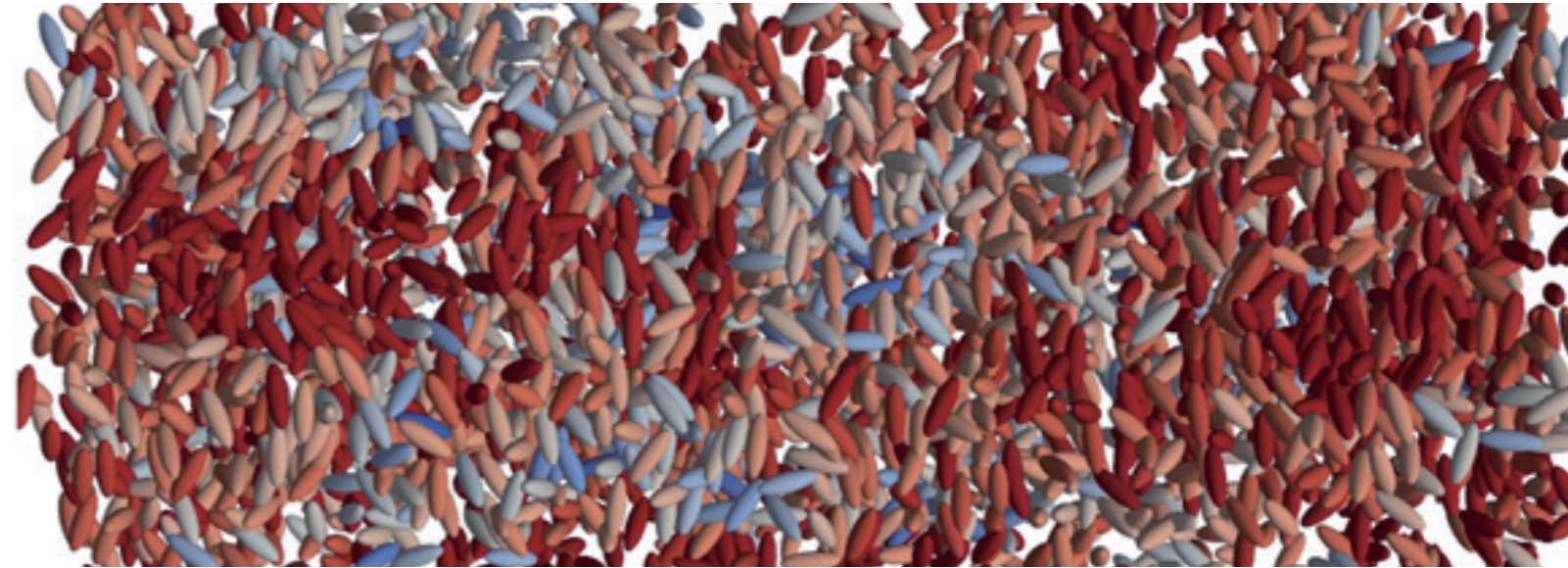




2nd BICTAM-CISM Symposium on Dispersed Multiphase Flows: from Measuring to Modeling



SPONSORS

-  International Union of Theoretical and Applied Mechanics
-  National Natural Science Foundation of China
-  Beijing International Center for Theoretical and Applied Mechanics
-  International Centre for Mechanical Sciences
-  School of Aerospace Engineering, Tsinghua University
-  Chinese Society of Theoretical and Applied Mechanics
-  Institute of Mechanics, Chinese Academy of Sciences



Beijing, China
August 21-23, 2024

<http://caliope.dem.uniud.it/BICTAM-CISM-2024/>

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WELCOME

On behalf of the Scientific and Organizing Committee we welcome you to the 2nd BICTAM-CISM Symposium on Dispersed Multiphase Flows.

The Symposium aims to bring together experts from Europe and China in the complementary fields of physics, applied mathematics, chemistry and engineering to present and discuss the progress in research, development, standards, and applications of the topics related to dispersed multiphase flows. The symposium promotes the exchange of new ideas, results and techniques by bringing together graduate students, post-doctoral researchers, faculty and researchers across university and industry. To ensure a long-lasting scientific interaction between the two communities, the Symposium is organized every 2 years, alternating between China and Europe. The first edition of the Symposium was organized in 2021 by BICTAM and Tsinghua University and, due to the Covid-19 pandemic, was held in a virtual mode. For this 2nd edition, we have received 62 abstracts from 11 countries and we look forward to the 7 keynote lectures and 55 regular lectures.

Welcome to the BICTAM-CISM Symposium on Dispersed Multiphase Flows: from Measuring to Modeling!



Guowei He, BICTAM & Chinese Academy of Sciences
Chairman of the Symposium



Cristian Marchioli, CISM & University of Udine
Chairman of the Symposium

August 20, 2024

SYMPOSIUM SCOPE

The Symposium will provide the opportunity to compare and contrast the different available approaches, giving a global overview of the most significant advancements in the field. It will also serve the purpose of identifying the main open issues and research pathways that the community should focus on in the future. To these aims the Symposium will bring together internationally renowned scientists from all horizons (analytical, numerical, and experimental) to foster scientific exchange and strengthen interdisciplinary work among engineers, applied mathematicians, and physicists through invited keynote lectures and contributed talks.

TOPICS

The Symposium spans a wide selection of topics in the broad area of dispersed multiphase flows. The focus will be on generic aspects and physics of particulate flows (both viscous and turbulent), be it computer simulations, laboratory or field measurements, and theoretical studies. Among the topics to be included are: dynamics of particles, bubbles, and droplets in free and wall-bounded turbulence; rigid and deformable particle suspensions; non-Newtonian dispersed flows; reactive dispersed flows; advances in measurement and simulation techniques; modeling of collision, agglomeration and fragmentation/breakage phenomena.

ORGANIZATION

The Symposium's physical venue will be the Grand Skylight Catic Hotel Beijing (18 Beichen East Road, near the bird's nest, the main venue of Beijing Olympic Games).

ACKNOWLEDGEMENT



The Symposium is sponsored by IUTAM, BICTAM, CISM, CSTAM, University of Udine, Institute of Mechanics of Chinese Academy of Sciences and School of Aerospace Engineering of Tsinghua University. The financial support by NSFC Basic Science Center Program (11988102, 12388101) is acknowledged.

