Tunneling between helical edge states through extended contacts

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The discovery of topological insulators in both two and three spatial dimensions has recently attracted a lot of interest. In two spatial dimensions they are the first realization of the quantum spin Hall (QSH) effect, characterized by the presence of a gap in the bulk and gapless edge states protected by time-reversal symmetry. The edge states of the QSH effect are helical, that is, their electrons have spin direction and momentum locked into each other [2, 3, 4].

In this talk [1], we will consider a QSH system in a two-terminal setup, with an extended tunneling contact connecting upper and lower edges [5, 6, 7]. We will analyze the effects of this geometry on the backscattering current as a function of voltage, temperature, and strength of the electron interactions.

We will find that this configuration may be useful to confirm the helical nature of the edge states and to extract their propagation velocity. By comparing with the usual quantum-point contact geometry [8, 9, 10], we will also observe that the power-law behaviors predicted for the backscattering current are recovered for low enough energies, while different power-laws also emerge at higher energies.

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