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Topological superconducting phases from inversion symmetry breaking order YUXUAN WANG, University of Illinois, GIL YOUNG CHO, KAIST, TAYLOR HUGHES, EDUARDO FRADKIN, University of Illinois — We analyze the superconducting instabilities in the vicinity of the quantum-critical point of an inversion symmetry breaking order. We first show that the fluctuations of the inversion symmetry breaking order lead to two degenerate superconducting (SC) instabilities, one in the s-wave channel, and the other in a time-reversal invariant odd-parity pairing channel (the simplest case being the same as the of 3He-B phase). Remarkably, we find that unlike many well-known examples, the selection of the pairing symmetry of the condensate is independent of the momentum-space structure of the collective mode that mediates the pairing interaction. We found that this degeneracy is a result of the existence of a conserved fermionic helicity, χ, and the two degenerate channels correspond to even and odd combinations of SC order parameters with $\chi = \pm 1$. As a result, the system has an enlarged symmetry $U(1) \times U(1)$, with each $U(1)$ corresponding to one value of the helicity χ. We discuss how the enlarged symmetry can be lifted by small perturbations, such as the Coulomb interaction or Fermi surface splitting in the presence of broken inversion symmetry, and we show that the resulting superconducting state can be topological or trivial depending on parameters.

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