The "mirage" gap as a signature of triplet superconductivity in an Ising superconductor

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The conventional two-dimensional superconductors are governed by the critical in-plane magnetic field above which the superconductivity is destroyed. Monolayer transition-metal dichalcogenides lack inversion symmetry and along with a strong spin-orbit coupling, lead to valley-dependent Zeeman-like spin splitting. This is the Ising spin-orbit coupling (ISOC) which then lifts the degeneracy of the two valleys and enhances the in-plane critical magnetic field. The finite energy pairings are thus obtained in such systems. The main superconducting gap-like feature shifted to finite energy is observed and termed as "mirage" gap [1]. The triplet correlations are introduced by the applied field, which then affects the critical field of Ising superconductors [2]. The equal-spin triplet pairing is always coupled to the singlet pairing thereby affecting the magnitude of singlet order parameter greatly at higher fields. The density of states (DOS) of the system changes once the triplet order parameter is introduced. The position and importantly the width of the mirage gap is affected by the opposing contributions from the singlet and the triplet order parameter. Thus, the width of the mirage gap can provide one of the signatures of triplet superconductivity in such Ising superconductors.

References:

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