Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Seminar

Role of mechanical force networks in amorphous solids

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Many materials in everyday life are amorphous i.e. lack periodic structures, yet behave as solids for all practical purposes. A prominent example of a thermal system is glassy materials which are ultra-viscous matter formed when a liquid is cooled rapidly and avoids crystallization. An ubiquitous example of an athermal system is granular matter which form rigid, jammed packings above a critical jamming density. A fundamental scientific question is to understand how these materials show solid-like mechanical response without having any periodic, long-range structural order. In jammed granular matter in mechanical equilibrium the answer lies in the formation of a system spanning, spatially heterogeneous, load-bearing mechanical network of large contact forces. This network, known as force chains, is well known but not well understood. We show how force chains can be computed from first principles at an arbitrary density. Thus our analysis reveals the precise relationship between the external force, the disorder in structure and the force network in static granular media. Further, we show that even in the presence of thermal fluctuations, like in ageing glass, mechanical networks of contact forces gradually becomes long-lived as the system is cooled, and plays a key role in determining (intermittent) structural relaxation. Thus the analysis of mechanical force networks is expected to reveal new insights about the question of whether a glass is a solid or a liquid.

Thursday, Mar 22nd 2018

4:00 PM (Tea/Coffee at 03:30 PM)

Auditorium, TIFR-H