SYMPOSIUM CHAIRMEN

- Professor Guowei He, BICTAM & Chinese Academy of Sciences (CHN)
- Professor Cristian Marchioli, CISM & University of Udine (ITA)

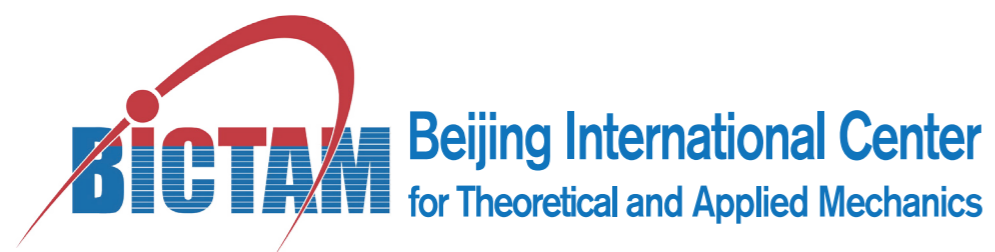
SCIENTIFIC COMMITTEE

- Professor Eric Climent (co-chair), IMFT Toulouse (FRA)
- Professor Xiqiao Feng, Tsinghua University (CHN)
- Professor Weixi Huang, Tsinghua University (CHN)
- Professor Guodong Jin, Chinese Academy of Sciences (CHN)
- Professor Jianzhong Lin, Zhejiang University (CHN)
- Professor Kun Luo, Zhejiang University (CHN)
- Professor Cristian Marchioli, University of Udine (ITA)
- Professor Ming-Jiu Ni, University of Chinese Academy of Sciences (CHN)
- Professor Christian Poelma, TU Delft (NED)
- Professor Wolfgang Schröder, RWTH Aachen (GER)
- Professor Alfredo Soldati, TU Wien (AUT)
- Professor Chao Sun (co-chair), Tsinghua University (CHN)
- Professor Markus Uhlmann, Karlsruhe Institute of Technology (GER)
- Professor Bing Wang, Tsinghua University (CHN)
- Professor Lianping Wang, Southern University of Science and Technology (CHN)
- Professor Chunxiao Xu, Tsinghua University (CHN)
- Professor Haitao Xu, Tsinghua University (CHN)
- Professor Zhaosheng Yu, Zhejiang University (CHN)
- Professor Lihao Zhao, Tsinghua University (CHN)
- Professor Xiaojing Zheng, Xidian University (CHN)

LOCAL ORGANIZING COMMITTEE

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- Mr. Jie Chen, Beijing Int. Center for Theoretical and Applied Mechanics (BICTAM)
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- Professor Weixi Huang, Tsinghua University
- Professor Guodong Jin, Institute of Mechanics & Chinese Academy of Sciences
- Ms. Yanan Tang, Beijing Int. Center for Theoretical and Applied Mechanics (BICTAM)
- Professor Bing Wang, Tsinghua University
- Professor Chunxiao Xu, Tsinghua University
- Professor Lihao Zhao (chair), Tsinghua University

ABOUT BICTAM

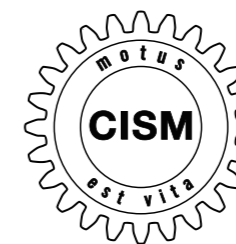


BICTAM, Beijing International Center for Theoretical and Applied Mechanics, is an international non-governmental scientific organization, which is affiliated to IUTAM (2010) and operates in close collaboration with the ISC Regional Office for Asia and the Pacific.

Founded in 2007, the Center's aim is to promote the development and application of mechanics in Asia and the Pacific region, which include improving the academic capability to conduct cutting-edge researches, advancing the ability to apply mechanics to solving problems of concern to society, promoting engagements with policy-makers and government, and creating a platform for academic exchange and communication. The Principal activity of the Center is to organize conferences, symposia, workshops and summer schools for subjects falling within the field of theoretical and applied mechanics and interdisciplinary branches that meet the needs of the countries in Asia and the Pacific, and in turn further the participation and contribution of the region to the global mechanics community.

The Center consists of the Scientific Committee with a Standing Committee and a Local Organizing Committee in Beijing which is an administrative organization in charge of various activities in China in relation to the Center. Located in the Institute of Mechanics, Chinese Academy of Sciences, the Center is supported by CSTAM and sponsored by the Institute of Mechanics, Chinese Academy of Sciences, Tsinghua University, Peking University, Xi'an JiaoTong University, Zhe Jiang University, Dalian University of Technology, Beijing Institute of Technology and Lanzhou University.

ABOUT CISM



CISM, International Centre for Mechanical Sciences, is a non-profit organization, founded in 1968 to favour the exchange and application of the most advanced knowledge in the mechanical sciences, in interdisciplinary fields like robotics, biomechanics, environmental engineering and in other fields (mathematics, information and system theory, operations research, computer science, artificial intelligence).

Located in the Palazzo del Torso in the center of Udine, the Centre's facilities include two lecture halls, seating 80 and 50 persons respectively, several smaller lecture and meeting rooms, the Centre's library, secretariat, administrative and technical offices. CISM is international in both scope and structure: the Scientific Council, rectors, lecturers are selected from among the acknowledged authorities in their respective fields the world over.

The principal activity of the Centre is the organization of courses, seminars, workshops, symposia, and conferences to present the state of the art of these sciences to researchers. It also provides advanced training for engineers operating in industry. The typical course or seminar is brief, but intense: a week of 35/40 lectures, more or less the equivalent of a university course of one semester. Participants pay a registration fee, but young researchers who cannot be supported by their own institutions may apply for scholarships. The CISM Guest House, adjacent to the Centre, provides accommodations for lecturers and a limited number of participants.

The Centre has produced over 600 texts, the collected lectures of CISM courses, together with the proceedings of symposia hosted by CISM, and selected monographs, published by Springer-Verlag in the joint CISM-Springer series. The journal *Mechanics Research Communications* was founded by CISM in collaboration with Pergamon Press, Oxford in 1973.

CISM is funded by the Friuli Venezia Giulia Region, the Province of Udine and the city of Udine, and local public and private institutions, together with other member institutions in Europe and abroad. CISM also benefited from financial support from National Research Council of Italy (CNR) and UNESCO.

Since the foundation of the University of Udine in 1978 a close relationship has formally developed between the two institutions, especially with regard to their cooperation in scientific and educational matters. In 2015 an agreement has been signed with the aim of promoting joint strategic activities toward a larger internationalization of the University.

CISM also has consolidated working relations with AIMETA, ECCOMAS, ERCOFTAC, EUROMECH, GAMM, IFToMM and IUTAM.

In 2006 CISM-Lab has been established as a CISM's spin-off with the aim of providing solutions to problems arising both in local administrations and in technologically advanced industries.

