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HIT TIMES

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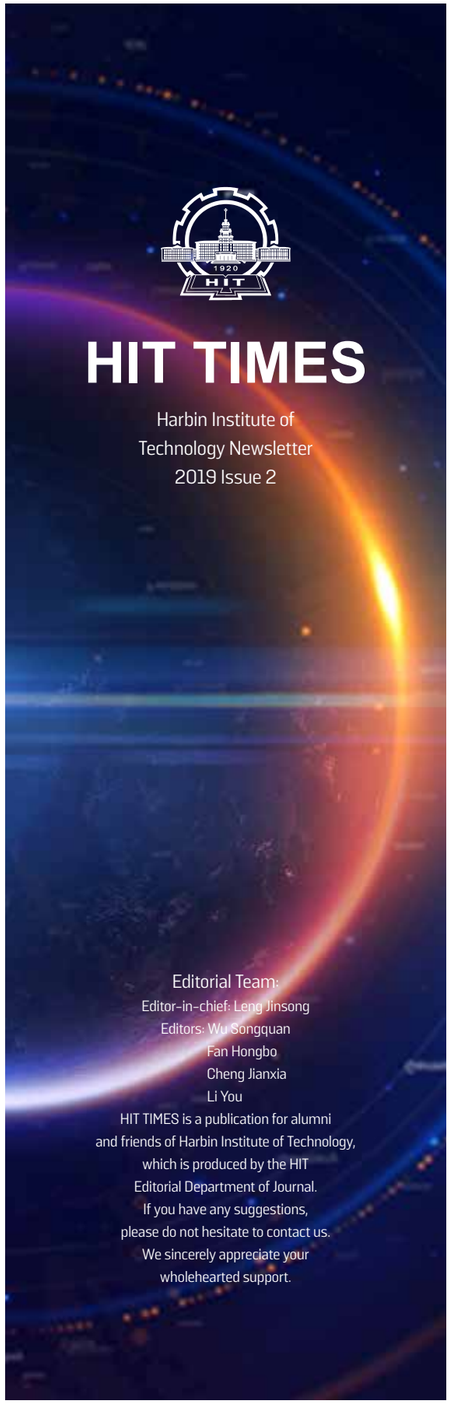

HIT TIMES

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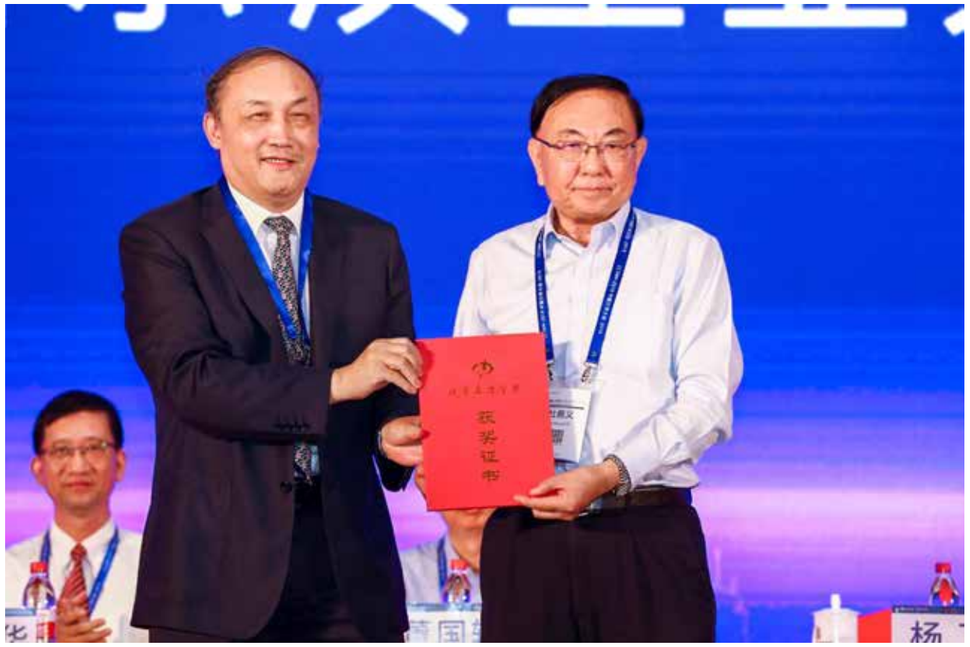


ACADEMICIAN DU SHANYI WON TSIEN HSUE-SHEN MECHANICS AWARD

On August 26, Du Shanyi, Academician of Chinese Academy of Engineering from Harbin Institute of Technology won the 2nd "Tsien Hsue-shen (Qian Xuesen) Mechanics Award."

Professor Du Shanyi is a mechanics and materials scientist who is engaging on the research and education about solid mechanics and composite materials. His major achievements include finding the solution to several key theoretical and technical problems in thermal protection materials and structures, the extension of mesomechanics to the mechanical analysis of advanced composite materials, the development of random inclusion theory and research on intelligent composite materials and structures. He won 2nd prize of the the National Science and Technology Progress Award, 2nd prize of the National Natural Science Award and 2nd prize of the National Technological Invention Awards. He was awarded as the "National Model Teacher," etc. Also as a senior technical

advisor of the China Aerospace Science and Technology Corporation, he makes outstanding contributions to China's aerospace industry.

"Tsien Hsue-shen Mechanics Award" was established by the Chinese Society of Theoretical and Applied Mechanics in 2014, and is awarded once every 4 years with only one winner each time. It aims to reward Chinese mechanics scientists who have made great contributions in the field of engineering science, in order to carry forward Academician Tsien Hsue-shen's academic ideas, innovative spirit and educational thought.

Professor Du said: "Mr. Tsien is a scientist I admire very much. As an educator, I will always bear in mind Mr. Tsien's century question about education and talents and cultivate outstanding young talents for our country; as a scientific and technical worker, I will continue to practice Mr. Tsien's ideas of 'Engineering Science' and 'System Science' and make unremitting efforts to build a strong country with powerful science and technology."

PROFESSOR DUAN GUANGREN ELECTED AS THE ACADEMICIAN OF THE CAS, PROFESSORS CAO XIBIN AND MA JUN ELECTED AS THE ACADEMICIANS OF THE CAE

On November 22, the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE) announced the list of new academicians in 2019. Three professors from Harbin Institute of Technology were on the list. Professor Duan Guangren was elected as an academician of the CAS, and Professor Cao Xibin and Professor Ma Jun were elected as academicians of the CAE. So far, the number of academicians of our university has increased to 39 (including the shared academicians).

Professor Duan Guangren, male, born in April 1962, is a member of the Communist Party of China and a member of the Society of Automation of China, IEEE and IET. He has engaged in the research of automatic control theory and applications for a long time and has established a number of parametric general solution formulas of control law to ensure the stability of the system. Furthermore, he has systematically put forward the parametric design theory of the control system through parameter optimization, which has solved the problem of A. Teel input saturation left over for 15 years. The main method is called "Duan method" by international scholars. It has been used in the simulations and experiments

of power system, four-rotor aircraft and other practical objects, as well as in the on-orbit application of attitude control law design of China's "Tiantong 1" large antenna satellite. He has made systematic and creative contributions to the parameterized design of control systems and won 2nd prize of two National Natural Science Awards (both ranked first). He has published 274 SCI papers, 2 monographs in English and 1 book in English. His single Chinese book won two National Book Awards. He presided over the major programs of the NSFC and the Innovation Group Program, the Changjiang Scholars Innovation Team Program of the Ministry of Education, and the major national special contract programs. He successively served as an expert in the Innovation Special Zone, an "863" expert, a member of the Academic Committee of the State Key Laboratory of Science and Technology of the Fifth Academy of Aerospace Sciences, and a member of the Information Science Department of the Science and Technology Commission of the Ministry.

Professor Cao Xibin, male, born in February, 1963, is a member of the Communist Party of China, an expert on the overall design of small satellites, a Distinguished Professor of Changjiang Scholars, and a national model teacher. He graduated from Harbin Institute of Technology in 1991 with a doctorate degree. At present, he is a member of the Evaluation Group of Aerospace Science and Technology Discipline of the Academic Degree Committee of the State Council, the chief scientist of Major Projects of the Innovation Special Zone, a member of the Committee of Experts in the Field of Aerospace, the vice-chairman of the Satellite General Technology Specialty Group, the vice-chairman of the Chinese Society for Space Science, and the vice-president of Harbin Institute of Technology. He also served as "973" technology chief, and a national "863" expert. He has engaged in the research of basic theory, innovative technology and engineering application of small satellites for a long time, and has made innovative achievements in the integration of small satellites, satellite-rocket integration and flexible platform design, making great contributions to the application of small satellites in the fields of space equipment, commercial remote sensing and deep space exploration. As the first completed person, he won two 2nd prizes of the National Technological Invention Award and one 2nd prize of the National Technological Progress Award. His three achievements were selected in the Top 10 Scientific and Technological Progress of Chinese Universities and two achievements were recorded in the 2016 White Paper of China's Aerospace Industry. He also won the First National Innovation Award, authorized 67 invention patents and published 2 monographs.

Professor Ma Jun, male, born in July 1962, is a member of the Communist Party of China. He has engaged in the research of water treatment theory and technology for a long time, and established the theoretical system of pollution removal for ferromanganese oxidizers with different valence. The technologies of permanganate pre-oxidation and ferrate pre-oxidation, advanced treatment by ozone catalytic oxidation, enhanced removal of heavy metals based on the characteristics of new ecological micro-interface, nano-composite membrane water treatment and advanced persulfate oxidation were developed. These technologies have been successfully applied to the purification and treatment of polluted source water, the advanced treatment and reuse of sewage, and have played an important role in many major pollution emergency projects. He is a recipient of the National Fund for Distinguished Young Scholars, a Distinguished Professor of Changjiang Scholars and a fellow of the Royal Society of Chemistry of the United Kingdom. He has been awarded the Young Scientist Award of China, the Achievement Award of Changjiang Scholars (Engineering Science Award), the Sustainable Water Award of the Royal Society of Chemistry of the United Kingdom and the Science Excellence Award of the American Chemical Society. He won two 2nd prizes of the National Technological Invention Award, one 1st prize of Heilongjiang Natural Science Award and three 1st prizes of Technological Invention Award. He has published more than 280 SCI papers, 129 of which were published in journals above IF6.0 as first author or correspondent, and granted more than 120 inventions and 6 US patents. His SCI papers were cited 13,524 times, and the H factor is 71.

PROFESSOR XU XIAOFEI WON THE IEEE TCSVC OUTSTANDING LEADERSHIP AWARD

From July 8 to 13, 2019, Professor Xu Xiaofei, Vice President of Harbin Institute of Technology and President of Harbin Institute of Technology Weihai Campus, led a delegation to attend the 2019 IEEE World Congress on Services in Milan, Italy, and won the "Outstanding Leadership Award" given by the IEEE Computer Society Technical Committee on Services Computing (TCSVC).

Founded in November 2003, the IEEE Computer Society Technical Committee on Services Computing (TCSVC) is an interdisciplinary academic community, aiming to promote the development of scientific research, engineering research and development, standard setting, educational systems, etc. in the field of service computing worldwide. IEEE World Congress on Services is a top-level series of conferences initiated by TCSVC, which covers the hot research issues in service computing related fields, such as network services, business services, cloud computing, big data, cognitive computing, edge computing and so on. This congress has a history of nearly 20 years. More than 560 scholars and industry workers from all over the world attended this year's congress.

