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small scale structures of turbulence in terms of entropy and fluctuation theorems JOACHIM PEINKE, ANDRÉ FUCHS, MATTHIAS WÄCHTER, Univ Oldenburg, SíLVIO M. UARTE QUEIRÓS, Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, PEDRO LIND, OsloMet University, ALAIN GIRARD, CEA-Grenoble , FREDDY BOUCHET, ens Lyon — We present experimental evidence that, together with the integral fluctuation theorem, a detailed-like fluctuation theorem holds for large entropy values in cascade processes in turbulent flows. Based on experimental data, we estimate the stochastic equations describing the scale-dependent cascade process in a turbulent flow through Fokker-Planck equations, and from the individual cascade trajectories an entropy term can be determined. Since the statistical fluctuation theorems set the occurrence of positive and negative entropy events in strict relation, we are able to verify how cascade trajectories, defined by entropy consumption or entropy production, are linked to turbulent structures: Trajectories with entropy production start from large velocity increments at large scale and converge to zero velocity increments at small scales; trajectories with entropy consumption end at small scale with finite size increments. A lower bound at small scale of these negative entropy trajectories increases linearly with the magnitude of the negative entropy value. This indicates a tendency to local discontinuities in the velocity field. Our findings show no lower bound of negative entropy values and thus for the piling up velocity differences on small scales. (Phys. Rev. F 5, 034602 (2020))

Joachim Peinke
Univ Oldenburg

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