Contribution ID: **6** Type: **not specified**

Talk Aurelia Chenu: Two transitions in complex eigenvalue statistics of the XXZ Hamiltonian with imaginary disorder: Hermiticity and integrability breaking

Tuesday 1 October 2024 10:00 (1 hour)

Two transitions in complex eigenvalue statistics of the XXZ Hamiltonian
with imaginary disorder: Hermiticity and integrability breaking

With Aurelia Chenu, Gernot Akemann, Federico Balducci, Patricia Pässler, Federico Roccati, Ruth Shir

Open quantum systems have complex energy eigenvalues which are expected to follow non-Hermitian random matrix statistics when chaotic, or 2-dimensional (2d) Poisson statistics when integrable. We investigate the spectral properties of a many-body quantum spin chain, the Hermitian XXZ Heisenberg model with imaginary disorder. Its rich complex eigenvalue statistics is found to separately break both Hermiticity and integrability at different scales of the disorder strength. With no disorder, the system is integrable and Hermitian, with spectral statistics corresponding to 1d Poisson. At very small disorder, we find a transition from 1d Poisson statistics to an effective D-dimensional Poisson point process, showing Hermiticity breaking. At intermediate disorder we find integrability breaking, and the statistics agrees with that of non-Hermitian complex symmetric random matrices in class AI^{dag}. For large disorder, we recover the expected 2d Poisson statistics.

Our analysis uses numerically generated nearest and next-to-nearest neighbour spacing distributions of an effective 2d Coulomb gas description at inverse temperature β, fitting them to the spin chain data. We confirm such an effective description of random matrices in class AI^{dag} and AII^{dag} up to next-to-nearest neighbour spacings.