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Disorder-enhanced topological protection and universal quantum criticality in a spin-3/2 time-reversal invariant topological superconductor SAYED ALI AKBAR GHORASHI, Department of Physics and Texas center for superconductivity, University of Houston, SETH DAVIS, Department of Physics, Rice University, MATTHEW S. FOSTER, Department of Physics and Rice center for Quantum Materials, Rice University — We study spin-3/2 topological superconductors that have been proposed as generalizations of Helium 3B, with potential applications to ultracold atoms and the half-Heusler compounds. A model with p-wave pairing has winding number 4, and exhibits both linear and cubically dispersing surface bands. Via an RG analysis, we show that for a clean surface, interactions are in fact only marginally relevant for an attractive coupling strength despite the cubic band van Hove singularity. Attractive interactions lead to a BCS-type instability that spontaneously breaks time-reversal symmetry at the surface. By contrast, quenched disorder is a strongly relevant perturbation. Numerically, we show that disorder drives the system to a stable fixed point of the RG flow governed by the same type of conformal field theory (CFT) that appears for spin-1/2 TSCs. In particular, the critical behavior of the global density of states and the multifractality of the surface wavefunctions are entirely universal (independent of disorder or band structure parameters, in agreement with CFT), and the system is stabilized against interactions. In this case, we conclude that topological protection is enhanced by disorder.

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