Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The dynamics of dense particles in turbulent channel flows: gravity, lift and particle clusters[1] AMIR ESTEGHAMATIAN, TAMER ZAKI, Johns Hopkins University — Particle resolved simulations are performed for settling dense spheres in vertical channel flows of Newtonian and FENE-P fluids. Despite a small solid-to-fluid density ratio (ρ_r=1.15), the results highlight a remarkable difference from previous studies of neutrally buoyant conditions (Esteghamatian, A., Zaki, T. A. Dilute suspension of neutrally buoyant particles in viscoelastic turbulent channel flow, Journal of Fluid Mechanics 875 (2019): 286-320). Dense particles experience a sustained slip velocity that lead to significant lift forces and to clustering. Conditional trajectory-averaged statistics highlight that the net lift forces play a dominant role in particle migration and, as a result, momentum transfer in the wall-normal direction.A competition between the rotation- and shear- induced lift forces leads to accumulation of the particles near the wall. The Voronoi diagram is used for identifying particle clusters in that region. The correlation between the normalized Voronoi areas and particle velocities highlights the difference between the motions of isolated and clustered particles.

[1]This work was supported in part by the National Science Foundation.

Amir Esteghamatian
Johns Hopkins University

Date submitted: 02 Aug 2020 Electronic form version 1.4