

Kavli Institute for Theoretical Physics

Exploration Conference



**Interfaces and Mixing
in Fluids, Plasmas, Materials**

**23 – 26 October 2023
Santa Barbara, USA**

We deeply thank

Kavli Institute for Theoretical Physics

We greatly appreciate

international research community, professional organizations, publishers

Interfaces and Mixing, their Dynamics and Kinetics

- Govern a broad range of processes in nature and technology
 - in fluids, plasmas and materials;
 - in turbulent and in coherent states;
 - from celestial to atomic events;
 - under conditions of high and low energy density.
- Our investigations include:
 - supernovae, molecular clouds, solar flares
 - dynamics and kinetics of matters at the extremes
 - fluid instabilities and interfacial mixing in fluids, plasmas, materials
 - fundamentals and applications of turbulence and turbulent mixing
 - interfacial processes in reactive flows, microfluidics, nanofabrication
 - materials processing and electro-catalysis.
- In these realistic environments
 - flow fields change sharply and rapidly, accelerations are strong;
 - energy releases are high, relaxations are weak
 - phases of matter are well pronounced.

We can now better understand what interfaces are

- Interface is a phase boundary broadly defined.
- Interface is a place where balances are achieved.
 - At interfaces
 - properties of matter experience dramatic changes at minuscule scales
 - microscopic interfacial transports define macroscopic fields in the bulk.
- Interfaces and interfacial mixing couple micro- to macro scales.
 - They are challenging to study
 - in the kinetic limit and in the continuous limit;
 - in theory, experiments, simulations.
- Interfaces and Interfacial Mixing impact
 - nearly every area of science, mathematics and engineering.
- Interface Dynamics and Kinetics are eligible to first principle considerations.
- Our target is on opinion independent results.

Interfaces and Mixing Conference

- We directed to explore the group theory based methodologies for solving conservation laws far from equilibrium.
- We aimed to associate theoretical solutions with physical observables in synergy with experiments and simulations.
- We targeted to approach the dynamics of interfaces and interfacial mixing at the levels of detail and abstraction not achieved before to capture their fundamentals in very distinct physical regimes.
- We examined
 - whether in fluids unstable interfaces can lead to turbulence and its anomalous scaling;
 - whether in plasmas the interface topology and transports are linked to volumetric fields;
 - whether in multi-phase materials the energy can scatter beyond conventional diffusion and/or can be trapped at atomic scales.
- The Conference provided the opportunity
 - to bring together researchers from various areas of science, mathematics, engineering;
 - to focus the attention on the long-standing problems of the unstable non-equilibrium dynamics and non-equilibrium kinetics of interfaces and interfacial mixing.

We appreciate the work

- Coordinators of the KITP Exploration Conference
 - Snezhana I. Abarzhi
 - William A. Goddard III
 - Katepalli R. Sreenivasan
- Scientific Advisory Committee of the Exploration Conference
 - Snezhana I. Abarzhi (The University of Western Australia, AUS)
 - W. David Arnett (The University of Arizona, USA)
 - Marcus Herrmann (Arizona State University, USA)
 - James G. Glimm (State University of New York Sony Brook, USA)
 - William A. Goddard III (California Institute of Technology, USA)
 - Bruce A. Remington (Lawrence Livermore National Laboratory, USA)
 - Mark Schlossman (University of Illinois Chicago, USA)
 - Katepalli R. Sreenivasan (New York University, USA)
- The KITP Administration
 - Lars Bildsten (Director, the KITP, USA)
 - Mark Bowick (Deputy Director, the KITP, USA)
- The KITP Support
 - Lisa Stewart (Chief Administrative Officer, the KITP, USA)
 - David Kaczorowski (Program Manager, the KITP, USA)
 - Claudia Gutierrez (Conference Coordinator, the KITP, USA)
 - Alina Gutierrez (Online Talks - Production & IT Coordinator, the KITP, USA)

We thank our speakers, lecturers, participants

- Our participants were:
 - active researchers - national / international, seasoned / young;
 - members of leading research institutions / highly reputable professional organizations;
 - from academia, national laboratories, industry.