Professor Xu Xiaofei served as the chairman of IEEE SCC 2019 conference. He has participated in many meetings of the steering committee of the conference and discussed the reform of congress format, planning of the next annual conference and other issues with other committee members. During the congress, he also presented an academic report titled "E-Sbot: a Soft Service Robot for User Centric Smart Service Delivery". In recent years, Professor Xu and his research group have been committed to the research of "Big Service" theory and intelligent service-related technologies. They published four papers in this year's congress, which have been recognized by international peers.

This year, Professor Xu Xiaofei was awarded the Outstanding Leadership Award by IEEE TCSVC for his pioneering leadership contributions to services computing. Dr. Rong Chang, current chairman of IEEE TCSVC, and Professor Michael Goul, chairman designate, jointly presented this award to him. The award ranks first among the five IEEE TCSVC awards and is nominated worldwide. The winners are strictly evaluated by an award committee composed of more than 10 top international scholars. This is the first time that a domestic scholar in China wins this award. As the director of CCF Technical Committee on Service Computing (CCF TCSC), Professor Xu Xiaofei spared no effort to promote the in-depth cooperation between CCF TCSC and IEEE TCSVC and led the scientific researchers in China's service computing field to show their talent and make continuous contributions on the international stage, forming a significant influence.

Chu Diandui, Wang Zhongjie, Tu Zhiying, Li Chunshan, Xu Hanchuan, et al. from Professor Xu's research group also attended the meeting and made a report at the meeting.■

Professor Xu Xiaofei and his research group

PROFESSOR LU HUILIN WON PSRI LECTURESHIP AWARD IN FLUIDIZATION

Recently, the annual meeting of American Institute of Chemical Engineers (AIChE) was held in Orlando, USA. Since established in 1997, each year this award recognizes only one individual's outstanding scientific/technical research contributions with impact in the field of fluidization and fluid-particle flow systems.

Professor Lu Huilin from the School of Energy Science and Engineering, Harbin Institute of Technology won the Lectureship Award in Fluidization. His work focuses on developing constitutive relationships for granular media in gas-solid fluidized beds. He has over 200 scientific papers with approximately 4,800 citations. In the annual meeting, he was invited to make a report titled “An Approach of Coupled KTGF of Euler Granular Phase and DEM of Lagrangian Discrete Particles Applied to Gas-Solid Fluidized Beds.”

The American Institute of Chemical Engineers (AIChE) is a professional organization for chemical engineers. The AIChE was established in 1908 to distinguish chemical engineers as a profession independent of chemists and mechanical engineers. Its annual meeting is the largest and most influential high-level international academic conference in the global chemical industry. It is not only a platform to display and exchange the latest achievements in the development of chemical industry, but also a bellwether to reflect the cutting-edge achievements in scientific research in this field. It is valued and recognized by the global peers in the field of chemical engineering and enjoys a high academic reputation. In 2019, over 5,900 scholars from 57 countries participated in the meeting. ■

PROFESSOR WU LIGANG ELECTED AS IEEE FELLOW

Professor Wu Ligang was elected as IEEE Fellow for his contributions to sliding mode control and robust filtering.

Wu Ligang was born in 1977 and he is currently a Full Professor of Control Science and Engineering at Harbin Institute of Technology. He won the National Science Fund for Distinguished Young Scholars in 2015 and the China Young Five Four Medal in 2016. He was named as a Changjiang Distinguished Professor in 2017 and Highly Cited Researcher since 2015. In the past decade, Professor Wu has been dedicated to the research of sliding mode control theory and its applications and novel robust filtering techniques. He has published over 170 scientific publications in these areas, including 7 authored research monographs in Springer and Wiley, 2 book chapters, over 130 international journal papers and 40 refereed conference papers with over 12,000 ISI citations and H-index 60 (over 15,500 Google citations and H-index 68). As an acknowledgement of the above explained pioneering work, Professor Wu received the prestigious Natural Science Award (first prize) from Heilongjiang province, China twice in 2013 and 2017, respectively, and received the prestigious National Natural Science Award in China in 2014.

The most distinct contribution of Professor Wu to the advancement of engineering and technology is in the area of sliding mode control theory and industrial applications. Professor Wu is one of the first researchers who proposed the novel idea of sliding mode control strategies, which have contributed in a crucial way to deal with complex dynamical systems such as stochastic systems, time-delay systems, singular systems and switched systems, among others. The uniqueness and the superiority of his pioneering work have made his papers a reference work for the entire scientific community active in the field of sliding mode control theory and applications. The second most distinct contribution of Professor Wu to the advancement of engineering and technology is in the area of robust filtering theory and its industrial applications, and model approximation. In this respect, he has developed a new framework for solving the state estimation problems for hybrid systems, such as switched systems, fuzzy systems and stochastic systems. In particular, Professor Wu, known to be among the first researchers, has introduced the novel idea of the parameter-dependent Lyapunov approach to solve the robust filtering and model reduction problems for hybrid systems. His results significantly reduce the conservatism in the traditional stability analysis in filtering problem. It should be mentioned here that such robust filtering techniques have been successfully utilized in industrial systems including power electronics, robot manipulators and aircrafts.

Professor Wu currently serves as an Associate Editor (or Editorial Board Member) for a number of journals, including *IEEE Transactions on Automatic Control*, *IEEE Transactions on Industrial Electronics*, *IEEE/ASME Transactions on Mechatronics*, *Information Sciences*, *Signal Processing*, *IET Control Theory and Applications*, *Circuits Systems and Signal Processing*. He is a member of program committees for some international conferences and a very active reviewer for many international journals.

HIGHLY CITED RESEARCHERS 2019

Awards & Honors
HIT TIMES 2019

On November 19th, the Web of Science Group, a Clarivate Analytics company, released the annual list of Highly Cited Researchers. The highly anticipated list identifies scientists and social scientists that produced multiple papers ranking in the top 1% by citations for their field and year of publication, demonstrating significant research influence among their peers.

In 2019, the 6,216 Highly Cited Researchers in various fields are from nearly 60 nations. From Mainland China, 636 researchers were named Highly Cited Researchers compared to 482 in 2018. In the main 21 Essential Science Indicator (ESI) categories, there has been a three-fold increase in the number of researchers named since 2014.

Ten researchers listing Harbin Institute of Technology as their primary institution were on the list, including Wu Chengwei, Gao Huijun, Qiu Jianbin, Liu Jianxing, Ma Jun, Wu Ligang, Zhang Lixian, Liu Ming, Yin Shen and Sun Weichao. One researcher listing Harbin Institute of Technology as the secondary affiliation was Professor Leopoldo G. Franquelo from Universidad de Sevilla. On the list, Professor Wu Ligang appeared in more than one field because of his cross-field impact with an exceptionally broad performance based on high impact papers across two fields.

FULL NAME	CATEGORY	PRIMARY AFFILIATION	SECONDARY AFFILIATION
Wu Chengwei	Cross-Field	Harbin Institute of Technology	-
Gao Huijun	Engineering	Harbin Institute of Technology	-
Qiu Jianbin	Engineering	Harbin Institute of Technology	-
Liu Jianxing	Engineering	Harbin Institute of Technology	-
Ma Jun	Environment and Ecology	Harbin Institute of Technology	-
Wu Ligang	Computer Science	Harbin Institute of Technology	-
Wu Ligang	Engineering	Harbin Institute of Technology	-
Zhang Lixian	Engineering	Harbin Institute of Technology	-
Liu Ming	Engineering	Harbin Institute of Technology	-
Yin Shen	Engineering	Harbin Institute of Technology	-
Sun Weichao	Engineering	Harbin Institute of Technology	-
Leopoldo G. Franquelo	Engineering	Universidad de Sevilla	Harbin Institute of Technology

TWO HIT TECHNOLOGIES SUPPORTED THE CONSTRUCTION OF BEIJING DAXING INTERNATIONAL AIRPORT

Recently, with the official operation of Beijing Daxing International Airport, two technologies innovated by HIT supported the construction of this airport received media attention. Xinhua News Agency, China News Agency, China Education News, China Education Online, Sina.com, Heilongjiang Daily, Heilongjiang Radio and Television, Northeast China Network, ZAKER Harbin, Harbin Television, and other media outlets have reported this information firsthand, revealing the great power of HIT behind the "Phoenix Wings".

In order to ensure the safe operation of the airport in winter, a team led by Professor Tan Yiqiu from the School of Transportation Science and Engineering jointly undertook a major research project “Key technology of self-snowmelt airport road surface construction and supporting devices” with CAAC Airport Construction Group. They developed new structures of thermal snow melting pavement, such as a fluid heating pavement system and a thermal pipeline pavement system, and built the first large-scale solid thermal snow melting pavement system in China. In 2016 and 2017, the technology was applied to Beijing Daxing International Airport.

Until now, the team is still responsible for the long-term performance monitoring and observation of the snow melting surface at the Beijing Daxing International Airport. According to the actual conditions of airport pavement, they compiled "Nomo map of thermal snow melting pavement system optimal operation," which contains 1,600 operation conditions and optimization strategies, providing a perfect basis for the efficient and safe operation of the system. According to the observation of the CAAC Airport Construction Group, the above work has realized an all-weather snow-free and ice-free airport, guaranteed flight safety, and achieved the design concept of "smart airport", "safe airport" and "green airport".

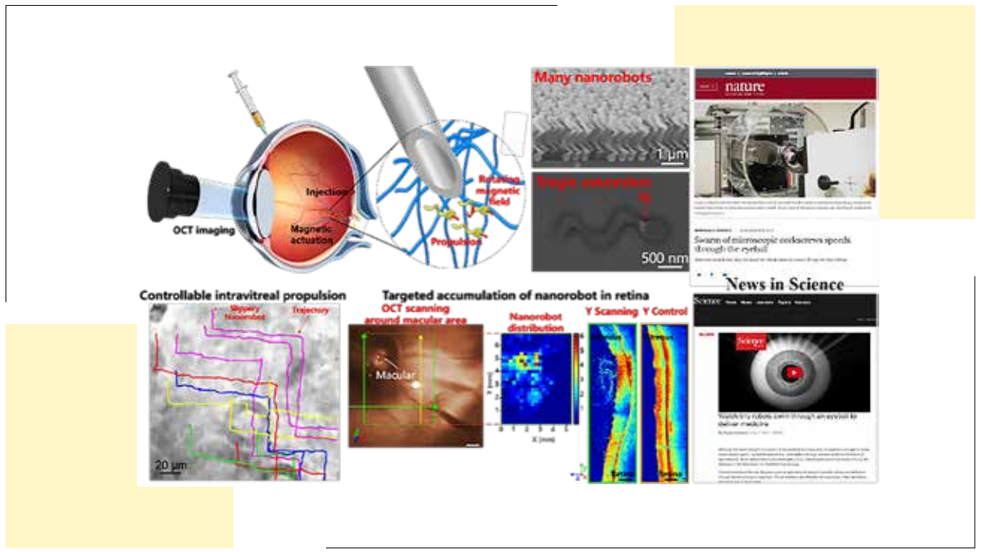
On the other hand, the team developed the anti-ice and anti-slip functional asphalt pavement technology which was applied to Beijing Daxing International Airport in 2018 and 2019. It effectively improves the anti-ice and anti-slip ability of asphalt pavement, which has an important strategic significance for the construction of a "smooth, safe and efficient" transportation system in cold regions.

ASSOCIATE PROFESSOR WU ZHIGUANG SELECTED IN "INNOVATORS UNDER 35 CHINA"

Wu Zhiguang, an Associate Professor from HIT, was selected as a pioneer in the MIT Technology Review "Innovators under 35 China," as his contribution to the micro-/nanorobots for targeted delivery *in vivo*.

