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Enhanced Diffusion in Quasi-Two-Dimensional Suspensions
ADAR SONN, HAIM DIAMANT, YAEL ROICHMAN, School of Chemistry, Tel Aviv University — We study the Brownian motion of quasi-two-dimensional suspensions of micron-sized particles parallel to a single wall. The dynamics of a suspension near a single wall has two characteristics; the self diffusivity is smaller than in unconfined suspensions, and the hydrodynamic interactions between particles decay with inter-particle distance r, as $1/r^3$. We track the motion of silica beads that sediment to the sample floor due to their high density. Screened Coulomb interactions between the bottom glass wall and the heavily charged surface of the beads maintain the beads floating a few hundred nanometers above the wall. We follow the change in the self diffusivity and hydrodynamic interactions as a function of particle area fraction in the sedimented monolayer, ϕ. As expected, the self diffusion decreases as ϕ increases; however, at large ϕ, we observed an increase in self diffusivity. We also observe strongly correlated motion between particles separated by a distance much larger than their distance from the wall. This long-range hydrodynamic coupling has non-trivial dependence on particles' density. Some possible explanations for these observations will be discussed.

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