Dispersion and transport of microswimmers interacting with boundaries

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Abstract

We consider a simple model of a two-dimensional microswimmer with fixed swimming speed. The direction of swimming changes according to a Brownian process, and the swimmer is interacting with boundaries. The shape of the swimmer determines the range of allowable values that its degrees of freedom can assume — its configuration space. Using natural assumptions about reflection of the swimmer at boundaries, we compute the swimmer's invariant distribution across a channel consisting of two parallel walls, and the statistics of spreading in the longitudinal direction. This gives us the effective diffusion constant of the swimmer's large scale motion. This model offers insight into experiments of scattering of swimmers from boundaries, and serves as an exactly-solvable baseline when comparing to more complex models. This is joint work with Hongfei Chen.

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