Drug delivery plays an important role in therapeutics and is used to treat diseases ranging from viral and bacterial infection to cancer. The conventional drug delivery systems primarily rely on passive diffusion, which suffers from the long diffusion time, ineffectiveness, and could result in strong side effects. Synthetic micro-/nanoscale robots able to be navigated into hard-to-reach tissues can serve as an ideal platform for targeted drug delivery. Despite the great promise, the micro/nanorobot based drug delivery is currently facing two major challenges to realize practical medical applications: poor penetration capability through various biological barriers, and the lack of imaging and control under deep tissue *in vivo*.

The major bottleneck for biological barrier penetration is the strong interaction between biological macromolecules and the micro-/nanobots. Consider that the main biological barriers are porous media consisting of macromolecules as backbone of network and aqueous media inserted in the network. Inspired by the liquid slipper interface from the nepenthes, for the first time, Wu has invented a liquid slippery nanolayer coating which enables efficient



penetration and propulsion of the magnetic helical nanobots through biological barriers. Such biomimetic slippers nanobots have a size below the mesh size of the barrier networks and can overcome the obstacle from the vitreous, accomplish centimeter distance within eyes, and reach the targeted area in retina. Such nanobots hold significant promise to load the ocular therapeutic agents and transport toward the disease area in the retina, achieving the active delivery for precise therapy for diverse ocular diseases. This work was published in *Science Advances*, and was highlighted in *Nature* and *Science*.

Since 1999, MIT Technology Review selects 35 "Innovators under 35" every year. Google co-founders Larry Page and Sergey Brin, Facebook founder Mark Zuckerberg, Stanford University Professor Cui Yi, CRISPR technology founder and MIT Professor Zhang Feng were all selected. In May 2017, MIT Technology Review launched the China list, aiming to tap the most innovative young Chinese and affirm their innovative research. The winners in this year include 17 researchers from oversea institutions such as Caltech and Princeton University, 2 entrepreneurs from science and technology companies, and 16 researchers from domestic institutions such as Tsinghua University. Associate Professor Wu Zhiguang is the first winner from Harbin Institute of Technology.

Associated Professor Wu Zhiguang received his Ph.D. in chemical engineering and technology from Harbin Institute of Technology. His doctoral dissertation was selected as excellent doctoral dissertation at HIT. In 2016, he was promoted as the associate professor. He used to work in the Max Planck Institute of Intelligent Systems (Germany) under the Alexander von Humboldt fellowship, and California Institute of Technology as a postdoc. Currently, he focuses on the development of micro-/nanobot and their biomedical application in Professor He Qiang's group. He has published more than 20 papers in top journals including *Science Robotics, Science Advances, Journal of American Chemical Society, Angewandte Chemie, ACS Nano, Advanced Functional Materials,* and *Small*. His research has been reported by *Nature, Science, Science Robotics* and other top academic media.

THE HITCSC STUDENT INNOVATION TEAM WON THE 1ST PRIZE IN IARC

(ASIA-PACIFIC VENUE)

On August 25th, mission 8 of the IARC (Asia Pacific Division) of the 28th International Aerial Robotics Competition was successfully held in Kunming. The HITCSC team from the School of Astronautics completed this generation of competitions with comprehensive technology and a stable performance.

The International Aerial Robotics Competition (IARC) was founded in 1991 and is currently the longest held aerial robotics competition in the world. The event, held annually, was sponsored by Professor Robert from Georgia Institute of Technology and the American Association of Unmanned Aerial Vehicles (AUVSI). The IARC aims to promote the advancement of drone technology by setting up challenging, practical and meaningful race missions. These tasks are almost impossible to achieve when presented, and the world will benefit when it is finally completed by aerial robots. Due to the technical difficulty of the competition, each generation of tasks often takes 3-5 years to complete, and each

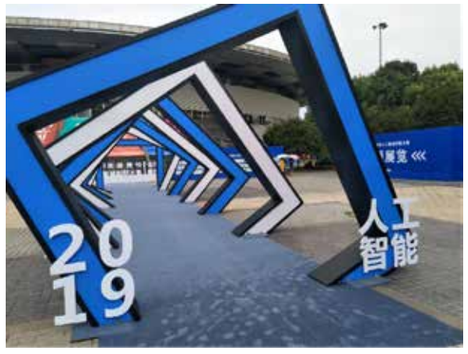
generation of tasks leads the development of robotics for five to ten years.

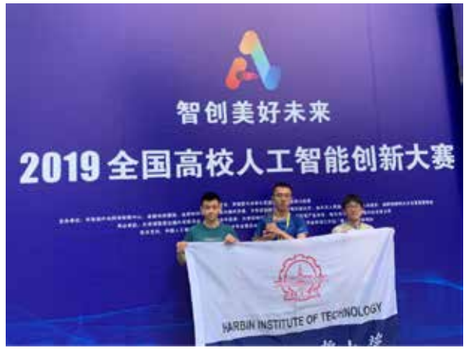
2019 is the second year of mission 8. In this mission, participants are required to interact with the remote non-electronic means of the drone. The four aerial robot assistants complete the task of unlocking the password, opening the lockbox and retrieving the components under the interference of enemy sentry aircraft. A total of 155 players from 16 universities in the Asia-Pacific region participated in the competition.

The HITCSC Student Innovation Team from the Control and Simulation Center achieved target recognition, autonomous navigation and collaborative planning and control after one year of hard work. The main players are all senior undergraduates: captain Liu Xiyang (responsible for the overall system), vice-captain Niu Yinbao (responsible for target recognition), Lin Zhaochen (responsible for control and planning), and team member Lv Zibo (responsible for speech recognition). The rest of the team included Cui Bohan, Deng Tianchen, Xu Qinzhe, et al. In the five rounds of competition, HITCSC's drones perfectly demonstrated voice interaction control, target identification, follow-up treatment, multi-machine collaborative search and decision-making, which won the appreciation of the judges.

Adhering to the school motto spirit of "The Strictest Standard, The Greatest Effort" while aiming at "cultivating outstanding young engineers," the HITCSC student innovation team will continue to explore and innovate in the future, and strive to achieve more dazzling achievements in the future competition. ■

HIT TEAM WON THE GRAND PRIZE OF THE NATIONAL COLLEGE ARTIFICIAL INTELLIGENCE INNOVATION COMPETITION



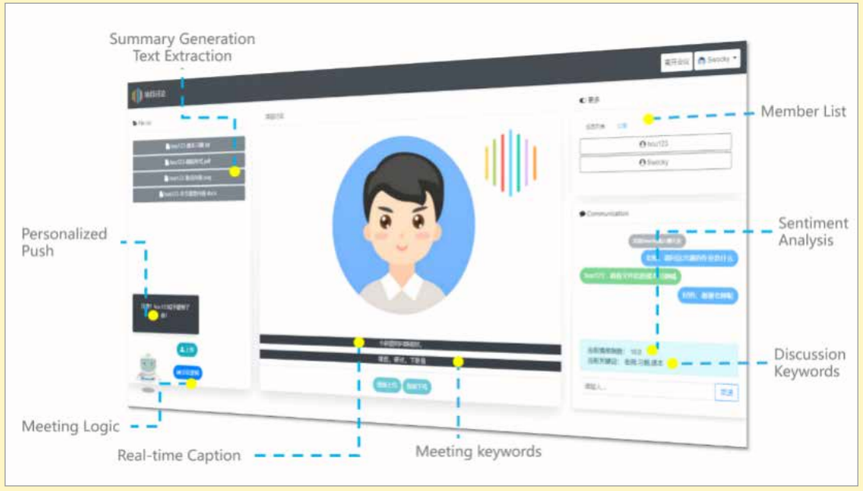


The 2019 National College Artificial Intelligence Innovation Competition was held in Chengdu from July 9 to 12, 2019. The entry titled "Online Conference Solution Based on Artificial Intelligence" developed by the team named "Score Up Convoy" won the grand prize in the "AI +" social service unit in the finals. These outstanding winners, Dong Yanchen, Hou Pengyu, Tan Jian and Zhu Yeqi, are third-year students of the School of Computer Science of HIT. Their supervisor is Tu Zhiying, Associated Professor from the School of Computer Science.

This competition is guided by the Youth Development Department of the Central Committee of the Communist Youth League and the Sichuan Provincial Committee of the Communist Youth League. The purpose of the competition is to build a good platform for college students to participate in scientific and technological innovation events and to stimulate their scientific and technological innovation ability. The competition started in May 2019 with 550 entries from 110 universities across the country. After the preliminary evaluation, 200 teams reached the final. There are six competition units in the competition, namely, "AI +" intelligent agriculture, "AI +" intelligent manufacturing, "AI +" cultural creativity, "AI +" transportation, "AI +" medical care and "AI +"social services.

The competition is based on competition units. 15 groups won the grand prize and 25 groups won the first prize, covering agriculture, automation, transportation, advanced manufacturing, smart home and other fields.

"AI Meeting" takes into account the existing note-taking records of the online conference system that is troubled by key information missing, cumbersome document processing, semantic understanding and other issues. Real-time subtitles are realized through voice transfer technology, and personalized information reminders are realized by the named entity recognition technology. Knowledge graphs help to generate meeting logic dynamically, and with seq2seq technology, minutes can be generated automatically. The project adopts self-developed push and encryption algorithms to make the conference intimate, safe and reliable. It has strong adaptability to various application scenarios such as daily meetings, smart classrooms, webinars and online salons. It provides users with a new conference experience in the artificial intelligence era.



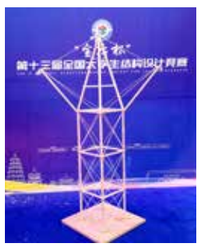
HIT TEAM WON THE FIRST PRIZE IN THE 13TH NATIONAL STRUCTURE DESIGN CONTEST FOR COLLEGE STUDENTS

On October 16-20, 2019, the 13th National Structure Design Contest for College Students was held at Xi'an University of Architecture and Technology. Three undergraduates, Ma Jinji, Tang Ning and Liang Yibang from the School of Civil Engineering formed a team named 'Tumu Jinghua' to participate in the competition on behalf of HIT.

The National Structure Design Contest for College Students is the most influential technological innovation event for college students in civil engineering in China, and is also one of the top 9 national academic competitions confirmed by the Ministry of Education. As the top-notch competition in civil engineering of Chinese universities, it is honored as "the most brilliant pearl in the crown of civil engineering."

The topic of the 13th competition was "Design and Production of Power Transmission Tower Model in Mountains". A total of 111 teams from 110 Chinese universities reached the finals. Following a fierce 4-day competition involving such sections as evaluation of design schemes, modeling and model loading, HIT's entry Before Dawn stood out among all entries and won the first prize in the competition. The advisers of the entry include Professor Shao Yongsong and Lu Shanshan from the School of Civil Engineering of HIT. It marks the fourth consecutive year that the HIT's team has been granted the first prize in the competition.

To prepare for the competition, the leadership of the School of Civil Engineering provided considerable support and tender care for the team members. The list of candidates who reached the finals was carefully determined after a complex process, from registration, training to screening. Many teachers and students have made dramatic efforts to finally triumph in a bruising battle. The school would like to express its heartfelt thanks to all teachers and students who contributed to the competition, and also hopes that civil engineering students can move ahead to make more achievements in the future. ■



STRUCTURAL BASIS OF ASSEMBLY OF THE HUMAN T CELL RECEPTOR-CD3 COMPLEX

On August 28th, 2019, a group led by Professor Huang Zhiwei from the School of Life Science at Harbin Institute of Technology reported a cryo-electron microscopy (cryo-EM) structure of a human TCR-CD3 complex in its unliganded state at 3.7 Å resolution. The structure reveals the mechanisms that underlie the assembly of TCR-CD3 and the intersubunit interactions of the complex. The research paper titled "Structural Basis of Assembly of the Human TCR-CD3 Complex" was published in *Nature*, and this paper is featured in the News & Views section.

