Lagrangian relative dispersion and intermittency in three-dimensional turbulence

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This talk reviews key findings from direct numerical simulations on the relative dispersion of fluid tracers in three-dimensional, incompressible turbulent flows. We focus on two distinct regimes: small-scale separations, characterized by the fluctuations of finite-time Lyapunov exponents, and inertial-range separations, which exhibit the hallmark explosive growth predicted by Richardson's law. Comparisons are drawn between simulation results and theoretical models, with particular attention to the roles of broken scale invariance and non-Markovian dynamics. We highlight how these effects influence turbulent mixing and outline several open questions that remain in the Lagrangian description of turbulence.