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Unified Multifractal Description of Eulerian and Lagrangian Velocity Increments in Turbulence L. CHEVILLARD, Johns Hopkins University, A. ARNEODO, B. CASTAING, E. LÉVÊQUE, J.-F. PINTON, S.G. ROUX, École Normale Supérieure de Lyon, France — In fully developed turbulence, most of the experimental, numerical and theoretical works have focused on the statistics of the Eulerian longitudinal velocity increments. It is now well established that the structure functions behave as power laws in the inertial range with a non linear exponent. This anomalous scaling is referred to the so-called intermittency phenomenon: the probability density function (PDF) of velocity is close to Gaussian, while the PDF of velocity gradients exhibits fat tails. Very recently, two experimental groups have succeeded in following particle tracers in turbulent flows realizing a Lagrangian description of the fluid. Lagrangian velocity shares many properties with its Eulerian counterpart but is found much more intermittent. We show that the multifractal approach, combined with a proper probabilistic formulation, reproduces the velocity increments PDFs, in both Eulerian and Lagrangian frameworks, for both the inertial and dissipative ranges of scales, using a single parameter function $\mathcal{D}(h)$ and a universal constant. This approach is shown to account quite well of the skewness of the longitudinal velocity increments PDF.

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