



KITP Conference: Interfaces and Mixing in Fluids, Plasmas, and Materials

(Oct 23-26, 2023)

Coordinators: Snezhana I. Abarzhi, William A. Goddard III, and Katepalli Sreenivasan

Monday, Oct 23, 2023

Session (Interfaces and Mixing - Theory), Chair: Ethan Vishniac (Johns Hopkins)

8:50am	Lars Bildsten (KITP)	Welcome[Video]
9:00am	Snezhana I. Abarzhi (U. Western Australia)	Introduction from Coordinators[Slides][Video][CC]
9:15am	David Campbell (BU)	The metastable state of the Fermi-Pasta-Ulam-Tsingou problem[Slides][Video][CC]
9:40am	Xi Chen (Beihang U)	Unbounded wall turbulence induced by inverse cascade [Slides][Video][CC]
10:05am	Alex Klimenko (The U of Queensland)	Would mixing be any different in a remote part of the universe?[Video][CC]
10:30am		Morning Break

Session (Fluids - Turbulence and Turbulent Mixing), Chair: Chihiro Matsuoka (Osaka Municipal U)

11:00am	James Glimm (Stony Brook)	Smooth solutions of the Navier-Stokes Equation[Slides][Video][CC]
11:30am	Kartik Iyer (Michigan Tech)	Scaling characteristics of hydrodynamic turbulence[Video][CC]
12:00pm	Alexander Migdal (NYU)	Exact solution of decaying turbulence[Video][CC]

LUNCH

Session (Fluids - Turbulence, Turbulent Mixing, and Interfacial Mixing), Chair: Snezhana Abarzhi (U. Western Australia)

2:00pm	Sreeni Katepalli Sreenivasan (NYU)	Turbulent convection at very high Rayleigh numbers and the weakly nonlinear theory by Herring, Busse and others [Video][CC]
2:30pm	Peter Vorobieff (UNM)	Interfacial instability as a single- and multiphase phenomenon[Slides][Video][CC]
3:00pm	William Irvine (U Chicago)	Weaving tangled vortex webs: vortex knots, conservation of helicity and turbulent blobs[Embargoed]
3:30pm		Afternoon Break

Session (Plasmas - Canonical, Astrophysical, High Energy Density), Chair: Paul Bellan (Caltech)

3:50pm	Ken Hara (Stanford)	Instabilities and non-classical transport in partially-ionized, partially-magnetized plasmas[Video][CC]
4:15pm	Bryce Barclay (Arizona State)	Vectorial EM signal reconstruction in stochastic, inhomogeneous media and optimal observation times[Slides][Video][CC]
4:40pm	Amita Das (IIT Delhi)	Magnetic turbulence in high intensity laser produced plasmas[Video][CC]
5:05pm	Drummond Fielding (Flatiron)	How rapid radiative cooling controls astrophysical turbulent mixing layers [Video][CC]
5:30pm		SHUTTLE BACK TO HOTEL

Tuesday, Oct 24, 2023

Session (Materials - Interfacial Processes and Reactive Dynamics), Chair: William Goddard (Caltech)

9:00am	Anastassia Alexandrova (UCLA)	Interfacial fluxionality in electrocatalysis: the ever-changing nature of the active site [Video][CC]
9:25am	Al Fortunelli (CNR)	ML-accelerated DFT sampling of catalytic processes at heterogeneous interfaces [Video][CC]
9:50am	Adri Van Duin (Penn State U)	Atomistic-scale simulations of realistic, complex, reactive materials: the ReaxFF method, its applications and recent developments for plasma simulations [Video][CC]
10:15am	Akihiro Morita (Tohoku U)	Microscopic mechanisms of ion transport and reactions at liquid-liquid interface[Video][CC]
10:40am		Morning Break

Session (Materials and Plasmas - Matter at the Extremes), Chair: Richard Sydora (U. Alberta)

11:00am	Frank Graziani (LLNL)	Shock physics in warm dense matter: A quantum hydrodynamics perspective[Slides][Video][CC]
11:30am	Vasily Zhakhovskiy (Joint Inst. for High Temperatures, Academy of Sciences)	Shock-induced melting and crystallization in titanium irradiated by ultrashort laser pulse[Slides][Video][CC]
12:00pm	Hiroshi Azechi (Osaka U)	Integral model of Rayleigh-Taylor and Richtmyer-Meshkov instabilities in inertial fusion plasmas[Video][CC]

LUNCH

Session (Interface Dynamics and Kinetics - Theory and Simulations), Chair: Hiroshi Azechi (Osaka U)

2:00pm	William Goddard (Caltech)	Reactive dynamics simulations at interfaces between solid and liquid materials: successes and difficulties[Slides][Video][CC]
2:45pm	Snezhana Abarzhi (U. Western Australia)	Interface dynamics in ideal and realistic fluids[Slides][Video][CC]

3:30pm

Afternoon Break

Session (Plasmas - Astrophysics and Magneto-hydrodynamics), Chair: Peng Oh (UCSB)

