

# CURRICULUM VITAE



## PERSONAL INFORMATION

Name: **Tommaso RUGGERI**

- Place and Date of Birth: Messina, 31/07/1947
- Website: <http://www.dm.unibo.it/~ruggeri/>
- Email: [tommaso.ruggeri@unibo.it](mailto:tommaso.ruggeri@unibo.it)
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## CURRENT POSITION AND AFFILIATION

- Emeritus Professor - Bologna University – since 1 November 2019.

## PREVIOUS POSITIONS

- Alma Mater Professor - Bologna University 2017-2019.
- Full Professor of Mathematical Physics. Department of Mathematics – University of Bologna 1980- 2017.
- Associate professor of Rational Mechanics –University of Bologna 1973-1980.
- Assistant professor of Rational Mechanics –University of Messina 1969-1973.

## EDUCATION

- Master's Degree in Theoretical Physics (magna cum laude) 30/06/1969 – University of Messina.

## RESEARCH ACTIVITY

Professor T. Ruggeri is the author of 270 publications, including four books and three monographs. His research is devoted to several Mathematical Physics problems, particularly non-linear wave propagation problems for hyperbolic systems and thermo-mechanics of continuous media (classical and relativistic).

In the first field, he produced original contributions concerning the symmetrization of hyperbolic systems of balance laws with convex entropy density and concerning the theory of acceleration and

shock waves. He has been one of the founders of modern Extended Thermodynamics in non-equilibrium thermodynamics and has written, jointly with Ingo Mueller, the well-known book *Rational Extended Thermodynamics* (Springer-Verlag, 1993 and 1998). Recent papers are devoted to a new approach to non-equilibrium thermodynamics, including polyatomic gases, moderate dense gases, and the mixture of gases. These results are collected in the recent books written jointly with Masaru Sugiyama *Rational Extended Thermodynamics Beyond Monatomic Gas* (Springer, 2015) and *Classical and Relativistic Rational Extended Thermodynamics of Gases* (Springer -2021).

## AWARDS

- 1975: Bonavera prize of the *Accademia delle Scienze di Torino* for the best research in Applied Mathematics for young researchers.
- 1999: Elected Member of the National *Accademia dei Lincei* in the Mechanics and Applied Mathematics class.
- 2001: Elected Member of the *Accademia Peloritana dei Pericolanti* di Messina.
- 2003: Invited to give the opening lecture to the *Unione Matematica Italiana Meeting* (Milan).
- 2007: An international scientific conference was dedicated to him for his 60 years – *Waves and Stability in Continuous Media* (WASCOM 2007) Scicli (Ragusa) organized by INdAM.
- 2009: Elected Member of the *Accademia delle Scienze dell'Istituto di Bologna* (Accademico Benedettino).
- 2009: Invited to give the inaugural lecture (prolusione) to the *922 Academic Year of the University of Bologna*.
- 2012: Prize of KIWANIS International - Messina Nuovo Ionio.
- 2013: Elected National Member of the *Accademia di Scienze Fisiche e Matematiche di Napoli*.
- 2016: Elected National Member of *Accademia Nazionale dei Lincei*.
- 2017: An international scientific conference was dedicated to him for his 70 years in Bologna *Waves and Stability in Continuous Media* (WASCOM 2017) organized by Alma Mater Studiorum University of Bologna and the Mathematical Department of Bologna University with the participation of the Rector of Bologna University Prof. Francesco Ubertini ([http://www.dm.unibo.it/~ruggeri/Wascom\\_Ruggeri.pdf](http://www.dm.unibo.it/~ruggeri/Wascom_Ruggeri.pdf)).
- 2018: International Prize Angiola Gili e Cataldo Agostinelli of the *Accademia di Torino per la Meccanica Pura o Fisica Matematica classica* (<https://www.accademiadelle scienze.it/article/3a14a347-f486-49fc-88cd-b7b00a97df44> ).
- 2019: Emeritus Professor of the University of Bologna.
- 2021: Elected Member of *Academia Europaea*.
- 2021: Elected Member of the *European Academy of Sciences and Arts*.
- 2021: Elected Member of the *European Academy of Sciences* (EurASc).

