KTH SOLID MECHANICS SEMINAR; Tuesday, March 7^{th}, 15.15; KTH Solid Mechanics Seminar room

Gustavo Gioia "Kolmogorovian turbulence in transitional pipe flows"

As everyone knows who has gradually opened a water faucet, pipe flows are initially laminar but become turbulent at high flow velocities. At intermediate velocities there is a transitional regime in which plugs of laminar flow alternate along the pipe axis with "flashes" of fluctuating, non-laminar flow. While it is known that flashes can fission, decay, and crowd out the intervening laminar plugs, the nature of "flash flow" (the flow inside flashes) remains poorly understood. In this talk we show experimentally that flash flow satisfies the Blasius law of fluid friction, which is diagnostic of turbulence; thus, flash flow is likely to be but turbulent flow. To verify this possibility, we show that the statistics of flash flow are in keeping with Kolmogorov's theory of the statistical structure of turbulence (so that, for example, at high wavenumbers, the turbulent-energy spectra of flash flow collapse onto the turbulent-energy spectra of turbulent flow, consistent with small-scale universality), with the implication that transitional pipe flows are segregated mixtures of a laminar phase and a turbulent phase. Our findings lend support to the widely-held, but hitherto unsubstantianted, notion that transitional pipe flows signal a non-equilibrium phase transition to turbulence. This research was carried out with **Rory Cerbus**, **Chien-Chia Liu**, and **Pinaki Chakraborty**, Okinawa Institute of Science and Technology Graduate University.

Gustavo Gioia is a professor of continuum physics at the Okinawa Institute of Science and Technology Graduate University, Japan. He was formerly affiliated with the College of Engineering, University of Illinois at Urbana-Champaign, where he served as assistant professor (2000-2006) and associate professor (up to 2011). He held postdoctoral positions at the University of Minnesota and at Rutgers University, received graduate degrees from Brown University (PhD, solid mechanics) and Northwestern University (MSc, theoretical and applied mechanics), and his undergraduate degree from the University of Buenos Aires (diploma, structural engineering). He is interested in the mechanics of fluids and solids (vide https://groups.oist.jp/cpu/gustavo-gioia).

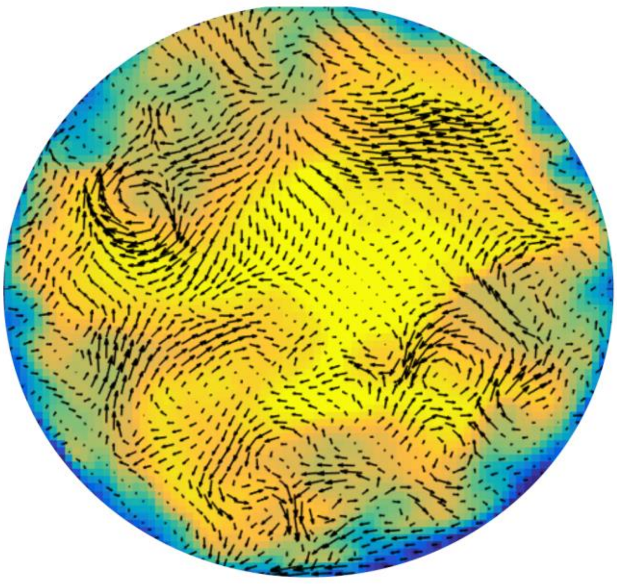

Figure 1: Velocity field in the interior of a turbulent flash measured by particle-image velocimetry. The colors represent the axial velocity in the pipe. OIST Fluid Mechanics Laboratory.