ICTS | INTERNATIONAL CENTRE for THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Condensed Matter Seminar

Title : Hyperbolic Lattices: From Hofstadter Butterfly to Experimentally Realizable Cayley Crystal Decomposition.

Speaker : Lavi Upreti (University of Konstanz, Germany)

Date : Friday, 28th June 2024

Time : 03:30 PM (IST)

Abstract : Hyperbolic lattices, characterized by negative curvature and non-commutative translations, offer a rich playground for exploring exotic electronic states. This talk explores these systems through a multifaceted approach, bridging theory and experiment. We begin with a concise introduction to hyperbolic lattices and then move to the results to present curvature-dependent Hofstadter butterfly spectrum in the presence of a magnetic field; we acknowledge the experimental challenges in directly realizing these structures. We introduce an indirect approach that decomposes the problem with hyperbolic lattices into two parts: curvature and non-commutative geometry. This method breaks down hyperbolic lattices into curved Euclidean lattices (amenable to strain engineering in graphene) and simpler non-Abelian Z_2 lattices generated by non-commuting translations (Cayley crystals).

In the first case, we investigate topological states in curved graphene, leveraging Kitaev's real-space index to characterize their behavior.

Finally, in the end, I will present our very recent findings (still under progress), revealing two distinct classes of states within these Z_2 lattices: Abelian states exhibiting conventional behavior and non-Abelian states experiencing a surprising Hall drift motion under an electric field. This intriguing result suggests the presence of an effective internal magnetic field in the non-Abelian sector, opening exciting avenues for investigating novel physical phenomena.

Venue : Madhava Lecture Hall

Zoom Link: https://icts-res-in.zoom.us/j/93286744997?pwd=CiYSjGGbNNWlQS8ri2odFd8bWw8kDO.1
Meeting ID: 932 8674 4997
Passcode: 282829