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ICTS Statistical Physics and Condensed Matter Seminar

Title : Symmetric tensor scars with tunable entanglement from volume to area law

Speaker : Bhaskar Mukherjee (S.N. Bose National Centre for Basic Sciences, Kolkata)

Date : Tuesday, 26 August 2025

Time : 11:30 AM (IST)

Abstract : Quantum many-body scars" (QMBS), atypical eigenstates of non-integrable Hamiltonians that weakly violate ergodicity, is currently one of the most active research topics in many-body physics. Initiated by the pioneering experiment in Rydberg quantum simulator [1], the field has seen rapid growth over the last 6 years [2]. I will discuss the construction of exact QMBS at infinite temperature in the non-integrable staggered Heisenberg model [3]. While the Bethe ansatz can be used to construct exact states in the low-magnon sectors [4], its extension to higher magnon sectors is notoriously difficult. I will then present a complimentary approach to construct exact QMBS in the high-magnon sectors by taking a symmetric superposition of triplet coverings [5]. The number of such symmetric tensor scars scales quadratically with system size, and their entanglement is highly tunable, which ranges from volume to logarithmic to area law depending on the choice of basis for the triplets.

References:

- 1) Probing many-body dynamics on a 51-atom quantum simulator, Bernien et al, Nature 551, 579-584 (2017).
- 2) Weak ergodicity breaking from quantum many-body scars, Turner et al, Nature Physics 14 (7), 745-749 (2018).
- 3) Stable infinite-temperature eigenstates in SU (2)-symmetric nonintegrable models, Turner et al, arXiv:2407.11956.
- 4) Exact generalized Bethe eigenstates of the non-integrable alternating Heisenberg chain, Melendrez et al, arXiv:2501.14017.
- 5) Symmetric tensor scars with tunable entanglement from volume to area law, Mukherjee et al, arXiv:2501.14024v2.

Venue : Madhava Lecture Hall

Zoom Link: <https://icts-res-in.zoom.us/j/95560396861?pwd=gabQwx05q8TTYrPXNvodIVJabMqihp.1>

Meeting ID: 955 6039 6861

Passcode: 262627