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Tunneling conductance and spectroscopy at step edges in chiral triplet superconductors

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Surface Andreev bound states and the spectra of single-particle excitations provide valuable insights into the electronic structures of unconventional superconductors, offering clues to the determination of pairing symmetry [1]. Recently, an STM study of heavy-fermion superconductor UTe_2 has observe electron-hole asymmetric tunneling differential conductance inside the superconducting gap at step edges [2]. Supported by crystallographic symmetry arguments and further experimental indications of triplet pairing, this observation suggests a realization of chiral triplet topological superconductivity. However, the cause of asymmetric tunneling signals remains elusive and awaits theoretical explanation.

In this study, we explore possible causes and models of the asymmetric tunneling signature in UTe_2 using Bogoliubov-de Gennes equations and the tunneling Hamiltonian formalism [3] to simulate STM experiments of chiral triplet superconductors. We discuss the relationship between chiral edge states and their contribution to tunneling signals. In addition, we carry out quantum transport analysis in normal-superconductor (NS) junctions based on BTK Formalism [4], which allows us to attribute the asymmetric tunneling signals to momentum selective tunneling at sample edges at a phenomenological level.

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