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# Vortex States and Boundary Theories in Topological Spin-Triplet Superconductors

Most unconventional superconductors are characterized by a non-trivial momentum structure of the Cooper pair wave function, represented by an explicit momentum dependence in the superconducting order parameter. A key challenge to understanding the fundamental nature of unconventional superconductivity is thus to establish the symmetry of this momentum dependence.

For spin-triplet superconductors, the Cooper pair wave function is symmetric in spin, so by the Pauli principle it must be of odd-parity in momentum space. Odd-parity spin-triplet superconductors are characterized by the appearance of zero-energy bound states on the boundaries of the material, due to the topological nature of the superconducting order parameter. Another signature is the appearance of zero-energy Majorana bound states at the core of superconducting vortices.

The recently discovered material UTe2 is a possible candidate for spin-triplet superconductivity. In addition, it may spontaneously break time-reversal symmetry upon entering the superconducting state, condensing into a chiral phase. While probing the momentum dependence of the Cooper pairs has proven to be extremely challenging due to the small energy scales of the material, recent experiments have shown progress utilizing a superconducting Scanning Tunnelling Microscopy (STM) tip to probe the surface of the material.

In this work, we will investigate the possible observable signatures of the different candidate phases considered for UTe2. Specifically, we will calculate the surface density of states in a superconducting phase with a vortex, to investigate whether this could in principle be used to distinguish between different superconducting orders, using STM measurements, or other experiments sensitive to the surface density of states.

## Field of study

Quantum Physics

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