Evidence Supporting BiPd as a Topological Superconductor

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Topological materials are scientifically fascinating and technologically appealing due to their unique electronic properties and behavior. The superconductor, BiPd, has the possibility of being a topological superconductor by virtue of its crystal structure being noncentrosymmetric, which means its crystal structure lacks a center of inversion symmetry. Its large spin-orbit coupling is therefore antisymmetric, making it a likely candidate material to host a topological superconducting state.

One method of determining if topological states are present is by measuring the Fermi surface of a material. This was accomplished via torque magnetometry, a technique that is highly sensitive to changes in the magnetization and allows a measurement of the angular dependence of the de Haas-van Alphen effect. The measurements were performed in a 35T resistive magnet coupled to a cryostat with a base temperature of 350 mK. Data from sweeping the magnetic field (a) are combined to produce (b) a map of the Fermi surface as a function of angle, which are compared to (c) calculations of the Fermi surface. Analysis of these data revealed that a nontrivial Berry phase is associated with the α frequency, strongly suggesting the presence of topological states in bulk BiPd.

Facilities used: DC Field Facility, 35-Tesla resistive magnet (Cell 12).