Abstract Submitted
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Lagrangian dynamics and statistical geometric structure of turbulence LAURENT CHEVILLARD, CHARLES MENEVEAU, Johns Hopkins University — The local statistical and geometric structure of three-dimensional turbulent flow can be described by properties of the velocity gradient tensor. A stochastic model is developed for the Lagrangian time evolution of this tensor, in which the exact nonlinear self-stretching term accounts for the development of well-known non-Gaussian statistics and geometric alignment trends. The non-local pressure and viscous effects are accounted for by a closure that models the material deformation history of fluid elements. The system is forced with a simple, white in time, Gaussian noise. The resulting stochastic system reproduces many statistical and geometric trends observed in numerical and experimental 3D turbulent flows. Examples include the non-Gaussian statistics of velocity gradient components, the preferential alignment of vorticity, nearly log-normal statistics of the dissipation, the tear-drop shape of the so-called R-Q joint probability density and anomalous scaling of velocity derivatives.

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