

Webinar

Incompressible polar active matter: Defects, Coarsening and Turbulence

Navdeep Rana

TCIS, Hyderabad

Suspensions of active polar particles show spectacular collective behaviour reminiscent of turbulence. Examples include bacteria colonies, bird flocks, and rods on a vibrating substrate. An individual particle in the suspension moves on the expense of free energy, internal or taken up from the environment. Furthermore, these systems break the time-reversal symmetry at an individual's level, which sets them apart from other non-equilibrium systems, such as boundary driven flows. Active suspensions where the dynamics of the surrounding fluid is ignored are called dry. On the other hand, the fluid flow is essential to understand the properties of a wet system. An ordered state is stable for a dry active suspension, whereas wet systems show complex flow structures with characteristic eddy size much larger than an individual swimmer's size.

In this talk, I will discuss the statistical and dynamical properties of incompressible polar active matter. First, I will present the coarsening dynamics of incompressible dry active matter. I will show how energy transfer takes place between different length scales, and how turbulence accelerates the coarsening. In the second part, I will discuss the instabilities of the ordered state and the resulting spatio-temporal chaos in a dense wet suspension. Finally, I will discuss how population fluctuations at the front of a bacterial colony growing on a substrate can alter its morphology under varying nutrient concentrations.

Tuesday, Jul 28th 2020

11:30 AM