Andreev Bound States in Topological Superconductors

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It is known that Andreev bound state is an important ingredient to identify unconventional superconductors [1]. Up to now, there have been several types of Andreev bound states stemming from their topological origins [2-3]. It can be classified into i)dispersionless flat band type realized in cuprate, ii)linear dispersion type realized in chiral superconductor like Sr_2RuO_4, iii)helical dispersion type realized in non-centrosymmetric superconductor and iv)cone type in the surface state on B-phase of superfluid ^{3}He [3].

Here we talk about exotic situation is expected in doped Weyl semimetal superconductors[4-5]. It has been noted that certain surfaces of Weyl semimetals have bound states forming open Fermi arcs, which are never seen in typical metallic states. We show that the Fermi arcs enable them to support an even more exotic surface state with crossed flat bands in the superconducting state. We clarify the topological origin of the crossed dispersionless flat bands and the relevant symmetry that stabilizes the cross point. Our symmetry analysis are applicable to known candidate materials of time-reversal breaking Weyl semimetals[6].

Reference:

[1]S. Kashiwaya and Y. Tanaka, Rep. Prog. Phys. 63 1641 (2000).

[2]Y. Tanaka, M. Sato, and N. Nagaosa, J. Phys. Soc. Jpn. 81 011013 (2012).

[3] M. Sato, *et al.*, Phys. Rev. Lett. 103 (2009) 020401.

[4] X. Wan, A. M. Turner, A. Vishwanath, and S. Y. Savrasov, Phys. Rev. B 83, 205101 (2011).

[5] A. A. Burkov and L. Balents, Phys. Rev. Lett. 107, 127205 (2011).

[6] B. Lu, K. Yada, M. Sato, and Y. Tanaka, Phys. Rev. Lett. 114 096804 (2015).