

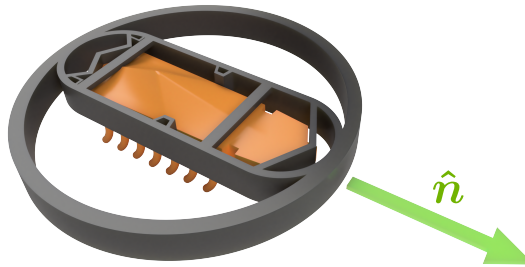
# Depinning and activated motion of chiral self-propelled robots

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Many different collective dynamics emerge from self-alignment, such as collective actuation in active solids and collective migration of motile agents. However, since self-aligning torque couples rotations and displacements at individual level, interesting dynamics arise even in the absence of interparticle interactions. We study experimentally, numerically and analytically, the dynamics of a chiral self-aligning active particle (cm-sized robots), pulled at a constant translational velocity. We show that the system can be mapped to a Brownian particle driven across a periodic potential landscape, and thus exhibits a rotational depinning transition in the noiseless limit, giving rise to a creep regime in the presence of rotational diffusion. We show that a simple model of chiral, self-aligning, active particles accurately describes such dynamics. The steady-state distribution and escape times from local potential barriers, corresponding to long-lived orientations of the particles, can be computed exactly within the model and is in excellent agreement with both experiments and particle-based simulations, with no fitting parameters. Our work thus consolidates such self-propelled robots as a model system for the study of chiral active matter, and highlights the interesting dynamics arising from the interplay between external and internal driving forces in the presence of a self-aligning torque.



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