

ICTS Colloquium

Title : Fractons: a novel paradigm for broken ergodicity

Speaker : Abhishodh Prakash (University of Oxford, UK)

Date : Tuesday, 10 September 2024

Time : 4:00 PM (IST)

Abstract : There is a long-standing quest to find settings where many-body dynamics cannot be described by conventional statistical mechanics. Typically, this happens when the ergodic hypothesis, on which statistical mechanics is founded, is strongly violated. Disorder is an often-employed recipe. In this talk, I will present a new path to ergodicity breaking through an interplay between symmetries and locality [1,2]. I will show that classical, non-relativistic particles conserving multipole moments, 'fractons', generically crystallize in any dimensions and spontaneously break symmetry and ergodicity. This is in violation of the theorem by Hohenberg, Mermin, Wagner and Coleman, and cannot be described by statistical mechanics. Classical fractons also exhibit other surprises: their dynamics is 'Machian' wherein isolated motion is forbidden, and is characterized by attractors, seemingly violating a folk-interpretation of Liouville's theorem. I will also discuss quantum fractons which have other nice features, including an exact characterization of novel restoring phase transitions [3].

[1] [Phys. Rev. B 109, 054313 \(2024\)](#)

[2] [Phys. Rev. B 110, 024305 \(2024\)](#)

[3] [arXiv:2408.10321](#)

Venue : Emmy Noether Seminar Room

Zoom Link: <https://icts-res-in.zoom.us/j/97420836308?pwd=tb2BXedGt8weRmhlAStd7fuTBxv0oE.1>

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