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Power Fluctuations and Irreversibility in Turbulence HAITAO XU, MPI for Dynamics & Self-Organization (MPIDS), Goettingen, Germany, ALAIN PUMIR, ENS-Lyon, Lyon, France, GREGORY FALKOVICH, Weizmann Institute of Science, Rehovot, Israel, EBERHARD BODENSCHATZ, MPI for Dynamics & Self-Organization (MPIDS), Goettingen, Germany, MICHAEL SHATS, HUA XIA, NICOLAS FRANCOIS, Australian National University, Canberra, Australia, GUIDO BOFFETTA, University of Torino, Torino, Italy — We show that for fluid turbulence irreversibility manifests itself in the evolution of the kinetic energy of individual fluid elements. We found in experiment and numerical simulations of two-dimensional and three-dimensional turbulence that fluid elements decelerate faster than accelerate. This asymmetry gives rise to negative third moments of energy changes of a fluid element, which we observed to remain constant for time delays in the range characteristic of turbulent eddies, independently of the flow details including space dimensionality. However, turbulence in two and three dimensions show striking differences in how energy is exchanged between fluid elements: pressure forces redistribute energy from fast to slow elements in two dimensions; conversely, in three dimensions, pressure transfers energy from slow to fast ones.

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