

Faraday Isolator with Composite Magnetooptical Elements — •Aleksey Starobor[1], Ivan Kuznetsov[1], Oleg Palashov[1], Aleksey Pestov[2], and Nikolay Chkhalo[2] — [1]Federal Research Center Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia — [2]Institute for Physics of Microstructures of the Russian Academy of Sciences, Nizhny Novgorod, Russia

Composite terbium gallium garnet/sapphire elements for Faraday isolators were produced by the SADB method. The resulting structures provided 34dB isolation ratio at laser power of 700W; the maximum operating power estimated to be over 2kW.

Oral CA-9.6 12:15 TRACK 1

Thermal Expansion Coefficient of Garnet and Bixbyite Laser Crystals Evaluated by First Principles Calculation — •Yoichi Sato[1,2] and Takunori Taira[1,2] — [1]RIKEN SPring-8 Center, RIKEN, Sayo-gun, Japan — [2]Institute for Molecular Science, Okazaki, Japan

We evaluated thermal expansion coefficients for laser host crystals by first principles calculation, of which for Y3Al5O12, Lu3Al5O12, Y2O3, Sc2O3, and Lu2O3 were estimated to 7.26, 7.52, 7.95,7.18, and 6.95×10-6 K-1 at 300 K, respectively.

CB-7: Short Wavelength Sources and Applications

Chair: Boon Ooi, KAUST, Djeddah, Saudi Arabia

Time: Thursday, 11:00–12:30 Location: TRACK 2

Keynote CB-7.1 11:00 TRACK 2

Advances towards deep-UV light emitting diode technologies — •Michael Kneissl[1,2], Giulia Cardinali[1], Johannes Enslin[1], Martin Guttmann[1], Christian Kuhn[1], Frank Mehnke[1], Marcel Schilling[1], Luca Sulmoni[1], Norman Susilo[1], Tim Wernicke[1], Hyun Kyong Cho[2], Johannes Glaab[2], Jan Ruschel[2], Sylvia Hagedorn[2], Neysha Lobo-Ploch[2], Carsten Netzel[2], Jens Rass[2], Sebastian Walde[2], Ulrike Winterwerber[2], Sven Einfeldt[2], and Markus Weyers[2] — [1]Institute of Solid State Physics, TU Berlin, Berlin, Germany — [2]Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany

Recent advances in development of AlGaN-based deep UV-LED technologies and applications will be discussed including the performance characteristics of UV emitters in the 265 nm and 230 nm wavelength bands.

Oral CB-7.2 11:45 TRACK 2

Photonic VCSEL-neuron for spike-rate representation of digital image data — •Matěj Hejda, Joshua Robertson, Julián Bueno, Juan Arturo Alanis, and Antonio Hurtado — Institute of Photonics, SUPA Department of Physics, University of Strathclyde, Glasgow, United Kingdom

We demonstrate high-speed image data encoding with a VCSEL-based spiking photonic neuron. Pixels from the RGB channels of colour images are rate-coded into optical spike trains, showing very good agreement between reconstructed and source images.

Oral CB-7.3 12:00 TRACK 2

How a ridge polariton laser is different from a standard ridge laser — •Thierry Guillet[1], Hassen Souissi[1], Maksym Gromovyi[4], Thiaka Gueye[1], Christelle Brimont[1], Laetitia Doyennette[1], Geoffrey Kreyder[2], Francois Reveret[2], Pierre Disseix[2], Francois Medard[2], Joel Leymarie[2], Guillaume Malpuech[2], Dmitry Solnyshkov[2], Blandine Alloing[3], Stephanie Rennesson[3], Fabrice Semond[3], Jesus Zuniga-Perez[3], Edmond Cambril[4], and Sophie Bouchoule[4] — [1]Laboratoire Charles Coulomb (L2C), Université de Montpellier, CNRS, Montpellier, France — [2]Université Clermont Auvergne, CNRS, SIGMA Clermont, Institut Pascal, Clermont-Ferrand, France — [3]UCA, CRHEA-CNRS, Rue Bernard Gregory, Valbonne, France — [4]Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, Palaiseau, France

We show how a ridge waveguide polariton laser is not governed by Bernard-Durrafourg condition (population inversion) as in standard ridge interband lasers. We discuss the case of GaN ridge polariton lasers operated up to 200K.

Oral CB-7.4 12:15 TRACK 2

Room temperature operation of SiC-cooled and AlGaInP-based, red-emitting membrane external-cavity surface-emitting lasers (MECSELs) — •Philipp Tatar-Mathes, Hoy-My Phung, Aaron Rogers, Antti Tukiainen, Patrik Rajala, Sanna Ranta, Hermann Kahle, and Mircea Guina — Optoelectronics Research Centre (ORC), Physics Unit / Photonics, Faculty of Engineering and Natural Sciences, Tampere University, Tampere, Finland

MECSELS are laser-active gain membranes sandwiched between two transparent heat spreaders in transmission mode. We present the first 680 nm SiC-MECSEL operating at room temperature with an observed output power of above 480 mW.

CC-5: THz Imaging

Chair: Miriam Vitiello, CNR, Pisa, Italy

Time: Thursday, 11:00–12:30 Location: TRACK 3

Invited CC-5.1 11:00 TRACK 3

Real-time terahertz imaging with a single-pixel detector — Rayko Stantchev[1], Kaidi Li[1], and •Emma Pickwell-MacPherson[1,2] — [1]The Chinese university of Hong Kong, Hong Kong, China — [2]Warwick University, Coventry, United Kingdom

THz imaging is getting faster! We are getting very close to video rate THz imaging. Here I will explain the advances made recently by my group relating to compressed sensing approaches and spatial modulator design.

Oral CC-5.2 11:30 TRACK 3

High-resolution terahertz single-pixel imaging for 2D spectral analysis — •Adam Vallés[1,2], Seigo Ohno[3], Takashige Omatsu[1,2], and Katsuhiko Miyamoto[1,2] — [1]Graduate School of Science and Engineering, Chiba University, Chiba, Japan — [2]Molecular Chirality Research Center, Chiba University, Chiba, Japan — [3]Graduate School of Science, Tohoku University, Sendai, Japan

We present a single-pixel imaging system for the entire high-frequency terahertz region, producing high pixel resolution images (1200 x 1200 pixels). We employ a metallic ring with directly perforated patterns and a subpixel digitization technique.

Oral CC-5.3 11:45 TRACK 3

Time-resolved, nonlinear control of terahertz waves in random media for spatiotemporal focusing — •Vittorio Cecconi, Vivek Kumar, Alessia Pasquazi, Juan S. Totero Gongora, and Marco Peccianti — University of Sussex, Brighton, Sussex, United Kingdom

We theoretically investigate spatiotemporal refocusing of broadband THz waves in random media. Our nonlinear wavefront shaping methodology allows controlling the temporal and spatial properties of the THz pulse by acting on the spatial degrees-of-freedom.

Oral CC-5.4 12:00 TRACK 3

Terahertz Optical Machine Learning — •Benedikt Limbacher[1,2], Sebastian Schönhuber[1,2], Moritz Wenclawiak[1,2], Martin A. Kainz[1,2], Aaron M. Andrews[2,3], Gottfried Strasser[2,3], Juraj Darmo[1,2], and Karl Unterrainer[1,2] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Center for Micro-and Nanostructures, TU Wien, Vienna, Austria — [3]Institute for Solid-State Electronics, TU Wien, Vienna, Austria

We present an optical implementation of machine learning in the terahertz domain, where we perform both the training as well as the predictions optically. We show that the system is accurate and noise resistant.

Oral CC-5.5 12:15 TRACK 3

Dielectric phase hologram for frequency-diverse millimeter and submillimeter-wave imaging applications — •Samu-Ville Pälli, Aleksi Tamminen, Juha Ala-Laurinaho, and Zachary Taylor — Department of Electronics and Nanoengineering, Millilab, Aalto University, Espoo, Finland

We present a dispersive, dielectric phase hologram capable of frequency-diverse beamforming in imaging applications at 220-330 GHz. Measured field patterns are computationally backpropagated onto hologram surface to compare the resulting phase modulation to simulations.

CD-7: Tunable Light Sources

Chair: Cornelia Denz, University of Münster, Münster, Germany

Time: Thursday, 11:00–12:30 Location: TRACK 4

Oral CD-7.1 11:00 TRACK 4

Proton radiation hardness of periodically poled Rb: KTiOPO4 for high-energy OPA at 2 μm — •Kjell Martin Mølster[1], Sophie Duzellier[2], Andrius Zukauskas[1], Myriam Raybaut[3], and Valdas Pasiskevicius[1] — [1]Department of Applied Physics, Royal Institute of Technology, KTH, Stockholm, Sweden — [2]DPHY, ONERA, Université Paris-Saclay, Palaiseau, France — [3]ONERA/DPHY, Université de Toulouse, Toulouse, France

Linear and nonlinear properties of Rb: PPKTP subjected to proton irradiation equivalent to 5-year Low-Earth-orbit mission have been investigated. Together with gamma irradiation tests, this work validates the suitability of this material for space-borne platforms.

Oral CD-7.2 11:15 TRACK 4

Parametrically amplified backward-wave optical parametric oscillator for generation of narrowband high-energy ns-pulses in the mid-infrared — •Kjell Martin Mølster[1], Jacopo Negri Rubens[2], Andrius Zukauskas[1], Carlota Canalias[1], Fredrik Laurell[1], and Valdas Pasiskevicius[1] — [1]Department of Applied Physics, Royal Institute of Technology, KTH, Stockholm, Sweden — [2]Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Pavia, Italy

We demonstrate a backward-wave optical parametric oscillator parametric power amplifier using PPRKTP. Single longitudinal mode pumping and amplifier seeding with the signal wave enables precision-tuned transform-limited nanosecond pulse generation with output energy scalability.

Oral CD-7.3 11:30 TRACK 4

Tunable multi-structured-beam optical parametric oscillator — •Varun Sharma[1,2], S. Chaitanya Kumar[3], G. K. Samanta[1], and M. Ebrahim-Zadeh[3,4] — [1]Photonic Sciences Lab., Physical Research Laboratory, Navarangpura, Ahmedabad, India — [2]Indian Institute of Technology-Gandhinagar, Ahmedabad, India — [3]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels , Barcelona, Spain — [4]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, 08010, Barcelona, Spain

We report a coherent light source simultaneously producing tunable beam of various spatial structures. Based on a picosecond optical parametric oscillator, the source generates Gaussian, vortex, Airy, and vortex Airy beams tunable across 1457-1680 nm.

Oral CD-7.4 11:45 TRACK 4

Domain dynamics in sub-μm Periodically Poled Rb-doped KTiOPO4 via coercive field engineering — •Patrick Mutter, Andrius Zukauskas , Valdas Pasiskevicius, and Carlota Canalias — Royal Institute of Technology, Stockholm, Sweden, Stockholm, Sweden

We demonstrate reliable periodic poling with periods down to 430 nm in 1mm-thick RKTP crystals by forming a coercive-field grating via ion exchange. The interplay between ion-exchange and domain dynamics is studied.

Oral CD-7.5 12:00 TRACK 4

Widely Tunable Polarization Modulation Instability in D2O-Filled Microstructured Optical Fiber — •Abraham Loredo-Trejo[1,2], Antonio Díez[1,2], Enrique Silvestre[1,3], and Miguel Andrés[1,2] — [1]Laboratory of Fiber Optics - ICMUV, Universidad de Valencia, Burjassot, Spain — [2]Departamento de Física Aplicada y Electromagnetismo - ICMUV, Universidad de Valencia, Burjassot, Spain — [3]Departamento de Óptica - ICMUV, Universidad de Valencia, Burjassot, Spain

Wide tuning of polarization modulation instability (PMI) in D2O-filled microstructured optical fiber is reported. Tuning of the PMI frequency shift from 1084 cm-1 to 2782 cm-1 was experimentally attained with 1064 nm pump.

Oral CD-7.6 12:15 TRACK 4

Design and analysis of depolarized four-wave mixing in chalcogenide photonic crystal fibers — •Arman Ayan, Svyatoslav Kharitonov, and Camille-Sophie Brès — École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

In this work, the effect of different depolarization schemes on the conversion efficiency of four-wave mixing in a chalcogenide photonic crystal fiber is calculated and experimentally analyzed for high-speed characterization of nonlinear fibers.

CF-7: Nonlinear Spectral Broadening

Chair: Stefan Haessler, Laboratoire d'Optique Appliquée, Palaiseau, France

Time: Thursday, 11:00–12:30 Location: TRACK 5

Oral CF-7.1 11:00 TRACK 5

Octave-Spanning Supercontinuum Generated in As_2S_3-Silica Waveguides Pumped by Tm-doped All-fibre MOPA — •Vasilii Voropaev[1], Shangran Xie[2], Aleksandr Donodin[3], Dmitrii Vlasov[1], Daniil Batov[1], Mikhail Tarabrin[1,4], Johann Troles[5], and Vladimir Lazarev[1] — [1]Science and Education Center for Photonics and IR-Technology, Bauman Moscow State Technical University, Moscow, Russia — [2]Max Planck Institute for the Science of Light, Erlangen, Germany — [3]Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom — [4]P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia — [5]Institut des sciences chimiques de Rennes, université de Rennes 1, Rennes, France

We experimentally and numerically demonstrate octave spanning supercontinua generation in As_2S_3-silica dual nanospike waveguides pumped by a thulium-doped all-fiber MOPA centred at 1.9 μm with 78 fs pulse duration and 200 kW peak power.

Oral CF-7.2 11:15 TRACK 5

GW Peak Power, sub-30-fs Pulses from Efficient Single-Stage Pulse Compressor at 400-kHz — •Alan Omar, Shahwar Ahmed, Martin Hoffmann, and Clara Saraceno — Ruhr-University Bochum, Bochum, Germany

We demonstrate pulse compression of 310-fs, 150 MW peak power pulses at 400 kHz repetition rate down to 27fs, >1 GW peak power using a single, dispersion-optimized Herriott-type multipass cell compressor with 92% overall efficiency.

Oral CF-7.3 11:30 TRACK 5

Chirped Pulse Amplification of 1.6 GHz Ti:Sapphire Frequency Comb Using a Tapered Semiconductor Amplifier — •Takashi Sakamoto[1] and Kosuke Yoshioka[1,2] — [1]Department of Applied Physics, School of Engineering, The University of Tokyo, Tokyo, Japan — [2]Photon Science Center, School of Engineering, The University of Tokyo, and PRESTO, JST, Tokyo, Japan

We demonstrate amplification of a 1.6 GHz Ti:Sapphire frequency comb using a tapered semiconductor amplifier. Stretched pulses at 855-865 nm were compactly amplified to 215 mW and compressed by combining a chirped Bragg grating.

Oral CF-7.4 11:45 TRACK 5

Compact 60 μJ, 60 fs, MHz-rate burst-mode laser for pump-probe experiments at the FLASH FEL facility — •Marcus Seidel[1], Federico Pressaco[1], Oender Akcaalan[1], Thomas Binhammer[2], John Darvill[1], Maik Frede[2], Uwe Grosse-Wortmann[1], Michael Heber[1], Christoph M. Heyl[1,3,4], Dmytro Kutnyakhov[1], Chen Li[1], Christian Mohr[1], Jost Müller[1], Oliver Puncken[2], Harald Redlin[1], Nora Schirmel[1], Sebastian Schulz[1], Angad Swiderski[1], Hamed Tavakol[1], Henrik Tünnermann[1], Caterina Vidoli[1], Lukas Wenthaus[1], Nils Wind[1,5], Lutz Winkelmann[1], Bastian Manschwetus[1], and Ingmar Hartl[1] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]neoLASE GmbH, Hannover, Germany — [3]Helmholtz-Institute Jena, Jena, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [5]Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany

A new burst-mode laser at the FLASH-FEL facility is presented. Multi-pass-cell spectral broadening enables compression of 900-fs pulses from Yb-amplifiers to 60-fs. Nonlinear-ellipse-rotation leads to significant pulse-contrast improvement. Excellent timing-, spectrum- and energy-stability is reported.

Oral CF-7.5 12:00 TRACK 5

A liquid-crystal based phase-shaper for multi-octave light sources — Vittorio Di Pietro[1,2], Simone Bux[2], Loic Ramousse[1,2], Cyrille Claudet[1], Gilles Cheriaux[1], Nicolas Forget[2], and •Aurélie Jullien[1] — [1]Université Côte d'Azur, CNRS, Institut de Physique de Nice, Valbonne, France — [2]FASTLITE, Antibes, France

A thermo-optically addressed liquid crystal device enables continuous spectral phase shaping over a spectral bandwidth spanning from 540nm to 2500nm (450Thz). The modulation dynamic is large enough to shape single-cycle pulses.

Oral CF-7.6 12:15 TRACK 5

Generation of Coherent Extreme-Ultraviolet Vector-Vortex beams — •Alba de las Heras[1], Alok Kumar Pandey[2], Julio San Román[1], Luis Plaja[1], Elsa Baynard[2], Guillaume Dovillaire[3], Moana Pittman[2], Charles G. Durfee[4], Sophie Kazamias[2], Olivier Guilbaud[1], and Carlos Hernández-García[1] — [1]Grupo de Investigación en Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, Universidad de Salamanca, E-37008, Salamanca, Spain — [2]Laboratoire Irène Joliot-Curie, Université Paris-Saclay, UMR CNRS, Rue Ampère, Bâtiment 200, F-91898, Orsay Cedex, France — [3]Imagine Optic, 18, rue Charles de Gaulle, 91400, Orsay, France — [4]Department of Physics, Colorado School of Mines, Golden, Colorado 80401, USA

We theoretically and experimentally introduce a novel structured EUV beam —a vector-vortex— which combines the helical phase and inhomogeneous polarization of vortex and vector beams. These beams are emitted as an azimuthally polarized attosecond light-spring.

CI-3: Microwave Photonics

Chair: Alessandro Tonello, Université de Limoges, Limoges, France

Time: Thursday, 11:00–12:30 Location: TRACK 6

Oral CI-3.1 11:00 TRACK 6

Low phase noise microwave generation from a direct-modulation optoelectronic oscillator (DM-OEO) — •Brian Sinquin, Marco Romanelli, Steve Bouhier, Mehdi Alouini, and Marc Vallet — Univ. Rennes, CNRS, Institut FOTON UMR 6082, Rennes , France

A direct-modulation optoelectronic oscillator generates 10 and 20 GHz signals. It exhibits 15 dBm output power and -135dBc/Hz phase noise at 10 kHz from the carrier at 10 GHz; -5 dBm and -126dBc/Hz at 20GHz.

Oral CI-3.2 11:15 TRACK 6

Frequency-to-time mapping using a phase-modulated frequency-shifting loop. — •Hongzhi Yang[1,2], Marc Brunel[3], Marc Vallet[3], Haiyang Zhang[1], and Changming Zhao[1] — [1]Beijing Institute of Technology, Beijing, China — [2]Qian Xuesen Laboratory of Space Technology, Beijing, China — [3]Univ Rennes, CNRS, Rennes, France

A recirculating fiber loop comprising phase modulation and amplification, operated in the Talbot condition, is shown experimentally to map the optical input spectrum in the time domain, with original features like temporal reflection and nonlinear mapping.

Oral CI-3.3 11:30 TRACK 6

Optical Frequency Comb and Active Demultiplexer-enabled 60 GHz mmW ARoF Transmission using Directly Modulated 64-QAM UF-OFDM signals — •Syed Tajammul Ahmad[1], Prajwal D. Lakshmijayasimha[1], Prince Anandarajah[1], and Aleksandra Kaszubowska[2] — [1]Dublin City University, Dublin, Ireland — [2]CONNECT Research Center, Trinity College Dublin, Dublin, Ireland

Active demultiplexer-enabled comb based mmW A-RoF transmission scheme is experimentally demonstrated. A BER below the HD-FEC limit of 3.8e-3 for 40 km fiber transmission of 60 GHz 64-QAM UF-OFDM RoF signal is achieved.

Oral CI-3.4 11:45 TRACK 6

Transmission of 5G using Tunable Dual-Wavelength Fiber Laser — •Hani Kbashi, Sharma Vishal, and Sergey Sergeyev — 1Aston Institute of Photonics Technologies, Aston University, Birmingham, United Kingdom

In this work, we demonstrate the generation of the tunable mmW ranging from 12.5 GHz to 110 GHz using a dual-wavelength fiber laser and then validate the 5G transmission over a 500 m FSO wireless-link.

Oral CI-3.5 12:00 TRACK 6

Optical-to-Wireless Carrier Frequency Down-Conversion by UTC-PD-Integrated HEMT: Dependence of Conversion Gain on UTC-PD Mesa Size — Kazuki Nishimura[1,3], Tomotaka Hosotani[1,3], Dai Nakajima[1,3], Tetsuya Suemitsu[2,3], Katsumi Iwatsuki[3], Taiichi Otsuji[1,3], and •Akira Satou[1,3] — [1]Research Institute of Electrical Communication, Tohoku University, Sendai, Japan — [2] Center for Innovative Integrated Electronic Systems, Tohoku University, Sendai, Japan — [3]Research Organization of Electrical Communication, Tohoku University, Sendai, Japan

We developed the so-called UTC-PD-integrated HEMT as an optical-to-millimeter-wave carrier-frequency down-converter for the future optical-wireless convergent networks. We experimentally revealed the conversion gain increases with decreasing the UTC-PD mesa size up to the diffraction limit.

Oral CI-3.6 12:15 TRACK 6

Highly Robust Optical Phase Decorrelation in Microwave Photonic Summation Systems Using Mode-Coupling Receiver — •Hamza Hallak Elwan, Fabienne Saliou, Gael Simon, and Philippe Chanclou — Orange Labs, Lannion, France

We propose a mode-coupling receiver (MCR) as a key component to achieve the optical combination structure with lower phase noise and insertion loss.

CK-5: Beam Manipulation

Chair: Martin Frimmer, ETH, Zurich, Switzerland

Time: Thursday, 11:00–12:30 Location: TRACK 7

Tutorial CK-5.1 11:00 TRACK 7

Photonic Crystal Devices for Sensing — Focusing on LiDAR Applications — — •Toshihiko Baba — Yokohama National University, Yokohama, Japan

Some photonic crystal devices are approaching to practical use. This presentation demonstrates an application to a nonmechanical optical beam scanner and FMCW LiDAR sensor system based on a Si photonics platform and slow light effect.

Oral CK-5.2 12:00 TRACK 7

Modulation of Cathodoluminescence Emission by Interference with External Light — •Valerio Di Giulio[1], Ofer Kfir[2,3], Claus Ropers[2,3], and F. Javier García de Abajo[1,4] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona), Spain — [2]University of Göttingen, IV. Physical Institute, Göttingen, Germany — [3]Max Planck Institute for Biophysical Chemistry (MPIBPC), Göttingen, Germany — [4]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We investigate the far-field emission produced by the synchronized interaction of a dimmed laser and a previously modulated electron. We find that a PINEM modulated electron leads to a strong suppression of the cathodoluminescence signal.

Oral CK-5.3 12:15 TRACK 7

Phase-Change Tunable Laser — •Jingyi Tian[1], Giorgio Adamo[1], Bera Kanta Lakshmi[2], Mengfei Wu[2], Maciej Klein[1,3], Jie Deng[2], Norman Soo Seng Ang[2], Ramón Paniagua-Domínguez[2], Hong Liu[2], Arseniy I. Kuznetsov[2], and Cesare Soci[1,3] — [1]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, 21 Nanyang Link, Singapore, Singapore, Singapore — [2]Institute of Materials Research and Engineering, Agency for Science Technology and Research (A*STAR), Innovis, Singapore , Singapore, Singapore — [3]Energy Research Institute @ NTU (ERI@N), Research Techno Plaza, Nanyang Technological University, 50 Nanyang Drive, Singapore , Singapore, Singapore

By combining high-refractive index, high optical gain and temperature-induced structural phase transitions of the hybrid perovskite films with scalable nanoimprint fabrication and all-dielectric metasurface design, we demonstrate the first phase-change tunable laser at optical region.

EA-5: Quantum Light Sources

Chair: Dmitry S. Bykov, University of Innsbruck, Innsbruck, Austria

Time: Thursday, 11:00–12:30 Location: TRACK 8

Oral EA-5.1 11:00 TRACK 8

Controlling the symmetry of a quantum dot via remote electric potentials — •Martin Esmann, Priya Priya, Hélène Ollivier, Abdelmounaim Harouri, Isabelle Sagnes, Aristide Lemaitre, Norberto Daniel Lanzillotti-Kimura, and Pascale Senellart — Centre de Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, 10 Boulevard Thomas Gobert, 91120 Palaiseau, France

We control the exciton fine-structure splitting of an epitaxial quantum dot via three electric potentials applied 50μm away. This approach is compatible with optical microcavities and enables efficient sources of entangled photon pairs.

Oral EA-5.2 11:15 TRACK 8

Photon pair generation in ultra-thin carbon nanotube films without phase-matching — •Philipp Jenke[1], Irati Alonso Calafell[1], Alessandro Trenti[1], Kimmo Mustonen[2], Lee Rozema[1], and Philip Walther[1] — [1]VCQ-Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Vienna, Austria — [2]Faculty of Physics, University of Vienna, Vienna, Austria

In sufficiently thin nonlinear materials, the phase-matching condition of four-wave mixing relaxes. We characterize the resulting broadband biphoton states by stimulated emission tomography, and present progress towards photon pair generation in ultra-thin carbon nanotube films.

Oral EA-5.3 11:30 TRACK 8

Quantum-Correlation-Preserving Single-Photon Conversion by Molecular Modulation in Gas-filled Hollow-Core Fibres — Rinat Tyumenev, Jonas Hammer, Nicolas Joly, •David Novoa, and Philip Russell — Max-Planck Institute for the Science of Light, Erlangen, Germany

Raman coherence waves created in hydrogen-filled single-ring hollow-core PCF are used to efficiently frequency up-shift the idler photon from a biphoton pair. Quantum correlations are preserved between the signal photon and the up-shifted idler photon.

Oral EA-5.4 11:45 TRACK 8

Cryogenic Parametric Down-Conversion in Titanium In-Diffused Lithium Niobate Waveguides — •Nina Amelie Lange[1], Jan Philipp Höpker[1], Raimund Ricken[2], Viktor Quiring[2], Christof Eigner[2], Christine Silberhorn[2], and Tim J. Bartley[1] — [1]Mesoscopic Quantum Optics, Paderborn University, Paderborn, Germany — [2]Integrated Quantum Optics, Paderborn University, Paderborn, Germany

We demonstrate spontaneous parametric down-conversion (SPDC) in nonlinear waveguides down to 4.7 K. Thus, our work shows that SPDC is integrable with superconducting detectors, which paves the way for developing novel integrated quantum photonic circuits.

Oral EA-5.5 12:00 TRACK 8

Spectral compression of narrowband single photons with a resonant cavity — Mathias A. Seidler[1], •Xi Jie Yeo[2], Alessandro Cerè[1], and Christian Kurtsiefer[1,2] — [1]Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore — [2]Department of Physics, National University of Singapore, Singapore, Singapore

We experimentally demonstrate a spectral compression scheme based on an asymmetric cavity and phase modulator, performed on heralded narrowband 795 nm single photons generated through a four-wave mixing process in cold Rubidium-87 atoms.

Oral EA-5.6 12:15 TRACK 8

Waveguide resonators as squeezed light sources — •Michael Stefszky, Matteo Santandrea, Felix vom Bruch, Christof Eigner, Raimund Ricken, Viktor Quiring, Harald Herrmann, and Christine Silberhorn — Integrated Quantum Optics Group, Institute for Photonic Systems (PhoQS), Paderborn University, Paderborn, Germany

Experiments have proven the usefulness of squeezed states in a wide range of applications. Here, we present squeezing results from our waveguide resonators and recent work towards incorporating an electro-optic modulator for length control.

EB-8: Quantum Computation and Error Correction

Chair: Ben Lanyon, University of Innsbruck, Innsbruck, Austria

Time: Thursday, 11:00–12:30 Location: TRACK 9

Invited EB-8.1 11:00 TRACK 9

Experimental deterministic correction of qubit loss — •Roman Stricker — University of Innsbruck, Innsbruck, Austria

Qubit loss is a fundamental obstacle towards large-scale and fault-tolerant quantum computers. We demonstrate an experimental toolbox for ion-qubit control and implement a full cycle of qubit-loss detection and correction on the topological surface code.

Oral EB-8.2 11:30 TRACK 9

Non-Clifford gate on Gottesman-Kitaev-Preskill encoded optical qubits with nonlinear feedforward — •Shunya Konno[1], Warit Asavanant[1], Kosuke Fukui[1], Atsushi Sakaguchi[1], Fumiya Hanamura[1], Petr Marek[2], Radim Filip[2], Jun-ichi Yoshikawa[1], and Akira Furusawa[1] — [1]Department of Applied Physics, School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan — [2]Department of Optics, Palacký University, 17. listopadu 1192/12, 77146 Olomouc, Czech Republic

We propose an experimentally feasible implementation of a non-Clifford gate on the Gottesman-Kitaev-Preskill qubits using nonlinear feedforward. Our result shows the versatility of nonlinear feedforward in a fault-tolerant optical universal quantum computation.

Oral EB-8.3 11:45 TRACK 9

Optimal Control of a Large Ensemble of Nitrogen-Vacancy Centers in Diamond for Pulsed Magnetometry — •Joshua D. Clement[1], Andreas F.L. Poulsen[1], James L. Webb[1], Rasmus H. Jensen[1], Kirstine Berg-Sørensen[2], Alexander Huck[1], and Ulrik L. Andersen[1] — [1]Center for Macroscopic Quantum States (bigQ), Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark

Nitrogen-Vacancy (NV) centers in diamond can measure biophysical magnetic signals with high sensitivity. With optimal control, we demonstrate pulse fidelity improvement for a large ensemble, leading to improved sensitivity in this experimental regime.

Oral EB-8.4 12:00 TRACK 9

Observation of PT-Symmetry Breaking in Quantum Correlations — •Friederike Klauck, Matthias Heinrich, and Alexander Szameit — Institute of Physics, University of Rostock, Rostock, Germany

We experimentally study the influence of PT-symmetry breaking on two-photon correlations in quasi-PT-symmetric waveguide couplers. In the unbroken phase, quantum interference is preserved. Beyond the PT-breaking point, we observe a characteristic rise of off-diagonal terms.

Oral EB-8.5 12:15 TRACK 9

Exploring complex graphs using 3D quantum walks of photon pairs — •Max Ehrhardt[1], Robert Keil[2], Lukas Maczewsky[1], Christoph Dittel[3,4], Matthias Heinrich[1], and Alexander Szameit[1] — [1]Universität Rostock, Institut für Physik, Rostock, Germany — [2]Universität Innsbruck, Innsbruck, Austria — [3]Albert-Ludwigs-Universität Freiburg, Physikalisches Institut, Freiburg, Germany — [4]EUCOR Centre for Quantum Science and Quantum Computing, Albert-Ludwigs-Universität Freiburg, Freiburg, Germany

We study three-dimensional quantum walks on complex graphs arising from the hybrid action of the spatial and polarization degrees of freedom for single photons in photonic waveguide circuits with tailored birefringence.

EC-5: Emerging Trends in Topology

Chair: Laura Pilozzi, CNR, Rome, Italy

Time: Thursday, 11:00–12:15 Location: TRACK 10

Oral EC-5.1 11:00 TRACK 10

Fractional Chern insulators of few photons: Hall plateaus from center-of-mass drifts and density profiles — Cecile Repellin[1], Julian Leonard[2], and •Nathan Goldman[3] — [1] Univ. Grenoble-Alpes, CNRS, LPMMC, 38000 Grenoble, France, Grenoble, France — [2]Department of Physics, Harvard University, Cambridge, USA — [3]Université Libre de Bruxelles, Brussels, Belgium

We analyze the center-of-mass Hall drift of a small ensemble of hardcore bosons, initially prepared in the ground state of the Harper-Hofstadter-Hubbard model. An emergent Hall plateau compatible with a fractional Chern insulator is identified.

Oral EC-5.2 11:15 TRACK 10

Topological protection versus degree of entanglement of two-photon edge states — Konrad Tschernig[1], Kurt Busch[2], and •Armando Perez-Leija[1] — [1]Max-Born Institute, Berlin, Germany — [2]Humboldt University of Berlin, Berlin, Germany

We investigate theoretically the physical mechanisms that contribute to the vulnerability of highly entangled two-photon edge states propagating in topological insulator photonic lattices.

Oral EC-5.3 11:30 TRACK 10

Characterizing Photonic Band Structures Using Topological Data Analysis — •Daniel Leykam[1] and Dimitris G. Angelakis[1,2] — [1]Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore — [2]School of Electrical and Computer Engineering, Technical University of Crete, Chania, Greece

We show how the topological data analysis technique of persistent homology may used to characterize topological properties of photonic band structures, from known topological phases to bands with novel multi-valley and looped dispersion relations.

Oral EC-5.4 11:45 TRACK 10

Supertoroidal Skyrmionic Light Pulses — •Yijie Shen[1], Yaonan Hou[1], Apostolos Zdagkas[1], Nikitas Papasimakis[1], and Nikolay Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

We report on a family of supertoroidal pulses with skyrmion-like topology propagating at the speed of light.

Oral EC-5.5 12:00 TRACK 10

Topologically structured singularity networks of light in three dimensions — •Ramon Droop, Eileen Otte, and Cornelia Denz — Institute of Applied Physics, Muenster, Germany

We combine polarization modulation with established scalar 3d structured light fields to introduce its vectorial analogon, namely, discrete non-diffracting and self-imaging vectorial fields. Thereby we finally enable shaping singularity propagation behavior in 3d space.

EF-6: Dissipative Solitons I

Chair: Mathias Marconi, Institut de Physique de Nice, Nice, France

Time: Thursday, 11:00–12:30 Location: TRACK 11

Oral EF-6.1 11:00 TRACK 11

Parametric solitons in optical resonator — •Nicolas Englebert[1], Francesco De Lucia[1,2], Pedro Parra-Rivas[1], Carlos Mas Arabí[1], Pier-John Sazio[2], Simon-Pierre Gorza[1], and François Leo[1] — [1]Université libre de Bruxelles, Bruxelles, Belgium — [2]University of Southampton, Southampton, United Kingdom

We experimentally demonstrate, for the first time, parametric driving of Kerr cavity solitons. As two different solitons, of opposite phase, exist for the same cavity parameters, we use them to generate random numbers.

Oral EF-6.2 11:15 TRACK 11

Breathing Cavity Solitons and Polychromatic Dispersive Radiation in a Near-Zero Dispersion Kerr Resonator — •Zongda Li[1,2], Yiqing Xu[1,2], Stephane Coen[1,2], Stuart G. Murdoch[1,2], and Miro Erkintalo[1,2] — [1]University of Auckland , Auckland , New Zealand — [2]The Dodd-Walls Centre for Photonic and Quantum Technologies, Auckland, New Zealand

We report on experimental observations of polychromatic dispersive wave emission by breathing Kerr cavity solitons under conditions of near-zero-dispersion driving. We also experimentally study the impact of third-order dispersion on the solitons' existence and stability.

Oral EF-6.3 11:30 TRACK 11

Zero-dispersion Kerr solitons in optical microresonators with octave-spanning dispersive wave formation — •Miles H. Anderson, Wenle Weng, Grigory Lihachev, Junqiu Liu, and Tobias J. Kippenberg — Institute of Physics (IPHYS), Swiss Federal Institute of Technology in Lausanne (EPFL), Lausanne, Switzerland

We generate a novel localised dissipative structure, the zero-dispersion soliton, in silicon nitride microresonators with vanishing group-velocity dispersion. The coherent frequency comb spans 135 THz, at 28 GHz line-spacing, enabled by higher-order dispersive wave formation.

Oral EF-6.4 11:45 TRACK 11

Dissipative Solitons in a Coherently Driven Active Fiber Ring Cavity — •Carlos Mas Arabi, Nicolas Englebert, Pedro Parra-Rivas, Simon Pierre Gorza, and François Leo — Université libre de Bruxelles, Brussels, Belgium

We analyze the formation of solitons in a coherently driven Kerr resonator incorporating an intracavity amplifier. By means of bifurcation analysis, we study the impact of the gain saturation on soliton dynamics

Oral EF-6.5 12:00 TRACK 11

Self-Pulsing in Photonic Dimers — •Jesús Yelo-Sarrión, Pedro Parra-Rivas, Nicolas Englebert, Carlos Mas-Arabí, François Leo, and Simon-Pierre Gorza — OPERA-Photonics, Bruxelles, Belgium

We theoretically and experimentally study the bifurcation diagram and the self-pulsing dynamics of photonic dimers with dissimilar detunings (Δ_1, Δ_2), made of fiber ring resonators. Our measurements agree with the driven dissipative Bose-Hubbard dimer model.

Oral EF-6.6 12:15 TRACK 11

Kerr Enhancement of Optomechanics in Microresonators — •George N. Ghalanos[1,2], Jonathan M. Silver[3], Shuangyou Zhang[1], Leonardo Del Bino[1], Toby Bi[1,4], and Pascal Del'Haye[1,4] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Imperial College London, London, United Kingdom — [3]National Physical Laboratory (NPL), Middlesex, United Kingdom — [4]Friedrich Alexander University Erlangen-Nuremberg, Erlangen, Germany

Kerr-effect induced resonance splittings can be utilized to actively enhance or suppress optomechanical sidebands in silica microtoroid resonators. The interplay between Kerr-effect and cavity optomechanics shows a promising route to precisely control optomechanical coupling rates.

CE-9: Nonlinear and Meta-materials

Chair: Katia Gallo, KTH – Royal Institute of Technology, Stockholm, Sweden

Time: Thursday, 11:00–12:30 Location: TRACK 12

Invited CE-9.1 11:00 TRACK 12

Second Harmonic Generation by Silicon Metamaterial on a Fibre Tip — •Jie Xu[1], Eric Plum[1], Vassili Savinov[1], and Nikolay I. Zheludev[1,2] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, SPMS, TPI, Nanyang Technological University, Singapore, Singapore

Patterning of amorphous silicon with chevron grooves yields a metamaterial frequency converter with a resonant second harmonic conversion efficiency of about 10^(-11)/W, exceeding the previously achieved value for silicon metamaterial by two orders of magnitude.

Oral CE-9.2 11:30 TRACK 12

Suppression of scattering induced by tailored non-Hermiticity — •Andrea Steinfurth[1], Ivor Krešić[2], Sebastian Weidemann[1], Mark Kremer[1], Konstantinos Makris[3,4], Matthias Heinrich[1], Stefan Rotter[2], and Alexander Szameit[1] — [1]Institute of Physics, Universität Rostock, Rostock, Germany — [2]Institute of Theoretical Physics, Vienna University of Technology (TU Wien), Vienna, Austria — [3]Physics Department, University of Crete, Heraklion, Greece — [4]Institute of Electronic Structure and Laser, FORTH, Heraklion, Greece

Light waves passing through inhomogeneous media commonly are subject to scattering and subsequent interference. We have optically implemented tailored non-Hermitian media in which scattering is suppressed for stationary as well as for time-dependent field distributions.

Oral CE-9.3 11:45 TRACK 12

Phase-change Optical Nonlinearity as a Cellular Automaton — Liwei Zhang[1,2], •Kevin F. MacDonald[1], and Nikolay I. Zheludev[1,3] — [1]University of Southampton, Southampton, United Kingdom — [2]Anqing Universtiy, Anqing, China — [3]Nanyang Technological University, Singapore, Singapore

We introduce a cellular automata methodology for studying photonics of light-induced phase transitions. Multiphysical complexity over disparate length/timescales is reduced to a simple, heuristic rule/parameter set in a model successfully describing several independent experimental datasets.

Oral CE-9.4 12:00 TRACK 12

Experimental investigation of optical feedback from periodically poled crystals for nonlinear frequency conversion — •Nils Werner, Selina Häuser, and Katrin Paschke — Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany

Optical feedback arising at the periodical poling structure of quasi phase matched crystals for nonlinear frequency conversion is investigated experimentally. The spatial and spectral emission characteristics of the feedback are analyzed and compared with calculations.

Oral CE-9.5 12:15 TRACK 12

Study of Third Harmonic Generation From Thin Gradient $Hf_xAl_yO_z$ Layers — •David Zuber[1,2], Sven Kleinert[1,2], Ayhan Tajalli[3], Morten Steinecke[4], Marco Jupé[2,4], Lars Jensen[2,4], Detlev Ristau[1,2,4], and Uwe Morgner[1,2,4] — [1]Institute of Quantum Optics, Leibniz Universitat Hannover, 30167 Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering-Innovation Across Disciplines), 30167 Hannover, Germany — [3]Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — [4]Laser Zentrum Hannover e.V., 30419 Hannover, Germany

We present a study of the third harmonic generation from gradient layers of the amorphous dielectric ternary mixture material $Hf_xAl_yO_z$, which enables us to derive the third order nonlinear susceptibility of the ternary mixture material.

CL + ECBO JS: Advances in Deep Tissue Imaging

Chair: Alexander Jesacher, Division of Biomedical Physics, Medical University, Innsbruck, Austria

Time: Thursday, 14:30–15:45 Location: TRACK 1

Invited CL + ECBO JS.1 14:30 TRACK 1

Deep Brain Endo-microscopy Using Multimode Optical Fibre — •Raphael Turcotte — NYU School of Medicine, New York, USA

Combined with wavefront shaping, multimode optical fibre can serve as minimally invasive endo-microscopes for deep-brain imaging. Here, we demonstrate how wavefront shaping can further enhance the capability of such systems for volumetric and chronic imaging.

Oral CL + ECBO JS.2 15:00 TRACK 1

Fast holographic scattering compensation for deep tissue biological imaging — •Molly A. May[1], Kai K. Kummer[2], Michaela Kress[2], Monika Ritsch-Marte[1], and Alexander Jesacher[1] — [1]Institute of Biomedical Physics, Medical University of Innsbruck, Innsbruck, Austria — [2]Institute of Physiology, Medical University of Innsbruck, Innsbruck, Austria

We develop a holographic phase-stepping interferometry algorithm for non-invasive scattering compensation that achieves >10x higher signal enhancement after one mode iteration than previous work and enables two-photon imaging in mouse hippocampal tissue down to 530 μm

Oral CL + ECBO JS.3 15:15 TRACK 1

Information Analysis and Limits of Imaging Through Complex Media — •Jack Radford and Daniele Faccio — University of Glasgow, Glasgow, United Kingdom

Using an information theoretical approach, we numerically show the existence of information for imaging through very thick scattering materials (beyond 100 transport mean free paths) using spatially-resolved time-of-flight detectors.

Oral CL + ECBO JS.4 15:30 TRACK 1

Entangled Two-Photon Absorption in Commercial Fluorophores — •Tobias Bernd Gäbler, Nitish Jain, Josue Ricardo León Torres, Patrick Hendra, and Markus Gräfe — Fraunhofer Institute of Applied Optics and Precision Engineering IOF, Jena, Germany

Our study addresses the applicability of simple and common fluorophores for entangled two-photon fluorescence microscopy. Using CW-pumped SPDC waveguides, we can measure linear absorption rates of entangled photons in standard fluorophores in life science.

CH-9: Hyperspectral Imaging

Chair: Sophie Brasselet, Director of the Institute Fresnel, CNRS, Marseille, France

Time: Thursday, 14:30–16:00 Location: TRACK 2

Oral CH-9.1 14:30 TRACK 2

Hyperspectral topography of the twisted, cholesteric patterns of an insect cuticle in the context of biomimicry — •Aurelie Jullien[1], Maxim Neradovskyi[1], Adriana Scarangella[2], and Michel Mitov[2] — [1]Institut de Physique de Nice, Université Cote d'Azur, CNRS, Valbonne, France — [2]CEMES, Université de Toulouse, Toulouse, France

By hyperspectral microscopy, a topographic study compares the textural, structural and spectral properties of the microcells of a scarab beetle with those of the polygonal texture formed in flat films of cholesteric liquid crystal oligomers.

Oral CH-9.2 14:45 TRACK 2

Fast, Frugal Image Reconstruction with a Dual Disperser Hyperspectral-Imager. — •Elizabeth Hemsley[1], Ibrahim Ardi[1,2], Simon Lacroix[1], Hervé Carfantan[2], and Antoine Monmayrant[1] — [1]LAAS-CNRS, Université de Toulouse, Toulouse, France — [2]IRAP, Université de Toulouse, Toulouse, France

We demonstrate experimentally the fast reconstruction of a hyperspectral image, utilizing a small number of acquisitions with programmable masks. The algorithm relies on a spectral separability assumption, and reconstructs the compressed datacube near-instantaneously.

Oral CH-9.3 15:00 TRACK 2

Tailoring spatial entropy in extreme ultraviolet focused beams for multi-spectral ptychography — •Xiaomeng Liu[1], Lars Loetgering[1], Anne de Beurs[1], Mengqi Du[1], Patrick Konold[1], Kjeld Eikema[2], and Stefan Witte[1] — [1]Advanced Research Center for Nanolithography, Amsterdam, Netherlands — [2]Vrije Universiteit, Amsterdam, Netherlands

We demonstrate a computational approach to designing diffractive optical elements that can be used to focus multispectral extreme-ultraviolet radiation from a high-harmonic generation source. The polychromatic focusing properties are experimentally confirmed using ptychography.

Oral CH-9.4 15:15 TRACK 2

Ultra-broadband few-cycle laser pulses for advanced multi-color FLIM microscopy — •Christian Maibohm[1], Rodrigo Ferreira[1,2], Oscar F. Silvestre[1], Rosa Romero[2,3], Helder Crespo[3], and Jana B. Nieder[1] — [1]INL - International Iberian Nanotechnology Laboratory, Braga, Portugal — [2]Sphere Ultrafast Photonics, Porto, Portugal — [3]IFIMUP, University of Porto, Porto, Portugal

We report on using few-cycle ultra-broadband laser pulses for advanced fluorescence lifetime microscopy showing efficient excitation across the full visible spectral range and sufficient peak power to excite endogenous markers for tacking of drug delivery.

Oral CH-9.5 15:30 TRACK 2

Compressive Spectroscopic Long-Wave Infrared Imaging — •Jake M. Charsley[1], Marius Rutkauskas[1], Yoann Altmann[1], Margaret Smith[2], Christina Young[2], and Derryck T. Reid[1] — [1]School of Engineering and Physical Sciences, Heriot–Watt University, Edinburgh, United Kingdom — [2]School of Culture and Creative Arts, College of Arts, University of Glasgow, Glasgow, United Kingdom

We report compressive spectroscopic imaging from 7–12 μm with a 4 cm^{-1} optical resolution, sampled at 25% of the Nyquist rate. Compressed measurements of plastics are presented with 640×512 pixels observed and reconstructed simultaneously.

Oral CH-9.6 15:45 TRACK 2

A Multimodal Label-Free Imaging Study of Zeolite Crystals — Naomi Omori[2], Sara Mosca[3], Ines Lezcano-Gonzalez[2], Ian K. Robinson[2], Luxi Li[4], Alex G. Greenaway[2], Paul Collier[5], Andrew M. Beale[2], and •Alessia Candeo[1] — [1]Politecnico di Milano, Milano, Italy — [2]University College London, London, United Kingdom — [3]Central Laser Facility, Didcot, United Kingdom — [4]Argonne National Laboratory, Lemont, USA — [5]Johnson Matthey Technology Centre, Reading, United Kingdom

A multimodal label-free optical imaging approach incorporating 3D confocal multispectral imaging, FLIM, and Raman mapping is utilised to visualise the distribution of emissive organic deposits generated during the detemplation process in catalytic zeolite crystals.

CF-8: Ultrashort Pulse Characterization

Chair: Günter Steinmeyer, Max Born Institute, Berlin, Germany

Time: Thursday, 14:30–16:00 Location: TRACK 3

Oral CF-8.1 14:30 TRACK 3

Ultrashort laser pulse characterization by means of amplitude swing — •Benjamín Alonso, Warein Holgado, and Íñigo J. Sola — University of Salamanca, Salamanca, Spain

The amplitude swing, a new and versatile concept for ultrafast pulse measurement based on the amplitude variation of two delayed pulse replicas, is presented. We have studied its robustness at a broad range of parameters.

Oral CF-8.2 14:45 TRACK 3

Temporal characterization of broadband, low-energy few-cycle pulses using surface third-harmonic generation dispersion-scan — •Tiago Gomes, Miguel Canhota, and Helder Crespo — Department of Physics and Astronomy, Faculty of Sciences, University of Porto, Porto, Portugal

A dispersion-scan technique based on surface third-harmonic generation is presented, enabling the characterization of broadband, few-cycle, low-energy ultrashort pulses.

Oral CF-8.3 15:00 TRACK 3

Spatiotemporal and polarization full characterization of complex ultrafast beams — •Íñigo J. Sola[1], Ignacio López-Quintás[1], Warein Holgado[1], Rokas Drevinskas[2], Peter G. Kazansky[2], Carlos Henández-García[1], and Benjamín Alonso[1,3] — [1]University of Salamanca, Salamanca, Spain — [2]University of Southampton, Southampton, United Kingdom — [3]Sphere Ultrafast Photonics, Porto, Portugal

A technique for the complete characterization of ultrashort pulsed beams on space, time and polarization is presented. It is applied to ultrafast vector beams exhibiting polarization evolving on time and space and compared with simulations.

Oral CF-8.4 15:15 TRACK 3

Broadband single-shot interferometric retrieval of spectral phase and amplitude — •Markus Lippl[1,2], Michael H. Frosz[1], Daniel R. Häupl[1,2], Paul Roth[1,2], Gordon K. L. Wong[1], Philip St.J. Russell[1,2], and Nicolas Y. Joly[2,1,3] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany — [3]Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany

The phase and amplitude of a single ultrashort pulse can be measured by interfering it with a circularly polarised supercontinuum generated in chirally twisted all-normal-dispersion PCF pumped by the same laser.

Oral CF-8.5 15:30 TRACK 3

Intra-Burst Pulse Characterization of a High-Power Post-Compressed Yb:YAG Laser at 100 kHz Repetition Rate — •Anne-Lise Viotti[1,2], Skirmantas Alisauskas[1], Henrik Tünnermann[1], Esmerando Escoto[1], Marcus Seidel[1], Katharina Dudde[1], Bastian Manschwetus[1], Ingmar Hartl[1], and Christoph M. Heyl[1,3,4] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Department of Physics, Lund University, Lund, Sweden — [3]Helmholtz-Institute Jena, Jena, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We report on intra-burst characterization of a 55 fs post-compressed high-power Yb:YAG laser at 100 kHz repetition rate. Flat burst characteristics including spectral/temporal amplitude and phase, pulse duration and high temporal contrast are demonstrated.

Oral CF-8.6 15:45 TRACK 3

Every single-shot CEP drift detection for near-infrared lasers with a modified TOUCAN method — •Mate Kurucz[1,2], Szabolcs Toth[1], Janos Csontos[1], Balint Kiss[1], and Eric Cormier[3,4] — [1]ELI-ALPS, ELI-HU Non-Profit Ltd, Szeged, Hungary — [2]University of Szeged, Szeged, Hungary — [3]Laboratoire Photonique Numérique et Nanosciences, Talence, France — [4]Institut Universitaire de France, Paris, France

The original TOUCAN device is capable of single-shot CEP drift measurement of ~3 μm lasers at arbitrary repetition rate. We have expanded this technique for near-infrared lasers and crosschecked results with a traditional measurement method.

