PHYSICAL MATHEMATICS SEMINAR

Spreading of Insoluble Surfactant on a Thin Liquid Film

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ABSTRACT:

I report on recent experiments on the well-studied problem of characterizing how a circular patch of insoluble surfactant spreads over a thin film of Newtonian fluid. New innovations allow for the simultaneous visualization of thin film height and surfactant distribution, over a range of surfactant concentrations. We observe several features that are inconsistent with numerical simulations of the standard Borgas-Gaver-Grotberg lubrication model, in which surfactant molecules are passively transported by the underlying fluid. At all surfactant concentrations, the observed distribution of surfactant is spatially much more uniform than expected from the model. Moreover, at low concentrations the spreading dynamics, measured by the location r(t) of the leading edge of the surfactant, is consistently given by a power law $r(t) \sim t^k$, with $k \sim 1/10$, much slower than either theoretical or numerical predictions. The resolution of this disagreement between theory and experiment may lie in phase transitions in the packing of surfactant molecules on the free surface, giving rise to modifications in the assumed dependence of surface tension on surfactant concentration.

This is joint work with Karen Daniels, Stephen Strickland and Ellen Swanson.

TUESDAY, OCTOBER 8, 2013
2:30 PM
Building E51, Room 149

Reception following in Building E17, Room 401A
(Math Dept. Common Room)

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