## **VISITING POSITIONS AND LECTURES:**

He was invited to deliver lectures at several international meetings and in many Universities as Visiting Professor. In particular:

### **Visiting:**

Providence – Brown University - (1984) invited by Prof. Dafermos;  
Paris (1984) invited by Prof. Y. Choquet-Bruhat;  
Berlin (1985, 1990, 1996, 2000) invited by Prof. Mueller;  
Marseille (2001, 2003, 2007, 2008, 2009,2010) invited by Prof. H. Gouin;  
Novi-Sad (2003, 2005, 2006, 2009, 2015,2023) invited by Proff. S. Simic and T. Atanacković;  
Nagoya (2003, 2006, 2008, 2010,2013, 2014, 2015, 2016) invited by Prof. M. Sugiyama;  
Hong Kong (2007, 2008, 2010, 2011) invited by Prof. C. Rogers;  
Sydney (2007) invited by Prof. C. Rogers;  
Birmingham (2008), invited by Prof. Y. D. Shikhmurzaev;  
Chengdu (2008, 2010, 2011) invited by Prof. N. Zhao;  
Mumbai (2009) invited by Prof. V. D. Sharma;  
Stanford (2010), invited by Prof. Tai Ping Liu;  
Shanghai – Fudan University (2011) invited by Prof. Zongmin Wu;  
Kitakiushu (2015, 2017,2019,2020) invited by Prof. Shigheru Taniguchi;  
Yokoyama (2017,2018), invited by Dr. Takashi Arima;  
Seul (2014, 2016,2018, 2019,2024), invited by Prof. Seung-Yeal Ha;  
Shanghai (2017) invited by Prof. Jie Lou;  
Wuhan (2019), invited by Prof. Qinghua Xiao;  
Taipei (2019) invited by Prof. Tai Ping Liu;  
Tomakomai (2019, 2020) invited by Prof. Takashi Arima;  
Konstanz (2022,2024) invited by Prof. Heinrich Freistühler;  
Aachen (2023) invited by Dr. Ferdinand Thein.  
Belgrade (2023) invited by the Serbian Academy of Science.  
Hangzhou – Westlake University (2024) invited by Prof. Marco Amabili.

### **General invited Lectures:**

University of Texas (Dallas 1980), WASCOM Meetings (from 1981 to 2023 every 2 years), Oberwolfach (1981, 1983, 1985, 1992, 1996, 1997, 2000, 2002, 2004, 2008), Collège de France (Paris 1984), Brown University (1984), Minnesota (Minneapolis 1984), Toronto (1984), Accademia dei Lincei (1984, 1986, 1988, 2016), Berlin (1985, 1998, 2005, 2011), Paris (1988, 1993), Warsaw (1990, 1996, 2005), IPERXX Meetings (from 1993 to 2011), Blauberun (2000), Seehim-Jugenheim (2001), Potsdam (2001), Heidelbergh (2001), Marseille (2001, 2003, 2007, 2008, 2013), Nagoya (2003, 2006, 2008, 2010, 2013), Kyoto (2003, 2006, 2013), Osaka (2004, 2006), Xi'an (2004), Shanghai (2005, 2017), Clermont-Ferrand (2005), Belgrade (2006,2023), Koriyama (2006), Tallin (2006), China-Italian Meeting (2004, 2006, 2008, 2010, 2012, 2014,2016), Dublin (2006), Hong Kong (2007, 2010), Sydney (2007), Melbourne (2007), Birmingham (2008), Chongqing (2008), Chengdu (2008, 2010), Palic (2009), Mumbai (2009), Stanford (2010), Providence (Brown University) (2011), Taipei (2012,2020), JAXA –Sagamihara (2013), IHES- Bures-sur-Yvette (Paris, 2014, 2015), Fukuoka (2014, 2017,2020), Novi Sad (2014, 2015), Seoul (2014, 2015, 2016,2024), Rio de Janeiro (2016),

Beijing (2017), Wuhan (2019), Taipei (2019), Levico (2021), CIRM-Luminy-Marseille (2022), Magdeburg (2022), Aachen (2023), Belgrade (2023), Hangzhou (2024).

