MAGNETIC FIELD DEPENDENCE OF THE SUPERCONDUCTING GAP NODE TOPOLOGY IN NON-CENTROSYMMETRIC SUPERCONDUCTORS

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In non-centrosymmetric superconductors, such as $CePt_3Si$[1], the combination of spin-orbit coupling and absence of inversion symmetry leads to coexistence of singlet and triplet pairing on the Fermi surface sheets. In a model developed by Hayashi et al[2], this coexistence leads to a line node of the superconducting gap line node on one of the Rashba split (non-Kramers degenerate) Fermi surface sheets, and a nodeless gap on the other sheet. This line node does not have topological stability against time reversal symmetry breaking perturbations[3,4]. We show that as a consequence of this lack of stability, an arbitrarily weak c-axis magnetic field will remove the line node[5]. Conversely a field in the a-b plane is shown to remove the line node on some regions of the Fermi surface, while bifurcating the line node in other directions, resulting in two 'boomerang'-like shapes. These line node topological changes are predicted to be observable experimentally in the low temperature heat capacity and other possible experimental probes of the gap nodal structure. We develop a multi-band model of superconductivity in this material, and speculate about possible implications of local breaking of inversion symmetry (from impurities, surfaces and lattice modulations) in other superconducting materials.

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