

凝縮系物理学ゼミナール

Condensed Matter Theory Seminar

Date: 13:30-15:00, Wednesday, 23, April 2025

Title: Exact Multifractal Dimensions of Non-Hermitian Skin Modes on a Cayley Tree

Speaker: Mr. Shu Hamanaka

Language: English

Abstract:

The Cayley tree serves as a useful toy model for Fock space, as its hierarchical structure mimics the way many-body states are connected via the action of the Hamiltonian.

Motivated by recent numerical findings of multifractality in the many-body non-Hermitian skin effect [1], I investigate a non-Hermitian model defined on the Cayley tree [2]. By generalizing Mahan's construction [3], I analytically obtain the complete set of eigenstates for arbitrary branching number and derive exact expressions for their multifractal dimensions.

In this seminar, I will begin with a pedagogical introduction to multifractal analysis. I will then demonstrate how the non-Hermitian skin effect exhibits multifractality in the many-body Hilbert space[1]. Following that, I will present the exact expressions for the multifractal dimensions of skin modes on the Cayley tree [2]. If time permits, I will also share numerical results on multifractal scaling for other graphs, including random regular graphs.

References:

- [1] SH, K. Kawabata, Phys. Rev. B 111, 035144 (2025).
- [2] SH, Askar A. Iliasov, Titus Neupert, Tomas Bzdusek, Tsuneya Yoshida, Phys. Rev. B 111, 075162 (2025).
- [3] G. D. Mahan, Phys. Rev. B 63, 155110 (2001).