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Classification of Gapped Topological Phases in 1D Interacting System XIE CHEN, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA, ZHENG-CHENG GU, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, CA 93106, USA, XIAO-GANG WEN, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA — Topological phases exist in quantum many-body systems beyond the usual symmetry breaking understanding of phase and phase transition. While a full classification of topological insulators and superconductors has been given for non-interacting fermions, the question of what phases exist for strongly interacting systems and how to identify them seems hard. Here we give a full classification of 1D gapped phases with possible topological and symmetry breaking order in both spin and fermion systems, based on the local unitary equivalence relation between short-range correlated matrix product states, which represent well the class of 1D gapped ground states. We find that in certain symmetry classes, the classification result for non- interacting systems is changed when strong interaction is allowed. Understanding about 1D system also allows us to obtain some simple results for topological phases in higher dimensions when certain symmetries are present.

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