Soft Living Active and Adaptive Matter

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Programming structural transitions in soft matter: physics and data driven approaches

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Abstract:

Colloidal suspensions, living cells, and polymer solutions are examples of soft matter systems whose interactions can be tailored to generate functional structures impacting fields of foods, biomaterials, and manufacturing. In my research, I study the behavior of far-from-equilibrium soft matter systems to generate insights to tailor structure formation. Traditionally, we have developed control over such systems using forward, physics-based approaches to understand and design systems for desired outcomes. More recently, inverse, data-driven approaches have emerged that augment our capacities and provide new means to interpret findings. In this talk, I present examples of both approaches and describe how they can be unified in research on soft matter systems.

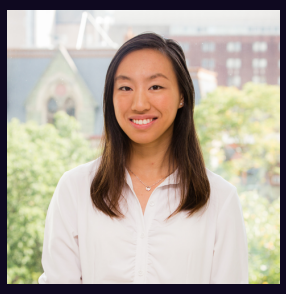
While colloidal assembly is typically studied in isotropic fluids, anisotropic fluids like nematic liquid crystals (NLCs) provide new opportunities to control interaction and assembly. NLC are comprise elongated molecules (nematogens) that co-align to minimize their free energy. Colloidal particles in NLC change the nematogen alignment and generate long-ranged interactions with each other and with boundaries. Using colloids and vessels with tailored boundaries, I tap into these effects to develop directed assembly schemes, controlling colloidal particle paths and positions to generate functional reconfigurable structures. Related concepts can be extended to elongated eukaryotic cells, which tend to organize in manners reminiscent of nematogens. I use this concept to study cellular organization on liquid crystalline elastomer substrates.

I close by presenting my vision for a research program in soft matter that draws on both forward and inverse approaches to lay foundations for soft material innovation.

Date:
10/10/2022

Time:
9:00 AM-10:15 AM (PT)
12:00 PM-1:15 PM (ET)

About the speaker:



Yimin Luo is an Otis William Fellow at University of California, Santa Barbara. Her current work aims at controlling cellular dynamics on liquid crystalline substrates. She holds a bachelor's degree from Rice University and earned her Ph.D. from the University of Pennsylvania in 2018. As part of her graduate work, she fabricated lithographic surfaces to sculpt nematic liquid crystal director fields, thereby steering the motion and guiding the assembly of microparticles in them. Prior to her current role, she spearheaded an effort to establish a unifying framework to test frictional contact model in industrially relevant systems, at the University of Delaware.

Dr. Luo was a fellow of BioPACIFIC MIP, leading the instrument development for microrheology and structure characterization to facilitate high-throughput material discovery. Yimin has received various awards including the Langmuir Student Oral Presentation Award. She was a finalist for Woman Interactive Materials Award from the Leibniz Institute for Interactive Materials, MIT ChemE Rising Stars, and presented at the University of Washington Distinguished Young Scholars Seminar series.

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Sign up at physics.ucmerced.edu/slaam/ to be included in the mailing list to receive a Zoom link.

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