Abstract Submitted
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Effective diffusivity in active Brownian suspensions[1] ERIC BURKHOLDER, JOHN BRADY, California Institute of Technology — We study the single-particle diffusion of a Brownian probe of size R in a suspension comprised of a Newtonian solvent and a dilute dispersion of active Brownian particles (ABPs) with size a, characteristic swim velocity U_0, and a reorientation time τ_R. These ABPs, or swimmers, have a run length $\ell = U_0\tau_R$, and a mechanical activity $k_sT_s = \zeta_a U_0^2\tau_R/6$, where ζ_a is the Stokes drag coefficient of a swimmer. When the swimmers are inactive, collisions between the probe and the swimmers sterically hinder the probe's diffusive motion. When the activity of the swimmers is greater than the Boltzmann energy, $k_sT_s > k_BT$, rather than being sterically hindered, the probe diffusivity is actually greater than its Stokes-Einstein-Sutherland diffusivity due to the mechanical energy imparted to the probe upon collisions with the swimmers. The active contribution to the effective diffusivity is a non-monotonic function of the swimmers' run length compared to the contact length between the probe and a swimmer: $\ell/(R+a)$. Comparisons are made to previous theoretical and experimental investigations of the hydrodynamic diffusion of a colloidal particle in a dilute suspension of swimming bacteria.

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