Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Thursday 30 November at 14:30
Simpkins Lee room

"Topological Surface State Visualization in Spin-Triplet Superconductor UTe2"

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Although UTe_2 appears to be the first 3D spin-triplet topological superconductor, its superconductive order-parameter Δ_k has not yet been established. If spin-triplet, it should have odd parity so that $\Delta_{-k} = -\Delta_k$ and, in addition, may break time-reversal symmetry. A distinctive identifier of 3D spin-triplet topological superconductors is the appearance of an Andreev bound state (ABS) on all surfaces parallel to a nodal axis, due to the presence of a topological surface band (TSB). Moreover, theory shows that specific ABS characteristics observable in tunneling to an *s*-wave superconductor distinguish between chiral and non-chiral Δ_k. To search for such phenomena in UTe_2 we employ *s*-wave superconductive scan-tip imaging of UTe_2[1] to discover a powerful zero-energy ABS signature at the (0-11) crystal termination[2]. Its imaging yields quasiparticle scattering interference signatures of two Δ_k nodes aligned with the crystal *a*-axis. Most critically, development of the zero-energy Andreev conductance peak into two finite-energy particle-hole symmetric conductance maxima as the tunnel barrier is reduced, signifies that UTe_2 superconductivity is non-chiral. Overall, the discovery of a TSB, of its a zero-energy ABS, of internodal scattering along the *a*-axis, and of splitting the zero-energy Andreev conductance maximum due to *s*-wave proximity, categorizes the superconductive Δ_k as the odd-parity non-chiral B_{3u} state[2].

[1] Nature, 618, 921–927 (2023)
[3] Gu, Wang, et al. Science (2023)