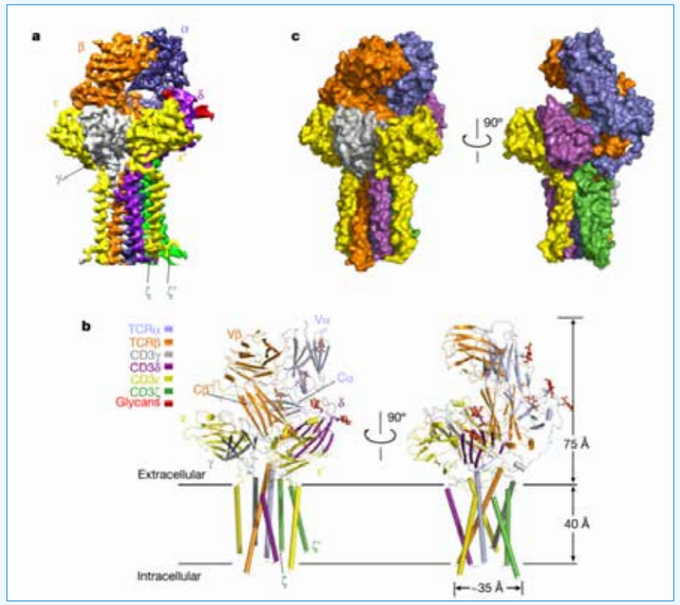
T cells are a critical component of the human adaptive immune system and have a critical role in pathogen infections, cancer and autoimmune diseases. The T cell receptor TCR is an antigen receptor expressed on the surface of T cells and initiates a T cell-mediated immune response by recognition of antigen peptides bound to major histocompatibility complex (pMHC). TCR carry out downstream signaling through its co-receptor CD3 signalling apparatus; the TCR-CD3 complex is formed through noncovalent association between TCR and CD3. Engagement of TCR by pMHC induces phosphorylation of intracellular immunoreceptor-tyrosine-based activation motifs (ITAMs) in the CD3ζ subunits. Signalling events downstream of these pathways include T cell activation, proliferation, cytokine production and effector functions.

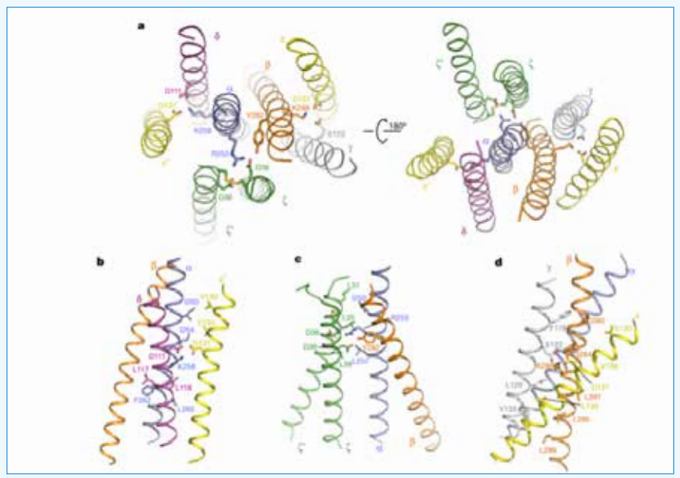
The TCR in mature T cells (about 95%) consists α and β subunits linked by disulfide bonds. The variable regions of TCRα/β (Vα and Vβ) are responsible for recognizing antigenic signals. TCR-CD3 complex consists of TCRα/β and the co-receptor CD3 containing the γ/ε, δ/ε' and ζ/ζ'

six subunits for signal transduction. In the past two decades, people have researched on how TCR extracellular variable regions recognize various antigens, but the structure foundation of TCR-CD3 complex assembly and signal transduction is still unknown.

In this study, the cells from different humans were first screened to determine the target TCR complexes for the study, a suitable chemical cross-linker was used to purify the TCR-CD3 complex, and then the TCR-CD3 complex was analyzed by cryo-electron microscopy. The overall structure of the TCR-CD3 complex is shaped like an ice cream cone, and the TCR-CD3 complex structure contains complete extracellular domain (ECD) as well as all transmembrane regions. The TCR-CD3 complex is assembled with 1:1:1:1 stoichiometry of TCRαβ:CD3γε:CD3δε:CD3ζζ, which is consistent with previous biochemical studies.

The extracellular domain of the TCR-CD3 complex is assembled with the constant region of TCRα/β and CD3 γ/ε and δ/ε' dimer forming a trimer-like structure proximal to the plasma membrane. The transmembrane segment of the CD3 complex adopts a barrel-like structure formed by interaction of the two transmembrane helices of CD3ζζ with those of CD3γε and CD3δε. Insertion of the transmembrane helices of TCRαβ into the barrel-like structure via both hydrophobic and ionic interactions

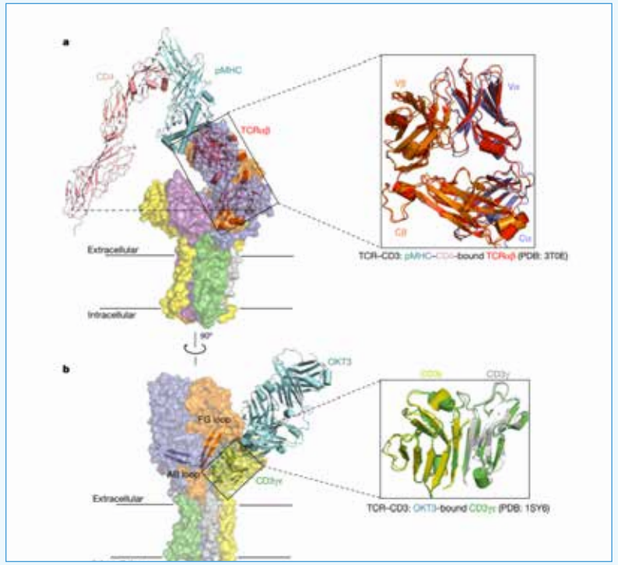




results in transmembrane assembly of the TCR-CD3 complex. The strong interaction of linker peptide on the membrane side of the TCR-CD3 subunit and the intramembrane region plays a key role in the assembly of TCR-CD3 complex. Interestingly, the comparison of TCR-CD3 with pMHC or OKT3 engaged subunits revealed that the binding of pMHC and OKT3 did not cause a significant change in the structure of TCR-CD3 complex.

The reviewer gave a high evaluation of our research: "The work represents a major milestone in the study of the molecular basis of cell-mediated, adaptive immune responses. By elucidating the first structure of the membrane assembly between a clonotypic T cell receptor and its CD3 co-receptor, this work greatly enhances our understanding of the 'triggering' mechanism which allows T cells to recognize and respond to aberrant peptide antigens."

Professor Huang Zhiwei from HIT and Professor Gao Ning from PKU are correspondent authors of this paper. Ph.D. student Dong De, postgraduate student Lin Jianquan from HIT and Ph.D. student Zheng Lvqin from PKU are the co-first authors of this paper. Zhang Bailing and Zhu Yuwei from HIT participated in part of the research. This research is financially supported by the National Natural Science Foundation of China and the Harbin Institute of Technology Young Scientists Studio Foundation.



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NEW PROGRESS IN BIODEGRADABLE SHAPE MEMORY POLYMER OCCLUSION DEVICES

Implantation of occlusion devices is an effective approach for the treatment of congenital heart diseases (CHDs) in clinics. However, most commercial clinical occlusion devices are currently made of nondegradable metals, which may lead to complications like perforation, allergies and erosion. Recently, a group led by Professor Leng Jinsong from the National Key Laboratory of Science and Technology On Advanced Composites in Special Environments at Harbin Institute of Technology published a paper titled "4D-Printed Biodegradable and Remotely Controllable Shape Memory Occlusion Devices" in *Advanced Functional Materials*. They demonstrated novel 4D-printed biodegradable, remotely controllable and personalized shape memory occlusion devices. By incorporating magnetic nanoparticles into the shape memory poly (lactic acid) matrix, the deployment of the occluders can be controlled remotely after implantation.

These occlusion devices successfully address some of the key drawbacks marring nondegradable metal occlusion devices. First, the occluder can promote cell adhesion, proliferation and tissue growth, facilitating the rapid endothelialization. Second, the occluder is biodegradable, avoiding the potential danger of the metal occluder remaining in the body forever. Other advantages of the 4D printed shape memory occluder are summarized as follows. Personalized occluders can be programmed to a linear temporary shape and the deployment process is remotely controllable, thus reducing the scar size during intervention and improving the success rate of clinical occlusion. The occluder can provide sufficient mechanical support for sealing defects even after 16 weeks of degradation in vitro and seal the defects completely and rapidly. It is worth mentioning that the ASD occluder is used as an example in this study; other types of occluders (e.g., ventricular septal defect occluders and left atrial appendage occluders) can also be designed and fabricated

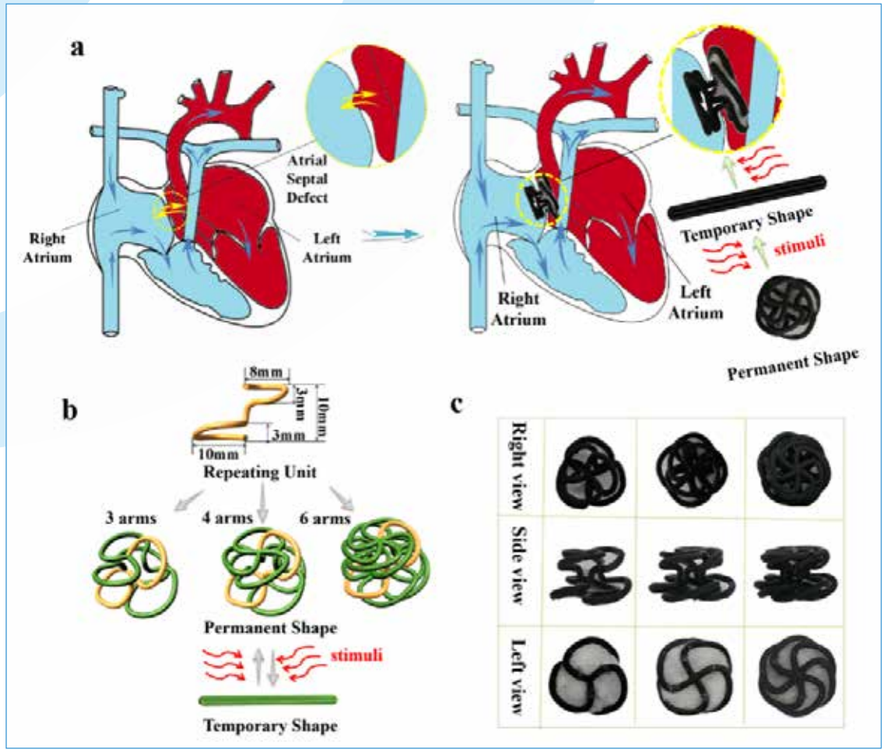

Figure (a) Schematic illustration of the ASD prototype before and after interventional therapy with an occluder; (b) schematic illustration of the design of three types of occluder frames with different arms; (c) 4D-printed occluders with frame and membranes

in a similar way. It is expected that the 4D-printed shape memory occluders can be used as a potential substitute for metal occlusion devices.

