



**DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY,
KANPUR**

PHYSICS COLLOQUIUM

“ Entropy Driven Ordering of Anisotropic Particles: Pathways of Crystallization and Vacancy Delocalization ”

Abstract

Dense systems of hard-interacting particles undergo disorder-order transitions by maximizing the configurational entropy. For isotropic constituents, such as hard spheres or disks, only translational entropy remains relevant; hence, these transitions are solely governed by the density. However, orientational entropy plays a crucial role for anisotropic particles when their orientational and translational dynamics become coupled because of interdigitation. This brings in an interplay between maximizing the orientational and translational components of the entropy, which was first addressed by Onsager in the seminal study of the isotropic to nematic transition of spherocylinders in 1949. We extend this concept by exploring how the interplay between the two components of configurational entropy dictates the pathways of crystallization and vacancy delocalization in a dense self-assembly of anisotropic particles.

In this talk, I will discuss the crystallization pathways of square Brownian platelets as they equilibrate to either hexagonal or rhombic crystals, depending on the osmotic pressure. These two crystalline phases respond disparately to a mono-vacancy, as the vacancy defect delocalizes, accompanied by a flow of local entropy, until it is absorbed globally. Our results show that the local entropy map is strongly correlated with, and therefore, can predict vacancy defect delocalization dynamics. Furthermore, a multiparticle defect in the rhombic crystalline phase induces a defect-induced phase transition, where the local ordering becomes hexagonal, leading to self-healing of the vacancy defect.

Speaker



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5:30 PM, 07 September 2026
(Monday) (Refreshment starts at
5:15 PM)



FB-382 (Prof. Amal Kumar
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