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Self-Assembled Magnetic Surface Swimmers: Theoretical Model[1]

IGOR ARANSON , MAXIM BELKIN, ALEXEY SNEZHKO , Argonne National Laboratory — The mechanisms of self-propulsion of living microorganisms are a fascinating phenomenon attracting enormous attention in the physics community. A new type of self-assembled micro-swimmers, *magnetic snakes*, is an excellent tool to model locomotion in a simple table-top experiment. The snakes self-assemble from a dispersion of magnetic microparticles suspended on the liquid-air interface and subjected to an alternating magnetic field. Formation and dynamics of these swimmers are captured in the framework of theoretical model coupling paradigm equation for the amplitude of surface waves, conservation law for the density of particles, and the Navier-Stokes equation for hydrodynamic flows. The results of continuum modeling are supported by hybrid molecular dynamics simulations of magnetic particles floating on the surface of fluid.

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