Fermi Surface Topological Invariants for Time Reversal Invariant Superconductors[1]

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A time reversal invariant (TRI) topological superconductor has a full pairing gap in the bulk and topologically protected gapless states on the surface or at the edge. In this paper, we show that in the weak pairing limit, the topological quantum number of a TRI superconductor can be completely determined by the Fermi surface properties, and is independent of the electronic structure away from the Fermi surface. In three dimensions (3D), the integer topological quantum number in a TRI superconductor is determined by the sign of the pairing order parameter and the first Chern number of the Berry phase gauge field on the Fermi surfaces. In two (2D) and one (1D) dimension, the Z_2 topological quantum number of a TRI superconductor is determined simply by the sign of the pairing order parameter on the Fermi surfaces. We also obtain a generic and explicit expression of the Z_2 topological invariant in 1D and 2D.

[1]In collaboration with Xiao-Liang Qi and Shou-Cheng Zhang, Stanford University.