

Abstract Submitted
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Superconducting proximity effect and Majorana fermions at the surface¹ LIANG FU, CHARLES KANE, University of Pennsylvania — A strong topological insulator is an insulating material in which spin-orbit interaction inverts the band gap at an odd number of time reversed pairs of points in the Brillouin zone. These materials have topologically protected gapless spin-split surface states, whose Fermi arc is characterized by a Berry's phase of π . We study the proximity effect between an s-wave superconductor and the surface states of a strong topological insulator. The resulting two dimensional state resembles a spinless $p_x + ip_y$ superconductor, but does not break time reversal symmetry. This state supports Majorana bound states at vortices. Such bound states obey non-Abelian statistics and have been studied in the context of topological quantum computing. We show that linear junctions between superconductors mediated by the topological insulator form a non chiral 1 dimensional wire for Majorana fermions, and that circuits formed from these junctions provide a method for creating, manipulating and fusing Majorana bound states.

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