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Symmetry-based dissipative preparation of matrix product states[1] LEO ZHOU, SOONWON CHOI, MIKHAIL LUKIN, Harvard University — Matrix product states (MPS) are a powerful class of many-body entangled states capable of describing a variety of quantum systems in 1D, including all symmetry-protected topological (SPT) phases. The symmetry of an MPS can be exploited for a simple scheme that prepares the state dissipatively. As an example, we provide an explicit scheme to prepare the Affleck-Kennedy-Lieb-Tasaki (AKLT) states, which exhibit spin-1 SPT order characterized by string order parameters and spin-1/2 degrees of freedom on the boundary. In our scheme, we harness the symmetry of the AKLT parent Hamiltonian to design a simple driven-dissipative dynamics requiring only global control, under which an arbitrary initial state deterministically evolves into one of the ground states. The use of symmetry allows for robust experimental implementation where no fine-tuning of control parameters is required while still leading to an exact steady state. We demonstrate our scheme via numerical simulations, and propose an efficient method using parallelization to prepare the quantum state even in large system sizes. A concrete protocol for implementation in an array of trapped neutral atoms is also presented.

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