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

Seminar

Discontinuous Shear Thickening, Yielding, and Fluidization in Models for Biological Tissues

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While the mechanical properties of biological tissues have surprisingly rich behavior, they are also crucial for many biological processes, such as embryogenesis, wound healing, and cancer invasion. However, they remain poorly understood. In this talk, I will first discuss discontinuous shear thickening (DST) in the vertex model for confluent tissues, along with a theoretical framework to describe it. I will show that DST arises from a non-zero yield stress and fluctuations that enable a crossover from liquid-like to solid-like rheology under external shear. I will then discuss the yielding behavior of tissues under active forcing and show that the yield force vanishes at a critical point distinct from the well-known rigidity transition. Next, I will discuss the dynamics of the vertex model under external shear, where relaxation proceeds via discrete T1 rearrangements, leading to strain-rate-dependent dynamics, dynamical heterogeneity, and shear localization. These results highlight the role of localized plastic events in governing macroscopic flow. In the last part of the talk, I will discuss an active elastoplastic model, in which relaxation occurs via plastic events and stress redistribution, capturing activity-induced fluidization and dynamical heterogeneity in these systems.

Wednesday, May 20th 2026

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Auditorium, TIFRH