Professor Leng Jinsong's team has long been engaged in shape memory polymers (Mat Sci Eng C-Mater, 2019, 97, 864; SCIENCE CHINA Technological Sciences, 2018, 48 (08): 811-826) and 4D printed intelligent biological devices (SCIENCE CHINA Technological Sciences, 2019, 49 (01): 13-25; SCIENCE CHINA Technological Sciences, 2018, 48 (01): 2-16), including 4D printed tissue scaffold materials (Composites Part A, 2019, 125, 105571; Acs Appl Mater Inter, 2016, 9, 876), structural design and mechanical analysis (Compos Sci Technol, 2019, 107866), as well as the functionalization (Carbon, 2019, 155, 77; ACS Appl Mater Interfaces, 2019, 11, 24523). ■

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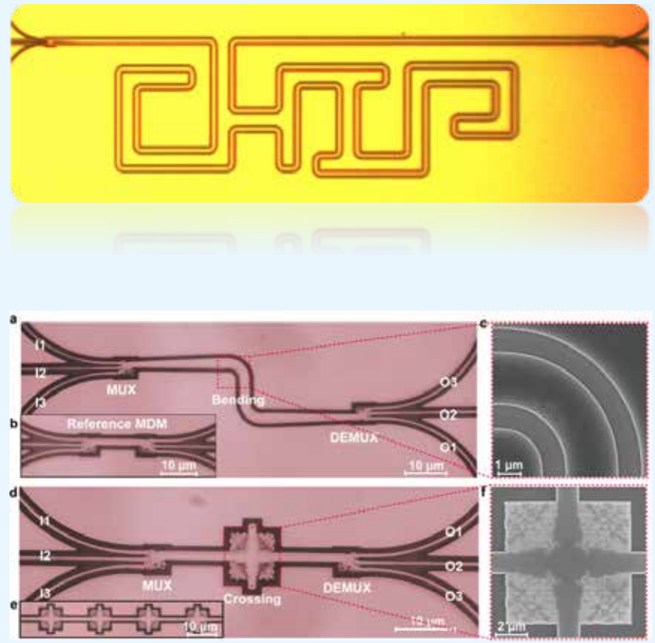
Cheng Lin, Jinxin Lv, Yuanshi Li, Fenghua Zhang, Jinrong Li, Yanju Liu, Liwu Liu,* Jinsong Leng.* 4D-printed biodegradable and remotely controllable shape memory occlusion devices. Advanced Functional Materials, 2019, 1906569. DOI: 10.1002/adfm.201906569

ARBITRARILY ROUTED MODE-DIVISION MULTIPLEXED PHOTONIC CIRCUITS FOR DENSE INTEGRATION



Recently, Dr. Xu Ke's research group from Harbin Institute of Technology, Shenzhen demonstrated a digitized meta-structure which can combat the routing problem of multimodephotonic integrated circuits (PIC). Compact and arbitrary routing of the high-speed mode-division multiplexing (MDM) signals were achieved. It opened the avenue towards large scale integration of multimode optical systems on chips. The research paper titled "Arbitrarily Routed Mode-Division Multiplexed Photonic Circuits for Dense Integration" was published in *Nature Communications*. This work was recommended as a candidate for "China's Top 10 Optical Breakthroughs in 2019".

PIC has made rapid progress in many high-tech fields such as high-performance computers, optical communications, quantum information, artificial intelligence, and so on. Compared with microelectronics, photonic IC offers the capability for parallel data processing and transmission. While wavelength division multiplexing has been widely implemented in fiber optical networks, MDM is emerging as another powerful technique to boost the data capacity. In the meantime, multi-color laser sources and precise wavelength control are not needed for the MDM system. However, the on-chip routing of MDM signals is highly vulnerable to sharp bending and cross connection due to radiation leakage and inter-mode coupling. This leaves us with a big challenge to shrink the device footprint and chip area, which eventually limits the photonic integration density.

In this study, the research team demonstrated the functional elements for MDM with an unprecedentedly small size. The multiplexing, sharp bending and direct cross connection for TE0–TE2 modes are achieved by the sophisticated waveguiding, which is realized by discretized meta-structure. This is an artificial photonic structure that is created with a random distribution of nanoholes. An optimization algorithm is utilized to design the structure with specific functionalities. Such a complex medium allows for arbitrary refractive index engineering at a deep subwavelength scale. Thus, it can potentially realize highly functional devices that are impossible for conventional design. In addition, the proposed devices are fully compatible with the standard silicon photonics foundry fabrication process.

The devices and the routing circuits were fabricated by an in-house micro-nano facility at the Shenzhen campus. The high-speed experiments were carried out in collaboration with Professor Du Jiangbing's group at Shanghai Jiao Tong University. High-speed signals (112 Gbit/s) encoded on three modes were successfully transmitted through arbitrarily routed circuits with a bit error rate under the forward error correction limit. This work will significantly improve the integration density of on-chip multi-mode photonic systems.

This work is supported by the National Natural Science Foundation of China.

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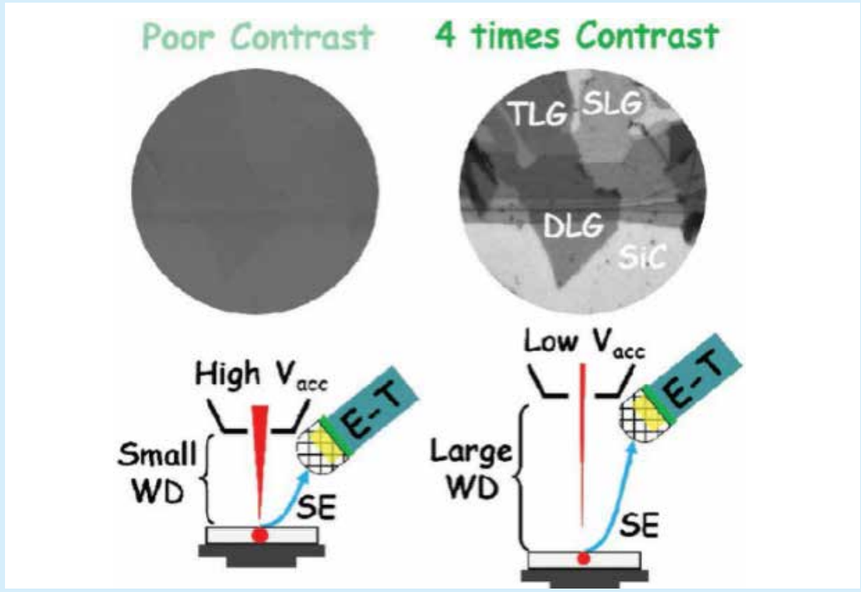
Yingjie Liu, Ke Xu, Shuai Wang, Weihong Shen, Hucheng Xie, Yujie Wang, Shumin Xiao, Yong Yao, Jiangbing Du, Zuyuan He, Qinghai Song, Arbitrarily routed mode-division multiplexed photonic circuits for dense integration. Nature Communications, 2019, 10, 3263

HIGH QUALITY SEM IMAGING OF SUPPORTED GRAPHENE MADE EASY

Accurate and fast characterization of atomically thick graphene has been much desired since the discovery of graphene. The properties and performance of graphene or graphene devices depend sensitively on various geometrical and structural characteristics such as dimensions, defects, and contaminations. With more than a decade of intensive investigations, with the opportunity of large-scale applications of graphene being on the horizon, sectors of academics and industries are more eager for accurate and fast characterization approaches.

SEM offers nanoscale spatial resolution, quick setup, and wafer-scale surveying capability. However, it is unfortunate that high contrast SEM imaging of supported graphene has yet to be fully exploited for accurate and effective differentiation between graphene and substrates, between distinct graphene layers, as well as clearly resolving fine features like wrinkles. This unfortunate overlook is certainly not profitable for fully exploiting the potential of SEM in characterizing graphene.

In their latest *Small* paper, Professor Gan's group (School of



Chemistry and Chemical Engineering) reported that, for both G/SiC and G/SiO_2/Si systems, the markedly improved SE image contrast (as high as five times) is feasibly realized by tuning V_{acc} and *WD* with the side-attached E-T SE detector. Traditionally, it has been considered more challenging to realize good image contrast for supported graphene with this detector. Furthermore, revealing the overlooked effect of *WD* immediately demonstrates a facile strategy for more effective SEM characterization of graphene and other 2D materials.

This work also theoretically contributed to the conceptual development of a unified model of V_{acc} and *WD* dependence of SE collected by the E-T SE detector. This model, though being semi-quantitative, put the mechanistic study of SEM imaging of graphene in a rational and solid foundation, which has been considerably lacking in the current literature.

This work not only contributes effective SEM characterization of graphene, but also gives the much-needed incentive for rethinking our conventional SEM imaging mindset for 2D materials. ■

REFERENCE

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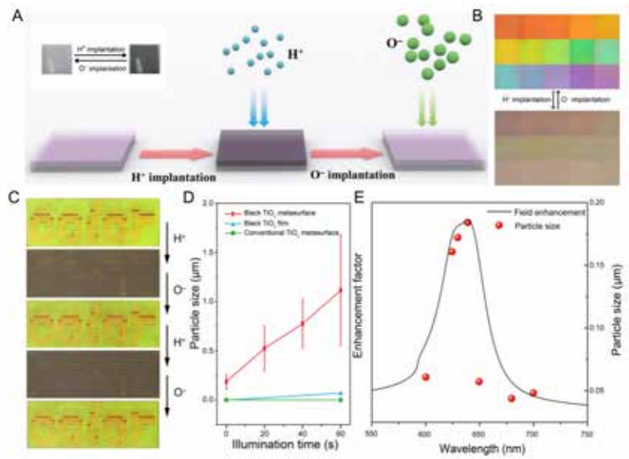
FORCING REACTIONS WITH METASURFACES

Recently, a group led by Professors Xiao Shumin and Song Qinghai from the Ministry of Industry and Information Technology Key Lab of Micro-Nano Optoelectronic Information System at Harbin Institute of Technology (Shenzhen) found a CMOS-compatible technique to produce black TiO_2 metasurfaces and explored their new opportunities in photo chemistry. The research paper titled "TiO_2 Metasurfaces: From Visible Planar Photonics to Photochemistry" was published in *Science Advances*.

To date, the physics of TiO_2 metasurfaces is almost complete, and the research attention is gradually switching to practical applications. However, despite the above progress and the recent advances on synchrotron radiation and optical coherence tomography, research on TiO_2 metasurfaces is mostly restricted to in static photonic devices. Furthermore, TiO_2 is a well-developed material in photocatalysis. The combination with photocatalysis can be an emerging opportunity for TiO_2 metasurfaces. However, there is a barrier between these two research areas. The TiO_2 metasurfaces usually work in visible spectrum, whereas TiO_2 catalysts absorb ultraviolet (UV) light.



To increase the absorption of visible light of TiO_2, the group treated the TiO_2 with a highly active H^+ and O^- plasma produced by inductively coupled plasma (ICP) etcher to realize the dynamic and revisable transition between TiO_2 and black TiO_2. Meanwhile, the nanostructures and refractive index of TiO_2 are well preserved during the transition processes. The structural color of the TiO_2 metasurface can be erased after H^+ implantation and recovered after O^- implantation. Moreover, they explored new opportunities of black TiO_2 metasurfaces in photochemistry. By controlling the conversion time, TiO_2 metasurfaces can either accelerate the chemical reaction speed or selectively respond to designed wavelengths. The research on black TiO_2 metasurfaces shall open new routes to novel photonic devices and even beyond photonics.

