Realization of Majorana Zero Modes within a Topological Hinge State

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Higher order topological insulators host helical, one-dimensional edge modes along its hinges that are protected by crystal and time-reversal symmetry (1). Proximity induced superconductivity on these hinge states is predicted to be topological in nature and provides a platform for the realization of Majorana zero modes (MZM). Similar to quantum spin Hall edge states, theoretical modeling shows the emergence of a MZM within a topological hinge state at an interface where superconductivity and magnetism influence these states. Previously, scanning tunneling microscopy (STM) studies have found evidence for the existence of topological hinge states on the surface of bismuth (2). To realize this new MZM platform, we grow epitaxial bismuth(111) thin films and iron clusters on top of the surface of niobium. Using high-resolution spectroscopic mapping as well as spin polarized measurements with the STM, we characterize the influence of superconductivity and magnetism on the hinge states. Our spectroscopic measurements show the presence of localized zero energy states at the interface between superconducting hinge states and the iron clusters. Comparing various experimental measurements with theoretical modelling, we will discuss how our observations are consistent with the presence of MZM in that system.

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(1) F. Schindler *et al.*, Nature Phys. 14, 918-924 (2018)
(2) I. Drozdov *et al*., Nature Phys. 10, 664–669 (2014)