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

Seminar

Symmetry and anomaly enforced quantum correlations in steady states and disordered ensembles

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Symmetries in ensembles of quantum states arising in disordered or open systems can manifest in two distinct ways: strong (exact) or weak (average). We show that their interplay enforces nontrivial quantum correlations in two settings relevant to quantum information and condensed-matter physics.

First, we analyse steady states of generic quantum channels with strong symmetries. While environmental coupling typically suppresses entanglement, strong symmetries can protect it even in highly entropic steady states. Remarkably, for channels with a global on-site non-Abelian symmetry such as SU(2), the steady-state bipartite entanglement grows as logN with the number of qudits N, despite volume-law classical entropy. We also study exotic entanglement phenomenology arising from channels exhibiting Hilbert-space fragmentation.

Second, we study disordered critical systems with average Lieb–Schultz–Mattis anomaly constraints, where translation symmetry holds only on average (weak) but on-site symmetries remain exact (strong). In the absence of spontaneous symmetry breaking, we argue that local operators exhibit two distinct forms of criticality depending on their symmetry charges. We confirm this in the well-studied random-singlet Heisenberg chain and the Gade phase in 2D class BDI, and uncover critical correlations that appear to have been overlooked in earlier work.

Friday, Jan 9th 2026

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

Seminar Hall, TIFRH