Interferometric and noise signatures of Majorana fermions in transport experiments

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Elementary excitations (often called quasiparticles) of condensed-matter systems can show features that are not displayed by the bare particles that they are composed of. Majorana-like quasiparticles that are their own antiparticles would be a particularly interesting excited state.

Recently, the possibility to realize Majorana-like quasiparticles on the surface of a three-dimensional topological insulator has attracted a lot of attention. It has been theoretically predicted that the domain wall of two superconducting regions support transport channels for Majorana fermions [1] and the interface of superconducting and magnetic regions give rise to transport channels for chiral Majorana fermions [2].

We propose to study noise correlations in a Hanbury Brown-Twiss type interferometer and find three signatures of the Majorana nature of the channels [3]. First, the average charge current in the outgoing leads vanishes. Furthermore, we predict an anomalously large shot noise in the output ports for a vanishing average current signal. Adding a quantum point contact to the setup, we find a surprising absence of partition noise which can be traced back to the Majorana nature of the carriers.

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