PHYSICAL MATHEMATICS SEMINAR

ELECTROHYDRODYNAMICS AND EPITROCHOIDS: DYNAMIC PATTERN FORMATION OF MICRON-SCALE OBJECTS NEAR ELECTRODES

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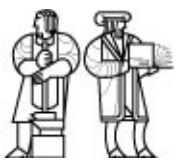
ABSTRACT:

Developing techniques to manipulate small objects is crucial for designing microfluidic lab-on-a-chip devices for chemical synthesis and medical diagnostic applications. Here, I present experimental and theoretical work on a technique based on electrohydrodynamic (EHD) flow. Application of an electric field induces an EHD flow around individual objects near an electrode. Nearby objects are mutually entrained in the respective flows, causing them to move toward one another. The superposition of flows around many objects often leads to the formation of striking patterns. For example, mixtures of rigid colloids with different polarizability arrange into morphologies including 'flowers', 'islands', and hexagonal or square superlattices. In contrast, suspensions composed of unilamellar vesicles of different sizes arrange into dynamic orbiting patterns, in which small vesicles orbit around larger vesicles in preferred orientations (i.e. 'bands'). This phenomenon is captured by a simple numerical model of point dipoles moving in a cellular flow, yielding a surprisingly rich phase diagram of trajectories including Cassini ovals and epitrochoids.

TUESDAY, OCTOBER 23, 2007
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)



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