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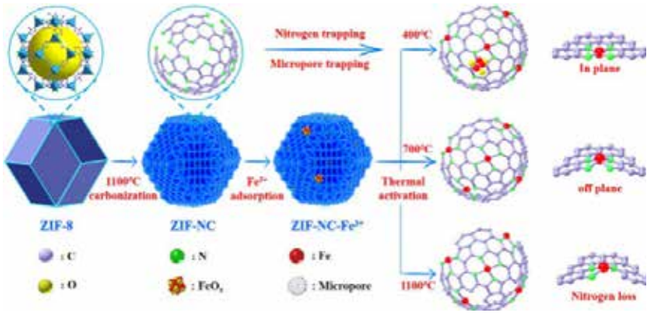
Yunkai Wu, Wenhong Yang, Yubin Fan, Qinghai Song, Shumin Xiao. TiO_2 metasurfaces: From visible planar photonics to photochemistry. Science Advances, 2019, 5: eaax0939

BREAKTHROUGH IN PLATINUM-GROUP-METAL FREE CATHODE CATALYST FOR PROTON-EXCHANGE MEMBRANE FUEL CELLS



A team led by Professor Wang Zhenbo from the School of Chemistry and Chemical Engineering, in collaboration with Associate Professor Wu Gang from University at Buffalo, The State University of New York, has made important progress in the field of fuel cell cathode catalyst. The research paper titled "Thermally Driven Structure-Performance Evolution of Atomically Dispersed Fe-N_4 Sites for Oxygen Reduction in Acids" was published in *Angewandte Chemie-International Edition*. This paper reported a high-performance Fe-N-C catalyst with atomically dispersed FeN_4 sites and unveiled the formation mechanism of efficient FeN_4 sites for the first time, which provides theoretical guidelines for the rational design of platinum group metal (PGM)-free catalysts for proton-exchange membrane fuel cells (PEMFC).

With high energy-efficiency and low CO_2 emission, PEMFC have been considered the most promising power sources for transportation and stationary applications. However, the use of expensive and scarce PGM catalysts for the sluggish oxygen reduction reaction (ORR) at the cathode hindered their large-scale application. To this end, tremendous efforts have been made to develop high-performance PGM-free catalysts by using earth-abundant and low-cost materials. However, the state of the art PGM-free catalysts iron and nitrogen co-doped carbon based Fe-N-C catalysts, is still suffering from insufficient activity and poor durability in acid media because the synthesis method of high-performance Fe-N-C catalysts is limited to traditional co-pyrolysis of precursors that contained metal, nitrogen, and carbon sources. This traditional synthesis concept has been primarily limiting catalyst performance improvement due to poor controls of catalyst morphology and local structures of active sites. Because of the complex synthesis procedures, the nature of such FeN_4 active sites and their formation mechanisms have remained elusive for a few decades. Further advancement called for a new synthesis strategy as well as theoretical guidelines for the formation mechanism of efficient FeN_4 catalytic center, which is still a blank area.

Aiming to develop a practical PGM-free catalyst, Professor Wang Zhenbo and his co-authors prepared a high-performance Fe-N-C catalyst with atomically dispersed FeN_4 sites through hosting Fe ions into a nitrogen-doped carbon followed by a controlled thermal activation. Through correlating the measured ORR activity/stability with Fe-N coordination structures formed at different temperatures, they found that the evolution of activity and stability of FeN_4 sites during thermal activation is associated with two critical factors: (i) the increase of active site density due to the transformation of ultra-fine FeOx particles to atomically dispersed FeN_4 sites and (ii) the change of intrinsic Fe-N bonds associated with strengthening bonding strength and shortening length from room temperature to the optimal 700°C. Importantly, precise control of the density of FeN_4 active sites can be realized without changing the carbon structure and morphologies, providing an ideal platform for mechanistic studies. This study provides fundamental understanding of FeN_4 site formation and updates our knowledge that high temperatures >800°C is not necessary for generating FeN_4 active sites for the ORR. In addition, the adsorption approach is proved effective to synthesize high-performance Fe-N-C catalysts. The optimal catalyst showed encouraging catalytic performance for the ORR in both acid solution and MEAs: (i) the half-wave potential reached up to 0.84 V (vs. RHE, 0.6 mg/cm^2) in standard three-electrode system; (ii) the MEA generated a current density of 0.030 A/cm^2 at 0.9 $V_{IR\text{-}free}$, which is among the highest one reported in literature and approaching to the U.S. DOE activity target (0.044 A/cm^2 @ 0.9 V).

The paper was supported by the National Natural Science Foundation of China.

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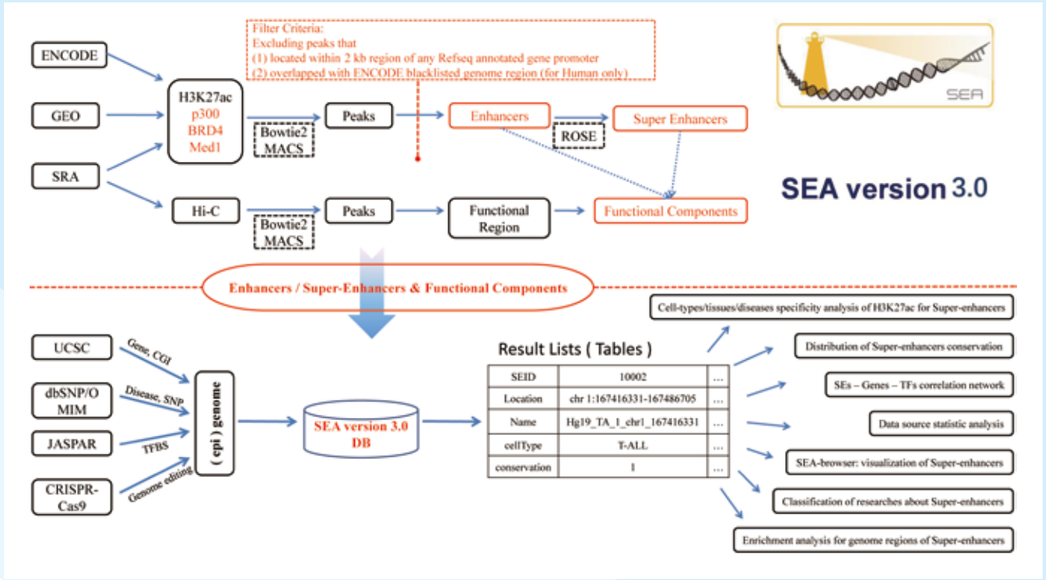
A COMPREHENSIVE EXTENSION AND UPDATE OF THE SUPER-ENHANCER ARCHIVE

Professor Zhang Yan's group from the School of Life Science at HIT has made significant progress in updating the super-enhancer archive version 3.0. The research paper titled "SEA Version 3.0: A Comprehensive Extension and Update of the Super-Enhancer Archive" was recently published in *Nucleic Acids Research (NAR)*.

Super-enhancers (SEs) are critical for the transcriptional regulation of gene expression and play key roles in oncogene transcriptional processes, cell differentiation and tissue development. As it is difficult and time consuming to experimentally identify novel super-enhancers from a range of cell types/tissues/diseases, computational identifying a large number of SEs through enriched signals of SE is recommended. They computationally identified 164,545 super-enhancers from 266 cell types/tissues/diseases of 11 species through the H3k27ac, BRD4, p300 and Med1 ChIP-Seq datasets, and updated the super-enhancer archive version 3.0 (SEA v.3.0, http://sea.edbc.org/). The 11 species include human, mouse, Drosophila, nematode, zebra fish, chicken, chimp, rhesus, sheep, xenopus tropicalis and stickleback. To facilitate super-enhancer research, SEA v.3.0 supports criteria query and shared the identified SEs in the data downloads module. The genome browser is updated to provide a comprehensive view of SEs in the genome, which includes ref-genes, CpG islands, peak landscapes by ChIP-Seq, spatial interactions by Hi-C, SNPs, methylation, expression and SpCas9 target sites, etc. Interfaces of GREAT and Enrichr are also provided for the enrichment analysis of SEs and SE related genes. Besides the specific analysis of H3K27ac status in super-enhancer regions, another new feature in SEA v.3.0 is Shannon Entropy, which is used to evaluate the specificity of SEs in multiple cell lines based on peak intensity. Networks among SEs, transcription factors and genes can be created to explore the role of SE in promoting transcription.

In brief, SEA v. 3.0 provides a comprehensive platform for the storage, annotation, query, functional analysis, and visualization of SEs, and will facilitate super-enhancer research, especially as related to development and disease.



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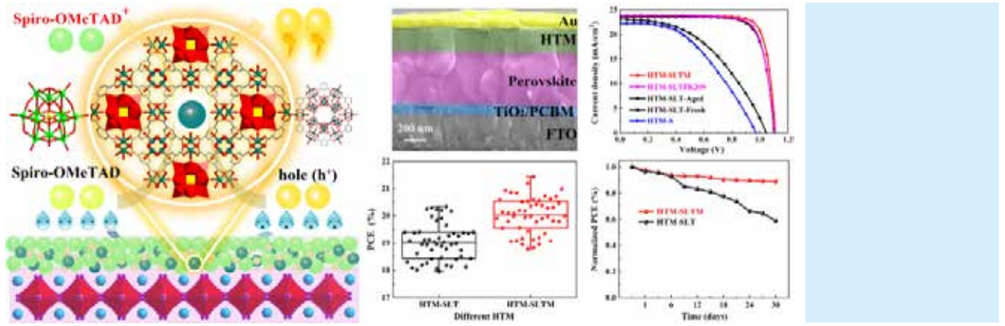
Research & Academia
HIT TIMES 2019

POLYOXOMETALATE "COMBINING" MOFs FOR HIGH-PERFORMANCE PEROVSKITE SOLAR CELLS



Recently, a team led by Professors Yang Yulin and Fan Ruiqing from the MIIT Key Laboratory of Critical Materials Technology for New Energy Conversion and Storage, School of Chemistry and Chemical Engineering, has made significant progress in perovskite solar cells. The research paper titled "Self-Assembly of Hybrid Oxidant POM@Cu-BTC for Enhanced Efficiency and Long-Time Stability of Perovskite Solar Cells" was published and identified as hot paper in the leading chemical journal, *Angewandte Chemie International Edition*.

Perovskite solar cells (PSCs) have recently achieved significantly rapid progress, reflecting dramatic enhancement in the power conversion efficiency (PCE). However, the hole transport materials (HTM) layer based on the Spiro-OMeTAD molecules still suffer from low conductivity, moderate hole-mobility and a lengthy period of oxidation time. In addition, lithium bis (trifluoromethanesulfonyl)-imide (Li-TFSI), one kind of commonly used as dopant to improve the devices, are easily attacked by water molecules, resulting in the unsatisfactory long-term stability of solar cells.

To address these issues, Professor Yang's team presents a facile and effective strategy by introducing hybrid porous material POM@Cu-BTC as an oxidant to the HTM layer. For the first time, the porosity of metal organic frameworks (MOFs) and the oxidation ability of polyoxometalates (POMs) are both systematically taken into consideration in the field of PSCs. This work pointed out POM@Cu-BTC could quantitatively and controllably oxidize Spiro-OMeTAD in an inert atmosphere and induced the improvement of conductivity and hole mobility. Therefore, the optimal device achieves a relatively high PCE 21.44% with enhancement of fill factor (***FF***, 0.80) and open circuit potential (V_{oc}, 1.11V) without boring air oxidation process. Benefiting from the robust framework of MOFs, the Li-TFSI was effectively protected and water resistance as well as stability of PSCs significantly improved. This work will lead a route to realize high-performance devices by employing POMs and MOFs, and also promote the commercialization of PSCs.

