Center for Environmental & Applied Fluid Mechanics

"Hidden Scale Invariance of the Navier-Stokes Turbulence"

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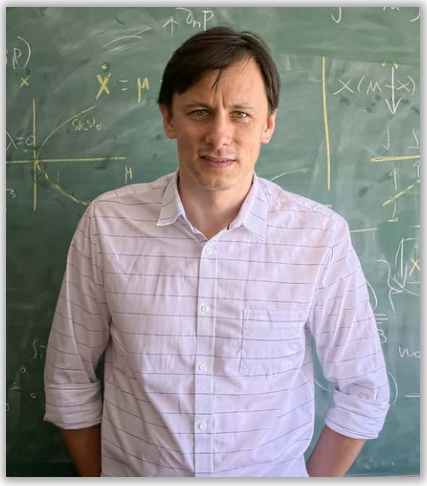

Abstract: The Navier-Stokes equations possess a family of scaling symmetries parametrized by the Holder exponent h. The Parisi-Frisch multifractal theory of developed turbulence assumes that each scaling symmetry is restored statistically on a fractal subset of phase space whose fractal dimension depends on h. In this lecture we show that the multifractality follows from an exact (hidden) scaling symmetry of equations of motion. This symmetry appears after a nonlinear space-time rescaling of the velocity field, which mathematically represents a projection in phase space. We show numerical evidence that the hidden scale invariance is restored statistically and discuss its implications for turbulence. This is a joint work with Simon Thalabard.

Bio: Dr. Mailybaev graduated in 1997 from the Lomonosov Moscow State University, getting degrees of Ph.D. in 1999 and D.Sc. (habilitation) in 2009. He worked as a researcher at the Institute of Mechanics of the same university till 2011, and then moved to the Instituto de Matemática Pura e Aplicada - IMPA in Rio de Janeiro. Currently he is a full professor at IMPA.

His research interests are now focused on the mathematical theory of developed turbulence, in particular, on the spontaneous stochasticity and hidden statistical symmetries in turbulence. Previous research activities also included the areas of singularity theory, nonlinear dynamics and wave dynamics with applications to engineering and physics.

Fall 2023 CEAFM Special Seminar

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