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Particle Interaction in Stratified Fluids[1] AREZOO ARDEKANI, AMIN DOOSTMOHAMMADI, University of Notre Dame — Hydrodynamics of many industrial and environmental systems is characterized by settling of suspended particles, interacting with each other and the surrounding fluid. Sedimentation of pollutants in the air and settling of marine snow particles in the ocean play an important role in several atmospheric and marine environmental processes. Hydrodynamics of these systems is markedly affected by the presence of vertical density variations that ubiquitously occurs due to temperature or salinity gradients in a fluid column. Despite the widespread implications of settling in stratified media, the fundamental mechanisms of particle interaction are not known to characterize the microstructure of stratified particulate systems. In a homogeneous fluid, a three-stage process, called "drafting, kissing, and tumbling", governs pair interaction of particles settling in tandem and explains the nonlinear behavior of particles in a particulate system. The pressure wake of the leading particle attracts the trailing particle. Upon collision of the particles, an unstable elongated body is formed and tumbles due to inertial effects. In a viscoelastic fluid, the elongated body settling along its long axis is stable and leads to chaining of the particles (drafting, kissing, and chaining). Our recent computational results reveal the role of density stratification on pair particle interaction. We use direct numerical simulations to fully resolve the particle-particle interaction in stratified fluids. The vital role of diffusivity of the stratified agent and the relative importance of inertial and buoyancy forces are investigated.

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