CM-5: Temporal and Spatial Beam Shaping for Laser Processing Part 2

Chair: Robert Thomson, Heriot-Watt University, Edinburgh, United Kingdom

Time: Thursday, 14:30–16:00 Location: TRACK 4

Oral CM-5.1 14:30 TRACK 4

Femtosecond laser micromachining and rocket propulsion of micro-particles optically trapped in hollow-core photonic crystal fibre — •Maria N. Romodina, Shangran Xie, Abhinav Sharma, Francesco Tani, and Philip St.J. Russell — Max Planck Institute for the Science of Light, Erlanden, Germany

We report micromachining of silica microparticles, optically levitated inside hollow-core photonic crystal fibre, by guided fs pulses. An ablation-related plasma flume at the output side of the particle rocket-propels the particles backwards at high speed.

Oral CM-5.2 14:45 TRACK 4

Tailored Laser wave packets for Advanced micro-engineering of materials — •Maria Manousidaki[1], Vladimir Yu. Fedorov [3,4], Dimitrios G. Papazoglou [1,2], Maria Farsari[1], and Stelios Tzortzakis[1,2,3] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, Heraklion, Greece — [2]Materials Science and Technology Department, University of Crete, Heraklion, Greece — [3]Science Program, Texas A&M University at Qatar, Doha, Qatar — [4]P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia

Advanced methods for multiscale microengineering of materials using tailored laser wave packets are being presented. Tunable abruptly autofocusing ring Airy beams enable multiscale photo-polymerization. A 3D holographic light shaping method for novel printing is demonstrated.

Oral CM-5.3 15:00 TRACK 4

Direct writing of 100% fill-factor geometry-controllable microlens arrays with laser catapulting — •Salvatore Surdo[1] and Martí Duocastella[1,2] — [1]Istituto Italiano di Tecnologia, Genova, Italy — [2]University of Barcelona, Barcelona, Spain

Laser catapulting is a novel laser additive and direct-write method for the rapid fabrication of geometry-controllable microlenses array, with high fill-factor and user-selectable arrangements, on top of a large variety of substrates and devices

Oral CM-5.4 15:15 TRACK 4

Experimental observation of Tornado Waves — Dimitris Mansour[1,2], Apostolos Brimis[1,3], Konstantinos G. Makris[1,3], and •Dimitris G. Papazoglou[1,2] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece — [2]Department of Material Science and Technology, University of Crete, Heraklion, Greece — [3]ITCP, Department of Physics, University of Crete, Heraklion, Greece

We demonstrate that the recently introduced Tornado Waves, comprised by complex superimposing fields that carry orbital angular momentum of opposite handedness, can be efficiently generated using spatial multiplexing techniques on a single phase modulation device.

Oral CM-5.5 15:30 TRACK 4

Femtosecond written phase-shifted-gratings and fiber Bragg gratings arrays using defocusing and phase-mask movement — •Aviran Halstuch and Amiel Ishaaya — Ben-Gurion University of the Negev, Beer-Sheva, Israel

Phase-shifted-gratings and arrays of fiber-Bragg-gratings are inscribed with a uniform phase-mask. These gratings are inscribed with 800 nm femtosecond pulses and a uniform phase-mask where the wavelength tube-ability is achieved by defocusing and phase-mask movement.

Oral CM-5.6 15:45 TRACK 4

Micro-processing of transparent material by modified Bessel beams generated with spatially displaced axicons — •Ernestas Nacius[1,2], Benas Stanionis[1,2], Pavel Gotovski[1,3], Orestas Ulčinas[1,2], Sergej Orlov[1], and Vytautas Jukna[1,4] — [1]Center for Physical Sciences and Technology, Coherent Optics laboratory , Vilnius, Lithuania — [2]Workshop of Photonics, Vilnius, Lithuania — [3]Faculty of Electronics, Vilnius Gediminas Technical University, Vilnius, Lithuania — [4]Laser Research Center, Vilnius University, Vilnius, Lithuania

In this work, we present novel Bessel-Gauss beams generated by displaced phase axicons manufactured as geometric phase optical elements. Practical applications of such beams in laser micro-machining of transparent material are demonstrated.

EG-6: Resonant Dielectric Nanostructures

Chair: Ann-Katrin Michel, University of Technology, Eindhoven, The Netherlands

Time: Thursday, 14:30–16:00 Location: TRACK 5

Oral EG-6.1 14:30 TRACK 5

Gallium Phopshide Nanostructures on Transparent Substrates for Nonlinear and Ultrafast Nanophotonics — •Benjamin Tilmann[1], Gustavo Grinblat[2], Yi Li[3], Rodrigo Berte Berte[1], Michael P. Nielson[4], Emiliano Cortes[1], Arseniy I. Kuznetsov[5], and Stefan A. Maier[1,6] — [1]Chair in Hybrid Nanosystems, Nanoinstitut München, Ludwig-Maximilians-Universität München, München, Germany — [2]Departamento de Física, FCEN, IFIBA-CONICET, Universidad de Buenos Aires, Buenos Aires , Argentinia — [3]School of Microelectronics, MOE Engineering Research Center of Integrated Circuits for Next Generation Communications, Southern University of Science and Technology, Shenzen, China — [4]School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Sydney, Australia — [5]Institute of Materials Research and Engineering, A*STAR, Singapore, Singapore — [6]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom

We demonstrate outstanding optical properties of nanostructured Gallium Phosphide thin-films on low refractive index substrates. By exciting at anapole-like resonances, we show strongly enhanced all-optical switching and second harmonic generation.

Oral EG-6.2 14:45 TRACK 5

Electro-optic lithium niobate metasurfaces in the visible — •Viola Valentina Vogler-Neuling, Helena Weigand, Marc Reig Escalé, Felix Ulrich Richter, David Pohl, Artemios Karvounis, Flavia Timpu, and Rachel Grange — ETH Zurich, Zurich, Switzerland

We report active tuning of a LiNbO3 metasurface based on the electro-optic effect in the MHz-range by applying 1.5 V ac voltage and show enhancement of the electro-optic modulation at the transmission resonance around 774 nm.

Oral EG-6.3 15:00 TRACK 5

Second-harmonic generation by resonance absorption on nanoplasmas in the bulk of dielectrics — •Kazem Ardaneh, Mostafa Hassan, Remi Meyer, Remo Giust, and Francois Courvoisier — FEMTO-ST Institute, Univ. Bourgogne Franche-Comte, UMR CNRS 6174, 15B avenue des Montboucons, Besancon, France

We report experimental and Particle in Cell simulation results of second harmonic generation from cylindrical nanoplasma created by a single femtosecond Bessel pulse inside the bulk of dielectrics.

Oral EG-6.4 15:15 TRACK 5

Spatially shaping waves to access inside of a highly reflecting photonic crystal — •Manashee Adhikary[1], Ravitej Uppu[1,2], Timon Vreman[1], Cornelis A. M. Harteveld[1], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Center for Hybrid Quantum Systems (Hy-Q), Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

We show the experimental demonstration of focussing light inside a photonic crystal within the photonic gap by using optical wavefront shaping.

Oral EG-6.5 15:30 TRACK 5

Anapole-Assisted Absorption Engineering in Arrays of Coupled Amorphous GaP Nanodisks — •Ludwig Hüttenhofer[1], Andreas Tittl[1], and Stefan A. Maier[1,2] — [1]Nanoinstitut Ludwig-Maximilians-Unversität, München, Germany — [2]Department of Physics Imperial College, London, United Kingdom

Anapole excitations in single dielectric nanoresonators enhance electromagnetic field confinement and absorption in the underlying material. Engineering the arrangement of a manifold of coupled particles enables strong amplification of this effect with large spectral tunability.

Oral EG-6.6 15:45 TRACK 5

Multi-order Nonlinear Mixing in Dielectric Nanoparticles for Bio-Oriented Applications — •Luca La Volpe[1], Gabriel Campargue[1], Geoffrey Gaulier[1], Ronan Le Dantec[2], Yannick Mugnier[2], Jean-Pierre Wolf[1], and Luigi Bonacina[1] — [1]Department of Applied Physics, Université de Genève, Genève, Switzerland — [2]Univ. Savoie Mont Blanc, SYMME, Annecy, France

We report on the multiple order nonlinear response, spanning from deep ultraviolet to short-wave infrared, of dielectric nanoparticles of various metal oxides upon femtosecond two-color excitation. The nonlinear response is demonstrated for photo-triggering applications.

CE-10: Crystals, Glasses and Ceramics

Chair: Maurizio Ferrari, CNR, Istituto di Fotonica e Nanotecnologie, Trento, Italy

Time: Thursday, 14:30–16:00 Location: TRACK 6

Oral CE-10.1 14:30 TRACK 6

All-Fiber Chalcogenide Saturable Absorber — •Arslan Anjum and Martin Rochette — McGill University, Montreal, Canada

We present an all-fiber saturable absorber made of chalcogenide glass compatible over a broad range of wavelengths, from the telecommunication band to the mid-infrared. Results include nonlinear saturation and mode-locking of a thulium-doped fiber laser.

Oral CE-10.2 14:45 TRACK 6

Microstructured optical fibers from 3D printed soft glass preforms: example of a mid-IR hollow core fiber — Julie Carcreff[1], François Chevire[1], Elodie Galdo[1], Ronan Lebullenger[1], Antoine Gautier[1], Jean-Luc Adam[1], David Le Coq[1], Radwan Chahal[1], Laurent Brilland[2], Johann Troles[1], and •Gilles Renversez[3] — [1]Univ Rennes, CNRS, ISCR-UMR 6226, 35000, Rennes, France — [2]SelenOptics, 263 Avenue Gal Leclerc, 35042, Rennes, France — [3]Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, 13013, Marseille, France

We report the fabrication of the first microstructured optical fiber drawn from a soft glass 3D printed preform. The obtained negative curvature hollow core fiber shows several transmission bands in the 2-12 μm range that are reproduced numerically.

Oral CE-10.3 15:00 TRACK 6

Novel Tm:(Y,Sc)2O3 Transparent Ceramics for Laser Applications — •Roman N. Maksimov[1,2], Vladislav A. Shitov[1], Vladimir V. Osipov[1], Egor V. Tikhonov[1], Guido Toci[3], Barbara Patrizi[3], Angela Pirri[4], and Matteo Vannini[4] — [1]Institute of Electrophysics UrB RAS, Ekaterinburg, Russia — [2]Ural Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, Russia — [3]Istituto Nazionale di Ottica, Consiglio Nazionale delle Ricerche, Sesto Fiorentino, Italy — [4]Istituto di Fisica Applicata "N. Carrara", Consiglio Nazionale delle Ricerche, Sesto Fiorentino, Italy

Highly transparent Tm-doped (Y,Sc)2O3 ceramics with lasing quality were fabricated for the first time using vacuum sintering of mixed sesquioxide nanoparticles with various Y/Sc balances synthesized by laser ablation

Oral CE-10.4 15:15 TRACK 6

Direct Imaging of Fractal-Dimensional Percolation in the 3D Cluster Dynamics of a Ferroelectric Super-Crystal — •Ludovica Falsi[1,2], Marco Aversa[1], Fabrizio Di Mei[1], Davide Pierangeli[1], FeiFei Xin[1,3], Aharon J. Agranat[4], and Eugenio DelRe[1] — [1]Department of Physics, University of Rome "La Sapienza", 00185 Rome, Italy, Rome, Italy — [2]S.B.A.I. Department, Physics Section, University of Rome "La Sapienza", 00161 Rome, Italy, Rome, Italy — [3]College of Physics and Materials Science, Tianjin Normal University, Tianjin, China, 300387, Tianjin, China — [4]Applied Physics Department, Hebrew University of Jerusalem, Jerusalem 91904, Israel, Jerusalem, Israel

We perform percolation analysis of crossed-polarizer transmission images in a biased nanodisordered bulk KTN:Li perovskite. Cluster imaging is achieved using high-resolution orthographic 3D projections based on giant refraction.

Oral CE-10.5 15:30 TRACK 6

Fabricating diffractive elements for mid-IR optics using the hot embossing technology — •Rafal Kasztelanic[1,2], Ireneusz Kujawa[2], Ryszard Stepien[2], and Ryszard Buczynski[1,2] — [1]Faculty of Physics, University of Warsaw, Pasteura 5, 02-093, Warsaw, Poland — [2]Lukasiewicz Research Network - Institute of Microelectronic and Photonics, Wolczynska 133, 01-919 , Warsaw, Poland

We report on the cost-effective fabrication of glass diffractive optical elements (DOE) operating in the midIR range. We use the nickel shim produced using the electroforming method and the hot embossing process for DOE replication.

Oral CE-10.6 15:45 TRACK 6

Longwave Infrared Photoresponse in Copper 7,7,8,8-tetracyano-2,3,5,6-tetraflouroquinodimethane (CuTCNQF4) — •Sivacarendran Balendhran[1], Aviraj Ingle[2], Wei Yan[3], Nima Sefidmooye Azar[3], Hyungjin Kim[4,5], Rajesh Ramanathan[2], James Bullock[3], Ali Javey[4,5], Vipul Bansal[2], and Kenneth Crozier[1,3,6] — [1]School of Physics, The University of Melbourne, Parkville, Australia — [2]NanoBiotechnology Research Laboratory (NBRL), School of Science, RMIT University, Melbourne, Australia — [3]Department of Electrical and Electronic Engineering, The University of Melbourne, Parkville, Australia — [4]Electrical Engineering and Computer Sciences, University of California at Berkeley, Berkley, USA — [5]Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkley, USA — [6]ARC Centre of Excellence for Transformative Meta-Optical Systems, The University of Melbourne, Parkville, Australia

We demonstrate room-temperature long-wave infrared photoresponse in CuTCNQF4, a metal organic charge transfer complex. CuTCNQF4 based photoconductors are realized via simple wet chemical reactions followed by drop cast and dielectrophoretic alignment processes.

CJ-5: Pulsed Fiber Laser

Chair: Jörg Neumann, Laser Zentrum Hannover, Hannover, Germany

Time: Thursday, 14:30–16:00 Location: TRACK 7

Oral CJ-5.1 14:30 TRACK 7

High-energy fiber optical parametric chirped-pulse oscillator — •Rezki Becheker[1], Mohamed Touil[1], Saïd Idlahcen[1], Mincheng Tang[1], Adil Haboucha[2], Benoit Barviau[1], Frédéric Grisch[1], Patrice Camy[3], Thomas Godin[1], and Ammar Hideur[1] — [1]CORIA - CNRS - Université de Rouen Normandie - INSA Rouen, Rouen, France — [2]Photonics Bretagne, Lannion, France — [3]CIMAP, ENSICAEN-CNRS-CEA-Université Caen Normandie, Caen, France

We experimentally demonstrate a high-energy broadly-tunable fiber optical parametric chirped pulse oscillator (FOPCPO), numerically analyze its operation, and discuss its potential for further energy scaling beyond the μJ level.

Oral CJ-5.2 14:45 TRACK 7

Amplification of a 1.03 μm optical frequency comb in the gain-managed nonlinear regime – measurements and simulations — •Dorota Tomaszewska[1], Robert Lindberg[2], Valdas Pasiskevicius[2], Fredrik Laurell[2], and Grzegorz Soboń[1] — [1]Laser & Fiber Electronics Group, Wroclaw University of Science and Technology, Wroclaw, Poland — [2]Department of Applied Physics, Royal Institute of Technology, Stockholm, Sweden

We demonstrate a measured and simulated data for amplification in gain-managed nonlinear regime. The setup, built using Ytterbium-doped fiber, provides 24 nJ pulses at 1068 nm with 50 nm width and 54 fs of duration.

Invited CJ-5.3 15:00 TRACK 7

Manufacturing 2D Material Based Saturable Absorbers: From Composites to Printing — •Tawfique Hasan — Cambridge Graphene Centre, University of Cambridge, 9 JJ Thomson Avenue, CB3 0FA, Cambridge, United Kingdom

Two-dimensional (2D) crystals have long been exploited as saturable absorbers (SA) for pulse generation. I will present the evolution of laboratory-scale manufacturing pathways of fiber-integrated devices from these materials toward the aim of repeatable performance.

Oral CJ-5.4 15:30 TRACK 7

Erbium Fiber Laser with 340 nJ, 63 fs Pulses from Standard Single Mode Telecom Fiber — •Kevin F. Lee[1], Gengji Zhou[2], Jie Jiang[1], Herbert G. Winful[3], and Martin E. Fermann[1] — [1]IMRA America, Inc., Ann Arbor, USA — [2]Dept. of Physics, University of Michigan, Ann Arbor, USA — [3]Dept. of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, USA

We greatly increase femtosecond Er fiber laser pulse energy by a simple phase shaping method with fiber Bragg gratings. We generate 110 nJ frequency comb pulses, and 340 nJ pulses at lower repetition rate.

Oral CJ-5.5 15:45 TRACK 7

Tunable Actively Mode-locked Bi-doped O-band Fibre Laser — •Naresh kumar Thipparapu, Shaif-ul Alam, Yu Wang, Shankar Pidishety, David J Richardson, and Jayanta Sahu — University of Southampton, Southampton, United Kingdom

We present an all-fiberized tunable actively mode-locked Bismuth-doped fibre laser operating from 1300-1370nm. In a MOPA configuration, an average output power of 92.5mW and pulse width of 7.5ns with energy 56.8nJ were achieved at 1340nm.

EF-7: Symmetry Breaking, Geometrical and Topological Effects

Chair: Alessia Pasquazi, University of Sussex, Brighton, United Kingdom

Time: Thursday, 14:30–16:00 Location: TRACK 8

Invited EF-7.1 14:30 TRACK 8

Spontaneous symmetry breaking in coherently driven-dissipative coupled nanocavities — •Bruno Garbin[1], Andrus Giraldo[2], Neil G. R. Broderick[3], Bernd Krauskopf[2], Ariel Levenson[1], and Alejandro M. Yacomotti[1] — [1]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, 91120 Palaiseau, France — [2]Dodd-Walls Centre, Mathematics Department, The University of Auckland, Private Bag 92019, Auckland 1142, New Zealand — [3]Dodd-Walls Centre, Physics Department, The University of Auckland, Private Bag 92019, Auckland 1142, New Zealand

We report on the first experimental observation of mirror symmetry breaking in coherently driven-dissipative coupled nanocavities. Our results pave the way to the experimental study of symmetry breaking at low photon number.

Oral EF-7.2 15:00 TRACK 8

Engineering a multimode coupling in doubly pumped parametric down-conversion: hot-spots and gain enhancement — •Ottavia Jedrkiewicz[1], Erica Invernizzi[2], Enrico Brambilla[2], and Alessandra Gatti[1] — [1]Istituto di Fotonica e Nanotecnologie, CNR, Como, Italy — [2]Università dell'Insubria, Como, Italy

We investigate parametric down-conversion in a nonlinear bulk crystal, driven by two non-collinear pump modes. Hot-spots with local gain enhancement corresponding to a transition from a three-mode to a four-mode coupling is observed.

Oral EF-7.3 15:15 TRACK 8

Interplay between geometric and dynamic phase in liquid crystals — •Chandroth P Jisha[1], Jeroen Beeckman[2], Stefan Nolte[1,3], and Alessandro Alberucci[1,3] — [1]Friedrich-Schiller University Jena, Jena, Germany — [2]Ghent University, Gent, Belgium — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We investigate light propagation in thick samples under the simultaneous influence of dynamic and geometric phase. Our experiments in liquid crystals show how the light self-trapping depends on the interplay of the two contributions.

Oral EF-7.4 15:30 TRACK 8

Two–membrane Cavity Optomechanics: Non–linear Dynamics And Measurement Of The Optomechanical Coupling — •Paolo Piergentili[1,2], Wenlin Li[1], Riccardo Natali[1,2], Nicola Malossi[1,2], David Vitali[1,2,3], and Giovanni Di Giuseppe[1,2] — [1]School of Science and Technology, Physics Division, University of Camerino, Camerino, Italy — [2]INFN, Sezione di Perugia, Perugia, Italy — [3]CNR-INO, Firenze, Italy

The non–linear dynamics of an optomechanical system of a two–membrane ethalon in a high–finesse Fabry–Pérot cavity is presented, and a novel procedure for the determination of the optomechanical single–photon coupling rate through Hopf–bifucartion introduced.

Oral EF-7.5 15:45 TRACK 8

Nonlinear corner states observed in Kagome higher-order photonic topological insulators — •Marco S. Kirsch[1], Yiqi Zhang[2], Mark Kremer[1], Lukas J. Maczewsky[1], S. K. Ivanov[3], Yaroslaf V. Kartashov[3,4], L. Torner[4], Dieter Bauer[1], Alexander Szameit[1], and Matthias Heinrich[1] — [1]Institut für Physik, Universität Rostock, Rostock, Germany — [2]School of Electronic Science and Engineering, Xi'an Jiaotong University, Xi'an, China — [3]Institute of Spectroscopy, Russian Academy of Sciences, Moscow, Russia — [4]CFO, Barcelona Institute of Science and Technology, Castelldefels, Spain

We experimentally investigate nonlinear Kerr dynamics in higher-order photonic topological insulators. We excite nonlinear topological corner-modes that are robust against structural perturbations. Their localization demonstrates nontrivial nonmonotonic behavior as the input power is increased.

CB-8: Semiconductor-based Frequency Combs

Chair: Angel Valle, CSIC, University of Cantabria, Santander, Spain

Time: Thursday, 14:30–16:00 Location: TRACK 9

Oral CB-8.1 14:30 TRACK 9

Upconversion sampling of mid-infrared quantum cascade laser frequency combs — •Philipp Taeschler, Matthew Singleton, Ruijun Wang, Mattias Beck, and Jérôme Faist — Institute of Quantum Electronics, Zürich, Switzerland

We demonstrate the formation of mid-infrared quantum cascade laser pulses using an external grating compressor. Femtosecond optical sampling is employed to measure the intensity profile of the obtained pulses.

Oral CB-8.2 14:45 TRACK 9

Coherently-Averaged Dual-Comb Spectrometer at 7.7 μm with Master and Follower Quantum Cascade Lasers — •Kenichi Komagata[1], Atif Shehzad[1], Giulio Terrasanta[2], Pierre Brochard[1], Renaud Matthey[1], Michele Gianella[3], Pierre Jouy[2], Filippos Kapsalidis[4], Mehran Shahmohammadi[4], Mattias Beck[4], Valentin J. Wittwer[1], Jerome Faist[4], Lukas Emmenegger[3], Thomas Südmeyer[1], Andreas Hugi[2], and Stephane Shilt[1] — [1]Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, CH-2000 Neuchâtel, Switzerland — [2]IRsweep AG, Laubisrütistrasse 44, CH-8712 Stäfa, Switzerland — [3]Empa, Laboratory for Air Pollution / Environmental Technology, CH-8600 Dübendorf, Switzerland — [4]Institute for Quantum Electronics, ETH Zurich, CH-8093 Zurich, Switzerland

We demonstrate a mid-infrared dual comb spectrometer with fully mutually-locked quantum cascade lasers frequency combs. This enables coherent averaging of the multiheterodyne beat, promising increased signal-to-noise ratio and reduced data processing for high-resolution mid-infrared spectroscopy.

Oral CB-8.3 15:00 TRACK 9

Electrical injection-locking dynamics of a frequency-modulated comb — Marcus Ossiander[1], •Dominik Auth[2], Johannes Hillbrand[3,4], Quentin Gaimard[5], Dmitry Kazakov[1], Marco Piccardo[1], Abderrahim Ramdane[5], Federico Capasso[1], Benedikt Schwarz[1,4], and Stefan Breuer[1,2] — [1]School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA — [2]Institute of Applied Physics, TU Darmstadt, 64289 Darmstadt, Germany — [3]Institute for Quantum Electronics, ETH Zurich, 8093 Zürich, Switzerland — [4]Institute of Solid State Electronics, TU Wien, 1040 Vienna, Austria — [5]Centre de Nanosciences et de Nanotechnologies, 91120 Palaiseau, France

Beat frequency tuning, stabilization and complete phase coherence of a quantum dash frequency-modulated comb by all-electrical injection locking is demonstrated experimentally and confirmed by simulations joining a stochastic with a coupled oscillator model.

Oral CB-8.4 15:15 TRACK 9

Coherent Broadening and Tuning of QCL Frequency Combs via RF-Injection — •Barbara Schneider, Filippos Kapsalidis, Matthew Singleton, Mathieu Bertrand, Mattias Beck, and Jérôme Faist — ETH Zürich, Zürich, Switzerland

We present RF-injection as a means of tuning the spectral and temporal properties of QCL frequency combs. At high injection powers we show on-off switching behavior resembling active modelocking.

Oral CB-8.5 15:30 TRACK 9

Dynamics of Optical Frequency Combs in Ring and Fabry-Perot Quantum Cascade Lasers — •Carlo Silvestri[1], Lorenzo Luigi Columbo[1], Massimo Brambilla[2], and Mariangela Gioannini[1] — [1]Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Torino, Italy — [2]Dipartimento Interateneo di Fisica, Politecnico ed Università degli Studi di Bari, Bari, Italy

We present a Time Domain Travelling Wave simulator to study the self-generation of Optical Frequency Combs (OFCs) in different Quantum Cascade Laser cavities. We demonstrate various dynamic scenarios from dense OFCs to solitons.

Oral CB-8.6 15:45 TRACK 9

Low RF line width frequency-modulated and amplitude-modulated combs — •Leonard Wegert[1], Dominik Auth[1], Christoph Weber[1], Dmitry Kazakov[2], Marco Piccardo[2], Johannes Hillbrand[3,4], Luke F. Lester[5], Benedikt Schwarz[2,3], Federico Capasso[2], and Stefan Breuer[1,2] — [1]Institute of Applied Physics, TU Darmstadt, 64289 Darmstadt, Germany — [2]School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA — [3]Institute of Solid State Electronics, TU Wien, 1040 Vienna, Austria — [4]Institute for Quantum Electronics, ETH Zürich, 8093 Zürich, Switzerland — [5]Department of Electrical and Computer Engineering, VTech, Blacksburg, Virginia 24061, USA

Frequency- and amplitude-modulated combs are generated by a semiconductor quantum dot laser. Frequency-modulated comb beat note line widths of 950 Hz and amplitude-modulated comb line width of 200 Hz indicate low-phase noise comb generation.

CD-8: Guided Wave Devices

Chair: Rachel Grange, ETH Zurich, Zurich, Switzerland

Time: Thursday, 14:30–16:00 Location: TRACK 10

Invited CD-8.1 14:30 TRACK 10

Spontaneous Parametric Down-Conversion in Nonlinear Metasurfaces — •Anna Fedotova[1], Tomás Santiago-Cruz[2,3], Vitaliy Sultanov[2,3], Maximilian Weissflog[1,4], Mohammadreza Younesi[1], Isabelle Staude[1,5], Thomas Pertsch[1,6], Frank Setzpfandt[1], and Maria V. Chekhova[2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany — [2]Max Planck Institute for the Science of Light, Erlangen, Germany — [3]University of Erlangen-Nürnberg, Erlangen, Germany — [4]Max Planck School of Photonics, Jena, Germany — [5]Institute of Solid State Physics, Friedrich Schiller University Jena, Jena, Germany — [6]Fraunhofer Institute of Applied Optics and Precision Engineering, Jena, Germany

We experimentally demonstrate biphoton generation by spontaneous parametric down-conversion in resonant metasurfaces. In our metasurfaces, Mie-type resonances enable more efficient biphoton generation compared to an unstructured thin film and allow shaping of the biphoton spectrum.

Oral CD-8.2 15:00 TRACK 10

Steering of Quantum Walks through Coherent Control of High-dimensional Bi-photon Quantum Frequency Combs — •Raktim Haldar[1,2], Anahita Khodadad Kashi [1,2], and Michael Kues[1,2] — [1]Institute of Photonics, Leibniz University Hannover, Nienburger Straße 17, D-30167, Hannover, Germany — [2]Hannover Centre for Optical Technologies, Leibniz University Hannover, Nienburger Straße 17, D-30167, Hannover, Germany

We demonstrate the all-optical coherent-control of a directional quantum walk with an asymmetric energy transport, which is initiated from an high-dimensional bi-photon integrated quantum frequency comb with multiple joint spectral correlation lines.

Oral CD-8.3 15:15 TRACK 10

Non-phase-matched spontaneous parametric down-conversion from lithium niobate thin films — •Ngoc My Hanh Duong, Andreas Maeder, Gregoire Saerens, Fabian Kaufmann, and Rachel Grange — ETH Zurich, Zurich, Switzerland

We perform spontaneous parametric down-conversion process in lithium niobate thin film on quartz with subwavelength thickness of 200 nm at telecom wavelength. We obtained two-photon generation with strong correlation signal at zero delay time.

Oral CD-8.4 15:30 TRACK 10

Entangled photons through thick scattering media: experiments and comparison with simulations of the biphoton wave function — •Gnatiessoro Soro, Eric Lantz, Alexis Mosset, and Fabrice Devaux — Institut FEMTO-ST, Département d'Optique P. M. Duffieux, Besançon, France

We report experimentally and numerically quantum correlations imaging through thick random media. We demonstrated that spatial correlations between twin photon are still detected but no in form of two-photon speckle-like patterns.

Oral CD-8.5 15:45 TRACK 10

Photon-Pair Generation in Mid-Infrared using $AgGaS_2$ Crystals — •Mohit Kumar, Thomas Pertsch, and Frank Setzpfandt — Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University Jena, Albert-Einstein-Str. 15, 07745 , Jena, Germany

We demonstrate non-degenerate photon-pair generation by spontaneous parametric down conversion in silver gallium sulfide $AgGaS_2$. Idler photons in the mid-infrared spectral range above 6 μm wavelength are generated correlated to signal photons in the visible.

JSIV-1: Optical Computing I

Chair: Demetri Psaltis, EPFL, Lausanne, Switzerland

Time: Thursday, 14:30–16:00 Location: TRACK 11

Invited JSIV-1.1 14:30 TRACK 11

Complex Photonics for Large Scale Machine Learning — •Sylvain Gigan — Sorbonne University, Paris, France

I will discuss how light propagation in complex media can be exploited for a variety of machine learning tasks, from classification to time-series predictions, to spin-glass simulations.

Oral JSIV-1.2 15:00 TRACK 11

Neural network computing using a large-area vertical-cavity surface-emitting laser — •Xavier Porte[1], Anas Skalli[1], Nasibeh Haghighi[2], Stephan Reitzenstein[2], James A. Lott[2], and Daniel Brunner[1] — [1]Institut FEMTO-ST, Université Bourgogne Franche-Comté, CNRS UMR 6174, Besançon, France — [2]Institut für Festkörperphysik, Technische Universität Berlin, Hardenbergstraße 36, 10623, Berlin, Germany

We implement a fully parallel photonic neural network based on the spatially distributed modes of a large-area semiconductor laser. All photonic connections are realized in hardware and the system is capable of autonomous operation.

Oral JSIV-1.3 15:15 TRACK 11

Optical computing with spatiotemporal fiber nonlinearities — •Ugur Tegin[1,2], Mustafa Yildirim[1], Ilker Oguz[1,2], Christophe Moser[1], and Demetri Psaltis[2] — [1]Laboratory of Applied Photonics Devices, Ecole polytechnique federale de Lausanne, Lausanne, Switzerland — [2]Optics Laboratory, Ecole polytechnique federale de Lausanne, Lausanne, Switzerland

A novel optical computing framework by harnessing spatiotemporal nonlinear effects of multimode fibers for machine learning is presented. With linear and nonlinear interactions of spatial fiber modes, a brain-inspired computation engine is experimentally realized.

Oral JSIV-1.4 15:30 TRACK 11

High-Speed Neuromorphic Computing Using Spin-Controlled VCSELs — •Krishan Harkhoe, Guy Verschaffelt, and Guy Van der Sande — Applied Physics Research Group, Vrije Universiteit Brussel, Brussel, Belgium

We demonstrate a performant delay-based reservoir computing system using a spin-controlled VCSEL, with processing speeds 20 times faster than similar state-of-the-art systems. The fast polarization dynamics also enables us to drastically shorten the delay line.

Oral JSIV-1.5 15:45 TRACK 11

Neuromorphic photoelectric elements based on metal oxides nanocrystallites — •Aleksandr Chezhegov[1], Igor Balashov[1], Artem Chizhov[2], Andrey Grunin[1], and Andrey Fedyanin[1] — [1]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia — [2]Faculty of Chemistry, Lomonosov Moscow State University, , Moscow, Russia

Photoelectric synapses based on ZnO, In2O3, TiO2, WO3 nanocrystallites with a wide set of parameters, different STM and LTM temporal characteristics, additional gas composition and temperature control parameters acting as neuromodulators was demonstrated.

EE-3: Ultrafast Molecular Dynamics

Chair: Jens Biegert, ICFO - The Institute of Photonic Sciences, Castelldefels, Spain

Time: Thursday, 14:30–16:00 Location: TRACK 12

Tutorial EE-3.1 14:30 TRACK 12

X-ray free-electron lasers: the attosecond - angström frontier for molecular dynamics — •Linda Young — Chemical Sciences and Engineering Division, Argonne National Laboratory, Lemont, USA

This tutorial will describe how ultrashort x-ray pulses are generated using free-electron lasers, including their spectral, temporal, coherence properties, and, their application to study photo-initiated electronic and nuclear dynamics in gas and liquid phase.

Oral EE-3.2 15:30 TRACK 12

Higher Order Trapped States of a Solitary-Wave Well — •Oliver Melchert[1,2,3], Stephanie Willms[1,2], Alexey Yulin[4], Ihar Babushkin[1,2], Uwe Morgner[1,2,3], and Ayhan Demircan[1,2,3] — [1]Institute of Quantum Optics, Leibniz University Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation Across Disciplines), Hannover, Germany — [3]Hannover Centre for Optical Technologies, Hannover, Germany — [4]Department of Nanophotonics and Metamaterials, ITMO University, St. Petersburg, Russia

We discuss trapping of radiation by an attractive, solitary-wave induced potential well. The supported trapped states are determined by a Schrödinger-type eigenproblem. They appear robust against perturbation and can be manipulated in various ways.

Oral EE-3.3 15:45 TRACK 12

Alignment echoes in unidirectionally rotating molecules — •Long Xu[1], Ilia Tutunnikov[1], Lianrong Zhou[2], Kang Lin[2], Junjie Qiang[2], Peifen Lu[2], Yehiam Prior[1], Ilya Sh. Averbukh[1], and Jian Wu[2,3] — [1]Weizmann Institute of Science, Rehovot, Israel — [2]East China Normal University, Shanghai, China — [3]Shanxi University, Taiyuan, China

Alignment echoes in unidirectionally rotating molecules are induced by a pair of time-delayed polarization-twisted ultrashort laser pulses and measured by the COLTRIMS apparatus. The results are supported by a detailed theoretical analysis.

CM-6: Joint Session CM with LiM

Chair: Vassilia Zorba, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Time: Thursday, 16:30–18:00 Location: TRACK 1

Oral CM-6.1 16:30 TRACK 1

Mastering micro-filamentation for semiconductor–metal ultrafast laser welding — •Maxime Chambonneau[1], Qingfeng Li[1], Vladimir Yu. Fedorov[2], Markus Blothe[1], Stelios Tzortzakis[2], and Stefan Nolte[1,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University Jena, Jena, Germany — [2]Science Program, Texas A&M University at Qatar, Doha, Qatar — [3]Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena, Germany

We demonstrate the first semiconductor-metal ultrafast laser welding by determining and precompensating the nonlinear focal shift in the filamentation regime in silicon for optimizing the energy deposition at the interface with copper.

Oral CM-6.2 16:45 TRACK 1

High-Speed Writing of Volume Gratings Inside of Transparent Materials — •Stephen Ho, Ehsan Alimohammadian, and Peter R. Herman — Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada

Nano-explosion of open-cavity voids were applied in combination with beam shaping and splitting by an SLM to enable high-speed nano-structuring of high resolution, 3D photonic crystals in glasses and polymer films for strong grating effects.

Oral CM-6.3 17:00 TRACK 1

Airy beam enables single pass curved in-volume modifications and cutting of borosilicate glass — •David Sohr[1,2], Jens Ulrich Thomas[2], and Stefan Skupin[1] — [1]Institut Lumière Matière, UMR5306 - UCBL - CNRS, Lyon, France — [2]SCHOTT AG, Mainz, Germany

We produced permanent laser modifications in borosilicate glass following an adjustable parabolic trajectory and used these for single pass cutting of a 500 μm glass sheet resulting in a well defined convex edge after etching.

Oral CM-6.4 17:15 TRACK 1

Design and Fabrication of Straight Waveguides, Tapers and S-Bends with Two-Photon Direct Laser Writing — •Tigran Baghdasaryan, Koen Vanmol, Francis Berghmans, Hugo Thienpont, Thomas Geernaert, and Jurgen Van Erps — Vrije Universiteit Brussel and Flanders Make, Brussels, Belgium

We have developed a special approach for numerical and experimental optimization of 3D-printed waveguiding components, which we used to demonstrate low-loss fiber-coupled waveguides, parabolic shape tapers and spline shape S-bends.

Oral CM-6.5 17:30 TRACK 1

Femtosecond Fabrication of 3D Free-Form Functional Glass Microdevices: Burst-Mode Ablation and Selective Etching Solutions — •Deividas Andriukaitis[1,2], Agnė Butkutė[1,2], Tomas Baravykas[1], Rokas Vargalis[1], Jokūbas Stančikas[1,2], Titas Tičkūnas[1], Valdas Sirutkaitis[2], and Linas Jonušauskas[1,2] — [1]Femtika Ltd., Vilnius, Lithuania — [2]Faculty of Physics, Vilnius, Lithuania

We investigate and compare the advantages and drawbacks of two advanced femtosecond direct laser writing methods (direct ablation using burst mode fabrication and selective glass etching) for potential applications in microfluidics, micromechanics and microoptics.

Oral CM-6.6 17:45 TRACK 1

Femtosecond UV laser lift-off technique for GaN coatings — •Domas Paipulas, Simas Butkus, and Valdas Sirutkaitis — Laser Research Center, Vilnius University, Vilnius, Lithuania

We present a rapid laser lift-off technique for thin GaN coating separation from sapphire utilizing femtosecond UV pulses and demonstrate that raster patterning can produce high-quality coatings without any stitching artifacts at an industrial processing rate.

CD-9: Nonlinear Applications at Extreme Wavelengths

Chair: Ebrahim-Zadeh, ICFO - The Institute of Photonic Sciences, Castelldefels, Spain

Time: Thursday, 16:30–18:00 Location: TRACK 2

Oral CD-9.1 16:30 TRACK 2

Continuous Wavelength Tuning Across 3.9–12.0 μm From a 1040-nm-Pumped Optical Parametric Oscillator Based On Orientation-Patterned GaP Grown On GaAs — Peter Schunemann[1], Kerr Johnson[2], Carl Farrell[2], Luke Maidment[3], Yiwen Shi[4], Jake Charsley[5], Marius Rutkauskas[5], and •Derryck Telford Reid[5] — [1]BAE Systems, Nashua, USA — [2]Chromacity Ltd, Edinburgh, United Kingdom — [3]ICFO – Institut de Ciencies Fotoniques, Barcelona, Spain — [4]University of Electronic Science and Technology of China, Chengdu, China — [5]Heriot–Watt University, Edinburgh, United Kingdom

We report the first nonlinear frequency conversion—specifically optical parametric oscillation—in OPGaP layers grown by hydride vapor-phase epitaxy on OPGaAs templates. A fan-out grating provides continuously wavelength-tunable broadband pulses covering 3.9–12 μm.

Oral CD-9.2 16:45 TRACK 2

Raman Red-shift Compressor: A Simple Approach for Scaling the High Harmonic Generation Cut-off — •Katherine Légaré[1], Reza Safaei[1], Guillaume Barette[1], Loïc Arias[1], Philippe Lassonde[1], Heide Ibrahim[1], Boris Vodungbo[2], Emmanuelle Jal[2], Jan Lüning[3], Nicolas Jaouen[4], Andrius Baltuška[5], François Légaré[1], and Guangyu Fan[1] — [1]INRS-EMT, Varennes, Canada — [2]Sorbonne Université, Paris, France — [3]Helmholtz-Zentrum Berlin, Berlin, Germany — [4]Synchrotron SOLEIL, Gif-sur-Yvette, France — [5]Vienna University of Technology, Vienna, Austria

Multidimensional solitary states brought by the Raman process in gas-filled hollow-core fibres are used to drive high harmonic generation, pushing the cut-off to higher photon energies and improving the conversion efficiency of extreme ultraviolet photons.

Oral CD-9.3 17:00 TRACK 2

Mid-Infrared Supercontinuum Generation in Germanium Waveguides — •Alberto Della Torre[1], Milan Sinobad[1], Remi Armand[1], Barry Luther-Davies[2], Pan Ma[2], Stephen Madden[2], David Moss[3], Arnan Mitchell[4], Jean-Michel Hartmann[5], Vincent Reboud[5], Jean-Marc Fedeli[5], Christelle Monat[1], and Christian Grillet[1] — [1]Université de Lyon, Institut des Nanotechnologies de Lyon , Ecully, France — [2]Laser Physics Centre, Australian National University, Canberra, Australia — [3]Optical Sciences Centre, Swinburne University of Technology, Hawthorn, Australia — [4]School of Engineering, RMIT University, Melbourne, Australia — [5]Université Grenoble Alpes,C EA-Leti,, Grenoble, France

We report the first experimental demonstration of supercontinuum generation (from 3.53 to 5.83 μm at the -30 dB level) in a pure germanium waveguide. We attribute the long wavelength extension limit to free-carrier absorption.

Oral CD-9.4 17:15 TRACK 2

Towards plasmonic-enhanced optical nonlinearities in graphene metal-heterostructures — •Alessandro Trenti[1], Irati Alonso Calafell[1], Lee A. Rozema[1], David Alcaraz Iranzo[2], Philipp K. Jenke[1], Joel D. Cox[3,4], Avinash Kumar[2], Hlib Bieliaiev[1], Sébastien Nanot[2,5], Cheng Peng[6], Dmitri K. Efetov[2], Jin-Yong Hong[6], Jing Kong[6], Dirk R. Englund[6], F. Javier García de Abajo[2,7], Frank H. L. Koppens[2,7], and Philip Walther[1] — [1]Vienna Center for Quantum Science and Technology (VCQ), Faculty of Physics, University of Vienna, Vienna, Austria — [2]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [3]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [4]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark — [5]Laboratoire Charles Coulomb (L2C), Université de Montpellier, CNRS, Montpellier, France — [6]Quantum Photonics Group, RLE, Massachusetts Institute of Technology, Cambridge, MA, USA — [7]ICREA-Institucio Catalana de Recerca i Estudis Avancats, Barcelona, Spain

Gate-tunable huge optical nonlinearities in graphene-metal heterostructures are reported. Moreover, plasmonic-mediated nonlinear enhancement is expected in the range 6-9 μm, which can be addressed by efficient spectral translation of mid-infrared photons into the visible.

Oral CD-9.5 17:30 TRACK 2

A Stabilized Doubly Resonant OPO for THz Applications — •Han Rao[1,2], Christian Markus Dietrich[1,2], José Ricardo Cardoso de Andrade[3], Ayhan Demircan[1,2], Ihar Babushkin[1,2,3], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany — [3]Max Born Institute, Berlin, Germany

We demonstrate that the self-locking region of doubly resonant parametric oscillators can be significantly increased by introducing higher order dispersion into cavity and we show a possibility of its stabilization using sum-frequency generation-based scheme.

Oral CD-9.6 17:45 TRACK 2

Strong optoacoustic interaction in hot CS_2-filled liquid-core optical fiber — •Andreas Geilen[1,2,3], Alexandra Popp[1,2,4], Daniel Walter[1,2], Mario Chemnitz[5], Saher Junaid[6,7], Christopher G. Poulton[8], Christoph Marquardt[1,2,4], Markus A. Schmidt[6,7], and Birgit Stiller[1,2] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany — [3]IMPRS, International Max Planck Research School - Physics of Light, Erlangen, Germany — [4]SAOT, Graduate School in Advanced Optical Technologies, Erlangen, Germany — [5]INRS-EMT, Qqébec, Canada — [6]Leibniz Institute of Photonic Technology, Jena, Germany — [7]Otto Schott Institute of Materials Research (OSIM), Jena, Germany — [8]School of Mathematical and Physical Sciences, University of Technology Sydney, Sydney, Australia

We present temperature dependent integrated Brillouin measurements inside a fully sealed, CS_2-filled liquid-core optical fiber. We demonstrate the influence of the temperature and pressure on two acoustic modes at temperatures up to 136 °C.

CJ-6: Fiber Laser Components

Chair: Jörg Neumann, Laser Zentrum Hannover, Hannover, Germany

Time: Thursday, 16:30–18:00 Location: TRACK 3

Oral CJ-6.1 16:30 TRACK 3

Influence of Thermo-Mechanical Mismatch when Nanoimprinting Anti-Reflective Structures onto Small-core Mid-IR Chalcogenide Fibers — •Christian R. Petersen[1,3], Mikkel B. Lotz[2], Christos Markos[1,3], Getinet Woyessa[1], David Furniss[4], Angela B. Seddon[4], Rafael J. Taboryski[2], and Ole Bang[1,3,5] — [1]DTU Fotonik, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]DTU Nanolab, Technical University of Denmark, Kgs. Lyngby, Denmark — [3]NORBLIS, Virum, Denmark — [4]Mid-Infrared Photonics Group, University of Nottingham, Nottingham, United Kingdom — [5]NKT Photonics, Birkerød, Denmark

We present thermal nanoimprinting of both small-core and large-core chalcogenide optical fibers, achieving increased transmission by up to 32.4%. We also report and discuss the first observation of core protrusion/contraction in small-core fibers.

Oral CJ-6.2 16:45 TRACK 3

Thermal Response Characterisation of First-order Fibre Bragg Gratings in Indium Fluoride Fibre — •Ismael Chiamenti[1,2], Tino Elsmann[1], Aaron Reupert[3], Oguzhan Kara[1], Martin Becker[1], Lothar Wondraczek[3], and Maria Chernysheva[1] — [1]Leibniz Institute of Photonic Technology, Leibniz-IPHT, Jena, Germany — [2]Federal University of Technology - Parana - UTFPR/DAELT, Curitiba, Brazil — [3]Otto Schott Institute of Materials Research, Friedrich Schiller University, Jena, Germany

Vis-fs-laser was used to inscribed first-order Bragg gratings in indium fluoride fibres. They presented high reflectivity, thermal stability and high thermal sensitivity that will contribute to the development of Mid-IR fibre lasers and sensing technologies.

Oral CJ-6.3 17:00 TRACK 3

Poling Optical Fibers with Electrical Corona Discharge — •João Manoel Barbosa Pereira[1,2], Åsa Claesson[1], Fredrik Laurell[2], Oleksandr Tarasenko[1], and Walter Margulis[1,2] — [1]RISE Research Institutes of Sweden, Kista, Sweden — [2]KTH Royal Institute of Technology, Stockholm, Sweden

Electric field created by electrical corona discharge is used to pole silicate fibers. The method explores a different configuration to enhance optical poling. An electrooptic coefficient of 0.086pm/V, and Vπ of 702V is obtained.

Oral CJ-6.4 17:15 TRACK 3

Simplified, athermal fiber designs for high power laser applications — •Gonzalo Palma-Vega[1,2], Stefan Kuhn[1], Till Walbaum[1], Nicoletta Haarlammert[1], and Thomas Schreiber[1] — [1]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7 , Jena, Germany — [2]Institute of Applied Physics, Friedrich-Schiller-University Jena, Albert-Einstein-Str. 15, Jena, Germany

We present numerical simulations towards an athermal fiber design. We discuss how to adjust the thermo-optical coefficient to mitigate thermal effects such as mode shrinking and transversal mode instabilities in high power fiber lasers.

Oral CJ-6.5 17:30 TRACK 3

Optimization of Chirp and Tilt of Fiber Bragg gratings for Raman Emission Suppression — •Weixuan Lin[1,2], Maxime Desjardins-Carriere[2], Benoit Sevigny[2], and Martin Rochette[1] — [1]McGill University, Montreal, Canada — [2]ITF Technologies, Montreal, Canada

Fiber Bragg gratings with a tilt of controlled angle and a chirp of controlled direction are analyzed for Raman suppression in a kW fiber laser. Results include laser output spectra and power conversion efficiency.

Oral CJ-6.6 17:45 TRACK 3

Raman fiber laser based on a 7-core fiber with fs-inscribed regular and random structures — •Alexander Dostovalov[1], Mikhail Skvortsov[1], Alexey Wolf[1], Victor Labuntsov[1,2], Olga Egorova[3], Sergey Semjonov[4], Stefan Wabnitz[2,5], and Sergey Babin[1,2] — [1]Institute of Automation and Electrometry of the SB RAS, Novosibirsk, Russia — [2]Novosibirsk State University, Novosibirsk, Russia — [3]Prokhorov General Physics Institute, Russian Academy of Sciences, Moscow, Russia — [4]Dianov Fiber Optics Research Center, Prokhorov General Physics Institute, Russian Academy of Sciences, Moscow, Russia — [5]Sapienza University of Rome, Rome, Italy

The results of Raman laser generating at the wavelength of ~1090 nm with output power up to 2.5 W based on the 7-core passive fiber with fs-inscribed regular and random structures in individual cores are presented.

CK-6: 3D Fabrication Techniques and Components

Chair: Olivier Gauthier-Lafaye, LAAS-CNRS, Toulouse, France

Time: Thursday, 16:30–18:00 Location: TRACK 4

Oral CK-6.1 16:30 TRACK 4

3D-printed core-cladding waveguides and adiabatic splitters for integrated photonic circuits — •Xavier Porte, Johnny Moughames, Laurent Larger, Maxime Jacquot, Muamer Kadic, and Daniel Brunner — Institut FEMTO-ST, Université Bourgogne Franche-Comté, CNRS UMR 6174, Besançon, France

We report single-step additive manufacturing of photonic waveguides for single-mode photonic interconnects. We 3D-printed waveguides with step-index and graded-index core-cladding transitions as well as efficient 1-to-4 single-mode beam splitters based on adiabatic coupling.

Oral CK-6.2 16:45 TRACK 4

Terahertz waves transmission in 3D printed photonic crystals — •Mauro Missori[1], Laura Pilozzi[1], and Claudio Conti[1,2] — [1]Institute for Complex Systems, National Research Council (ISC-CNR), Rome, Italy — [2]Department of Physics, University Sapienza, Rome, Italy

We exploit 3D-printed components as a low-cost, rapid, and versatile tool for the fabrication of THz photonic crystals and carry out experiments and simulations of their spectral behaviour.

Oral CK-6.3 17:00 TRACK 4

Scalable photonic splitters based on 3D laser lithography — •Johnny Moughames, Xavier Porte, Laurent Larger, Maxime Jacquot, Muamer Kadic, and Daniel Brunner — Femto-st, University of Franche-Comté, Besançon, France

We present scalable 3D photonic splitters fabricated using 3D laser lithography. Splitters comprise optical waveguide with 1.2μm diameter, and we characterize 1x9 I/O branching topology. Finally, we demonstrate a 225 input and 529 output interconnect.

Oral CK-6.4 17:15 TRACK 4

Fiber-connected 3D Printed Hollow-core Light Cage for Gas Detection — •Bumjoon Jang[1], Julian Gargiulo[2], Jisoo Kim[1], Johannes Bürger[2], Hartmut Lehmann[1], Torsten Wieduwilt[1], Stefan A. Maier[2,3], and Markus A. Schmidt[1,4,5] — [1]Leibniz Institute of Photonic Technology, Jena, Germany — [2]Faculty of Physics, Ludwig-Maximilians-Universität München, München, Germany — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom — [4]Otto Schott Institute of Materials Research (OSIM), Friedrich Schiller University of Jena, Jena, Germany — [5]Abbe Center of Photonics and Faculty of Physics, Jena, Germany

The light cage is a 3D nanoprinted hollow-core waveguide which can be used as a light-matter interaction platform. Here we present the fiber-connected light cage and demonstrate ammonia sensing using tunable diode laser absorption spectroscopy.

