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Quantum walks of interacting particles in low-dimensional lattices[1] TIRTHAPRASAD CHATTARAJ, ROMAN KREMS, Univ British Columbia — We study the effects of long-range hopping and long-range interparticle interactions on the quantum walk of hard-core bosons in ideal and disordered lattices. We find that the range of hopping has a much more significant effect on the particle correlation dynamics than the range of interactions. While attractively and repulsively interacting pairs with short-range hopping in 1D lattices undergo the same dynamics, long-range hopping introduces asymmetry with respect to the sign of the interaction. We examine the relative role of repulsive and attractive interactions on the dynamics of scattering by isolated impurities and Anderson localization in disordered lattices. We find that weakly repulsive interactions increase the probability of tunneling through isolated impurities and decrease the localization in one-dimensional systems. The results for 1D lattices are obtained by direct diagonalization of the Hamiltonian. For 2D lattices, we employ an approach based on the recursive calculation of the Green's functions for two interacting particles.

[1]Phys. Rev. A 94, 023601 (2016)

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