

Interdisciplinary Research Institute for the Sciences (IRIS) Seminar

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11:00am – 12:00pm

LO1317

Surface Fluctuating Hydrodynamic Methods for Fluid-Structure Interactions in Cell Mechanics

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Abstract:

We introduce surface fluctuating hydrodynamics approaches for investigating transport and fluid-structure interactions within curved fluid interfaces arising in cell mechanics. We focus particularly on drift-diffusion dynamics of proteins and microstructures within lipid bilayer membranes and related systems. We show how a mesoscale description of the surface mechanics can be formulated accounting for geometry in the hydrodynamics and thermal fluctuations. The stochastic equations pose challenges for use in practice, including, (i) a need for accurate and stable discretizations of geometric terms and differential operators on the surface, (ii) techniques for hydrodynamics handling surface incompressibility constraints, and (iii) stiffness from rapid time-scales introduced by the thermal fluctuations. We show how spectral methods and meshfree approaches can be used to obtain practical computational simulation methods. We then investigate the role of geometry in hydrodynamic transport and the collective drift-diffusion dynamics of proteins within curved membranes.