### **ORGANISATION OF CONFERENCES, WORKSHOPS, SCHOOLS:**

Wascom series Conferences, GNFM Ravello Summer Schools (every year since 2000), and many others (see web page).

### **MEMBER OF THE EDITORIAL BOARD:**

Member of the Editorial Board of Cont. Mech. and Thermody. (Springer) 1989-2006.  
Member of the Editorial Board of Rend. Lincei, Matematica ed Applicazioni (EMS) since 1999.  
Member of the Editorial Board of Ricerche di Matematica (Springer) since 2005.  
Member of the Editorial Board of BUMI 2007-2013.  
Member of the Editorial Board of International Journal of Non-Linear Mechanics (Elsevier) 2012-2018 and since 2022.  
Member of the Editorial Board of Springer INdAM Series 2013-2020.  
Member of the Editorial Board of Le Matematiche since 2016.  
Member of the Editorial Board of Entropy since 2020.  
Member of the Editorial Board of Philosophical Transactions of the Royal Society A since 2023.

### **JOURNAL REFEREEING:**

Journal of Mathematical Physics, Physical Review A, Physical Review B, Physical Review E; Physics of Fluids, Physics Letters, Physica D: Nonlinear Phenomena; Annals of Physics; Journal of Physics A: Mathematical and General; Nuovo Cimento; Meccanica; Annali Matematica Pura ed Applicata; Bollettino Unione Matematica Italiana; Rendiconti del Circolo Matematico di Palermo; Wave Motion; Zeitschrift fur Angewandte Mathematik und Physik, International Journal of Mathematics and Mathematical Sciences; Acta Mechanica, Journal of Mathematical Analysis and Applications, Archive Rational Mechanics and Analysis, Continuum Mechanics and Thermodynamics, Comptes Rendus de l'Académie des Sciences; International Journal of Engineering Science; Applied Mathematical Modelling; Applied Mathematics and Computation; Chaos, Solitons & Fractals; Computers and Mathematics with Applications; European Journal of Mechanics - B/Fluids; International Journal of Engineering Science; International Journal of Non-Linear Mechanics; Physics Letters A. Mechanics Research Communications, ...

### **AFFILIATIONS**

He is a member of:

ISIMM (International Society for the Interaction of Mechanics and Mathematics);  
G.N.F.M. (Gruppo Nazionale Fisica Matematica);  
UMI (Unione Matematica Italiana);

and in the past also, of:

I.N.F.N. (Istituto Nazionale di Fisica Nucleare);  
AMS (American Mathematical Society);  
SIMAI (Società Italiana Matematica Applicazioni Industriali).

### **PREVIOUS STUDENTS:**

A. Strumia (Full Professor, Bari), A. Muracchini (Full Professor, Bologna), A. Mentrelli (Associate Professor, Bologna), L. Seccia (Associate Professor, Bologna), F. Brini (Associate Professor, Bologna).

*Foreign Post Doc:* J. Au (Industrial Engineer - Berlin), S. Simic (Full Professor – Novi Sad), J. Lou (Full Professor - Shanghai), N. Zhao (Full Professor- Chengdu), S. Taniguchi (Associate Professor - Kitakyushu), T. Arima (Associate Professor - Tomakomai), J. Kim (Assistant Professor - Seoul).

