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

Seminar

Emergence of mesoscale flows under non-equilibrium drive in crowded environments

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The emergence of surprising collective behaviours in systems driven out of equilibrium by local energy injection at the particle level remains a central theme in the study of active matter. Recently, chaotic flows reminiscent of turbulence have garnered significant attention due to their appearance in diverse biological and physical active matter systems. In this talk, I will demonstrate how even the simplest model of active particles - self-propelled point particles - can exhibit mesoscale flows, characterised by streams and vortices, when very persistent active forces compete with crowding at high densities. I will show that these flows can also emerge under weak alignment interactions.

In the second part, I will introduce a minimal model of non-reciprocal interactions inspired by human crowds, which generates collective flows strikingly similar to those of the self-propelled particles. Interestingly, as the system approaches the equilibrium limit by reducing non-reciprocity, it undergoes an absorbing phase transition characterised by an infinite number of absorbing states and critical exponents consistent with the conserved directed percolation universality class.

Tuesday, Jan 21st 2025

14:30 Hrs (Tea / Coffee 14:15 Hrs)

Auditorium, TIFRH