Nodal gap structure in weak-coupling non-centrosymmetric superconductors

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In non-centrosymmetric superconductors, the antisymmetric spin-orbital coupling (ASOC) may split the degeneracy of conduction electrons and allows the admixture of spin-singlet and spin-triplet pairing state. However, such a pairing state could be complicated by strong electronic correlations and its coexistence with magnetism in heavy fermions. It is, therefore, desired to study weak-coupling superconductors which pairing states can be solely tuned by adjusting their ASOC strength. Here we will present the evidence of nodal gap structure in weak-coupling non-centrosymmetric superconductors $Li_2(Pd_{1-x}Pt_x)_3B$ [1] and Y_2C_3 [2] by measuring the magnetic penetration depth. It is found that Li_2Pd_3B shows BCS-like superconductivity, but gapless superconductivity eventually develops while substituting Pd with Pt. Similarly, evidence of line nodes is also observed in Y_2C_3. We argue that these results are best understood as arising from the admixing of spin-singlet and spin-triplet order parameters as a result of the broken inversion symmetry, which ratio can be tuned by ASOC.
[1] H. Q. Yuan, et al., Phys. Rev. Lett. 97, 017006 (2006). [2] J. Chen, et al., arXiv:1102.0622v1, PRB (in press).

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