



## Physical Sciences Seminar

# Ergodicity breaking in flat-band lattices

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Interacting particles in lattices with single-particle flat bands, which are composed of compact localized states (CLSs), can break ergodicity either strongly or weakly. In this talk, I will discuss two mechanisms, local Hilbert space fragmentation and highly-excited non-thermal eigenstates. First, I will discuss Bose-Hubbard models in a family of diamond necklace lattices where CLSs occupy the up and down sites of each diamond. By performing an appropriate basis rotation, the fragmentation of the many-boson Hilbert space becomes apparent in the adjacency graph of the Hamiltonian. The models present a conserved quantity related to the occupation of the CLSs that uniquely identifies the different sub-sectors of the Hilbert space. Due to the fragmentation of the Hilbert space, the distribution of entanglement entropies of the system presents a nested-dome structure. We will find weak thermalization through sub-sector-restricted entanglement evolution and a wide range of entanglement entropy scalings from area-law to logarithmic growth. We will characterize the system in depth, demonstrating that the fragmentation is quantum, local, and strong. Next, I will discuss the generalization of this mechanism to other models with single-particle flat bands. In particular, we will discuss the conditions that the flat-band lattices must fulfill in order to host local Hilbert space fragmentation. Finally, for lattices that do not satisfy these conditions, I will explore the generation of an arbitrary number of non-thermal eigenstates through the  $2^{\sqrt{n}}$  versions of each model.

**Tuesday, February 21, 2023 11:00am - 12:00pm**

Big Seminar Room B (big) 63 seats (I23.EG.102)



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.

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