Abstract Submitted
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2D Superexchange mediated magnetization dynamics in an optical lattice[1] R.C. BROWN, Joint Quantum Institute, NIST & UMD, R. WYLLIE, Joint Quantum Institute, NIST & UMD; GTRI, S.B. KOLLER, E.A. GOLDSCHMIDT, M. FOSS-FEIG, J.V. PORTO, Joint Quantum Institute, NIST & UMD — The competition of magnetic exchange interactions and tunneling underlies many complex quantum phenomena observed in real materials. We study non-equilibrium magnetization dynamics in an extended 2D system by loading effective spin-1/2 bosons into a spin-dependent optical lattice, and we use the lattice to separately control the resonance conditions for tunneling and superexchange. After preparing a non-equilibrium anti-ferromagnetically ordered state, we quench the lattice to its final configuration, and observe relaxation dynamics governed by two well-separated rates. These rates scale with the underlying Hamiltonian parameters associated with superexchange and tunneling. Remarkably, with tunneling off-resonantly suppressed, we are able to observe superexchange dominated dynamics over two orders of magnitude in magnetic coupling strength, despite the presence of vacancies. In this regime, the measured timescales are in agreement with simple theoretical estimates, but the detailed dynamics of this 2D, strongly correlated, and far-from-equilibrium quantum system remain out of reach of current computational techniques.

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