Seminar/Talk

Confined viscous flows: flowing in curved space and hydrodynamic interactions

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Confined flows are encountered at all scales in nature, whether it's in our blood vessels or in fluids like oil flowing through underground rocks. The emergence of microfluidics as a lab-on-a-chip technology has paved the way for studying these flows, moving away from the constraints of in-situ measurements.In this talk, I investigate two fundamental questions about the dynamics of confined fluids. In the first part, through a combination of model experiments, numerical simulations, and analytical work, I explain how the curvature of space alters the typical plug flows of confined fluids in homogeneous environments. After establishing the impact of isotropic curvature heterogeneity, I demonstrate how local curvature anisotropies act as singular perturbations. By drawing an analogy with the laws of electrostatics in two dimensions, I illustrate that these results are not limited to confined flows but also encompass the entire range of Laplacian problems to which they belong, from diffusive transport in solutions to Ohmic transport in 2D materials.In a second part, I show how the competition between hydrodynamic and potential interactions results in the melting of crystalline emulsions even when forced far from equilibrium in a homogeneous manner. I demonstrate in particular how hydrodynamic interactions propel dislocations upstream of the forcing to form statistically stationary but perpetually rearranging polycrystals.

Thursday, November 2, 2023 11:00am - 12:00pm
Moonstone Bldg / Ground floor / Seminar Room F (I24.EG.030f)

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