Oral CK-6.5 17:30 TRACK 4

3D printed photonic structure for generation to zeroth- and high-order Bessel beams from a single-mode optical fiber — •Innem Reddy[1,2], Andrea Bertoncini[1], and Carlo Liberale[1,3] — [1]Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology, Saudi Arabia, Thuwal, Saudi Arabia — [2]Department of Electrical Engineering, University at Buffalo, NY USA, Buffalo, USA — [3]Computer, Electrical and Mathematical Science and Engineering Division, King Abdullah University of Science and Technology, Saudi Arabia, Thuwal, Saudi Arabia

We present a 3D micro-printed structure based on photonic crystal fiber design to transform the beam output from a single-mode fiber into zeroth- and higher-order Bessel beams.

Oral CK-6.6 17:45 TRACK 4

Möbius strip microlasers — •Stefan Bittner[1], Yalei Song[2,3], Yann Monceaux[2], Kimhong Chao[2], Hector M. Reynoso de la Cruz[2,4], Clément Lafargue[2], Dominique Decanini[5], Barbara Dietz[3], Joseph Zyss[2], Alain Grigis[6], Xavier Checoury[5], and Mélanie Lebental[2] — [1]Chair in Photonics, LMOPS, CentraleSupélec, Université de Lorraine, Metz, France — [2]Laboratoire Lumière, Matiére et Interfaces (LuMIn), CNRS, ENS Paris-Saclay, CentraleSupélec, Gif-sur-Yvette, France — [3]School of Physical Science and Technology, Lanzhou University, Lanzhou, China — [4]Science and Engineering Division, University of Guanajuato, Léon, Mexico — [5]Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, Palaiseau, France — [6]Laboratoire d'Analyse, Géométrie et Applications, CNRS, Université Sorbonne Paris Cité, Université Paris 13, Villetaneuse, France

We fabricate organic Möbius strip microlasers by direct laser writing. Experiments, FDTD mode calculations and ray tracing calculations indicate that the lasing modes confined in a 1 μm-thick Möbius strip are localized on periodic geodesics.

CH-10: Optical Metrology

Chair: Crina Cojocaru, University of Catalonia, Terrassa, Spain

Time: Thursday, 16:30–18:00 Location: TRACK 6

Oral CH-10.1 16:30 TRACK 6

Deeply Sub-Wavelength Non-Contact Optical Metrology of Sub-Wavelength Objects — •Carolina Rendón-Barraza[1], Eng Aik Chan[1], Guanghui Yuan[1], Giorgio Adamo[1], Tanchao Pu[2], and Nikolay I. Zheludev[1,2] — [1]Centre for Disruptive Photonic Technologies, The Photonics Institute, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore — [2]Centre for Photonic Metamaterials and Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

We experimentally demonstrate that a linear dimension of a sub-wavelength nanoscale object can be measured with an accuracy of ~λ/260 by a deep-learning-enabled examination of its diffraction pattern.

Oral CH-10.2 16:45 TRACK 6

Two-Color Interferometry in the Mid-Infrared based on Quantum Cascade Lasers for Absolute Distance Measurement with Nanometer-Scale Precision — •Renaud Matthey[1], Atif Shehzad[1], Philippe Giaccari[2], Richard Maulini[3], Thomas Südmeyer[1], and Stéphane Schilt[1] — [1]University of Neuchâtel, Neuchâtel, Switzerland — [2]Micos Engineering GmbH, Dübendorf, Switzerland — [3]Alpes Lasers SA, Saint-Blaise, Switzerland

A frequency-stabilized quantum cascade laser source is used for two-color interferometry to measure absolute distances with nm-scale precision, achieved by fractional phase measurements at 10^-3 at the optical wavelength and 4·10^-4 at a synthetic wavelength

Oral CH-10.3 17:00 TRACK 6

Laser ranging with analog all-optical coherent pulse compression using a frequency shifting loop — Vincent Billault[1,2], •Vicente Durán[3], Carlos R. Fernández-Pousa[4], Vincent Crozatier[2], and Hugues Guillet de Chatellus[1] — [1]University Grenoble Alpes, CNRS, LIPhy, Grenoble, France — [2]Thales Research & Technology, Palaiseau, France — [3]Universitat Jaume I, GROC-UJI, INIT, Castellón de la Plana , Spain — [4]Universitat Miguel Hernández, Engineering Research Center (I3E), Elche, Spain

We perform laser ranging using a dual-comb system that generates trains of chirped optical waveforms with slightly different periods. This provides analog pulse compression with low-frequency electronics and the possibility of expanding the ambiguity range.

Oral CH-10.4 17:15 TRACK 6

Long-distance laser positioning system by using acousto-optic deflector — •Mitsuru Musha, Mika Tajiri, and Yuichi Takeuchi — Institute for Laser Science, University of Electro-communications, Tokyo, Japan

We have developed novel satellite positioning system by using acousto-optic deflectors which measures two-dimensional angle and the distance between satellites which would be utilized for a precision formation flying in space

Oral CH-10.5 17:30 TRACK 6

Robust and High-Speed Cavity-Enhanced Vernier Spectrometer — •Chuang Lu[1], Francisco Senna Vieira[1], Aleksander Głuszek[2], Isak Silander[1], Grzegorz Soboń[2], and Aleksandra Foltynowicz[1] — [1]Department of Physics, Umeå University, Umeå, Sweden — [2]Laser and Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland

We demonstrate a new robust design of a continuous-filtering Vernier spectrometer based on a compact femtosecond Er:fiber laser. It allows detection of CO_2 at 1570 nm and CH_4 at 1650 nm with acquisition rates up to 100 Hz.

Oral CH-10.6 17:45 TRACK 6

Frequency-Comb-Assisted Swept-Wavelength Interferometry — •KRISHNA TWAYANA, Zhichao Ye, Óskar B Helgason, Magnus Karlsson , and Victor Torres-Company — Chalmers University of Technology, Gothenburg, Sweden

We use a frequency comb to calibrate the frequency axis in swept-wavelength interferometry. We apply the technique to laser spectroscopy of microresonators and demonstrate it can disentangle intrinsic from extrinsic Q in loaded Q measurements.

EA-6: Polaritons and Quantum Fluids of Light

Chair: Magdalena Stobinska, University of Warsaw, Warsaw, Poland

Time: Thursday, 16:30–18:00 Location: TRACK 7

Invited EA-6.1 16:30 TRACK 7

Universal KPZ scaling in the coherence of a 1D polariton condensate — •Jacqueline Bloch — Center for Nanoscience and Nanotechnology, CNRS-Paris Saclay University, Palaiseau, France

We demonstrate KPZ universal scaling in the spatio-temporal decay of the first order coherence of a 1D polariton condensate. These results highlight the fundamental difference between such driven dissipative condensates and equilibrium systems.

Oral EA-6.2 17:00 TRACK 7

Interplay between polarization and quantum correlations in a coherently driven polariton pillar cavity — •Olivier Bleu[1,2], Jesper Levinsen[1,2], and Meera M. Parish[1,2] — [1] School of Physics and Astronomy, Monash University,, Clayton, Australia — [2]ARC Centre of Excellence in Future Low-Energy Electronics Technologies, Monash University, Clayton, Australia

We revisit the problem of a polariton pillar cavity driven by a low intensity coherent pump accounting for the polarization degree of freedom. Our results are of relevance for the experimental pursuit of polariton blockade effects.

Oral EA-6.3 17:15 TRACK 7

Stimulated cooling of Frenkel exciton-polariton gas in a non-equilibrium Bose-Einstein condensate — •Anton V. Zasedatelev[1,2], Evgeny S. Andrianov[3,4], Vladislav Yu. Shishkov[3,4], Anton V. Baranikov[1], Yurii E. Lozovik[5,6], and Pavlos G. Lagoudakis[1,2] — [1]Skolkovo Institute of Science and Technology, Moscow, Russia — [2]Department of Physics and Astronomy, University of Southampton, Southampton, United Kingdom — [3]Dukhov Research Institute of Automatics (VNIIA), Moscow, Russia — [4]Moscow Institute of Physics and Technology, Moscow, Russia — [5]Institute for Spectroscopy RAS, Moscow, Russia — [6]Moscow Institute of Electronics and Mathematics, National Research University Higher School of Economics, Moscow, Russia

We explored non-equilibrium thermodynamics of Frenkel exciton-polaritons in organic microcavities bearing strong light-matter interaction. Our experimental study demonstrates stimulated cooling of polariton gas down to $\sim 40K$ above the Bose-Einstein condensation threshold at ambient conditions.

Oral EA-6.4 17:30 TRACK 7

Steady-state superfluidity of light in a tunable cavity at room temperature — •Giel Keijsers[1], Zhou Geng[1], Kevin J.H. Peters[1], Michiel Wouters[2], and Said R.K. Rodriguez[1] — [1]AMOLF, Amsterdam, Netherlands — [2]University of Antwerp, Antwerp, Belgium

We report the first observation of superfluid cavity photons. Remarkably, the superfluid state emerges in a steady state and at room temperature, due to the strong thermo-optical nonlinearity of our oil-filled cavity.

Oral EA-6.5 17:45 TRACK 7

Photon Pair Correlations in Semiconductor-Superconductor Light Sources — •Shlomi Bouscher[1], Dmitry Panna[1], Krishna Balasubramanian[1,2], Ronen Jacovi[1], Ankit Kumar[1], Christian Schneider[3], Sven Hoefling[3], and Alex Hayat[1] — [1]Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel — [2]Electrical Engineering Faculty, Indian institute of technology, Kanpur, India — [3]Technische Physik, Physikalisches Institut and Wilhelm Conrad Röntgen Research Center for Complex Material Systems, Universität Würzburg, Wurzburg, Germany

We demonstrate evidence of photon pair correlations, resulting from injected Cooper-pairs in superconductor-semiconductor structures. Such structures can be utilized for multiple applications including enhanced two-photon gain, electrically-driven entangled-photon generation and Bell-state analyzers.

EC-6: Topology in Driven-dissipative Systems

Chair: Alexander Szameit, Rostock University, Rostock, Germany

Time: Thursday, 16:30–18:00 Location: TRACK 7

Invited EC-6.1 16:30 TRACK 7

Topological Insulator Surface-Emitting Laser Array — Alex Dikopoltsev[1], Tristan H. Harder[2], Eran Lustig[1], Oleg A. Egorov[3], Johannes Beierlein[2], Adriana Wolf[2], Monika Emmerling[2], Christian Schneider[2], Sven Höfling[2], Mordechai Segev[1], and •Sebastian Klembt[2] — [1]Physics Department, Technion, 32000 Haifa, Israel — [2]Technische Physik, Wilhelm-Conrad-Röntgen-Research Center for Complex Material Systems, and Würzburg-Dresden Cluster of Excellence ct.qmat, Universität Würzburg, 97074 Würzburg, Germany — [3]ITFO, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, 07743 Jena, Germany

We present the first experimental demonstration of a topological insulator VCSEL array. Using the crystalline topological insulator model, we implement a 30 vertical-emitter array displaying an extended coherent mode emitting at a single wavelength.

Oral EC-6.2 17:00 TRACK 7

Topological optical and phononic interface modes by simultaneous band inversion — •Martin Esmann, Omar Ortiz, Priya Priya, Anne Rodriguez, Aristide Lemaitre, and Norberto Daniel Lanzillotti-Kimura — Centre de Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, 10 Boulevard Thomas Gobert, 91120 Palaiseau, France

We construct colocalized optical and phononic interface modes by simultaneous band inversion in a GaAs/AlAs heterostructure. The topological robustness manifests in a resilient Brillouin cross-section with potential applications for robust optomechanical resonators.

Oral EC-6.3 17:15 TRACK 7

Role of the bus waveguide in the nonlinear reciprocity breaking in a Taiji microresonator — •Riccardo Franchi[1], Alberto Muñoz de las Heras[2], Stefano Biasi[1], Mher Ghulinyan[3], Iacopo Carusotto[2], and Lorenzo Pavesi[1] — [1]Nanoscience Laboratory, Department of Physics, University of Trento, Trento, Italy — [2]INO-CNR BEC Center and Department of Physics, University of Trento, Trento, Italy — [3]Sensors and Devices, Fondazione Bruno Kessler, Trento, Italy

We demonstrated how an asymmetric microresonator in the nonlinear regime behaves as a nonreciprocal system and we discussed the role of the bus waveguide asymmetry and its Fabry-Pérot oscillations.

Oral EC-6.4 17:30 TRACK 7

Topological edge solitons in χ^2 media — •Sergey Ivanov[1,2], Yaroslav Kartashov[2,3], Alexander Szameit[4], Lluis Torner[3], and Vladimir Konotop[5] — [1]Moscow Institute of Physics and Technology, Dolgoprudny, Moscow region, Russia — [2]Institute of Spectroscopy, Russian Academy of Sciences, Troitsk, Moscow, Russia — [3]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona), Spain — [4]Institute for Physics, University of Rostock, Rostock, Germany — [5]Departamento de Física and Centro de Física Teórica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal

We present the first example of the Floquet topological edge soliton supported by parametric interactions in quadratic nonlinear media with inscribed arrays of helical waveguides.

Oral EC-6.5 17:45 TRACK 7

Implementation of a non-Hermitian phase transition in quasicrystals based on a Floquet Aubry-André-Harper model — Mark Kremer[1], •Sebastian Weidemann[1], Stefano Longhi[2], Martin Wimmer[3], Ulf Peschel[3], and Alexander Szameit[1] — [1]Institut für Physik, Universität Rostock, Rostock, Germany — [2]Dipartimento di Fisica, Politecnico di Milano and Istituto di Fotonica e Nanotecnologie del Consiglio Nazionale delle Ricerche, Milano, Italy — [3]Institute of Solid State Theory and Optics, Friedrich Schiller University Jena, Jena, Germany

We propose and experimentally demonstrate a novel Floquet Aubry-André-Harper model, where we measure the Harper-Hofstadter Butterfly and the localization phase transition. Furthermore, a non-Hermitian extension is studied, measuring a simultaneous PT and localization phase transition.

CL-3: Advanced Biological Microscopy

Chair: Chiara Stringari, Laboratory for Optics and Biosciences, Ecole Polytechnique, Palaiseau,France

Time: Thursday, 16:30–18:00 Location: TRACK 8

Invited CL-3.1 16:30 TRACK 8

3D and parallelized RESOLFT for volumetric live cell imaging — •Ilaria Testa — KTH-SciLifeLab, Stockholm, Sweden

we present a new RESOLFT microscope capable of delivering sub-80 nm 3D resolution in whole living cells with a new interference pattern applied to reversible photo-switching. Live cell volumetric imaging is demonstrated.

Oral CL-3.2 17:00 TRACK 8

Time-Resolved STED Microscopy with Single-Photon Detector Array: a Perfect Synergy — •Giorgio Tortarolo[1], Simonluca Piazza[1,2], Andrea Bucci[1,3], Paolo Bianchini[4], Colin J.R. Sheppard[4,5], Alberto Diaspro[4,6], Eli Slenders[1], Sami Koho[1], Marco Castello[1,2], and Giuseppe Vicidomini[1] — [1]Molecular Microscopy and Spectroscopy, Istituto Italiano di Tecnologia, Genoa, Italy — [2]Genoa Instruments, Genoa, Italy — [3]DIBRIS, University of Genoa, Genoa, Italy — [4]Optical Nanoscopy & NIC@IIT, Istituto Italiano di Tecnologia, Genoa, Italy — [5]School of Chemistry, University of Wollongong, Wollongong, Australia — [6]DIFI, University of Genoa, Genoa, Italy

We introduce a versatile time-resolved microscopy platform based on the SPAD array detector, enabling dual-color background-free STED-ISM imaging.

Oral CL-3.3 17:15 TRACK 8

Circular-dichroism SHG microscopy probes the polarity distribution of out-of-plane collagen fibril assemblies — Margaux Schmeltz[1], Claire Teulon[1], Maxime Pinsard[2], Uwe Hansen[3], Maged Alnawaiseh[4], Djida Ghoubay[5], Vincent Borderie[5], Gervaise Mosser[6], Carole Aimé[6], François Légaré[2], •Gaël Latour[1,7], and Marie-Claire Schanne-Klein[1] — [1]Laboratoire d'Optique et Biosciences, Ecole polytechnique, CNRS, Inserm, Institut Polytechnique de Paris, Palaiseau, France — [2]Institut National de la Recherche Scientifique, Centre Energie Matériaux et Télécommunications, Varenne, Canada — [3]Institute for Musculoskeletal Medicine, University Hospital Münster, Münster, Germany — [4]Department of Ophthalmology, University of Münster Medical Center, Münster, Germany — [5]Sorbonne Université, CHNO des Quinze Vingt, INSERM, Institut de la Vision, GRC32, CIC1423, Paris, France — [6]Sorbonne Université, CNRS, Laboratoire de Chimie de la Matière Condensée de Paris (LCMCP), Paris, France — [7]Université Paris-Saclay, Saint-Aubin, France

Experiments on human corneas and theoretical analysis of the chiral SHG response including magnetic contributions show that circular-dichroism SHG microscopy specifically reveals assemblies of out-of-plane collagen fibrils and probes their sub-micrometer scale polarity distribution.

Oral CL-3.4 17:30 TRACK 8

Structural imaging of keratoconic human corneas using polarization-resolved Second Harmonic Generation microscopy — •Clothilde Raoux[1], Margaux Schmeltz[1], Marion Bied[1], Maged Alnawaiseh[2], Uwe Hansen[3], Gaël Latour[1,4], and Marie-Claire Schanne-Klein[1] — [1]Laboratory for Optics and Biosciences, Ecole polytechnique, CNRS, INSERM, Institut Polytechnique de Paris, Palaiseau, France — [2]Department of Ophthalmology, Hospital Fulda, University of Marburg, Campus Fulda, Fulda, Germany — [3]Institute for Musculoskeletal Medicine, University Hospital Münster, Münster, Germany — [4]Université Paris-Saclay, Saint-Aubin, France

We implement polarization-resolved second harmonic generation microscopy to characterize the orientation distribution of collagen lamellae in human cornea. We evidence a less ordered distribution in keratoconic corneas, in agreement with their deteriorated mechanical behaviour.

Oral CL-3.5 17:45 TRACK 8

Fundamental Bounds on the Precision of Classical Interferometric Imaging Techniques — Dorian Bouchet[1,2], Jonathan Dong[3], Dante Maestre[4,5], Clara Conrad-Billroth[4,5], and •Thomas Juffmann[4,5] — [1]Debye Institute for Nanomaterials Science, Utrecht, Netherlands — [2]Université Grenoble Alpes, CNRS, LIPhy, Grenobles, France — [3]Laboratoire Kastler Brossel, Ecole Normale Supérieure, Université PSL,CNRS, Sorbonne Université, Collège de France, Paris, France — [4]University of Vienna, Faculty of Physics, VCQ, Vienna, Austria — [5]Max Perutz Laboratories,Department of Structural and Computational Biology, Vienna, Austria

Interferometric imaging is a widely used in physics, biology, and in clinical applications. Here we derive and discuss bounds on the achievable phase measurement precision that can be obtained using classical linear optical systems.

EE-4: Ultrafast Characterisation and Manipulation at Nanoscale

Chair: Ayhan Demircan, Hannover Centre for Optical Technologies, Hannover, Germany

Time: Thursday, 16:30–18:00 Location: TRACK 9

Oral EE-4.1 16:30 TRACK 9

Ultrafast Detection and Manipulation of a Persistent Trion Coherence in a Single CdSe/ZnSe Quantum Dot — •Philipp Henzler[1], Matthias Holtkemper[2], Christian Traum[1], Doris E. Reiter[2], Tilmann Kuhn[2], Denis V. Seletskiy[1,3], and Alfred Leitenstorfer[1] — [1]Department of Physics and Center for Applied Photonics, University of Konstanz, D-78457 Konstanz, Germany — [2]Institute of Solid State Theory, University of Münster, D-48149 Münster, Germany — [3]Department of Engineering Physics, Polytechnique Montréal, Montréal, Québec H3T 1J4, Canada

Femtosecond microscopy reveals long-lived quantum beats between highly excited trion states probed via biexcitonic absorption. Pump-probe polarization provides control over phase and amplitude. Interesting processes of few-fermion quantum dynamics after single-electron excitation are reported.

Keynote EE-4.2 16:45 TRACK 9

High-field physics in nanostructures — •Matthias Kling — Physics Department, Ludwig-Maximilians-Universität Munich, Garching, Germany — Max Planck Institute of Quantum Optics, Garching, Germany

The talk will highlight recent research results and show perspectives for studies of high-field physics in nanostructures.

Oral EE-4.3 17:30 TRACK 9

Aggregation Dependent Light-Heat Conversion Dynamics in Gold Nanoparticles Loaded Agarose Gel — •Andrea Mazzanti[1], Luca Moretti[1], Arianna Rossetti[2], Andrea Schirato[1,3], Laura Polito[4], Fabio Pizzetti[2], Alessandro Sacchetti[2], Paolo Laporta[1,5], Giulio Cerullo[1,5], Filippo Rossi[2], Margherita Maiuri[1], and Giuseppe Della Valle[1,5] — [1]Dipartimento di Fisica, Politecnico di Milano, Milan, Italy — [2]Dipartimento di Chimica, Materiali e Ingegneria Chimica "Giulio Natta", Politecnico di Milano, Milan, Italy — [3]Istituto Italiano di Tecnologia, Genoa, Italy — [4]Consiglio Nazionale delle Ricerche, CNR-SCITEC, Milan, Italy — [5]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Milan, Italy

We investigate, through a combination of ultrafast pump-probe spectroscopy and numerical modeling, the phototermal properties of Au nanoparticles loaded hydrogels. Drug delivery experiments demonstrate increased release efficiency in aggregates with respect to coated nanoparticles.

Oral EE-4.4 17:45 TRACK 9

Probing Free Carrier and Exciton Dynamics in a Bulk Semiconductor with Two-Dimensional Electronic Spectroscopy — •Jonas Allerbeck[1,2], Thomas Deckert[1,2], Laurens Spitzner[2], and Daniele Brida[1,2] — [1]Université du Luxembourg, Luxembourg, Luxembourg — [2]University of Konstanz, Konstanz, Germany

Ultrafast spectroscopy employing a sequence of phase-locked pump pulses provides a unique method to precisely track the exciton dynamics in bulk gallium selenide with sub-10 fs temporal and 4 meV (1 THz) spectral resolution.

JSIV-2: Learning in Imaging and Metrology I

Chair: Christophe Moser, EPFL, Lausanne, Switzerland

Time: Thursday, 16:30–18:00 Location: TRACK 10

Invited JSIV-2.1 16:30 TRACK 10

On the use of machine learning for computational imaging — •George Barbastathis — Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

I will discuss the use of machine learning with physics priors for imaging systems that heavily rely on computation to overcome ill-posedness and noise.

Oral JSIV-2.2 17:00 TRACK 10

Deeply Subwavelength Topological Microscopy — Tanchao Pu[1], Jun-Yu Ou[1], Edward Rogers[1,2], Nikitas Papasimakis[1], Peter J. Smith[2,3,4], and •Nikolay I. Zheludev[1,5] — [1]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Institute for Life Sciences, University of Southampton, Southampton, United Kingdom — [3]Biological Sciences, Faculty of Natural and Environmental Sciences, University of Southampton, Southampton, United Kingdom — [4]Marine Biological Laboratory, Woods Hole, Massachusetts , USA — [5]Centre for Disruptive Photonic Technologies & TPI, SPMS, Nanyang Technological University, Singapore, Singapore

We report on far-field imaging of subwavelength objects at resolution exceeding $\lambda/20$ by employing topologically structured light and artificial intelligence.

Oral JSIV-2.3 17:15 TRACK 10

Full characterization of partially measured systems with neural networks — •Babak Rahmani[1], Damien Loterie[1], Eirini Kakkava[2], Navid Borhani[2], Ugur Tegin [2], Demetri Psaltis[2], and Christophe Moser[1] — [1]Laboratory of applied photonics devices, EPFL, Lausanne, Switzerland — [2]Laboratory of optics, EPFL, Lausanne, Switzerland

We propose a method based on neural networks to characterize a complex optical system from intensity-only measurements. The characterization involves learning the forward and backward mappings of the system that can be subsequently used to project or image arbitrary patterns.

Oral JSIV-2.4 17:30 TRACK 10

Time-efficient object recognition in quantum ghost imaging — •Valeria Rodríguez-Fajardo, Chané Moodley, Jonathan Pinnell, Bereneice Sephton, and Andrew Forbes — School of Physics, University of the Witwatersrand, Johannesburg, South Africa

Ghost imaging is a promising imaging technique with time-efficiency as its main limitation. We optimised experimental parameters and introduced deep-learning for image enhancement and object recognition offering an 80% improvement in the image reconstruction time.

Oral JSIV-2.5 17:45 TRACK 10

Optical Counting of Particles Too Small to See — •Eng Aik Chan[1], Carolina Rendón-Barraza[1], Guanghui Yuan[1], Tanchao Pu[2], Jun-Yu Ou[2], Nikitas Papasimakis[2], and Nikolay I. Zheludev[1,2] — [1]Centre for Disruptive Photonic Technologies, Nanyang Technological University, Singapore, Singapore — [2]Centre for Photonic Metamaterials and Optoelectronics Research Centre, University of Southampton, Southampton , United Kingdom

Artificial intelligence analysis of the light scattered on groups of particles of different sizes allows counting of them and classifying them by size, even if they are too small($\lambda/7$) to be resolved by the microscope.

CB-9: Dynamics and Novel Concepts in Semiconductor Lasers

Chair: Frédéric Grillot, Université Paris Diderot, Paris, France

Time: Thursday, 16:30–18:00 Location: TRACK 11

Oral CB-9.1 16:30 TRACK 11

Pseudo mode-locking — •Günter Steinmeyer[1,2], Esmerando Escoto[1,3], and Ayhan Demircan[4] — [1]Max-Born-Institut, Berlin, Germany — [2]Institut für Physik, Humboldt Universität zu Berlin,, Berlin, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [4]Cluster of Excellence PhoenixD and the Institute of Quantum Optics, Leibniz University, Hannover, Germany

In the recent decade, numerous reports of self mode-locking met controversial reception. For the first time, we offer a theoretical explanation for those disputed experimental reports in the framework of the Haus Master Equation.

Oral CB-9.2 16:45 TRACK 11

Highly parallel ultra-fast random number generation from a stable-cavity broad-area semiconductor laser — Kyungduk Kim[1], •Stefan Bittner[1,2], Yongquan Zeng[3], Stefano Guazzotti[4], Ortwin Hess[4], Qi Jie Wang[3], and Hui Cao[1] — [1]Department of Applied Physics, Yale University, New Haven, USA — [2]Chaire in Photonics, LMOPS, CentraleSupélec and Université de Lorraine, Metz, France — [3]Center for OptoElectronics and Biophotonics, Nanyang Technological University, Singapore, Singapore — [4]School of Physics and CRANN Institute, Trinity College Dublin, Dublin, Ireland

We use spatio-temporal interference of many lasing modes and spontaneous emission in a specially designed stable cavity for parallel random number generation. With 127 spatial channels, a total bit rate of 250 Tbit/s is reached.

Oral CB-9.3 17:00 TRACK 11

Experimental study of the randomness of the dynamics of a laser diode under stimulated Brillouin scattering optical feedback — Leidy Johana Quintero-Rodríguez[1], Ignacio Enrique Zaldívar-Huerta[1], Yanhua Hong[2], Cristina Masoller[3], and •Min Won Lee[4] — [1]Instituto Nacional de Astrofísica, Óptica y Electrónica, Puebla, Mexico — [2]Bangor University, Bangor , United Kingdom — [3]Universitat Politècnica de Catalunya, Terrassa, Spain — [4]Université Sorbonne Paris Nord, Villetaneuse, France

We study two optical feedback configurations and quantify the randomness of the diode laser output. We show that the light from stimulated Brillouin backscattering feedback generates a more random signal, as compared to conventional feedback.

Oral CB-9.4 17:15 TRACK 11

Gain-Switched Semiconductor Laser Driven Soliton Microcombs — •Wenle Weng[1], Aleksandra Kaszubowska-Anandarajah[2], Jijun He[1], Prajwal Lakshmijayasimha[3], Erwan Lucas[1], Junqiu Liu[1], Prince Anandarajah[3], and Tobias Kippenberg[1] — [1]Swiss Federal Institute of Technology in Lausanne, Lausanne, Switzerland — [2]Trinity College Dublin, Dublin, Ireland — [3]Dublin City University, Dublin, Ireland

Using phase-engineered coherent laser pulses produced by gain-switched semiconductor lasers, we generate low-power-threshold soliton microcombs whose repetition frequencies are in the X-band and K-band microwave ranges.

Oral CB-9.5 17:30 TRACK 11

High-Power Quasi-CW Diode-Pumped 750 nm VECSEL Emitting a Peak Power of 29.6 W and an Average Power of 8.5 W — •Pascal J. Weinert[1], Marius Grossmann[2], Uwe Brauch[1], Michael Jetter[2], Peter Michler[2], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Stuttgart, Germany — [2]Institut für Halbleiteroptik und Funktionelle Grenzflächen (IHFG), Center for Integrated Quantum Science and Technology (IQST), and Stuttgart Research Center of Photonic Engineering (SCoPE), University of Stuttgart, Stuttgart, Germany

We present a quasi-CW diode-pumped AlGaAs-based VECSEL emitting a maximum peak power of 29.6 W and an average power of 8.52 W around 750 nm. Power scaling was achieved by scaling both pump area and pump duty cycle.

Oral CB-9.6 17:45 TRACK 11

Ultrawide-band chaotic breathing in semiconductor laser — •Tushar Malica[1,2], Guillaume Bouchez[1,2], Delphine Wolfersberger[1,2], and Marc Sciamanna[1,2] — [1]Chaire Photonique, LMOPS, CentraleSupélec,2 Rue Edouard Belin , 57070 Metz, France — [2]. Université de Lorraine, LMOPS, 2 Rue Edouard Belin , 57070 Metz, France

An optical delay system with phase-conjugate feedback is shown to operate as a three timescale superharmonic system and consistently exhibit novel, nonlinear, and spatiotemporally complex dynamics with state-of-the-art chaos bandwidth values of ~35 GHz.

PD-1: Postdeadline Session 1

Time: Thursday, 18:30–20:00 Location: TRACK 1

postdeadline papers

PD-2: Postdeadline Session 2

Time: Thursday, 18:30–20:00 Location: TRACK 2

postdeadline papers

CG-P: CG Poster Session

Time: Thursday, 10:00–11:00 Location: TRACK 1

CG-P.1 10:00 TRACK 1

Double-Foci Beamline for Attosecond Transient Reflection Spectroscopy — •Giacomo Inzani[1], Giacinto D. Lucarelli[1,2], Bruno Moio[1,2], Nicola Fabris[3], Liliana Moscardi[4], Gian Luca Dolso[1], Nicola Di Palo[1], Fabio Frassetto[3], Luca Poletto[3], Mauro Nisoli[1,2], and Matteo Lucchini[1,2] — [1]Department of Physics, Politecnico di Milano, Milano, Italy — [2]Institute for Photonics and Nanotechnologies, IFN-CNR, Milano, Italy — [3]Institute for Photonics and Nanotechnologies, IFN-CNR, Padova, Italy — [4]Center for Nano Science and Technology@PoliMi, Istituto Italiano di Tecnologia, Milano, Italy

We present a novel beamline for attosecond IR-XUV pump-probe reflection spectroscopy in solids. The actively stabilized delay line and the simultaneous characterization of pulses in a sequential double-foci geometry paves the way for innovative experiments.

CG-P.2 10:00 TRACK 1

Controlling polarization of attosecond pulses with plasmonic-enhanced bichromatic counter-rotating circularly polarized fields — Irfana N. Ansari[1], •Cornelia Hofmann[2,3], Lukas Medišauskas[2], Maciej Lewenstein[4,5], Marcelo F. Ciappina[4,6,7,8], and Gopal Dixit[1] — [1]Indian Institute of Technology Bombay, Mumbay, India — [2]Max Planck Institute for the Physics of Complex Systems, Dresden, Germany — [3]University College London, London, United Kingdom — [4]ICFO - Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain — [5]ICREA, Barcelona, Spain — [6]Institute of Physics of the ASCR, ELI Beamlines Project, Prague, Czech Republic — [7]Guangdong Technion–Israel Institute of Technology, Shantou, China — [8]Technion–Israel Institute of Technology, Haifa, Israel

We apply a bichromatic counter-rotating laser field with spatially inhomogeneous enhancement. The direction and the strength of the plasmonic field enhance or suppress certain recombining electron trajectories, thus modifying the ellipticity of attosecond pulses.

CG-P.3 10:00 TRACK 1

12.9 mW high harmonic generation at 26.5 eV enabled by a sub-20 fs visible laser — •Robert Klas[1,2], Alexander Kirsche[1,2], Joachim Buldt[1], Henning Stark[1], Steffen Hädrich[3], Jan Rothhardt[1,2,4], and Jens Limpert[1,2,4] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, 07745 Jena, Germany — [2]Helmholtz Institute Jena, 07743 Jena, Germany — [3]Active Fiber Systems GmbH, 07745 Jena, Germany — [4]Fraunhofer Institute of Applied Optics and Precission Engeneering, 07745 Jena, Germany

High harmonic generation driven by a 515 nm, 18.6 fs pulses at 50 W average power, resulting in a record average power of 12.9 mW in a single harmonic line at 26.5 eV is presented.

CG-P.4 10:00 TRACK 1

In Situ Measurement of the Cooper Minimum in Argon — •Graham Brown, Chunmei Zhang, Dong Hyuk Ko, and Paul Bruce Corkum — University of Ottawa, Ottawa, Canada

We simulate a collinear two-color attosecond in situ measurement in argon and show that in situ techniques measure a variation of the electron group delay around the Cooper minimum.

CG-P.5 10:00 TRACK 1

Angle-resolved Photoelectron Spectroscopy of large Water Clusters ionized by an XUV Comb — •Lorenzo Colaizzi[1,2], Loren Ban[3], Andrea Trabattoni[1], Vincent Wanie[1,4], Krishna Saraswathula[1], Erik P. Månsson[1], Philipp Rupp[5,6], Qingcao Liu[5,6], Lennart Seiffert[7], Elisabeth A. Herzig[7], Andrea Cartella[1,8], Bruce L. Yoder[3], François Légaré[4], Matthias F. Kling[5,6], Thomas Fennel[7], Ruth Signorell[3], and Francesca Calegari[1,2,8,9] — [1]Center for Free-Electron Laser Science, Hamburg, Germany — [2]Physics Department, University of Hamburg, Hamburg, Germany — [3]Department of Chemistry and Applied Biosciences, Laboratory of Physical Chemistry, ETH Zürich, Zürich, Switzerland — [4]Institut National de la Recherche Scientifique, Varennes (Qc), Canada — [5]Max Planck Institute of Quantum Optics, Garching, Germany — [6]Department of Physics, Ludwig-Maximilians-Universität München, Garching, Germany — [7]Institute of Physics, University of Rostock, Rostock, Germany — [8]The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, , Hamburg, Germany — [9]Institute for Photonics and Nanotechnologies CNR-IFN, , Milano, Italy

We performed angle-resolved photoelectron spectroscopy of water clusters ionized by an extreme-ultraviolet attosecond pulse train. A clean signature of the clusters was isolated from the water monomer contribution, to be used for time-resolved attosecond spectroscopy.

CG-P.6 10:00 TRACK 1

Capillary-Based High-Harmonic Generation Driven by Different Laser Systems — •Samuel M. Senior, William S. Brocklesby, and Peter Horak — Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

We compare the performance of different pump laser systems for coherent high-energy radiation generation in argon-filled capillaries by full-scale numerical simulations including pump pulse propagation, electron wavefunction dynamics, and harmonic radiation propagation.

CG-P.7 10:00 TRACK 1

High-average-power and high-pulse-energy CEP-stable few-cycle pulses: Status of the ELI-ALPS HR2 laser system — •Steffen Hädrich[1], Evgeny Shestaev[2], Nico Walther[1], Tamas Nagy[3], Peter Simon[4], Andreas Blumenstein[4], Arno Klenke[2,5], Robert Klas[2,5], Joachim Buldt[2], Henning Stark[2], Martin Gebhardt[2], Sven Breitkopf[1], Peter Jojart[6], Imre Seres[6], Zoltan Varallyay[6], Adam Börzsönyi[6], Tino Eidam[1], and Jens Limpert[1,2,5,7] — [1]Active Fiber Systems GmbH, Jena, Germany — [2]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [3]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [4]Laser-Laboratorium Göttingen, Göttingen, Germany — [5]Helmholtz-Institute Jena, Jena, Germany — [6]ELI-ALPS, Szeged, Hungary — [7]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We present progress on pulse compression and CEP stabilization of the ELI-ALPS HR2 system. It delivers >1 kW, 10 mJ, 300 fs pulses with excellent power stability of 0.3% RMS over 9 hours.

CG-P.8 10:00 TRACK 1

Compression of Single-Cycle Optical Pulses Based on Self-Induced Transparency Soliton Attraction — •Rostislav Arkhipov[1,2], Mikhail Arkhipov[1], Ihar Babushkin[3], Ayhan Demircan[3], Uwe Morgner[3], and Nikolay Rosanov[2] — [1]St. Petersburg State University, St. Petersburg, Russia — [2]Ioffe Institute, St. Petersburg, Russia — [3]Institute of Quantum Optics, Leibniz University Hannover and Cluster of Excellence PhoenixD, Hannover, Germany

We study theoretically a novel robust way of single-cycle pulse compression via attraction of subcycle SIT-like components of incident pulse.

CG-P.9 10:00 TRACK 1

Vision for Terahertz Electric Field Driven Chemistry: Exploring photodissociation dynamics from Coulomb Explosion processes via time resolved FT-VIS spectroscopy — •Viktor Chikan, Karoly Mogyorosi, and Krisztina Sarosi — ELI-ALPS, Szeged, Hungary

Time -resolved FT-VIS emission spectroscopy allows investigating the neutral

photodissociation processes from Coulomb explosion or XUV/attosecond pump experiments. The high-resolution FT-VIS detection scheme approach facilitates studies of reaction control from in the intense THz pulses.

CG-P.10 10:00 TRACK 1

Towards High-Order Harmonic Generation in Laser Produced Plasmas — •Jan Mathijssen[1], Stefan Witte[1,2], and Kjeld S. E. Eikema[1,2] — [1]Advanced Research Center for Nanolithography, Amsterdam, Netherlands — [2]LaserLab, Vrije Universiteit, Amsterdam, Netherlands

We have developed a pump-probe experiment that allows us to investigate the spatial and temporal characteristics of laser-produced plasmas by means of analysing high-order harmonic generation spectra produced in those plasmas.

CG-P.11 10:00 TRACK 1

Dalitz Plots in Classical Electrodynamics of Light-Matter Interactions — •Huber Nieto-Chaupis — Universidad Autónoma del Perú, Lima, Peru

The Dalitz's technique commonly applied at High-Energy Physics to identify new particles, is employed in this paper with the Hartemann-Kerman theory in shifted-frequency versus laser intensity plots to explore emission of laser-photons by a free-electron.

CG-P.12 10:00 TRACK 1

Light-induced valleytronics in pristine graphene — •Mrudul Muraleedharan Shylaja[1], Gopal Dixit[1], Alvaro Jimenez-Galan[2], and Misha Ivanov[2] — [1]Indian Institute of Technology Bombay, Mumbai, India — [2]Max Born Institute , Berlin, Germany

It is assumed that achieving light-induced valley-polarisation in graphene is impossible. Here we demonstrate valley-selective excitation and high-harmonic generation in graphene by using the combination of two counter-rotating circularly polarized fields.

CG-P.13 10:00 TRACK 1

Fingerprints of Majorana fermions in high harmonic spetroscopy — •Adhip Pattanayak, Sumiran Pujari, and Gopal Dixit — Indian Institute of Technology Bombay, Mumbai, India

We simulate HHG from 1D Kitaev model that hosts Majorana edge modes in its topological phase. HHG is sensitive to phase transition. The population dynamics of Majorana edge modes are different from bulk modes.

CG-P.14 10:00 TRACK 1

Quantum bridges in phase space – Interference and non-classicality in enhanced ionisation — •Heloise Chomet, Dhruva Sarkar, and Carla Figueira de Morisson Faria — University College London, London, United Kingdom

We perform a phase-space analysis of strong-field enhanced ionisation in molecules. Optimal conditions require minimising population trapping and using a quantum-interference induced bridging mechanism to feed into ionisation pathways along the field gradient.

CG-P.15 10:00 TRACK 1

Angular dependence of non-perturbative VUV harmonics in silicon — •Pawan Suthar and Martin Kozák — Faculty of Mathematics and Physics, Charles University, Ke Karlovu 3, 12116, Prague 2, Czech Republic

Non-perturbative high harmonics up to 8.1eV in silicon in reflection geometry have been observed. The dependence of harmonics on crystal orientation has been studied and compared with TDDFT calculations to elucidate the role of interband and intraband polarizations.

CG-P.16 10:00 TRACK 1

Angle-Resolved Attosecond Streaking of Twisted Attosecond Pulses — •Irfana Ansari, Deependra Jadoun, and Gopal Dixit — Indian Institute of Technology Bombay, Mumbai, India

The present work investigates the amount of orbital angular momentum encoded in Laguerre-Gaussian modes of twisted attosecond pulses via energy- and angle-resolved attosecond streaking in pump-probe setup.

CG-P.17 10:00 TRACK 1

Effects of Pulse Pesdetal in High-Contrast Laser-Foil Interactions — •Zsolt Lécz[1,2], Ales Necas[3], and Sargis Ter-Avetisyan[1] — [1]National Laser-Initiated Transmutation Laboratory, University of Szeged, Szeged, Hungary — [2]ELI-ALPS, ELI-HU Non-Profit Ltd., Wolfgang Sandner Str. 3., Szeged, Hungary — [3]TAE Technologies, Pauling 19631, Foothill Ranch, California, USA

The laser-solid interaction at low intensities involves highly collisional effects, because the collision frequency is close to the plasma frequency. We discuss this regime and present kinetic simulations revealing some unusual effects observed in the case of ultra-thin foils.

CG-P.18 10:00 TRACK 1

The Inbetweeners - Beyond Born-Type Methods — •Abbie Charlotte Bray, Andrew Maxwell, and Carla Figueira De Morisson Faria — University College London , London, United Kingdom

We use the Coulomb Quantum Orbit Strong-Field Approximation to probe excited states, revealing rescattering is no longer confined to the polarisation axis and identify the orbits responsible for a non-vanishing photoelectron signal.

CG-P.19 10:00 TRACK 1

Investigation of Electron Acceleration using Chirped Radially Polarized Pulsed Bessel-X Beams — •Klemensas Laurinavičius, Sergej Orlov, and Gytis Braždžiūnas — State research institute Center for Physical Sciences and Technology , Vilnius, Lithuania

We use subluminal and superluminal group velocities of non-diffracting Bessel-X beams for electron acceleration. Single electron dynamics in a pulsed laser beam shows that it is possible to counteract Doppler effect by using temporal chirp.

CG-P.20 10:00 TRACK 1

Plasma-filled optical microcavity — •Baheej Bathish[1], Itai Hyams[1], Stanislav Kreps[1], Mark Douvidzon[1], Fuchuan Lei[2], Jonathan Ward[2], Sho Kasumie[2], Sile Nic Chormaic[2], Oren Cohen[1], Raanan Gad[3], and Tal Carmon[4] — [1]Technion, Israel Institute of Technology, Haife, Israel — [2]Okinawa Institute of Science, Okinawa, Japan — [3]Hebrew University of Jerusalem, Jerusalem, Israel — [4]Tel Aviv University, Tel Aviv, Israel

We design and fabricate a plasma containing micro-resonator, and then experimentally demonstrate a continuous in time [CW] resonantly enhanced light plasma interaction. Optical refraction smaller than one is measured in the resonator.

CG-P.21 10:00 TRACK 1

First-principles calculations for determining the thickness to maximize HHG efficiency of laser-irradiated nano films — •Shunsuke Yamada and Kazuhiro Yabana — University of Tsukuba, Tsukuba, Japan

We present first-principles calculations based on TDDFT for HHG in reflection and transmission from Si nano films. We show that the HHG is the strongest when the thickness of Si nano film is 2-15 nm.

EE-P: EE Poster Session

Time: Thursday, 10:00–11:00 Location: TRACK 2

EE-P.1 10:00 TRACK 2

Real-Time Study of Coexisting States in Laser Cavity Solitons — •Pierre-Henry Hanzard[1], Maxwell Rowley[1], Antonio Cutrona[1], Sai Chu[2], Brent Little[3], Roberto Morandotti[4,5], David Moss[6], Benjamin Wetzel[7], Juan Sebastian Totero Gongora[1], Marco Peccianti[1], and Alessia Pasquazi[1] — [1]University of Sussex, Falmer, United Kingdom — [2]University of Hong Kong, Hong Kong, China — [3]Xi'an Institute of Optics and Precision Mechanics, Xi'an, China — [4]INRS-EMT, Varennes, Canada — [5]University of Electronic Science and Technology, Chengdu, China — [6]Swinburne University of Technology, Hawthorn, Australia — [7]Université de Limoges, Limoges, France

We experimentally demonstrate the presence of two coexisting states in Laser Cavity Solitons (LCS) Microcombs. By using the Dispersive Fourier Transform technique, we show the simultaneous presence of both LCS and a background modulation.

EE-P.2 10:00 TRACK 2

Long-lasting Molecular Orientation Induced by a Single THz Pulse — •Long Xu, Ilia Tutunnikov, Erez Gershnabel, Yehiam Prior, and Ilya Sh. Averbukh — Weizmann Institute of Science, Rehovot, Israel

We present a novel phenomenon of the long-lasting orientation of symmetric- and asymmetric-top polar molecules by a single short THz pulse.

EE-P.3 10:00 TRACK 2

Angular Distribution of Different Spectral Components of THz Radiation from Femtosecond Laser Filament in Static Electric Field — •Georgy Rizaev[1,2], Andrey Koributˆ[2], Yakov Grudtsyn[2], Dmitrii Pushkarev[2], Daria Mokrousova[2], Daniil Shipilo[2,3], Nikolay Panov[2,3], Irina Nikolaeva[2,3], Leonid Seleznev[2], Olga Kosareva[2,3], and Andrey Ionin[2] — [1]Moscow Institute of Physics and Technology, Dolgoprudny, Moscow Region, Russia — [2]P.N. Lebedev Physical Institute of RAS, Moscow, Russia — [3]M.V. Lomonosov Moscow State University, Moscow, Russia

Angular distributions of the THz radiation generated in a single-color filament in external electric field are studied. It is shown that for low-frequency and high-frequency components of THz radiation the angular distrubutions differ significantly.

EE-P.4 10:00 TRACK 2

Ultrafast radially-polarized laser beams having spatio-temporal couplings and broken symmetry — •Spencer Jolly — Brussels Photonics (B-PHOT), Dept. Of Applied Physics and Photonics, Vrije Universiteit Brussel, Brussels, Belgium

We present a model showing the properties of tightly-focused ultrashort radially-polarized laser pulses with spatio-temporal couplings and broken cylindrical symmetry. Implications are on strong-field laser-matter interaction including electron acceleration.

EE-P.5 10:00 TRACK 2

Nonlinear propagation of necklace-shaped beams through gas-filled capillaries to generate few-cycle energetic pulses in the visible — •Aurora Crego, Julio San Roman, and Enrique Conejero Jarque — University of Salamanca, Salamanca, Spain

We obtain numerically 50 μJ ultrashort visible necklace beams by self-phase modulation together with soliton self-compression for different constant pressures in a gas-filled capillary. The robustness of the process to non-ideal beam profiles is discussed.

EE-P.6 10:00 TRACK 2

Fast response of dual-pulse supercontinuum generation — •Yongyuan Chu, Tuo Liu, and Hairun Guo — Shanghai University, Shanghai, China

we experimently investigate dual-comb supercontinuum generation in nonlinear waveguides, where a radio frequency comb is introduced and is demonstrated being transferred to the entire continuum, indicating the effect of radio broadcasting in optical frequency domain.

EE-P.7 10:00 TRACK 2

Valley-dependent Bloch-Siegert shift in monolayer WSe2: transition to the strong-field regime — •Martin Kozák, Petr Koutenský, František Trojánek, and Petr Malý — Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

Valley-dependent Bloch-Siegert shift of the excitonic resonance in WSe2 monolayer induced by few-cycle midinfrared pulses is observed. We study the transition to the strong-field regime, in which the ponderomotive energy approaches the driving photon energy.

EE-P.8 10:00 TRACK 2

Optimization of terahertz radiation generation in air by adjusting time delay between the pump pulses — •Danas Buozius, Viktorija Tamuliene, and Virgilijus Vaicaitis — Vilnius university laser research center, Vilnius, Lithuania

Terahertz radiation generation by focused femtosecond laser pulses in air was investigated experimentally and theoretically. The optimal timing between bichromatic pump pulses is shown to strongly depend on the pulse energy.

EE-P.9 10:00 TRACK 2

Transfer of Direct to Indirect Bound Excitons by Electron Intervalley Scattering in Cs2AgBiBr6 Double Perovskite Nanocrystals — •Amrita Dey, Alexander Richter, Tushar Debnath, He Huang, Lakshminarayan Polavarapu, and Jochen Feldmann — 1Chair for Photonics and Optoelectronics, Nano-Institute, Ludwig Maximilian University , Munich, Germany

The strong absorption resonance at the optical band edge of Cs2AgBiBr6 nanocrystals originates due to direct bound exciton. The electrons undergo intervalley scattering resulting in the transfer of direct bound exciton to indirect bound exciton.

EE-P.10 10:00 TRACK 2

Dissection of multipulse laser damage with time resolved digital holography — •Balys Momgaudis, Mikas Vengris, and Andrius Melninkaitis — Vilnius University Laser research Center, Vilnius, Lithuania

In this work experimental study of multipulse optical damage formation is presented. Using time resolved digital holography the response of fused quartz to 20-2500 pulses is mapped in the range of 0-5ps at intermediate energies.

EE-P.11 10:00 TRACK 2

Instabilities and time dependent polarization in ultrafast erbium doped fiber laser — •Miguel López-Ripa[1], Benjamín Alonso[1], Sebastián Jarabo[2], Francisco Javier Salgado-Remacha[2], Juan Carlos Aguado[3], and Íñigo Juan Sola[1] — [1]Grupo de Aplicaciones del Láser y Fotónica (ALF), Departamento de Física Aplicada, University of Salamanca, Salamanca, Spain — [2]Departamento de Física Aplicada, Facultad de Ciencias, Universidad de Zaragoza, Zaragoza, Spain — [3]Grupo de Comunicaciones Ópticas, Escuela Técnica Superior de Ingenieros de Telecomunicación, University of Valladolid, Valladolid, Spain

We study experimentally a mode-locked pulsed erbium doped fiber laser with an outer amplification stage presenting different regimes of unstable shot-to-shot emission of pulses. In addition, the pulses show time-evolving polarization, which is experimentally characterized.

EF-P: EF Poster Session

Time: Thursday, 10:00–11:00 Location: TRACK 3

EF-P.1 10:00 TRACK 3

Experimental observation of self-symmetrization of two-component localized structures in coherently driven passive Kerr resonators — •Julien Fatome[1,2], Gang Xu[2], Bruno Garbin[3], Nicolas Berti[1], Gian-Luca Oppo[4], Stuart G. Murdoch[2], Miro Erkintalo[2], and Stéphane Coen[2] — [1]CNRS-Université Bourgogne-Franche-Comté, Dijon, France — [2]The University of Auckland, Auckland, New-Zealand — [3]Université Paris-Saclay C2N, Palaiseau, France — [4]University of Strathclyde, Glasgow, United Kingdom

We demonstrate how a π-phase shift birefringent defect introduced within a two-component coherently driven passive Kerr resonator leads to flip-flopping dynamics and self-symmetrization, enabling the emergence of spontaneous symmetry-broken localized vectorial structures with unprecedented robustness.

