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Numerical Study of Charged Inertial Particles in Turbulence using a Coupled Fluid-P^{3}M Approach YUAN YAO, JESSE CAPECELATRO, University of Michigan, Ann Arbor — Non-trivial interactions between charged particles and turbulence play an important role in many engineering and environmental flows, including clouds, fluidized bed reactors, charged hydrocarbon sprays and dusty plasmas. Due to the long-range nature of electrostatic forces, Coulomb interactions in systems with many particles must be handled carefully to avoid $O(N^2)$ computations. The particle-mesh (PM) method is typically employed in Eulerian-Lagrangian (EL) simulations as it avoids computing direct pairwise sums, but it fails to capture short-range interactions that are anticipated to be important when particles cluster. In this presentation, the particle-particle-particle-mesh (P^{3}M) method that scales with $O(N \log N)$ is implemented within a EL framework to simulate charged particles accurately in a tractable manner. The EL-P^{3}M method is used to assess the competition between drag and Coulomb forces for a range of Stokes numbers and charges. Simulations of like- and oppositely-charged particles suspended in a two-dimensional Taylor-Green vortex and three-dimensional homogeneous isotropic turbulence are reported. One-point and two-point statistics obtained using PM and P^{3}M are compared to assess the effect of added accuracy on collision rate and clustering.

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