Notre Dame Science
Department of Physics

ACTIVE MAGNETIC COLLOIDS: FROM SELF-ASSEMBLED SWIMMERS TO SIMPLE ROBOTS

Dr. Igor Aronson
Materials Science Division, Argonne National Laboratory

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(Refreshments at 3:30 P.M. NSH 202)

Self-assembly, a natural tendency of simple building blocks to organize into complex architectures, is a unique opportunity for contemporary materials science. In order to support structural complexity and functional diversity, self-assembled materials must actively consume energy and "live" out of equilibrium. We study a simple active colloidal system: a ferromagnetic colloidal suspension confined at the interface between two immiscible liquids and energized by an alternating magnetic field. Depending on the frequency and amplitude of magnetic field, a variety of dynamic self-assembled structures is observed: from self-propelled magnetic swimmers - magnetic snakes to localized asters and arrays of asters. Locomotion can be further controlled by a small magnetic field applied parallel to the interface. The asters, remotely controlled by an external magnetic field, perform simple robotic functions including capture, transport, and positioning of target particles. Observed phenomena are described by a first-principles mathematical model for the dynamic self-assembly of magnetic colloids at a water-air interface. The ability to manipulate colloidal structures is crucial for the further development of self-assembled microrobots.

Colloquium

All interested persons are cordially invited to attend.