Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Clustering and relative velocity of heavy particles under gravitational settling in isotropic turbulent flows[1] GUODONG JIN, GUO-WEI HE, LNM, Institute of Mechanics, Chinese Academy of Sciences — Clustering and intermittency in radial relative velocity (RRV) of heavy particles of same size settling in turbulent flows can be remarkably changed due to gravity. Clustering is monotonically reduced at Stokes number less than 1 under gravity due to the disability of the centrifugal mechanism, however it is non-monotonically enhanced at Stokes number greater than 1 due to the multiplicative amplification in the case that the proposed effective Kubo number is less than 1. Although gravity causes monotonical reduction in the rms of RRV of particles at a given Stokes number with decreasing Froude number, the variation tendency in the tails of standardized PDF of RRV versus Froude number is obviously different: the tails become narrower at a small Stokes number, while they become broader at a large Stokes number. The mechanism of this variation stems from the compromise between the following two competing factors. The mitigation of correlation of particle positions and the regions of high strain rate which are more intermittent reduces the intermittency in RRV at small Stokes numbers, while the significant reduction in the backward-in-time relative separations will make particle pairs see small-scale structures, leading to a higher intermittency in RRV at large Stokes numbers.

[1]NSAF of China (grant number U1230126); NSFC (grant numbers 11072247 and 11232011)

Guodong Jin
LNM, Institute of Mechanics, Chinese Academy of Sciences

Date submitted: 08 Jul 2015 Electronic form version 1.4