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An one-dimensional spin- $\frac{1}{2}$ model realizing the time-reversal symmetry protected phase WENJIE JI, XIAO-GANG WEN, Massachusetts Inst of Tech-MIT — Symmetry protected topological (SPT) phases are one kind of phases beyond the classification described by Landau symmetry breaking paradigm. Topological insulators and spin-1 AKLT model are all familiar examples of SPT phases. Towards looking for more realistic SPT models, we consider the simplest bosonic case, i.e., one dimensional spin- $\frac{1}{2}$ model, with one of the smallest symmetry group, i.e., time-reversal symmetry. We present such a SPT model, called YZY model, of which the time-reversal symmetry operation T , has the property $T^2 = 1$. We show that it has four gapless edge modes realizing the projective representation of the symmetry and how the SPT phase is robust under any perturbation with respect to time-reversal symmetry alone. Moreover, the phase diagram of the hybrid model with both YZY and Heisenberg interaction is identified and analyzed both analytically by conformal field theory and numerically by tensor-network renormalization, giving an example of the phase transition between SPT phase and other kind of phases such trivial symmetric phase and gapless phase.

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