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How Gaussian is the Velocity Gradient Tensor at Large Scales in Hydrodynamic Turbulence? LAURENT CHEVILLARD, YI LI, CHARLES MENEVEAU, The Johns Hopkins University, Baltimore, MD. — Fully developed turbulent flows exhibit a continuous range of exited scales, from the finest (dissipative range) towards the integral scale where energy is injected. Many theoretical approaches use the assumption that at large scales the fluctuations display Gaussian statistics. This has also been repeatedly confirmed based on measurements of longitudinal velocity increments in the Eulerian framework and temporal velocity increments in the Lagrangian framework. When the separation is comparable to integral scales of the flow, the PDFs of these velocity increments display Gaussian statistics, in contrast to the elongated tails and non-Gaussian statistics at smaller scales. Motivated by recent insights gained from Restricted Euler dynamics, we examine the statistics of the full velocity gradient tensor and several of its invariants relevant to the transfer of energy from large to small scales. Using Direct Numerical Simulations, we study the coarse-grained and band-pass Eulerian velocity gradient tensor. Among other features, we show that even at the integral length scale, the gradient statistics deviate from Gaussianity.

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