S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Physics of Complex Systems

18th May,2023 **3.00 PM** **ONLINE / FERMION**

SPEAKER

Dr. Raj Kumar Manna,
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TITLE OF THE TALK

Shape morphing of chemically active elastic sheets, and tissues

ABSTRACT

Shape-morphing of two-dimensional elastic materials is a vital and ubiquitous transformation in synthetic and biological systems. Due to their compliant nature, these shape-changing materials can deform continuously to adapt their shape to the external environment. My talk will focus on these shape-changing elastic materials in synthetic (chemically active sheets) and biological systems (tissue).

The first part of my talk will discuss the design principles for driving shape changes of 2D elastic sheets in fluid-filled microchambers. The sheets are coated with a catalyst to generate controllable fluid flows, which transform the sheets into complex 3D shapes. Moreover, a single sheet that encompasses multiple catalytic domains can transform into a variety of 3D shapes through the addition of one or more reactants. The mechanism can be used to perform self-sustained operations, including, self-rotating, and self-oscillating behavior.

The second part of my talk will describe the shape-morphing of Kupffer's vesicle (KV) in the zebrafish embryo as it undergoes programmed asymmetric cell shape changes to establish the left-right axis of the embryo. Here we employ the 3D Vertex model to investigate KV cell shapes and cell distribution for a range of values of tailbud tissue fluidity and KV propulsion velocity, and compare to experiments. Our findings provide insight into the physical mechanisms that regulate organogenesis, and may help identify new targets for therapeutics.

HOST FACULTY

Prof. Jaydeb Chakrabarti, Senior Professor
DEPT. OF PHYSICS OF COMPLEX SYSTEMS

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