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

Seminar

Geometric and quantum phenomena on projected branes

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Interparticle interactions, presence of impurities or disorder, and topology and geometry of wavefunctions determine the low temperature behaviors of quantum materials, which crucially depend on their dimensionality. However, crystals are naturally bound to live within three spatial dimensions, which thereby provides a natural constraint on the possible quantum phases that can be observed in nature.

In this talk, first I will promote a general principle of constructing effective Hamiltonian of a lower-dimensional brane or subsystem (quasi-crystalline and crystalline), embedded within the higher dimensional parent crystals via the Schur complement. Then I will show a plethora of examples to establish that the Schur complemented Hamiltonian of the brane provide a window into the landscape of the topological phases in higher dimensions in terms of the bulk-boundary correspondence, probing through the lattice dislocations, and the quantum transport, e.g. the chiral anomaly, when projecting it from parent two- or three-dimensional topological crystals. Furthermore, this construction successfully harnesses discrete crystalline symmetry protected topological phases on the projected branes that are, however, only present on their parent higher-dimensional crystals as well as topological superconductors.

Finally, I will show that such projected two-dimensional branes feature the quantum phase diagrams and quantum criticality of three-dimensional disordered Anderson model and dirty Weyl semimetals. Some of the possible experimental platforms to test these theoretical predictions and future directions of this general theme of pursuit will be highlighted.

Friday, May 15th 2026

14:00 Hrs (Tea / Coffee 13:45 Hrs)

Auditorium, TIFRH