SYMPOSIUM VENUE

Grand Skylight Catic Hotel 北京凯迪克格兰云天大酒店

Address: 18 Beichen East Road, near the bird's nest, the main venue of Beijing Olympic Games

(北京朝阳区-北辰东路18号) Phone: +86-10-84971188

From Beijing Capital International Airport (Terminal 1-3) to Grand Skylight Catic Hotel

- **Taxi:** the cost is around 80 – 120 CNY. If you arrive after 23:00, a taxi ride is the only choice.
- **Subway (06:20–22:50, 29 CNY):** Take Airport Express Line (Subway), transfer at Sanyuanqiao Station(三元桥) to Line 10. Then transfer at Beitucheng Station(北土城) to Line 8. The destination is Olympic Sports Center Station(奥体中心), which is a 20-minute walk to the Grand Skylight Catic Hotel.



Walking routine from Olympic Sports Center Station to Grand Skylight Catic Hotel.

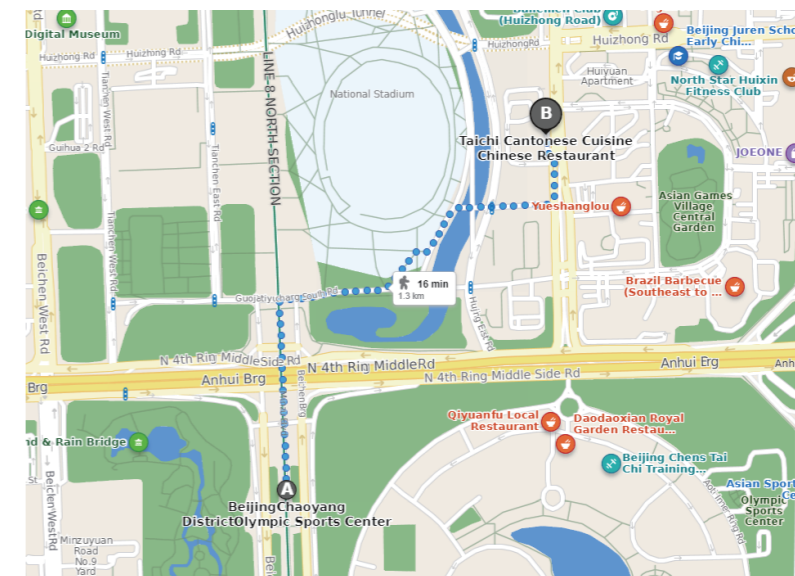
- **Airport Shuttle Bus (06:00– 22:30 the next day, 22 CNY):** Shuttle Gongzhufen Line, transfer at Xibahe Station (i.e. Xi Ba He Station) (西坝河) to Bus No. 419. The destination is Guo Jia Ti Yu Chang Dong (Niao Chao) (国家体育场东(鸟巢)), which is a 1-minute walk to the Grand Skylight Catic Hotel.



Walking routine from Guo Jia Ti Yu Chang Dong (Niao Chao) to Grand Skylight Catic Hotel.

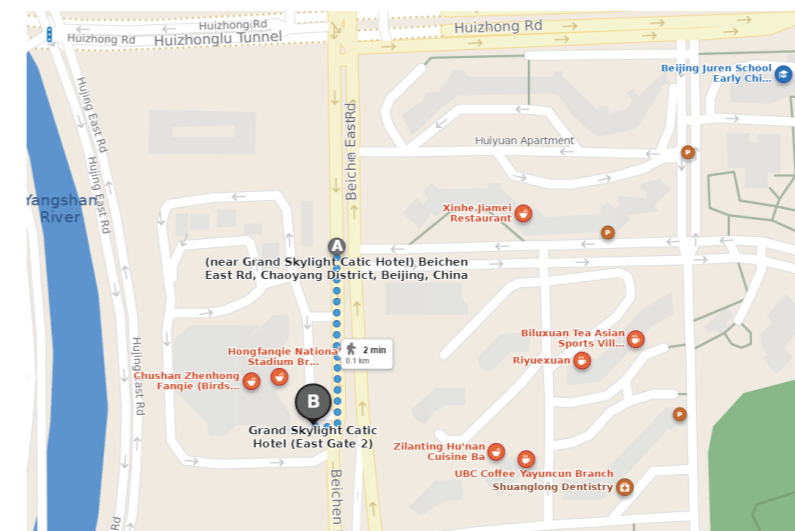
From Beijing Daxing International Airport to Grand Skylight Catic Hotel:

- **Taxi:** the cost is around 160 – 250 CNY. If you arrive after 23:00, a taxi ride is the only choice.
- **Subway (06:20–23:00, 40 CNY):** Take Daxing Airport Express Line (Subway), transfer at Caoqiao Station to Line 19. Then transfer at Mudanyuan Station to Line 10. Then transfer at Beitucheng Station to Line 8. The destination is Olympic Sports Center Station, which is a 20-minute walk to the Grand Skylight Catic Hotel.



Walking routine from Olympic Sports Center Station to Grand Skylight Catic Hotel.

- **Airport Shuttle Bus (06:00– 22:30 the next day, 16 CNY):** Shuttle Zhongguancun Line, transfer at Hangtian Bridge Station (i.e. Space Bridge North Station) to Bus No. 645. The destination is Guo Jia Ti Yu Chang Dong (Niao Chao), which is a 1-minute walk to the Grand Skylight Catic Hotel.



Walking routine from Guo Jia Ti Yu Chang Dong (Niao Chao) to Grand Skylight Catic Hotel.

For more detailed information of Beijing transportation, you may refer to the following website: <https://www.travelchinaguide.com/cityguides/beijing/transportation/>

WEATHER

· During the symposium, the temperature in Beijing is around 21~30°C (71.6~86°F). It is recommended to wear lightweight, breathable clothing like cotton shirts and shorts, along with sun protection.

