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Out-of-time-order correlations in many-body localized and thermal phases[1] XIAO CHEN, KITP, TIANCI ZHOU, UIUC, DAVID HUSE, Princeton University, EDUARDO FRADKIN, UIUC — We use the out-of-time-order (OTO) correlators to study the slow dynamics in the many-body localized (MBL) phase. We investigate OTO correlators in the effective ("l-bit") model of the MBL phase, and show that their amplitudes after disorder averaging approach their long-time limits as power-laws of time. This power-law dynamics is due to dephasing caused by interactions between the localized operators that fall off exponentially with distance. The long-time limits of the OTO correlators are determined by the overlaps of the local operators with the conserved l-bits. We demonstrate numerically our results in the effective model and three other more "realistic" spin chain models. Furthermore, we extend our calculations to the thermal phase and find that for a time-independent Hamiltonian, the OTO correlators also appear to vanish as a power law at long time, perhaps due to coupling to conserved densities. In contrast, we find that in the thermal phase of a Floquet spin model with no conserved densities the OTO correlator decays exponentially at long times.

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