

Long-ranged hydrodynamic interaction between confined particles

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We consider the hydrodynamic interactions between particles suspended in a quiescent viscous fluid, which is confined in a long linear channel. At steady state, these interactions are known to be exponentially screened beyond a distance comparable to the channel width [1, 2]. The screening is shown to be qualitatively modified, however, when the time-dependent response and finite compressibility of the host liquid are taken into account [3]. Diffusive compression modes in the confined liquid [4] cause the particles to have velocity correlations of unbounded range, whose amplitude decays with time only as $t^{-3/2}$. This long-ranged effect was demonstrated using a simplified analytical theory and lattice-Boltzmann simulations [3]. It has been subsequently confirmed in a more detailed analytical calculation [5].

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- [1] N. Liron and R. Shahar, *J. Fluid Mech.* **86**, 727 (1978).
 - [2] B. Cui, H. Diamant, and B. Lin, *Phys. Rev. Lett.* **89**, 188302 (2002).
 - [3] D. Frydel and H. Diamant, *Phys. Rev. Lett.* **104**, 248302 (2010).
 - [4] M. H. J. Hagen, I. Pagonabarraga, C. P. Lowe, and D. Frenkel, *Phys. Rev. Lett.* **78**, 3785 (1997).
 - [5] B. U. Felderhof, *J. Chem. Phys.* **134**, 024505 (2011).