### **TEACHING ACTIVITY**

- He taught *Meccanica Razionale* for 44 years since 1973 for students of the Engineering Faculty (Ingegneria Civile, Edile, Ambientale, Chimica e Nucleare);
- Since 2006 he has been teaching *Mathematical Physics* for Laurea Magistrale in Ingegneria Civile. Course that also holds now for substitute teaching.
- Moreover, he taught several Courses of *Istituzioni di Matematica* for students of Political Sciences and students of Engineering in Forlì and Reggio Emilia.
- He taught several courses for PHD students in Mathematics and Civil Engineering and he belonged for several years to the Mathematical PHD Scientific Committee in Bologna. Moreover, he taught a course of PHD for Mathematical students at Messina University.
- Abroad, he taught some PHD courses in Nagoya (Japan 2001) and in Seoul (South Korea 2016, 2019).
- He was a supervisor for the thesis preparation of 5 Master's students and 1 Ph.D. student, a supervisor of 2 Research Grants Students, and was in the committee for PhD examination (4, India, 1 Serbia, 1 Repubblica Ceca).
- He wrote several teaching books:
  - 1) *Appunti di Meccanica Razionale. Richiami di Calcolo Vettoriale e Matriciale*. Pitagora ed. Bologna (1989).
  - 2) *Laboratorio di Matematica - Primo Corso: Temi di Analisi Matematica e Software Matematico*. In Coll. con S. Matarasso. Progetto Leonardo - Esculapio Ed. Bologna (1991).
  - 3) *Laboratorio di Meccanica Razionale: Esercizi, Temi di esame e Software Matematico*. In Coll. con A. Muracchini, L. Seccia. Progetto Leonardo - Esculapio Ed. Bologna (1991).
  - 4) *Labmat2 - Dispense di Analisi Matematica II con l'utilizzo di Software Matematico. Vol. 1: Funzioni reali di più variabili; Applicazioni nel campo complesso; Programma Tredimw.exe*. In Coll. con S. Matarasso. Progetto Leonardo - Esculapio Ed. Bologna (1993).
  - 5) *Labmat2 -*

*Dispense di Analisi Matematica II con l'utilizzo di Software Matematico. Vol. 5: Elementi di Equazioni differenziali con esempi di dinamica del punto; Temi di esame di Analisi II; Programma Diff2w.exe; Worksheets con Maple V. In Coll. con S. Matarasso. Progetto Leonardo - Esculapio Ed. Bologna (1994). 6) Analisi Matematica 2: Calcolo Differenziale. In Coll. con S. Matarasso. Progetto Leonardo - Esculapio Ed. Bologna (1995). 7) Esercizi e temi d'esame di Meccanica Razionale. In Coll. con A. Muracchini, L. Seccia. Progetto Leonardo - Esculapio Ed. Bologna (1997). 8) Esercitazioni di Meccanica Razionale con Matlab e Simulink. In Coll. con A. Muracchini, L. Seccia. Progetto Leonardo - Esculapio Ed. Bologna (1997). 9) Esercizi e temi d'esame di Meccanica Razionale per i Corsi di Laurea Triennale in Ingegneria. In Coll. con A. Muracchini, L. Seccia. Progetto Leonardo - Ed. Esculapio, Bologna (2005). 10) Meccanica Razionale per l'Ingegneria. In Coll. con P. Biscari, G. Saccomandi, M. Vianello. Ed. Monduzzi, Bologna (2005). 11) Introduzione alla Termomeccanica dei Continui. Ed. Monduzzi (2007). 12) Meccanica Razionale. In Coll. con P. Biscari, G. Saccomandi, M. Vianello. Ed. Springer, Milano (2013, 2015, 2016, 2022). 13) Introduzione alla Termomeccanica dei Continui. II Edizione Riveduta e Corretta Ed. Monduzzi, Milano (2013, 2016). 14) Esercizi e temi d'esame di Meccanica Razionale. In Coll. Con F. Brini, A. Muracchini e L. Seccia (2019).*

### THIRD MISSION

Prof. Ruggeri was Coordinator of the Bologna Section of “*I Lincei per una Didattica nelle Scuole: Una rete Nazionale*” organized by the Accademia Nazionale dei Lincei. Moreover, he gave several conferences for scientific dissemination: Festival della Scienza (Palermo 2009); Meeting “Nuovi Licei: l’Avventura della Conoscenza” – Fondazione San Paolo con il Patrocinio del MIUR (Roma 2010); Summer School “Fisica in Moto” (Ducati – Bologna 2011); Conferenze della Facoltà di Ingegneria (Bologna 2011); VIII Festival Scienza e Filosofia (Foligno 2017).

