TIFR Centre for Interdisciplinary Sciences
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Seminar

Phase transitions in bacterial aggregation to chimera clocks: understanding and building active evolvable matter

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Biological systems are a truly unique state of matter - active, adaptive and evolving. Cells, biological tissues, highly coordinated animal groups and interacting populations are a form of complex materials with emergent coherent properties that arise from mechanical and socially-mediated interactions between individuals. Unlike in purely physical systems, a biological individual is capable of processing information, in addition to tuning dynamically adaptive response. These augmented capabilities of individual units allow a population to exhibit collective organization and behaviour, beyond what is found in traditional materials. Such a perspective naturally suggests two complementary approaches: (i) to distill unifying physical principles that govern biological systems by probing them as a unique state of matter or as a unique class of dynamical systems and (ii) to construct de novo, using traditional materials, systems with functions that are defining features of living matter such as self propulsion, replication etc. and study the resulting emergent collective behavior. In revealing the differences between the different systems, artificial and biological, as well as the underlying commonalities in mathematical features, we hope to better understand the relationship between microscopic and macroscopic emergent collective behaviour in systems far from equilibrium and ultimately, in biology. In this talk I will present these viewpoints based on two different experiments using bacteria and mechanical oscillators. Particularly, I will discuss phase transitions underlying aggregation of bacteria under stress and non-linear interactions between populations of mechanical oscillators.

Tuesday, Feb 24th 2015

11:30 AM (Tea/Coffee at 11:15 AM)

Seminar Hall, TCIS