CONTACT

If you have any questions, please contact with the conference staffs below:

- Mr. Jianda Huang, +86 18475945249, hjd22@mails.tsinghua.edu.cn
- Dr. Zhiwen Cui, +86 13261678025, cuizhiwen@tsinghua.edu.cn
- Dr. Yansong Li, +86 13261657186, lys2023@mail.tsinghua.edu.cn
- Prof. Lihao Zhao, +86 18832921983, zhaolihao@tsinghua.edu.cn

KEYNOTES

Keynote 1:



Professor Anke Lindner

University Paris Diderot (FRA)

Dynamics of rigid and flexible fibers in complex microfluidic geometries: Transport properties and sorting potential

Abstract:

The understanding of microparticle transport in flows and complex environments is crucial in numerous situations, ranging from the depollution of oceans to prevention of bacterial contamination in soils or medical devices, to the development of particle separation devices or even motion inside the cell nucleus. In most cases, microparticles have complex shapes and properties, as elongated or more complex forms, they can be deformable and, in some cases, self-propelled. These particles are interacting with flows in complex environments such as bifurcating networks, porous media or the crowded interior of the cell. Particle transport then results from the interplay between particle properties, flow properties and the characteristics of the environment. Here we will investigate the transport of rigid and flexible fibers in complex flows using microfluidic model systems. We will address the question of individual particle dynamics and morphologies for polymeric fibers and actin filaments and will discuss their role in particle transport. The knowledge gained in simple flows will be used to address transport in the presence of obstacles or though pillar arrays. We will address the sorting potential of such geometries.

Bio:

Dr. Anke Lindner joined the physics department of Paris University (UP) in 2013 and holds a full professor position there. Her research group is part of the PMMH lab at the Ecole Supérieure de Physique et Chimie (ESPCI), Paris. She obtained her PhD from the Ecole Normale Supérieure, Paris in 2000 and her Habilitation from the University Pierre et Marie Curie (UPMC), Paris in 2010. She has worked as a consultant at McKinsey and Company, in Zurich, Switzerland and as a Post-Doctoral fellow at ESPCI. Prior to her appointment at UPD held an assistant professor position at UPMC. Her research topics can best be summarized as "flow of complex fluids" and cover a broad range of topics from rheology of granular or active suspensions, to adhesion of soft viscoelastic materials and more recently fluid structure interactions, microfluidics and elastic flow instabilities. She has published more than 80 papers in journals as PRL, Phys. Fluids, PNAS, Lab on Chip, JNNFM, Nature Communication, Nature Physics, Advanced Science or JFM. She has recently been awarded an ERC consolidator grant and became a fellow of the APS-DFD in November 2019. She is the Maurice Couette award winner of the French Society of Rheology 2019 and received the silver medal of the CNRS in 2021.

Keynote 2:**Professor Stéphane Zaleski**

Sorbonne University (FRA)

Numerical prediction of mass transfer**Abstract:**

We describe an experimental model of a bottom blown metallurgical ladle, and its simulation; The main observable of interest is the amount of mass transferred from the metal phase (modelled by water) to the slag phase (modelled by oil). The direct numerical computation is impossible in practice because of the huge values of the Peclet number, and a subgrid model is employed instead. Agreement between simulation and experiment is within experimental error.

Bio:

Stéphane Zaleski is Professor of Mechanics at Sorbonne Université and member of the Institut Jean Le Rond d'Alembert. After early years at the Physics Laboratory of ENS Paris where he obtained his PhD under the supervision of Yves Pomeau, and at the applied math group of MIT he joined the Mechanics group at University of Paris 6. He investigates numerical methods for multiphase flows with applications to atomization, cavitation, porous media flow, nucleate boiling, hydrometallurgy, moving contact lines and droplet impact, including several variants of the Volume of Fluid method, the Edge Based Interface Tracking method, the Diffuse Interface method and Molecular Dynamics. He has written several computer codes for the simulation of two-phase flow including PARIS Simulator (with D. Fuster, Y. Ling, R. Scardovelli and G. Tryggvason) and is an active user of the basillisk platform. Recently he applied these techniques to the study of Covid-19 airborne transmission by micron-sized droplets. He is Associate Editor of the Journal of Computational Physics and of Computers & Fluids. He leads the ERC-Advanced project TRUFLOW on mass transfer at large Schmidt numbers and is a member of L'Institut universitaire de France.

Keynote 3:**Professor Lianping Wang**

SUSTech (CHN)

**Turbulence modulation by suspended finite-sized solid particles:
DNS and theoretical modeling****Abstract:**

The presence of a dispersed phase substantially modifies small-scale fluid turbulence. However, there has not been a comprehensive mechanistically-based understanding to predict turbulence modulation. In the first part of this talk, I will discuss interface-resolved simulation results pertaining to turbulence modulation by suspended finite-sized solid particles. In the second part, I will review our recent efforts towards physics-based modeling of turbulence modulation, focusing on the modulation of turbulent kinetic energy by dispersed particles. The model is formulated based on an energy flux balance equation at an inertial-sub-range scale which naturally incorporates five relevant system governing parameters: ratio of particle size to Kolmogorov length, particle-to-fluid density ratio, particle volume fraction, relative mean slip velocity, and local flow Reynolds number. The model predictions are then compared to results from particle-resolved simulations and high-fidelity experiments. The capabilities of the model in explaining augmentation and attenuation of turbulence by the dispersed particles as well as the decay rate of turbulent kinetic energy will be discussed.

Bio:

Professor Lian-Ping Wang received a Bachelor degree in Mechanics from Zhejiang University, Hangzhou, China in 1984, and a PhD in Mechanical Engineering from Washington State University in 1990. He was then a Visiting Research Associate at Brown University from 1990 to 1992, after which he was a Research Associate at Pennsylvania State University from 1992 to 1994 and an Assistant Professor of Mechanical Engineering at the University of Delaware from 1994 to 2001. He became an Associate Professor in 2001 and a Professor in 2010 at the University of Delaware. In 2017, he was appointed a Chaired Professor at Southern University of Science and Technology, China. Prof. Wang's areas of expertise include computational fluid dynamics, turbulence, particle-laden flow and immiscible multiphase flow.

Keynote 4:**Professor Ping Wang**

Lanzhou University (CHN)

A direct numerical simulation of two-phase flow on an erodible particle bed based on the particle-point model and four-way coupling**Abstract:**

Eulerian-Lagrangian simulations of particle-laden flows have been used in many physical contexts. Although particle-resolved simulation is the best since it accurately resolves particle-fluid interaction, it is still challenging so far due to the vast computation cost. A strategy based on the particle-point model, with acceptable accuracy and computing efficiency, is crucial for simulating multiphase flow. We proposed correct drag and lift force models for saltating particles according to the data from a particle-resolved simulation of two-phase turbulent flow over an erodible bed. Accordingly, we perform a direct numerical simulation of this two-phase flow based on the particle-point method, with the back-coupling from the particles to the fluid and particle-particle collisions. The force models and the schemes of the force calculation are compared with the particle-resolved direct numerical simulation under the same physical parameters. The results highlight the sensibility of particle transport at different locations to the force models.

