ICTS Biophysics Seminar

Title : Decoding and shaping active self-organization in living materials

Speaker : Shreyas Gokhale (Massachusetts Institute of Technology, USA)

Date : Wednesday, 13 November 2024

Time : 2:30 PM (IST)

Abstract : The formation of self-organized structures with complex dynamics is pivotal in regulating biological function from sub-cellular to ecological scales. Such self-organization emerges from interactions between multiple active units that consume ambient free energy to generate motion. Despite considerable progress, how symmetries and interactions on the scale of active units determine structure and dynamics on macroscopic scales remains an open question. I will present our recent results that address this question in living crystals of starfish embryos. We show that two distinct mechanisms of chiral symmetry breaking, namely embryo spin and precession, give rise to two distinct stable states: fluctuating and oscillatory. Furthermore, the oscillatory state can be selectively excited from the fluctuating state by applying mechanical perturbations, potentially enabling work generation from living materials. Finally, drawing upon my previous research on colloidal self-assembly driven by motile bacteria, I will highlight the potential of active self-organization for designing engineered living materials.

References:

- Selective excitation of work generating cycles in nonreciprocal living solids Yu-Chen Chao*, Shreyas Gokhale*, Lisa Lin*, Alasdair Hastewell*, Alexandru Bacanu, Yuchao Chen, Junang Li, Jinghui Liu, Hyunseok Lee, Jörn Dunkel and Nikta Fakhri, arXiv:2410.18017, 2024.
- Odd dynamics of living chiral crystals Tzer Han Tan, Alex Mietke, Hugh Higginbotham, Yuchao Chen, Junang Li, Peter Foster, Shreyas Gokhale, Jörn Dunkel and Nikta Fakhri, Nature, 607, 287-293, 2022.
- Dynamic clustering of passive colloids in dense suspensions of motile bacteria Shreyas Gokhale*, Junang Li*, Alexandre Solon, Jeff Gore and Nikta Fakhri Physical Review E, 105, 054605, 2022.

Venue : Feynman Lecture Hall
Zoom Link: https://icts-res-in.zoom.us/j/98322231213?pwd=WgO9bBXD6uMrDBKVLIcYa2EjpgLmLV.1
Meeting ID: 983 2223 1213
Passcode: 571092