EF-P.2 10:00 TRACK 3

Spatio-temporal nonlinear dynamics in array of coupled multimode microresonators — •Aleksandr Tusnin, Alexey Tikan, and Tobias Kippenberg — Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

We theoretically investigate pattern formation and nonlinear dynamics in arrays of coupled multimode optical microresonators. We show the effective two-dimensional nature of the system and examine the arising spatio-temporal modelocking mechanism.

EF-P.3 10:00 TRACK 3

Mode dynamics during transition into Kerr self-cleaning regime for laser beams propagated in a multimode GRIN fiber — •Mikhail D. Gervaziev[1,2], Innokentiy Zhdanov[1,2], Denis S. Kharenko[1,2], Evgeniy V. Podivilov[1,2], Sergey A. Babin[1,2], and Stefan Wabnitz[1,3] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia — [3]DIET, Sapienza University of Rome, Rome, Italy

Mode decomposition method realized by phase only SLM was investigated numerically to reveal the most critical factors and succesfully applied for the beams emerging from the GRIN multimode fiber in linear and nonlinear regimes.

EF-P.4 10:00 TRACK 3

Wavelength correlations in a fiber optical parametric oscillator — •Mohamed Touil, Rezki Bechker, Thomas Godin, and Ammar Hideur — CORIA - CNRS - Université de Rouen Normandie - INSA Rouen, Rouen, France

We explore the spectral correlations in a fiber optical parametric oscillator using an original combination of statistical tools including mutual information analysis. We demonstrate, among other results, that such correlations can be shaped.

EF-P.5 10:00 TRACK 3

Bichromatic synchronized chaos in driven coupled electro-optomechanical nanoresonators — Guilhem Madiot[1], Franck Correia[1], Sylvain Barbay[1], and •Rémy Braive[2] — [1]Centre de Nanosciences et Nanotechnologies, Palaiseau, France — [2]Université de Paris, Paris, France

In mechanically coupled electrooptomechanical nanocavities, we present an experimental and theoretical investigation of synchronization on the route to chaos and in the chaotic regime at two distinct carrier frequencies referred to as bichromatic chaos.

EF-P.6 10:00 TRACK 3

Simultanious generation of pulse trains with different periods in a class C quantum-dot heterolaser — •Vladimir Kocharovsky[1], Alexey Mishin[1], Ekaterina Kocharovskaya[1], Vladimir Kukushkin[1], and Vitaly Kocharovsky[1,2] — [1]Institute of Applied Physics, Russian Academy of Science, Nizhny Novgorod, Russia — [2]Department of Physics and Astronomy, Texas A\& M University, College Station, USA

Numerical solution to Maxwell-Bloch equations for a low-Q CW superradiant laser with symmetric Fabry-Perot cavity shows a highly asymmetric grating of polarization and population inversion of active centers accompanied by counter-propagating waves with different amplitudes.

EF-P.7 10:00 TRACK 3

Spatiotemporal Wave Pattern Stabilization by Graded Dissipation in Multimode Fibers — •Vladimir Kalashnikov[1,2] and Stefan Wabnitz[1,3] — [1]Dipartimento di Ingegneria dell'Informazione, Elettronica e Telecomunicazioni, Sapienza Universita di Roma, Roma, Italy — [2]Institute of Photonics, Vienna University of Technology, Vienna, Austria — [3]Novosibirsk State University, Novosibirsk, Russia

The dissipation-enhanced mode-cleaning concept is proposed, which could provide a spatiotemporal soliton generation in a multimode fiber laser, mode control in fiber amplifiers, spatial-multiplexing informational networks, and metaphorical modeling of weakly-dissipative quantum systems.

EF-P.8 10:00 TRACK 3

Coherence study of DSR-like pulses in passively mode-locked fiber lasers — •Meriem Kemel[1], Mohamed Salhi[1], Charles Ciret[1], Georges Semaan[1], Ahmed Nady[1,2], and François Sanchez[1] — [1]Laboratoire de Photonique d'Angers, Université d'Angers, 2 Bd Lavoisier, 49045, Angers, France — [2]Department of Physics, Faculty of science, Beni-Suef University, Beni-Suef, Egypt

To be considered as dissipative soliton resonance (DSR), the square pulses in passively mode-locked fiber lasers must be temporally coherent. Here we study the coherence of ns pulses with Mach-Zehnder and dispersive Fourier transform methods.

EF-P.9 10:00 TRACK 3

Temporal analogue of the Fresnel diffraction by a phase plate in linear and nonlinear optical fibers — •Anastasiia SHEVELEVA and Christophe FINOT — Laboratoire Interdisciplinaire CARNOT de Bourgogne, DIJON Cedex, France

We investigate evolution of a continuous wave modulated by abrupt temporal phase jumps. Numerical and analytical study of linear propagation replicates near-field diffraction patterns, whereas Kerr nonlinearity stimulates emergence of coherent structures.

EF-P.10 10:00 TRACK 3

Combinatorial Optimization using the Optical Potts Machine — •Mostafa Honari Latifpour[1,2] and Mohammad-Ali Miri[1,2] — [1]Queens College, The City University of New York, New York, USA — [2]Physics Program, The Graduate Center of the City University of New York, New York, USA

We show that networks of phase-tristable optical parametric oscillators simulate the three-state Potts model. A direct simulation of the underlying nonlinear dynamical model provides an efficient path toward combinatorial optimization.

EF-P.11 10:00 TRACK 3

Statistics of SPM rogue waves — •Rasmus E. Hansen[1], Christian R. Petersen[1,2], and Ole Bang[1,2,3] — [1]DTU Fotonik, Department of Photonics Engineering, Kgs. Lyngby, Denmark — [2]NORBLIS IVS, Virum, Denmark — [3]NKT Photonics A/S, Birkerød, Denmark

We present the dynamics of the novel normal dispersion SPM rogue wave, including a statistical analysis of it. The SPM rogue wave has interesting applications in mid-IR supercontinuum generation.

EF-P.12 10:00 TRACK 3

Polarization instabilities in mode-locked Er-doped fiber laser — •Sergey Sergeyev, Hani Kbashi, and Vishal Sharma — Aston Institute of Photonic Technologies, Birmingham, United Kingdom

For Er-doped fiber laser mode-locked by Nonlinear Polarization Rotation, we present a theoretical analysis of complex polarization dynamics driven by polarization instabilities tunable by changing the synchronization scenario between orthogonal states of polarization.

EF-P.13 10:00 TRACK 3

Noise suppression through extreme self-phase modulation in cascaded mid-IR supercontinuum generation — •Rasmus E. Hansen[1], Christian R. Petersen[1,2], and Ole Bang[1,2,3] — [1]DTU Fotonik, Department of Photonics Engineering, Kgs. Lyngby, Denmark — [2]NORBLIS IVS, Virum, Denmark — [3]NKT Photonics A/S, Birkerød, Denmark

Coupling a modulational instability based supercontinuum from a ZBLAN fibre into a highly nonlinear chalcogenide fibre leads to extreme SPM and resulting noise suppression through spectral averaging.

EF-P.14 10:00 TRACK 3

Stable non-equidistant pulsing patterns in an excitable micropillar laser with delayed optical feedback — •Soizic Terrien[1], Venkata A. Pammi[2], Bernd Krauskopf[1], Neil G.R. Broderick[1], and Sylvain Barbay[2] — [1] The Dodd-Walls Centre for Photonic and Quantum Technologies, The University of Auckland, Auckland, Australia — [2]Universite Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, UMR9001, Palaiseau, France

We consider a model of an excitable microlaser with delayed optical feedback, and demonstrate that periodic pulsing solutions corresponding to non-equidistant pulses in the feedback cavity exist and are stable in large regions of the parameters.

EF-P.15 10:00 TRACK 3

Slow-Light Enhanced Second-Harmonic Generation Using a π-Phase Shifted Moiré Grating in a Quasi-Phased-Matched Medium — •Thomas E Maybour, Devin H Smith, and Peter Horak — University of Southampton, Southampton, United Kingdom

We investigate the use of a superstructure refractive index grating to enhance nonlinear wavelength conversion in a quasi-phase matched crystal. Our coupled-mode theory predicts significantly increased conversion efficiency in short crystals.

EF-P.16 10:00 TRACK 3

Optical Bistability Induced by Free Carrier Dispersion in the Silicon Micro-Ring Resonators — •Andrey Nikitin[1], Alexandr Kondrashov[1], Vitalii Vitko[1], Ilya Ryabcev[1], Galina Zaretskaya[1], Alexander Ershov[1], Dmitry Konkin[2], Andrey Kokolov[2], Leonid Babak[2], and Alexey Ustinov[1] — [1]St. Petersburg Electrotechnical University "LETI", St. Petersburg, Russia — [2]Tomsk State University of Control Systems and Radioelectronics "TUSUR", Tomsk, Russia

We report on the observation of the carrier-induced optical bistability in the CW silicon micro-ring resonators. The dominant role of the free-carrier effect is confirmed in the framework of an original theory.

CJ-P: CJ Poster Session

Time: Thursday, 13:30–14:30 Location: TRACK 1

CJ-P.1 13:30 TRACK 1

Self-Healing Properties of Fibre Laser Petal-like Beams — Jaclyn Chan[1], •Natasha Vukovic[1], Christophe Codemard[2], and Michalis Zervas[1] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]TRUMPF Laser UK, Hedge End, Southampton, United Kingdom

We report on the experimental investigation of self-healing properties of petal-like beams from a kW-class singlemode output from a multimode delivery fibre with adjustable beam profile. The degree of self-healing depends on the blocking arrangement.

CJ-P.2 13:30 TRACK 1

Highly efficient watt-level single frequency 461 nm laser — •Sébastien Vidal[1], Chen-Hao Feng[2], Bruno Desruelle[3], Giorgio Santarelli[2], Philippe Bouyer[2], Andréa Bertoldi[2], and Johan Boullet[1] — [1]ALPhANOV, TALENCE, France — [2]LP2N, TALENCE, France — [3]MUQUANS, TALENCE, France

A CW laser at 461 nm is generated by frequency doubling an amplified diode laser with a resonant cavity. The best conversion efficiency achieved is 87% which gives more than 1 W at 461 nm.

CJ-P.3 13:30 TRACK 1

Analytical Modelling of Nested-Ring Thulium-Doped Fibre Lasers — •Matthew J. Barber, Peter C. Shardlow, and W. Andrew Clarkson — Optoelectronics Research Centre, Southampton, United Kingdom

An analytical model is presented for exploring nested-ring Tm fibre laser dopant profiles that are able to reduce the gain differential between short and long wavelengths and allow greater access to the short wavelength regime.

CJ-P.4 13:30 TRACK 1

Experimental study of the pump configuration's impact on gain-managed nonlinear amplification in an Yb-doped fiber amplifier — •Christoffer Krook, Robert Lindberg, and Valdas Pasiskevicius — 1. Department of Applied Physics, Royal Institute of Technology, 10691 Stockholm, Sweden

We present an experimental comparison of a gain-managed nonlinear amplifier operated under co- and counter-pumped configurations. Our results indicate that compressed pulses from co-/counter-pumped configurations are shorter/have more energy contained in the main peak.

CJ-P.5 13:30 TRACK 1

Self-Selection of the Out-of-Phase Supermode in an All-Solid Large Mode Area Multicore Fiber Laser — •Yakov Greenberg[1], Amiel Ishaaya[1], and Seongwoo Yoo[2] — [1]Ben-Gurion University of the Negev, Beer Sheva, Israel — [2]Nanyang Technological University, Singapore, Singapore

We present the detailed numerical analysis and design, as well as an experimental demonstration of out-of-phase mode selection and its power scaling in an all-solid 6-core Yb-doped large-mode-area multi-core fiber laser.

CJ-P.6 13:30 TRACK 1

Dispersion Compensating Ring Fibre in the C-Band for OAM Mode — •Wenqian Zhao[1], Xu Han[1], Wenpu Geng[1], Yingning Wang[1], Yuxi Fang[1], Changjing Bao[2], Zhi Wang[1], Yan-ge Liu[1], Yongxiong Ren[2], Zhongqi Pan[3], and Yang Yue[1] — [1]Institute of Modern Optics, Nankai University, Tianjin, China — [2]Department of Electrical Engineering, University of Southern California, Los Angeles, USA — [3]Department of Electrical & Computer Engineering, University of Louisiana at Lafayette, Lafayette, USA

We propose and design a ring-shaped polycyclic dispersion conpensating fiber for OAM mode. At 1550 nm, a -18.248-ps/(nm·km) negative dispersion with a slope of -0.1635 ps/(nm2·km) for OAM1,1 mode is achieved within the C band.

CJ-P.7 13:30 TRACK 1

Control of multi-soliton generation in fiber 8-figure laser by tunable spectral filtering — •Alexey Kokhanovskiy[1], Evgeny Kuprikov[1], Kirill Serebrennikov[1], and Sergey Turitsyn[1,2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Aston Institute of Photonic Technologies, Birmingham, United Kingdom

We demonstrate switching between different multi-solitons regimes in figure of eight laser with tunable spectral filtration. Laser provides adjustment a number of bounded solitons up to 18, conditions of soliton molecules generation is also considered.

CJ-P.8 13:30 TRACK 1

Distributed temperature measurements in holmium-doped fiber lasers — •Vladimir Kamynin[1], Alexey Wolf[2], Mikhail Skvortsov[2], Serafima Filatova[1], Mariya Kopyeva[1,3], Vladimir Tsvetkov[1], and Sergey Babin[2] — [1]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [2]Institute of Automation and Electrometry of the SB RAS, Novosibirsk, Russia — [3]Peoples' Friendship University of Russia, RUDN University, Moscow, Russia

Distributed temperature measurements in holmium fiber lasers are demonstrated. It is shown that in Ho-doped fiber lasers pumped at 1.125 μm, temperature difference at different parts of fiber reached more than 30 °C.

CJ-P.9 13:30 TRACK 1

withdrawn

CJ-P.10 13:30 TRACK 1

Selective Excitation of Fundamental Mode in Fusion Spliced Antiresonant Hollow-Core Fiber — •Charu Goel[1], Muhammad Rosdi Abu Hassan[2], Wonkeun Chang[2], and Seongwoo Yoo[2] — [1]The Photonics Institute, Nanyang Technological University, Singapore, Singapore — [2]School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore

We demonstrate selective excitation of fundamental mode with 90.8% coupling efficiency, in a tapered antiresonant hollow-core fiber fusion spliced with a large mode area commercial solid core fiber at 1 μm wavelength.

CJ-P.11 13:30 TRACK 1

A triple cladding fiber for pulse stretching — •Konstantin Bobkov and Mikhail Likhachev — Prokhorov General Physics Institute of the Russian Academy of Sciences, Dianov Fiber Optics Research Center, Moscow, Russia

We demonstrate an optimized triple cladding fiber for ultrashort pulses stretching. Optimization allowed a reduction of a complexity of the fiber production and an increase of the nonlinear effects threshold.

CJ-P.12 13:30 TRACK 1

Extrinsic Fabry-Perot interferometer with supermode interference — •Monserrat del C. Alonso-Murias[1], David Monzón-Hernandez[1], Enrique Antonio-Lopez[2], Axel Schülzgen[2], Rodrigo Amezcua-Correa[2], and Joel Villatoro[3,4] — [1]Centro de Investigaciones en Óptica A. C., Loma del Bosque 115 C. P. 37150, León, México — [2]CREOL The College of Optics and Photonics, University of Central Florida, Orlando, 162700, Florida, USA — [3]Department of Communications Engineering, University of the Basque Country, 48013, Bilbao, Spain — [4]Ikerbasque-Basque Foundation for Science, E-48011, Bilbao, Spain

We proposed and demonstrated a novel extrinsic fiber Fabry Perot interferometer build with a strongly coupled multicore fiber. The extrinsic Fabry Perot can exhibit an interference pattern with a cavity length up to 20 mm.

CJ-P.13 13:30 TRACK 1

New Method for Generation of a Specific Number of Pulses per Bunch in Yb-doped All-PM-Fibre Laser — Aleksey Ivanenko[1], Boris Nyushkov[1,2], Sergey Smirnov[1], and •Sergey Kobtsev[1] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Novosibirsk State Technical University, Novosibirsk, Russia

We present a new method for obtaining variable pulse bunches in synchronously-pumped Yb-fibre lasers by controlling small detuning between rates of pumping and output pulses. We show its advantages, prospects, and possibilities of electronic control.

CJ-P.14 13:30 TRACK 1

Dispersion-tailoring of a NALM-based all-PM Er-doped femtosecond fiber laser — •Zbigniew Łaszczych and Grzegorz Soboń — Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland

In this work, dispersion management of a NALM-based Er-doped fiber laser is experimentally investigated. Continuously adjustable net dispersion and flexible phase bias support the usefulness of demonstrated setup as an optimization testbed of ultrafast laser systems.

CJ-P.15 13:30 TRACK 1

125 μJ ultra-short pulses delivered by a PM Yb-doped tapered fiber amplifier — •Simon Boivinet[1], Alexandre Gognau[1], Antonio Baylón-Fuentes[2], Yves Hernandez[1], and Jean-Bernard Lecourt[1] — [1]Multitel, Mons, Belgium — [2]Euro-Multitel, Mons, Belgium

A chirped pulse amplification architecture using a PM Yb-doped tapered fiber with an output diameter of 56 μm is reported. This fiber laser delivers pulses with 125 μJ energy and 1 ps duration.

CJ-P.16 13:30 TRACK 1

Pulsed operation of Random Distributed Feedback Raman Fiber Laser with Varying Repetition Rate Through Self-gain-modulation — Nikita Tarasov[1], Leonid Melnikov[2], Ilya Vatnik[3], Yulia Mazhirina[2], and •Dmitry Churkin[3] — [1]Aston University, Birmingham, United Kingdom — [2]Saratov State Technical University, Saratov, Russia — [3]Novosibirsk State University, Novosibirsk, Russia

We experimentally demonstrate that random fiber laser can be operated in pulsed regime via self-gain-switching with varying repetition rate depening on power and laser length and being proportional to an odd integer number.

CJ-P.17 13:30 TRACK 1

Side Pump Combiner Fabrication on a Photonic Crystal Fiber in (1 + 1) x 1 Configuration — •Yakup Midilli, Bartu Şimşek, and Bülend Ortaç — Bilkent University – UNAM National Nanotechnology Research Center and Institute of Materials Science and Nanotechnology, Ankara, Turkey

A side pump combiner has been fabricated in a (1 + 1) x 1 configuration for the first time on a photonic crystal fiber with a pump efficiency of 84%.

CJ-P.18 13:30 TRACK 1

Demonstration of a Novel Cladding Light Stripper Fabrication Method Based On Poly (Chloro-P-Xylene) Polymer Material — •Yakup Midilli[1], Görkem Liman[2], Gökhan Demirel[2], and Bülend Ortaç[1] — [1]Bilkent University – UNAM National Nanotechnology Research Center and Institute of Materials Science and Nanotechnology, Ankara, Turkey — [2]Bio-inspired Materials Research Laboratory (BIMREL), Department of Chemistry, Faculty of Science, Gazi University, Ankara, Turkey

Poly (chloro-p-xylene) [PPX] polymer material has been coated onto the fiber samples in a controlled manner on the order of nm scale to fabricate cladding light stripper by chemical vapor deposition technique.

CJ-P.19 13:30 TRACK 1

Bend Insensitive W-type Single Mode Fiber with 30μm Mode Field Diameter — •Vasilii Ustimchik[1], Dmitrijs Saharovs[2], Andrey Grishchenko[2], Yuri Chamorovskii[3], and Valery Filippov[1] — [1]Ampliconyx Ltd, Tampere, Finland — [2]Ceram Optec SIA, Livani, Latvia — [3]Fryazino branch of Kotel'nikov Institute of Radio Engineering and Electronics, Fryazino, Moscow region, Russia

Bend insensitive LMA W-fiber was manufactured with 40 μm core diameter (NA=0.03, M2=1.11). Transfer efficiency of the fundamental mode reached 88% through 5 m of the fiber. Attenuation, measured using cut-back method is <0.023 dB/m.

CJ-P.20 13:30 TRACK 1

High peak power nanosecond Er/Yb laser at a low repetition rate — •Svitlana Pavlova[1,3], Emre Yagci[1], Koray Eken[1], Emre Altay[1], and Ihor Pavlov[1,2,3,4] — [1]FiberLast, Ankara, Turkey — [2]Department of Physics, Middle East Technical University, Ankara, Turkey — [3]Institute of Physics of the NAS of Ukraine, Kyiv , Ukraine — [4]Center for Solar Energy Research and Applications (GÜNAM), Middle East Technical University, Ankara, Turkey

We have successfully generated 4.7 ns pulses with 32 kW of peak power and 162 μJ pulse energy at the repetition rate of 30-60 kHz. The maximum fraction of ASE was just 1.6%.

CK-P: CK Poster Session

Time: Thursday, 13:30–14:30 Location: TRACK 2

CK-P.1 13:30 TRACK 2

Fabricating WSi based superconducting mircowire single photon detectors with laser lithography — •Maximilian Protte[1], Varun B. Verma[2], Jan Philipp Höpker[1], Richard P. Mirin[2], Sae Woo Nam[2], and Tim J. Bartley[1] — [1]Department of Physics, Paderborn University, Paderborn, Germany — [2]National Institute of Standards and Technology, Boulder, USA

Laser lithography is a versatile tool for developing large-scale integrated optical structures. We show that it is also capable of structuring SNSPDs with saturated internal detection efficiency.

CK-P.2 13:30 TRACK 2

Fabrication tolerance impact on BIC metasurface resonances — •Julius Kühne[1], Thomas Weber[1], Lucca Kühner[1], Juan Wang[1], Stefan A. Maier[1,2], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Munich, Germany — [2]The Blackett Laboratory, London, United Kingdom

We numerically and experimentally investigate the impact of fabrication tolerance on the resonance quality of different bound state in the continuum resonator geometries, revealing crucial design guidelines for robust and high-performance BIC-based metasurface applications.

CK-P.3 13:30 TRACK 2

Fano Resonances in Nanostructured Thin Films — Lina Grineviciute[1,2], Ceren Babayigit[2,3], Julianija Nikitina[1,2], and •Kestutis Staliunas[2,4,5] — [1]Center for Physical Sciences and Technology, Vilnius, Lithuania — [2]Laser Research Center, Vilnius University, Vilnius, Lithuania — [3]Department of Electrical and Electronic Engineering, TOBB University of Economics and Technology, Ankara, Turkey — [4]Institució Catalana de Recerca i Estudis Avancats (ICREA), Barcelona, Spain — [5]Universitat Politècnica de Catalunya (UPC), Barcelona, Spain

We design and fabricate nano-modulated thin films, which, due to Fano resonances with its planar modes, show sharp (angle, wavelength) dependences of transmission. Ideal for a compact spatial and frequency filtering.

CK-P.4 13:30 TRACK 2

Adiabatic Waveguide Taper Profile Optimization on Al2O3/Si Platform for Polarization Insensitive Fiber-to-Chip Light Coupling — •Can Ozcan, J. Stewart Aitchison, and Mo Mojahedi — Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada

Optimization of inverse taper profiles were performed on an augmented low index waveguide for fiber-to-chip light coupling. The optimized polynomial taper profiles yielded only 0.3 dB loss at 250 μm length with no polarization dependence.

CK-P.5 13:30 TRACK 2

Fast laser induced phase change of Bismuth based random metasurfaces for tunable photonics — Miguel Alvarez, Marina García-Pardo, Fatima Cabello, Johann Toudert, Emmanuel Haro-Poniatowski, •Rosalia Serna, and Jan Siegel — Laser Processing Group, Instituto de Óptica, IO-CSIC, Madrid, Spain

We characterize the dynamic visible optical response of a bismuth-based metasurface in the visible upon nanosecond laser excitation. We demonstrate a tunable switching window in the 10-100ns range and its stability for >10.000 cycles.

CK-P.6 13:30 TRACK 2

Tunable Polarization Insensitive CMOS Compatible Graphene/Si Guided Mode Resonance Active Filter — •Prateeksha Sharma[1], Eleftheria Lampadariou[2], Spyros Doukas[2], Elefterios Lidorikis[2], and Ilya Goykhman[1] — [1]Technion-Israel Institute of Technology, Haifa, Israel — [2]University of Ioannina, Ioannina, Greece

We propose and investigate polarization insensitive graphene/Si tunable guided-mode resonance filters operating at telecom wavelengths, which offers narrow resonances of 1nm and an extinction ratio of (>10 dB) for reflection and spectral tuning respectively.

CK-P.7 13:30 TRACK 2

Effect of Thermal Crosstalk on Travelling-wave Mach-Zehnder Modulator — •Souvaraj De[1,2], Ranjan Das[1], Thomas Kleine-Ostmann[2], and Thomas Schneider[1] — [1]Technische Universität Braunschweig, Braunschweig, Germany — [2]PTB Braunschweig, Braunschweig, Germany

A deep trench assisted travelling wave Mach-Zehnder modulator with improved bandwidth is proposed for effective shielding from the thermal crosstalk. Subsequently, we obtained a better bit error rate performance for the modified design.

CK-P.8 13:30 TRACK 2

Gap solitons supported by mode hybridisation in Lithium Niobate nano-waveguides — •William R. Rowe[1], Andrey V. Gorbach[1], Halvor Fergestad[2], Katia Gallo[2], and Dmitry V. Skryabin[1] — [1]Centre for Photonics and Photonic Materials, Department of Physics, University of Bath, Bath, United Kingdom — [2]Department of Applied Physics, KTH Royal Institute of Technology, Stockholm, Sweden

We investigate a system of one fundamental frequency and two hybridised second harmonic modes in Lithium Niobate nano-waveguides. We find three-component solitons exist with their spectrum in the gap of the hybridised second harmonic modes.

CK-P.9 13:30 TRACK 2

Toward optical circuits using tweezers position-control. — Stanislav Kreps[1], Mark Douvidzon[1], Baheej Bathish[1], Tom Lekiewicz Abudi[1], Vladimir Shuvayev[2], Lev Deych[2], and •Tal Carmon[3] — [1]Technion Institute of Technology, Haifa, Israel — [2]City University of New York, New York, USA — [3]Tel Aviv University, Tel Aviv, Israel

We experimentally demonstrate optical circuits composed of several spherical-resonators that their position is controlled with optical tweezers. The resonance structure and spectral distribution are measured and compared with the numerical and analytical Mie theory.

CK-P.10 13:30 TRACK 2

Modeling and Fabrication of an Antireflection Microstructure on an AgClBr Fiber by Single-pulse Femtosecond Laser Ablation — Mikhail Tarabrin[1,2,3], •Andrey Bushunov[1,3], Andrei Teslenko[1,3], Valdimir Lazarev[1], Tatiana Sakharova[4], Jonas Hinkel[4,5], Iskander Usenov[4,6], Torsten Doehler[5], Ute Geissler[5], and Viacheslav Artyushenko[4] — [1]Bauman Moscow State Technical University, Moscow, Russia — [2]P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Novosibirsk, Russia — [3]Novosibirsk State University, Novosibirsk, Russia — [4]Art Photonics GmbH, Berlin, Germany — [5]Technical University of Applied Science Wildau, Wildau, Germany — [6]Technische Universität Berlin, Berlin, Germany

AgClBr fiber end face transmittance of 92.8% at 10.6 um and an average transmittance of 91.8% in the 7-14 um range were achieved by single-pulse femtosecond laser ablation.

CK-P.11 13:30 TRACK 2

Thermal Self-stabilisation of a Microcavity on the Surface of an Optical Fibre with Active Core — •Dmitry Kudashkin[1], Dmitry Krisanov[1], Sergey Khorev[2], Dmitry Churkin[1], and Ilya Vatnik[1] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Zecotek Photonics, Inc., Richmond, Canada

We propose a technique for thermal tuning and thermal self-stabilisation of cylindrical microresonators formed on the surface of optical fibres. The method is based on launching light into the fiber core with strong absorption.

CK-P.12 13:30 TRACK 2

Stimulated Brillouin Scattering on AlGaAs on Sapphire platform — •Hitesh Kumar Sahoo, Yi Zheng, Chanju Kim, Michael Galili, Kresten Yvind, Leif Katsuo Oxenløwe, Minhao Pu, and Hao Hu — Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, Denmark

We propose and demonstrate on-chip stimulated Brillouin scattering (SBS) on the AlGaAs on sapphire platform, which can simultaneously confine optical and acoustic waves. High Brillouin gain is achieved using longitudinal acoustic mode without suspended structures.

CK-P.13 13:30 TRACK 2

Position dependence of local density of states in 3D band gap of a finite photonic crystal — •Charalampos P. Mavidis[1,2], Anna C. Tasolamprou[2], Shakeeb B. Hasan[3,6], Thomas Koschny[4], Eleftherios N. Economou[2,5], Maria Kafesaki[1,2], Costas M. Soukoulis[2,4], and Willem L. Vos[3] — [1]Department of Materials Science and Technology, University of Crete, Heraklion, Greece — [2]Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, Heraklion, Greece — [3]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [4]Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames, Iowa, USA — [5]Department of Physics, University of Crete, Heraklion, Greece — [6]Current address: ASML Netherlands B.V., , Veldhoven, Netherlands

We investigate the local density of states in 3D woodpile finite photonic crystals. We find exponential decay of the LDOS from the crystal's surface to the center and show large inhibitions for small crystals.

CK-P.14 13:30 TRACK 2

Study of dye local photo-bleaching obtained by UV lithography for photonics applications — •Alban Gassenq, Kevin Chevrier, Antoine Bard, Jean-Michel Benoit, Clémentine Symonds, and Joel Bellessa — Univ Lyon, Institut Lumière Matière, UMR5306, LYON, France
In this work, we have studied local photo-bleaching to modulate the refractive index of TDBC dye layers only over a limited wavelength range and spatial region for wavelength selective optical grating fabrication.

CK-P.15 13:30 TRACK 2

Thermally reconfigurable loss in a passive optical cavity — •Aneesh Dash, Viphretuo Mere, Shankar K. Selvaraja, and Akshay K. Naik — Indian Institute of Science, Bangalore, India
We demonstrate thermo-optic tuning of the quality factor from 3000 to 10000 and extinction ratio from $\approx 0\ dB$ to $25\ dB$ in a passive silicon micro-ring resonator. This work opens several possibilities for reconfigurable photonics.

CK-P.16 13:30 TRACK 2

Nanostructured multilayer optical coatings for angular filtering of light — •Lina Grineviciute[1], Ceren Babayigit[2], Darius Gailevičius[3,4], Martynas Peckus[3,4], Mirbek Turduev[5], Tomas Tolenis[1], Mikas Vengris[3], Hamza Kurt[2], and Kestutis Staliunas[3,6,7] — [1]Center for Physical Sciences and Technology, Vilnius, Lithuania — [2]TOBB University of Economics and Technology, Ankara, Turkey — [3]Vilnius University, Vilnius, Lithuania — [4]Femtika, Vilnius, Lithuania — [5]TED University, Ankara, Turkey — [6]ICREA, Barcelona, Spain — [7]UPC, Dep. de Fisica, Barcelona, Spain
In this study, we propose a possibility to create 2D photonic crystal based on nanostructured multilayer coating and demonstrate a conceptually novel mechanism of spatial filtering in the near-field domain.

CK-P.17 13:30 TRACK 2

Generalized Lorenz-Mie theory of complex source vortex beams — •Justas Berškys and Sergej Orlov — State research institute Center for Physical Sciences and Technology, Vilnius, Lithuania
We present a generalized Lorenz-Mie theory of complex source vector vortex beams and employ it to investigate the interaction with nanoparticles and a cluster made out of them.

CK-P.18 13:30 TRACK 2

Finely-Tailored Transverse and Longitudinal Variable-Coupling in subwavelength grating metamaterial waveguides arrays — •Anne Talneau and Flore Hentinger — CNRS C2N , Palaiseau, France
Sub-wavelength grating metamaterials are proposed to provide versatile and finely-tailored variable-coupling within waveguide arrays, in both the transverse and longitudinal direction. Optical operation is analyzed using the Coupled Mode Theory and 3D-FDTD simulation

CK-P.19 13:30 TRACK 2

Design and control of NxN microphotonics switch array based on non-adiabatic theory — •Anastasiia Sheveleva, Christophe Finot, and Pierre Colman — Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR CNRS 6303, Universite de Bourgogne Franche-Comte, Dijon, France
Weak modulation of the propagation parameters is sufficient to control the flow of light within a densely packed array of waveguides. The modulation must obey strict selection rules that make this non-adiabatic technique robust.

CK-P.20 13:30 TRACK 2

High performance optical interference filters fabrication using automatically optimized optical monitoring strategy — •Janis Zideluns[1], Fabien Lemarchand[1], Detlef Arhilger[2], Harro Hagedorn[2], and Julien Lumeau[1] — [1]Institut Fresnel, Marseille, France — [2]Bühler Leybold Optics, Alzenau, Germany
The fabrication of high performance optical interference filters is demonstrated. We present a novel optical monitoring method based on optimized optical monitoring wavelength. Various filters are used to illustrate the method.

CK-P.21 13:30 TRACK 2

Optical spatial differentiation with suspended subwavelength gratings — •Ali Akbar Darki[1], Alexios Parthenopoulos[1], Bjarke R. Jeppesen[2], Jens V. Nygaard[3], and Aurelien Dantan[1] — [1]Department of Physics and Astronomy, Aarhus University, Aarhus, Denmark — [2]Interdisciplinary Nanoscience Center (iNano), Aarhus University, Aarhus, Denmark — [3]Department of Engineering, Aarhus University, Aarhus, Denmark
We noninvasively characterize the profile of large-area subwavelength gratings directly patterned on suspended silicon nitride membranes and demonstrate high-quality first- and second-order spatial differentiation of the transverse profile of an optical beam using guided-mode resonance.

CK-P.22 13:30 TRACK 2

withdrawn

CL-P: CL Poster Session

Time: Thursday, 13:30–14:30 Location: TRACK 3

CL-P.1 13:30 TRACK 3

Ultrafast laser induced cavitation bubbles in water in the presence of optical aberrations — Alberto Aguilar[1], Aurélien Bernard[1], Amélie De Saint-Jean[1], Emmanuel Baubeau[1], Damien Decq[1], Aurélien Bertail[1], and •Cyril Mauclair[1,2] — [1]Keranova, Saint Etienne, France — [2]Laboratoire Hubert Curien, UMR 5516 CNRS, Université de Lyon, Université Jean Monnet, Saint Etienne, France
We study ultrafast laser induced cavitation bubbles in water in the presence of controlled aberrations. Deterioration of the laser intensity distribution and the cavitation amplitude is observed and compared for different aberrations via time-resolved imaging.

CL-P.2 13:30 TRACK 3

Comparison of Continuous Wave and Ultrashort Pulsed Holmium-doped Fiber Lasers Exposure on Ex-vivo Tissue — •Mariya S. Kopyeva[1,2], Serafima A. Filatova[1], Vladimir A. Kamynin[1], Tamara K. Chekhlova[1,2], and Vladimir B. Tsvetkov[1] — [1]Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia — [2]Peoples' Friendship University of Russia, Moscow, Russia
We compared the ablation of ex-vivo tissues by holmium-doped fiber lasers operating in continuous wave and ultrashort pulsed modes. The relation between the laser systems parameters and ablation results was considered.

CL-P.3 13:30 TRACK 3

Technologies for microfluidic devices fabrication: laser ablation vs stereolithography — •Bastian Carnero, Ana Isabel Gomez-Varela, Carmen Bao-Varela, and Maria Teresa Flores-Arias — Faculty of Physics, Universidade de Santiago de Compostela, Santiago de Compostela, Spain
Optical technologies have proven their versatility to manufacture microfluidic devices . Laser-based techniques have recently appeared, capable of overcoming the complexity and waste production of photolithography. We analyse two laser-based technologies for microfluidics applications: laser ablation and stereolithography.

CL-P.4 13:30 TRACK 3

Biocompatibility analysis of thermal and UV-curable polydimethylsiloxane for semi blood vessel-like model fabrication — •Ana Isabel Gómez-Varela[1], Bastián Carnero[1], Ezequiel Álvarez[2,3], María Teresa Flores-Arias[1], and María del Carmen Bao-Varela[1] — [1]Universidade de Santiago de Compostela, Facultade de Física e Facultade de Óptica e OPtometría , Santiago de Compostela, Spain — [2]Universidade de Santiago de Compostela, Facultade de Farmacia, Santiago de Compostela, Spain — [3]Centro de Investigacion Biomedica en Red de Enfermedades Cardiovasculares (CIBERCV), Madrid, Spain
UV-curable PDMS as an alternative to thermal curing PDMS for fabricating blood vessel-like devices is presented. Its biocompatibility is analyzed seeding human umbilical vein endothelial cells (HUVECs). Results close to thermal curing PDMS are obtained.

CL-P.5 13:30 TRACK 3

Theoretical and experimental study of the vector beams generated with an axicon pair and uniaxial crystals — •Alexandru Craciun[1,2], Oana Grigore[1], and Traian Dascalu[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Atomistilor 409, Magurele 077125, Romania — [2]Doctoral School of Physics, University of Bucharest, Atomistilor 405, Magurele 077125, Romania
We analyze the polarization state and the transversal distribution in the focal plane for various configurations of vector beams. The set-up presented herein allows the modification of the focal shape by changing the input polarization.

CL-P.6 13:30 TRACK 3

Density Functional Theory Modelled Absorption and Raman Spectra Applicable to Ergocalciferol (Vitamin D2) and Cholecalciferol (D3) — •Ojars Balcers[1], Ulises Miranda[2], and Rita Veilande[2] — [1]Vidzeme University of Applied Sciences, Valmiera, Latvia — [2]Institute of Atomic Physics and Spectroscopy, University of Latvia, Riga, Latvia

The modelled spectrum of vitamin D2 and D3 using the density functional theory of absorption and Raman spectra are presented and the comparison with measurement of commercially obtained vitamin D2 and D3 are done.

CL-P.7 13:30 TRACK 3

Assessment of the diagnostic effectiveness of terahertz radiation in oral soft tissue lesions — •Ataberk Atalar[1], Melis Gelgeç[1], Hakan Altan[1], Emre Barış[2], Kıvanç Kamburoğlu[3], Esra E. Çakmak[3], and Nejlan Eratam[3] — [1]Middle East Technical University, Ankara, Turkey — [2]Gazi University, Ankara, Turkey — [3]Ankara University, Ankara, Turkey

Measurements show that the utilization of THz attenuated total internal reflection spectroscopy can be more advantageous in detecting oral soft tissue lesions as a non-invasive diagnostic tool. The effectiveness of this system will be investigated.

CL-P.8 13:30 TRACK 3

Correlating microbial bioluminescence to the different phases of growth using a 2004 nm VCSEL-based 2f wavelength modulation spectroscopy — Zarin A S, •Arup Lal Chakraborty, and Saumyakanti Khatua — IIT Gandhinagar, Gandhinagar, India

Microbial bioluminescence from Photobacterium leiognathi is recorded simultaneously with the mole fraction of metabolic carbon dioxide that was extracted using a VCSEL-based 2f WMS technique to reveal strong correlation between bioluminescence and cell concentration.

JSI-4: Optophononic and Optothermal Characterization and Techniques

Chair: Sebastian Volz, The University of Tokyo, Japan

Time: Friday, 8:30–10:00 Location: TRACK 1

Invited JSI-4.1 8:30 TRACK 1

Surface phonon polariton: the 4th heat carrier in SiN nanofilms — •Masahiro Nomura, Yunhui Wu, Jose Ordonez-Miranda, Roman Anufriev, and Sebastian Volz — The University of Tokyo, Tokyo, Japan

We demonstrate that surface phonon polaritons can be the dominant thermal energy carriers in SiN nanofilms. Their contribution becomes larger in thinner films and at higher temperatures, where phonons' contribution becomes less.

Oral JSI-4.2 9:00 TRACK 1

Experimental Study of Anisotropic Mean Free Path of Phonon and Microscale Thermal Diffusivity of Liquid Crystals and Polymers — •Junko Morikawa[1], Shuhei Kurose[1], and Meguya Ryu[2] — [1]Tokyo Institute of Technology, Tokyo, Japan — [2]Advanced Industrial Science and Technology, Tsukuba, Japan

The anisotropies of phonon group velocity and thermal diffusivity of liquid crystals and polymers were experimentally determined. The origin of the anisotropy in the bulk thermophysical properties are discussed, considering the phonon current correlation spectrum.

Oral JSI-4.3 9:15 TRACK 1

Optical wavelength dependence of photoacoustic signal of gold nanofluid — •Marco Gandolfi[1], Francesco Banfi[2], and Christ Glorieux[3] — [1]CNR-INO and Department of Information Engineering, University of Brescia, Brescia, Italy — [2]FemtoNanoOptics group Université de Lyon, Institut Lumière Matière (iLM), Université Lyon 1 and CNRS, Villeurbanne, France — [3]Laboratory of Soft Matter and Biophysics, Department of Physics and Astronomy, KU Leuven, Leuven, Belgium

We introduce a numerical opto-thermo-mechanical model to analyse the photoacoustic signal generated by gold nanospheres immersed in water. We discuss how the light wavelength and the temperature dependent water thermal expansion coefficient affect the results.

Oral JSI-4.4 9:30 TRACK 1

Photothermal Characterization at a Nanoscopic Scale — •Roberto Li Voti — Dipartimento SBAI, Sapienza Università di Roma, Rome, Italy

Recent advances for the optothermal characterization of chiral materials, ordered/disordered nanowires/spheres by Photothermal techniques are summarized. IR radiometry is introduced to measure the thermal property at a nanoscopic scale.

Oral JSI-4.5 9:45 TRACK 1

Brillouin spectroscopy in optophononic micropillars in the 18-350 GHz range — •Anne Rodriguez, Edson Cardozo de Oliveira, Priya Priya, Fabrice-Roland Lamberti, Abdelmounaim Harouri, Isabelle Sagnes, Carmen Gomez-Carbonell, Martina Morassi, Aristide Lemaître, Loïc Lanco, Pascale Senellart, Martin Esmann, and Norberto Daniel Lanzillotti-Kimura — Centre de nanosciences et de nanotechnologies, Palaiseau, France

We present two filtering technique based respectiely on the match/mismatch of the laser and pillar optical modes to measure Brillouin scattering in 3D optophononic resonators.

CC-6: THz Devices and Communications

Chair: Emma Pickwell-MacPherson, University of Warwick, Coventry, United Kingdom

Time: Friday, 8:30–10:00 Location: TRACK 2

Invited CC-6.1 8:30 TRACK 2

Towards 6G communications with terahertz on-chip topological photonics — Yihao Yang[1], Yuichiro Yamagami[2], Xiongbin Yu[2], Prakash Pitchappa[1], Julian Webber[2], Baile Zhang[1], Guillaume Docournou[3], Masayuki Fujita[2], Tadao Nagatsuma[2], and •Ranjan Singh[1] — [1]Nanyang Technological University, Singapore, Singapore — [2]Osaka University, Osaka, Japan — [3]University of Lille, Lille, France

We present Valley Hall topological waveguides that support the transport of terahertz waves through sharp corners without any loss. Such interconnects are ideal for the realization of sixth-generation (6G) communication which will rely heavily on terahertz on/ off-chip wave management.

Oral CC-6.2 9:00 TRACK 2

1-THz plasmonic double-mixing in a dual-grating-gate high-electron-mobility transistor — Tomotaka Hosotani[1,2,3], Akira Satou[1,3], Yuma Takida[4], Hiromasa Ito[4], Hiroaki Minamide[4], and •Taiichi Otsuji[1,3] — [1]Research Institute of Electrical Communication, Tohoku University, Sendai, Japan — [2]JSPS, Tokyo, Japan — [3]Research Organization of Electrical Communication, Tohoku University, Sendai, Japan — [4]RIKEN Center for Advanced Photonics, RIKEN, Sendai, Japan

We demonstrate the 1-THz band photonic double-mixing operation by using plasmonic technology. The operating frequency range is much higher than the electron transit time limitation of the device thanks to the plasmonic operation mechanisms.

Oral CC-6.3 9:15 TRACK 2

Observation of Ultrafast THz Self-actions in Graphene Based Modulators — •Anastasios D. Koulouklidis[1], Eudokia Kyriakou[1,2], Christina Daskalaki[1], M. Said Ergoktas[3,4], Anna C. Tasolamprou[1], Maria Kafesaki[1,2], Coskun Kocabas[3,4,5], and Stelios Tzortzakis[1,2,6] — [1]Institute of Electronic Structure and Laser, FORTH, Heraklion, Greece — [2]Department of Materials Science and Technology, University of Crete, Heraklion, Greece — [3]Department of Materials, University of Manchester , Manchester, United Kingdom — [4]National Graphene Institute, University of Manchester, Manchester, United Kingdom — [5]Henry Royce Institute for Advanced Materials, University of Manchester, Manchester, United Kingdom — [6]Science Program, Texas A\&M University at Qatar, Doha, Qatar

We demonstrate an ultrafast self-induced terahertz absorption modulator operating at 2.3 THz. A modulation of 50 dB is observed in the absorption when the THz field strength increases from 145 to 654 kV/cm.

Oral CC-6.4 9:30 TRACK 2

Sub-picosecond broadband frequency modulation of terahertz three-dimensional meta-atoms — •Paul Goulain[1], Anastasios Koulouklidis[2], Jean-Michel Manceau[1], Christina Daskalaki[2], Bruno Paulillo[1], Kenneth Maussang[3], Sukhdeep Dhillon[3], Joshua Freeman[4], Lianhe Li[4], Edmund Linfield[4], Stelios Tzortzakis[2,5,6], and Raffaele Colombelli[1] — [1]Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]Institute of Electronic Structure and Laser, Foundation for Research and Technology – Hellas (FORTH), Heraklion, Greece — [3]Laboratoire de Physique de l'Ecole normales supérieure, Paris, France — [4]School of Electronic and Electrical Engineering, Leeds, United Kingdom — [5]Department of Materials Science and Technology, Heraklion, Greece — [6]Science Program, Texas A&M University at Qatar, Doha, Qatar

Ultra-fast modulation of 3D THz LC resonators is presented with a 280 GHz frequency shift obtained in 200fs. The overall modulation cycle of the device takes 2 ps, yet convoluted by the probing technique.

Oral CC-6.5 9:45 TRACK 2

Terahertz Amplifier with Optical Threshold — •Martin A. Kainz[1,2], Michael Jaidl[1,2], Benedikt Limbacher[1,2], Dominik Theiner[1,2], Miriam Giparakis[2,3], Maximilian Beiser[2,3], Aaron M. Andrews[2,3], Gottfried Strasser[2,3], and Karl Unterrainer[1,2] — [1]Photonics Institute, Wien, Austria — [2]Center for Micro- and Nanostructures, Wien, Austria — [3]Institute of Solid State Electronics, Wien, Austria

A Terahertz optical amplifier based on a Quantum Cascade laser structure with a lossy double-metal cavity is demonstrated. Amplification appears only above a certain threshold and an amplification of 17 dB is achieved.

CG-6: Lasers and High-Order Harmonic Generation

Chair: Laszlo Veisz, Umeå University, Umeå, Sweden

Time: Friday, 8:30–10:00 Location: TRACK 3

Oral CG-6.1 8:30 TRACK 3

Wavelength-tunable few-cycle mid-infrared laser pulses from frequency domain optical parametric amplification — •Gilles Dalla-Barba[1,2], Philippe Lassonde[1], Gaëtan Jargot[1], Elissa Haddad[1], Antoine Laramée[1], Adrien Leblanc[3], Heide Ibrahim[1], Eric Cormier[2,4], and François Légaré[1] — [1]Institut National de la Recherche Scientifique, centre EMT, Varennes, Canada — [2]Laboratoire Photonique Numérique et Nanosciences, UMR 5298, Talence, France — [3]Laboratoire d'Optique Appliquée, UMR 7639, Palaiseau, France — [4]Institut Universitaire de France, Paris, France

We report on a toolbox for both generation and characterization of 20 μJ mid-infrared few-cycle pulses tunable from 5.6 μm to 13.5 μm with pulse durations ranging from 6.4 to 1.3 optical cycles.

Oral CG-6.2 8:45 TRACK 3

Optimization of Optical Parametric Chirped-pulse Amplification — •Peter Fischer[1], Alexander Muschet[1], Tino Lang[2], Roushdey Salh[1], and Laszlo Veisz[1] — [1]Department of Physics, Umeå University, Umea, Sweden — [2]2. Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

Saturation in optical parametric chirped-pulse amplification enhances system performance. However, various spectral components saturate differently. We numerically and experimentally demonstrate control of saturation for a broad spectral range and optimize overall gain and conversion efficiency.

Oral CG-6.3 9:00 TRACK 3

A wavelength-tunable few-cycle, millijoule-level short-wavelength infrared source for strong-field XAS/ATAS — •Patrick Rupprecht, Lennart Aufleger, Alexander Magunia, Stefano Amberg, Nikola Mollov, Felix Henrich, Christian Ott, and Thomas Pfeifer — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

We present a few-cycle laser pulse source with a center wavelength tunability from 1-2 μm for strong-field XAS/ATAS. Millijoule-level pulses are provided at a 1 kHz repetition rate with <1.2% stability over >160 hours.

Oral CG-6.4 9:15 TRACK 3

70mJ nonlinear compression and scaling route for Yb amplifier using large-core hollow fibers — •Guangyu Fan[1,2], Paolo Carpeggiani[1], Zhensheng Tao[3], Giulio Coccia[1], Resa Safaei[2], Edgar Kaksis[1], Audrius Pugzlys[1], François Légaré[2], Bruno Schmidt[4], and Andrius Baltuška[1] — [1]Institute of Photonics, TU Wien, Vienna, Austria — [2]Institut National de la Recherche Scientifique, Centre Énergie Matériaux et Télécommunications, Montreal, Canada — [3]State Key Laboratory of Surface Physics, Department of Physics, Fudan University, Shanghai, China — [4]few-cycle Inc., Montreal, Canada

We illustrate the energy scaling rules of hollow-core fiber nonlinear compression for high energy Yb technologies. As a demonstration, 70 mJ 230 fs pulses were compressed down to 25 fs with 1.3 TW peak power.

Oral CG-6.5 9:30 TRACK 3

Generation of high harmonics in silicon metasurfaces boosted by bound states in the continuum — •Kirill Koshelev[1,2], George Zograf[2], Viacheslav Korolev[3], Anastasia Zalogina[1,2], Duk-Yong Choi[4], Richard Hollinger[3], Barry Luther-Davies[4], Michael Zürch[3,5], Daniil Kartashov[3], Christian Spielmann[3], Sergey Makarov[2], Sergey Kruk[1,6], and Yuri Kivshar[1,2] — [1]Nonlinear Physics Center, Australian National University, Canberra, Australia — [2]Department of Physics and Engineering, ITMO University, St. Petersburg, Russia — [3]Institute of Optics and Quantum Electronics, Friedrich-Schiller University Jena, Jena, Germany — [4]Laser Physics Centre, Australian National University, Canberra, Australia — [5]University of California, Berkeley, USA — [6]Ultrafast Nanophotonics Group, Paderborn University, Paderborn, Germany

By utilizing optical bound states in the continuum supported by resonant asymmetric silicon metasurfaces in the mid-IR spectral range we demonstrate generation of odd optical harmonics, from the 3rd to the 11th order

Oral CG-6.6 9:45 TRACK 3

7th harmonic generation in gases for coherent 150 nm light production — •Arthur Schönberg[1,2,3], Haydar Sarper Salman[1,2,3], Ayhan Tajalli[1], Ingmar Hartl[1], and Christoph M. Heyl[1,2,3] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Helmholtz-Institut Jena, Jena, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We investigate the 7th harmonic generation conversion efficiency and pulse energy output of a 1025 nm source in rare gases. The measurements yield 5×10^{-6} maximum efficiency, limited by collective effects from a phase-mismatched generation process.

