Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Particle-droplet interaction in turbulent channel flow ARASH HAJISHARIFI, CRISTIAN MARCHIOLI, University of Udine, ALFREDO SOLDATI, TU Wien — We examine the interaction between small (sub-Kolmogorov) slightly inertial particles and large deformable droplets in turbulent channel flow. To simulate such solid-liquid-liquid flow, we exploit a Eulerian-Lagrangian methodology based on direct numerical simulation of turbulence, coupled with a Cahn-Hilliard Phase Field Model to capture the interface dynamics and Lagrangian tracking to compute particle trajectories. We model the particle-interface interaction via a capillary force based on the liquid-liquid surface tension and on the local interface curvature. This force gives a potential well that drives particle accumulation on the droplet interface, which acts as particle adsorber. We quantify particle-interface interaction in a simplified situation where the droplets have the same density and viscosity of the carrier liquid (mimicking a water-oil emulsion), and particles are one-way coupled with the fluids. Particle-induced deformation of the interface and the effect of gravity are neglected. Preliminary simulations indicate that particles tend to aggregate in regions of the interface characterized by high curvature, and that this tendency is modulated by particle inertia: The higher the inertia of the particles, the stronger the tendency to escape from the interface.

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Date submitted: 30 Jul 2019 Electronic form version 1.4