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Stability of Emergent Kinetics in Optical Lattices with Artificial Spin-Orbit Coupling MENGSU CHEN, VITO SCAROLA, Virginia Tech — Artificial spin-orbit coupling in optical lattices can be engineered to tune band structure into extreme regimes where the single-particle band flattens leaving only inter-particle interactions to define many-body states of matter. Lin et al. [Phys. Rev. Lett 112, 110404 (2014)] showed that under such conditions interactions lead to a Wigner crystal of fermionic atoms under approximate conditions: no bandwidth or band mixing. The excitations were shown to possess emergent kinetics with fractionalized charge derived entirely from interactions. In this work we use numerical exact diagonalization to study a more realistic model with non-zero bandwidth and band mixing. We map out the stability phase diagram of the Wigner crystal. We find that emergent properties of the Wigner crystal excitations remain stable for realistic experimental parameters. Our results validate the approximations made by Lin et al. and define parameter regimes where strong interaction effects generate emergent kinetics in optical lattices.

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