Bio:

Dr. Ping Wang received a PhD in Engineering Mechanics from Lanzhou University in 2011. After that, she visited Tsinghua University and worked at Korea Advanced Institute of Science and Technology (KAIST) as a postdoctoral Researcher. Wang's areas of expertise includes wall turbulence, particle-laden flow and environmental fluid mechanics (sand/dust storm). In recent years, she has published over 40 peer-reviewed articles in top journals of fluid mechanics and geoscience, including Journal of Fluid Mechanics, Physical Review Fluid, Physics of Fluids, Journal of Geophysical Research and International Journal of Multiphase Flow.

Keynote 5 :**Professor Francesco Picano**

University of Padova (ITA)

Effects of particle inertia in turbulent suspensions**Abstract:**

Particle suspensions are frequently present both in industrial applications and in environmental flows. In these contexts the typical flow velocity and length-scale are so high that inertial effects critically determine the dynamics with the flow usually turbulent. Dealing with suspensions constituted by small particles dispersed in a carrier fluid flow, the inertia at particle scale can play a non-trivial role altering the mass and momentum transfer with respect to a single-phase flow. Results from different datasets based on particle-resolved interface DNS will be considered in order to highlight these aspects. In particular, the effects of different particle features, such as size, density and concentration, will be discussed during the talk.

Bio:

Presently, full professor of Fluid Dynamics at University of Padova since 2022, before associate professor in 2015 and Assistant in 2014. Since 2000, coordinator of the PhD program in Sciences, Technologies and Measurements for Space at University of Padova. The academic career started with a PhD in Theoretical and Applied Mechanics at Sapienza University of Roma, Italy in 2007, followed by some years as post-docs at Sapienza University and at Royal Institute of Technology, KTH Mechanics, Stockholm, Sweden, in 2011-2014. Research interests widen on physics and modeling of multiphase flows with application to environmental and industrial suspensions, turbulent sprays and respiratory flows. Fluid-structure interactions problems with solid breakup have been considered with application to porous media fracturing. More recently, phenomenologies and models concerning complex and/or compressible turbulent flows have been investigated. Around 80 papers have been published in high-quality journals on these topics. PI of many international computational projects and member of the Domain Panel - Engineering, Mathematics and Computer Sciences of EuroHPC for European computational research grants.

Keynote 6:



Professor Jianfu Zhao

Chinese Academy of Sciences (CHN)

Bubble dynamics in different gravity conditions aboard China space station

Abstract:

Due to large difference between the densities of the liquid and its vapour, bubble dynamics, flow structures and heat transfer performances of boiling in different gravity conditions exhibit distinct difference. With the help of simulated gravity environment provided by the Variable Gravity Science Rack (VGR) in Wentian Lab Module of China Space Station (CSS), the project vgBOILING-CSS, one of the first batch of two scientific experiment tasks utilizing VGR, has been performed for studying bubble dynamics and heat transfer during nucleate pool boiling in the past one and a half years in a wide range of gravity levels from 2g to the background microgravity environment aboard CSS. An abnormal gravity scaling behaviour, namely an enhancement rather than deterioration of the heat transfer with the decreasing gravity, has been discovered in the nucleate pool boiling region with low heat flux. The largest diameter of growing isolated bubble attached on the heating surface is found to be inversely proportional to gravity and proportional to the 0.3-power of the superheating. Different interactions among bubbles are also observed. The preliminary findings obtained from the project vgBOILING-CSS will be reported and discussed in the present lecture.

The present research is supported financially by the National Key R&D Program of China under the grant of 2022YFF0503502 and China Manned Space Engineering Program under the grant of YYWT0601EXP18.

Bio:

Dr. Jian-Fu ZHAO received a Bachelor's degree in Engineering Mechanics from Tsinghua University, Beijing, China in 1990, a Master's degree in Fluid Mechanics from Zhejiang University, Hangzhou, China in 1993, and a PhD in Hydraulics and River Dynamics from Wuhan University of Hydraulic and Electric Engineering (presently Wuhan University), Wuhan, China in 1998. He was then a Post-Doc Researcher at National Microgravity Laboratory/CAS, Institute of Mechanics, Chinese Academy of Sciences from 1998 to 2000, after which he was an Assistant Professor (from September 2000), an Associate Professor (from January 2001), and a Full Professor (from January 2005) at Institute of Mechanics, Chinese Academy of Sciences. He was also a Visiting Professor from 2008 to 2014 at Sun Yat-sen University, Guangzhou, China. Presently, He is also a Professor at the University of the Chinese Academy of Sciences, Beijing, China, and a Visiting Professor at Qingdao University, Qingdao, China. His main research interests are focused the fundamental research of microgravity fluid physics and R&D of multiphase thermal fluid systems for space applications. He has involved closely in more than ten space experiment projects aboard the China Space Station Tiangong, the Chinese recoverable satellites RS-22/SJ-8/SJ-10, the Russia Space Station MIR, and so on. He also participated in related R&D tasks in several space missions such as Chang' E-3, Chang' E-5, SJ-20, and so on. He is currently a member of the Executive Council of the Chinese Society of Space Researches (CSSR) and the Chair-person of the Committee of Microgravity Science and Applied Research/CSSR, a member of Committees of relevant National Societies including CSTAM, CSET, CSA, CSM, and CSHST, an Associate Editor of Microgravity Science and Technology (Springer), and a member of 6 journals' editorial boards.

Keynote 7 (Closing Lecture):



Professor Sivaramakrishnan Balachandar

University of Florida (USA)

Recent innovations in Euler-Lagrange simulations of dispersed multiphase flows

Abstract:

Euler-Lagrange (EL) technique has been widely employed for solving particle, droplet, and bubble-laden flows. Since flow around the individual particles is not resolved, the accuracy of the technique depends on the fidelity of the point-particle force laws used. The main focus of this talk is the use of emerging machine learning techniques along with physical insight into the averaging processes involved in the EL technique can yield closures that recover fully-resolved-like accuracy at orders of magnitude lower cost.

