

SPEAKER:

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TITLE:

Hamiltonian density of states from free probability theory

ABSTRACT:

Suppose the eigenvalue distributions of two matrices M_1 and M_2 are known. What is the eigenvalue distribution of the sum M_1+M_2 ? This problem has a rich pure mathematics history dating back to H. Weyl (1912) with many applications in various fields. Free probability theory (FPT) answers this question under certain conditions. We will describe FPT and show examples of its powers for approximating physical quantities such as the density of states of the Anderson model, quantum spin chains, and gapped vs. gapless phases of Floquet systems. These physical quantities are often hard to compute exactly (provably NP-hard). Nevertheless, using FPT and other ideas from random matrix theory excellent approximations can be obtained. Besides the applications presented, we believe the techniques will find new applications in fresh new contexts.