Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Students' Annual Seminar

Active Hamiltonian Dynamics with Symplectic Algorithms: From Breathing Modes to Flocking

Antik Bhattacharya

Self-assembly enables nature to build complex forms, from multicellular organisms to complex animal structures, such as flocks of birds, through the interaction of a large number of limited and unreliable individuals. Flocking and forming compact groups of collectively moving individuals is a hallmark of animal group behaviour. We are developing a model system which in thermal equilibrium might have behaviour similar to active matter which is inherently non-equilibrium in nature, a 2D Hamiltonian fluid made of particles carrying spins coupled to their velocities. Making symplectic schemes for these kinds of Hamiltonian is our primary interest. Our initial results suggest that this conservative system can exhibit phase coexistence between a collectively moving droplet and a still gas. The particle displacements within the droplet have similar correlations to those of bird flocks and bacterial motion. Due to the nature of the coupling between spin and the momentum degrees of freedom of the model, this system can support a living crystal, similar to the recent experimental work on the Volvox colony.

Friday, Mar 15th 2024

11:30 Hrs (Tea / Coffee 11:15 Hrs)

CR-1, TIFR-H