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Does Suspension Crowding Screen Hydrodynamic Interactions?

YU SU, ROSEANNA N. ZIA, Cornell University, JAMES W. SWAN, Massachusetts Institute of Technology — Resistance and mobility functions describe linear couplings between moments of the hydrodynamic traction on a suspended particle and the motion of that or other particles. For two isolated spheres, these functions are well known and have been applied directly in the solution of many important problems for dilute colloidal dispersions. We have devised a new stochastic technique to calculate an analogous set of functions for two spheres immersed in a suspension that are then used to model the near-equilibrium dynamics of concentrated dispersions, including viscoelasticity and long-time diffusion. Of interest is the degree of screening of hydrodynamic interactions by the intervening medium. We find that the mobility is unscreened at the pair level, even in suspensions of high concentration, confirming that hydrodynamic interactions are an essential part of the dynamics of crowded systems and cannot be neglected in favor of simple renormalization schemes. We compare our results for the hydrodynamic interactions between suspended particles to predictions from two-point microrheology. This technique can be used to infer the complex viscosity from long-ranged decay of the pair mobility in viscoelastic materials.

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