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Pseudospin representation of the two-site Anderson-Hubbard model

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The state of an Anderson localized system can be described in terms of the occupation of a set of single-particle wave functions which are localized in space. When interactions are added, single-particle wave functions are no longer well defined, so what is a useful description of the state of a many-body localized system and what about it is localized? Given that any system with Hilbert-space dimension 2^N may be described by an Ising-type Hamiltonian, it has been proposed that in a fully many-body localized system the Ising pseudospins in this representation may be chosen to be local. Actually constructing these spins is non-trivial. While a number of approaches have been proposed, few explicit examples exist and almost all work has been on spin systems. Here we present the Hamiltonian of a two-site Hubbard model with disorder and nearest-neighbor interactions written in terms of pseudospins, and we explore the form of these pseudospins and their evolution as a function of hopping amplitude.

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