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Experimental characterization of coherent dynamics in a spin chain CHANDRASEKHAR RAMANATHAN, Dartmouth College, JAMES LEE, Oxford University, PAOLA CAPPELLARO, Massachusetts Institute of Technology, LORENZA VIOLA, Dartmouth College, DAVID CORY, Institute for Quantum Computing and University of Waterloo — We experimentally characterize the coherent room-temperature magnetization dynamics of a spin chain evolving under an effective double-quantum Hamiltonian. Our results indicate that a localized magnetic moment travels down the chain with a group velocity of 6.04 ± 0.38 μm/s, corresponding to coherent transport over $N \approx 26$ spins on the timescale of the experiment. We also characterize the influence of the ends of the chains on the magnetization dynamics. Our results are in excellent agreement with a nearest-neighbor-coupled analytical model that predicts that the dynamics are restricted to a Liouville space that only grows quadratically with the number of spins. This suggests that the long-range couplings present in the experimental system only cause a slow leakage out of the subspace. As the double-quantum Hamiltonian is related to the standard one-dimensional XX Hamiltonian by a similarity transform, our results can be directly extended to XX quantum spin chains, which have been extensively studied in the context of both quantum magnetism and quantum information processing

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