### MANAGING ACTIVITY

- Director of Summer School of GNFM (Ravello) 2018 - present
- President of the Scientific Committee of the Istituto Nazionale di Alta Matematica (INdAM) 2011-2019.
- Director of the National Group of Mathematical Physics (GNFM) of INdAM 2000-2017.
- Member of the Scientific Committee of the Istituto Nazionale di Alta Matematica (INdAM) 2000-2019.
- Scientific Coordinator of the Alma Mater Research Center on Applied Mathematics AM<sup>2</sup> of the University of Bologna 2014-2021.
- Member of the Executive Committee of the International Society for the Interaction of Mechanics and Mathematics (ISIMM) 2008-2014.
- Vice Dean of Engineering Faculty of University of Bologna 1995-2001.
- Director of Interdepartmental Research Centre of Applied Mathematics (CIRAM) 1991-1997.

## BIBLIOMETRIC INDEXES

In Google Scholar Citations <http://scholar.google.it/citations?user=u9bjPgYAAAAJ&hl=it>  
Prof. Ruggeri has 9468 citations with h-index = 46, i10-index = 147 and he belongs to the Top Italian Scientist web site <https://www.topitalianscientists.org/#>

According to Researchgate: [https://www.researchgate.net/profile/Tommaso\\_Ruggeri](https://www.researchgate.net/profile/Tommaso_Ruggeri)  
he has a score higher than 98% of ReserchGate Members with h-index=44.

## SCIENTIFIC PRODUCTION AND PUBLICATIONS

Professor T. Ruggeri is the author of 270 publications, among which there are 4 books and 3 monographs.

**PRINCIPAL PUBLICATIONS** (for the full bibliography see:  
([http://www.dm.unibo.it/~ruggeri/bib\\_ruggeri2.html](http://www.dm.unibo.it/~ruggeri/bib_ruggeri2.html) ).

### Books:

- 1) MUELLER I., RUGGERI T., “*Extended Thermodynamics*”, *Springer Tracts in Natural Philosophy*, 37, pp.: 231, (1993).
- 2) MUELLER I., RUGGERI T., “*Rational Extended Thermodynamics*”, *Springer Tracts in Natural Philosophy*, 37, pp.: 397, ISBN/ISSN: 0-387-98373-2, (1998).
- 3) RUGGERI T., SUGIYAMA M., “*Rational Extended Thermodynamics beyond Monatomic Gas*”. *Springer*, pp.: 376, ISBN 978-3-319-13340-9, (2015).
- 4) RUGGERI T., SUGIYAMA M., “*Classical and Relativistic Rational Extended Thermodynamics of Gases*”. *Springer*, pp.: 669, ISBN 978-3-030-59143-4 (2021).

### Chapters in Books:

- 5) RUGGERI T., “*Extended Relativistic Thermodynamics* in the book of Yvonne Choquet Bruhat *General Relativity and the Einstein equations*, pp. 334-340. *Oxford Univ. Press*, ISBN 978-0-19-923072-3, (2009).
- 6) RUGGERI T., “*Some recent results on multi-temperature mixture of fluids*”, in *Continuous Media with Microstructure*, B. Albers (Ed.), *Springer –Verlag* ISBN: 978-3-642-11444-1, (2010).
- 7) RUGGERI T., *Molecular Extended Thermodynamics of a Rarefied Polyatomic Gas*. in *Trends un Applications of Mathematics to Mechanics*, Editors E. Rocca, U. Stefanelli, L. Truskinoski and A. Visintin. *Springer INDAM Series* 27, 265-287 (2018).
- 8) RUGGERI T., TANIGUCHI, S., *Shock Waves in Hyperbolic Systems of Non-Equilibrium Thermodynamics*. In: Berezovski A., Soomere T. (eds) *Applied Wave Mathematics II. Mathematics of Planet Earth*, vol 6. *Springer, Cham* ISBN: 978-3-030-29950-7, (2019).

