Uniform-in-diffusivity Chaotic Mixing and the Batchelor Spectrum

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Many observations of the statistical properties of fluids in physically relevant settings agree with the analytical theories of turbulence that stem from the engineering and physics communities; these theories combine various reasonable approximations with axioms that researchers derive from experimental observation. Although the theories successfully obtain accurate and useful approximations for physical observations, no mathematically rigorous justifications currently exist that start from the governing Navier-Stokes equations and systematically deduce these predictions — not even in extremely idealized situations, i.e., in a periodic box with stochastic white-in-time forcing. This goal of mathematical rigor is the ultimate verification that the governing equations are indeed sufficiently predictive of the true, observed behavior and accurately model the most relevant physics.

Read the full story on SIAM News: https://sinews.siam.org/Details-Page/uniform-in-diffusivity-chaotic-mixing-and-the-batchelor-spectrum