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Department of Physics
SEMINAR

Half-Quantum Vortices in Spin-Triplet Superconductors

by

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ALL INTERESTED ARE WELCOME

Abstract

The spin-counterflow half-quantum vortex (HQV), in which the circulating charge-neutral spin and charge supercurrents take up exactly half of the phase winding around the vortex, is a highly unusual topological object expected in a single crystalline superconducting sample possessing a spin-triplet superconducting order parameter (OP). The formation of HQVs was first reported in mesoscopic samples of Sr_2RuO_4 by cantilever torque magnetometry measurements over a decade ago, which excludes spin-singlet superconductivity in this material, an issue that is being debated currently. The discovery of HQVs also raised important questions on the HQV itself, including its stability and dynamics. These issues have remained largely unexplored, at least not experimentally. In this talk I will discuss our work on the detection of HQVs in mesoscopic, doubly connected cylinders of single-crystalline Sr_2RuO_4 of a mesoscopic size and the examination of the effect of the in-plane magnetic field needed for the stabilization of the HQV by magnetoresistance (MR) oscillations measurements, which yielded several distinct features including a dip and a secondary peak in the MR oscillations seen only in the presence of a sufficiently large in-plane magnetic field and measurement current. The observation of the HQV in mesoscopic Sr_2RuO_4 provides not only additional support to spin-triplet pairing in Sr_2RuO_4 but also insights into the physics of the HQV, including its associated spontaneous spin polarization.