CJ-7: Mid-IR Fiber Laser Sources and Components

Chair: Bülend Ortaç, Bilkent University - UNAM, Bilkent, Turkey

Time: Friday, 8:30–10:00 Location: TRACK 4

Oral CJ-7.1 8:30 TRACK 4

Picosecond Pulse Generation from a Wavelength Tunable Er:ZBLAN Mid-Infrared Fiber Laser — •Maria Pawliszewska[1,2], Matthew R. Majewski[2], and Stuart D. Jackson[2] — [1]Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland — [2]MQ Photonics Research Centre, Faculty of Science and Engineering, Macquarie University, Sydney, Australia

We report on a mid-infrared erbium ZBLAN fiber laser mode-locked with frequency shifted feedback. The generated pulses exhibited a minimum pulse duration of 21 ps in 2.7 - 2.8 μm wavelength range.

Oral CJ-7.2 8:45 TRACK 4

1725nm all-fiber SWIR CW laser using W-type Tm:Ge doped fiber — •Raghuraman Sidharthan, Shaoxiang Chen, Yuhao Chen, Chen Jian Chang, and Seongwoo Yoo — Nanyang Technological University, Singapore, Singapore

We report a all-fiber CW laser operating at 1725nm using a W-type Tm:Ge fiber, where wavelength selection is done by bending technique, operating at an output power of >1W at a slope efficiency of 37%.

Invited CJ-7.3 9:00 TRACK 4

Mid-IR gas-filled hollow-core fiber lasers based on Raman gases — Yazhou Wang[1], Manoj Dasa[1], Abubakar Adamu[1], J. Enrique Antonio-Lopez[2], Md. Selim Habib[3], Rodrigo Amezcua-Correa[2], Ole Bang[1], and •Christos Markos[1] — [1]DTU Fotonik, Technical University of Denmark, Kgs. Lyngby, Denmark — [2]CREOL, The College of Optics and Photonics, University of Central Florida, Orlando, USA — [3]Department of Electrical and Computer Engineering, Florida Polytechnic University, Lakeland, USA

We present an overview of our activities on the emerging mid-infrared gas-filled fiber Raman laser technology in terms of wavelength, pulse energy, quantum efficiency, and stability. These results provide important reference for future spectroscopic applications.

Oral CJ-7.4 9:30 TRACK 4

Widely-Tunable Operation of a Thulium Doped Fibre Laser Between 1654 nm and 2025 nm — Mark Burns, Peter Shardlow, and •William Clarkson — University of Southampton, Southampton, United Kingdom

A widely tunable thulium-doped alumino-silicate fibre laser is reported. The laser was core-pumped by an erbium-doped fibre laser at 1580nm and was continuously tunable over a 371 nm tuning range, from 1654-2025 nm.

Oral CJ-7.5 9:45 TRACK 4

Mid- and Near-Infrared Spectral Broadening in Deuterium-Filled Gas Fiber Raman Laser — •Alexey Gladyshev, Yury Yatsenko, Anton Kolyadin, Ivan Pritulenko, and Igor Bufetov — Prokhorov General Physics Institute of the Russian Academy of Sciences, Dianov Fiber Optics Research Center, Moscow, Russia

Two-cascade Raman conversion (1.03→1.49→2.68 μm) of ultrashort pulses in a D2-filled revolver fiber is investigated. By controlling the pump duration and the gas pressure, we demonstrate nonlinear spectral broadening in both near-IR and mid-IR range.

EA-7: Quantum Interferences

Chair: Nina Amelie Lange, Paderborn University, Paderborn, Germany

Time: Friday, 8:30–10:00 Location: TRACK 5

Oral EA-7.1 8:30 TRACK 5

Quantum optical coherence: From linear to nonlinear interferometers — •Kai-Hong Luo[1], Matteo Santandrea[1], Michael Stefszky[1], Jan Sperling[1], Marcello Massaro[1], Alessandro Ferreri[2], Polina R. Sharapova[2], Harald Herrmann[1], and Christine Silberhorn[1] — [1]Integrated Quantum Optics Group, Institute for Photonic Quantum Systems (PhoQS), Paderborn University, Paderborn, Germany — [2]Department of Physics and CeOPP, Paderborn University, Paderborn, Germany

We report on results from linear, semi-nonlinear and nonlinear interferometric systems, elucidating the unique first-order classical and second-order quantum coherence properties between them.

Oral EA-7.2 8:45 TRACK 5

Anti Hong-Ou-Mandel Interference with a Dissipative Beamsplitter — •Anton N. Vetlugin[1], Ruixiang Guo[1], Cesare Soci[1], and Nikolay I. Zheludev[1,2] — [1]Nanyang Technological University, Singapore, Singapore — [2]University of Southampton, Southampton, United Kingdom

We experimentally demonstrate for the first time that, in contrast to classical Hong-Ou-Mandel experiment performed with a dissipation-free beamsplitter, bosons anti-coalesce while fermions ‘coalesce’ on a dissipative beamsplitter.

Oral EA-7.3 9:00 TRACK 5

Demonstration of Lossy Linear Transformations and Two-Photon Interference via Singular Value Decomposition — •Simon White[1], Kai Wang[2,3], Alexander Szameit[4], Andrey A. Sukhorukov[2,5], and Alexander Solntsev[1] — [1]School of Mathematical and Physical Sciences, University of Technology Sydney, Ultimo, Australia — [2]Nonlinear Physics Centre, Research School of Physics, The Australian National University, Canberra, Australia — [3]Ginzton Laboratory and Department of Electrical Engineering, Stanford University, Stanford, USA — [4]Institut für Physik, Universität Rostock, Rostock, Germany — [5]ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Canberra, Australia

We experimentally demonstrate a method based on singular value decomposition, designed for non-unitary transformations of photon states. We show how this approach enables the control of photon-pair correlations in a system of coupled waveguides.

Oral EA-7.4 9:15 TRACK 5

2 photons interference in twin images — •Fabrice DEVAUX, Alexis MOSSET, and Eric LANTZ — Insitut Femto-st, UMR 6174 CNRS, Besançon, France

We report the experimental observation of Two-photon interference of 1500 spatial modes by measuring momentum spatial coincidences between the pixels of the far-field images of two strongly multimode SPDC beams propagating through a HOM interferometer.

Oral EA-7.5 9:30 TRACK 5

Quantum Walks of Photon Pairs in Su-Schrieffer-Heeger Lattices — •Friederike Klauck, Matthias Heinrich, and Alexander Szameit — Institute of Physics, University of Rostock, Rostock, Germany

We experimentally study quantum correlations in a two-photon quantum walk at the topological and trivial edge of Su-Schrieffer-Heeger waveguide lattices. Topological protection leads to a wider spreading of the state compared to the trivial edge.

Oral EA-7.6 9:45 TRACK 5

Generation of Schrödinger cat states by generalized photon subtraction — •Kan Takase, Jun-ichi Yoshikawa, Warit Asavanant, Mamoru Endo, and Akira Furusawa — Department of Applied Physics, School of Engineering, The University of Tokyo, Tokyo, Japan

We propose a method that improves the generation rate of optical Schrödinger cat states by multiple orders from the conventional method. Our method would open a way for practical quantum computing and quantum communication.

EB-9: Quantum Tomography and State Estimation

Chair: Fabio Sciarrino, Sapienza Università di Roma, Rome, Italy

Time: Friday, 8:30–10:00 Location: TRACK 6

Oral EB-9.1 8:30 TRACK 6

Robust and Efficient High-Dimensional Quantum State Tomography — •Markus Rambach[1,2], Mahdi Qaryan[1,2], Michael Kewming[1,2], Christopher Ferrie[3], Andrew G. White[1,2], and Jacquiline Romero[1,2] — [1]Australian Research Council Centre of Excellence for Engineered Quantum Systems, Brisbane, Australia — [2]School of Mathematics and Physics, University of Queensland, Brisbane, Australia — [3]Centre for Quantum Software and Information, University of Technology Sydney, Sydney, Australia

We experimentally demonstrate self-guided quantum tomography, a technique that is robust, precise, and efficient, overcoming limitations of standard tomography. It works naturally on multiple qubits and qudits, pure and mixed states, and any physical system.

Oral EB-9.2 8:45 TRACK 6

Randomized Compressive State Tomography with No A-priori Information Using a Quantum Pulse Gate in Time and Frequency — •Jano Gil-Lopez[1], Syamsundar De[1], Benjamin Brecht[1], Yong Siah Teo[2], Hyunseok Jeong[2], Luis L. Sanchez-Soto[3,4], and Christine Silberhorn[1] — [1]Integrated Quantum Optics Group, Institute for Photonic Quantum Systems (PhoQS), Paderborn, Germany — [2]Department of Physics and Astronomy, Seoul, South Korea — [3]Max-Planck-Institut f¨ur die Physik des Lichts, Erlangen, Germany — [4]Departamento de Óptica, Facultad de Física, Madrid, Spain

We consider a randomized compressive tomography technique to reconstruct low rank near-coherent signals in the time-frequency domain using extremely few measurements and no a priori knowledge. We present results on reconstructed random high-dimensional states.

Oral EB-9.3 9:00 TRACK 6

Detector Tomography of Superconducting-Nanowire Photon-Number-Resolving Detector — •Tatsuki Sonoyama[1], Mamoru Endo[1], Mikihisa Matsuyama[1], Fumiya Okamoto[1], Shigehito Miki[2,3], Hirotaka Terai[2], Masahiro Yabuno[2], Fumihiro China[2], and Akira Furusawa[2] — [1]Department of Applied Physics, School of Engineering, The University of Tokyo, Tokyo, Japan — [2]Advanced ICT Research Institute, National Institute of Information and Communications Technology, Kobe, Japan — [3]Graduate School of Engineering, Kobe University, Kobe, Japan

We improved photon number resolving performance of superconducting nanowire photon detector without multiplexing by waveform pattern matching. Furthermore, we evaluated the performance by detector tomography and confirmed the detector can discriminate up to five photons.

Oral EB-9.4 9:15 TRACK 6

Cross-verification of independent quantum devices — •Martin Ringbauer — University of Innsbruck, Innsbruck, Austria

Today's noisy quantum computers are pushing the limits of classical computation. We present a scalable cross-check procedure to verify their performance in a hardware agnostic way and without relying on classical simulation.

Oral EB-9.5 9:30 TRACK 6

Certification of Non-Gaussian States using Double Homodyne Detection — •Ganaël Roeland[1], Ulysse Chabaud[2,3], Mattia Walschaers[1], Frédéric Grosshans[3], Valentina Parigi[1], Damian Markham[3,4], and Nicolas Treps[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, ENS-PSL Université, Collège de France, Centre National de la Recherche Scientifique, Paris, France — [2]Université de Paris, IRIF, CNRS, Paris, France — [3]Sorbonne Université, LIP6, CNRS, Paris, France — [4]JFLI, CNRS, National Institute of Informatics, University of Tokyo, Tokyo, Japan

We show that non-Gaussian properties of quantum states, such as Wigner negativity, can be efficiently and experimentally certified using double homodyne detection, without the need of full tomography.

Oral EB-9.6 9:45 TRACK 6

Photonic angular super-resolution using twisted N00N-states — •Markus Hiekkamäki[1], Frédéric Bouchard[2], and Robert Fickler[1] — [1]Tampere University, Tampere, Finland — [2]National Research Council of Canada, Ottawa, Canada

The increased phase sensitivity of N00N-states encoded in orbital angular momentum (OAM) modes can be harnessed in estimating rotations with an increased sensitivity. We experimentally demonstrate this with two-photon OAM N00N-states in a single beam.

EF-8: Dissipative Solitons II

Chair: Svetlana Gurevich, University of Münster, Münster, Germany

Time: Friday, 8:30–10:00 Location: TRACK 7

Oral EF-8.1 8:30 TRACK 7

Spectral soliton complex with asymmetric dispersion — Joshua P. Lourdesamy[1], Justin Widjadja[1], •Antoine F. J. Runge[1], Tristram J. Alexander[1], and C. Martijn de Sterke[1,2] — [1]Institute of Photonics and Optical Science, School of Physics, The University of Sydney, Sydney, Australia — [2]The University of Sydney Nano Institute , Sydney, Australia

We experimentally observe soliton complexes formed by two fundamental solitons centred at different frequencies, but with identical group velocities, from a dispersion-managed fibre laser. An asymmetric dispersion leads to spectral asymmetry and non-trivial phase ramps.

Oral EF-8.2 8:45 TRACK 7

Higher dimensional oscillations of soliton molecules in ultrafast fiber laser — •Pierre Colman, Aurelien Coillet, Said Hamdi, Patrice Tchofo-Dinda, and Philippe Grelu — ICB Laboratory, Universite Bourgogne-Franche-Comte, Dijon, France

We observed experimentally a periodic energy exchange between solitons bound into a molecule, confirming recent numerical predictions. The classification of soliton molecules dynamics requires extra dimensions beyond the usual pulses' relative temporal separations and phases.

Oral EF-8.3 9:00 TRACK 7

Symmetry protection against mode crossings for dissipative Kerr soliton generation in microresonator chains — •Alexey Tikan[1], Aleksandr Tusnin[1], Johann Riemensberger[1], Mikhail Churaev[1], Kenichi Komagata[1,2], Xinru Ji[1], Rui Ning Wang[1], Junqiu Liu[1], and Tobias J. Kippenberg[1] — [1]Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne , Switzerland — [2]Laboratoire Temps-Fréquence, Neuchâtel, Switzerland

The accessibility of solitons in driven-dissipative photonic dimers drastically varies for different supermode families. We explain the origin of this phenomenon and show its crucial influence on any soliton lattice configuration including topological arrangements.

Oral EF-8.4 9:15 TRACK 7

Bright and dark localized states in doubly resonant optical parametric oscillators — •Pedro Parra-Rivas[1], Carlos Mas-Arabí[1], Lendert Gelens[2], and Francois Leo[1] — [1]Université Libre de Bruxelles, Bruxelles, Belgium — [2]KU Leuven, Leuven, Belgium

We analyze the bifurcation structure of bright and dark localized states arising in doubly resonant dispersive optical parametric oscillators. We show that bright states undergo collapsed snaking, while dark ones experience homoclinic snaking.

Oral EF-8.5 9:30 TRACK 7

Supercontinuum Generation by Polychromatic Soliton Molecules — •Stephanie Willms[1,2], Oliver Melchert[1,2,3], Surajit Bose[2], Alexey Yulin[4], Uwe Morgner[1,2,3], Ihar Babushkin[1,2], and Ayhan Demircan[1,2,3] — [1]Cluster of Excellence PhoenixD, Hannover, Germany — [2]Institute of Quantum Optics, Leibniz University Hannover, Hannover, Germany — [3]Hannover Centre for Optical Technologies, Hannover, Germany — [4]Department of Nanophotonics and Metamaterials, ITMO University, Saint Petersburg, Russia

We investigate the propagation dynamics of polychromatic soliton molecules regarding their ability to generate a bright coherent supercontinuum. An efficient scheme is presented and analogies to the quantum mechanical dissociation process are highlighted.

Oral EF-8.6 9:45 TRACK 7

Rotating and Spiralling Optomechanical Cavity Solitons — •Giuseppe Baio, Gordon Robb, Thorsten Ackemann, Alison Yao, and Gian-Luca Oppo — Department of Physics, University of Strathclyde, Glasgow, Scotland, United Kingdom

Stable spatial solitons due to self-structuring in a cloud of cold atoms in a cavity can rotate or spiral under the action of laser light with optical angular momentum, leading to controllable atomic transport

CK-7: Photonic Crystals

Chair: Giovanna Calo, Politecnico di Bari, Bari, Italy

Time: Friday, 8:30–10:00 Location: TRACK 8

Oral CK-7.1 8:30 TRACK 8

Design and Realization of a Three-dimensional Dielectric Zero-Index Metamaterial based on Steiner Tree Networks — •Haoyi Yu, Qiming Zhang, and Min Gu — University of Shanghai for Science and Technology, Shanghai, China

A 3D dielectric Zero-Index-Medium (ZIM) based on Steiner tree networks is proposed and demonstrated, which provides a 3D platform to study properties of Dirac-like cone and realization of ZIM with ultra-low loss at optical frequency.

Oral CK-7.2 8:45 TRACK 8

Enhanced design strategy for Mesoscopic Self-Collimation — •Sergio Iván Flores Esparza, Antoine Monmayrant, Olivier Gauthier-Lafaye, and David Gauchard — C.N.R.S; LAAS, Toulouse, France

Mesoscopic photonic crystals combine reflectivity control and self-collimation. We show that prioritizing antireflectivity allows to easily design and parametrize efficient mesoscopic self-collimation structures, without having to resort to impedance matching complex structures between PhC slabs.

Oral CK-7.3 9:00 TRACK 8

Embedded InP-on-Si 1D photonic crystal emitting in the topological mode — •Markus Scherrer[1], Seonyeong Kim[2], Hee Jin Choi[2], Chang-Won Lee[2], and Kirsten Moselund[1] — [1]IBM Research - Europe, Rüschlikon, Switzerland — [2]Hanbat National University, Daejeon, South Korea

We demonstrate for the first time an embedded one-dimensional topological photonic structure based on a III-V photonic crystal on silicon, which shows localized single mode emission from the topological state located in the bandgap center.

Oral CK-7.4 9:15 TRACK 8

Light transport by a 3D cavity superlattice in a photonic band gap — •Manashee Adhikary[1], Marek Kozon[1,2], Ravitej Uppu[1,3], Cornelis A. M. Harteveld[1], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Mathematics of Computational Science (MACS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [3]Center for Hybrid Quantum Systems (Hy-Q), Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

We show the first experimental evidence of light transport within the band gap of a 3D photonic crystal that is functionalized with a superlattice of point defects that act as resonant cavities.

Oral CK-7.5 9:30 TRACK 8

Scaling method for identification of confined states of light in arbitrary dimension — •Marek Kozon[1,2], Matthias Schlottbom[2], Jaap J. W. van der Vegt[2], and Willem L. Vos[1] — [1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Mathematics of Computational Science (MACS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands

Identification and classification of confined light states is crucial for photonic crystals with defects, but so far only indirect methods exist. We propose a direct scaling-based classification method and apply it to realistic structures.

Oral CK-7.6 9:45 TRACK 8

Floquet dynamics in photonic crystal optomechanical nanoresonator — •Guilhem Madiot[1], Karl Pelka[2], André Xuereb[2], and Rémy Braive[1,3] — [1]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [2]Department of Physics, University of Malta, Malta, Malta — [3]Université de Paris, Paris, France

We explore the interaction between a mechanical resonator and a modulated thermo-optic cavity, using an integrated photonic crystal nanomembrane. These results open perspectives in the realization of logic gates using multimode optomechanical devices.

EG-7: Electron-light Interactions

Chair: Kirsten Moselund, IBM Research Europe, Zurich, Switzerland

Time: Friday, 8:30–10:00 Location: TRACK 9

Oral EG-7.1 8:30 TRACK 9

Continuous-wave electron-light interaction in high-Q whispering gallery microresonators — •Jan-Wilke Henke[1], Arslan Sajid Raja[2], Armin Feist[1], Junqiu Liu[2], Germaine Arend[1], Guanhao Huang[2], Fee Jasmin Kappert[1], Rui Ning Wang[2], Jiahe Pan[2], Ofer Kfir[1,3], Claus Ropers[1,3], and Tobias J. Kippenberg[2] — [1]4th Physical Institute - Solids and Nanostructures, University of Göttingen, 37077 Göttingen, Germany — [2]Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), CH-1015 Lausanne, Switzerland — [3]Max Planck Institute for Biophysical Chemistry, 37077 Göttingen, Germany

We observe CW-driven inelastic electron-photon scattering at a fiber-integrated high-Q Si_3N_4 microresonator. The interaction is enabled by the strong, resonantly enhanced coupling between the electrons and the confined optical whispering gallery mode.

Oral EG-7.2 8:45 TRACK 9

THz photon-assisted tunneling in hBN encapsulated graphene quantum dot — •Simon Messelot[1], Elisa Riccardi[1], Sylvain Massabeau[1], Michael Rosticher[1], Kenji Watanabe[2], Takashi Taniguchi[2], Jérôme Tignon[1], Sukhdeep Dhillon[1], Robson Ferreira[1], Sébastien Balibar[1], Takis Kontos[1], and Juliette Mangeney[1] — [1]Laboratoire de Physique de l'Ecole normale supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France — [2]National Institute for Materials Science, Tsukuba, Japan

We investigate the quantum response of hBN encapsulated graphene quantum dot (GQD) to coherent THz illumination. We demonstrate photon-assisted tunneling induced by THz illumination, showing light-matter interaction between THz radiation and GQD electronic levels.

Oral EG-7.3 9:00 TRACK 9

Single-Mode, Broadband, Near Infrared Light Emission from Metal-Oxide-Semiconductor Tunnel Junctions in Silicon Photonics — •Michael Doderer[1], Killian Keller[1], Joel Winiger[1], Michael Baumann[1], Andreas Messner[1], David Moor[1], Daniel Chelladurai[1], Yuriy Fedoryshyn[1], Jared Strait[2], Amit Agrawal[2], Markus Parzefall[3], Lukas Novotny[3], Henry Lezec[2], Juerg Leuthold[1], and Christian Haffner[1,2] — [1]Institute of Electromagnetic Fields, ETH Zurich, Zurich, Switzerland — [2]Physical Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, USA — [3]Photonics Laboratory, ETH Zurich, Zurich, Switzerland

We demonstrate electroluminescence from inelastic electron tunnelling directly coupled into a single-mode silicon waveguide. The near-infrared emission into a resonator with $Q_{max} = 47$ achieves narrowest emission observed to date for light emitting tunnel junctions.

Oral EG-7.4 9:15 TRACK 9

Control of Photogalvanic Currents in Topological Insulator Metamaterials — Xinxing Sun[1], Giorgio Adamo[1], Mustafa Eginligil[2,4], Harish N. S. Krishnamoorthy[1], Nikolay I. Zheludev[1,2,3], and •Cesare Soci[1,2] — [1]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore, Singapore — [2]Division of Physics and Applied Physics, Nanyang Technological University, Singapore, Singapore — [3]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [4]Nanjing Tech University (Nanjing Tech), Nanjing, China

Patterning of topological insulator with mirror-symmetric forms of planar chiral design yields photogalvanic currents with opposite directions due to the interplay between the spin-momentum locking and polarization conversion in the pattern.

Oral EG-7.5 9:30 TRACK 9

High-purity free-electron momentum states prepared by three-dimensional optical phase modulation — •Armin Feist[1,2], Sergey V. Yalunin[1], Sascha Schäfer[3], and Claus Ropers[1,2] — [1]4th Physical Institute, University of Göttingen, Göttingen, Germany — [2]Max Planck Institute for Biophysical Chemistry, Göttingen, Germany — [3]Institute of Physics, University of Oldenburg, Oldenburg, Germany

We demonstrate a laser-based and femtosecond-switchable inelastic electron beam splitter. Coherent optical phase modulation of 200-keV electrons at a thin electron-transparent membrane prepares a high-purity three-dimensional momentum superposition state, characterized in energy and momentum space.

Oral EG-7.6 9:45 TRACK 9

Unidirectional currents in asymmetric nanojunctions and electronic wavepacket interference — •Ihar Babushkin[1], Liping Shi[2], Anton Husakou[3], Oliver Melchert[1], Ayhan Demircan[1], Christoph Lienau[4], Misha Ivanov[3], Uwe Morgner[1], and Milutin Kovacev[1] — [1]Institute of Quantum Optics, Leibniz University, Welfengarten 1, 30167, Hannover, Germany — [2]Westlake University, 18 Shilongshan Road 310024, Hangzhou, China — [3]Max Born Institute, Max Born Str. 2a, 12489, Berlin, Germany — [4]Carl von Ossietzky University, Oldenburg, Germany

CW currents in asymmetric nanojunctions in strong optical fields can be created. Here we discuss the mechanism and show that it is rooted in the inter-cycle interference of the electronic wavepackets in the nanogap.

EI-4: Many Body States and Non-linear Dynamics

Chair: Polina Plochocka, CNRS Toulouse, France

Time: Friday, 8:30–10:00 Location: TRACK 10

Oral EI-4.1 8:30 TRACK 10

Condensation and spatial coherence of Exciton-Polaritons in a MoSe2 monolayer - microcavity — •Carlos Anton-Solanas[1,2], Maximilian Waldherr[1], Martin Klaas[1], Holger Suchomel[1], Tristan H. Harder[1], Hui Cai[3], Evgeny Sedov[4,5,6], Sebastian Klembt[1], Alexey V. Kavokin[4,5,7], Sefaattin Tongay[8], Kenji Watanabe[9], Takashi Taniguchi[10], Sven Höfling[1,11], and Christian Schneider[1,2] — [1]Universität Würzburg, Würzburg, Germany — [2]Carl von Ossietzky University, Oldenburg, Germany — [3]University of California, Merced, USA — [4]Westlake University, Hangzhou, China — [5]Westlake Institute for Advanced Study, Hangzhou, China — [6]Vladimir State University, Vladimir, Russia — [7]St. Petersburg State University, St. Petersburg, Russia — [8]Arizona State University, Tempe, USA — [9]Research Center for Functional Materials, Tsukuba, Japan — [10]International Center for Materials Nanoarchitectonics, Tsukuba, Japan — [11]University of St. Andrews, St. Andrews, United Kingdom

Our experiments demonstrate the strong light-matter coupling and the bosonic condensation of exciton-polaritons in an atomically thin layer of MoSe2 coupled to a hybrid micro-cavity.

Oral EI-4.2 8:45 TRACK 10

Condensation signatures of a degenerate many-body state of interlayer excitons in a van der Waals MoSe2–WSe2 heterostack — •Lukas Sigl[1], Florian Sigger[1], Mirco Troue[1], Kenji Watanabe[2], Takashi Taniguchi[2], Ursula Wurstbauer[3], and Alexander Holleitner[1] — [1]1. Walter Schottky Institut and Physics Department, TUM, Munich, Germany — [2]2. National Institute for Materials Science, Tsukuba, Ibaraki, Japan — [3]3. Institute of Physics, University of Münster, Münster, Germany

We observe several condensation criticalities in photogenerated exciton ensembles hosted in MoSe2–WSe2 heterostacks with respect to photoluminescence intensity, linewidth, and temporal coherence pointing towards a coherent many-body quantum state below 10 K.

Oral EI-4.3 9:00 TRACK 10

Twist-Tailoring Hybrid Excitons In Van Der Waals Homobilayers — •Fabian Mooshammer[1], Philipp Merkl[1], Simon Ovesen[2], Samuel Brem[2], Anna Girnghuber[1], Kai-Qiang Lin[1], Marlene Liebich[1], Chaw-Keong Yong[1], Roland Gillen[3], Janina Maultzsch[3], John Lupton[1], Ermin Malic[2], and Rupert Huber[2] — [1]Department of Physics, University of Regensburg, Regensburg, Germany — [2]Department of Physics, Chalmers University of Technology, Gothenburg, Sweden — [3]Institute of Condensed Matter Physics, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen-Nürnberg, Germany

By probing internal 1s–2p transitions with phase-locked mid-infrared pulses, we trace how the twist angle precisely controls the binding energy and lifetime of hybrid excitons in transition metal dichalcogenide bilayers.

Oral EI-4.4 9:15 TRACK 10

Exciton Diffusion in Strained Atomically Thin Semiconductors — •Robert Schmidt[1], Roberto Rosati[2], Samuel Brem[2], Raül Perea-Causín[3], Iris Niehues[1], Steffen Michaelis de Vasconcellos[1], Ermin Malic[2,3], and Rudolf Bratschitsch[1] — [1]Institute of Physics and Center for Nanotechnology, University of Münster, Münster, Germany — [2]Department of Physics, Philipps-Universität Marburg, Marburg, Germany — [3]Department of Physics, Chalmers University of Technology, Gothenburg, Sweden

We measure and calculate the strain-dependent exciton diffusion coefficient in atomically thin transition metal dichalcogenides, which is governed by relative changes of the energies of bright and momentum-dark excitons.

Oral EI-4.5 9:30 TRACK 10

Polarization-Resolved Second Harmonic Generation Imaging microscopy of 2D Materials — •Sotiris Psilodimitrakopoulos[1], Leonidas Mouchliadis[1], George Miltos Maragkakis[1,2], George Kourmoulakis[1,3], Ioanna Demeridou[1,2], Andreas Lemonis[1], George Kioseoglou[1,3], and Emmanuel Stratakis[1,2] — [1]Institute of Electronic Structure and Laser-Foundation for Research and Technology-Hellas, GR-711 10, Heraklion, Greece — [2]Physics Department, University of Crete, GR-700 13, Heraklion, Greece — [3]Department of Materials Science and Technology, University of Crete, GR-700 13, Heraklion, Greece

All optical, large area polarization-resolved SHG imaging microscopy in 2D materials, reveals lattice imperfections, probes valley population imbalance and measures twist angle in stacked layers, in real-time, pixel-by-pixel and in the same substrate that those materials are produced.

Oral EI-4.6 9:45 TRACK 10

Signature of 2p exciton in hBN-encapsulated monolayer MoSe2 revealed by sum frequency generation spectroscopy — •Shinya Takahashi[1], Satoshi Kusaba[1], and Koichiro Tanaka[1,2] — [1]Department of Physics, Kyoto University, Kyoto, Japan — [2]Institute for Integrated Cell-Material Sciences, Kyoto University, Kyoto, Japan

Excitons in monolayer MoSe2 have unique properties due to low dimensional environment. Here, 2p excitons were directly observed by sum frequency generation spectroscopy and this has potency for more accurate determination of fundamental optical parameters.

CM-7: Surface and Volume Processing

Chair: Johannes Heitz, Johannes Kepler University, Linz, Austria

Time: Friday, 8:30–10:00 Location: TRACK 11

Oral CM-7.1 8:30 TRACK 11

Femtosecond Laser Written Mechanical Micro-Resonators for Integrated Switching and Modulation of Optical Signals — •Roberto Memeo[1,2], Michele Spagnolo[1], Riccardo Motta[1], Andrea Crespi[1,2], and Roberto Osellame[2,1] — [1]Dipartimento di Fisica - Politecnico di Milano, Milano, Italy — [2]Istituto di Fotonica e Nanotecnologie - Consiglio Nazionale delle Ricerche (IFN - CNR), Milano, Italy

Here we present micro-mechanical resonating structures for integrated photonic applications. These micro-resonators are written by Femtosecond Laser Micromachining and coupled to optical waveguides to act as switches or modulators.

Oral CM-7.2 8:45 TRACK 11

High Damage Threshold Ultrafast Laser Nanostructuring in Silica Glass — •Xin Chang, Yuhao Lei, Huijun Wang, Gholamreza Shayeganrad, Chun Deng, and Peter Kazansky — Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

The damage threshold of femtosecond laser-induced nanoporous modification comparable to pristine silica glass was demonstrated, enabling high-performance geometric phase optical elements for high-power applications.

Oral CM-7.3 9:00 TRACK 11

High-resolution microfabrication through a graded-index multimode optical fiber — •Georgia Konstantinou[1], Damien Loterie[1,2], Eirini Kakkava[3], Demetri Psaltis[3], and Christophe Moser[1] — [1]École Polytechnique Fédérale de Lausanne, Laboratory of Applied Photonics Devices, CH-1015, Lausanne, Switzerland — [2]Readily3D SA EPFL Innovation Park, Bâtiment C CH-1015 , Lausanne, Switzerland — [3]École Polytechnique Fédérale de Lausanne, Laboratory of Optics, CH-1015, Lausanne, Switzerland

A fiber-based 3D printing system based on the Transmission Matrix method and wavefront shaping is used for the fabrication of smooth micro-structures by two-photon polymerization. The focused spot is scanned digitally and initiates photo-polymerization.

Oral CM-7.4 9:15 TRACK 11

Laser Induced Dielectric Material Modifications Using Burst Of Spatio-Temporally Focused Laser Pulses — •Paul Quinoman, Benoît Chimier, and Guillaume Duchateau — University of Bordeaux-CNRS-CEA, Centre Lasers Intenses et Applications, Talence, France

The spatio-temporal focusing of a train of femtosecond laser pulses in fused silica is numerically investigated.The absorbing region geometry is controlled through the pulse-to-pulse increase in lattice temperature and energy absorption.

Oral CM-7.5 9:30 TRACK 11

Femtosecond Laser Surface-structuring for Cell-repellent Functionalization of Medical Implants — •Martina Muck[1], Benedikt Wolfsjäger[1], Karoline Seibert[2], Christian Maier[2], Achim Walter Hassel[3], Werner Baumgartner[4], and Johannes Heitz[1] — [1]Institute of Applied Physics, Johannes Kepler University Linz, Linz, Austria — [2]Hofer GmbH & Co KG, Fürstenfeld, Austria — [3]Institute of Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Linz, Austria — [4]Institute of Biomedical Mechatronics, Johannes Kepler University Linz, Linz, Austria

Femtosecond laser-induced micro- and nanostructures at anodized Ti bone screws result in repellence of osteoblasts. This shall enable removal of these implants when the bone is healed without destruction of the newly grown bone matrix.

Oral CM-7.6 9:45 TRACK 11

Electrically conductive porous carbon structures fabricated by laser direct carbonization of bamboo — •Rikuto Miyakoshi[1], Fumiya Morosawa[1], Shuichiro Hayashi[1], and Mitsuhiro Terakawa[1,2] — [1]School of Integrated Design Engineering, Keio University, Yokohama, Japan — [2]Department of Electronics and Electrical Engineering, Keio University, Yokohama, Japan

Electrically conductive structures composed of highly crystalline graphitic carbon were fabricated by the femtosecond-laser carbonization of bamboo. Owing to the naturally-porous structure of bamboo, the fabricated structures were highly porous and attractive for capacitive applications.

CH-11: Quantum Sensing and Imaging

Chair: Alejandro Turpin, University of Glasgow, Glasgow, United Kingdom

Time: Friday, 11:00–12:30 Location: TRACK 1

Invited CH-11.1 11:00 TRACK 1

Enhanced Quantum Imaging SPAD arrays — •Federica Villa, Fabio Severini, Francesca Madonini, and Franco Zappa — Politecnico di Milano - Dipartimento di Elettronica, Informazione e Bioingegneria, Milano, Italy

Quantum imaging demands challenging detector requirements: single-photon sensitivity, sub-ns timing, and photon coincidences spatial resolution. We discuss pros and cons of different SPAD sensors suitable as quantum imagers and we provide guidelines for next-generation ones.

Oral CH-11.2 11:30 TRACK 1

Mid-infrared microscopy with undetected photons — •Inna Kviatkovsky[1], Helen M Chrzanowski[1], and Sven Ramelow[1,2] — [1]Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany — [2]IRIS Adlershof, Humboldt-Universität zu Berlin, Berlin, Germany

We demonstrate that nonlinear interferometry with entangled photons provides a powerful and cost-effective technique for microscopy in the mid-IR, harnessing the maturity of silicon-based detection technology to allow wide-field imaging of biological samples at room-temperature.

Oral CH-11.3 11:45 TRACK 1

Analysis of a quantum imaging system based on SPAD detection — •Fabio Severini, Francesca Madonini, and Federica Villa — Dipartimento di Elettronica, Informazione e Biongegneria, Politecnico di Milano, Milano, Italy

Classical imaging boundaries can be surpassed exploiting quantum correlations in twin-beams coupled to detectors revealing temporal correlations with maximized signal-to-noise ratio. Measurement errors affecting SPAD-arrays with on-chip coincidence detection are analyzed and presented.

Oral CH-11.4 12:00 TRACK 1

Polarization entanglement-enabled quantum holography — •Hugo Defienne, Bienvenu Ndagano, Ashley Lyons, and Daniele Faccio — School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom

By exploiting polarization entanglement between photons, we demonstrate a quantum holography approach that circumvents the need for first-order coherence that is vital to classical holography, with potential for biological imaging and high-dimensional quantum states characterization.

Oral CH-11.5 12:15 TRACK 1

Single photon holography with undetected light — •Marta Gilaberte Basset[1], Sebastian Töpfer[1], Juan .P Torres[2], Jorge Fuenzalida[1], Fabian Steinlechner[1], and Markus Gräfe[1] — [1]Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena, Germany — [2]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain

We experimentally implement phase shifting holography in a non-linear interferometer. This allows fast and convenient holographic phase and transmission sensing of samples with spectral separation of illumination and detection.

CI-4: Emerging Technologies for Telecommunications

Chair: Peter Horak, ORC Southampton, Southampton, United Kingdom

Time: Friday, 11:00–12:30 Location: TRACK 2

Keynote CI-4.1 11:00 TRACK 2

Practical Quantum Communication and Processing — •Fabio Bovino — Dept. SBAI SAPIENZA University of Rome, ROMA, Italy

Multirail Architecture encode the whole state space in a complex optical circuit, and it provides a novel class of small or intermediate-scale processors that allow "quantum supremacy" and practical implementation of quantum communication and authentication.

Oral CI-4.2 11:45 TRACK 2

Improvement in orbital angular momentum mode sorting of optical vortices by using polarization gratings — •Keisaku Yamane[1], Kensuke Iitsuka[1], Moritsugu Sakamoto[2], Hiroshi Ono[2], Kazuhiko Oka[3], Yasunori Toda[1], and Ryuji Morita[1] — [1]Hokkaido University, Sapporo, Japan — [2]Nagaoka University of Technology, Nagaoka, Japan — [3]Hirosaki University, Hirosaki, Japan

The detection accuracy in orbital angular momentum (OAM) decomposition of optical vortices was remarkably improved by use of beam duplication technique based on polarization gratings, together with our newly developed sidelobe reduction filter.

Oral CI-4.3 12:00 TRACK 2

Direct visualization of bimodal-propagation-induced spatial self-imaging — •Mario Ferraro[1], Fabio Mangini[2], Mario Zitelli[1], Alioune Niang[2], Alessandro Tonello[3], Vincent Couderc[3], Fabrizio Frezza[1], and Stefan Wabnitz[1] — [1]Department of Information Engineering, Electronics and Telecommunications (DIET), Sapienza University of Rome, Rome, Italy — [2]Department of Information Engineering (DII), University of Brescia, Brescia, Italy — [3]Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France

We exploit silica defects photoluminescence for directly visualizing the self-imaging arising from the interference of LP01 and LP11 modes of a bimodal optical fiber. This provides a length-independent method to determine the fiber cut-off.

Oral CI-4.4 12:15 TRACK 2

Photonics-Based Cholesky Decomposition — •Mahsa Salmani, Enxiao Luan, Sreenil Saha, Behrooz Semnani, and Armaghan Eshaghi — Huawei Technologies Canada, Markham, Canada

In this paper, a photonic computing architecture for Cholesky decomposition implementation is proposed. By exploiting the bandwidth and lossless light propagation, the proposed architecture provides a significant improvement in time efficiency as compared to GPUs.

CF-9: Sources for Dual Comb Spectroscopy

Chair: Oleg Pronin, Helmut-Schmidt-University, Hamburg, Germany

Time: Friday, 11:00–12:30 Location: TRACK 3

Oral CF-9.1 11:00 TRACK 3

Comb-Line-Resolved Spectroscopy of Acetylene Driven by a Free-Running Dual-Comb Thin-Disk Laser — •Norbert Modsching, Jakub Drs, Pierre Brochard, Julian Fischer, Stéphane Schilt, Valentin J. Wittwer, and Thomas Südmeyer — Laboratoire Temps-Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Avenue de Bellevaux 51, Neuchâtel, Switzerland

We demonstrate that dual-comb thin-disk lasers are suitable for fast high-resolution spectroscopy in the near-infrared. Operating with 240-fs, 6-8 W and 97-MHz, these are highly attractive sources for nonlinear frequency-conversion for dual-comb mid-infrared applications.

Oral CF-9.2 11:15 TRACK 3

Single-Mode Laser Diode Pumped Yb:CaF_2 Dual-Comb Oscillator — Daniel Koenen, Benjamin Willenberg, Justinas Pupeikis, Sandro Camenzind, •Christopher R. Phillips, and Ursula Keller — Department of Physics, Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland

We demonstrate a free-running, polarization-multiplexed Yb:CaF2 dual-comb laser with 100-fs pulses at 161-MHz repetition-rate and 115-mW average power per comb pumped by a single-mode laser diode. The tunable repetition-rate difference was set to 1.15-kHz.

Oral CF-9.3 11:30 TRACK 3

Simple Approach for Ambiguity-Free Dual-Comb Ranging Using an Intrinsically Modulated Single-Cavity Laser Source — •Jakob Fellinger[1], Georg Winkler[1], Aline S. Mayer[1], Valentina Shumakova[1], Lukas W. Perner[1], P. E. Collin Aldia[1], Vito F. Pecile[1], Tadeusz Martynkien[2], Pawel Mergo[3], Grzegorz Soboń[4], and Oliver H. Heckl[1] — [1]1. University of Vienna, Faculty of Physics, Faculty Center for Nano Structure Research, Christian Doppler Laboratory for Mid-IR Spectroscopy and Semiconductor Optics, Vienna, Austria — [2]2. Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Wroclaw, Poland — [3]3. Laboratory of Optical Fiber Technology, M. Curie-Skłodowska University, Lublin, Poland — [4]4. Laser & Fiber Electronics Group, Wroclaw University of Technology, Wroclaw, Poland

We present a simple approach for ambiguity-free dual-comb ranging. We exploit the intrinsic Intensity modulation of a single-cavity dual-color dual-comb for simultaneous time-of-flight and dual-comb distance measurements enabling us to overcome ambiguity limitations.

Oral CF-9.4 11:45 TRACK 3

Towards fully passive deep UV Dual-Comb Spectroscopy. — •Tobias Hofer — Helmut Schmidt University, Hamburg, Germany

Passive high power dual frequency comb thin-disk oscillator operating at 1030 nm wavelength was extended in green preserving its performance. This holds promise towards performing first Dual-Comb Spectroscopy in UV and deep UV regions.

Oral CF-9.5 12:00 TRACK 3

Attosecond-Precision Dual-Oscillator Infrared Field-Resolved Spectroscopy Employing Electro-Optic Delay Tracking — •Alexander Weigel[1,2,3], Theresa Buberl[1,2], Philip Jacob[1,2], Tatiana Amotchkina[1,2], Christina Hofer[1,2,3], Michael Trubetskov[1], Philipp Sulzer[1,2,4,5], Syed Ali Hussain[2,3], Wolfgang Schweinberger[1,2], Vladimir Pervak[1,2], Ferenc Krausz[1,2], and Ioachim Pupeza[1,2] — [1]Max-Planck Institute of Quantum Optics, Garching, Germany — [2]Ludwig Maximilians University Munich, Garching, Germany — [3]Center for Molecular Fingerprinting (CMF), Molekuláris- Ujjlenyomat Kutató Közhasznú Nonprofit Kft., Budapest, Hungary — [4]Department of Physics and Astronomy, University of British Columbia, Vancouver, Canada — [5]Quantum Matter Institute, University of British Columbia, Vancouver, Canada

The delay between ultrashort light pulses emitted by two modelocked oscillators is monitored via second-order nonlinear processes. Modulating their detuned repetition frequencies at >1 kHz enables attosecond-precision mid-infrared electric-field-resolved measurement of a 7-ps time window.

Oral CF-9.6 12:15 TRACK 3

Superposition of two independent FDML lasers — •Christin Grill[1], Simon Lotz[1], Torben Blömker[1], Mark Schmidt[2], Wolfgang Draxinger[1], Jan Philip Kolb[1], Christian Jirauschek[2], and Robert Huber[1] — [1]Institute of Biomedical Optics, University of Lübeck, Lübeck, Germany — [2]Department of Electrical and Computer Engineering, Technical University of Munich, Munich, Germany

Coherence properties are crucial for applications of Fourier domain mode locking but cannot be measured with conventional methods. Beating of two independent FDML lasers gives novel in-sights in its linewidth and carrier envelope phase slip.

CM-8: Modelling and In-situ Diagnostics

Chair: Jan Siegel, Instituto de Optica, CSIC, Madrid, Spain

Time: Friday, 11:00–12:30 Location: TRACK 4

Oral CM-8.1 11:00 TRACK 4

Predictive Visualisation of Fibre Laser Machining via Deep Learning — •Alexander F. Courtier[1], Michael McDonnell[1], Matt Praeger[1], James A. Jacob Grant[1], Christophe Codemard[1,2], Paul Harrison[2], Ben Mills[1], and Michalis Zervas[1] — [1]Optoelectronics Research Centre, Southampton, United Kingdom — [2]TRUMPF Laser UK, Southampton, United Kingdom

Deep learning was used to produce a visual prediction for the appearance of stainless steel when machined via a 2kW fibre laser for different laser scan speeds, hence demonstrating the potential for modelling light-matter interactions.

Oral CM-8.2 11:15 TRACK 4

A benchmarked vectorial model and flexible software-tool for in-bulk laser processing — •Qingfeng Li[1], Maxime Chambonneau[1], Markus Blothe[1], Herbert Gross[1,2], and Stefan Nolte[1,2] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University Jena, Albert-Einstein-Str. 15, 07745, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745, Jena, Germany

We introduce a flexible, fast, and benchmarked vectorial model for focused laser beams. By taking the aberrations induced by the focusing elements and the planar interface into account, the in-bulk intensity distributions are precisely described.

Oral CM-8.3 11:30 TRACK 4

Time-Resolved Digital Holography System with High Phase Precision for Detail Observation in Laser Ablation Dynamics — •Shotaro Kawano, Miu Tamamitsu, Haruyuki Sakurai, Kuniaki Konishi, Takuro Ideguchi, Junji Yumoto, and Makoto Kuwata-Gonokami — The University of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan

To observe slight thermodynamical changes in materials in laser ablation, we constructed a coaxial time-resolved digital holography optical system with a novel interferometer, which realizes high spatial resolution and high optical-phase-delay precision.

Oral CM-8.4 11:45 TRACK 4

Vlasov Simulation of Electron Dynamics in Solids Under Intense Laser Fields — •Mizuki Tani[1,2], Tomohito Otobe[2], Yasushi Shinohara[1,3], and Kenichi L. Ishikawa[1,3,4] — [1]Department of Nuclear Engineering and Management, School of Engineering, The University of Tokyo, Tokyo, Japan — [2]Kansai Photon Science Institute, National Institutes for Quantum and Radiological Science and Technology, Kyoto, Japan — [3]Photon Science Center, Graduate School of Engineering, The University of Tokyo, Tokyo, Japan — [4]Research Institute for Photon Science and Laser Technology, The University of Tokyo, Tokyo, Japan

We propose a Vlasov-LDA-based semi-classical approach for laser-driven electron dynamics in solids. We extend the pseudo particle method to periodic systems. The computation results agree excellently with the time-dependent density functional theory and experimental results.

Oral CM-8.5 12:00 TRACK 4

Time-Resolved Ablation Dynamics of Indium Tin Oxide — •Goran Erik Hallum[1], Dorian Kürschner[2], Heinz Paul Huber[1], and Wolfgang Schulz[2] — [1]Munich University of Applied Sciences, Munich, Germany — [2]RWTH Aachen University, Aachen, Germany

We utilize a pump-probe microscopy setup in order to observe the dynamic reflectivity of indium tin oxide ablation irradiated with ultrashort laser pulses with a near-infrared central wavelength of 1056 nm and sub-ps pulse durations.

Oral CM-8.6 12:15 TRACK 4

All multimode smart endoscopic cleaning system monitored by LIBS spectroscopy — •Badr Shalaby[1,2], Yann Leventoux[1], Marc Fabert[1], Tigran Manduryan[1], Sébastien Février[1], Dominique Pagnoux[1], and Vincent Couderc[1] — [1]Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France — [2]Physics Department, Faculty of Science, Tanta University, Tanta, Egypt

We demonstrate a new dual Q-switched laser based on a Nd:YAG crystal pumped by a Q-switched laser diode. We can clean and determine a sample composition using multimode smart endoscopic system monitored by LIBS spectroscopy.

CD-10: Nonlinear Spectroscopy and Microscopy

Chair: Derryck Reid, Herriot-Watt University, Edinburgh, United Kingdom

Time: Friday, 11:00–12:30 Location: TRACK 5

Oral CD-10.1 11:00 TRACK 5

Precisely Targeting Molecular Absorption Lines in 2 μm Region by Optical Parametric Oscillator using Type-II PPRKTP — •Yaqun Liu, Kjell Martin Mølster, Andrius Zukauskas, Cherrie Lee, and Valdas Pasiskevicius — Royal Institute of Technology, Stockholm, Sweden

Precise refractive index dispersion and thermooptic expansions experimentally verified here, allow harnessing distinct advantages of 2μm type-II PPRKTP OPOs for targeting absorption lines in greenhouse gasses. Specific design examples employing temperature and pump-tuning are provided.

Oral CD-10.2 11:15 TRACK 5

Low-Threshold Fully-Stabilized Mid-Infrared Frequency Comb Generation — •Mikhail Roiz[1], Jui-Yu Lai[2], Juho Karhu[1,3], and Markku Vainio[1,4] — [1]University of Helsinki, Helsinki, Finland — [2]HC Photonics Corp., Hsinchu, Taiwan — [3]Aalto University, Espoo, Finland — [4]Tampere University, Tampere, Finland

We demonstrate a method for mid-infrared frequency comb generation featuring extremely low threshold (30 pJ) and high conversion efficiency (63.5%). The method is based on continuous wave seeded optical parametric generation in nonlinear waveguides.

Oral CD-10.3 11:30 TRACK 5

Spectral Narrowing and Wavelength Tuning in Injection-Seeded Pulsed Optical Parametric Oscillator for Photoacoustic Methane Analyzer — Evgeniy Erushin[1,2], Boris Nyushkov[1,2], Aleksey Ivanenko[1], Igor Korel[2], Andrey Boyko[1], Nadezhda Kostyukova[1,2], and •Dmitry Kolker[1,2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Novosibirsk State Technical University, Novosibirsk, Russia

We demonstrate possibility to enhance spectroscopic capabilities of mid-IR pulsed optical parametric oscillators based on fan-out PPLN by combining their wavelength tunability with injection-seeding technique providing spectral narrowing. This approach allows advanced photoacoustic gas analysis.

Oral CD-10.4 11:45 TRACK 5

High-Power Fiber-Pumped Continuous-Wave Difference-Frequency-Generation at 2.26 μm — • Sukeert[1], Chaitanya Kumar Suddapalli[1], and Majid Ebrahim-Zadeh[1,2] — [1]ICFO—Institut de Ciències Fotòniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [2]Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We report high-power single-pass continuous-wave difference-frequency-mixing of Yb and Tm-fiber lasers in MgO:PPLN, generating ~4 W of output power at 2262 nm, with excellent power stability of 0.5%rms over 1.5 hours, in high beam quality.

Oral CD-10.5 12:00 TRACK 5

Waveguide-based optical parametric amplification for coherent Raman imaging — •Niklas M. Lüpken[1], Thomas Würthwein[1], Klaus-J. Boller[2,1], and Carsten Fallnich[1,2,3] — [1]Institute of Applied Physics, University of Münster, Münster, Germany — [2]MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [3]Cells in Motion Interfaculty Centre, University of Münster, Münster, Germany

We present a light source for narrowband coherent Raman imaging, with the potential to be set up as an all-integrated device, based on four-wave mixing in silicon nitride waveguides.