Bio:

S. "Bala" Balachandar got his undergraduate degree in Mechanical Engineering at the Indian Institute of Technology, Madras in 1983 and his MS and PhD in Applied Mathematics and Engineering at Brown University in 1985 and 1989. From 1990 to 2005 he was at the University of Illinois, Urbana-Champaign, in the Department of Theoretical and Applied Mechanics. From 2005 to 2011 he served as the Chairman of the Department of Mechanical and Aerospace Engineering at the University of Florida. Currently he is a distinguished professor at the University of Florida. He is the Newton C. Ebaugh Professor of Mechanical & Aerospace Engineering and the Director of College of Engineering Institute for Computational Engineering. Bala received the Francois Naftali Frenkiel Award from American Physical Society (APS) Division of Fluid Dynamics (DFD) in 1996 and the Arnold O. Beckman Award and the University Scholar Award from University of Illinois. He is Fellow of ASME and the American Physical Society Division of Fluid Dynamics. He was the recipient of ASME Freeman Fellowship Award (2017), Gad Hetsroni Senior Researcher Award from ICMF (2019), Outstanding Alumnus Award from the Indian Institute of Technology, Madras (2019), Outstanding Doctoral Mentoring Award from the University of Florida (2020), Thermal Fluids Engineering Award from the American Society of Thermal Fluids Engineers (2022), and University of Florida Research Foundation Professorship (2023). He is currently the co-editor-in-chief of the International Journal of Multiphase Flow and an associate editor of the Theoretical and Computational Fluid Dynamics.

SYMPOSIUM SCHEDULE-AT-A-GLANCE

Tuesday, August 20, 2024

Hotel Lobby (1F)

Time	
14:00-21:00	Registration
18:30-20:00	Dinner Buffet (Cafe Elysee, 1F)

Wednesday, August 21, 2024

Yun Hai Ballroom (3F)

Time	
9:00-9:15	Opening Remarks
9:15-10:00	Keynote Lecture: Anke Lindner, FRA
10:00-10:30	Session #1-1 (regular talks)
10:30-10:45	Coffee Break
10:45-12:00	Session #1-2 (regular talks)
12:00-13:30	Lunch Buffet (Cafe Elysee, 1F)
13:30-14:15	Keynote Lecture: Stephane Zaleski, FRA
14:15-15:45	Session #2-1 (regular talks)
15:45-16:00	Coffee Break
16:00-18:00	Session #2-2 (regular talks)
18:30-20:00	Banquet (Tai Chi Chinese Restaurant, 2F)

Thursday, August 22, 2024

Yun Hai Ballroom (3F)

Time	
9:00-9:45	Keynote Lecture: Lianping Wang, CHN
9:45-10:30	Session #3-1 (regular talks)
10:30-10:45	Coffee Break
10:45-12:00	Session #3-2 (regular talks)
12:00-13:30	Lunch Buffet (Cafe Elysee, 1F)
13:30-14:15	Keynote Lecture: Ping Wang, CHN
14:15-15:45	Session #4-1 (regular talks)
15:45-16:00	Coffee Break
16:00-18:00	Session #4-2 (regular talks)
18:30-20:00	Dinner Buffet (Cafe Elysee, 1F)

Friday, August 23, 2024

Yun Hai Ballroom (3F)

Time	
9:00-9:45	Keynote Lecture: Francesco Picano, ITA
9:45-10:30	Session #5-1 (regular talks)
10:30-10:45	Coffee Break
10:45-12:00	Session #5-2 (regular talks)
12:00-13:30	Lunch Buffet (Cafe Elysee, 1F)
13:30-14:15	Keynote Lecture: Jianfu Zhao, CHN
14:15-15:15	Session #6 (regular talks)
15:15-15:30	Coffee Break
15:30-16:15	Closing Lecture: Sivaramakrishnan Balachandar, USA
16:15-16:30	Closing Remarks

SYMPOSIUM PROGRAM

Wednesday August 21st (Day 1)

	Time		CHAIRPERSON
	From	To	
	9:00	9:15	Opening Remarks by Guowei He and Cristian Marchioli Lihao Zhao
Keynote #1	9:15	10:00	Dynamics of rigid and flexible fibers in complex microfluidic geometries: Transport properties and sorting potential Keynote Speaker: Anke Lindner, University Paris Diderot, France
Session #1-1	10:00	10:15	#1: Dynamics of slender flexible fibers in turbulent channel flow Cristian Marchioli and Davide Di Giusto University of Udine, Italy
	10:15	10:30	#2: Rotation and orientation of inertialess spheroidal particles in turbulent channel flow with spanwise rotation Dongming Chen ¹ , Wenjun Yuan ¹ , Lihao Zhao ² and Helge I. Andersson ³ 1. Xi'an Jiaotong University, China; 2. Tsinghua University, China; 3. Norwegian University of Science and Technology, Norway
	10:30	10:45	Coffee Break
Session #1-2	10:45	11:00	#3: Angular dynamics of spheroids in shear flows: Effect of slip-induced fluid-inertial torque Zhiwen Cui , Huancong Liu, Jingran Qiu and Lihao Zhao Tsinghua University, China
	11:00	11:15	#4: Numerical investigations of turbulent channel flows laden with motion-restricted oblate spheroids Yang Li ¹ , Zhenhua Xia ² and Lianping Wang ³ 1. Hangzhou Dianzi University, China; 2. Zhejiang University, China; 3. Southern University of Science and Technology, China
	11:15	11:30	#5: Hydrodynamic behavior of inertial elongated microswimmers in a horizontal channel Yuxiang Ying and Jianzhong Lin Zhejiang University, China
	11:30	11:45	#6: Spatial distribution and swimming behaviour of calanoid copepods in stratified fluids: linear vs. stair-stepping stratifications Ye Tian , Wanting Cheng, Binyang Lyu and Shi-Di Huang Southern University of Science and Technology, China
	11:45	12:00	#7: Chemical reactions and multi-species diffusion inside an irregular-shaped porous particle Shuaiqi Zhao , Rui Zhang, Han Huang, Kunpeng Zhao and Bofeng Bai Xi'an Jiaotong University, China
	12:00	13:30	Lunch Buffet (Cafe Elysee, 1F)
Keynote #2	13:30	14:15	Numerical prediction of mass transfer Keynote Speaker: Stéphane Zaleski, Sorbonne University, France
Session #2-1	14:15	14:30	#8: Mechanism of superswell formation in geophysical two-phase thermal convection Xiaoju Zhu ¹ , Yixiao Wang ² , Hao-Ran Liu ³ and Lihao Zhao ² 1. Max Planck Institute for Solar System Research, Germany; 2. Tsinghua University, China; 3. University of Science and Technology of China, China
	14:30	14:45	#9: Enhanced heat transport led by dispersing particles in thermal vibrational convection under microgravity Kai Leong Chong , Xili Guo, Jian-Zhao Wu, Bofu Wang and Quan Zhou Shanghai University, China
	14:45	15:00	#10: Flow dynamics and heat transport in turbulent Rayleigh-Bénard convection laden with neutrally buoyant balls Xianfei Zhang , Pei-Jiang Qin, Shi-Di Huang, Zhen-yuan Gao and Xu Zhu Southern University of Science and Technology of China, China
	15:00	15:15	#11: An efficient multi-direct forcing IBM for simulating heat and mass transfer processes of particle-laden flows Wei Chen , Shuai Wang, Kun Luo and Jianren Fan Zhejiang University, China

