PHYSICAL MATHEMATICS SEMINAR

MICROFLUIDICS WITH MULTIPLE PHASES: FROM STOKES FLOW TO PARTICLE SYNTHESIS

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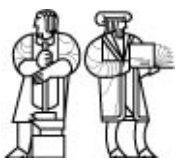
ABSTRACT:

The talk will address characteristics of microscale gas-liquid flows and exemplify combinations of such flows with transport processes and chemical reactions. The transient behavior of microscale multiphase flows allows us to overcome limitations that are often associated with single-phase microfluidic systems.

A wide range of flow conditions in microfluidic networks of rectangular cross section is considered. At low velocities, a very regular succession of gas bubbles and liquid segments that we call 'segmented flow' is obtained. The liquid films that interconnect subsequent liquid segments were first studied by Bretherton and Taylor. In difference to these classical studies of axisymmetric bubble shapes, films break at the small bubble velocities we are interested in (Ca = 0.001 - 0.2) and liquid menisci form in the corners of our rectangular channels, increasing streamwise communication. Flow patterns and the velocity field inside liquid segments are characterized by an integrated sensor, fluorescence microscopy and particle image velocimetry. Recirculation inside liquid segments provides an efficient mixing mechanism for miscible liquids. Axial dispersion is decreased in segmented flow, enabling the on-chip synthesis of uniformly sized nanoparticles, e.g., CdSe quantum dots.

TUESDAY, SEPTEMBER 27 2005
2:30 PM
Building 3, Room 370

Refreshments at 3:30 PM in Building 2, Room 349.



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