3:50pm Bob Fisher (UMass Dartmouth)

Turbulent detonation in type Ia supernovae[[Slides](#)][[Video](#)][[CC](#)]

4:15pm David Hosking (Princeton)

Metastability of MHD atmospheres and their relaxation[[Video](#)][[CC](#)]

4:40pm Michael Zingale (Stony Brook)

Convective mixing in stellar reactive flows[[Video](#)][[CC](#)]

5:15pm Ethan Vishniac (Johns Hopkins)

Magnetic field transport in thin accretion disks[[Slides](#)][[Video](#)][[CC](#)]

5:30pm

RECEPTION

6:00pm

SPECIAL EVENT DINNER

8:00pm

SHUTTLE BACK TO HOTEL

Wednesday, Oct 25, 2023

Session (Fluids - Turbulence and Turbulent Mixing), Chair: Kartik Iyer (Michigan Tech)

9:00am Toshiyuki Gotoh (Nitech)

Spectrum of passive scalar variance with inherent time scale in turbulence[[Slides](#)][[Video](#)][[CC](#)]

9:25am Lipo Wang (Univ. of Michigan-Shanghai Jiao Tong U Joint Inst.)

Structure of turbulence based on multi-level extremal points[[Slides](#)][[Video](#)][[CC](#)]

9:50am Yuli Chashechkin (Ishlinsky Inst. for Problems in Mechanics, Academy of Sciences)

Inseparable actively interacting waves, vortices and ligaments in a new mechanism for densities of miscible liquids, gases or plasma equalizing[[Slides](#)][[Video](#)][[CC](#)]

10:15am Sergey Chefranov (Technion - Israel Institute of Technology)

A new precise analytical solution to the main turbulence problem[[Slides](#)][[Video](#)][[CC](#)]

10:40am

Morning Break

Session (Fluids - Instabilities and Interfacial Mixing), Chair: James Glimm (Stony Brook)

11:00am Marcus Herrmann (Arizona State)

A dual-scale LES model for sub-filter dynamics of immiscible interfaces[[Video](#)][[CC](#)]

11:30am Chihiro Matsuoka (Osaka Metropolitan U)

Nonlinear interaction of vortex sheets in multi-interface Kelvin-Helmholtz, Rayleigh-Taylor, and Richtmyer-Meshkov instabilities[[Slides](#)][[Video](#)][[CC](#)]

12:00pm Snezhana Abarzhi (U. Western Australia)

Fluid instabilities and interfacial mixing[[Slides](#)][[Video](#)][[CC](#)]

LUNCH

Session (Interfaces in Fluids, Plasmas, Materials - Experiment), Chair: William Irvine (U Chicago)

2:00pm Mark Schlossman (UIC)

Ion-extractant complexation and transport near liquid-liquid interfaces in solvent extraction processes[[Video](#)][[CC](#)]

2:30pm Dan Ilyin (Stanford)

Interfaces and mixing in three-dimensional micro-printing technology[[Video](#)][[CC](#)]

3:00pm Richard Sydora (U. Alberta)

Experiments and simulation of the turbulent mixing between multiple spinning magnetized plasma pressure filaments[[Video](#)][[CC](#)]

3:30pm

Afternoon Break

Session (Interface Dynamics - Numerical Modeling), Chair: Marcus Herrmann (Arizona State)

3:50pm Stanley Osher (UCLA)

In-Context Operator Networks (ICON): Towards Large Scientific Learning Models[[Slides](#)][[Video](#)][[CC](#)]

4:15pm Alexei Chekhlov (Dassault Systemes)

Lattice Boltzmann model in general curvilinear coordinates applied to exactly solvable 2D flow problems[[Slides](#)][[Video](#)][[CC](#)]

4:40pm Thomas Hou (Caltech)

Potentially singular behavior of 3D incompressible Navier-Stokes[[Slides](#)][[Video](#)][[CC](#)]

5:05pm Tulin Kaman (U Arkansas)

Recent advancements in front-tracking based Rayleigh-Taylor simulations[[Slides](#)][[Video](#)][[CC](#)]

5:30pm

RECEPTION

6:00pm

SPECIAL EVENT DINNER

8:00pm

SHUTTLE BACK TO HOTEL

Thursday, Oct 26, 2023

Session (Fluids - Realistic Environments), Chair: Tulin Kaman (U of Arkansas)

9:00am Guido Boffetta (U Turin)

Rayleigh-Taylor mixing in porous media[[Video](#)][[CC](#)]

9:25am Alexander Nepomnyashchy (Technion)

Marangoni convection in solutions[[Video](#)][[CC](#)]

9:50am Daniela Tordella (Polito)

Super-saturation of turbulent fluctuations in atmospheric cloud-environmental air unsteady interfaces[[Slides](#)][[Video](#)][[CC](#)]

10:15am Juan Lopez (Arizona State)

Mixing and transport of dissolved CO₂ in water by a rotating knife edge[[Slides](#)][[Video](#)][[CC](#)]