Wednesday August 21st (Day 1)

	Time		CHAIRPERSON	
	From	To		
	15:15	15:30	#12: Numerical simulation of biomass pyrolysis by using thermally-thick models Xiaoke Ku Zhejiang University, China	
	15:30	15:45	#13: Particle transport and deposition in wall-sheared thermal turbulence Ao Xu , Ben-Rui Xu and Heng-Dong Xi Northwestern Polytechnical University, China	
	15:45	16:00	Coffee Break	
Session #2-2	16:00	16:15	#14: Wall-bounded thermal turbulent convection driven by heat-releasing point particles Yantao Yang ¹ and Yuhang Du ² 1. Peking University, China; 2. Hebei University of Technology, China	
	16:15	16:30	#15: Artificial neural network modeling small-scale turbulence for large-eddy simulation of heavy particles in flows Guodong Jin and Jiangtao Tan Institute of Mechanics, CAS, China	
	16:30	16:45	#16: Combining structural and stochastic approaches to reproduce particle preferential concentration and intermittency in the Large Eddy Simulation of two-way coupled particle-laden flows Clément Morhain ¹ , Roxane Letournel ² , Ludovic Goudenège ³ , Marc Massot ⁴ and Aymeric Vié ¹ 1. EM2C laboratory - CentraleSupélec, France; 2. SAFRAN Tech, France; 3. Fédération de Mathématiques de CentraleSupélec, France; 4. CMAP, Polytechnique, France	
	16:45	17:00	#17: Modeling dispersed phase transport in Wall-Model Large-Eddy-Simulations Xiang'En Kong , Federico Dalla Barba and Francesco Picano University of Padova, Italy	
	17:00	17:15	#18: Large-eddy simulation of particle-laden isotropic turbulence using machine-learned subgrid-scale model Qi Wu ¹ , Yaomin Zhao ¹ , Yipeng Shi ¹ and Shiyi Chen ² 1. Peking University, China; 2. Southern University of Science and Technology, China	
	17:15	17:30	#19: Sub-grid modelling of filtered drag force for clustered particle-laden flows based on interface-resolved simulation data Yan Xia and Zhaosheng Yu Zhejiang University, China	
	17:30	17:45	#20: Sinking characteristics of submillimeter microplastic fibers in still water and rising bubbly flow: from measuring to modeling Fangyang Yuan and Hao Yuan Jiangnan University, China	
	17:45	18:00	#21: A three-layer model for the dam-break flow of particulate suspensions driven by sedimentation Andrea Bondesan ¹ , Laurence Girolami ^{2,3} , François James ⁴ and Loïc Rousseau ² 1. Università di Parma, Italy; 2. Université de Tours, France; 3. INRAE--Aix-Marseille Université, France; 4. Université d'Orléans, France	
		18:30	20:00	Banquet (Tai Chi Chinese Restaurant,2F)
				Zhaosheng Yu
			Xiaoke Ku	

Thursday August 22nd (Day 2)

	Time		CHAIRPERSON
	From	To	
Keynote #3	9:00	9:45	Turbulence modulation by suspended finite-sized solid particles: DNS and theoretical modeling Keynote Speaker: Lianping Wang, SUSTech, China
Session #3-1	9:45	10:00	#22: Localization-delocalization transition for light particles in turbulence Ziqi Wang , Xander de Wit and Federico Toschi Eindhoven University of Technology, Netherlands
	10:00	10:15	#23: Caustics formation and collision of inertial particles in homogeneous and isotropic turbulence Yu Zhang , Jiangtao Tan, Guodong Jin and Haitao Xu Tsinghua University, China
	9:30	10:30	#24: The role of turbulence and biofouling in the vertical transport of buoyant microplastic particles in the Ocean. Thisal Mandula Sugathapala ¹ , Tonia Capuano ² , Luca Brandt ³ , Daniele Iudicone ⁴ and Gaetano Sardina ¹ 1. Chalmers University of Technology, Sweden; 2. University of Dhaka, Bangladesh; 3. Politecnico di Torino, Italy; 4. Stazione Zoologica Anton Dohrn, Naples, Italy
	10:30	10:45	Coffee Break
Session #3-2	10:45	11:00	#25: Particle dispersion and turbulence modulation in fully-developed turbulent channel flow: influence of Saffman lift force Zuoli Xiao and Yucang Ruan Peking University, China
	11:00	11:15	#26: Relative dispersion in free surface turbulence Yaxing Li ¹ , Yifan Wang ² , Yinghe Qi ² and Filippo Coletti ² 1. Zhejiang University, China; 2. ETH Zurich, Switzerland
	11:15	11:30	#27: Accelerations of large inertial particles in turbulence Yaning Fan ¹ , Cheng Wang ¹ , Linfeng Jiang ² , Chao Sun ¹ and Enrico Calzavarini ³ 1. Tsinghua University, China; 2. University of Twente, Netherlands; 3. Université de Lille, France
	11:30	11:45	#28: Efficient point-based simulation of four-way coupled particles in turbulence at high number density Xander de Wit , Rudie Kunnen, Herman Clercx and Federico Toschi, Eindhoven University of Technology, Netherlands
	11:45	12:00	#29: High order accurate and robust building block solvers of DNS solver for 3D periodic domain: Advection solver, inhomogeneous diffusion solver and Poisson solver Qing Li ¹ , Zecheng Li ² , Qinmin Zheng ² and Chong Pan ² 1. Tianmushan Laboratory, China; 2. Beihang University, China;
	12:00	13:30	Lunch Buffet (Cafe Elysee, 1F)
Keynote #4	13:30	14:15	A direct numerical simulation of two-phase flow on an erodible particle bed based on the particle-point model and four-way coupling Keynote Speaker: Ping Wang, Lanzhou University, China
Session #4-1	14:15	14:30	#30: Micron-particle separation with rising Taylor bubbles Rhandrey Maestri ¹ , Clemens Bilsing ² , Lars Büttner ² , Jürgen Czarske ² , Uwe Hampel ^{1,2} , Gregory Lecrivain ¹ 1. Helmholtz-Zentrum Dresden-Rossendorf, Germany; 2. Technische Universität Dresden, Germany;
	14:30	14:45	#31: Primary break-up in closed-coupled gas atomization (CCGA) Rene van Hout ¹ , Tiansong Cheng ² , Ron Leibovici ¹ and Bo Kong ² 1. Technion - Israel Institute of Technology, Israel; 2. Guangdong Technion Israel Institute of Technology
	14:45	15:00	#32: How do dense emulsions flow? Federico Toschi ¹ , Ivan Girotto ² , Andrea Scagliarini ³ , Roberto Benzi ⁴ , Lei Yi ⁵ and Chao Sun ⁶ 1. Eindhoven University of Technology, Netherlands; 2. ICTP, Italy; 3. IAC-CNR, Italy; 4. University of Tor Vergata, Italy; 5. UMass, USA; 6. Tsinghua University, China
			Zuoli Xiao

