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Slowest local operators in quantum spin chains HYUNGWON KIM, Rutgers University, MARI CARMEN BANULS, IGNACIO CIRAC, Max-Planck-Institute for Quantum Optics, MATTHEW HASTINGS, Station Q, Microsoft Research, DAVID HUSE, Princeton University — We numerically construct slowly relaxing local operators in a nonintegrable spin-1/2 chain. Restricting the support of the operator to M consecutive spins along the chain, we exhaustively search for the operator that minimizes the Frobenius norm of the commutator with the Hamiltonian and show that the Frobenius norm bounds the time scale of relaxation of the operator. We find operators with significantly slower relaxation than the slowest simple "hydrodynamic" mode due to energy diffusion. Using both exhaustive search and tensor network techniques, we find similar slowly relaxing operators for a Floquet spin chain and for quantum circuits on spin chains; these systems are hydrodynamically "trivial," with no conservation laws restricting their dynamics. We argue that such slow relaxation may be a generic feature following from locality and unitarity.

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