

Abstract Submitted
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Mean-field description of topological charge $4e$ superconductors

VICTORIA GABRIELE, JING LUO, JEFFREY C. Y. TEO, University of Virginia — BCS superconductors can be understood by a mean-field approximation of two-body interacting Hamiltonians, whose ground states break charge conservation spontaneously by allowing non-vanishing expectation values of charge $2e$ Cooper pairs. Topological superconductors, such as one-dimensional p -wave wires, have non-trivial ground states that support robust gapless boundary excitations. We construct a four-body Hamiltonian in one dimension and perform a mean-field analysis. The mean-field Hamiltonian is now quartic in fermions but is still exactly solvable. The ground state exhibits 4-fermion expectation values instead of Cooper pair ones. There also exists a topological phase, where the charge $4e$ superconductor carries exotic zero energy boundary excitations.

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