Many-body localization phase in a spin-driven chiral multiferroic chain

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„Many-body localization (MBL) is an emergent phase in correlated quantum systems with promising applications, particularly in quantum information. Here, we unveil the existence and analyze this phase in a chiral multiferroic model system. Conventionally, MBL occurrence is traced via level statistics by implementing a standard finite-size scaling procedure. Here, we present an approach based on the full distribution of the ratio of adjacent energy spacings. We find a strong broadening of the histograms of counts of these level spacings directly at the transition point from MBL to the ergodic phase. The broadening signals reliably the transition point without relying on an averaging procedure. The fast convergence of the histograms even for relatively small systems allows monitoring the MBL dynamics with much less computational effort. Numerical results are presented for a chiral spin chain with a dynamical Dzyaloshinskii-Moriya interaction, an established model to describe the spin excitations in a single-phase spin-driven multiferroic system. The multiferroic MBL phase is uncovered and it is shown how to steer it via electric fields.[1]

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