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Gradient statistics around particle tra jectory in turbulence ENRICO CALZAVARINI, Univ. of Twente (The Netherlands), LUCA BIFERALE, Univ. of Roma, Tor Vergata (Italy), MASSIMO CENCINI, Univ. of Roma, La Sapienza (Italy), FEDERICO TOSCHI, IAC-CNR (Italy) — Fluid velocity increments at different spatial locations or times in a three-dimensional turbulent flow display both highly non-Gaussian fluctuations and long-range correlations. A statistical description of their properties represents one of the most intriguing problem of turbulence research. Theoretically, it has been suggested that a possible mechanism for their large fluctuations may be the nonlinear self-stretching that occurs during the Lagrangian evolution of the velocity gradients. We address here by Direct Numerical Simulations the fluid gradient temporal statistics along lagrangian trajectories of fluid tracers and of heavy/light inertial particles. High-resolution $Re_\lambda \simeq 180$ (512^3) and $Re_\lambda \simeq 380$ (2048^3) numerical results are employed. In particular, by computing velocity Lagrangian Structure Functions and coarse-grained moments of the energy dissipation rate and enstrophy field along the trajectories, we perform an analysis of the Refined Kolmogorov Similarity Hypothesis (Kolmogorov 1962) in the framework of Lagrangian turbulence. Statistics of the topological properties of the carrier flow along trajectories are also examined. Joint probability density between the Q-R invariants of the gradient tensor and their time evolutions along trajectories of tracers and inertial particles will be discussed.

Enrico Calzavarini
Univ. of Twente (The Netherlands)

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