Harbin Institute of Technology is the only academic unit. PhD student Dong Yayu and Postdoctoral faculty Dr. Zhang Jian join as the first authors.

This work was financially supported by the National Natural Science Foundation of China, the Natural Science Foundation of Heilongjiang Province, the China Postdoctoral Science Foundation and the Postdoctoral Foundation of Heilongjiang Province.

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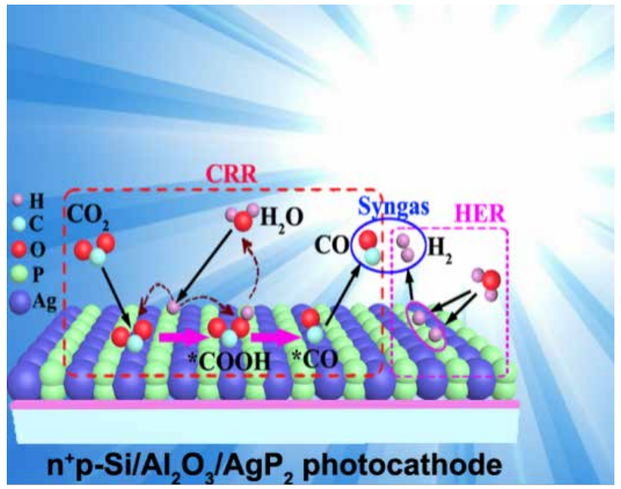
Yayu Dong, Jian Zhang, Yulin Yang, Lele Qiu, Debin Xia, Kaifeng Lin, Jiaqi Wang, Xiao Fan, Ruiqing Fan. Self-assembly of hybrid oxidant POM@Cu-BTC for enhanced efficiency and long-time stability of perovskite solar cells. Angew. Chem. Int. Ed., 2019, 58, 17610-17615, DOI: 10.1002/anie.201909291

BIG STEP IN PRODUCING SOLAR FUELS

Associate Professor Qiu Yejun from the school of Materials Science and Engineering at Harbin Institute of Technology, Shenzhen, published a paper titled "Colloidal Silver Diphosphide (AgP_2) Nanocrystals as Low Overpotential Catalysts for CO_2 Reduction to Tunable Syngas" in the journal *Nature Communications*. This work was completed in collaboration with Associate Professor Scott M. Geyer from Wake Forest University.

Syngas is a critical feedstock because it can subsequently be upgraded to synthetic liquid fuels and industrials chemicals via industrial Fischer-Tropsch processes. Currently, non-renewable fossil fuels (e.g., coal, petroleum coke, and natural gas) are the main sources for syngas production, all of which increase the consumption of fossil fuel and environmental crisis. Converting CO_2 and H_2O into syngas with a tunable CO/H_2 ratio by use of solar energy is an ideal approach to achieving a carbon-neutral energy cycle. The development of an efficient and selective catalyst is critical to make this technology feasible. In this work, we have demonstrated a hot-injection method to synthesize ultrasmall sub-4 nm silver diphosphide (AgP_2) nanocrystals as a catalyst towards electrochemical CO_2-to-CO reduction. The novel catalyst allows the conversion of CO_2 into fuel with minimal energy loss compared to the current state-of-the-art process. Additionally, utilizing the ultralow overpotential and wide syngas range of the AgP_2 catalyst, we constructed a photocathode for CO_2 reduction consisting of an n^+p-Si wafer coated with ultrathin Al_2O_3 by ALD, followed by AgP_2 NCs. This design yields a record onset potential of 0.2 V vs. RHE for CO production and a partial photocurrent density for CO at -0.11 V *vs.* RHE ($j_{-0.11,\,CO}$) of -3.2 mA cm^{-2}, exceeding all other reported photocathodes for selective CO_2-to-CO reduction.



This work offers guidance for the rational design of not only efficient and stable metal/non-metal alloyed CO_2 reduction electrocatalysts, but also for the design of hybrid photocathodes with optimized interfaces for efficient and stable solar-driven CO_2 reduction.

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Hui Li, Peng Wen, Dominique S. Itanze, Zachary D. Hood, Xiao Ma, Michael Kim, Shiba Adhikari, Chang Lu, Chaochao Dun, Miaofang Chi, Yejun Qiu and Scott M. Geyer. Colloidal silver diphosphide (AgP_2) nanocrystals as lowoverpotential catalysts for CO_2 reduction to tunable syngas. Nature Communication, 2019, DOI: 10.1038/s41467-019-13388-8

HIT TEAM SOLVED THE STRUCTURE OF A NOVEL TYPE OF MICROBIAL RHODOPSIN

Recently, Dr. He Yuanzheng's group in HIT Center for Life Science (HCLS) solved the structure of a novel type of microbial rhodopsin, heliorhodopsins. The result was recently published in *Cell Research*.

Microbial rhodopsins (MRs) comprise a large family of photon-activated membrane proteins with versatile functions that have been extensively exploited in optogenetics. Heliorhodopsins are a totally new class of MRs, with a low homology (<15%) to all other MRs and a unique membrane topology in which their N-termini face the intracellular side and C-termini face the extracellular side. The structural insight into the new class of MR remains unknown.

Through structural approaches, Dr. He's group solved the crystal structure of heliorhodopsins and mechanistically addressed the key physiological properties of heliorhodopsin, such as pump/channel activity and the long photocycle. The structural information provided by Dr. He's group will aid future functional studies and the potential applications of this new class rhodopsin.■

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Lu Y, Zhou XE, Gao X, Wang N, Xia R, Xu Z, Leng Y, Shi Y, Wang G, Melcher K, Xu HE, He Y. Crystal structure of heliorhodopsin 48C12. Cell Research, 2019, doi: 10.1038/s41422-019-0266-0

BREAKTHROUGH ON NONCOMMUTATIVE ANALYSIS

In recent years, the noncommutative analysis group of the Institute for Advanced Study on Mathematics (IASM) at HIT has made a series of important progress on some interdisciplinary research fields such as harmonic analysis on quantum tori, quantum derivatives, and quantum information.

Noncommutative analysis is a newly growing and developing research field in functional analysis, which contains operator spaces, quantum probability, and noncommutative harmonic analysis. Simultaneously, it is deeply related to some branches in pure mathematics such as operator algebra and classical harmonic analysis, as well as quantum information and quantum field theory. In recent decades, the research on noncommutative analysis is very active and productive. Led by Professor Xu Quanhua, a young research group on noncommutative analysis has gathered in IASM, which makes noncommutative analysis a main research field of IASM.

In 2018, three members of the noncommutative analysis group, Xu Quanhua, Yin Zhi, and Xiong Xiao, started a study on the analysis aspect of quantum tori for the first time. They have systematically developed a functional analysis theory using quantum probability, noncommutative harmonic analysis, and Fourier multipliers. Their work has not only pushed the development of analysis on noncommutative manifolds and non-ablien groups, but also had important applications on the research fields, including noncommutative geometry, quantum Hall effect, noncommutative partial differential equations and so on.

In 2019, Xiong Xiao and his coauthors, Professor Fedor Sukochev and Dr. Edward McDonald from University of New South Wales (Sydney), have given a complete characterization of quantum differentiability on quantum tori. They have also developed Dixmier trace formulae for these quantum differentials. In a following work by them, Xiong Xiao and his coauthors have extended their results on quantum tori to corresponding ones on quantum Euclidean spaces. All these results have initiated applications of noncommutative analysis to noncommutative geometry, and will be of great help to promote the development of noncommutative differential geometry.

In addition, Wu Jinsong of the noncommutative analysis group has been working on fundamental theory of quantum information by noncommutative analysis tool for many years. In 2019, Wu Jinsong and his coauthors, Professor Arthur Jaffe (Harvard University), Dr. Kaifeng Bu (Zhejiang University), and Professor Liu Zhengwei (Tsinghua University), proved a quantum de Finetti Theorem by applying the pictorial formulation of Parafermion algebra, which is a hot topic in the current research of quantum probability and quantum information.

This series of research results have been published in the top journal of American Mathematical Society, *Memoirs of the American Mathematical Society*, and in the top journal of the mathematical physics field, *Communications in Mathematical Physics*.

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Research & Academia
HIT TIMES 2019

NEWS & EVENTS

HIT PRESIDENT ZHOU YU LED DELEGATION TO VISIT RUSSIA

On September 15th, the 20th session of the China-Russia Committee on Humanities Cooperation was held in St. Petersburg, Russia. Chinese Vice Premier Sun Chunlan and Russian Deputy Prime Minister Tatyana Golikova co-chaired the meeting. HIT President Zhou Yu was invited to attend the meeting and

signed a memorandum of understanding with Nikolay Kropachev, Rector of St. Petersburg State University, on co-hosting the "Sino-Russian Joint Campus of St. Petersburg University of Technology" in Harbin.

The HIT delegation held talks with Mr. Kropachev on follow-up issues for constructing the Sino-Russian joint campus. Mr. Kropachev said that in recent years, relying on the Sino-Russian Joint Research Center and the representative office of St. Petersburg University, the two sides have achieved fruitful cooperation in personnel training, scientific research, academic exchanges, and other fields. Witnessed by the vice premiers from both countries, the signing of the Joint Campus Cooperation Agreement marks a new level of cooperation.

HIT President Zhou Yu introduced the latest progress of the Sino-Russian joint campus construction project. He said that the Heilongjiang Provincial People's Government fully supports the construction of the joint campus. On April 23, 2019, Governor of Heilongjiang Province Wang Wentao hosted a special meeting on the Sino-Russian Joint Campus

