Abstract Submitted
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Turbulent pair dispersion in the presence of gravity[1] KELKEN CHANG, BENEDICT MALEC, RAYMOND SHAW, Michigan Technological University — We present numerical evidence of the alteration in the turbulent pair dispersion of heavy particles with two different Stokes numbers (bidisperse), whose effect on the dispersion is further compounded when a uniform gravitational acceleration is present. Lagrangian particle trajectories for fluid tracers, and bidisperse inertial particles with and without gravity were calculated from a direct numerical simulation of homogeneous, isotropic turbulence. Particle pair dispersion shows a short-time, ballistic (Batchelor) regime and a transition to super-ballistic dispersion that is suggestive of the emergence of Richardson scaling. The commonly used equation of motion for inertial, sedimenting particles and Kolmogorov scaling arguments are shown to capture the essential features of the pair dispersion at very short time and length scales. Between the ballistic and super-ballistic regions, the dispersions of both tracers and monodisperse inertial particles display a sub-ballistic behavior that is strongly suppressed in the bidisperse case. We attribute the suppression of the dispersion to a reduction in the correlation between velocity and acceleration increments, whose behavior we attempt to capture using a stagnation point model.

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