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Lagrangian acceleration time scales in anisotropic turbulence[1]
ROMAIN VOLK, Univ Lyon, Ens de Lyon, Univ Claude Bernard, CNRS, Laboratoire de Physique, Lyon, France, PETER HUCK, NATHANAEL MACHICOANE, University of Washington - Department of Mechanical Engineering, Seattle, WA, USA — We present experimental Lagrangian measurements of tracer particle acceleration auto-correlation functions in an anisotropic and inhomogeneous flow spanning the typical range of experimentally accessible Reynolds numbers. The large scale forcing of the flow creates a stagnation point topology where straining motion governs the anisotropic velocity and acceleration fluctuations. We show that the time scales of the acceleration components remain anisotropic at high Reynolds numbers and that they are related to the dissipative time scale by the Lagrangian structure function scaling constants C_0 and a_0. The scaling relation proposed herein is supported by observations using experimental Lagrangian trajectory data sets and analytical calculations using a jointly-Gaussian two-time stochastic model. Examination of acceleration power spectra show that acceleration fluctuations become isotropic in the dissipative range which suggests that the acceleration time scale is not only determined by small scales, but also by large and anisotropic scales whose contributions are substantial, even in the high Reynolds number limit.

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Romain Volk
Univ Lyon, Ens de Lyon, Univ Claude Bernard, CNRS, Lab de Physique

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