ICTS Condensed Matter Seminar

Title : Spectral form factor in generic many-body quantum chaotic systems across all Dyson symmetry classes

Speaker : Dibyendu Roy (Raman Research Institute, Bengaluru)

Date : Wednesday, 16 July 2025

Time : 2:30 PM (IST)

Abstract : I shall discuss the emergence of random matrix theory (RMT) spectral correlations in the chaotic phase of generic periodically kicked interacting quantum many-body systems by analytically calculating spectral form factor (SFF), $K(t)$, up to two leading orders in time, t. We explicitly consider the presence or absence of time reversal symmetry ($\mathcal{T}$) to investigate all three Dyson symmetry classes. While the number of diagrams that contribute to the SFF in the first and second order in t for $\mathcal{T}$-invariant systems with $\mathcal{T}^2 = 1$ and in the absence of $\mathcal{T}$-symmetry is finite, the number of such diagrams is exponentially large in t for $\mathcal{T}$-invariant systems with $\mathcal{T}^2 = -1$. For this, we have developed a new diagrammatic technique using reduced diagrams to include contributions from many diagrams of different permutations of basis states. In all three cases, the system-size (L) scaling of the Thouless time t^*, beyond which the SFF takes the universal RMT form, is determined by eigenvalues of a doubly stochastic matrix M. For strongly interacting fermionic chains, M is SU(2) invariant in all three cases, leading to $t^* \propto L^2$ in the presence of U(1) symmetry. In the absence of U(1) symmetry, we find $t^* \propto L^0$, due to gapped non-degenerate second-largest eigenvalue of M or $t^* \propto \ln(L)$ due to gapped second-largest eigenvalue with degeneracy $\propto L^\zeta$.
Reference: Leading and beyond leading-order spectral form factor in chaotic quantum many-body systems across all Dyson symmetry classes, Vijay Kumar, Tomaˇz Prosen, and Dibyendu Roy, arXiv: 2502.04152 (2025)

Venue : Emmy Noether Seminar Room
Zoom Link: https://icts-res-in.zoom.us/j/92034918331?pwd=ItTKeaIaTqcbT533GejAjI3n2SKQe2.1
Meeting ID: 920 3491 8331
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