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**Velocity fluctuations and hydrodynamic dispersion in a settling suspension of solid particles with finite Reynolds numbers** XIAOLONG YIN, DONALD KOCH, School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, NY 14853 — It is well known that, in simulations of settling particles with periodic boundary conditions, the long-range nature of Stokes flow hydrodynamic interactions leads to an algebraic divergence of particles' velocity variance and hydrodynamic diffusivity with increasing domain size. This paper explores the impact that fluid inertia has on these scaling behaviors. Our lattice-Boltzmann simulations of settling particles with Reynolds numbers of 1-10 indicate that the particle and fluid velocity variance grow logarithmically with system size as has been predicted theoretically by Koch (1993) for randomly distributed particles with Oseen velocity disturbances. However, the coefficient of the logarithmic function is reduced by partial buoyancy screening associated with a deficit of particles in the wake of a test particle. The hydrodynamic diffusivity is proportional to the product of the root-mean-square velocity and the system size, consistent with a scaling theory in which the decorrelation of particle velocities results from fluctuation-induced sampling of the fluid velocity disturbance caused by the other particles

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