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Hydrodynamically interacting particles confined by a spherical cavity via dynamic simulation: a model for intracellular transport CHRISTIAN APONTE-RIVERA, YU SU, ROSEANNA ZIA, Cornell University — We study the short- and long-time self-diffusion of hydrodynamically interacting colloids enclosed within a spherical cavity as a model for intracellular transport. Prior models of such behavior began with a single enclosed particle; attempts to enlarge such models to many particles have seen limited success owing to the challenges of accurately modeling many-body far-field and singular near-field hydrodynamic interactions. To overcome these difficulties we have developed a new set of hydrodynamic mobility functions to couple particle motion with hydrodynamic force moments which, when inverted and combined with near-field resistance functions form a complete coupling tensor that accurately captures both far-field and near-field physics, for an arbitrary number of particles enclosed by a spherical cavity of arbitrary relative size. The mobility functions are implemented into a Stokesian dynamics framework, and particle motion obtained via dynamic simulation. We present results for a range of volume fractions from dilute to concentrated, and a range of particle-to-cavity size ratios, where an interplay between entropic restriction and hydrodynamic entrainment give rise to novel diffusive behavior. Results are compared to experiments with excellent agreement.

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