Abarzhi, Snezhana I
Alexandrov, Anastasia
Azechi, Hiroshi
Barclay, Bryce
Bellan, Josette
Bellan, Paul
Boffetta, Guido
Bolanos, Simon
Campbell, David K
Chan, WH Ronald
Chashechkin, Yuli
Chefranov, Sergei G
Chekhlov, Alexei
Chen, Gui-Qiang
Chen, Li-Jen
Chen, Xi
Clark, Aurora
Cowley, Steven
Daripa, Prabir
Das, Amita
Doughty, Benjamin L
Duin, Adri van
Fielding, Drummond
Fisher, Robert

Fortunelli, Alessandro
Fukumoto, Yasuhide
Glimm, James G
Goddard, William A III
Gotoh, Toshiyuki
Graziani, Frank R
Hara, Ken
Herrmann, Marcus
Hill, Desmon L
Hosking, David
Hou, Thomas Y
Hurisse, Olivier
Huysmans, Luca
Hwang, Connor H
Ilyin, Dan V
Irvine, William TM
Iyer, Kartik
Ji, Yong
Kamal, Tulin
Kerstein, A R
Klimenko, Alex
Knobloch, Edgar
Li, J Tony
Li, Xiaolin

Lopez, Juan M
Mahalov, Alex
Matsuoka, Chihiro
Migdal, Alexander
Morita, Akihiro
Nepomnyashchy, Alik
Oh, Peng
Osher, Stanley
Schlossman, Mark
Sreenivasan, Katepalli R
Sydora, Richard
Tordella, Daniela
Verma, Mahendra K
Vishniac, Ethan
Vorobieff, Peter
Wallstrom, Timothy
Wang, Lipo
Welfert, Bruno D
Williams, Kurt C
Wright, Cameron E
Zhakhovsky, Vasillii
Zingale, Michael

- We thank our participants for valuable contributions to the Conference Program.

Conference Structure

- The Conference Topics included
 - Interfaces and Mixing
 - Theory; Experiments; Simulations.
 - Fluids
 - Instabilities & Interfacial Mixing; Turbulence & Turbulent Mixing; Realistic Environments.
 - Plasmas
 - Astrophysical Plasma; High Energy Density Plasma; Canonical Plasma.
 - Materials
 - Interfacial Processes; Reactive Dynamics; Matter at the Extremes.
- The Conference consisted of lectures and talks.
 - The Book of Abstracts includes over 70 accepted presentations.
 - The Program contained 56 lectures and talks, with $\sim 2/3$ in-person and $\sim 1/3$ virtual talks.
 - Active discussions were held after the presentations and during the breaks.
- The research contributions to the Conference were the high quality works.
 - Presentations by leading experts invited by the Organizers.
 - Presentations by members of international research community.
 - Submissions were peer-review [coordinators & members of scientific advisory committee].

Publications and Proceedings

- Presentations were digitally recorded by the KITP.
 - Recordings are available at the KITP web-site and KITP YouTube Channel (doi).
 - Links to the Accepted Presentations are also available at tmbw.org.
- Book of Abstracts is prepared.
 - The Book of Abstracts can be found at tmbw.org.
- Conference works are invited to
 - special collections organized in renowned journals by lead publishers
 - US National Academy of Sciences, Springer Nature, Institute of Physics, Frontiers, MDPI.
- You are welcome to submit your research to the Conference Publications.
 - Please stay tuned for updates and technical details.
- We fully leverage capabilities of 'Turbulent Mixing and Beyond' Program (20+ books since 2007)
 - Springer & Springer Nature Applied Science; National Academy of Sciences of the USA & Proceeding of the National Academy of Sciences of the USA; Royal Society Publishing & Philosophical Transactions of the Royal Society; Frontiers Publishing & Frontiers of Applied Mathematics and Statistics; American Institute of Physics & Physics of Fluids and Physics of Plasma; Institute of Physics & Physica Scripta; International Center for Theoretical Physics.

Welcome

The Kavli Institute for Theoretical Physics
Exploration Conference
'Interfaces and Mixing in Fluids, Plasmas, Materials'

was organized

- to advance knowledge of fundamental aspects of non-equilibrium dynamics and kinetics of interfaces and interfacial mixing;
- to progress their predictive modeling capabilities, physical description and, ultimately, control;
- to positively impact the progress of science, technology and society.

The success of the Conference consisted from the successful work of all of us.

Thank you for your valuable contributions.

Welcome to the Community!