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Experimental observation of non-ergodic behavior in the tilted Fermi-Hubbard model THOMAS KOHLERT, SEBASTIAN SCHERG, BHARATH HEBBE MADHUSUDHANA, IMMANUEL BLOCH, MONIKA AIDELSBURGER, Ludwig Maximilian University of Munich — Using ultracold fermionic ^{40}K atoms in an optical lattice we study the dynamics of the one-dimensional Fermi-Hubbard model subject to an external linear potential ("tilt"), which has recently attracted considerable theoretical and experimental interest in the context of ergodicity-breaking and constrained dynamics. Starting from a charge-density wave initial state (quarter filling) we measure the spin-resolved time evolution of the occupation imbalance between even and odd lattice sites as a local probe of localization. We identify two fundamentally different regimes: At short times we measure parity-projected real-space Bloch oscillations which, depending on the strength of the tilt, exhibit interaction induced damping and frequency modulation. At long times the dynamics reveal a robust steady state imbalance up to about 300 tunneling times, whose value depends on the interaction strength. We compare our experimental results to numerical calculations employing tDMRG on short time scales and exact diagonalization on long timescales and find excellent agreement throughout. Finally, we couple adjacent 1D systems to probe the crossover from a non-ergodic 1D to an ergodic 2D system and find a spin-dependent decay of the imbalance depending on the transverse coupling strength.

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