Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The Rapid Distortion of Two-Way Coupled Particle-Laden Turbulence MOHAMED KASBAOUI, DONALD KOCH, OLIVIER DESJARDINS, Cornell University — The modulation of sheared turbulence by dispersed particles is addressed in the two-way coupling regime. The preferential sampling of the straining regions of the flow by inertial particles in turbulence leads to the formation of clusters. These fast sedimenting particle structures cause the anisotropic alteration of turbulence at small scales in the direction of gravity. These effects are investigated in a revisited Rapid Distortion Theory (RDT), extended for two-way coupled particle-laden flows. To make the analysis tractable, we assume that particles have small but non-zero inertia. In the classical results for single-phase flows, the RDT assumption of fast shearing compared to the turbulence time scales leads to the distortion of frozen turbulence. In particle-laden turbulence, the coupling between the two phases remains strong even under fast shearing and leads to a dynamic modulation of the turbulence spectrum. Turbulence statistics obtained from RDT are compared with Euler-Lagrange simulations of homogeneously sheared particle-laden turbulence.

Mohamed Kasbaoui
Cornell University

Date submitted: 01 Aug 2017 Electronic form version 1.4