Time Reversal Symmetry Breaking in Noncentrosymmetric Superconductor Re₆Ti

D.Singh¹, Sajilesh K.P²**, A.D Hillier², and R.P Singh¹

¹Indian institute of science education and research Bhopal, Bhopal, 462066, India
²ISIS facility, STFC Rutherford Appleton Laboratory, Harwell Science and Innovation Campus, Oxfordshire, OX110QX, UK

Superconductors with noncentrosymmetric crystal structure are of considerable interest due to their possible realization of unconventional superconductivity [1]. The lack of inversion symmetry in the lattices of these materials has significant implications on the symmetry of their superconducting state. The direct consequence of the broken inversion symmetry was first recognized in the noncentrosymmetric superconductor (NCS) CePt₃Si [2]. It shows upper critical field exceeding Pauli limiting field, indicating unconventional behaviour. In an NCS, the lack of inversion symmetry introduces a Rashba-type antisymmetric spin-orbit coupling (ASOC), which results in the splitting of spin-up and spin-down conduction electron energy bands. This leads to exhibit an unconventional ground-state, which consists of an admixture of spin-singlet and spin-triplet Cooper pairs. Nevertheless, it has yet to be conclusively verified in any material to this date. We have investigated the superconducting state of the noncentrosymmetric superconductor Re₆Ti ($T_c = 6$ K) using muon-spin rotation/relaxation ($\mu$SR) technique. The zero-field muon experiment shows the presence of spontaneous magnetic fields in the superconducting ground state, indicating time-reversal symmetry breaking (TRSB). However, the low-temperature transverse field muon measurements suggest nodeless s-wave superconductivity. The results have implied that Re₆Ti has an unconventional superconducting ground state that features a dominant s-wave component, with the exact nature of the triplet component undetermined [3].

References:


** e-mail: sajil@iiserb.ac.in