Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Multi-Scale Analysis of Lagrangian Properties of Turbulence
MICHAEL WILCZEK, CRISTIAN LALESCU, Max Planck Institute for Dynamics and Self-Organization — Turbulence is a multi-scale problem in space and time with a broad range of strongly interacting degrees of freedom. Lagrangian tracer particles advected with the flow sample this spatio-temporal complexity. This naturally leads to the question of how Lagrangian properties are affected by the scales of turbulence. We attempt to answer this question numerically and theoretically adopting a coarse-graining approach. In an extensive DNS (direct numerical simulation) study, we track tracer particles advected by spatially coarse-grained velocity fields. This allows to distinguish the impact of large-scale sweeping effects and small-scale intermittency on Lagrangian aspects of turbulence. In this presentation we will present results on Lagrangian particle dispersion and velocity fluctuations for various coarse-graining scales. The results will furthermore be discussed in the context of Eulerian-Lagrangian bridging relations.

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Date submitted: 18 Jul 2016 Electronic form version 1.4