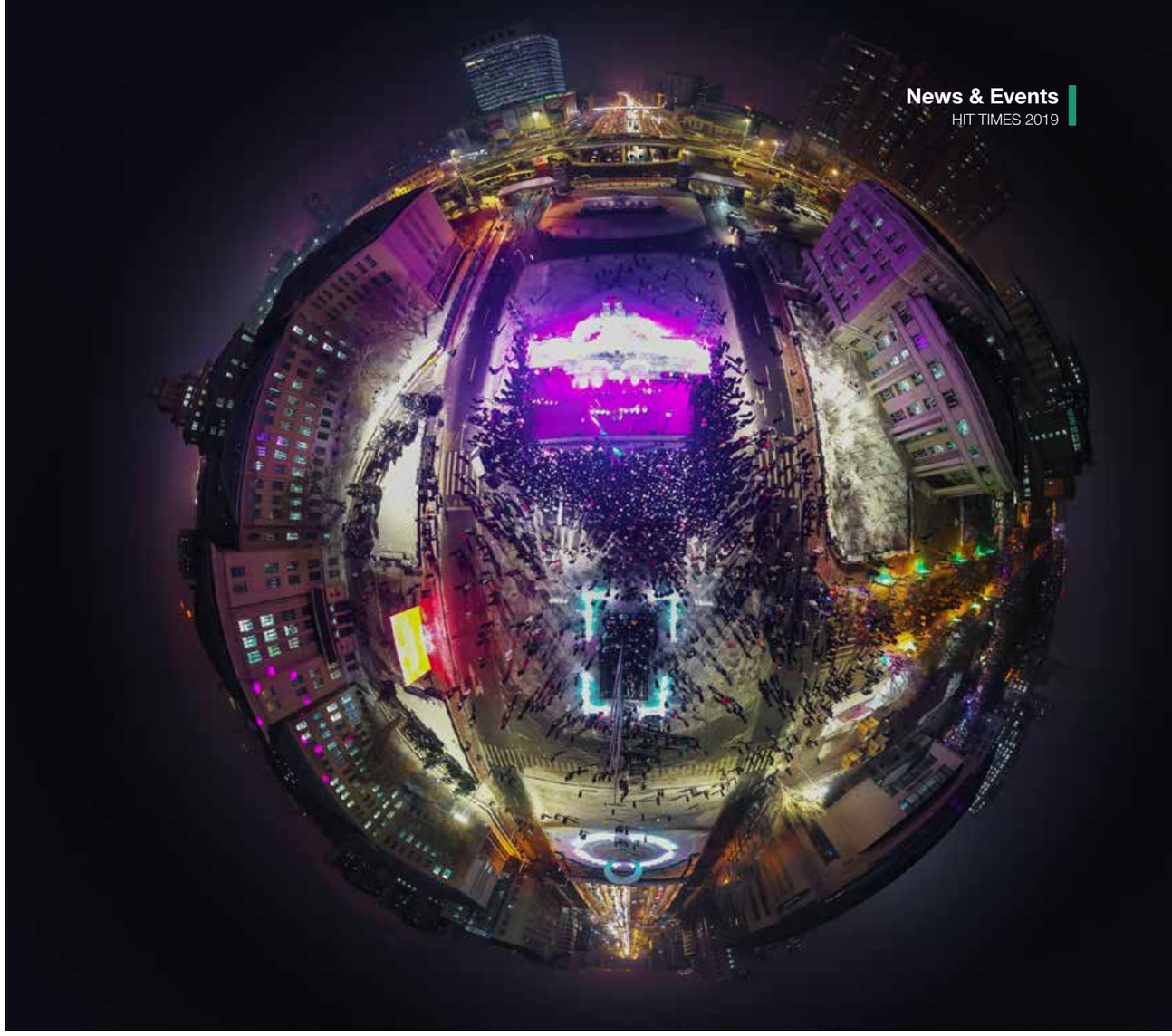
Project between St. Petersburg State University and HIT. He hoped that China and Russia would speed up the construction of joint campuses, devote themselves to building a scientific and educational park where Chinese and Russian culture, history and modern culture blend, and set an example of Sino-Russian cooperation in running schools, scientific and technological innovation, and cultural exchange.

Mr. Zhou also attended the China-Russia University President Round-Table Forum at St. Petersburg State University of Economics, and delivered a keynote speech titled "Seizing the Strategic Opportunity of the 'Silk Road Economic Zone' and 'Eurasian Economic Union', Creating a New Era of Scientific and Cultural Exchange between Chinese and Russian Universities–Cooperation and Prospects." Based on the Sino-Russian comprehensive strategic partnership of cooperation in the new era and the "2020-2021 Sino-Russian Year of Scientific and Technological Innovation," he introduced the characteristics and achievements of the cooperation and put forward some suggestions on the future cooperation. The presidents and vice-presidents of 21 universities from China and Russia attended the forum and made speeches.

HIT PRESIDENT ZHOU YU ATTENDED THE ANNUAL PRESIDENTS MEETING ON BUILDING WORLD-CLASS UNIVERSITIES & ANNUAL PRESIDENTS FORUM

From October 18 to 19, the Annual Presidents Meeting on Building World-Class Universities & the Annual Presidents Forum was held at Xi'an Jiaotong University. HIT President Zhou Yu attended the meeting and made a speech titled "Working Together, Promoting Tradition, Exploring the HIT Plan of Building World-Class University."

The speech was started by two textbooks *Electrotechnics* and *Theoretical Mechanics*, which have been reprinted many times. He summarized HIT's four inspirations of building world-class university with Chinese characteristics: Based on national conditions, Masters leading, collaborative research, reform and innovation. He pointed out that the effect of excellent teams is crucial at HIT, such as the team of new radar system led by Academician Liu Yongtan, the team of special composite materials led by Academician Du Shanyi, the team of micro-satellite technology research, the molecular biology innovation team, etc. In the future, we should give full play to the advantages and characteristics of excellent teams and explore how to build a world-class university.



HIT CAMPUS ICE AND SNOW FESTIVAL

On the evening of December 19, people crowded in the plaza of the Electric Machinery Building to witness the opening of the 3rd HIT Campus Ice & Snow Festival. Xiong Sihao, HIT Deputy Party Secretary, officially opened the festival. HIT Vice Party Secretary, HIT Vice President An Shi, and HIT Secretary of Commission for Discipline Inspection Yao Limin gave awards to the winners. HIT Propaganda Minister Wu Songquan chaired the opening ceremony.

From December 17 to 19, the International University Ice Sculpture Competition, organized by the School of Architecture, was held at HIT. More than 30 teams participated in the competition, including from the China University of Science and Technology, Xi'an Jiaotong University, Dalian University of Technology, Harbin Institute of Technology, etc. After 3-day competition, “National Rhythm of Auspicious Spirit” from Harbin University of Technology won the 1st prize.

Alongside the pedestrian street, there were many delicacies, such as skewers, sugar coated haws, sweet dumplings, cakes and so on. With passion, people played "ice and snow culture" games, such as grabbing ice cubes, ice and snow balls, three snowmen, ice and snow clocks, etc. This year's Ice and Snow Festival made teachers and students feel the unique charm of ice & snow culture and ice & snow sports at home. ■

HIT VICE PRESIDENT DING XUEMEI ATTENDED THE EXCELLENT ALLIANCE OF UNIVERSITIES PRESIDENTS FORUM

On October 11th, the "Excellent Alliance of Universities Presidents Forum 2019 -- the 10th Presidents Association" was held at Chongqing University.

As the rotating presidency, Southeast University made an annual summary from 2018 to 2019. During the meeting, the participants discussed the "Working Plan for 2019-2020" made by Chongqing University, which is going to have the rotating presidency in 2020, and elected Beijing Institute of Technology as the rotating presidency in 2021. Vice President of Harbin Institute of Technology (HIT) Ding Xuemei attended the forum and gave a keynote speech titled "The Development and Innovation of First-Class Talent Cultivation System."

She introduced the construction and reform of the talent training system at HIT based on analysing the implications and challenges of higher education development at first. She pointed out that higher education must conform to the trend of social and economic development with reform and development, and must adapt to and serve the sustainable development of economy, society, environment and individuals. In the future, HIT will adhere to Chinese President Xi Jinping's new era socialism with Chinese characteristics and cultivate more talent for building our country. ■

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HIT VICE PRESIDENT CAO XIBIN MET WITH THE EXECUTIVE EDITOR OF THE INTERNATIONAL JOURNAL SCIENCE

On July 1st, HIT Vice President Cao Xibin met with Monica M. Bradford, the Executive Editor of the international journal *Science*. He introduced the history, characteristic disciplines, research fields and development plan of our university, and he hoped to carry out extensive exchange and cooperation with the *Science*. Mrs. Bradford highly appraised the tradition of running a school and the strength of scientific research of our university and introduced the related situation of the journal in detail. She also communicated about the cooperation issues with the Editorial Department of the *Journal of Harbin Institute of Technology*.

At the invitation of the Editorial Department of the *Journal of Harbin Institute of Technology*, Monica M. Bradford made a report titled "Publishing with the Science Family of Journals." Editor-in-chief and Professor Leng Jinsong chaired the seminar.

After receiving a bachelor's degree in chemistry from St. Mary's College, Monica Bradford has been working at the journal *Science* for 30 years. At present, she is the Executive Editor of the international journal *Science*. In this position she oversees the peer-review and selection of manuscripts and the copyediting and proofreading process for three journals: *Science*, *Science Signaling* and *Science Translational Medicine*. Monica has been heavily involved in the development of *Science*'s web and new media offerings. During the report, she introduced the journal *Science*, *Science Advances, Science Translational Medicine, Science Signaling, Science Immunology* and *Science Robotics* in terms of publishing mode, review process, new media construction, data policy, etc. She also introduced the characteristics of the articles accepted by *Science*: it should greatly promote scientific understanding, present important innovative data and concepts, answer the questions widely concerned by the scientific community and have a high degree of scientific knowledge.

In the questioning process, teachers and students actively asked questions about article publishing, scientific research, journal influence, publishing process, etc. Monica gave detailed and patient answers to everyone's questions. The report successfully finished with warm applause from teachers and students. In this activity, teachers and students from our university interacted closely with the executive editor of a top international journal, broadened their horizons, and obtained more references about doing cutting-edge scientific research, publishing high-quality articles, improving the publishing quality, etc.

HIT PRESIDENT'S ASSISTANT FAN FENG VISITED EUROPE

News & Events
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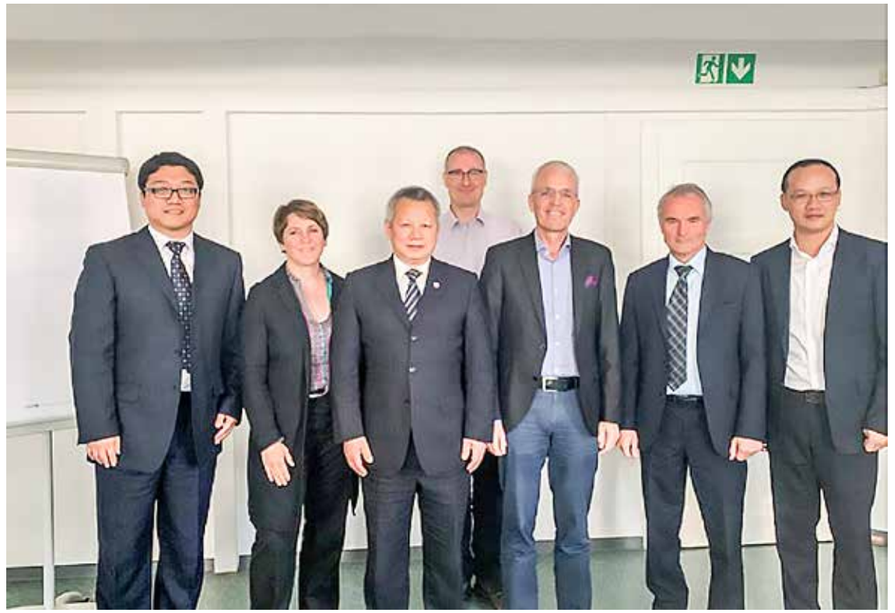

From October 22 to 23, HIT President's Assistant Fan Feng attended the 10th Workshop of the Sino-European Engineering Education Platform and made a keynote speech at Eindhoven University of Technology.

He had in-depth exchange with nearly 60 representatives on sharing engineering education experience and planning, industrial innovation in the context of China and Europe, education internationalization and other issues.

On October 25, Professor Fan Feng visited Dresden University of Technology and met with officers from the Department of Civil Engineering, School of Civil and Environmental Engineering, Department of Electrical and Computer Engineering and the school office. They hoped to use the scientific research cooperation between relevant professors of civil engineering as an opportunity to carry out in-depth exchange between teachers and students at the inter-school level. They also discussed the cooperation with St. Petersburg National University to build a tripartite cooperation.

WORLD HAND IN HAND GALA 2019

On the evening of December 1, the World Hand in Hand Gala 2019 was held at the auditorium of the HIT Main Building. HIT President's Assistant Fan Feng, Counsellor of the Russian Federation in Harbin Vladimir Oshchepkov and other guests attended the party and watched the performance together with more than 1,000 faculty and students.

This year is the 10th year of the gala. Since 2010, the World Hand in Hand Gala is held annually to provide an opportunity for international students to experience Chinese culture and show their personalities. It also promotes the friendship between China and the world. The gala has become an important platform for the display and exchange of Chinese and foreign cultures.

No matter where you are from
We are family together
Hand in hand
We are one
One world, one dream
Creating brilliance together










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