JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Friday, October 5, 2018
3:00 PM, 132 Gilman Hall

"*Particles in Turbulence: Velocity Gradients and Collisions*"

Presented by Dr. Perry Johnson
Stanford University - Center for Turbulence Research

Winner of the 2017 Corrsin-Kovasznay Outstanding Paper Award

The dynamics of small particles in turbulent flows are important for a wide range of industrial and environmental applications. In this talk, I will address modeling challenges for two important phenomena for determining the fate of particles in turbulence.

First, the fluid velocity gradient determines the torque and deformation stress experienced by the particle along its trajectory. I will demonstrate how a stochastic model for the velocity gradient along tracer particle trajectories can be constructed by careful treatment of unclosed terms. This approach reproduces signature topological and non-Gaussian features of small-scale turbulence in a computationally efficient manner and has been successfully coupled with large-eddy simulations for simulating liquid droplet deformation dynamics. Future directions for including particle inertia effects will be discussed.

Secondly, inter-particle collisions not only control key processes such as coalescence, aggregation, and encounter rates; but can also strongly influence particle concentration profiles in wall-bounded flows. While turbophoresis traps particles near the wall, inter-particle collisions can be very effective at mitigating this effect. I will show how this effect can be modeled in a Lagrangian-Eulerian approach with a reduced number of computational particles by artificially enhancing the collisional diameter of the particles. Both the low and high Stokes number regimes will be considered.