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Resonant leap-frog dynamics of interacting spin-orbit coupled fermions in optical lattices MIKHAIL MAMAEV, ANA MARIA REY, JILA, NIST and Department of Physics, University of Colorado, Boulder — Ultracold atoms in optical lattices offer a powerful platform for studying interplay between single-particle motion and interactions. We investigate the many-body dynamics of strongly interacting spin-1/2 fermions under a laser drive that induces spin-orbit coupling. The drive frequency is made resonant with the Hubbard repulsion, inducing non-perturbative density-dependent tunneling. An isolated atom is confined, but two or more neighbours enable motion for each other. This setup yields resonance-assisted interacting dynamics on fast timescales in the Mott insulating limit, as an alternative to prior experiments using tilted lattices. The system exhibits parity-dependent long-time localization of initial atomic configurations, where odd strings of atoms become stuck while even ones spread ballistically. In addition, long-range doublon correlations are developed at higher filling fraction. All results are accessible with current state-of-the-art experiments using alkaline earth atoms.

Mikhail Mamaev
University of Colorado, Boulder

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