

UC SAN DIEGO NANOENGINEERING

Monday, February 13, 2017

Seminar Presentation: 11:00am – 12:00pm

Cymer Conference Center, SME 248

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Forces, Stresses, and the (Thermo?) Dynamics of Active Matter

Abstract:

A core feature of many living systems is their ability to move, to self-propel, to be active. From bird flocks to bacteria swarms, to even cytoskeletal networks, “active matter” systems exhibit collective and emergent dynamics owing to their constituents’ ability to convert chemical fuel into mechanical activity. Here, I present a new framework to interpret living matter as a material and understand its complex behavior using tools of hydrodynamics, kinetic theory, and nonequilibrium statistical mechanics. I combine experimental and computational methods to demonstrate how intrinsic activity imparts new behaviors to soft materials that explain a variety of complex phenomena, including the collective motion of self-propelled particles and the complete loss of shear viscosity in fluid suspensions. Additionally, I engineer giant phospholipid vesicles of active matter that model the nonequilibrium stresses generated by biopolymers and molecular motors inside living cells. These nature-inspired soft materials have tunable properties that could be used as mechanical devices with applications in sustainable manufacturing, robotics, and biotechnology.

Biosketch:

Sho is a Chemical Engineering PhD student at Caltech, where he works with Professor John Brady on the statistical mechanics and rheology of nonequilibrium active matter fluids. Last year, he was a visiting scholar in Professor Jan Vermant’s soft matter and interfacial rheology group at ETH Zürich. Prior to enrolling at Caltech, Sho earned a bachelors in Chemical Engineering from UC Berkeley. He is a recipient of the Gates Millennium Scholars fellowship by The Bill & Melinda Gates Foundation and the NSF Graduate Research Fellowship. Starting in the summer, Sho will return to UC Berkeley as a Miller Research Fellow and will be hosted by Professor Daniel Fletcher in Bioengineering and Biophysics.