Abstract Submitted
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On-site confinement of excitations in a strongly anisotropic Heisenberg spin and qubit chain LEA SANTOS, Dartmouth College, MARK DYKMAN, Michigan State University — We study localization of many-excitation states in a system of spins and qubits, and the equivalent problem of many-particle localization of spinless fermions. Recently we proposed a bounded sequence of site energies that leads to the lifetime of all on-site localized single- and many-particle states that is orders of magnitude longer than the reciprocal intersite hopping integral.[1] The method was based on mapping delocalization on particle-particle scattering and eliminating resonant scattering processes up to a high order. However, the required bandwidth of site energies increased linearly with the energy of inter-particle interaction, or with the energy of the Ising part of the spin-spin (qubit-qubit) interaction. It therefore became inconvenient for the models of quantum computers (QCs) where this coupling is strong, such as a QC based on electrons on helium. Here we develop an alternative approach which leads to long localization lifetime for strong interaction for much smaller bandwidth of site energies. It takes advantage of the band-like spectrum of energies that can be transferred in two-particle scattering, with bands being formed by processes where the number of nearest neighbors changes by 0, 1, 2, etc. By opening gaps in the combined site energies in the region of these bands, we can eliminate resonant scattering up to high order in the hopping integral.

[1]L.F. Santos et al., Phys. Rev. A **71** (2005).

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