Thursday August 22nd (Day 2)

	Time		CHAIRPERSON
	From	To	
	15:00	15:15	#33: A sharp method for the simulation of flow past a 3D liquid body with arbitrary shape and viscosity: from inviscid bubble to rigid sphere Jie Zhang ¹ , Bo-Lin Wei ¹ and Ming-Jiu Ni ² 1. Xi'an Jiaotong University, China; 2. University of Chinese Academy of Sciences
		15:15	15:30
	15:30	15:45	#35: MPI solver of particle-laden compressible flow: Numerical method and validation Qing Li ¹ , Zhaosheng Yu ² , Chong Pan ³ , Jianqiang Chen ⁴ and Xianxu Yuan ⁴ 1. Tianmushan Laboratory, China; 2. Zhejiang University, China; 3. Beihang University, China; 4. State Key Laboratory of Aerodynamic, China
	15:45	16:00	Coffee Break
Session #4-2	16:00	16:15	#36: The dynamics of rising spherical droplets (experiments and simulations) Éric Climent ¹ , Hadrien Godé ¹ , Dominique Legendre ¹ , Fabrice Lamadie ² and Sophie Charton ² 1. IMFT - Université de Toulouse, CNRS, France; 2. Univ. Montpellier, Marcoule, France
		16:15	16:30
	16:30	16:45	#38: A unified two-scale gas-liquid two-fluid model with capillarity and interface regularization through a mass transfer between scales Marc Massot ¹ , Giuseppe Orlando ¹ , Arthur Loison ¹ , Samuel Kokh ² and Teddy Pichard ¹ 1. Ecole polytechnique, Centre de Mathématiques Appliquées, France; 2. CEA, Service de Génie Logiciel pour la Simulation, France
		16:45	17:00
	17:00	17:15	#40: Numerical simulation of turbulent bubbly upflow in a vertical channel: Effect of density ratio Zixuan Yang and Min Lu Institute of Mechanics, Chinese Academy of Sciences, China
	17:15	17:30	#41: Numerical study of microbubble distribution and turbulence modulation in vertical turbulent channel flow Fang-Yu Chen , Lihao Zhao, Chun-Xiao Xu and Wei-Xi Huang Tsinghua University, China
		17:30	17:45
	17:45	18:00	#43: Flow and particle movement phenomenon in turbulent channels with different fins K Sun and X Feng Wuhan University of Science and Technology, China
	18:30	20:00	Dinner Buffet (Cafe Elysee, 1F)

Friday August 23rd (Day 3)

	Time		CHAIRPERSON
	From	To	
Keynote #5	9:00	9:45	Effects of particle inertia in turbulent suspensions Keynote Speaker: Francesco Picano, University of Padova, Italy
Session #5-1	9:45	10:00	#44: Quantifying the formation mechanism of particle streaks in near-wall turbulence Ruifeng Hu ¹ , Lei Shi ¹ , Xiaodong Gong ¹ , Xiaowei Zhu ² and Xiang Yang ³ 1. Lanzhou University, China; 2. Portland State University, USA; 3. Pennsylvania State University, USA
		10:00	10:15
	10:15	10:30	#46: Influence of secondary flow induced by riblets on the particle distribution and transport in wall turbulence Jianda Huang , Chunxiao Xu and Lihao Zhao Tsinghua University, China
	10:30	10:45	Coffee Break
Session #5-2	10:45	11:00	#47: Multiscale understanding of explosive dispersal of granular media Kun Xue ¹ , Jiarui Li ² , Junsheng Zeng ² and Lvlan Miu ¹ 1. Beijing Institute of Technology, China; 2. Institute of Applied Physics and Computational Mathematics, China
		11:00	11:15
	11:15	11:30	#49: Framework and results of the 2024 International CFD challenge on long-range indoor dispersion of pathogen-laden aerosols Jordi Pallares ¹ , Akim Lavrinenko ¹ , Cristian Marchioli ² , Salvatore Cito ¹ and Alexandre Fabregat ¹ 1. Universitat Rovira i Virgili, Spain; 2. University of Udine, Italy
		11:30	11:45
	11:45	12:00	#51: The phenomenon of cavitation occurring in liquid droplets containing solid particles Haojun Zhao and Bing Wang Tsinghua University, China
	12:00	13:30	Lunch Buffet (Cafe Elysee, 1F)
Keynote #6	13:30	14:15	Bubble dynamics in different gravity conditions aboard China space station Keynote Speaker: Jianfu Zhao, Chinese Academy of Sciences (CHN)
Session #6	14:15	14:30	#52: High order numerical methods for compressible multiphase flows and application Baolin Tian Beihang University, China
		14:30	14:45
	14:45	15:00	#54: The numerical methods and applications at the particle and mesoscale for the compressible gas-particle flow Baoqing Meng ¹ , Junsheng Zeng ² and Baolin Tian ² 1. Institute of Mechanics, Chinese Academy of Sciences, China; 2. Beihang University, China;
		15:00	15:15
	15:15	15:30	Coffee Break

Friday August 23rd (Day 3)

	Time			CHAIRPERSON
	From	To		
Closing Lecture	15:30	16:15	Recent innovations in Euler-Lagrange simulations of dispersed multiphase flows	Cristian Marchioli
			Keynote Speaker: Sivaramakrishnan Balachandar, University of Florida (USA)	
Closing	16:15	16:30	Closing Remarks	Guowei He, Cristian Marchioli

2nd BICTAM-CISM Symposium on Dispersed Multiphase Flows: from Measuring to Modeling

ABSTRACTS

