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Stroboscopic Generation of Topological Protection[1]

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An exciting prospect for quantum simulation is the possibility of generating and studying systems whose ground states possess topological order and which can be used to robustly store and process quantum information. The Hamiltonians governing these phases frequently require more-than-2-body interactions that are hard or even impossible to realize naturally. We present a dynamic emulation approach for realization of such a Hamiltonian with n-body ($n > 2$) interactions on a set of neutral atoms trapped in an addressable optical lattice, using only 1- and 2-body physical operations together with a dissipative protocol that allows thermalization to finite temperature or cooling to the ground state. Based on a stroboscopic approach to time evolution, the method allows generation of time evolution of states under the Hamiltonian, in addition to generation of the ground state. It also allows for finite temperature simulation and hence for study of topological protection as a function of system size and temperature. We demonstrate the approach with application to dynamic simulation of the toric code Hamiltonian, ground states of which can be used to robustly store quantum information when coupled to a low temperature reservoir.

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