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Percolation Approach to Many-Body Localization

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Abstract:

A direct numerical approach to many-body localization is limited to small system sizes of the order of 20 sites. We have developed a numerical algorithm to study the percolation aspects of the problem, being able to deal with systems with up to 120 sites. We first solve the one-body problem and calculate the interaction matrix elements between any four states, two incomings and two outgoing. When this interaction, in absolute value, is larger than the single particle energy difference of the transition we assume that the two configurations involved are connected. Starting from an initial random configuration, in the single particle basis, we look recursively for all new configurations connected to it and study the size of the cluster of connected configurations as a function of size and disorder energy, for a given value of the transfer energy and of the interaction energy. We analyze the asymptotic behavior of the distribution of cluster sizes.