

Abstract Submitted  
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**Exploring localization and out-of-time ordered correlations in nuclear spin chains** XUAN WEI, Massachusetts Inst of Tech-MIT, CHANDRASEKHAR RAMANATHAN, Dartmouth College, PAOLA CAPPELLARO, Massachusetts Inst of Tech-MIT — Measuring the spread of information is a complex but central task for characterizing out-of-equilibrium many-body dynamics. We present a novel correlation metric capable of detecting information spread in a many-spin system at high temperature. We experimentally demonstrate the use of this metric to probe information scrambling in a solid-state spin system using nuclear magnetic resonance (NMR). We observe a slow growth of correlations consistent with the phenomenology of many-body localization (MBL). In addition, we experimentally measure in our system the commutator square, akin to out-of-order correlations, and observe a similar slow growth in the MBL regime. Furthermore, we observe a fast growth of the commutator square near a critical point corresponding to a symmetry breaking phase transition.

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