Point Contact Spectroscopy of High-Spin Pairing in Topological Half-Heusler Superconductors

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In materials with non-centrosymmetric crystallographic structures, it has long been known that the lack of inversion symmetry can give rise to odd-parity spin-triplet pairing states. We report superconductivity and magnetism in a new family of topological semimetals, the ternary half Heusler compounds RPtBi and RPdBi (R : rare earth). In this series, tuning of the rare earth f-electron component allows for simultaneous control of both lattice density via lanthanide contraction, as well as the strength of magnetic interaction via de Gennes scaling, allowing for a unique tuning of both the normal state band inversion strength, superconducting pairing and magnetically ordered ground states. With superconductivity appearing in a system with non-centrosymmetric crystallographic symmetry as well as p-orbital derived spin-3/2 quasiparticles, the possibility of high-spin Cooper pairing (i.e. beyond triplet) with non-trivial topology analogous to that predicted for the normal state electronic structure provides a unique and rich opportunity to realize both predicted and new exotic excitations in topological materials. We will present experimental studies of the superconducting gap structure using point contact spectroscopy performed on RPtBi series of materials in the superconducting state.

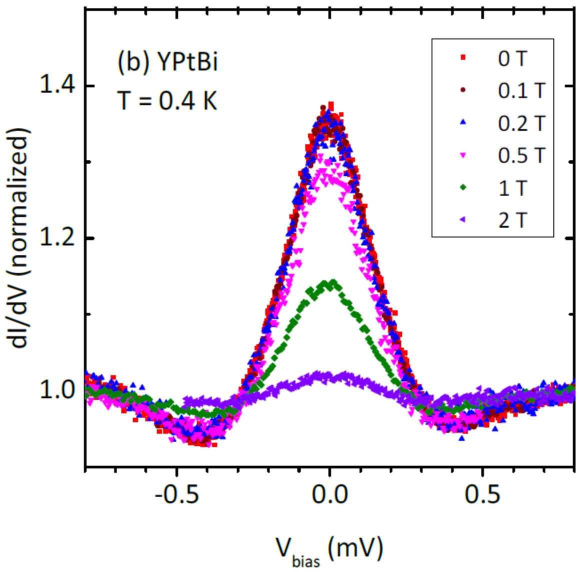

Figure. Soft point-contact spectroscopy conductance spectra of YPtBi as a function of magnetic field. An enhancement of roughly 40% is observed at zero bias for 0.4 K base temperature [1].

References

[1] H. Kim et al 2016 *arXiv:1603.03375*