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

Webinar

Simulations and Theory in Active Granular Matter: Nonequilibrium Phase Transitions and Nonreciprocal Interactions

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Vibrated monolayers of macroscopic grains show dramatic collective behaviour. They serve as useful laboratories to test ideas on active matter, exploring the roles of confinement and obstacles. A mechanically agitated monolayer of elongated, tapered macroscopic particles provides a faithful imitation of motility, transducing the energy of vertical vibration into directed horizontal motion. In these systems the constituent particles individually take up and dissipate energy, thus moving, interacting and aligning collectively.

In my talk I will present the collective behaviour and their theories of vibrated rods and beads system. First, I will discuss the transitions of polar active particles, in the presence of a V-shape obstacle, and account theoretically for our observations as competition between motility induced phase separation and collective expulsion of smectic tilt-boundary structure that form inside the wedge. Next I will talk about the non-reciprocal interaction between two motile rods in an elastic medium through a theoretical model in terms of the coupled dynamics of rod orientations and the displacement field of the ambient crystalline medium created by the moving rod. We confirm our prediction in our simulation and experiments on polar granular rods moving through a dense monolayer of beads in its crystalline phase, via calculated displacement fields and particles trajectories. I will conclude by explaining the steady state segregation instability of flocking rods, with initial state being randomly placed and oriented rods, in monolayer of beads, at high density.

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11:30 AM