Oral CD-10.6 12:15 TRACK 5

Speckle-assited structured illumination stimulated Raman scattering microscopy — •Julien Guilbert[1], Awoke Negash[1], Simon Labouesse[2], Sylvain Gigan[1], Anne Sentenac[3], and Hilton Barbosa de Aguiar[1] — [1]Laboratoire Kastler Brossel, ENS-Université PSL, CNRS, Sorbonne Université, Collège de France, Paris, France — [2]Department of Electrical, Computer, and Energy Engineering, University of Colorado, Boulder, USA — [3]Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, Marseille, France

We present a far-field computational microscopy technique, using speckle-based structured illumination, enabling stimulated Raman scattering super resolution imaging of biological specimens at high speed.

CL-4: Spectroscopy, Label-Free Imaging and Sensing

Chair: Guiseppe Vicidomini, Molecular Microscopy and Spectroscopy, Center for Human Technologies, Istituto Italiano di Tecnologia, Genoa, Italy

Time: Friday, 11:00–12:15 Location: TRACK 6

Oral CL-4.1 11:00 TRACK 6

Detecting Protein Alteration within an Exosome by Means of a Coated Dielectric Microsphere Resonator — •Mandana Jalali[1], Niels Benson[2], and Daniel Erni[1] — [1]General and Theoretical Electrical Engineering (ATE), Faculty of Engineering, University of Duisburg-Essen, and CENIDE – Center for Nanointegration Duisburg-Essen, Duisburg, Germany — [2]Institute of Technology for Nanostructures (NST), Faculty of Engineering, University of Duisburg-Essen, and CENIDE – Center for Nanointegration Duisburg-Essen, Duisburg, Germany

The fraction of protein content in an exosome is sensed in a label free manner by means of a coated microsphere resonator as a technique for early stage cancer diagnosis and fundamental cancer studies.

Oral CL-4.2 11:15 TRACK 6

Towards Broadband Mid-Infrared Fully Integrated Protein Sensor employing a Quantum Cascade Laser and Quantum Cascade Detector — •Alicja Dabrowska[1], Mauro David[2], Andreas Schwaighofer[1], Borislav Hinkov[2], Andreas Harrer[2], Gottfried Strasser[2], and Bernhard Lendl[1] — [1]Institute of Chemical Technologies and Analytics,Technische Universität Wien,, Vienna, Austria — [2]Institute of Solid State Electronics & Center for Micro- and Nanostructures,Technische Universität Wien, Vienna, Austria

We present a combination of quantum cascade laser and quantum cascade detectors for broadband mid-IR spectroscopy sensing of bovine milk proteins in aqueous solution.

Oral CL-4.3 11:30 TRACK 6

Excited State Decay Pathways Of Epigenetic DNA Nucleosides Tracked With Sub-20-fs UV Pulses — •Piotr Kabacinski[1], Marco Romanelli[2], Eveliina Ponkkonen[3], Irene Conti[2], Thomas Carell[3], Marco Garavelli[2], and Giulio Cerullo[1] — [1]Dipartimento di Fisica, Politecnico di Milano, Milano, Italy — [2]Dipartimento di Chimica Industriale, Universita degli Studi di Bologna, Bologna, Italy — [3]Department of Chemistry, Ludwig-Maximilians Universitat Munchen, Munchen, Germany

Modified nucleosides establish a second layer of information in DNA. We characterized all four epigenetic nucleosides via the combination of sub-30-fs transient absorption spectroscopy and molecular electronic structure calculations.

Oral CL-4.4 11:45 TRACK 6

Tracking Conical Intersection Dynamics Of Tryptophan With Sub-20-fs UV Pulses — •Piotr Kabacinski[1], Vishal K. Jaiswal[2], Rocio Borrego-Varillas[1], Barbara E. Noguiera de Faria[3], Marzio G. Gentile[2], Irene Conti[2], Sandro De Silvestri[1], Marco Garavelli[2], Ana M. De Paula[3], and Giulio Cerullo[1] — [1]IFN-CNR, Dipartimento di Fisica, Politecnio di Milano, Milano, Italy — [2]Dipartimento di Chimica Industriale, Universita degli Studi di Bologna, Bologna, Italy — [3]Departamento de Fisica, Universidade Federal de Minas Gerais, Belo Horizonte-MG, Brazil

Tryptophan can serve as a local probe of UV-excited protein dynamics. We track primary photoinduced processes in tryptophan using sub-30-fs transient absorption spectroscopy and QM/MM computations to reveal its conical intersections.

Oral CL-4.5 12:00 TRACK 6

Single Cell Elastography using Optical Tweezers and Optical Coherence Tomography — •Maxim Sirotin[1], Maria Romodina[1], Evgeny Lyubin[1], Irina Soboleva[1,2], and Andrey Fedyanin[1] — [1]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia — [2]Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Moscow, Russia

We report on the development of a single cell elastography method based on optical tweezers and optical coherence tomography. This all-optical method makes it possible to evaluate cellular mechanical properties without applying any probes.

CJ-8: High Power Fiber Lasers

Chair: Mikhail Likhachev, Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russia

Time: Friday, 11:00–12:30 Location: TRACK 7

Invited CJ-8.1 11:00 TRACK 7

Transverse Mode Instability in High-Power Fiber Laser Systems: a "Hot Topic" — •Cesar Jauregui[1], Christoph Stihler[1,3], Sobhy Kholaif[1,2], Yiming Tu[1,2], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We review the current understanding of TMI as well as present the most promising strategies and fiber designs proposed to enable a further scaling of the output average power of fiber laser systems.

Oral CJ-8.2 11:30 TRACK 7

Towards CEP-stable single-cycle pulses with microjoule-level energy at 8 MHz repetition rate — •Francesco Tani[1], Jacob Lampen[2], Daniel Schade[1,3], Jie Jiang[2], Martin E. Fermann[2], and Philip St.J. Russell[1,3] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]IMRA America, Inc., Ann Arbor, USA — [3]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

A 20 cm long Kr-filled single-ring hollow core PCF, pumped by 36 fs pulses from a low-noise Yb fibre laser at 8 MHz, produces 7.3 fs pulses with microjoule-level energy.

Oral CJ-8.3 11:45 TRACK 7

Q-Switched Rod-Type Multicore Fibre Laser Delivering 3.1 mJ Pulses — •Christopher Aleshire[1], Albrecht Steinkopff[1], Maximilian Karst[1,2], Arno Klenke[1,2], Cesar Jauregui[1], Stefan Kuhn[3], Johannes Nold[3], Nicoletta Haarlammert[3], Thomas Schreiber[3], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Friedrich-Schiller-University Jena, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

A custom rod-type multicore Yb-doped fibre is used in Q-switched operation, achieving 3.1 mJ pulse energy. The fibre design, laser performance, and prospects for further power scaling in multistage MCF amplifiers will be discussed.

Oral CJ-8.4 12:00 TRACK 7

BOAS VLMA Yb Doped High Power Single Mode Fiber Lasers — Achille Monteville[1], David Landais[1], Olivier Le Goffic[1], Laurent Provino[1], Germain Giraud[2], Eric Lallier[3], and •Thierry Taunay[1] — [1]Photonics Bretagne, Lannion, France — [2]Azur Light Systems, Pessac, France — [3]Thalès TRT, Palaiseau, France

We report on a new fiber design for VLMA fibers based on a simple Bend Oriented All-Solid step index principle. Truly single mode Yb doped VLMA fibers were successfully manufactured with 90% optical-optical efficiency.

Oral CJ-8.5 12:15 TRACK 7

High-Power Cladding Light Stripper with Vapor Deposition of Polyethersulfone — •Bartu Şimşek, Ozan Aktaş, Ali Karatutlu, Ahmet Başaran, Elif Yapar Yıldırım, Yakup Midilli, and Bülend Ortaç — National Nanotechnology Research Center, Ankara, Turkey

Vapor deposition of high index engineered polymer over fiber cladding was presented. Performance of device was tested with 171.3 W launched cladding light and it was reduced by 17.72 dB at the output.

CK-8: Non-Linear Integrated Photonics

Chair: Stephane Clemmen, Université Libre de Bruxelles / Ghent University, Belgium

Time: Friday, 11:00–12:30 Location: TRACK 8

Oral CK-8.1 11:00 TRACK 8

Long-term Stability of Lithium Niobate on Insulator PICs for Metrological Applications — •Ewelina Obrzud[1], Hamed Sattari[1], Thibault Voumard[2], Gregory Choong[1], Séverine Denis[1], Jacopo Leo[1], Thibault Wildi[2], Olivier Dubochet[1], Michel Despont[1], Steve Lecomte[1], Tobias Herr[2], Amir Ghadimi[1], and Victor Brasch[1] — [1]Swiss Center for Electronics and Microtechnology (CSEM), Neuchatel, Switzerland — [2]Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

We demonstrate that lithium niobate integrated photonics allows for reliable nonlinear applications under continuous femtosecond laser irradiation. Over >400 hours, a stable octave-spanning supercontinuum plus second-harmonic generation allows for direct self-referencing of a frequency comb.

Oral CK-8.2 11:15 TRACK 8

Supermode-based second harmonic generation in a nonlinear interferometer — •David Barral[1], Virginia D'Auria[2], Florent Doutre[2], Tommaso Lunghi[2], Sébastien Tanzilli[2], Alicia Petronela Rambu[3], Sorin Tascu[3], Juan Ariel Levenson[1], Nadia Belabas[1], and Kamel Bencheikh[1] — [1]Centre de Nanosciences et de Nanotechnologies C2N, Palaiseau, France — [2]Université Côte d'Azur, CNRS, Institut de Physique de Nice (INPHYNI), Nice , France — [3]Research Center on Advanced Materials and Technologies, Alexandru Ioan Cuza University of Iasi, Iasi, Romania

We experimentally demonstrate supermode-based SHG through a specifically-designed integrated LiNbO3 nonlinear interferometer made of linear and nonlinear directional couplers with a fully-fibered pump paving the way for the demonstration of on-chip supermode-based entanglement.

Oral CK-8.3 11:30 TRACK 8

High-yield, wafer-scale fabrication of ultralow-loss, dispersion-engineered silicon nitride photonic circuits — •Junqiu Liu, Guanhao Huang, Rui Ning Wang, Jijun He, Arslan Raja, Johann Riemensberger, Grigory Lihachev, Nils Engelsen, and Tobias Kippenberg — Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

For widespread applications of nonlinear photonic integrated circuits, ultralow optical losses and high fabrication throughput are required. Here, we present a CMOS fabrication technique for photonic microresonators with mean quality factors exceeding 30 millions and wafer-level yield.

Oral CK-8.4 11:45 TRACK 8

AlGaAs-on-insulator Waveguides for Highly Efficient Photon Pair Generation — •Hatam Mahmudlu[1,2,3], Stuart May[4], Ali Angulo[1,2,3], Marc Sorel[4,5], and Michael Kues[1,2,3] — [1]Institute of Photonics, Leibniz University Hannover, Hannover, Germany — [2]Hannover Centre for Optical Technologies, Leibniz University Hannover, Hannover, Germany — [3]Cluster of Excellence PhoenixD (Photonic, Optics, and Engineering – Innovation Across Disciplines), Leibniz University Hannover, Hannover, Germany — [4]School of Engineering, University of Glasgow, Glasgow, United Kingdom — [5]Institute of Technologies for Communication, Information and Perception (TeCIP), Sant'Anna School of Advanced Studies, Pisa, Italy

We demonstrate the generation of correlated photon pairs in AlGaAs-on-insulator waveguides through spontaneous four-wave mixing at telecom wavelengths with a generation efficiency of 0.096 × 10^12 pairs/(s×W^2), one of the highest achieved in integrated structures.

Oral CK-8.5 12:00 TRACK 8

Gallium phosphide transfer printing for integrated nonlinear photonics — •Maximilien Billet[1,2,3], Nicolas Poulvellarie[1,2,3], Camiel Op de Beeck[1,2], Luis Reis[1,2,3], Yoan Léger[4], Charles Cornet[4], Fabrice Raineri[5], Isabelle Sagnes[5], Konstantinos Pantzas[5], Grégoire Beaudoin[5], Gunther Roelkens[1,2], Francois Leo[3], and Bart Kuyken[1,2] — [1]Photonics Research Group, Ghent University-IMEC, Ghent, Belgium — [2]Center for Nano and Biophotonics (NB-Photonics), Ghent, Belgium — [3]OPERA-Photonique, Université libre de Bruxelles, Bruxelles, Belgium — [4]Université Rennes, INSA Rennes, CNRS, Institut FOTON – UMR 6082, Rennes, France — [5]Centre de Nanosciences et de Nanotechnologies (C2N), CNRS, Université. Paris Sud. Paris Saclay, Palaiseau, France

Recently, gallium phosphide-on-insulator (GaP-OI) has been proposed as an efficient platform for second and third order nonlinear applications. Here we show GaP transfer printing as a novel versatile integration technique allowing for decent resonators building and second harmonic generation (SHG).

Oral CK-8.6 12:15 TRACK 8

Extreme localisation of light in driven-dissipative photonic lattices — •Omar Jamadi[1], Bastian Real[1], Krzysztof Sawicki[2], Nicolas Pernet[3], Isabelle Sagnes[3], Aristide Lemaître[3], Luc Le Gratiet[3], Abdelmounaim Harouri[3], Sylvain Ravets[3], Jacqueline Bloch[3], and Alberto Amo[1] — [1]Université de Lille, CNRS, UMR 8523 – PhLAM – Physique des Lasers, Atomes et Molécules, Lille, France — [2]Institute of Experimental Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland — [3]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France

We demonstrate a new way to engineer localised modes in photonic lattices, based on the driven dissipative nature of our polariton resonators and the chiral symmetry of the honeycomb lattice.

EE-5: Novel Ultrafast Sources

Chair: John Travers, Heriot-Watt University, Glasgow, United Kingdom

Time: Friday, 11:00–12:30 Location: TRACK 9

Oral EE-5.1 11:00 TRACK 9

Terahertz pulse generation by multi-color laser fields with linear vs. circular polarization — •Alexandre Stathopulos[1,2], Colomban Tailliez[1,2], Danas Buožius[4], Ihar Babushkin[4,5], Virgilijus Vaičaitis[4], Stefan Skupin[3], and Luc Bergé[1,2] — [1]CEA-DAM, DIF, 91297 Arpajon, France — [2]Université Paris-Saclay, CEA, LMCE, 91680 Bruyères-le-Châtel, France — [3]Institut Lumière-Matière, UMR 5306 Université Lyon 1 - CNRS, Université de Lyon, 69622 Villeurbanne, France — [4]Institute of Quantum Optics, Leibniz University Hannover, Welfengarten 1, 30167 Hannover, Germany — [5]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering-Innovation Across Disciplines), 30167 Hannover, Germany

We report that, for both linear and circularly polarized femtosecond multi-color laser pulses, the infrared to terahertz conversion efficiency increases with the number of laser harmonics.

Oral EE-5.2 11:15 TRACK 9

Dispersion Management of Mid-Infrared Filamentation in Dense Gases — •Olga Kosareva[1,2], Nikolay Panov[1,2], Daniil Shipilo[1,2], and Irina Nikolaeva[1,2] — [1]Faculty of Physics, M. V. Lomonosov Moscow State University, MOSCOW, Russia — [2]P. N. Lebedev Physical Institute of the Russian Academy of Sciences, MOSCOW, Russia

In 3D+t numerical simulations, we propose an experiment, where a mixture of gases (nitrogen and water vapor) is used for the continuous transition from X- to O-shaped angle-wavelength spectrum of a femtosecond infrared filament.

Oral EE-5.3 11:30 TRACK 9

High-Energy Pulse Compression in the Mid-Wave Infrared — •Tamas Nagy, Lorenz von Grafenstein, Dennis Ueberschaer, and Uwe Griebner — Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

We compress 45mJ, 2.4ps pulses of a 1kHz holmium laser emitting at 2.05μm wavelength to 90fs duration in a stretched hollow-core fiber. The pulses comprise >20mJ energy at >20W average power, setting a new milestone.

Oral EE-5.4 11:45 TRACK 9

Role of dispersion and compression ratio on the temporal contrast of SPM-broadened post-compressed pulses — •Esmerando Escoto[1], Anne-Lise Viotti[1,2], Skirmantas Alisauskas[1], Henrik Tünnermann[1], Marcus Seidel[1], Katharina Dudde[1], Bastian Manschwetus[1], Ingmar Hartl[1], and Christoph M. Heyl[1,3,4] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Department of Physics, Lund University, Lund, Sweden — [3]Helmholtz-Institute Jena, Jena, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We explore the effects of dispersion and compression ratio on pulse post-compression. We show by numerical simulations, supported by experimental data, that ultrashort pulses with high temporal contrast can be produced at high compression ratios.

Oral EE-5.5 12:00 TRACK 9

Efficient tunable UV pulse generation from a green pumped fs-OPCPA — •Tino Lang, Skirmantas Alisauskas, Mehdi Kazemi, Ayhan Tajalli, and Ingmar Hartl — Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

We present highly efficient up-conversion schemes for broadband SH-pumped OPCPAs. Utilizing the Yb-pump in a cascaded-SFG, 69% conversion efficiencies to 300nm were obtained without degradation. The tunable UV pulses are compressed in glass to 75fs.

Oral EE-5.6 12:15 TRACK 9

Field-resolved interference among dark waves — •Lenard Vamos[1], Igor Tyulnev[1], Luke Maidment[1], Christian Hensel[1], Ugaitz Elu[1], Michael Enders[1], and Jens Biegert[1,2] — [1]ICFO - Institut de Ciencies Fotoniques, Castelldefels, Barcelona, Spain — [2]ICREA, Castelldefels, Barcelona, Spain

Frequency-time analysis of field-resolved measurements provides a direct insight and deeper understanding of the temporal decay process of individual lines in a complex absorption spectrum.

EH-5: Hybrid, Tunable and Nonlinear Metasurfaces

Chair: Alexey Krasavin, King's College London and London Centre for Nanotechnology, London, United Kingdom

Time: Friday, 11:00–12:30 Location: TRACK 10

Oral EH-5.1 11:00 TRACK 10

Graphene-Based Metasurfaces for Efficient Third Harmonic Generation — •Anna Theodosi[1,2], Odysseas Tsilipakos[2], Costas M. Soukoulis[2,3], Eleftherios N. Economou[2], and Maria Kafesaki[1,2] — [1]Department of Materials Science and Technology, University of Crete, Heraklion, Greece — [2]Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, Heraklion, Greece — [3]Ames Laboratory—U.S. DOE and Department of Physics and Astronomy, Iowa State University , Ames, USA

Graphene-based metasurfaces are investigated for efficient third-harmonic generation in the THz regime. By exploiting 2D-patterned graphene patches and aligning the fundamental and third-harmonic frequencies with metasurface resonances, we achieve conversion efficiencies up to -19dB.

Oral EH-5.2 11:15 TRACK 10

Programmable Huygens' metasurfaces for active optical phase control — •Aleksandrs Leitis[1], Andreas Heßler[2], Sophia Wahl[2], Matthias Wuttig[2], Thomas Taubner[2], Andreas Tittl[1], and Hatice Altug[1] — [1]Institute of Bioengineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland — [2]Institute of Physics (IA), RWTH Aachen University, Aachen, Germany

We present tunable metasurfaces with incorporated phase change materials for optical phase control in transmission mode. The versatility of these metasurfaces is demonstrated by optically programming spatial light phase distributions with single meta–unit precision and retrieving high–resolution phase–encoded images.

Oral EH-5.3 11:30 TRACK 10

Nanomechanical Bistability in Photonic Metamaterial — •Dimitrios Papas[1], Jun-Yu Ou[1], Eric Plum[1], and Nikolay I. Zheludev[1,2] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, SPMS, TPI, Nanyang Technological University, Singapore, Singapore

A nanowire array decorated with plasmonic resonators acts as optically bistable device. The optical properties of this metamaterial exhibit hysteresis and bistability when it is driven by a piezo actuator across its mechanical resonance frequency.

Oral EH-5.4 11:45 TRACK 10

Overcoming optical performance and diffusion issues in thermally tunable phase-change metasurfaces — •Joe Shields, Carlota Ruiz de Galarreta, Jacopo Bertolotti, and C. David Wright — College of Engineering Mathematics and Physical Sciences, Exeter, United Kingdom

We experimentally demonstrate how thermally activated diffusion can irreversibly degrade the optical performance of thermally tunable phase-change material based metasurfaces to unacceptable levels, and validate a way to address such a fundamental issue via incorporating ultrathin Si_3N_4 barrier layers.

Oral EH-5.5 12:00 TRACK 10

Anomalous Resonance Frequency Shift in Liquid Crystal-Loaded Metamaterials — •Eleni Perivolari[1], Vasilis Apostolopoulos[1], Malgosia Kaczmarek[1], and Vassili A. Fedotov[2] — [1]Physics and Astronomy, University of Southampton, Southampton, United Kingdom — [2]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom

We show that Babinet complementary patterns of metamaterials may not exhibit the same frequency tuning range when integrated with liquid crystals due to anisotropy of local fields and strong orientational optical nonlinearity of liquid crystals.

Oral EH-5.6 12:15 TRACK 10

Temperature-tunable Surface Lattice Resonances in Plasmonic Metasurfaces — •Timo Stolt[1], Jussi Kelavuori[1], Viatcheslav Vanyukov[2], Heikki Rekola[2], Jarno Reuna[1], Tommi K. Hakala[2], and Mikko J. Huttunen[1] — [1]Tampere University, Tampere, Finland — [2]University of Eastern Finland, Joensuu, Finland

We demonstrate post-fabrication tuning of the spectral properties of plasmonic surface lattice resonances by controlling the ambient temperature. Our method opens interesting pathways towards actively tunable metamaterial devices.

CC-7: THz QCL

Chair: Heinz-Wilhelm Huebers, DLR, Berlin, Germany

Time: Friday, 11:00–12:30 Location: TRACK 11

Oral CC-7.1 11:00 TRACK 11

Millimeter Wave Photonics with Terahertz Semiconductor Lasers — Valentino Pistore[1], Hanond Nong[1], Pierre-Baptiste Vigneron[2], Katia Garrasi[3], Sarah Houver[4], Lianhe Li[5], Giles Davies[5], Edmund Linfield[5], Jerome Tignon[1], Juliette Mangeney[1], Raffaele Colombelli[2], Miriam Vitiello[3], and •Sukhdeep Dhillon[1] — [1]Laboratoire de Physique de l'Ecole Normale Supérieure, Paris, France — [2]Centre de Nanosciences et de Nanotechnologies , Palaiseau, France — [3]NEST, CNR - Istituto Nanoscienze and Scuola Normale Superiore , Pisa, Italy — [4]ONERA, Palaiseau, France — [5]University of Leeds, Leeds, United Kingdom

Photonic solutions for generating free space millimeter radiation is a fast developing field that combines optoelectronics and RF domains. Here we present a quantum-cascade-laser based solution for THz laser emission and millimeter wave generation in a single device.

Oral CC-7.2 11:15 TRACK 11

Demonstration of a Resonantly Amplified Terahertz Quantum Cascade Detector — •Paolo Micheletti, Jerome Faist, Tudor Olariu, Mattias Beck, and Giacomo Scalari — ETH Zurich, Zürich, Switzerland

The photon-driven nature of the transport in terahertz quantum cascade laser can be exploited to detect light. Fast tunable detectors are demonstrated with responsivities higher then 17 V/W and working temperature up to 100 K.

Oral CC-7.3 11:30 TRACK 11

THz electroluminescence from non-polar ZnO quantum cascade structures — •Borislav Hinkov[1], Bo Meng[2], Hahn T. Hoang[1], Nolwenn Le Biavan[3], Denis Lefebvre[3], David Stark[2], Martin Franckié[2], Almudena Torres-Pardo[4], Julen Tamayo-Arriola[5], Miguel M. Bajo[5], Adrian Hierro[5], Jerome Faist[2], Jean-Michel Chauveau[3], and Gottfried Strasser[1] — [1]TU Wien, Institute of Solid State Electronics, Vienna, Austria — [2]ETH Zürich, Institute for Quantum Electronics, Zurich, Switzerland — [3]CNRS-CRHEA and Universite Cote d'Azur, Valbonne, France — [4]Universidad Complutense de Madrid, Departamento de Ouimica Inorganica, Madrid, Spain — [5]Universidad Politecnica de Madrid, ISOM, Madrid, Spain

Non-polar m-ZnO is a new material in THz-intersubband optoelectronics for overcoming previous LO-phonon-energy-based limitations as in GaAs-based THz-QCLs. We present a novel fabrication-scheme for $ZnO/Zn_{0.88}Mg_{0.12}O$ THz-QCL structures, yielding the first observation of THz-electroluminescence in ZnO.

Oral CC-7.4 11:45 TRACK 11

Terahertz intersubband electroluminescence from n-type germanium quantum wells — •David Stark[1], Muhammad Mirza[2], Luca Persichetti[3], Michele Montanari[3], Sergej Markmann[1], Mattias Beck[1], Thomas Grange[4], Stefan Birner[4], Michele Virgilio[5], Chiara Ciano[3], Michele Ortolani[6], Cedric Corley[7], Giovanni Capellini[3,7], Luciana Di Gaspare[3], Monica De Seta[3], Douglas J. Paul[2], Jérôme Faist[1], and Giacomo Scalari[1] — [1]Institute for Quantum Electronics, Department of Physics, ETH Zürich, Zürich, Switzerland — [2]James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom — [3]Dipartimento di Scienze, Universita Roma Tre, Roma, Italy — [4]nextnano GmbH, München, Germany — [5]Dipartimento di Fisica "E. Fermi," Universita di Pisa, Pisa, Italy — [6]Sapienza University of Rome, Department of Physics, Rome, Italy — [7]IHP - Leibniz-Institut für innovative Mikroelektronik, Frankfurt (Oder), Germany

We report the observation of intersubband electroluminescence from n-type Ge/SiGe quantum cascade structures at THz frequencies. This is an important step towards an integrated THz quantum cascade laser on silicon.

Oral CC-7.5 12:00 TRACK 11

All-Optical Control of Quantum Cascade Random Lasers Enhanced by Deep Learning — •Benedikt Limbacher[1,2], Sebastian Schönhuber[1,2], Nicolas Bachelard[3], Martin A. Kainz[1,2], Aaron M. Andrews[2,4], Hermann Detz[5], Gottfried Strasser[2,4], Juraj Darmo[1,2], Stefan Rotter[3], and Karl Unterrainer[1,2] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Center for Micro-and Nanostructures, TU Wien, Vienna, Austria — [3]Institute for Theoretical Physics, TU Wien, Vienna, Austria — [4]Institute for Solid-State Electronics, TU Wien, Vienna, Austria — [5]Central European Institute of Technology, Brno, Czech Republic

We show that the emission spectra of quantum cascade random lasers can be controlled by optically exciting electron-hole pairs. State of the art machine learning allows us to generate desired spectra almost instantaneously.

Oral CC-7.6 12:15 TRACK 11

Systematic search for single mode QCL at 4.7THz and post-process frequency tuning — •Tudor Olariu, Mattias Beck, Giacomo Scalari, and Jérôme Faist — Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland

A systematic search of THz QCL operating at 4.745 THz is performed by tracking the measured against the designed frequency, and frequency tuned post-process by changing the local geometry and therefore the effective refractive index.

JSIV-3: Optical Computing II

Chair: Daniel Brunner, FEMTO-ST, Besançon, France

Time: Friday, 11:00–12:15 Location: TRACK 12

Oral JSIV-3.1 11:00 TRACK 12

Exploiting a Distributed Nonlinearity in a Photonic Coherent Fiber-Based Reservoir Computer — •Jaël Pauwels[1,2], Guy Verschaffelt[1], Serge Massar[2], and Guy Van der Sande[1] — [1]Applied Physics Research Group, Vrije Universiteit Brussel, B-1050 Brussels, Belgium — [2]Laboratoire d'Information Quantique, Université libre de Bruxelles, B-1050 Brussels, Belgium

We have used a reservoir computer to investigate, both numerically and experimentally, the exploitation of a distributed optical nonlinearity. We demonstrate the importance of bulk nonlinearities for future all-optical operation of larger reservoir computers.

Oral JSIV-3.2 11:15 TRACK 12

Noise-Resistant Optical Implementation of Analogue Neural Networks — •Diego Arguello Ron, Morteza Kamalian-Kopae, and Sergei Turitsyn — Aston University, Birmingham, United Kingdom

Optical implementations of analogue artificial neural networks are susceptible to the inevitable fabrication and environment noise. Here we show how robustness of such networks can be enchanced by the noise injection during the training stage.

Oral JSIV-3.3 11:30 TRACK 12

Mutually coupled random lasers in complex photonic networks — •Antonio Consoli[1,3], Niccoló Caselli[1,2], and Cefe López[3] — [1]ETSI de Telecomunicación, Universidad Rey Juan Carlos, Madrid, Spain — [2]Departamento de Química Física, Universidad Complutense de Madrid, Madrid, Spain — [3]Instituto de Ciencia de Materiales de Madrid (ICMM), Consejo Superior de Investigaciones Científicas (CSIC), Madrid, Spain

Random lasers are studied in networks where mutual coupling is demonstrated by detecting unique spectral signatures from compound cavities. Proposed experiments and simulations provide the basis for larger networks and use in complex computational tasks.

Oral JSIV-3.4 11:45 TRACK 12

Forecasting turbulence in a passive resonator with supervised machine learning — •Saliya Coulibaly[1], Florent Bessin[3], Marcel Clerc[2], and Arnaud Mussot[1] — [1]Université de Lille, Lille, France — [2]Universidad de Chile, Santiago, Chile — [3]Aston University , Birmingham, United Kingdom

Chaotic dynamics implies an exponential magnification of any inaccuracy in the initial conditions. Consequently, long-term forecasting becomes an elusive task. Here, we address the predictability of experimental extreme events through the machine learning.

Oral JSIV-3.5 12:00 TRACK 12

Metasurface-based Polarization-insensitive Beam Splitter with Deep Learning — •Firat Cem Savas[1], Yusuf Abdulaziz Yilmaz[1], Ipek Anil Atalay[1], and Hamza Kurt[1,2] — [1]TOBB University of Economics and Technology, Ankara, Turkey — [2]Korea Advanced Institute of Science and Technology, Daejeon, South Korea

In this study, all-dielectric metasurface-based beam splitter is realized by a deep neural network to split the beam at the angle of $\pm 46.8^\circ$ and achieve more than 0.97 transmission value for TE and TM polarizations.

CD-11: All-optical Control and Wavelength Conversion

Chair: Uwe Morgner, Leibniz Universität Hannover, Hannover, Germany

Time: Friday, 14:30–16:00 Location: TRACK 1

Invited CD-11.1 14:30 TRACK 1

Applications for interferometry and sub-millisecond phase modulation with liquid crystal light valves — •Stefania Residori[1], Umberto Bortolozzo[1], and Jean-Pierre Huignard[2] — [1]HOASYS, Valbonne, France — [2]Jphopto, Paris, France

Liquid crystal light valves are optically addressed spatial light modulators combining liquid crystals with a photosensitive material. Sub-millisecond response times are obtained in small index modulation regimes, useful for dynamic holography, imaging and lidar applications.

Oral CD-11.2 15:00 TRACK 1

Monolithic $LiNbO_3$ Metasurface for Steering and Polarization-Encoding of Second-Harmonic Generation in the Visible — •Luca Carletti[1], Attilio Zilli[2], Fabio Moia[3], Andrea Toma[3], Marco Finazzi[2], Costantino De Angelis[1], Dragomir Neshev[4], and Michele Celebrano[2] — [1]Department of Information Engineering, University of Brescia, Brescia, Italy — [2]Physics Department, Politecnico di Milano, Milano, Italy — [3]Istituto Italiano di Tecnologia, Genova, Italy — [4]ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Research School of Physics, Australian National University, Canberra, Australia

We demonstrate monolithic lithium niobate metasurfaces for spatial and polarization encoding of second-harmonic generation in the visible spectrum with a conversion efficiency of 2.4×10^{-8} at a pump intensity as low as 0.5 GW/cm^2.

Oral CD-11.3 15:15 TRACK 1

Opto-thermally controlled beam steering in nonlinear all-dielectric metasurfaces — •Davide Rocco[1,2], Marco Gandolfi[2,1], Andrea Tognazzi[1,2], Olesiya Pashina[3], Kristina Frizyuk[3], George Zograf[3], Sergey Makarov[3], Carlo Gigli[4], Giuseppe Leo[4], Mikhail Petrov[3], and Costantino De Angelis[1,2] — [1]University of Brescia, Brescia, Italy — [2]National Institute of Optics CNR – INO, Brescia, Italy — [3]ITMO University, St Petersburg, Russia — [4]Université de Paris, Paris, France

We design an all-dielectric nonlinear metasurface where the generated second harmonic signal can be steered by means of an optical control beam of moderate power in the visible range.

Oral CD-11.4 15:30 TRACK 1

Constraint-free wavelength conversion supported by giant refraction in a 3D perovskite Super-Crystal — •Ludovica Falsi[1,2], Luca Tartara[3], Fabrizio Di Mei[1], Mariano Flammini[1], Jacopo Parravicini[4,5], Davide Pierangeli[1], Gianbattista Parravicini[6], Paolo Di Porto[1], FeiFei Xin[1,7], Aharon J. Agranat[8], and Eugenio DelRe[1] — [1]Department of Physics, University of Rome "La Sapienza", 00185 Rome, Italy, Rome, Italy — [2]S.B.A.I. Department, Physics Section, University of Rome "La Sapienza", 00161 Rome, Italy, Rome, Italy — [3]Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, I-27100 Pavia, Italy, Pavia, Italy — [4]Dipartimento di Scienza dei Materiali, Università di Milano-Bicocca, I-20125 Milano, Italy, Milano, Italy — [5]Erasmus Centre for Innovation, Erasmus University Rotterdam, Rotterdam, Netherlands, Rotterdam, Netherlands — [6]Dipartimento di Fisica, Università di Pavia, I-27100 Pavia, Italy, Pavia, Italy — [7]College of Physics and Materials Science, Tianjin Normal University, Tianjin, China, 300387, Tianjin, China — [8]Applied Physics Department, Hebrew University of Jerusalem, Jerusalem 91904, Israel, Jerusalem, Israel

We perform second-harmonic-generation experiments in KTN:Li in conditions of giant broadband refraction. The process occurs with a wide spectral acceptance, an ultra-wide angular acceptance and with no polarization selectivity.

Oral CD-11.5 15:45 TRACK 1

Large, Electric-Field Induced Tunable and Reversible $\chi(2)$ in PZT Thin Films for on-chip second-order nonlinearities — •Gilles F. Feutmba[1,2,3], Artur Hermans[2,3], John P. George[1,3], Irfan Ansari[1,2,3], Dries Van Thourhout[1,3], and Jeroen Beeckman[2,3] — [1]Liquid Crystals and Photonics Group, Ghent University, Ghent, Belgium — [2]Photonics Research Group, Ghent University-imec, Ghent, Belgium — [3]Center for Nano- and Biophotonics (NB-Photonics), Ghent University, Ghent, Belgium

We demonstrate strong optical nonlinearity in PZT thin films grown on glass substrates. We report a $\chi(2)$ of 128 pmV-1. Hysteresis measurements demonstrate the reversibility of the $\chi(2)$ with DC field.

CL-5: Dynamic and Advanced Light Shaping

Chair: Kate Grieve, Vision Institute, Quinze Vingts National Ophthalmology Hospital, Paris, France

Time: Friday, 14:30–15:45 Location: TRACK 2

Oral CL-5.1 14:30 TRACK 2

Photon-efficient three-dimensional simultaneous multicolor particle tracking by multiplexed PSF engineering — •Nadav Opatovski[1], Yael Shalev-Ezra[2], Lucien E. Weiss[2], Boris Ferdman[1], Reut Orange[1], and Yoav Shechtman[1,2] — [1]Russel Berrie Nanotechnology Institute, Technion - Israel Institute of Technology, Haifa, Israel — [2]Department of biomedical engineering, Technion - Israel Institute of Technology, Haifa, Israel

Spectral information is encoded into shape of the PSF, using spectrally-dependent PSF engineering. By multiplexing spectrally-defined PSFs, we obtain multicolor, large FOV 3D localization microscopy with high spatiotemporal resolution, all on a single camera sensor.

Oral CL-5.2 14:45 TRACK 2

Adaptive glasses wavefront sensorless Full-Field OCT for high-resolution in vivo retinal imaging over a wide FOV — •Yao Cai[1,2], Jules Scholler[1], Kassandra Groux[1], Oliver Thouvenin[1], Claude Boccara[1], Pedro Mecê[1], and Kate Grieve[2] — [1]Institut Langevin, ESPCI Paris, CNRS, PSL University, Paris, France — [2]Quinze-Vingts National Eye Hospital, Paris, France

We propose a compact full-field OCT assisted by an adaptive lens positioned in front of the eye for wavefront correction, enabling to ally high resolution (2μm$\times 2\mu$m$\times 8\mu$m) with a wide field-of-view ($5^{\circ}\times 5^{\circ}$) for in vivo retinal imaging.

Oral CL-5.3 15:00 TRACK 2

3D micro-printed hybrid photonic structure for single-fiber Optical Tweezers — •Innem Reddy[1,2], Andrea Bertoncini[1], and Carlo Liberale[1,3] — [1]Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology, Saudi Arabia, Thuwal, Saudi Arabia — [2]Department of Electrical Engineering, University at Buffalo, NY USA, Buffalo, USA — [3]Computer, Electrical and Mathematical Science and Engineering Division, King Abdullah University of Science and Technology, Saudi Arabia, Thuwal, Saudi Arabia

We present an on-fiber 3D micro-printed structure to create customizable single-fiber optical tweezers. It contains waveguiding, reflecting, and refracting micro-optical elements stacked to generate a high-NA focal spot.

Oral CL-5.4 15:15 TRACK 2

Au-Capped Si Nanowhiskers for Size-Dependent Improved Fluorescence of Fluorophores — •Ali Karatutlu[1], İsa Şeker[2], Mehmet Karakız[3], Kurtuluş Gölcük[4], and Bülend Ortaç[1] — [1]Bilkent University UNAM - Institute of Materials Science and Nanotechnology, Ankara, Turkey — [2]Alyse Built-in Appliances, Organized Industrial Zone, Amasya, Turkey — [3]Cumhuriyet University, Department of Mechatronics Engineering, Sivas, Turkey — [4]Institute of Experimental Epileptology and Cognition Research, Life and Brain Center, University of Bonn Medical Center, Bonn, Germany

Numerical simulations using the finite element method support the Si NWs size-dependent fluorescence enhancement factors with a signal amplification factor from 2 to 7 demonstrating the optimum position of the fluorophore within the hot spot.

Oral CL-5.5 15:30 TRACK 2

Metalens-based Particle Routing in Continuous-flow Microchannels — •Shengqi Yin, Fei He, Nicolas G Green , and Xu Fang — School of Electronics and Computer Science, University of Southampton, Southampton, United Kingdom

We demonstrate dielectric metalenses with phase profiles that respond to changes in two input control light beams, resulting in a steerable focal line. We further show their application of particle routing in continuous-flow microchannels.

EH-6: Applications of Metamaterials and Metasurfaces

Chair: Kosmas Tsakmakidis, National and Kapodistrian University of Athens, Athens, Greece

Time: Friday, 14:30–16:00 Location: TRACK 3

Oral EH-6.1 14:30 TRACK 3

Molecular Optomechanical Springs for Infrared Metasurface Detectors — •Angelos Xomalis[1], Xuezhi Zheng[2], Rohit Chikkaraddy[1], and Jeremy J. Baumberg[1] — [1]NanoPhotonics Centre, Cavendish Laboratory, Department of Physics, University of Cambridge, Cambridge, United Kingdom — [2]Department of Electrical Engineering (ESAT-TELEMIC), KU Leuven, Leuven, Belgium

Molecular optomechanical springs self-assembled in nanometre-scale metallic cavities allow extreme optomechanical coupling and single mid-infrared photon sensitivity. Here we achieve frequency upconversion of 9-10μm mid-infrared incoming photons to visible photons via SERS in doubly-resonant metasurfaces.

Oral EH-6.2 14:45 TRACK 3

Asymmetric Transmission in Nano-opto-mechanical Metamaterials at μW Power Levels — •Jinxiang Li[1], Kevin F. MacDonald[1], and Nikolay I. Zheludev[1,2] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore, Singapore

In linear optics, reciprocity dictates that transmission of (conventional) absorbers is identical in forward and backward propagation directions. We present an optomechanically nonlinear metamaterial providing intensity-dependent transmission asymmetry reaching 60% at microwatt power levels.

Oral EH-6.3 15:00 TRACK 3

Nonlinear THz metasurface and metagrating emitters utilizing C3 meta-atoms — •Cormac McDonnell[1], Junhong Deng[2], Simos Sideris[1], Guixin Li[2], and Tal Ellenbogen[1] — [1]Tel Aviv University, Tel Aviv, Israel — [2]University of Science and Technology Shenzen, Shenzen, China

We utilize nanostructured meta-atoms with C3 symmetry to develop plasmonic THz metagrating emitters which result in the generation of broadband THz pulses with full polarization and phase control

Oral EH-6.4 15:15 TRACK 3

All-dielectric Metasurfaces Enabling Imaging-based Real-time Biosensing — •yasaman jahani[1], Eduardo R. Arvelo[1], Filiz Yesilkoy[2], Kirill Koshelev[3,4], Chiara Cianciaruso[5], Michele De Palma[5], Yuri Kivshar[3], and Hatice Altug[1] — [1]Institute of Bioengineering, École Polytechnique Fédérale de Lausanne (EPFL), lausanne, Switzerland — [2]Department of Biomedical Engineering, University of Wisconsin–Madison, Madison, USA — [3]Nonlinear Physics Center, Australian National University, Canberra , Australia — [4]Department of Physics and Engineering, ITMO University, St Petersburg, St Petersburg, Russia — [5]School of Life Sciences, École Polytechnique Fédérale de Lausanne (EPFL), lausanne, Switzerland

We present an in-flow label-free biosensor supporting high-quality-factor resonances based on bound-states-in-the-continuum and novel data-processing. The biosensor is integrated with an imaging platform offering solutions to eliminate sophisticated and bulky spectroscopy requirements for point-of-care applications.

Oral EH-6.5 15:30 TRACK 3

Novel Metal Oxide Metasurface-based Optical Solar Reflectors — •Kai Sun[1], Wei Xiao[1], Ioannis Zeimpekis[1], Mirko Simeoni[2], Alessandro Urbani[2], Matteo Gaspari[2], Sandro Mengali[2], Ivano Indiveri[3], Behcet Alpat[3], Lars Kildebro[4], Javier Aizpurua[5], Dan Hawak[1], C.H. (Kees) de Groot[1], and Otto L. Muskens[1] — [1]University Southampton, Southampton, United Kingdom — [2]Consorzio C.R.E.O., L'Aquila, Italy — [3]Maprad S.r.l., Perugia, Italy — [4]NIL Technology, Kongens Lyngby, Denmark — [5]Centro de Física de Materiales - Materials Physics Center, Centro Mixto CSIC-UPV/EHU, San Sebastian, Spain

Optical solar reflectors (OSRs) play a crucial role in the spacecraft thermal control. Through a novel plasma patterning technique, we present novel Al:ZnO based meta-OSRs with a planar topological surface but an optical metasurface.

Oral EH-6.6 15:45 TRACK 3

Passive radiative cooler for solar cells' temperature and efficiency control — •George Perrakis[1,2], Anna C. Tasolamprou[1], George Kenanakis[1], Eleftherios N. Economou[1,3], Stelios Tzortzakis[1,2,4], and Maria Kafesaki[1,2] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (FORTH), 70013 Heraklion, Heraklion, Greece — [2]Dept. of Materials Science and Technology, Univ. of Crete, Heraklion, Greece — [3]Dept. of Physics, University of Crete GR-71003, Heraklion, Greece — [4]Science Program, Texas A&M University at Qatar, P.O. Box 23874, Doha, Qatar

We present a radiative cooling approach for photovoltaic cells' temperature and efficiency evaluation. We derive the maximum temperature-drop requirements and apply the approach in a nano-micro-grating remarkably enhancing both thermal radiation emission and solar absorption.

CJ-9: Speciality Fiber Lasers

Chair: Bülend Ortaç, Bilkent University - UNAM, Bilkent, Turkey

Time: Friday, 14:30–16:00 Location: TRACK 4

Oral CJ-9.1 14:30 TRACK 4

Single-Mode All-Chalcogenide Brillouin Fiber Laser — •Mohsen Rezaei and Martin Rochette — McGill University, Montreal, Canada

We propose the first all-chalcogenide Brillouin fiber laser, as well as the first all-chalcogenide ring cavity. The resulting single-mode laser increases the coherence length of the pump by a factor of >7.

Oral CJ-9.2 14:45 TRACK 4

Al2O3-P2O5-SiO2 fibers doped with an ultra-high Yb2O3 concentration — Denis Lipatov[1], Alexey Abramov[1], Alexey Guryanov[1], Konstantin Bobkov[2], Tatiana Zaushitsyna[2], Mikhail Bubnov[2], and •Mikhail Likhachev[2] — [1]G.G. Devyatykh Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia — [2]Prokhorov General Physics Institute of the Russian Academy of Sciences, E.M. Dianov Fiber Optics Research Center, Moscow, Russia

Ultra-highly-Yb-doped aluminophosphorosilicate fibers has been studied. Ultra-short (3.7 cm in length) 1030-nm-signal amplifier with pump-to-signal convention efficiency of 65% relative to input pump at 976 nm was demonstrated using developed fiber.

Oral CJ-9.3 15:00 TRACK 4

Spectral Properties of Optical Discharge in Hollow-Core Optical Fibers — •Igor Bufetov, Anton Kolyadin, Yury Yatsenko, and Alexey Kosolapov — Prokhorov General Physics Institute of the Russian Academy of Sciences, Dianov Fiber Optics Research Center, Moscow, Russia

Emission spectra of an optical discharge propagating along a hollow-core fiber under the action of pulsed laser radiation were measured. The averaged spectrum of the discharge plasma corresponds to the black body radiation at~15kK.

Oral CJ-9.4 15:15 TRACK 4

Gamma Radiation Effect on Ytterbium-Doped Optical Fibers: Investigation of Color Centers — •Esra Kendir, Yakup Midilli, Hüseyin Can Çamiçi, Ali Karatutlu, Elif Yapar Yıldırım, and Bülend Ortaç — Bilkent University UNAM—Institute of Materials Science and Nanotechnology, Ankara, Turkey

Our research findings indicate that the color centers related to Al, P, and Si elements occur with the gamma radiation in the Yb-doped optical fibers, resulting in the fibers' performance decreasing with these color centers.

Oral CJ-9.5 15:30 TRACK 4

Free-running and imposed-wavelength cavities for high power continuous-wave Tm3+, Ho3+ codoped single-oscillator fiber laser — •Arnaud Motard[1,2], Christophe Louot[1], Thierry Robin[3], Benoit Cadier[3], Nicolas Dalloz[1], Anne Hildenbrand-Dhollande[1], and Inka Manek-Hönninger[2] — [1]French-German research Institute of Saint-Louis, F-68300 Saint-Louis, France — [2]Université Bordeaux, CNRS CEA, CELIA UMR5107, F-33405 Talence, France — [3]IXBLUE PHOTONICS, F-22300 Lannion, France

We demonstrate a monolithic high efficiency (45%) single-oscillator Tm3+, Ho3+-codoped fiber laser providing an output power of up to 195 W at 2.09 μm in continuous regime with an excellent beam quality (M2 < 1.1).

Oral CJ-9.6 15:45 TRACK 4

Simple CW-UV generator by SHG technique with double-clad Pr-doped waterproof fluoro-aluminate glass fiber laser — •Yasushi Fujimoto[1,5], Masamori Nakahara[2], Paul Binun[2], Shinji Motokoshi[3], Osamu Ishii[4], Muneyuki Watanabe[4], Masaaki Yamazaki[4], Tsutomu Shinozaki[2], Tsuyoshi Sato[2], and Masaki Fukagawa[2] — [1]Chiba Institute of Technology, Narashino, Japan — [2]Kimmon Koha Co., Ltd., Itabashi-ku, Japan — [3]Institute for Laser Technology, Nishi-ku, Japan — [4]Sumita Optical Glass, Inc., Saitama City, Japan — [5]Institute of Laser Engineering, Suita, Japan

We demonstrated a CW-UV output over 500 mW using a single-mode double-clad structured Pr-doped waterproof fluoride glass fiber laser by a SHG technique and suggest this system produces a very unique and simple CW-UV generator.

CK-9: Novel Technologies and Materials for Micro-photonics

Chair: Anna Lena Giesecke, Group Leader Nanophotonics, AMO GmbH, Aachen, Germany

Time: Friday, 14:30–16:00 Location: TRACK 5

Oral CK-9.1 14:30 TRACK 5

Qualification of Femtosecond Laser-Written Waveguides for Space Environment — •Simone Piacentini[1,2], Tobias Vogl[3,4,5], Giacomo Corrielli[2,1], Ping Koy Lam[5], and Roberto Osellame[2,1] — [1]Dipartimento di Fisica, Politecnico di Milano, Milano, Italy — [2]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Milano, Italy — [3]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universitat Jena, Jena, Germany — [4]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [5]Centre for Quantum Computation and Communication Technology, Department of Quantum Science, Research School of Physics and Engineering, The Australian National University, Acton ACT, Australia

After exposure to the doses of protons and gamma-rays expected in a Low Earth Orbit environment, we show that femtosecond laser-written photonic circuits in glass are space compatible and can be employed in satellite-based experiments

Oral CK-9.2 14:45 TRACK 5

Nonlinear formation of photonic microresonators by slow optical cooking — •Gabriella Gardosi and Misha Sumetsky — Aston university, Birmingham, United Kingdom

The recently discovered method for slow optical cooking of microresonators at water-filled silica microcapillaries is characterised by the spectral evolution of the WGM cutoff wavelength, which can be positive linear, nonlinear and, even negative.

Oral CK-9.3 15:00 TRACK 5

Lithography-Free Fabrication of Extraordinary Transmission Plasmonic Metasurfaces Over Large Areas Employing Ultrafast Lasers — Noemi Casquero[1], •Carlota Ruiz de Galarreta[1,2], Euan Humphreys[2], Jacopo Bertolotti[2], Javier Solis[1], C. David Wright[2], and Jan Siegel[1] — [1]Laser Processing Group, Instituto de Optica, IO-CSIC, Madrid, Spain — [2]College of Engineering Mathematics and Physical Sciences, University of Exeter, Exeter, United Kingdom

We present a direct writing technique using ultrafast lasers towards high throughput, large area, lithography free and energy efficient fabrication of plasmonic optical metasurfaces based on the extraordinary transmission effect.

Oral CK-9.4 15:15 TRACK 5

Reflection and transmission effects of surface plasmon polaritons at dielectric microstructure boundaries — •Lei Zheng[1,2], Carsten Reinhardt[3], and Bernhard Roth[1,2] — [1]Leibniz University Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Enigineering-Innovation Across Disciplines), Hannover, Germany — [3]Hochschule Bremen, Hannover, Germany

In this work, Special plasmonic structures were designed and realized for the on-chip light manipulation. The reflection and transmission effects of surface plasmon polaritons at dielectric microstructure boundaries were investigated.