10:40am

Morning Break

Session (Fluids and Materials - Instabilities and Interfacial Processes), Chair: Akihiro Morita (Tohoku U)

11:00am Aurora Clark (Utah)

Geometric and topological descriptors of the organization and dynamics at soft-matter interfaces[[Slides](#)][[Video](#)][[CC](#)]

11:30am Benjamin Doughty (Oak Ridge NL)

Liquid/liquid interfaces at and away from equilibrium[[Video](#)][[CC](#)]

12:00pm Yasuhide Fukumoto (Kyushu U)

Effect of compressibility on Kelvin-Helmholtz and Rayleigh-Taylor instabilities[[Slides](#)][[Video](#)][[CC](#)]

12:30pm

Lunch Break

Session (Plasmas and Fluids - Astrophysics and Magneto-hydrodynamics), Chair: David Campbell (BU)

- 2:00pm Peng Oh (UCSB) [Turbulent mixing layers in multi-phase gas](#)[\[Slides\]](#)[\[Video\]](#)[\[CC\]](#)
- 2:30pm Simon Bolanos (UCSD) [Laboratory study of the initial stages of quasi-parallel collisionless shocks at high Alfvén Mach number using high-power lasers](#)[\[Video\]](#)[\[CC\]](#)
- 3:00pm Paul Bellan (Caltech) [Experimental observation of cascade of qualitatively different plasma instabilities](#)[\[Video\]](#)[\[CC\]](#)

3:30pm **Afternoon Break**

Session (Fluids - Numerical Modeling of Realistic Environments), Chair: Mark Schlossman (UIC)

- 4:00pm Josette Bellan (Caltech) [Characteristics of multi-species mixing in high-pressure turbulent flow from direct numerical simulations](#)[\[Video\]](#)[\[CC\]](#)
- 4:25pm Timothy Wallstrom (LANL) [Estimating reaction rates from models of variable-density turbulent flow](#)[\[Slides\]](#)[\[Video\]](#)[\[CC\]](#)
- 4:50pm Alan Kerstein (Stochastic Sciences Inc.) [Investigations of turbulence-modulated interfaces using a stochastic model](#)[\[Slides\]](#)[\[Video\]](#)[\[CC\]](#)
- 5:15pm Snezhana I. Abarzhi (U. Western Australia), William A. Goddard III (Caltech) [Summary from Coordinators](#)[\[Slides\]](#)[\[Video\]](#)[\[CC\]](#)
- 5:30pm **CONFERENCE END SHUTTLE TO BWSCI *Also available to SB Airport and SB Airbus, Goleta location. (See Registration Desk BEFORE THURSDAY to sign up.)**

Asynchronous Talks

- WH Ronald Chan (Stanford U) [Theory and simulations of scale-dependent Rayleigh-Taylor dynamics](#)
- Gui-Qiang George Chen (Oxford U)
Li-Jen Chen (NASA/Goddard Space Flight Center) [Compressible Discontinuities and Free Boundary Problems](#)
- Prabir Daripa (Texas A&M)
Desmon L Hill (U of Western Australia) [Turbulence and magnetic reconnection in star wind-magnetosphere interaction](#)
- Olivier Hurisse (Electricite de France) [Model and effect of nonuniform mixing on polymer flooding](#)
- Luca Huysmans (U of Cambridge) [An analysis of the buoyancy and drag parameters in Rayleigh-Taylor dynamics](#)
- Connor H Hwang (Stanford U) [A stochastic scheme for front tracking on unstructured meshes](#)[\[Slides\]](#)
- Yong Ji (Harbin Institute of Technology) [Non-uniqueness and Inadmissibility of the Vanishing Viscosity Limit of the Passive Scalar Transport Equation.](#)
- Edgar Knobloch (U of California, Berkeley)
J Tony Li (U of Western Australia)
Xiaolin Li (Stony Brook U) [Scale-dependent Rayleigh-Taylor dynamics with variable acceleration in a finite-sized domain for three-dimensional flows](#)
- Alex Mahalov (Arizona State U) [MMS observations of magnetic field geometric structures in turbulent magnetosheath](#)
- Mahendra K Verma (Indian Institute of Technology Kanpur)
Bruno D Welfert (Arizona State U)
Kurt C Williams (U of Western Australia)
Cameron E Wright (U of Western Australia) [Triply periodic fixed flux convection](#)
- [Fluid dynamics mathematical aspects of supernova remnants](#)
- [Front Tracking and Application to Parachute Simulation in Turbulent Flow](#)
- [Vectorial EM Propagation Governed by the 3D Stochastic Maxwell Vector Wave Equation in Stratified Turbulent Interface Layers in Ionosphere](#)
- [Variable Energy Flux in Turbulence](#)
- [Interface and mixing in a stably stratified tilted square cavity](#)
- [Fluctuations spectra in Rayleigh-Taylor mixing](#)
- [Effect of adiabatic index on Richtmyer-Meshkov flows induced by strong shocks](#)