Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Modulation of inter-phase, cross-scale momentum transfer by preferentially-concentrated inertial particles MIRALIREZA NABAVI BAVIL, Arizona State University, MARIO DI RENZO, Sapienza University of Rome, JEONGLAE KIM, Arizona State University — Decaying homogeneous isotropic turbulence suspended with inertial point particles is investigated for understanding inter-phase, cross-scale interactions. Using a wavelet multiresolution analysis, the cross-scale transfer of turbulence kinetic energy (TKE) is quantified with a good spectral and spatial resolution and characterized as a function of the particle Stokes number St_k. Due to the spatially-local nature of the preferential concentration, the work done by the critical particles ($St_k = 1$) is increasingly intermittent in space. However, the subfilter-scale energy transfer by the triadic interactions becomes less intermittent than that of the particle-free simulation. Conditioned analysis is performed by evaluating joint probability density function of wavelet statistics. In contrast to the preferential concentration in the one-way coupled simulations, small-scale kinetic energy is positively correlated with the coarse-grained particle-number density where local TKE fluctuations are higher than the average. A collective work done by the high-concentration critical particles amplifies turbulent fluctuations, consistent to the unconditioned wavelet analysis.

Miralireza Nabavi Bavil
Arizona State University

Date submitted: 01 Aug 2020 Electronic form version 1.4