



Topological Superconductors

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Topological superconductors:

- ❑ A topological superconductor (TSC) is made of a topological insulator (TI) and a superconductor.
- ❑ A TI has the property that its bulk is insulating, but electrons are able to move around freely on its surface as with the case of metals.
- ❑ A superconductor can conduct electricity with zero resistance at some critical temperature T_c .
- ❑ In a superconductor electrons form Cooper pairs, whereas in a TI the single-electron states are filled up to the Fermi surface.

Topological superconductors:

- ❑ Placing a TI in contact with a superconductor would result in the proximity effect, where T_c of the superconductor is suppressed and signs of weak superconductivity are observed in the TI.
- ❑ The surface states of a TSC are made up of Majorana fermions (MFs), which are their own antiparticles.
- ❑ MFs were originally proposed by Ettore Majorana in 1937 as a way of understanding neutrinos; they were never observed as fundamental particles, but are believed to arise in condensed matter settings.

Topological superconductors:

- ❑ MFs can aid in constructing quantum computers, and are predicted to aid in the realization of supersymmetry.
- ❑ Research in TSCs is in its early stages and MFs are major contributors, where they are considered to exist as quasiparticle excitations.
- ❑ The direct observation of MFs in condensed matter settings is based on the possibility of creating emergent particles, which are the result of interacting a TI and a superconductor.