- 9) RUGGERI T., **Multiscale Phenomena in Continuum Mechanics: Mesoscopic Justification on Rational Extended Thermodynamics of Gases with Internal Structure**. P. Giovine, P.M. Mariano, G. Mortara (eds.) in Views on Multiscale Modelling of Granular Materials in Advances in Continuum Mechanics , Volume 44, ISBN 978-3-030-49267-0 - Birkhauser. (2020).
- 10) RUGGERI T., **Godunov Symmetric Systems and Rational Extended Thermodynamics**. In Continuum Mechanics, Applied Mathematics and Scientific Computing: Godunov's Legacy. Demidenko, G.V., Romenski, E., Toro, E., Dumbser, M. (Eds.). ISBN 978-3-030-38869-0 (2020).

**Papers:**

- 11) BOILLAT G., RUGGERI T., **"Reflection and transmission of discontinuity waves through a shock wave. General theory including also the case of characteristic shocks"**, Proceedings of the Royal Soc. of Edinburgh. 83-A, pp.17-24 (1979).
- 12) BOILLAT G., RUGGERI T., **"On the evolution law of the weak discontinuities for hyperbolic quasi-linear systems"**, Wave Motion, 1, (2), pp.149-152 (1979).
- 13) RUGGERI T., STRUMIA A., **"Main field and convex covariant density for quasi-linear hyperbolic systems. Relativistic fluid dynamics"**, Ann. Inst. H. Poincare', 34 , pp.: 19 , (1981).
- 14) CHOQUET BRUHAT Y., RUGGERI T., **"Hyperbolicity of the 3+1 system of Einstein equations"**, Comm. Math. Phys., 89, pp. 269-275 (1983).
- 15) LIU I.S., MÜLLER I., RUGGERI T., **"Relativistic thermodynamics of Gases"**, Annals of Physics, 169 (1), pp. 191-219 (1986).
- 16) RUGGERI T., **"Galilean Invariance and Entropy Principle for Systems of Balance Laws. The Structure of the Extended Thermodynamics"**, Continuum Mech. Thermodyn., 1, pp. 17 (1989).
- 17) BOILLAT G., RUGGERI T., **"Hyperbolic Principal Subsystems: Entropy Convexity and Subcharacteristic Conditions"**, Arch. Rat. Mech. Anal., 137, pp.: 15 (1997).
- 18) BOILLAT G., RUGGERI T., **"Moment Equations in the Kinetic Theory of Gases and Wave Velocities"**, Continuum Mech. Thermodyn. 9, pp. 205-212 (1997).
- 19) LIU T.P., RUGGERI T., **"Entropy Production and Admissibility of Shocks"**, Acta Math. Appl. Sin., Engl. Ser. 19 (1), pp. 1-12 (2003).
- 20) RUGGERI T., SERRE D., **"Stability of Constant Equilibrium State for Dissipative Balance Laws System with a Convex Entropy"**, Quart. of Appl. Math., 62 (1), pp. 163-179 (2004).
- 21) RUGGERI T., SIMIC S., **"On the hyperbolic system of a mixture of Eulerian Fluids: A comparison between single- and multi-temperature models"**, Math. Meth. Appl. Sci., 30, pp. 827-849 (2007).
- 22) RUGGERI T., SIMIC S., **"Average Temperature and Maxwellian Iteration in Multi-temperature Mixtures of Fluids"**. Phys. Rev. E 80, 026317 (2009).
- 23) RUGGERI T., LOU J., **"Heat Conduction in multi-temperature mixture of fluids: the role of the average temperature"**. Phys. Letters A 373, 3052 (2009).
- 24) LOU J., RUGGERI T., **"The dynamics of spreading and immune strategies of sexually transmitted diseases on scale-free network"**. Journal of Mathematical Analysis and Applications 365 (1), 210-219 (2010).



