PHYSICAL MATHEMATICS SEMINAR

Stability and dynamics of Marangoni-driven flows undergoing phase change

PEDRO SÁENZ

Massachusetts Institute of Technology

ABSTRACT:

In this talk we discuss the stability and dynamics of Marangoni-driven flows undergoing phase change by means of direct numerical simulations and experiments. The novelty of the general approach developed in this work lies in the fact that the problems under consideration are addressed with novel fully-coupled two-phase flow models in 3D, which enable realistic investigations of the interface energy and mass transfer mechanisms at a local scale. Two problems are examined in detail: laterally-heated liquid layers and volatile sessile droplets. The former configuration is naturally vulnerable to the formation of an oscillatory regime characterized by a myriad of thermal wave-like patterns propagating along the gas-liquid interface, i.e. hydrothermal waves. We first discuss the implications of such thermocapillary instabilities in saturated environment and then examine the effects of including phase change. In the second part of the presentation, we turn our attention to volatile sessile droplets and describe the flow dynamics emerging in non-spherical drops as well as the effects of contact-line dynamics in heated configurations. We show that non-sphericity leads to the spontaneous development of previously unknown azimuthal currents and pairs of counter-rotating vortices in the drop's micro flow. Finally, we illustrate experimentally the complex evaporation mechanisms resulting in well-defined non-spherical drops of pure liquids and binary mixtures. Have you ever wondered how a drop with a triangular contact area evaporates?

TUESDAY, OCTOBER 27, 2015
2:30 PM
Building E18, Room 466A

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

http://math.mit.edu/pms/

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