Universität Konstanz

SFB 767 Sonderseminar

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Interferometer with helical current - does it manifest topological insulator edge states?

Quantum transport properties of a one-dimensional ring model with helical current will be discussed. The behavior of the helical ring with long-range hopping and characterized by zero energy crossings in the energy spectrum is very much similar to that of one-dimensional edge states of a 2D topological insulator. We apply Aharonov-Bohm flux in the two-terminal helical ring in presence of Rashba spin-orbit interaction and explore how the spin polarization behavior changes depending on the applied magnetic flux and the incoming electron energy. The most interesting feature that we articulate in this system is that zero-energy crossings appear in the energy spectra at $\Phi=0$ and also at integer multiples of half-flux quantum values ($n\Phi_0/2$, n being an integer) of the applied magnetic flux. We investigate the transport properties of the ring using Green's function formalism and find that the zero energy transmission peaks corresponding to those zero energy crossings vanish in presence of Rashba spin-orbit interaction. We also incorporate static random disorder in our system and show that the zero energy crossings and transmission peaks are not immune to disorder even in absence of Rashba spin-orbit interaction. The latter prevents the possibility of behaving these helical states in the ring like topological insulator edge states.

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