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Hydrodynamic entrapment, scattering, and escape of swimming bodies near colloidal particles SAVERIO SPAGNOLIE, Univ of Wisconsin-Madison, GREGORIO MORENO FLORES, Pontificia Universidad Catolica de Chile, DENIS BARTOLO, Ecole Normale Supérieure de Lyon, ERIC LAUGA, Cambridge University — Microorganisms and other self-propelling bodies in viscous fluids are known to traverse complex trajectories in the presence of boundaries, due to passive hydrodynamic and other physical effects. Motivated by the experimental findings of Takagi et al. on self-propulsion in a field of colloidal particles, we derive the far-field hydrodynamic interaction between model "pusher" and "puller" dipole swimmers and no-slip spherical bodies of varying size. Using the analytical estimates for the swimming trajectories, we predict the critical colloid size or dipole strength for which hydrodynamic entrapment occurs, the scattering dynamics for near-obstacle interactions, and the consequences of Brownian fluctuations. The dynamics include billiard-like motion between colloids, intermittent periods of entrapped/orbiting states near single colloids, and apparently randomized escape behavior. We envision applications of the theory to techniques for sorting microorganisms or other self-propelled swimmers, and to the behavior of motile suspensions in inhomogeneous environments.

Saverio Spagnolie
Univ of Wisconsin-Madison

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