Quantum Electronic Transport in Topological Insulator Nanoribbons

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Abstract

Topological insulators (TIs) are bulk insulators including metallic (and topological) surface states, which are topologically protected by time-reversal symmetry. The topological surface states are also known to be spin-helical, meaning that the electron spin is aligned parallel to the surface and normal to the momentum. Since the spin orientation of the surface electrons are locked perpendicular to their translational momentum, the metallic edge states in TIs are protected from backscattering by chiral spin texture and thus expected to exhibit highly quantum-coherent charge and spin transport, making this TI material to be a promising platform for novel quantum information devices. Here I will briefly introduce our recent experimental observations of quantum electronic transport in TI nanowires, such as the weak antilocalization effect, Aharonov-Bohm oscillations, Shubnikov-de Haas oscillations, and superconducting proximity effects. Our observations would be useful for device applications of TI nanostructures in the field of quantum information processing.

References

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