Soft Living Active and Adaptive Matter

CCBM NSF-CREST CENTER FOR CELLULAR AND BIOMOLECULAR MACHINES

Excitable nonreciprocal solids

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Abstract:

Emergent nonreciprocal interactions in active condensed matter can give rise to phases that are impossible to realize in equilibrium. In this talk, I will discuss our recent discovery and investigations of two stable macroscopically nonreciprocal states, one static and one oscillatory, in living chiral crystals of starfish embryos. The two phases are characterized by two distinct mechanisms of parity breaking, namely, the spinning of individual embryos, and the precession of their axis of rotation. I will discuss how the oscillatory phase can be excited from the static phase in a highly selective manner using external mechanical perturbations in the form of uniaxial compression steps. Our theoretical model predicts, and data analysis confirms that the two mechanisms of parity breaking retain distinctive dynamical signatures in the dispersion relation of these nonequilibrium solids. In a broader context, our findings demonstrate how distinct mechanisms of symmetry breaking on the particle scale can govern steady state properties as well as excitations in active mechanical metamaterials.

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

About the speaker:

Shreyas Gokhale is a Physics of Living Systems (PLS) Postdoctoral Fellow in the Department of Physics at MIT, working primarily with the groups of Prof. Nikta Fakhri and Prof. Jörn Dunkel. He is interested in understanding nonequilibrium self-organization in active matter using a combination of experiments, data analysis, and theory.

Shreyas obtained a PhD in experimental soft matter physics from Prof. Ajay Sood's group at the Indian Institute of Science, working in close collaboration with Prof. Rajesh Ganapathy at JNCASR. His doctoral research focused on polycrystalline grain growth and glass formation in colloidal systems. He then moved to MIT as a Human Frontier Science Program (HFSP) Postdoctoral Fellow to study synchronization of bacterial population oscillations in Prof. Jeff Gore's group, before transitioning to active matter research.

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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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