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Quantum carpets in a one-dimensional tilted optical lattices[1]
CARLOS ALBERTO PARRA MURILLO, MANUEL HUMBERTO MUOZ ARIAS, JAVIER MADROERO, Universidad del Valle — A unit filling Bose-Hubbard Hamiltonian embedded in a strong Stark field is studied in the off-resonant regime inhibiting single- and many-particle first-order tunneling resonances. We investigate the occurrence of coherent dipole wavelike propagation along an optical lattice by means of an effective Hamiltonian accounting for second-order tunneling processes. It is shown that dipole wave function evolution in the short-time limit is ballistic and that finite-size effects induce dynamical self-interference patterns known as quantum carpets. We also present the effects of the border right after the first reflection, showing that the wave function diffuses normally with the variance changing linearly in time. This work extends the rich physical phenomenology of tilted one-dimensional lattice systems in a scenario of many interacting quantum particles, the so-called many-body Wannier-Stark system.

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