Oral CK-9.5 15:30 TRACK 5

Rabi Splitting using Gold Nano-Bipyramids and Monolayer MoS2 — •Julia Lawless[1], Calin Hrelescu[1], Carolyn Elliott[1,3], Lisanne Peters[2], Niall McEvoy[2], and Louise Bradley[1,3] — [1]School of Physics and AMBER, Trinity College Dublin, Dublin, Ireland — [2]School of Chemistry and AMBER, Trinity College Dublin, Dublin, Ireland — [3]IPIC, Tyndall National Institute, Cork, Ireland

Bipyramids were investigated as a nanoresonator to achieve strong coupling with monolayer MoS2. It was shown that larger bipyramids could couple more strongly, even without increasing the number of coupled excitons, contrasting to other nanostructures.

Oral CK-9.6 15:45 TRACK 5

Semi-Dirac transport and localization in polaritonic graphene — •Bastián Real[1], Omar Jamadi[1], Marijana Milićević[2], Nicolas Pernet[2], Philippe St-Jean[2], Tomoki Ozawa[3], Gilles Montambaux[4], Isabel Sagnes[2], Aristide Lamaître[2], Luc Le Gratiet[2], Abdelmounaim Harouri[2], Sylvain Ravets[2], Jacqueline Bloch[2], and Alberto Amo[2] — [1]Univ. Lille, CNRS, UMR 8523—PhLAM—Physique des Lasers Atomes et Molécules, F-59000 Lille, France — [2]Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, 91120, Palaiseau, France — [3]Advanced Institute for Materials Research, Tohoku University, Sendai 980-8577, Japan — [4]Université Paris-Saclay, CNRS, Laboratoire de Physique des Solides, 91405, Orsay, France

Strain strongly affects the transport and localization properties of graphene. Here we implement compressed polariton honeycomb lattices to evidence the highly anisotropic transport of polaritons and to observe directional vacancy states with chiral symmetry.

CC-8: THz QCL-combs and Imaging

Chair: Sukhdeep Dhillon, LPENS/CNRS, Paris, France

Time: Friday, 14:30–16:00 Location: TRACK 6

Oral CC-8.1 14:30 TRACK 6

Pure and Self-starting Harmonic Combs in THz Quantum Cascade Lasers: Theory and Experiments — •Andres Forrer[1], Yongrui Wang[2], Mattias Beck[1], Alexey Belyanin[2], Jérôme Faist[1], and Giacomo Scalari[1] — [1]ETH Zürich, Zürich, Switzerland — [2]Texas A & M University, College Station, USA

We present experimental results of self-starting harmonic combs in THz Quantum Cascade Lasers with a single, sub-kHz linewidth beatnote. The coherence between optical modes is verified and our theoretical model explains the experiments.

Oral CC-8.2 14:45 TRACK 6

Comb Operation In Terahertz Quantum Cascade Ring Lasers — •Michael Jaidl[1,2], Nikola Opacak[3], Martin A. Kainz[1,2], Sebastian Schönhuber[1,2], Dominik Theiner[1,2], Benedikt Limbacher[1,2], Maximilian Beiser[2,3], Miriam Giparakis[2,3], Aaron M. Andrews[2,3], Gottfried Strasser[2,3], Benedikt Schwarz[2,3], Juraj Darmo[1,2], and Karl Unterrainer[1,2] — [1]Photonics Institute, Vienna, Austria — [2]Center for Micro- and Nanostructures, Vienna, Austria — [3]Institute of Solid State Electronics, Vienna, Austria

We present comb formation in ring-shaped THz quantum cascade lasers. Devices are self-starting operating in a harmonic state transitioning into a dense comb regime exhibiting over 30 equidistant modes covering a bandwidth of 622 GHz.

Oral CC-8.3 15:00 TRACK 6

Reshaping the emission of a THz quantum cascade laser frequency comb through an on-chip graphene modulator — •Alessandra Di Gaspare[1], Eva A. A. Pogna[1], Osman Balci[2], Sachin M. Shinde[2], Lianhe Li[3], Cinzia di Franco[4], A. Giles Davies[3], Edmund Linfield[3], Andrea C. Ferrari[2], Gaetano Scamarcio[4], and Miriam S. Vitiello[1] — [1]NEST, CNR-NANO and Scuola Normale Superiore, Pisa, Italy — [2]Cambridge Graphene Centre, Cambridge , United Kingdom — [3]School of Electronic and Electrical Engineering, University of Leeds, Leeds, United Kingdom — [4]CNR-IFN and Dipartimento Interateneo di Fisica, Università degli Studi di Bari, Bari, Italy

We present a graphene-on-polyimide THz modulator with a tunable-by-design optical bandwidth. By coupling the modulator with a THz quantum cascade laser frequency comb, we show it can fully compensate the cavity dispersion.

Oral CC-8.4 15:15 TRACK 6

Synthetized Terahertz Frequency Combs — •Dominik Theiner[1,2], Benedikt Limbacher[1,2], Karl Unterrainer[1,2], and Juraj Darmo[1] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Center for Micro- and Nanostructures, TU Wien, Vienna, Austria

A synthesized tunable Terahertz frequency comb (FC) source with center frequencies up to 3.6 THz exhibiting linewidths below 10 MHz is presented that is based on commercially available fiber integrated optical components.

Oral CC-8.5 15:30 TRACK 6

THz Quantum Cascade Laser Frequency Comb based on a Y-coupled Planarized Waveguide — •Urban Senica, Tudor Olariu, Paolo Micheletti, Mattias Beck, Jérôme Faist, and Giacomo Scalari — ETH Zurich, Zurich, Switzerland

We present a Y-coupled planarized THz Quantum Cascade Laser, operating as a frequency comb with a THz emission spanning over 500 GHz. Broadband phase locking is indicated by far-field interference patterns throughout the whole operating range of the laser.

Oral CC-8.6 15:45 TRACK 6

Terahertz Near-field Nanoscopy Based on Self-mixing Interferometry with Quantum Cascade Resonators — •Eva A. A. Pogna[1], Kimberly Reichel[1], Carlo Silvestri[2], Simone Biasco[1], Leonardo Viti[1], Alessandra di Gaspare[1], Lorenzo L. Columbo[2], Massimo Brambilla[3], Gaetano Scamarcio[4], and Miriam S. Vitiello[1] — [1]NEST, CNR-Istituto Nanoscienze and Scuola Normale Superiore, Pisa, Italy — [2]Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Torino, Italy — [3]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [4]Dipartimento Interateneo di Fisica, Università degli Studi e Politecnico di Bari, Bari, Italy

We discuss the performances of innovative THz near-field nanoscopy systems based on self-mixing interferometry with THz quantum cascade resonators endowed with different degrees of spatial and temporal coherence

JSIV-4: Learning in Imaging and Metrology II

Chair: Sylvain Gigan, University of Sorbonne, Paris, France

Time: Friday, 14:30–16:00 Location: TRACK 7

Invited JSIV-4.1 14:30 TRACK 7

Inferring spatial scenes from their time-resolved multipath echoes — •Valentin Kapitany[1], Alex Turpin[2], Jack Radford[1], Davide Rovelli[1], Ashley Lyons[1], Ilya Starshynov[1], and Daniele Faccio[1] — [1]University of Glasgow, School of Physics and Astronomy, Glasgow, United Kingdom — [2]University of Glasgow, School of Computing Science, Glasgow, United Kingdom

We show that measuring multipath temporal echoes of 3D scenes, instead of just direct reflections, provides sufficient information to reconstruct the scenes with a single-pixel detector. We demonstrate this experimentally using radio-frequency and acoustic data.

Oral JSIV-4.2 15:00 TRACK 7

Convolutional Neural Network for Self Mixing Interferometry — •Stéphane Barland[1] and François Gustave[2] — [1]Université Côte d'Azur, Institut de Physique de Nice, Valbonne, France — [2]ONERA - Université Paris Saclay, Palaiseau, France

We design and train a convolutional neural network to reconstruct the complex displacement of a target from a self-mixing interferometric signal. The network's prediction is robust against noise, alignment configurations and even across experimental setups.

Oral JSIV-4.3 15:15 TRACK 7

Intelligent imaging sensor out of two-photon polymerized microcavities with self-sensing boosting — •Anton Saetchnikov[1], Elina Tcherniavskaia[2], Vladimir Saetchnikov[2], and Andreas Ostendorf[1] — [1]Ruhr University Bochum, Bochum, Germany — [2]Belarusian State University, Minsk, Belarus

In this work we report on realization of the microresonator-based imaging sensor with self-sensing boosting fabricated with two-photon polymerization and supplemented by machine learning for highly accurate predictions of the variations in the ambient environment.

Oral JSIV-4.4 15:30 TRACK 7

100 laser beam array phase-locked in a neural network loop — •Alexandre Boju[1,2], Maksym Shpakovych[2], Geoffrey Maulion[2], Vincent Kermene[2], Paul Armand[2], Agnès Desfarges-Berthelemot[2], and Alain Barthelemy[2] — [1]CILAS Ariane Group, Orléans, France — [2]XLIM Research Institute, Limoges, France

We report on fast phase control of large laser array with quasi-reinforcement learning of a neural network in an error reduction loop. We demonstrate the experimental phase-locking of 100 beams with a lambda/30 residual error.

Oral JSIV-4.5 15:45 TRACK 7

Deep Reinforcement Learning Control of White-Light Continuum Generation — Carlo Valensise[1], Alessandro Giuseppi[2], Giulio Cerullo[1], and •Dario Polli[1] — [1]IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milano, Italy — [2]DIAG, University of Rome "La Sapienza", Roma, Italy

An actor-critic Deep Reinforcement-Learning architecture is used to generate long-term-stable white-light continuum without a-priori knowledge of the system acting on the crystal position and on the power and numerical aperture of the driving beam.

CH-12: Fiber-based Sensors I

Chair: Robert Halir, University of Málaga, BIONAND - Centro Andaluz de Nanomedicina y Biotecnología, Málaga, Spain

Time: Friday, 14:30–16:00 Location: TRACK 8

Oral CH-12.1 14:30 TRACK 8

Hollow-Core-Fiber Delivery of Broadband Mid-Infrared Light for Remote Multi-Species Spectroscopy — Kerr Johnson[1], Pablo Castro-Marin[2], Carl Farrell[1], Ian Davidson[3], Greg Jasion[3], Natalie Wheeler[3], Francesco Poletti[3], David Richardson[3], and •Derryck Telford Reid[2] — [1]Chromacity Ltd, Edinburgh, United Kingdom — [2]Heriot–Watt University, Edinburgh, United Kingdom — [3]Univ. of Southampton, Southampton, United Kingdom

High-resolution multi-species spectroscopy is achieved by delivering mid-infrared light through a hollow-core silica fiber. Concentrations of H37Cl, H35Cl, H2O, CH4, C3H6O and C3H8O are simultaneously obtained by a multi-parameter fit with up to 5-ppb precision.

Oral CH-12.2 14:45 TRACK 8

Impact of Pressure-Induced Differential Refractive Index in Raman Spectroscopy using Hollow-Core Fibres — •Thomas Kelly[1], Ian Davidson[1], Shuichiro Rikimi[1], Gregory Jasion[1], Matthew Partridge[1], William Brooks[2], Michael Foster [2], Francesco Poletti[1], David Richardson[1], Peter Horak[1], and Natalie Wheeler[1] — [1]University of Southampton, Southampton, United Kingdom — [2]Is-Instruments Ltd., Tonbridge, United Kingdom

Here we report an improvement in the performance of a hollow core microstructured optical fibre Raman gas sensor by 80% through loading gas into the core, raising the refractive index, and reducing the fibre attenuation.

Oral CH-12.3 15:00 TRACK 8

Localized temperature and pressure measurements inside CS2-filled fiber using stimulated Brillouin scattering — •Alexandra Popp[1,2,3], Andreas Geilen[1,2,4], Daniel Walter[1,2], Mario Chemnitz[5], Saher Junaid[6,7], Christopher G. Poulton[8], Christoph Marquardt[1,2,3], Markus A. Schmidt[6,7], and Birgit Stiller[1,2] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany — [3]SAOT, Graduate School in Advanced Optical Technologies, Erlangen, Germany — [4]IMPRS, International Max Planck Research School - Physics of Light, Erlangen, Germany — [5]INRS-EMT, Qubec, Canada — [6]Leibniz Institute of Photonic Technology, Jena, Germany — [7]Otto Schott Institute of Materials Research (OSIM), Jena, Germany — [8]School of Mathematical and Physical Sciences, University of Technology Sydney, Sydney, Australia

We present localized Brillouin measurements inside a CS2-filled liquid-core optical fiber. Local temperature and pressure changes can be discriminated using Brillouin Optical Correlation Domain Analysis with a resolution of 4cm.

Oral CH-12.4 15:15 TRACK 8

Modelling of pressure-driven gas flow in a nodeless Anti-Resonant Hollow Core Fiber for laser absorption spectroscopy — •Piotr Bojęś[1], Karol Krzempek[1], Piotr Jaworski[1], Paweł Kozioł[1], Ziemowit Malecha[2], Grzegorz Dudzik[1], Fei Yu[3], Dakun Wu[3], Karol Malecha[4], Meisong Liao[3], and Krzysztof Abramski[1] — [1]Faculty of Electronics, Wroclaw University of Science and Technology, Wrocław, Poland — [2]Faculty of Mechanical and Power Engineering, Wroclaw University of Science and Technology, Wrocław, Poland — [3]Shanghai Institute of Optics and Fine Mechanics, Shanghai, China — [4]Faculty of Microsystem of Electronics and Photonics , Wroclaw University of Science and Technology, Wrocław, Poland

We present the results of modelling of pressure-driven gas flow in a 15 meter long nodeless Antiresonant Hollow Core Fiber allowing for predicting the gas exchange time in the fiber-aided laser absorption spectroscopy-based gas sensors.

Oral CH-12.5 15:30 TRACK 8

Accurate measurement of Poisson ratio in optical fibers based on forward-stimulated Brillouin scattering — •Luis Alberto Sánchez[1], Antonio Díez[1,2], José Luis Cruz[1,2], and Miguel Vicente Andrés[1,2] — [1]Laboratory of Fiber Optics, ICMUV, Universidad de Valencia, Burjassot, Spain — [2]Departamento de Física Aplicada y Electromagnetismo, Universidad de Valencia, Burjassot, Spain

We report the high-accuracy measurement of the Poisson's ratio of an optical fiber over a range of temperatures of one hundred degrees based on the forward-stimulated Brillouin scattering effect.

Oral CH-12.6 15:45 TRACK 8

Towards Multimode-fiber-based Two-photon Endoscopy — •Matthias C. Velsink[1,2], Lyubov V. Amitonova[2,3], and Pepijn W.H. Pinkse[1] — [1]MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands — [2]Advanced Research Center for Nanolithography (ARCNL), Amsterdam, Netherlands — [3]Department of Physics and Astronomy, Vrije Universiteit Amsterdam, Amsterdam, Netherlands

We demonstrate a method towards two-photon endoscopy based on time-domain wavefront shaping through a multimode fiber. This allows grid scanning of an ultrashort pulse over the output facet of the fiber with a perturbation-insensitive input.

CG-7: High-Repetition XUV and X-ray Sources

Chair: Birgitta Bernhardt, Technical University Graz, Graz, Austria

Time: Friday, 14:30–16:00 Location: TRACK 9

Oral CG-7.1 14:30 TRACK 9

A high-repetition rate attosecond pulse source for coincidence spectroscopy — •Cord L. Arnold, Sara Mikaelsson, Jan Vogelsang, Chen Guo, Ivan Sytcevich, Anne-Lise Viotti, Fabian Langer, Yu-Chen Cheng, Saikat Nandi, Anna Olofsson, Robin Weissenbilder, Johan Mauritsson, Anne L'Huillier, and Mathieu Gisselbrecht — Department of Physics, Lund University, Lund, Sweden

We present a high-repetition rate, atttosecond light source, emitting controlled short trains of attosecond pulses. We study one-photon double-ionization of He by detecting He^{2+} and the two correlated photoelectrons in coincidence with full angular resolution.

Oral CG-7.2 14:45 TRACK 9

Comparison of 100-kHz Near-IR and Mid-IR Driven High-Harmonic Generation in the Water Window — •Pierre-Alexis Chevreuil, Stefan Hrisafov, Fabian Brunner, Justinas Pupeikis, Christopher Richard Phillips, Lukas Gallmann, and Ursula Keller — ETH Zürich, Zürich, Switzerland

We report the generation of water window harmonics (283-543 eV) with a 0.8-μm driver at 100 kHz repetition rate, and compare the results with high-harmonic generation at 2.2 μm.

Oral CG-7.3 15:00 TRACK 9

100 kHz water window soft X-ray high-order harmonic generation through pulse self-compression in an antiresonant hollow-core fiber — •Martin Gebhardt[1,2], Tobias Heuermann[1,2], Robert Klas[1,2], Chang Liu[1,2], Alexander Kirsche[1,2], Mathias Lenski[1], Ziyao Wang[1], Christian Gaida[1,5], Jose Enrique Antonio-Lopez[3], Axel Schülzgen[3], Rodrigo Amezcua-Correa[3], Jan Rothhardt[1,2,4], and Jens Limpert[1,2,4] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]CREOL, College of Optics and Photonics, University of Central Florida, Orlando, FL, USA — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany — [5]Active Fiber Systems GmbH, Jena, Germany

We present pulse self-compression and soft X-ray HHG in a single gas-filled hollow-core fiber resulting in a flux >10^6 Photons/s/eV at 300 eV. The source is driven by a thulium-doped fiber-laser at 98 kHz repetition rate.

Oral CG-7.4 15:15 TRACK 9

High-flux Attosecond Source at 100 kHz Repetition Rate — •Peng Ye[1], Lénárd Gulyás Oldal[1,2], Tamás Csizmadia[1], Zoltán Filus[1], Tímea Grósz[1], Massimo De Marco[1], Péter Jójárt[1], Imre Seres[1], Zsolt Bengery[1], Zoltán Várallyay[1], Barnabás Gilicze[1], Subhendu Kahaly[1,2], Katalin Varjú[1,3], and Balázs Major[1] — [1]ELI-ALPS, ELI-HU Non-Profit Ltd., Wolfgang Sandner utca 3., Szeged, H-6728, Hungary, Szeged, Hungary — [2]Institute of Physics, University of Szeged, Dóm tér 9, Szeged 6720, Hungary, Szeged, Hungary — [3]Department of Optics and Quantum Electronics, University of Szeged, Dóm tér 9, Szeged 6720, Hungary, Szeged, Hungary

We report the generation of 50 pJ attosecond pulse trains at 100-kHz using an annular laser beam, which is the highest one until now among systems of repetition rate higher than 10 kHz.

Oral CG-7.5 15:30 TRACK 9

Integrated Filter for the Separation between XUV and IR Beam in High-order Harmonic Generation in a chip — •Anna Gabriella Ciriolo[1], Rebeca Martínez Vázquez[1], Gabriele Crippa[2], Valer Tosa[3], Aldo Frezzotti[4], Michele Devetta[1], Roberto Osellame[1,2], Caterina Vozzi[1], and Salvatore Stagira[2,1] — [1]Institute for Photonics and Nanotechnologies, National Research Council, Milano, Italy — [2]Politecnico di Milano, Dipartimento di Fisica, Milano, Italy — [3]National Institute for R&D of Isotopic and Molecular Technologies, Cluj-Napoca, Romania — [4]Politecnico di Milano, Department of Aerospace Science and Technology, Milano, Italy

We demonstrate the spatial separation of a considerable portion of the XUV from the fundamental IR driving beam in high-order harmonic generation by an integrated system of microchannels realized through Femtosecond Laser Micromachining.

Oral CG-7.6 15:45 TRACK 9

Continuously tunable high photon flux high harmonic source at 50-70 eV — •Alexander Kirsche[1,2], Robert Klas[1,2], Martin Gebhardt[1,2], Lucas Eisenbach[1], Wilhelm Eschen[1], Joachim Buldt[1], Henning Stark[1], Jan Rothhardt[1,2,3], and Jens Limpert[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University, Jena, Germany — [2]Helmholtz-Institute, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

A fast and fully tunable table-top extreme ultraviolet high harmonic source with record-high photon flux at energies of 50-70 eV based on blueshift in a capillary is presented.

CD-12: Raman Amplification and Nonlinear Media

Chair: Tal Ellenbogen, Tel Aviv University, Tel Aviv, Israel

Time: Friday, 16:30–18:00 Location: TRACK 1

Keynote CD-12.1 16:30 TRACK 1

Cascaded Raman lasing with single molecular monolayers — •Andrea Armani, Andre Kovach, Arynn Gallegos, Jinghan He, and Hyungwoo Choi — University of Southern California, Los Angeles, USA

By combining organic small molecules with exceptionally high optical nonlinearities with silica integrated resonators, ultra-low threshold cascaded Raman lasing and anti-Stokes generation with mW thresholds has been demonstrated.

Oral CD-12.2 17:15 TRACK 1

Spectrum Synthesizer Based on Two-Stage Transient Stimulated Raman Chirped-Pulse Amplification in KGW crystal — •Augustinas Petrulėnas, Paulius Mackonis, Aleksej Rodin, and Vytenis Girdauskas — Solid State Laser laboratory, Center for Physicsal Science and Technology, Vilnius, Lithuania

A spectrum synthesizer based on two-stage Transient Stimulated Raman Chirped-Pulse Amplification in KGd(WO4)2 crystals provides a tailored bandwidth ~38nm of amplified supercontinuum pulses with a positive chirp sufficient for transform-limited pulsewidth of ~50fs after compression.

Oral CD-12.3 17:30 TRACK 1

Interacting Ring-Airy Beams in Nonlinear Media — •Charles W. Robson and Marco Ornigotti — Tampere University, Tampere, Finland

The interactions between overlapping ring-Airy beams in a local Kerr medium are numerically investigated, predicting controllable regions of low intensity during propagation. This may prove useful for optical tweezing applications in nonlinear media.

Oral CD-12.4 17:45 TRACK 1

Second Harmonic Generation in Spliced Poled Fibers — •Wasyhun Asefa Gemechu[1,2], Umberto Minoni[1], Daniele Modotto[1], Alessandro Tonello[3], and Vincent Couderc[3] — [1]Dipartimento di Ingegneria dell'Informazione, Università di Brescia, via Branze 38, 25123 Brescia, Italy — [2]Ethiopian Space Science and Technology Institute, Addis Ababa, Ethiopia — [3]Université de Limoges, XLIM, UMR CNRS 7252, 123 Av. A. Thomas, 87060 Limoges, France

The saturation length of the nonlinear region induced in a fiber by optical poling has been studied and a significant enhancement of second harmonic generation efficiency by splicing segments of independently poled fibers is shown.

CJ-10: Fiber Optical Techniques and Applications

Chair: William Wadsworth, University of Bath, Bath, United Kingdom

Time: Friday, 16:30–18:00 Location: TRACK 2

Oral CJ-10.1 16:30 TRACK 2

Soliton detuning of 68.5 THz corresponding to a wavelength shift from 1560 nm to 2400 nm in a highly nonlinear suspended core tellurite fiber — •Tanvi Karpate[1,2], Grzegorz Stepniewski[1,2], Dariusz Pysz[2], Anupamaa Rampur[3], Yuriy Stepanenko[4], Ryszard Buczynski[1,2], and Mariusz Klimczak[1,2] — [1]Faculty of Physics, University of Warsaw, Pasteura 7, 02-093 , Warsaw, Poland — [2]Łukasiewicz Research Network - Institute of Electronic Materials Technology, Wólczyńska 133, 01-919 , Warsaw, Poland — [3]Institute of Applied Physics, University of Bern, Sidlerstrasse 5, 3012 , Bern, Switzerland — [4]Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224 , Warsaw, Poland

We investigate soliton self-frequency shift in suspended core tellurite fibers. Owing to high nonlinearity, detuning exceeding 68 THz is observed upon injecting 90 fs, 1560 nm laser pulses in just 5 cm long fiber sample.

Oral CJ-10.2 16:45 TRACK 2

Importance of Topological Charge Preservation in Vectorial Modulational Instability in Chiral Three-Core PCF — •Paul Roth[1,2], Michael H. Frosz[1], Philip St.J. Russell[1,2], and Gordon K. L. Wong[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

The presence of polarisation modulational instability gain in circularly birefringent chiral PCF is critically dependent on preserving the total topological charge of the fields. Experiments on a PCF with a threefold symmetric core confirm this.

Oral CJ-10.3 17:00 TRACK 2

Frenet-Serret analysis of helical Bloch modes in N-fold rotationally symmetric rings of coupled spiralling optical waveguides — •Yang Chen[1] and Philip Russell[1,2] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, University of Erlangen-Nuremberg , Erlangen, Germany

Frenet-Serret theory is generalised to the case of a chiral ring of N coupled birefringent cores. The dispersion and polarisation of the helical Bloch modes are derived, for the first time properly including torsion effects.

Oral CJ-10.4 17:15 TRACK 2

Ultrafast gyroscopic measurements in passive Mach-Zehnder interferometer via time-stretch technique — •Igor Kudelin[1], Srikanth Sugavanam[2], and Maria Chernysheva[3] — [1]Aston Institute of Photonic Technologies, Birmingham, United Kingdom — [2]IIT Mandi, Kamand, India — [3]Leibniz Institute of Photonic Technology, Jena, Germany

We demonstrate a phase-based method to detect rotation in a passive all-fibre Mach-Zehnder interferometer via the Dispersive Fourier Transformation. The resolution of the angular velocity measurements is 5.78 μrad/s at acquisition rate of 15 MHz.

Oral CJ-10.5 17:30 TRACK 2

Influencing Unidirectionality Threshold and Final Direction by Loss Management in a Reciprocal Fiber Ring Laser — •Muhammad Assad Arshad, Alexander Hartung, and Matthias Jäger — Leibniz-Institut für Photonische Technologien e. V, Jena, Germany

We present an isolator free unidirectional all fiber ring laser. The unidirectionality is triggered far above the lasing threshold. The directional preference and the required pump power are influenced through loss management in the ring.

Oral CJ-10.6 17:45 TRACK 2

Arbitrary Waveform Generation by Cavity Dumping of Hybrid Fibre Laser with Two Active Media — •Boris Nyushkov[1,2], Aleksey Ivanenko[1], Sergey Smirnov[1], and Sergey Kobtsev[1] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]Novosibirsk State Technical University, Novosibirsk, Russia

We present a new method for the direct laser synthesis of nanosecond-scale optical waveforms with freely-tunable repetition rate and relatively high energy by digitally-controlled cavity dumping of a hybrid fiber laser with two active media.

CK-10: Micro and Nano Resonators

Chair: Stefano Pelli, CNR-IFAC "Nello Carrara", Sesto Fiorentino, Italy

Time: Friday, 16:30–18:00 Location: TRACK 3

Oral CK-10.1 16:30 TRACK 3

Bound states in the continuum in symmetry broken resonator rings — •Lucca Kühner[1,2], Haoran Ren[1,2], Rodrigo Berté[1,2], Stefan A. Maier[1,2,3], Yuri S. Kivshar[4,5], and Andreas Tittl[1,2] — [1]Chair in Hybrid Nanosystems, Ludwig-Maximilians-University , Munich, Germany — [2]Center for NanoScience, Ludwig-Maximilians-University , Munich, Germany — [3]The Blackett Laboratory, Imperial College, London, United Kingdom — [4]Nonlinear Physics Center, Australian National University , Canberra, Australia — [5]Department of Nanophotonics and Metamaterials, ITMO University , St. Petersburg, Russia

We demonstrate a novel ring-shaped nanophotonic platform based on bound states in the continuum with substantially smaller footprint while keeping straightforward tunability via the asymmetry of the constituent blocks.

Oral CK-10.2 16:45 TRACK 3

Optical Microring Resonance Split Removal via Localized Photolytic Refractive Index Modifications — •Timo Lipka and Hoc Khiem Trieu — Institute of Microsystems Technology, Hamburg University of Technology, Hamburg, Germany

Random backscattering phenomena in microrings can result in modal splitting, degrading integrated photonic systems. We present a novel correction technique for silicon resonators for in-situ removal of resonance splits caused by backreflected waves at sidewalls.

Oral CK-10.3 17:00 TRACK 3

Experimental demonstration of a bat microresonator — •Yong Yang, Manuel Crespo-Ballesteros, and Misha Sumetsky — Aston Institute of Photonics Technology, Aston University, Aston Triangle, Birmingham, United Kingdom

We experimentally demonstrate an optical microresonator fabricated at the 125-micron diameter optical fiber having an eigenmode which amplitude is uniform along the more than 100 microns of the fiber length with 7% accuracy.

Oral CK-10.4 17:15 TRACK 3

Resonant Mode Tuning of Ge2Sb2Te5 Coated Silica Microresonators — •Ersin Huseyinoglu[1], Erol Özgür[1], Gökhan Bakan[2], Bülend Ortaç[1], and Aykutlu Dana[3] — [1]Institute of Materials Science and Nanotechnology, National Nanotechnology Research Center, Bilkent University, Ankara, Türkiye — [2]National Graphene Institute, University of Manchester, Manchester, United Kingdom — [3]E.L. Ginzton Laboratory, Stanford University, California, USA

The large scale utilization of the optical microresonators was hindered by obstacles originated from fabrication errors. By using chalcogenide coating, a method to tune resonant modes permanently was demonstrated to correct deviations from designed parameters.

Oral CK-10.5 17:30 TRACK 3

Coupled non-Hermitian nanoresonators for meta-optics design — •Vinel Vinel, Zejian Li, Carlo Gigli, Adrien Bensemhoun, Adrien Borne, Cristiano Ciuti, and Giuseppe Leo — Matériaux et Phénomènes Quantiques, Université de Paris, Paris, France

We report on a systematic study of the coupling between nanoresonators, aimed at proposing and assessing an analytical non-Hermitian tight-binding Hamiltonian formalism for advanced nanophotonics meta-systems.

Oral CK-10.6 17:45 TRACK 3

Continuum- Coupled Microcavities — •Tom Lenkiewicz Abudi[1], Mark Douvidzon[1], Baheej Bathish[1], and Tal Carmon[2] — [1]Technion-Israel Institute of Technology, Haifa, Israel — [2]Tel-Aviv University, Tel-Aviv, Israel

We present a hybrid-resonator made of a continuous-membrane nearby to a dialectic disk. We control the membrane position to tune resonance frequency, bring nanoparticles to the optical mode, remove them, and bring new ones

CH-13: Temporally and Spatially Structured Beams and Microscopy

Chair: Marco Grande, Polytechnic University of Bari, Bari, Italy

Time: Friday, 16:30–18:00 Location: TRACK 4

Oral CH-13.1 16:30 TRACK 4

Adaptive optics of temporal focusing microscopy by utilizing structured illumination — •Tomohiro Ishikawa[1,2], Keisuke Isobe[1,3], Kenta Inazawa[1,2], Fumihiko Kannari[2], and Katsumi Midorikawa[2] — [1]RIKEN Center for Advanced Photonics, 2-1 Hirosawa, Wako, Saitama, Japan — [2]Department of Electronics and Electrical Engineering, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan — [3]Department of Advanced Imaging, Graduate School of Biostudies, Kyoto University, Kyoto, Japan

We presernt adaptive optics of wide-field temporal focusing microscopy by utilizing structured illumination, which works well even if strong out-of-focus fluorescence exists or a sample is thick.

Oral CH-13.2 16:45 TRACK 4

Parallelized Light-sheet Microscopy with Flexible and Encoded Illumination — •Alessandro Zunino[1,2], Francesco Garzella[1,3], Alberta Trianni[1,2], Peter Saggau[1,4], Paolo Bianchini[1], Alberto Diaspro[1,2], and Martì Duocastella[1,5] — [1]Istituto Italiano di Tecnologia, Genoa, Italy — [2]University of Genoa, Genoa, Italy — [3]University of Parma, Parma, Italy — [4]Baylor College of Medicine, Houston, USA — [5]University of Barcelona, Barcelona, Spain

We present an innovative parallelized light-sheet microscope for high-speed volumetric imaging at high signal-to-background and signal-to-noise ratios. The idea is to encode/decode illumination sequences of multiple planes acquired with extended depth-of-field detection.

Oral CH-13.3 17:00 TRACK 4

Contrast enhancement in volumetric two-photon microscopy using multiple orders of Bessel beam — •Hongsen He[1], Yu-Xuan Ren[1], Ryan K. Y. Chan[1], W. L. So[2], Hiu Ka Fok[2], Cora S. W. Lai[2,3], Kevin K. Tsia[1,3], and Kenneth K. Y. Wong[1,3] — [1]Department of Electrical and Electronic Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong, China — [2]School of Biomedical Science, The University of Hong Kong, Pokfulam Road, Hong Kong, China — [3]Advanced Biomedical Instrumentation Centre, Hong Kong Science Park, Shatin, New Territories, Hong Kong, China

We demonstrate a contrast-enhanced volumetric two-photon microscopy by cancelling the side lobes of the fundamental 0th-order Bessel beam using the 3rd-order Bessel beam based on the well-matched ring patterns.

Oral CH-13.4 17:15 TRACK 4

Single-beam high-accuracy longitudinal position measurement using spiralling beams — •Shashi Prabhakar, Stephen Plachta, Marco Ornigotti, and Robert Fickler — Tampere University, Tampere, Finland

By harnessing the property of radially self-accelerating light, we achieved a measurement accuracy in longitudinal position of about 2~μm over a range of more than 2~mm using a single beam and a quadrant detector.

Oral CH-13.5 17:30 TRACK 4

Temporal light control with the time-gated transmission matrix — •Louisiane Devaud[1], Bernhard Rauer[1], Jakob Melchard[2], Mickaël Mounaix[3], Matthias Kühmayer[2], Stefan Rotter[2], and Sylvain Gigan[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, École Normale Supérieure, Paris Sciences et Lettres (PSL) Research University, CNRS, Collège de France, Paris, France — [2]Institute for Theoretical Physics, Vienna University of Technology (TU Wien), Vienna, Austria — [3]School of Information Technology and Electrical Engineering, Brisbane, Australia

A short pulse of light gets elongated passing through a scattering medium. A coherence-gating measurement enables us to measure the transmission matrix at a certain delay and use its singular vectors to redistribute temporally the energy delivery behind the medium.

Oral CH-13.6 17:45 TRACK 4

Vectorial structures of light with acceleration and deceleration — •Wagner Buono, Keshaan Singh, Angela Dudley, and Andrew Forbes — University of the Witwatersrand, Johannesburg, South Africa

We show for the first time a global polarization structure that rotates with periodic acceleration and deceleration in free space. The evolutions of the transverse vector structure and the local State of Polarization are characterized.

CI-5: Transmission Devices

Chair: Robert Killey, UCL, London, United Kingdom

Time: Friday, 16:30–18:00 Location: TRACK 5

Oral CI-5.1 16:30 TRACK 5

2x4 Spatial Switch Exploiting On-Chip Beam Steering — •Tobias Blatter[1], Antoine Finck[1], Yannick Horst[1], Yuriy Fedoryshyn[1], Eva De Leo[2], Bertold I. Bitachon[1], Wolfgang Heni[2], Ueli Koch[1], Andreas Messner[1], Maurizio Burla[1], Romain Bonjour[1], and Juerg Leuthold[2] — [1]Institue of Electromagnetic Fields (IEF), Zürich, Switzerland — [2]Polariton Technologies AG, Rüschlikon, Switzerland

We present a 2x4 spatial switch capable of steering 72 GBd/s NRZ signals freely to multiple outputs determined by their carrier wavelength. Insertion losses and footprint is <5 dB and 0.7 sqmm, respectively.

Oral CI-5.2 16:45 TRACK 5

Directional Radiated Emission From Converging Waveguide Arrays — •Pascal D. Knefeli[1], Matthias Heinrich[1], Lukas J. Maczewsky[1], Andrey A. Sukhorukov[2], and Alexander Szameit[1] — [1]Institute of physics, Universität Rostock, Rostock, Germany — [2]ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Nonlinear Physics Centre, Research School of Physics, Australian National University, Canberra, Australia

We experimentally explore the leaky mode dynamics in evanescently coupled arrays of optical single-mode waveguides with variable spacing and show how judiciously designed tapered arrays may give rise to directed emissions within the lattice plane.

Oral CI-5.3 17:00 TRACK 5

Electroabsorption Modulated Laser Based on Identical Epitaxial Layer and Transmission Line Technology — •Ali Al-Moathin[1], Shengwei Ye[1], Scott Watson[1], Eugenio Di Gaetano[1], Qusay Raghib Ali Al-Taai[1], Iain Eddie[2], Chong Li[1], Lianping Hou[1], Anthony Kelly[1], and John H. Marsh[1] — [1]University of Glasgow , Glasgow, United Kingdom — [2]Sivers Photonics Ltd., Glasgow, United Kingdom

An electroabsorption modulated DFB laser has been fabricated based on an identical epitaxial layer design, HSQ planarization, and transmission line technology. It operates at a wavelength of 1572 nm with 18 GHz bandwidth.

Oral CI-5.4 17:15 TRACK 5

Traveling-Wave Electroabsorption Modulated Laser Based on Identical Epitaxial Layer Scheme and HSQ Planarization — •Ali Al-Moathin[1], Chong Li[1], Jue Wang[1], Qusay Raghib Ali Al-Taai[1], Iain Eddie[2], Shengwei Ye[1], Lianping Hou[1], Stephen Thoms[1], Anthony Kelly[1], and John H. Marsh[1] — [1]University of Glasgow , Glasgow, United Kingdom — [2]Sivers Photonics Ltd., Glasgow, United Kingdom

We present a travelling-wave electroabsorption modulated laser based on the identical epitaxial layer scheme and HSQ planarization. The extinction ratio was 22 dB and the modulator circuit shows good electrical matching around 39 GHz.

Oral CI-5.5 17:30 TRACK 5

Magneto-photonic on-chip device for all-optical reading of magnetic memory — •Figen Ece Demirer, Sander Reniers, Reinoud Lavrijsen, Bert Koopmans, and Jos van der Tol — Eindhoven University of Technology, eindhoven, Netherlands

The device implements magnetic racetrack-memory as its cladding. Uses magneto-optic effect to determine the magnetization direction, therefore read the magnetic bits. Built in IMOS platform, it modulates mode intensity at 20 GHz.

Oral CI-5.6 17:45 TRACK 5

Gigahertz Mid-Infrared Interband Cascade Detectors: Photo-Response Saturation by a Femtosecond Oscillator — •Léonard Matthieu Krüger[1], Johannes Hillbrand[2], Jonas Heidrich[1], Maximilian Beiser[2], Robert Weih[3], Johannes Koeth[3], Christopher Richard Phillips[1], Benedikt Schwarz[2], Gottfried Strasser[2,4], and Ursula Keller[1] — [1]Department of Physics, Institute for Quantum Electronics, ETH Zurich, Zürich, Switzerland — [2]Institute of Solid State Electronics, TU Wien, Vienna, Austria — [3]Nanoplus Nanosystems and Technologies GmbH, Gerbrunn, Germany — [4]Center for Micro- and Nanostructures, TU Wien, Vienna, Austria

We measured the bias-dependent photo-response and saturation behaviour of an interband cascade laser with a femtosecond OPO. The dynamic response shows a double-exponential decay, while a reverse bias increases the saturation power and 3-dB-bandwidth.

JSIV-5: Learning Metasurfaces - Nanostructures - Spectroscopy

Chair: George Barbastathis, Massachusetts Institute of Technology, Cambridge, USA

Time: Friday, 16:30–18:00 Location: TRACK 6

Oral JSIV-5.1 16:30 TRACK 6

Infrared Metasurfaces Augmented by Artificial Intelligence for Monitoring Dynamics between All Major Classes of Biomolecules — •Aurelian John-Herpin, Deepthy Kavungal, Lea von Mücke, and Hatice Altug — École Polytechnique Fédérale de Lausanne (EPFL), Institute of Bioengineering, Lausanne, Switzerland

Highly sensitive, broadband mid-IR metasurfaces for spectroscopy are augmented with artificial intelligence to allow the label-free monitoring of biomolecules from all major classes. This pioneering bioanalytical technology offers unprecedented opportunities for unravelling complex biomolecular processes.

Oral JSIV-5.2 16:45 TRACK 6

Metasurface design platform for highly efficient wavefront engineering — •Maksim Makarenko, Arturo Burguete-Lopez, Fedor Getman, and Andrea Fratalocchi — King Abdullah University of Science And Technology, Thuwal, Saudi Arabia

In this work, we propose a universal design platform for the development of wavefront engineering structures. We demonstrate this approach's efficiency by producing a series of highly efficient common optical devices.

Oral JSIV-5.3 17:00 TRACK 6

Removing Non-Resonant Background from CARS spectra via Deep Learning — Carlo Valensise[1], Alessandro Giuseppi[2], Federico Vernuccio[1], Alejandro De la Cadena[1], Giulio Cerullo[1], and •Dario Polli[1] — [1]Physics Department, Politecnico di Milano, Milano, Italy — [2]DIAG, University of Rome "La Sapienza", Roma, Italy

We present a novel approach to remove the spurious non-resonant background from broadband coherent anti-Stokes Raman scattering spectra in real time based on deep learning, without requiring the measurement of reference spectra.

Oral JSIV-5.4 17:15 TRACK 6

Sample-efficient dataset generation for Deep Learning based inverse design of photonic nanostructures — Soumyashree S. Panda, Harshul Tandan, and •Ravi S. Hegde — Indian Institute of Technology , Gandhinagar, India

We find that unsupervised clustering techniques can be exploited for creating training datasets to reduce the burden of model training. This has implications for broadening applicability of Deep-learning to complicated structures requiring lengthy computations.

Oral JSIV-5.5 17:30 TRACK 6

Stacked neural networks for predicting scattering spectra of core–(multi)shell particles — Lina Kuhn[1], •Taavi Repän[2], and Carsten Rockstuhl[1,2] — [1]Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Germany

We present stacked neural networks approach to predict scattering spectra from core-shell particles (with multiple shells), where we stack multiple independently trained ANNs, each corresponding to a shell (or the core) of the particle.

Oral JSIV-5.6 17:45 TRACK 6

Segmentation integration in multivariate curve resolution applied to coherent anti-Stokes Raman scattering — •Damien Boildieu[1,2], David Helbert[2], Eric Champion[3], Amandine Magnaudeix[3], Philippe Leproux[1], and Philippe Carré[2] — [1]XLIM-Université de Limoges, Limoges, France — [2]XLIM-Université de Poitiers, Poitiers, France — [3]IRCER-Université de Limoges, Limoges, France

We introduce an original approach for processing CARS congested spectra, based on multivariate curve resolution with non-negative least squares. We add a hyperspectral segmentation and regularization constraint and introduce the use of convolutional neural networks.

CM-9: 3D Laser Structuring of Transparent Materials

Chair: Razvan Stoian, Université Jean Monnet, St-Etienne, France

Time: Friday, 16:30–18:00 Location: TRACK 7

Invited CM-9.1 16:30 TRACK 7

3D laser nanolithography of crystals — •Airán Ródenas[1,2], Petra Paie[2], Giacomo Corrielli[2], and Roberto Osellame[2] — [1]Universidad de La Laguna (ULL), San Cristobal de La Laguna, Spain — [2]Istituto di Fotonica e Nanotecnologie (IFN), Milan, Italy

We will present details on how femtosecond pulse direct laser writing combined with wet etching can produce nanophotonic lattices with sufficiently well controlled feature sizes to develop a 3D nanolithography protocol.

Oral CM-9.2 17:00 TRACK 7

Towards 5D Optical Data Storage with High Writing Speed — •Huijun Wang, Yuhao Lei, Xin Chang, Chun Deng, Gholamreza Shayeganrad, and Peter Kazansky — University of Southampton, Southampton, United Kingdom

5D optical data storage with high writing speed of 8 kB/s and nearly 100% readout accuracy of multilayer data is demonstrated by ultralow-loss ultrafast laser nanostructuring in silica glass

Oral CM-9.3 17:15 TRACK 7

Nanoscale energy deposition in glass by double ultrashort Gauss-Bessel pulses — •Jesus del Hoyo[1,2], Remi Meyer[1], Luca Furfaro[1], and François Courvoisier[1] — [1]FEMTO-ST Institute, Univ. Bourgogne Franche-Comté, CNRS, 15B Avenue des Montboucons, 25030, Besançon, France — [2]Applied Optics Complutense Group, Optics Department, Universidad Complutense de Madrid, Facultad de Ciencias Físicas, Plaza de las Ciencias, 1, 28040 , Madrid, Spain

Ultrashort laser Bessel pulses create semi-metallic Warm Dense Matter, that efficiently absorbs a second pulse. This increases energy confinement, and thus channel drilling efficiency. This opens new routes for laser processing of transparent materials.

Oral CM-9.4 17:30 TRACK 7

Photonic components in polymers made by femtosecond pulses — •Dmitrii Perevoznik[1,2], Surajit Bose[1], Sven Burger[3], Ayhan Demircan[1,2], and Uwe Morgner[1,2,4] — [1]Institute of Quantum Optics, Leibniz Universität Hannover, Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation AcrossDisciplines), Hannover, Germany — [3]Zuse Institute Berlin, Berlin, Germany — [4]Laser Zentrum Hannover e.V., Hannover, Germany

We report on a new waveguide writing concepts in PMMA. We found and investigate the optimal writing parameters to create single-mode waveguides with minimal propagation losses as well as demonstrate 2D and 3D Y-splitters.

Oral CM-9.5 17:45 TRACK 7

Polarization controlled orientation of LiNbO3 nanocrystals induced in Li2O – Nb2O5 – SiO2 – B2O3 glasses by femtosecond laser irradiation — •Elisa Muzi[1,2], Maxime Cavillon[1], Matthieu Lancry[1], François Brisset[1], Benjamin Sapaly[1], Davide Janner[2], and Bertrand Poumellec[1] — [1]Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), Université Paris-Saclay, Orsay, France — [2]Department of Applied Science and Technology (DISAT), Politecnico di Torino, Torino, Italy

Femtosecond laser irradiation of B2O3-containing Li2O – Nb2O5 – SiO2 glasses enables fast crystallization of LiNbO3 nanocrystals. Their spatial orientation can be controlled by light polarization, which provides additional degrees of freedom for photonic applications.

CF-10: Strong Field and Ultrafast Phenomena

Chair: Daniele Brida, University of Luxembourg, Luxembourg

Time: Friday, 16:30–18:00 Location: TRACK 8

Invited CF-10.1 16:30 TRACK 8

Controlling condensed matter with lightwave fields and forces — Christoph P. Schmid[1], Lukas Z. Kastner[1], Carmen Roelcke[1], Stefan Schlauderer[1], Christoph Lange[1], Jascha Repp[1], Johannes Reimann[2], Jens Güdde[2], Ulrich Höfer[2], Stephan W. Koch[2], Mackillo Kira[3], and •Rupert Huber[1] — [1]Department of Physics, University of Regensburg, 93040 Regensburg, Germany — [2]Department of Physics, University of Marburg, 35032 Marburg, Germany — [3]Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA

Atomically strong multi-terahertz waves drive novel subcycle quantum dynamics, including spin and pseudospin switching, high-harmonics from topological Dirac currents, and superresolution band-structure mapping. Lightwave STM allows for the first femtosecond atomic force control of molecules.

Oral CF-10.2 17:00 TRACK 8

Light-Field-Driven Current Control in Dielectrics with pJ-Level Laser Pulses at 80 MHz Repetition Rate — •Václav Hanus[1], Viktória Csajbók[1], Zsuzsanna Pápa[1,2], Judit Budai[2], Zsuzsanna Márton[2], Gellért Kiss[1], Péter Sándor[1], Pallabi Paul[3], Adriana Szeghalmi[3,4], Zilong Wang[5], Boris Bergues[5,6], Matthias Kling[5,6], György Molnár[7], János Volk[7], and Péter Dombi[1,2] — [1]Wigner Research Centre for Physics, Budapest, Hungary — [2]ELI-ALPs Research Institute, Szeged, Hungary — [3]Institute of Applied Physics, Abbe Center of Photonics, Jena, Germany — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany — [5]Physics Department, Ludwig-Maximilians-Universität Munich, Garching, Germany — [6]Max Planck Institute of Quantum Optics, Garching, Germany — [7]Centre for Energy Research, Institute of Technical Physics and Materials Science, Budapest, Hungary

We demonstrate transient metallization and lightwave-driven current control with 300-pJ pulses at 80 MHz repetition rate in dielectrics (SiO_2 and HfO_2), and semiconductor GaN. This will permit to move current control toward GHz repetition rate.

Oral CF-10.3 17:15 TRACK 8

Extreme polarization dependent infrared supercontinuum generation in uncladded silicon nitride waveguide — •Eirini Tagkoudi[1], Caroline G. Amiot[2], Goëry Genty[2], and Camille-Sophie Brès[1] — [1]École polytechnique fédérale de Lausanne – EPFL, Lausanne , Switzerland — [2]Tampere University, Tampere, Finland

We demonstrate fiber-pumped short-wave infrared supercontinuum generation in an uncladded Si3N4 waveguide exhibiting extreme polarization sensitivity. Leveraging TM/TE dispersion engineering we can switch from flat SPM-dominated all-normal dispersion regime to octave spanning solitonic regime.

Oral CF-10.4 17:30 TRACK 8

Synchronization of ultrafast pulses and pulse front tilt removal inside samples — Remi Meyer[1], Chen Xie[1,2], Luc Froehly[1], Remo Giust[1], Luca Furfaro[1], Cyril Billet[1], and •Francois Courvoisier[1] — [1]FEMTO-ST Institute, Univ. Bourgogne Franche-Comte, Besancon, France — [2]Ultrafast Laser Laboratory, Key Laboratory of Opto-electronic Information Technology of Ministry of Education, School of Precision Instruments and Opto-electronics Engineering, Tianjin, China

Ultrafast imaging requires probe pulses compressed in the sample and free from pulse front tilt. This is conventionally difficult to characterize after high NA microscope objectives. We solve these issues using a Kerr-based transient grating.

Oral CF-10.5 17:45 TRACK 8

Cage solitons of the Haus Master Equation — •Günter Steinmeyer[1,2], Esmerando Escoto[1,3], and Ayhan Demircan[4] — [1]Max-Born-Institut, Berlin, Germany — [2]Humboldt-Universität, Berlin, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [4]Cluster of Excellence PhoenixD and the Institute of Quantum Optics, Hannover, Germany

Soliton solutions with varying degree of spectral convexity are discussed, showing excellent agreement with measured pulse shapes of few-cycle lasers and ANDi fiber lasers, filling a void in understanding mode-locked lasers with ultrabroad spectra.

CH-P: CH Poster Session

Time: Friday, 10:00–11:00 Location: TRACK 1

CH-P.1 10:00 TRACK 1

Antiresonant Hollow Core Fiber-assisted Photothermal Spectroscopy of Nitric Oxide at 5.26 μm — •Karol Krzempek[1], Paweł Kozioł[1], Piotr Jaworski[1], Grzegorz Dudzik[1], and Walter Belardi[2] — [1]Laser & Fiber Electronics Group, Faculty of Electronics, Wroclaw University of Science and Technology, Wroclaw, Poland — [2]Université de Lille, CNRS, UMR 8523—PhLAM—Physique des Lasers, Atomes et Molécules, Lille, France

In this work we present a Photothermal Spectroscopy-based gas sensor utilizing a 25 cm-long side-drilled borosilicate Antiresonant Hollow-Core Fiber forming an absorption cell for sensitive detection of nitric oxide molecules at 5.26 μm wavelength range.

CH-P.2 10:00 TRACK 1

Investigation of In-Gap Field Enhancement at Terahertz Frequencies for a Metasurface Enhanced Sensor — •Halime Tugay[1], Hakan Altan[1], Yasemin Demirhan[2], Lutfi Ozyuzer[2], and Cumali Sabah[3] — [1]dapartment of physics, metu, ankara, Turkey — [2]iztech, izmir, Turkey — [3]northern cyprus campus, metu, mersin, Turkey

In this work by utilizing the non-linear gap enhancement effect we designed and analyzed a metasurface sensor structure that utilizes the phase transition in a VO2 thin film layer.

