Exotic pairing states in Fe-chalcogenide superconductors

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Takasada Shibauchi

Department of Advanced Materials Science, University of Tokyo, Kashiwa 277-8561, Japan

Fe-chalcogenide superconductors have intriguing properties [1] including the nonmagnetic nematic order and its quantum critical points, possible time-reversal symmetry beraking (TRSB) in the superconducting state, and the topological superconductivity. I will review recent progress in the studies of FeSe-based superconductors. In $FeSe_{1-x}S_x$ superconductors, the nematic order can be completely suppressed at x=0.17, above which possible ultranodal pairing state with Bogoliubov Fermi surfaces appears with a reduced critical temperature T_c [2-5]. By using the electron irradiation, we study the impurity effect in the unlranodal state, from which we find the lifting of gap nodes by disorder, suggesting that the Bogoliubov Fermi surfaces are susceptible to distruption by the disorder, as in the case of accidental nodes not protected by the pairing symmetry [5]. In the Te substitution case, we find evidence for TRSB superconductivity in the bulk from zero-field muon spin relazation measuremetns, which suggests that the topological superconductivity discussed in this system is a unique case with the coexsistence between TRSB superconductivity and topologically nontrivial electronic structure [6].

References

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