Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The role of collective effects on the enhancement of the settling velocity of inertial particles in turbulence PETER HUCK, cole Normale Suprieure de Lyon, COLIN BATESON, University of Washington, ROMAIN VOLK, cole Normale Suprieure de Lyon, ALAIN CARTELLIER, University of Grenoble Alpes, MICKAEL BOURGOIN, cole Normale Suprieure de Lyon, ALBERTO ALISEDA, University of Washington — A particle-laden homogeneous isotropic turbulence experiment is used to study the role that collective effects (e.g. particle-particle aerodynamic interactions) have on the settling velocity of inertial particles (Stokes $0.1 < \mathrm{St} < 0.3$). Conditional averaging of the particle vertical velocity on the local concentration identifies three settling regimes: low concentration fast-tracking, rapid increase in settling velocity at intermediate concentrations, and saturation at large concentrations. The latter effect, associated with four-way coupling, displays qualitative agreement with simulations in the literature and is a new experimental observation. Fluctuations up to an order of magnitude larger than the background volume fraction are measured using Voroni analysis which is used in a model developed in the spirit of volume-averaged multiphase flow methods, that gives a consistent interpretation, and quantitative predictive power, of the three settling regimes measured.

Peter Huck
cole Normale Suprieure de Lyon

Date submitted: 28 Jul 2017 Electronic form version 1.4