CH-P.3 10:00 TRACK 1

Raman Gas Analyzer of Carbon Isotopologues with 50 ppm Level Sensitivity — Ian Chubchenko[1], •Evgeniy Popov[1], Konstantin Grigorenko[1], Valeriia Kurikova[1], Leonid Konopelko[1], Pavel Loiko[2], and Vladimir Vitkin[1] — [1]ITMO University, St. Petersburg, Russia — [2]Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), Caen, France

We describe the results on calibration of a Raman gas analyzer in terms of gas volume fraction measurements, as well as determine the limit of detection for two methane isotopologues - 12CH4 and 13CH4.

CH-P.4 10:00 TRACK 1

Feedback cooling of a trampoline in a high-finesse cavity from room temperature — •Angelo Manetta — Center for Macroscopic Quantum States bigQ, Department of Physics, Technical University of Denmark, Lyngby, Denmark

We achieved feedback cooling of a SiN tethered membrane (trampoline) in a high finesse optical cavity down to an average phonon occupation number of 4000 starting from room temperature using coherent light at telecom wavelength.

CH-P.5 10:00 TRACK 1

Analysis of engineered aluminum-based plasmonic devices decorated with graphene/2D nanomaterials for enhanced biosensing applications in the near-infrared region — Sambhavi Shukla and •Pankaj Arora — Birla Institute of Technology and Science, Pilani, Pilani, India

The work utilizes the modified Attenuated Total Reflection configuration, to detect minute refractive index changes using surface plasmons. Highly-sensitive Aluminum-based plasmonic devices decorated with Graphene/2D nanomaterials are engineered to demonstrate biosensing in the near-infrared region.

CH-P.6 10:00 TRACK 1

Liquid immersion enables 3D printable diffractive optical elements — •Reut Orange-Kedem, Elias Nehme, Lucien E. Weiss, Boris Ferdman, Onit Alalouf, Nadav Opatovski, and Yoav Shechtman — Technion Israel institute of technology, Haifa, Israel

By immersing a diffractive optical element in a near-index-matched solution we demonstrate a method to controllably scale up the dimensions of the DOE. This enables a low-cost fabrication method without compromising optical performance.

CH-P.7 10:00 TRACK 1

A high-throughput Hyperspectral Microscope based on a Birefringent Ultrastable Common-Path Interferometer — •Cristian Manzoni, Giulio Cerullo, Gianluca Valentini, Alessia Candeo, Renzo Vanna, Benedetto Ardini, Daniela Comelli, and Andrea Bassi — IFN-CNR Politecnico di Milano, Milan, Italy

We introduce a Fourier-transform hyperspectral microscope based on an ultrastable interferometer. It enables wide-field acquisition with broad spectral coverage, tunable spectral resolution, high sensitivity. We provide examples of applications for fluorescence and Raman imaging.

CH-P.8 10:00 TRACK 1

Optical Magnetic Field Sensing based on Metamaterial Nanomechanics — Guoqiang Lan[1,2], Jun-Yu Ou[1], and •Eric Plum[1] — [1]University of Southampton, Southampton, United Kingdom — [2]Heilongjiang University, Harbin, China

We demonstrate an optical magnetic field sensor based on a metamaterial-microcavity. Actuation of the microcavity by the magnetic Lorentz force controls its reflectivity. Such sensors promise microscale spatial, sub-millisecond temporal and microtesla magnetic field resolution.

CH-P.9 10:00 TRACK 1

Widely Electrically Tuneable QCLs for Rapid Detection of Volatile Organic Molecules — •Raphael Brechbühler, Philipp Scheidegger, Herbert Looser, André Kupferschmied, Lukas Emmenegger, and Béla Tuzson — Laboratory for Air Pollution / Environmental Technology, Empa, CH-8600 Dübendorf, Switzerland

Widely electrically tunable quantum-cascade lasers using the Vernier effect are applied for the spectroscopic detection of volatile organic molecules. Our custom driving electronics allows for rapid switching between and fast scanning within individual laser-emission-frequency clusters.

CH-P.10 10:00 TRACK 1

Statistical Model for SPAD-based Time-of-Flight systems and photons pile-up correction. — •Alfonso Incoronato, Mauro Locatelli, and Franco Zappa — politecnico di milano, milano, Italy

This work proposes a discrete-time statistical model of SPAD systems, useful to predict their behaviour in defined external conditions. Furthermore, the same model can be used to correct the distortion introduced by the detector.

CH-P.11 10:00 TRACK 1

Non-Destructive Testing and Imaging of Marine Coatings using High-Resolution Mid-Infrared Optical Coherence Tomography — •Christian Petersen[1,3], Christos Markos[1,3], Niels Israelsen[1,3], Peter Rodrigo[2], Getinet Woyessa[1], Peter Tidemand-Lichtenberg[2], Christian Pedersen[2], and Ole Bang[1,3,4] — [1]DTU Fotonik, Technical University of Denmark, 2800 Kgs Lyngby, Denmark — [2]DTU Fotonik, Technical University of Denmark, 4000 Roskilde, Denmark — [3]NORBLIS, 2830 Virum, Denmark — [4]NKT Photonics, 3460 Birkerød, Denmark

We report on fast and high-resolution mid-infrared OCT imaging of marine coatings, demonstrating its applicability for measuring wet film thickness, and for non-destructive inspection of particles and defects.

CH-P.12 10:00 TRACK 1

Highly flexible deep learning based speckle correlation extraction — •Yangyundou Wang[1], Zhaosu Lin[2], Yiming Li[2], Chuanfei Hu[2], Hui Yang[2], and Min Gu[1] — [1]Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China — [2]School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China

We show that the trained convolutional neural network (COECNN) is able to extract scalable speckle correlation and make high-quality sparsity object predictions through an entirely different set of diffusers.

CH-P.13 10:00 TRACK 1

An Optical Fiber-based SPR Sensor for Colorectal Cancer Diagnosis — Renata Xavier, Jessica Alpino, •Cleumar Moreira, and Rossana Cruz — IFPB Instituto Federal de Educação, Ciencia e Tecnologia da Paraiba, Joao Pessoa, Brazil

An optical fiber-based surface plasmon resonance sensor for colorectal cancer (CRC) diagnosis is presented here. In the proposed study, plastic (Polymethyl Methacrylate - PMMA) and fluoride-based (ZBLAN – ZrF4, BaF2, LaF3, ALF3, NaF) core materials have been investigated.

CH-P.14 10:00 TRACK 1

Hydrogen Optical Sensor based on Dielectric Grating Functionalized with Gasochromic Materials — Daria P. Kulikova[1], Alina A. Dobronosova[1,2], Yevgeniy M. Sgibnev[1], Igor A. Nechepurenko[1], Eugeny D. Chubchev[1], Aleksandr S. Baburin[1,2], Evgeny V. Sergeev[1,2], Eugeniy S. Lotkov[1,2], Georgiy M. Yankovskii[1,2], Ilya A. Rodionov[1,2], Alexander V. Baryshev[1], and •Alexander V. Dorofeenko[1,3] — [1]Dukhov Research Institute of Automatics (VNIIA), Moscow, Russia — [2]FMN Laboratory, Bauman Moscow State Technical University, Moscow, Russia — [3]Institute for Theoretical and Applied Electromagnetics, Moscow, Russia

We demonstrate an optical hydrogen sensor based on Al2O3 dielectric grating and WO3/Pd gasochromic materials. The use of ultrathin (1-2 nm) palladium film has decreased losses and enhanced sensitivity. Sensor durability was studied.

CH-P.15 10:00 TRACK 1

Fourier Transform Spectrometer Combined with a Mid-Infrared Supercontinuum Source for Trace Gas Sensing — •Mohammadreza Nematollahi, Amir Khodabakhsh, Khalil Eslami Jahromi, Roderik Krebbers, Muhammad Ali Abbas, and Frans J. M. Harren — Trace Gas Research Group, Department of Molecular and Laser Physics, Institute for Molecules and Materials, Radboud University, 6525 AJ , Nijmegen, Netherlands

We present a multi-species trace gas sensor based on a mid-infrared supercontinuum source, a multi-pass cell, and a compact home-built Fourier transform spectrometer, demonstrating 1GHz spectral resolution and detection sensitivity of a few hundred $ppbv.Hz^{-1/2}$.

CH-P.16 10:00 TRACK 1

Fiber-coupled balanced-detection interferometric cavity-assisted photothermal spectroscopy for SO2 and CO detection — •Johannes P. Waclawek[1,2], Harald Moser[1,2], and Bernhard Lendl[1] — [1]Technische Universität Wien, Vienna, Austria — [2]Competence Center CHASE GmbH, Vienna, Austria

Highly sensitive, selective, as well as compact SO2 and CO trace gas sensing by balanced-detection ICAPS employing an overall fiber-coupled probe laser configuration is reported.

CH-P.17 10:00 TRACK 1

Pitchfork Bifurcation of a Nonlinear Optical Resonator Enhances Sensing Speed and Precision — •Kevin J.H. Peters and Said R.K. Rodriguez — Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

We demonstrate a novel optical sensing scheme based on a hysteretic resonator. The sensitivity of our sensor scales as a square-root function of the perturbation strength. Counterintuitively, the precision increases for fast measurements.

CH-P.18 10:00 TRACK 1

Silicon micro-electromechanical resonator for enhanced photoacoustic gas detection. — •Wioletta Trzpil, Nicolas Maurin, Roman Rousseau, Diba Ayache, Aurore Vicet, and Michael Bahriz — IES, Univ. Montpellier, CNRS, F-34000 , Montpellier, France

We present a new sensitive (11ppmv in 1s on ethylene using QCL) concept of gas sensor based on photoacoustic spectroscopy using silicon micro-resonator with capacitive transduction. We compared the limit of detection to commercial QTF.

CH-P.19 10:00 TRACK 1

The Effect of Internal Loss on the Visibility of a Seeded SU(1,1) Interferometer — •Isaac Jonas — Bar Ilan university , Ramat Gan, Israel

We present an analysis of a seeded SU(1,1) interferometer in the high-loss regime. This configuration retains its quantum properties on top of the classical stimulation, rendering it practical in applications of quantum illumination and sensing.

CH-P.20 10:00 TRACK 1

Evaluating Confocal Microscopy as a Tool to Diagnose Red Blood Cell Diseases — •Laura Rey-Barroso[1], Mónica Roldán[2,5], Francisco J. Burgos-Fernández[1], Susanna Gassiot[3,5], Anna Ruiz-Llobet[4], Ignacio Isola[3,5], and Meritxell Vilaseca[1] — [1]Centre for Sensors, Instruments and Systems Development, Technical University of Catalonia, Terrassa 08222, Spain — [2]Unit of Confocal Microscopy, Service of Pathological Anatomy, Hospital Sant Joan de Déu, Esplugues de Llobregat 08950, Spain — [3]Laboratory of Hematology, Service of Laboratory Diagnosis, Hospital Sant Joan de Déu, Esplugues de Llobregat 08950, Spain — [4]Service of Pediatric Hematology, Hospital Sant Joan de Déu, Esplugues de Llobregat 08950, Spain — [5]Institute of Pediatric Research, Hospital Sant Joan de Déu, Esplugues de Llobregat 08950, Spain

Red blood cell diseases are difficult to diagnose since they present characteristics that are somehow unspecific. In order to observe what could be affected at a cellular level, confocal microscopy was applied in this work.

CH-P.21 10:00 TRACK 1

Multi-channel laser Doppler anemometer for airborne integration as real-time optical wind vector sensor — •Oliver Kliebisch, Peter Mahnke, Raoul-Amadeus Lorbeer, Nico Miller, and Matthias Damm — German Aerospace Center, Institute of Technical Physics, Stuttgart, Germany

A rack-mounted laser Doppler anemometer (LDA) for integration into an research aircraft is presented. The LDA is tested as a potential optical air data sensor for measuring true air speed and local airflow angles.

CH-P.22 10:00 TRACK 1

InAs/AlAsSb-Based Quantum Cascade Detector at 2.7 μm — •Miriam Giparakis[1], Hedwig Knötig[1], Maximilian Beiser[1], Hermann Detz[2], Werner Schrenk[2], Benedikt Schwarz[1], Gottfried Strasser[1,2], and Aaron M. Andrews[1] — [1]Institute of Solid STate Electronics E362, TU Wien, Vienna , Austria — [2]Center for Micro- and Nanostructures E057-12, TU Wien, Vienna , Austria

A quantum cascade detector based on the InAs/AlAs0.16Sb0.84 material system was grown by molecular beam epitaxy. The device showed a room temperature peak response at the above bandgap wavelength of 2.7 μm, CO2 absorption line.

CH-P.23 10:00 TRACK 1

High-Precision Interferometry With Helical Light Beams — •Nicola Kerschbaumer[1], Lucas Fochler[1], Michael Reichenspurner[1], Theobald Lohmüller[1], Michael Fedoruk[2], and Jochen Feldmann[1] — [1]Chair for Photonics and Optoelectronics, Nano-Institute LMU Munich, Department of Physics, Munich, Germany — [2]Vortex Photonics, Munich, Germany

We report that interferometry of helical light beams provides benefits for precision measurements of transparent and fluidic samples. Details on generating optical vortex beams using spiral phase plates in a Michelson interferometer will be discussed.

CH-P.24 10:00 TRACK 1

Q- factor enhancement in photonic crystal cavities based on trapezoidal slotted nano-sticks for refractive index sensing — •Jesus Hernan Mendoza-Castro[1,2], Liam O'Faolain[3,4], and Marco Grande[1] — [1]Dipartimento di Ingegneria Elettrica e dell'Informazione, Politecnico di Bari, Bari, Italy — [2]Institute of Chemical Technologies and Analytics, Vienna University of Technology, Vienna, Austria — [3]Centre for Advanced Photonics and Process Analysis, Munster Technological University, Cork, Ireland — [4]Tyndall National Institute, Cork, Ireland

We present the design of slotted high-Q factor photonic crystal cavity in which an improvement of 2 orders of magnitude in the Q factor, as a function of angle sidewalls and number segments, is demonstrated

CH-P.25 10:00 TRACK 1

High-Q whispering-gallery-mode resonator of material with strong Faraday Effect. — •Andrey Danilin[1], Grigorii Slinkov[2], Valery Lobanov[3], Kirill Min'kov[4], and Igor Bilenko[5] — [1]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia — [2]Faculty of Physics, Lomonosov Moscow State UniversityFaculty of Physics, Lomonosov Moscow State University, Moscow, Russia — [3]Russian Quantum Center, Moscow, Russia — [4]Russian Quantum Center, Moscow, Russia — [5]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia

We investigated the magneto-optical effect in the Terbium Gallium Garnet WGMR possessing the record quality factor Q=1.45×10^8 for such material. We have observed an eigenfrequency modulation and polarization declination induced by a harmonic magnetic field.

CH-P.26 10:00 TRACK 1

Investigation of the influence of the number of spectral channels in colorimetric analysis — •Alessio Stefani[1], Theresa Götz[1], Jan Vieregge[1], Marco Wiedmann[1], Waldimir Tschekalinskij[1], Nina Holzer[1], Volker Peters[1], Martin Dold[2], Marie-Luise Bauerfeld[2], and Stephan Junger[2] — [1]Fraunhofer Institute for Integrated Circuits IIS, Erlangen, Germany — [2]Fraunhofer Institute for Physical Measurement Techniques IPM, Freiburg, Germany

We investigate the influence factors such as number, spacing and bandwidth of spectral channels of multispectral sensors used in colorimetric analysis, combing measurements, simulation and machine learning to infer the desired chemical parameters.

EG-P: EG Poster Session

Time: Friday, 10:00–11:00 Location: TRACK 2

EG-P.1 10:00 TRACK 2

Speckle engineering through singular value decomposition of the transmission matrix — •Louisiane Devaud[1], Bernhard Rauer[1], Jakob Melchard[2], Matthias Kühmayer[2], Stefan Rotter[2], and Sylvain Gigan[1] — [1]Laboratoire Kastler Brossel, Sorbonne Université, École Normale Supérieure, Paris Sciences et Lettres (PSL) Research University, CNRS, Collège de France, Paris, France — [2]Institute for Theoretical Physics, Vienna University of Technology (TU Wien), Vienna, Austria

We study speckles obtained behind a scattering media. We show that through the singular value decomposition of the medium transmission matrix and its Fourier filtering we can control the speckle's correlations.

EG-P.2 10:00 TRACK 2

Nonlinear optics at the nanoscale: experiment versus theory — •Laura Rodríguez[1], Crina Cojocaru[1], Michael Scalora[2], and Jose Trull[1] — [1]Department of physics, University Politècnica de Catalunya, Terrassa, Spain — [2]Aviation and Missile Center, US Army CCDC, Redstone Arsenal, Huntsville, USA

We report a comparison of experimental and numerical results that conduct to the understanding of the harmonic generation at nanoscale from different strategic materials for nanophotonics: semiconductors (GaAs), conductive oxides (ITO) and metals (Au).

EG-P.3 10:00 TRACK 2

The role of wall's curvature on the quantum tunneling within subnanometer gaps — •Mandana Jalali[1], Jan T. Svejda[1], Jesil Jose[2], Sebastian Schlücker[2], and Daniel Erni[1] — [1]General and Theoretical Electrical Engineering (ATE), Faculty of Engineering, University of Duisburg-Essen, and CENIDE – Center for Nanointegration Duisburg-Essen, Duisburg, Germany — [2]Department of Chemistry, University of Duisburg-Essen, and CENIDE – Center for Nanointegration Duisburg-Essen, Universitätsstr. 5, Essen, Germany

The effect of wall's curvature on the quantum tunneling within an air gap in gold nanodimers is investigated to realize the relation between the dimer radius or the wall's curvature and the red-shift in the surface plasmon (SP) coupling band.

EG-P.4 10:00 TRACK 2

Nonadiabatic Tunneling Of Photoelectrons Induced By Few-Cycle Near-Fields — •Béla Lovász[1], Péter Sándor[1], Zsolt G. Kiss[1], Balázs Bánhegyi[1], Zsuzsanna Pápa[1,2], Judit Budai[2], Christine Prietl[3], Joachim R. Krenn[3], and Péter Dombi[1,2] — [1]Wigner Research Centre for Physics, Budapest, Hungary — [2]ELI-ALPS Research Institute, Szeged, Hungary — [3]Institut für Physik, Karl-Franzens-Universitaet, Graz, Austria

We recorded nanoplasmonic photoemission spectra for the regime of nonadiabatic electron tunneling. Characteristic features of multi-photon and strong-field emission are both present in a narrow range of intensities, signifying the transition interaction region.

EG-P.5 10:00 TRACK 2

Crystal-oriented surface functions d-parameters of noble metals in plasmonic applications — •Álvaro Rodríguez Echarri[1], P. A. D. Gonçalves[2], C. Tserkezis[2], F. Javier García de Abajo[1,3], N. Asger Mortensen[2,4], and Joel Cox[2,4] — [1]ICFO – Institut de Ciències Fotòniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain, Castelldefels, Spain — [2]Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — [3] ICREA – Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys 23, 08010 Barcelona, Spain, Barcelona, Spain — [4]Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark

Feibelman d-parameters are characterized for a variety of noble metals and different crystallographic orientations. We use a rigorous quantum mechanical model to compute them and propose a variety of cases for their use in plasmonic applications.

EG-P.6 10:00 TRACK 2

Ultrasensitive Probing of Plasmonic Hot Electron Occupancies in Gold — •Judit Budai[1,2], Péter Petrik[3], Péter Dombi[1,4], and Zsuzsanna Pápa[1,4] — [1]ELI-ALPS, ELI-HU Non-Profit Ltd., Szeged, H-6728, Hungary — [2]Department of Optics and Quantum Electronics, University of Szeged, Szeged, H-6720, Hungary — [3]Institute of Technical Physics and Materials Science, Centre for Energy Research, Budapest, H-1121, Hungary — [4]Wigner Research Centre for Physics, Budapest, H-1121, Hungary

We probed surface plasmon-assisted hot electron excitations in a gold film. Based on the in-depth measurement of the dielectric function with ellipsometry, we demonstrate the existence of a hot electron population near the gold-air interface.

EG-P.7 10:00 TRACK 2

Theory of "hot" photo-luminescence from Drude metals — •Yonatan Sivan and Yonatan Dubi — Ben-Gurion University, Beer-Sheva, Israel

We provide the first complete electronic and photonic theory of luminescence from Drude metals. We resolve a series of arguments about the basic nature of the emission, its spectral shape and electric field dependence.

EG-P.8 10:00 TRACK 2

High-Harmonic Spectroscopy through Matter Talbot-Lau Interferometry — •Ana García-Cabrera, Carlos Hernández-García, and Luis Plaja — Grupo de Investigación en Aplicaciones del Láser y Fotónica, Universidad de Salamanca, Salamanca, Spain

We demonstrate an ultrafast matter-Talbot effect in the nonlinear response of a low-dimensional solid to an intense laser. Our results show that it leaves a unique spectroscopic trace, opening the way for high-harmonic Talbot-Lau spectroscopy.

EG-P.9 10:00 TRACK 2

Large Third-Order Nonlinear Optical Effect Induced by Plasmonic Metasurface with Sub-nm Gaps — •Takashi Takeuchi and Kazuhiro Yabana — Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan

We computationally investigated third-order nonlinear optical effects induced by plasmonic metasurfaces with sub-nm gaps. It has been clarified that the nonlinear effects are strongly enhanced by quantum tunneling and/or overbarrier currents through the sub-nm gaps.

EG-P.10 10:00 TRACK 2

Interaction of photonic wheel with cluster of nanoparticles — •Justas Berškys and Sergej Orlov — State research institute Center for Physical Sciences and Technology, Vilnius, Lithuania

We present an investigation of novel type optical beam with transversely orientated angular momentum to its propagation direction interaction with nanoparticles and clusters. The focus is on angular momentum, torques and forces during the interaction.

EG-P.11 10:00 TRACK 2

Thermal effect in plasmon assisted photocatalysis: a parametric study — •Ieng Wai Un and Yonatan Sivan — School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

We show that the temperature rise in plasmon-assisted photocatalysis is weakly-dependent on the illumination wavelength, pulse duration, particle shape, size, and density, but is strongly-sensitive to the beam size and the host thermal conductivity.

EG-P.12 10:00 TRACK 2

Plasmon mediated interactions between fluorescent emitters in weak and strong coupling regime. — •Kevin Chevrier[1], Camilo Pérez[1], Dorian Bouchet[1], Rémi Carminati[1], Yannick De Wilde[1], Jean-Michel Benoit[2], Alban Gassenq[2], Clémentine Symonds[2], Joel Bellessa[2], and Valentina Krachmalnicoff[1] — [1]Institut Langevin, ESPCI Paris, Université PSL, CNRS, Paris, France — [2]Institut Lumière Matière, Université Claude Bernard Lyon 1, CNRS, Villeurbanne, France

We investigate the plasmon mediated interaction between two different ensembles of fluorescent emitters, the first weakly coupled to a surface plasmon and the second strongly coupled to a surface plasmon.

EG-P.13 10:00 TRACK 2

Breaking the Selection Rules of Spin-Forbidden Molecular Absorption in Plasmonic Nanocavities — •Oluwafemi Ojambati — Cavendish Laboratory, Department of Physics, JJ Thompson Avenue, University of Cambridge, Cambridge, United Kingdom

We observe that a plasmonic nanocavity activates a molecular absorption peak from a forbidden transition. Time-dependent density functional theory reveals that Au atoms induce spin mixing to allow the new absorption.

EG-P.14 10:00 TRACK 2

Targeted positioning of quantum dots inside 3D silicon photonic crystals observed by synchrotron X-ray fluorescence tomography — •Andreas S. Schulz[1], Diana A. Grishina[1], Cornelis A.M. Harteveld[1], Alexandra Pacureanu[2], Jurriaan Huskens[1], G. Julius Vancso[1], Peter Cloetens[2], and Willem L. Vos[1] — [1]University of Twente, Enschede, Netherlands — [2]European Synchrotron Radiation Facility (ESRF), Grenoble, France

We perform X-ray fluorescence tomography of a 3D photonic band gap crystal made from silicon with embedded quantum dot nanocrystals. We obtain the position of the quantum dots with a resolution of 50 nm.

EG-P.15 10:00 TRACK 2

Tailoring the response of gold nanoantennas in optical near-field measurements: orientation and field size — •Rebecca Büchner[1], Thomas Weber[1], Stefan A. Maier[1,2], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, 80539 München, Germany — [2] The Blackett Laboratory, Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom

We study how the response of nanoantennas in near-field measurements depends on orientation and field-size, finding distinct regimes for weak and strong tip-antenna coupling and revealing the influence of collective effects on individual antenna signals.

EG-P.16 10:00 TRACK 2

Silicon nanostructures for efficient high-harmonic generation — •Pavel Peterka and Martin Kozák — Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

We propose and numerically optimize silicon nanostructures for enhancement of high-harmonic generation efficiency. The field enhancement is reached by conical shape of the surface or by an anapole mode in silicon disks on glass substrate.

JSIV-P: JSIV Poster session

Time: Friday, 10:00–11:00 Location: TRACK 3

JSIV-P.1 10:00 TRACK 3

Deep Learning based Inverse Design of Integrated Silicon Nanophotonic Gratings — •Ahmad Usman, Hussaina Ali Akbar, Anusha Rahman, Zeeshan Karim, and Syed Hasan Asim — Habib University, Karachi, Pakistan

We demonstrated deep learning based inverse design of integrated silicon nanophotonic grating. Predicted geometries by the inverse design algorithm resulted in mean-square-error of the order of 10-4 while comparison of simulated and predicted transmission response.

JSIV-P.2 10:00 TRACK 3

A Scheme for Optical Reservoir Computers with Atomic Memory — •Elizabeth Robertson [1,2], Lina Jaurigue[2], Luisa Esguerra-Rodriguez[1,2], Guillermo Gallego[2], Kathy Lüdge[2], and Janik Wolters[1,2] — [1]Deutsches Zentrum f ür Luft- und Raumfahrt e.V. (DLR), Berlin , Germany — [2]Technische Universität Berlin, Berlin, Germany

We introduce an discrete opto-electronic reservoir computer with memory elements modelled using an SOA saturation profile as a non-linearity. The reservoir is used to learn a logical XOR function with a test accuracy of 80%.

JSIV-P.3 10:00 TRACK 3

Deep Neural Networks with Time-Domain Synthetic Photonic Lattices — •Artem Pankov[1], Oleg Sidelnikov[1], Ilya Vatnik[1], Dmitry Churkin[1], and Andrey Sukhorukov[2] — [1]Novosibirsk State University, Novosibirsk, Russia — [2]The Australian National University, Canberra, Australia

We reveal that synthetic photonic lattice based on coupled fiber rings can realise deep neural networks foroptical pulse trains, and demonstrate the capabilities in efficient training for signal distortion compensation and nonlinear transformations.

JSIV-P.4 10:00 TRACK 3

Optical Convolutional Neural Network with Atomic Non-linearity — •Mingwei Yang[1,2], Elizabeth Robertson[2,3], Luisa Esguerra Rodriguez[2,3], and Janik Wolters[2,3] — [1]Humboldt-Universität zu Berlin, Newtonstr.15, D-12489 , Berlin, Germany — [2]Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Rutherfordstraße 2, D-12489, Berlin, Germany — [3]Technische Universität Berlin, Straße des 17. Juni 135, D-10623, Berlin, Germany

An optical convolutional neural network is demonstrated in which linear operations are implemented by lenses and spatial light modulators (SLMs), while an optical non-linearity is realized by a cesium vapor cell as a saturable absorber.

JSIV-P.5 10:00 TRACK 3

XY Neural Networks — •Nikita Stroev[1] and Natalia Berloff[1,2] — [1]Skolkovo Institute of Science and Technology, Moscow, Russia — [2]University of Cambridge, Cambridge, United Kingdom

We show how to build complex structures based on the nonlinear blocks of the XY model (accessible within many condensed matter systems) with the final target of realizing the deep learning architectures, that are able to perform complicated tasks.

CM-P: CM Poster Session

Time: Friday, 13:30–14:30 Location: TRACK 1

CM-P.1 13:30 TRACK 1

Element Migration and Local Refractive Index Control in Silicate Glass by Femtosecond Laser Induced Element Redistribution — •Manuel Macias-Montero[1], Francisco Muñoz[2], Belén Sotillo[3], Jesús del Hoyo[4], Rocío Ariza[1], Paloma Fernandez[3], Jan Siegel[1], and Javier Solis[1] — [1]Laser Processing Group, Instituto de Óptica (IO-CSIC), Madrid, Spain — [2]Instituto de Cerámica y Vidrio (ICV-CSIC), Madrid, Spain — [3]Department of Materials Physics, Faculty of Physics, University Complutense of Madrid, Madrid, Spain — [4]Department of Optics, Faculty of Physics, University Complutense of Madrid, Madrid, Spain

Fs-laser induced element redistribution is applied to write microstructures with high positive refractive index contrast in ad-hoc compositionally designed silicate glass and to fabricate infrared optical waveguides, evaluating the glass modification mechanism.

CM-P.2 13:30 TRACK 1

Prediction of the morphological features of laser-based patterned surfaces through the use of machine learning approaches — Maria-Christina Velli[1,2], •George Tsibidis[1], Alexandros Mimidis[1,3], Evangelos Skoulas[1,3], Yiannis Pantazis[4], and Emmanuel Stratakis[1,2] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), Heraklion, Greece — [2]Department of Physics, University of Crete, Heraklion, Greece — [3]Department of Material Science, University of Crete, Heraklion, Greece — [4]Institute of Applied and Computational Mathematics, Foundation for Research and Technology—Hellas, Heraklion, Greece

We have shown in this work that Machine-Learning based approaches can be used in laser-based fabrication as a predictive tool towards forecasting the laser parameters to produce application based morphological features on the surface of artificial materials.

CM-P.3 13:30 TRACK 1

High energy density deposition inside the bulk of dielectrics via resonance absorption — •Mostafa Hassan, Kazem Ardaneh, Remi Meyer, Chen Xie, Cyril Billet, Luca Furfaro, Luc Froehly, Remo Giust, and Francois Courvoisier — FEMTO-ST Institute, Univ. Bourgogne Franche-Comte, UMR CNRS 6174, Besancon, France

We demonstrate with experiments and simulations that femtosecond Bessel beams create in dielectrics over-dense nanoplasmas with diameter below 200 nm, which open high aspect ratio nanochannels. The main mechanism is collisionless resonance absorption.

CM-P.4 13:30 TRACK 1

Using liquid crystals as tuneable waveplates in femtosecond laser direct written waveguides — •Kim Lammers[1], Alessandro Alberucci[1], Alexander Szameit[2], and Stefan Nolte[3] — [1]Institute of Applied Physics, Abbe School of Photonics, Friedrich Schiller University Jena, Jena, Germany — [2]Institut für Physik, Universität Rostock, Rostock, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We demonstrate the use of liquid crystals as switchable retardation elements embedded in femtosecond laser direct written waveguides, allowing a switch e.g. from anti-diagonal to diagonal output polarization.

CM-P.5 13:30 TRACK 1

Study of femtosecond laser post-processing regimes for dispersion tailoring of fiber Bragg gratings — •Timothy O. Imogore[1], Ria G. Krämer[1], Thorsten A. Goebel[1], Christian Matzdorf[1], Daniel Richter[1], and Stefan Nolte[1,2] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Albert-Einstein-Straße 15, 07745, Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Albert-Einstein-Straße 7, 07745, Jena, Germany

This study investigates for the first time, the evolution of the average refractive index (and by consequence the dispersion) of an inscribed fiber Bragg grating with respect to the femtosecond laser post-processing parameters.

CM-P.6 13:30 TRACK 1

Conical Beams for Directing Chemical Etching along Deeply-Focussed Femtosecond Laser Modification Tracks — •Ehsan Alimohammadian, Erden Ertorer, and Peter R. Herman — Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada

Conical phase front beam shaping is shown to enable chemical etching control of femtosecond laser modification tracks, compensating for surface aberration, enhancing etching rates, and providing a new means for shaping the cross-sectional channel profile.

CM-P.7 13:30 TRACK 1

Off-Axis Filament Based Fiber Bragg Gratings for Azimuthally Resolved Displacement Sensing — Hossein Mahlooji[1], •Abdullah Rahnama[2], Gligor Djogo[2], Fae Azhari[1], and Peter R. Herman[2] — [1]Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Rd., M5S3G8., Toronto, Canada — [2]Department of Electrical and Computer Engineering, University of Toronto, 10 King's College Rd., M5S 3G4, Toronto, Canada

Aberrated femtosecond laser pulses were applied to telecommunication fiber, forming long and uniform filament arrays with narrow Bragg resonances. Overlaid gratings with rotational and positional offsets enabled photoelastic bending responses for azimuthally resolved displacement sensing.

CM-P.8 13:30 TRACK 1

Creation of high-contrast structures in superpositions of higher order Bessel beams for laser processing of glasses — •Paulius Šlevas[1,2], Erminas Kozlovskis[1], Sergej Orlov[1], Pavel Gotovski[1,3], and Orestas Ulčinas[1,2] — [1]Center for Physical Sciences and Technology, Coherent Optics laboratory, Vilnius, Lithuania — [2]Workshop of Photonics, Vilnius, Lithuania — [3]Faculty of Electronics, Vilnius Gediminas Technical University, Vilnius, Lithuania

We report on generation of complex transverse intensity distribution beams, by superimposing several Bessel beams of higher order and different spatial frequencies, using geometrical phase elements and applications of such beams for glass processing.

CM-P.9 13:30 TRACK 1

Time-resolved imaging and simulations of SiO2 films dynamic fracture due to laser-induced confined micro-explosion at Si/SiO2 interface — •Igor Sakaev[1], John Linden[2,3], and Amiel Ishaaya[1] — [1]Ben Gurion University of the Negev, Beer Sheva, Israel — [2]Additive Manufacturing Group, Orbotech Ltd., Yavne, Israel — [3]Bar Ilan University, Ramat Gan, Israel

PECVD SiO2 films on Si substrate irradiated by short laser pulses undergo dynamic fracture due to near-interface micro-explosion resulting in flyer ejection, spallation and fragmentation. The phenomena are investigated using time-resolved imaging and finite-elements simulations.

CM-P.10 13:30 TRACK 1

Laser Processing for Surface Protection of Marble through Hydrophobicity Enhancement — Rocio Ariza[1], Miguel Alvarez[1], Javier Solis[1], Gloria Costas[2], Leo Tribaldo[2], and •Jan Siegel[1] — [1]Laser Processing Group, Instituto de Óptica, IO-CSIC, Madrid, Spain — [2]Levantina y asociados de minerales, Novelda, Spain

Irradiation with ultrashort laser pulses was used to alter the surface wettability of marble. Combined with a surface ageing process, contact angles of 144º were obtained, showing great potential for withstanding environmental degradation and pollution.

CM-P.11 13:30 TRACK 1

Hologram Recording Using Ultrashort Laser Pulses — Yuri Kotsiuba[1,2], Ihor Hevko[1], and •Iaroslav Gnilitskyi[1,3] — [1]NoviNano LLC, Lviv, Ukraine — [2]Karpenko Physico-Mechanical Institute of the NAS of Ukraine, Lviv, Ukraine — [3]Department of Photonics, Lviv Polytechnic National University, Lviv, Ukraine

In this paper, we introduce a method of recording quasi-holograms on the steel by varying the spatial orientation of LIPSS. The obtained results will be the basis for a new technology of recording diffraction optical elements by ultrashort pulses.

CM-P.12 13:30 TRACK 1

Laser Induced Periodic surface structure formation in solids via mid-IR Ultrashort Pulses — •Stella Maragkaki[1], George D. Tsibidis[1], Roland Flender[2], Ludovit Haizer[2], Zsuzsanna Pápa[2], Zsuzsanna Márton[2], and Emmanuel Stratakis[1,3] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), Heraklion, Greece — [2]ELI-ALPS, ELI-HU Non-Profit Ltd., Szeged, Hungary — [3]Department of Physics, University of Crete, Heraklion, Greece

Ultrafast laser-induced LIPSS in the mid-infrared spectral region is a yet predominantly unexplored field with a large potential for a wide range of applications. Here, we present a parametric investigation on solids complemented with theoretical calculations.

CM-P.13 13:30 TRACK 1

Large Area Surface Ablation and Micropatterning of Transparent Dielectrics with Femtosecond UV Laser Pulses — •Dominyka Stonytė, Vytautas Jukna, Simas Butkus, and Domas Paipulas — Laser Research Center, Faculty of Physics, Vilnius University, Vilnius, Lithuania

We present the results of a direct femtosecond UV laser surface ablation of transparent materials. Laser parameters are optimized for a minimal surface roughness value using our theoretical model that can also predict the ablation depth.

CM-P.14 13:30 TRACK 1

Ultrafast laser micromachining of x-ray gratings and sub-micron hole patterns with differents beam shapes — Romain Carreto[1], Beat Lüscher[1], Ronald Holtz[1], and •Bojan Resan[1,2] — [1]Institute of Product and Production Engineering (IPPE), University of Applied Sciences and Arts Northwestern Switzerland (FHNW), Windisch, Switzerland — [2]Faculty of Medicine, Josip Juraj Strossmayer University, Osijek, Croatia

We compare micromachining results with Gaussian and Bessel beams using an UV 10-picosecond laser system, in order to obtain tungsten gratings for X-ray interferometry medical imaging, and sub-micrometer hole patterns in tungsten foil.

CM-P.15 13:30 TRACK 1

Fabrication of Microfluidic Macromolecule Separator by Femtosecond Direct Laser Writing — •Linas Jonušauskas[1,2], Deividas Andriukaitis[1,2], Dovilė Andrijec[1], Rokas Vargalis[1], Olga Kornyšova[3], Agnė Butkutė[1,2], Tomas Dervinskas[3], Vilma Kaškonienė[3], Mantas Stankevičius[3], and Audrius Maruška[3] — [1]Femtika Ltd., Vilnius, Lithuania — [2]Laser Research Center, Faculty of Physics, Vilnius University, Vilnius, Lithuania — [3]Department of Chemistry, Vytautas Magnus University, Kaunas, Lithuania

In this work, a hybrid additive-subtractive direct laser writing is used to fabricate a passive, multi-level filter-based macromolecule separator. Sub-diffraction limited resolution, femtosecond bursts, and laser-independent methods to are used to improve the processing outcome.

CM-P.16 13:30 TRACK 1

Laser Induced Periodic Surface Structured c-Si Solar Cell with more than 16% efficiency — Arian Goodarzi[1], Ozun Candemir[1], Hisham Nasser[1,2], Mona Zolfaghari Borra[1,2], Ezgi Genc[2], Emine Hande Ciftpinar[1,3], Alpan Bek[1,2,3], •Rasit Turan[1,2,3], and Ihor Pavlov[1,2] — [1]Department of Physics, Middle East Technical University, Ankara, Turkey — [2]The Center for Solar Energy Research and Applications (GÜNAM), Middle East Technical University,, Ankara, Turkey — [3]Micro and Nanotechnology Graduate Program, Middle East Technical University, Ankara, Turkey

Photonic properties of c-Si solar cell surface are enhanced by Laser Induced Periodic Surface Structuring. More than 16% efficiency is achieved without any chemical texturing of the surface.

CM-P.17 13:30 TRACK 1

Volumetric 3D printing of conductive ceramics — •Jorge Madrid-Wolff [1], Georgia Konstantinou[1], Damien Loterie[2], Paul Delrot[2], and Christophe Moser[1] — [1]Laboratory of Applied Photonics Devices, School of Engineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — [2]Readily3D , Lausanne, Switzerland

Two-photon additive manufacturing of ceramic materials has demonstrated high-precision manufacturing of tools at the micrometer scale. Here, we propose single photon volumetric additive manufacturing to overcome limitations on print size and which avoid the need for support materials.

CM-P.18 13:30 TRACK 1

High Aspect Ratio Micro-Hole Drilling in Silicon Using Subsurface Laser Processing and Selective Chemical Etching — •Mona Zolfaghari Borra[1,2], Behrad Radfar[1,2], Hisham Nasser[1], Rasit Turan[1,2,3], Ihor Pavlov[1,3], and Alpan Bek[1,2,3] — [1]The Center for Solar Energy Research and Applications (GÜNAM), Middle East Technical University, Ankara, Turkey — [2]Micro and Nanotechnology Graduate Program, Middle East Technical University, Ankara, Turkey — [3]Department of Physics, Middle East Technical University, Ankara, Turkey

We demonstrate a high aspect ratio micro-hole drilling technique using nanosecond-pulsed fiber laser focused in Si-subsurface followed by selective chemical etching. To obtain holes along with damage-free surfaces, the chemistry of the etching solution is optimized.

CM-P.19 13:30 TRACK 1

Formation of thermochemical laser-induced periodic surface structures on zirconium films by focused femtosecond laser beam — •Kirill Bronnikov[1,2], Alexander Dostovalov[1,2], Konstantin Okotrub[1], Viktor Korolkov[1,2], and Sergey Babin[1,2] — [1]Institute of Automation and Electrometry of the SB RAS, Novosibirsk, Russia — [2]Novosibirsk State University, Novosibirsk, Russia

Periodic structures were formed on zirconium films with a thickness of 50-170 nm using near-IR femtosecond laser pulses. The dependency of the period and structure uniformity on pulse energy and scanning rate was observed.

CM-P.20 13:30 TRACK 1

Laser assisted oxygen cutting of thick mild steel with off-axis beam delivery of 400 W fiber-coupled diode lasers — •Igor Sakaev and Amiel Ishaaya — Ben Gurion University of the Negev, Beer Sheva, Israel

Laser assisted oxygen cutting of 20-40 mm mild steel using total 400 W fiber-coupled diode lasers power is demonstrated. The laser beam is delivered off-axis to the cutting oxygen jet perpendicular to surface of the workpiece.

CM-P.21 13:30 TRACK 1

Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation — •Olga Koritsoglou[1], Olivier Utéza[1], David Grojo[1], Nicolas Sanner[1], Didier Loison[2], and Alexandros Mouskeftaras[1] — [1]Aix Marseille University, CNRS, LP3 UMR 7341, Marseille, France — [2]Institut de Physique de Rennes, CNRS, Rennes, France

We use a time-resolved transmission microscopy setup to study fs laser-generated shockwaves in transparent media. Our goal is to provide insight in the relation between absorbed laser energy density and induced stress fields.

CM-P.22 13:30 TRACK 1

Direct Laser Writing of Optical Waveguides with Precipitated Silver Nanoparticles in Zinc Phosphate Glass — •Georgiy Shakhgildyan, Alexey Lipatiev, Sergey Fedotov, Maxim Vetchinnikov, Sergey Lotarev, and Vladimir Sigaev — Mendeleev University of Chemical Technology, Moscow, Russia

We report on the laser writing of nonlinear optical waveguides in zinc phosphate glass containing silver. We show that fabricated waveguides could be used for the supercontinuum generation of light in the near-IR range.

CM-P.23 13:30 TRACK 1

Ultrafast-laser inscription of β-BaB2O4 crystal-in-glass waveguides in borate glass — •Sergey V. Lotarev, Alexey S. Lipatiev, Andrey S. Naumov, Tatiana O. Lipateva, Sergey S. Fedotov, and Vladimir N. Sigaev — D. Mendeleev University of Chemical Technology, Moscow, Russia

In this study, we demonstrate direct femtosecond laser writing of β-BaB2O4 crystal waveguides in the inside of 47,5BaO-5Al2O3-47,5B2O3 glass. The propagating mode profile was evaluated in the near field as Gaussian with slightly elliptical cross-section.

CM-P.24 13:30 TRACK 1

Effects of various misalignments and beam impurities on creation of optical needle using Pancharatnam–Berry phase elements — Pavel Gotovski[1,2], Paulius Slevas[1,3], •Sergej Orlov[1], Orestas Ulčinas[1,3], and Sergej Orlov[1,3] — [1]Center for Physical and Technology Sciences, Vilnius, Lithuania — [2]Vilnius Gediminas Technical University, Faculty of Electronics, Vilnius, Lithuania — [3]Workshop of Photonics, Vilnius, Lithuania

We consider optical elements based on the space-domain Pancharatnam–Berry phase for the generation of an optical needle. Both numerically and experimentally generation of an optical needle with imperfect input beams and misalignments is investigated.

CM-P.25 13:30 TRACK 1

Periodic Surface Structures Induced by 2-μm Femtosecond Pulses on ITO — •Balázs Bánhegyi[1], László Péter[1], Zsuzsanna Pápa[1,2], and Péter Dombi[1,2] — [1]Wigner Research Centre for Physics, Budapest, Hungary — [2]ELI-ALPS Research Institute, ELI-HU Nonprofit Kft, Szeged, Hungary

We analyze periodic surface structures produced by 2-μm femtosecond laser pulses on indium-tin-oxide thin-film with SEM and element analysis. The generated double-periodic morphologies are discussed in the frame of finite-difference and finite-element simulations.

CM-P.26 13:30 TRACK 1

Tomographic Volumetric Additive Manufacturing in Scattering Resins — •Jorge Madrid-Wolff[1], Antoine Boniface[1], Matthieu Jonin[1], Paul Delrot[2], Damien Loterie[2], and Christophe Moser[1] — [1]Laboratory of Applied Photonics Devices, School of Engineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — [2]Readily3D, Lausanne, Switzerland

Tomographic Additive Manufacturing produces three-dimensional objects by projecting light patterns onto cell-laden hydrogels. We improve print resolution and reduce the effects of scattering by incorporating a refractive-index matching agent.

CM-P.27 13:30 TRACK 1

Direct laser writing of 3D microstructures for photocatalytic applications — •Ioannis Syngelakis[1,2], Elmina Kabouraki[1], George Kenanakis[1], Argyro Klini[1], and Maria Farsari[1] — [1]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece — [2]Department of Materials Science and Technology, University of Crete, Heraklion, Greece

The present work investigates the potential increase of the active surface area of TiO2 nanorods, synthesised on 3D microstructures, in order to efficiently enhance their photocatalytic performance.

CM-P.28 13:30 TRACK 1

Selective Laser Etching of Crystalline Sapphire for 3D Structure Fabrication — •Agne Butkute, Beatrice Siauryte, Domas Paipulas, Romualdas Sirutkaitis, and Valdas Sirutkaitis — Laser Research Center, Faculty of Physics, Vilnius University, Vilnius, Lithuania

Selective laser etching is perspective technology in high quality 3D structures formation in glasses and crystals. However, SLE of crystals is not widely studied. Here we present SLE optimisation for crystalline sapphire processing.

CM-P.29 13:30 TRACK 1

Direct Correlation of Local Fluence to Ablation Morphology Created by a Single Femtosecond Laser Pulse — •Haruyuki Sakurai, Kuniaki Konishi, Hiroharu Tamaru, Junji Yumoto, and Makoto Kuwata-Gonokami — The University of Tokyo, Tokyo, Japan

We develop a method to directly correlate the two-dimensional ablated crater profile to the incident beam profile. We use this method to qualitatively explore previously unexplored intra-crater features in the femtosecond ablation of sapphire.

CM-P.30 13:30 TRACK 1

Bio inspired Surface engineering via Ultrafast Laser Patterning for textiles made of polymers — •Erieta-Katerina Koussi, Cyril Mauclair, and Xxx Sedao — University of Lyon, Jean Monnet University,UMR 5516 CNRS, Laboratory Hubert Curien, Saint Etienne, France

In this work, we investigate the optimal laser parameters to reproduce liquid repellent properties on PET and PA66 fluoralkyl-free polymers for textile industry.

The first tests of DLIP texture on the impact of silicon are presented.

CM-P.31 13:30 TRACK 1

Triphenylamine-based aldehydes as photoinitiators for multiphoton polymerization — •Dimitra Ladika[1,2], Guillaume Noirbent[3], Frédéric Dumur[3], Didier Gigmes[3], Areti Mourka[1], Maria Farsari[1], and David Gray[1] — [1]Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, HERAKLIO,CRETE, Greece — [2]Department of Materials Science and Technology, University of Crete, HERAKLIO,CRETE, Greece — [3]Aix Marseille Univ., CNRS, ICR, UMR 7273, Marseille, France

Presentation of three triphenylamine-based aldehydes which can be used as photoinitiators for Multiphoton Lithography. Besides their efficient formulations, they show good quality 3D prints with high aspect ratios and feature sizes in the sub-micrometer regime.

CM-P.32 13:30 TRACK 1

Pyrolyzed microstructures made by two-photon polymerization: comparative study — •Margarita Margarita[1], Tigran Baluyan[1], Ksenia Abrashitova[1], Grigory Kulagin[1], Alexander Petrov[1], Artem Chizhov[1], Tatyana Shatalova[1], Dmitry Chubich[2], Daniil Kolymagin[2], Alexey Vitukhnovsky[2], Vladimir Bessonov[1], and Andrey Fedyanin[1] — [1]Lomonosov Moscow State University, Moscow, Russia — [2]Moscow Institute of Physics and Technology (National Research University), Moscow, Russia

Two-photon polymerization is a powerful technology to make 3D microstructures. Post-processing pyrolysis enhances both microstructures' resolution and chemical composition. We have analyzed shrinkage, elemental composition, survival rate and adhesion of microstructures made of three photoresists.

CM-P.33 13:30 TRACK 1

Femtosecond Laser micromachining of Various Materials for Industrial Engraving Applications — •David Pallarés-Aldeiturriaga[1] and Xxx Sedao[1,2] — [1]Hubert Curien Laboratory, University of Lyon, Jean Monnet University University, UMR 5516 CNRS, F-42000, Saint Étienne, France — [2]GIE Manutech-USD, 20 rue Benoit Lauras, F-42000 , Saint Étienne, France

A new optimization protocol for industrial femtosecond laser engraving has been developed. It has been applied to Polyether ether ketone (PEEK), sapphire and silicon carbide (SiC), producing remarkable results in all cases.

CM-P.34 13:30 TRACK 1

In-situ emissivity change estimation with machine vision and a multispectral camera system for Ti-6Al-4V heat treatment processes — •Beñat Arejita[1,2], Juan Fernando Isaza[1], and Aitzol Zuloaga[2] — [1]EXOM Engineering, Barakaldo, Spain — [2]UPV/EHU, Bilbao, Spain

In this work we present a method for in-situ estimation of emissivity changes in Ti-6Al-4V annealing processes using a multispectral camera system and applying machine vision techniques in the visual and NIR spectra.

CM-P.35 13:30 TRACK 1

Femtosecond laser texturing of surfaces: applications in industrial scale production — Deividas Čereška[1], Gabrielius Kontenis[1,2], Arnas Žemaitis[1,2], Rokas Vargalis[1], Greta Merkininkaitė[1,3], and •Gedvinas Nemickas[1] — [1]Femtika Ltd, Vilnius, Lithuania — [2]Laser Research Center, Vilnius University, Vilnius, Lithuania — [3]Department of Chemistry, Vilnius University, Vilnius, Lithuania

femtosecond laser-induced surface functionalities in high speed and the capabilities of their applications in the industry.

CM-P.36 13:30 TRACK 1

Laser scribing of Sb2Se3 thin-film solar cells — •Fabio Giovanardi[1], Foroogh Khozeymeh[1], Francesco Bissoli[2], Stefano Rampino[2], Edmondo Gilioli[2], Giovanna Trevisi[2], Massimo Mazzer[2], and Stefano Selleri[1] — [1]University of Parma, Department of Engineering and Architecture, Parma, Italy — [2]IMEM-CNR, Institute of Materials for Electronics and Magnetism, Parma, Italy

A preliminary test of laser scribing in Sb2Se3 solar cell manufacturing has been performed. SEM image and EDAX analysis confirm the removal of the TCO layer without damaging the underlying absorber.