Abstract Submitted
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**Using phase space methods to study many-body localization in spin systems with long-range interactions**[1] SEAN MULEADY, Department of Physics, University of Colorado, Boulder, ARGHAVAN SAFAVI-NAINI, MICHAEL L. WALL, JILA, NIST, and University of Colorado, Boulder, RAHUL NANDKISHORE, Department of Physics, University of Colorado, Boulder, ANA MARIA REY, JILA, NIST, and University of Colorado, Boulder — Many-body localized (MBL) systems fail to thermalize and may be used as robust quantum memories with intriguing entanglement properties. In one-dimensional systems with short-range interactions, we have been able to gain an excellent understanding of the nature of the MBL phase. However, very little is known about the fate of the MBL phase when the interactions are extended to long range. Here, we use extensive numerical simulations to study the existence and characteristics of an MBL phase in the presence of power-law decaying interactions. We use matrix product state (MPS) methods, which are exact but limited to modest system sizes, as well as approximate phase space techniques based on the discrete truncated Wigner approximation (DTWA), which allow the exploration of larger systems sizes, longer times, and even higher dimensions. Additionally, we characterize the dynamical behavior of relevant observables, such as entanglement entropy, quantum Fisher information, and imbalance, and assess their utility in identifying the MBL phase in experiments.

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