

Surprising Feature in a Topological Superconductor Candidate

A new hint of topological superconductivity has been identified in an iron-based superconductor.

By **Michael Schirber**

Topological superconductors hold promise for fault-tolerant quantum computing, but isolating signatures of the desired topological states has proven an elusive goal. A new study of an iron-based superconductor has identified a surprising feature—a plateau in the conductance at zero voltage—that is associated with edge currents in the material [1]. This plateau is not direct proof of one of the desired topological states, but the experiment may provide a new way to probe candidate materials.

The research focused on a particular iron chalcogenide, $\text{FeTe}_{0.55}\text{Se}_{0.45}$, which exhibits superconductivity; band-structure topology; and broken time-reversal symmetry. These three properties are the essential “ingredients” of a topological superconductor, says Kenneth Burch of Boston College.

For their study, Burch and his colleagues placed electrodes at

different locations on thin flakes of the material and measured the conductance as the applied voltage was varied. With one electrode on an edge and another on the flake surface, the conductance showed a peak at zero voltage. Surprisingly, this peak flattened into a plateau when the second electrode was moved to the same edge. This edge sensitivity suggested that the plateau arises from a spatially extended (nonlocal) mode confined to the boundary. Such an edge current is an expected consequence of topological states.

The team reproduced these results with ten different samples, which suggested that the plateau is not a measurement artifact. They also performed control experiments with related materials, showing that the plateau’s appearance requires band-structure topology and broken time-reversal symmetry. However, confirming the presence of topological states will require further evidence, such as measuring the direction sensitivity (or chirality) of the edge currents.

Michael Schirber is the Deputy Editor of *Physics Magazine*.

REFERENCES

1. W. Liu *et al.*, “Nontrivial boundary-mediated superconducting transport in a TRSB topological iron-based superconductor,” *Phys. Rev. X* **16**, 041022 (2026).



Credit: W. Liu *et al.* [1]