Soft Living Active and Adaptive Matter

The many phases of a cell

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Abstract:

Cells are a remarkable example of multiphase living fluids - billions of proteins and nucleic acids self-organize by phase transitions into diverse coexisting assemblies called biomolecular condensates. How dozens of interacting species in complex environments and subject to non-equilibrium fluxes encode for macroscopic properties remains challenging to decipher. In this talk, I will introduce a framework to predict emergent behavior in multiphase living fluids - drawing on ideas across non-equilibrium theory, statistical physics, and applied mathematics. By integrating phase-field simulations and random-matrix theory, I will first describe a model of fluids with randomly interacting components that exhibits complex yet surprisingly predictable multiphase coexistence. I will subsequently describe how active chemical fluxes can tunably modify emergent phase behavior, even in the absence of compositional changes. Finally, when interactions are partially structured i.e. non-random, I will show that there are statistical constraints on number of steady-state properties. I will conclude by highlighting few open questions and exciting future directions at the intersection of biomolecular condensates and soft living matter.

Date:
09/12/2022

Time:
9:00 AM-10:15 AM (PT)

About the speaker:

Dr. Krishna Shrinivas is an interdisciplinary scientist with broad interests in biophysics and soft matter, with an emphasis on investigating self-organization in cell biology. Towards this, he develops quantitative theoretical and computational frameworks and collaborates extensively with diverse experimental scientists.

Dr. Shrinivas is currently an Independent Fellow of Quantitative Biology at Harvard University, jointly funded by NSF and the Simons Foundation. He previously trained as a chemical engineer, completing his PhD at MIT working with Arup K. Chakraborty and his B.Tech (Honors) at IIT-Madras.

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