Vortex Theory Now – Frontiers of Mathematical Physics

Machikaneyama Kaikan, Osaka University, Toyonaka Campus

http://www.osaka-u.ac.jp/en/access/toyonaka.html

(map No. 35)

2012. 10. 06 (Sat.)

0950-1000

Opening Address

Takashi Suzuki (*Graduate School of Engineering Science, Osaka University*)

1000-1040

Tsukasa Iwabuchi (*Department of Mathematics, Chuo University*)

Global Solutions for the Navier-Stokes Equations in the Rotational Framework

In this talk, we consider the Cauchy problems for the Navier-Stokes equations with the Coriolis force in the homogeneous Sobolev spaces. Without the Coriolis force, it is known that the existence of global solutions is obtained for small initial data in the Lebesgue spaces, Sobolev spaces. On the other hand, we consider large initial data in the homogeneous Sobolev spaces to show the existence of global solutions if the speed of rotation is sufficiently large.

1050-1130

Takeshi Matsumoto (*Department of Physics, Kyoto University*)

Low Reynolds Number Turbulence in a Viscoelastic Fluid

A viscoelastic fluid, such as a dilute polymer solution, is known to become turbulent at very low Reynolds number. However this requires high Weissenberg number, which means that a characteristic time scale of the polymer motion (often modeled as a nonlinear spring) is larger than the flow time scale. By using a numerical simulation of the so-called FENE-P model of a viscoelasitc fluid, we discuss peculiar properties of the turbulence state.

1140-1220

Shinichiro Shima (*Hyogo Prefecture University*)

Super-Droplet Approach to Simulate Precipitating Trade-Wind Cumuli -Comparison of Model Results with RICO Aircraft Observations

Super-Droplet Method (SDM) is a particle-based and probabilistic approach to simulate aerosol, cloud and rain microphysical processes. This method enables the accurate

simulation of cloud microphysics with less demand on computation. In this talk, after introducing the method briefly, our recent results on the comparison of SDM simulations with observations will be presented.

1400-1450

Makoto Tsubota (*Department of Physics, Osaka City University*)

Quantized Vortices and Quantum Turbulence

We discuss recent important topics in quantum fluid dynamics and quantum turbulence. Quantum turbulence (QT) was discovered in superfluid ^{4}He in the 1950s, but this is still one of the most important topics in low temperature physics. The realization of atomic Bose-Einstein condensation in 1995 has proposed another important stage for this issue. A general introduction to this issue and a brief review of the basic concepts are followed by the recent developments of the studies of QT. I will discuss some of the interesting topics on the vortex dynamics and quantum turbulence.

1500-1550

Yasuhide Fukumoto (*Institute of Mathematics for Industry, Kyushu University*)
Youichi Mie (*Sumitomo Rubber Industries Ltd*)

Energy, Pseudomomentum and Stokes Drift of Kelvin Waves and Their Application to Weakly Nonlinear Stability of an Elliptic Vortex

Three-dimensional waves on the core of a cylindrical vortex are called the Kelvin waves. A steady vortical flow goes through instability via resonance of two Kelvin waves, which is called the Moore-Saffman-Tsai-Widnall instability. From the viewpoint of the Hamiltonian spectra, a necessary condition for occurrence of the instability is either that the signatures of the energies of the relevant Kelvin waves are different or that the energies are both zero. In order to carry out calculation of the wave energy up to second order in disturbance amplitude, in practice, the disturbance should be restricted to kinematically accessible ones in which any local circulation is preserved. As a byproduct, we can deduce the mean flow of second order in amplitude induced by nonlinear interaction of this restricted disturbance. We pursue the relation of this mean flow with the pseudomomentum and the Stokes drift. The mean flow thus obtained is indispensable for proceeding to the weakly nonlinear stage.

1610-1700

Clément Sire (*Laboratoire de Physique Théorique, University of Toulouse & CNRS, France)*

Synchronization In Long-range Interacting Systems

Long-range interacting systems with a very large number of particles N are known to present long-lived quasi-stationary states (QSS; lifetime diverging with N), which do not coincide with the Boltzmann thermodynamic equilibrium state, and which depend on the initial conditions. We present an analytic characterization of these QSS at large kinetic energy for the Hamiltonian Mean-Field model, which leads to the discovery of a novel frequency synchronization mechanism.

1710-1800

Hiroshi Ohtsuka (*School of Engineering, Miyazaki University*)

On Some Properties of Mean Fields of Equilibrium Vortices Described by the Hamiltonian of Vortices

According to the scenario of Onsager to explain large scale long lived coherent structures in two dimensional flows, mean fields of the equilibrium of a large number of vortices are known to be derived. In this talk we present our resent results concerning the variational structure of the blow-up solutions to the Lioville-Gel'fand equation, which give insights on the relation between mean fields of equilibrium vortices (of an infinite number) and the Hamiltonian of vortices (of a finite number).

1830-2000

Banquet at Machikaneyama Kaikan

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