Soft Living Active and Adaptive Matter

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Flocking through complex environments

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Abstract:

The spontaneous collective motion of self-propelled agents is ubiquitous in the natural world, and it often occurs in complex environments, be it bacteria and cells migrating through polymeric extracellular matrix or animal herds and human crowds navigating structured terrains. Much is known about flocking dynamics in pristine backgrounds, but how do spatio-temporal heterogeneities in the environment impact such collective self-organization? I will present two model systems, a colloidal active fluid negotiating disordered obstacles and a confined dense bacterial suspension in a viscoelastic medium, as controllable platforms to explore this question and highlight general mechanisms for active self-organization in complex environments. By combining theory and experiment, I will show how flocks on disordered substrates organize into a novel dynamic vortex glass phase, akin to vortex glasses in dirty superconductors, while the presence of viscoelasticity can calm the otherwise turbulent swarming of bacteria, allowing the emergence of a large scale coherent and even oscillatory vortex when confined on the millimetre scale.

Date:
6/7/2021

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

About the speaker:

Dr. Suraj Shankar is currently a Junior Fellow at the Harvard Society of Fellows. He obtained his Ph.D. in physics from Syracuse University during which he was also a graduate fellow and visiting affiliate at the Kavli Institute of Theoretical Physics in Santa Barbara. Prior to this, he received a B. Tech. (Hons.) in chemical engineering from the Indian Institute of Technology Madras, India

He was awarded the Syracuse University dissertation prize for his doctoral work, and was a recipient of the APS dissertation award in statistical and nonlinear physics in 2020. His research interests are broadly in soft matter and biophysics, with an emphasis on their geometric and topological aspects. His current work is focused on active matter, control theory, extreme mechanics and morphogenesis.

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