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

Seminar

Structural origin of relaxation in dense colloidal suspensions

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Amorphous solids relax via slow molecular rearrangement induced by thermal fluctuations or applied stress. Microscopic structural signatures predicting these structural relaxations have been long searched for but have so far only been found in dynamic quantities such as vibrational quasi-localised soft modes or with structurally trained neural networks. A physically meaningful structural quantity remains elusive. We will present a structural order parameter derived as the inverse of the depth from the mean-field caging potential experienced by the particles due to their neighbours, which reliably predicts the occurrence of structural relaxations. The parameter, derived from density functional theory, is a measure of susceptibility to particle rearrangements that can effectively identify weak or defect-like regions in disordered systems. Using experiments on dense colloidal suspensions, we demonstrate a causal relationship between this structural order parameter and the particle rearrangements, which lead to relaxation of the system due to thermal fluctuations or applied shear. Our work paves the way to a structural understanding of the relaxation of a wide range of amorphous solids, from suspensions to metallic glasses.

Tuesday, Feb 13th 2024

11:30 Hrs (Tea / Coffee 11:15 Hrs)

Auditorium, TIFR-H