- 25) ZHAO N., MENTRELLI A., RUGGERI, T., and SUGIYAMA M., **Admissible shock waves and shock-induced phase transitions in a van der Waals fluid**. *Physics of Fluids* **23**, 086101-1, 086101-18 (2011).
- 26) ARIMA T., TANIGUCHI S., RUGGERI, T. and SUGIYAMA M., “**Extended thermodynamics of dense gases**”, *Continuum Mech. Thermodyn.* **24**, 271-292 (2012).
- 27) ARIMA T., TANIGUCHI S., RUGGERI T. and SUGIYAMA M., “**Thermodynamic theory of the shock wave structure in a rarefied polyatomic gas: Beyond the Bethe-Teller theory**”. *Phys. Rev. E* **89**, 013025, (2014).
- 28) ARIMA T., RUGGERI T., SUGIYAMA M. “**Rational Extended Thermodynamics of a Rarefied Polyatomic Gas with Molecular Relaxation Processes**”. *Phys Rev E* **96**, 042143-1, 042143-20 (2017).
- 29) PENNISI S., RUGGERI T. “**Ultrarelativistic limit of a Rarefied Gas with Internal Structure**”. *Journal of Mathematical Physics*, **59**, 043102 (2018).
- 30) HA S-Y., RUGGERI T. “**A thermodynamic consistent model for emergent behavior in Flocks and comparison with multitemperature mixture of fluids**”. *Arch. Rational Mech. Anal.* **223**, 1397–1425 (2018).
- 31) HA S-Y., KIM, J., RUGGERI T., “**Emergent behaviors of Thermodynamic Cucker-Smale Particles**” *SIAM J. Math Anal.* **50**, (3), 3092-3121, (2018).
- 32) HA S-Y., KIM, J., RUGGERI T., “**From the relativistic mixture of gases to the relativistic thermomechanical Cucker-Smale flocking**”. *Arch. Rational Mech. Anal.* **235** 1661–1706 (2020).
- 33) PENNISI S., RUGGERI T. **Classical Limit of Relativistic Moments Associated with Boltzmann–Chernikov Equation: Optimal Choice of Moments in Classical Theory**”. *Journal of Statistical Physics* **179**, 231–246 (2020).
- 34) HA, S-Y., PARK H., RUGGERI, T., SHIM W. “**Emergent Behaviors of Thermodynamic Kuramoto Ensemble On A Ring Lattice**”. *Journal of Statistical Physics* **181**, 917–943 (2020).
- 35) RUGGERI T, XIAO Q., ZHAO H., **Nonlinear Waves in Relativistic Gases of Massive Particles with Synge Energy**, *Arch. Rational Mech. Anal.* **239**, 1061-1109 (2021).
- 36) HA S-Y., KANG M., PARK H., RUGGERI T., SHIM W. “**Emergent behaviors of the continuum Thermodynamic Kuramoto model in a large coupling regime**” *Journal of Differential Equations* **300**, 519-564, (2021).
- 37) HWANG, B-H., YUN, S-B. RUGGERI, T., “**On a Relativistic BGK model for polyatomic Gases near equilibrium**”. *Siam J Math. Anal.* **54**, (3) 2906-2947 (2022).
- 38) RUGGERI, T., TANIGUCHI S., “**A Complete Classification of Sub-Shocks in a Shock Structure of a Binary Mixture of Eulerian Gases with Different Degrees of Freedom of a Molecule**. *Phys. Fluids* 066116, (2022).
- 39) ARIMA T., CARRISI, M. C., PENNISI, S., RUGGERI T., **Classical Limit of a New Hierarchy of Moments and Qualitative Analysis**, *Partial Differ. Equ. Appl.* **3**, 39 (2022).
- 40) ARIMA T., MENTRELLI A., RUGGERI T., **Navier-Stokes-Fourier equations as a parabolic limit of a general hyperbolic system of rational extended thermodynamics**, *Int. Journ. of non-linear Mech.* **151**, 104379 (2023).
- 41) RUGGERI T., **Eckart equations, Maxwellian iteration and Relativistic Causal Theories of Divergence type**. *Phil. Trans. R. Soc. A* **381**: 20220371. <https://doi.org/10.1098/rsta.2022.0371> (2023).
- 42) RUGGERI T., **A Nonlinear approach to Viscoelasticity via Rational Extended Thermodynamics**. *International Journal of Non–Linear Mechanics* **160** 104658 (2024).