Seminário de sistemas dinâmicos e estocásticos

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Chaos, scalar mixing, and passive scalar turbulence for models in fluid mechanics

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Resumo:

In models of fluid mechanics, Lagrangian flow ϕ^t on the fluid domain describes the motion of a passive particle advected by the fluid. Absent obstructions such as coherent structures such as vortices, Lagrangian flow ϕ^t is typically expected to be chaotic in the sense of (1) sensitivity with respect to initial conditions and (2) fast mixing of passive scalars (equivalently H^{-1} decay for passive scalars). I will present joint work with Jacob Bedrossian (U Maryland) and Sam Punshon-Smith (Brown U) in which we rigorously verify these chaotic properties for various incompressible and stochastically forced fluid models on the periodic box, including stochastic 2D Navier-Stokes and hyperviscous 3D Navier-Stokes. I will also present our recent application of these results to the study of passive scalar turbulence in the Batchelor regime, i.e., the steady state of passive scalars in a fluid (at fixed viscosity) attained as molecular diffusivity goes to 0. In this setting, we are able to prove Batchelor's inverse power law for the power spectrum, the passive scalar analogue of Kolmogorov's $-4/3$ law for the power spectrum in the inertial range of a turbulent 3D fluid.

Data: 20/11 - 11:00 (GMT-3) - Via Zoom - Meeting ID: 954 5882 9621 - Passcode: 954848

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