Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Shape- and scale-dependent coupling between inertialess spheroids and velocity gradients in turbulence NIMISH PUJARA, University of Wisconsin - Madison, CRISTIAN LALESCU, MICHAEL WILCZEK, Max Planck Institute for Dynamics and Self-Organization — Particles of different shapes and sizes are commonly found suspended in a turbulent flow in the environment and in industrial processes. To better understand the dynamics of neutrally-buoyant, non-spherical particles in dilute concentrations, we compute the motion of inertialess spheroids in direct numerical simulations of turbulence using one-way forcing. Particles of different sizes are modelled as as tracers after the velocity field has been coarse-grained at different filter scales. The focus is on the statistics of particle rotations and what they reveal about the interaction between the particles and velocity gradients. While particle rotations in the co-ordinate axes fixed to each particle show interesting variations with particle shape and filter scale, the mean-square value of particle angular velocity in the global co-ordinate axes is nearly constant across all shapes and scales. These trends are further probed by examining the particle alignment with fluid vorticity and how this depends on particle shape and filter scale. Finally, a comparison between these results and laboratory experiments provides insights into how particle inertia may influence particle-turbulence coupling for large, anisotropic particles.

Nimish Pujara
University of Wisconsin - Madison

Date submitted: 12 Jul 2019 Electronic form version 1.4