
Spin Orbit interactions, time reversal symmetry and spin filtering

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Abstract

Quantum computing requires the ability to write and read quantum information on the spinors of electrons. Here we discuss writing information on *mobile* electrons, which move through mesoscopic (or molecular) quantum wire networks. When such a network is connected to one source and one drain then time-reversal symmetry and unitarity imply no spin polarization. Tunable spin filtering can be achieved by adding a magnetic field, which breaks time-reversal symmetry, or by leakage, which breaks unitarity. Alternatively, filtering is also achieved with more than one drain. Specific examples include transport through a mesoscopic Aharonov-Bohm interferometer and through a helical molecule. Filtering can also be achieved for a single one-dimensional wire which has spin-orbit interactions, when the chain vibrates in the transverse direction. Such a single wire can also change the Josephson current between two superconductors.

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