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Particle-scale fluctuations and hindered settling of a granular dispersion at low-Re[1] TED BRZINSKI, JAMES STADLER, IVAN TSEYTLIN, CHARLES WALKER, Haverford College — Dense dispersions of grains sedimenting in a fluid at low-Re are characterized by mean settling velocities which are hindered relative to Stokes settling. Hindered settling data can be collapsed to a master curve which is well-described by the Richardson-Zaki function $H(\phi) \equiv v/v_s = (1-\phi)^n$, where ϕ is the particle volume fraction, but with different exponents: $n \approx 5.5$ for systems with a small Peclet number, and $n \approx 4.5$ for systems with large Peclet number. This branching occurs at a surprisingly large value of Pe$\approx 10^8$. We report the results of our latest experimental investigations into this unexpected behavior. Using diffusing-wave spectroscopy, we characterize the spatio-temporal particle velocity fluctuations on scales as small as the expected Brownian motion for our experimental systems, and systematically vary Peclet number around the branching-value to identify differences in the grain-scale dynamics between systems on either branch of the hindered settling function.

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Ted Brzinski
Haverford College

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