Graduate Student Research Seminar

Spring 2025

Molecular Motion Near a Soft Fluctuating Membrane

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Monday, October 6th
3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

Dispersed particles moving near interfaces experience anisotropic resistance due to hydrodynamic interactions with the boundary. Since the pioneering work of Lorentz, several analytical expressions have been derived for spherical particles in Stokes flow near planar walls and liquid–liquid interfaces. However, our understanding of particle motion near soft, thermally fluctuating interfaces—such as lipid membranes, a canonical biological example—remains in its infancy. Numerical investigations to date have primarily focused on particles significantly larger than the molecular length scales. Here, we use the dissipative particle dynamics (DPD) method to investigate the mobility of particles on the order of angstroms in size, near a fluctuating membrane. We compare our results to the reference case of transport near a planar wall and identify two distinct mobility regimes: significantly enhanced mobility near the membrane and slightly reduced mobility farther away. In contrast to the planar wall, the membrane exhibits both surface undulations and thermal fluctuations. To isolate the origin of the observed behavior, we study the mobility near a static (non-fluctuating) membrane, allowing us to separate the effects of thermal fluctuations from those of surface undulations.

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