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A dissipative random velocity field for fully developed fluid turbulence LAURENT CHEVILLARD, Laboratoire de Physique de l'ENS Lyon, RODRIGO PEREIRA, Instituto de Fisica, Universidade Federal do Rio de Janeiro, C.P. 68528, 21945-970, Rio de Janeiro, RJ, Brazil, CHRISTOPHE GARBAN, Institut Camille Jorban, Universite Lyon 1, Lyon, France — We investigate the statistical properties, based on numerical simulations and analytical calculations, of a recently proposed stochastic model for the velocity field of an incompressible, homogeneous, isotropic and fully developed turbulent flow. A key step in the construction of this model is the introduction of some aspects of the vorticity stretching mechanism that governs the dynamics of fluid particles along their trajectory. An additional further phenomenological step aimed at including the long range correlated nature of turbulence makes this model depending on a single free parameter that can be estimated from experimental measurements. We confirm the realism of the model regarding the geometry of the velocity gradient tensor, the power-law behaviour of the moments of velocity increments, including the intermittent corrections, and the existence of energy transfers across scales. We quantify the dependence of these basic properties of turbulent flows on the free parameter and derive analytically the spectrum of exponents of the structure functions in a simplified non dissipative case. A perturbative expansion shows that energy transfers indeed take place, justifying the dissipative nature of this random field.

Laurent Chevillard
Laboratoire de Physique de l'ENS Lyon

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