Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Scattering states of the Majorana-bound-state-supporting vortices at the interface of a topological insulator and an s-wave superconductor ADAM DURST, Hofstra University — We consider an isolated vortex in the 2D proximity-induced superconducting state formed at the interface of a 3D topological insulator (TI) and an s-wave superconductor (sSC). Prior calculations of the bound states of this system famously revealed a zero-energy state that is its own conjugate, a Majorana fermion bound to the vortex core. We calculate, not the bound states, but the scattering states of this system, and ask how the spin-momentum-locked massless Dirac form of the single-particle Hamiltonian, inherited from the TI surface, affects the cross section for scattering Bogoliubov quasiparticles from the vortex. As in the case of an ordinary superconductor, this is a two-channel problem with the vortex mixing particle-like and hole-like excitations. And as in the ordinary case, the same-channel differential cross section diverges in the forward direction due to the Aharonov-Bohm effect, resulting in an infinite total cross section but finite transport and skew cross sections. We calculate the transport and skew cross sections numerically, via a partial wave analysis, as a function of both quasiparticle excitation energy and chemical potential. Novel effects emerge as particle-like or hole-like excitations are tuned through the Dirac point.

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Date submitted: 13 Oct 2015 Electronic form version 1.4