

Brownian dynamics of a self-propelled particle on a substrate

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The overdamped Brownian motion of a self-propelled particle which is driven by a projected internal force is studied using the Langevin equation method. The swimmer under study is restricted to move along a linear channel or in a two-dimensional plane. Its orientation, the direction of the internal force, is either freely diffusing on the the unit sphere or confined to a plane, which is perpendicular to the substrate. For a subset of the cases considered the impact of a uniaxial torque is also investigated. The model is relevant for active particles like catalytically driven Janus particles and bacteria moving on a substrate. Analytical results for the mean position and the mean square displacement are presented and analyzed for several special situations.