**Spin Filtering: writing quantum**

**information on mobile qubits**

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Quantum computing requires the ability to write and read quantum information on the spinors of electrons. This work considers *mobile* electrons, which move through mesoscopic (or molecular) quantum wire networks. Combining spin-orbit interactions (tunable by external gate voltages), and the Aharonov-Bohm flux (tunable by an external magnetic field), one can have a spin filter: for arbitrary incoming electrons, the outgoing electrons are polarized along a desired direction. This amounts to '*writing*' the desired information on the spinor of the electrons. (a) Specific results will be presented for a simple closed interferometer. [1] (b) The above filtering is robust against leaking of electrons, in an open interferometer. Leakage breaks time-reversal symmetry, and can thus replace the magnetic flux. [2] (c) At a given electron energy, filtering can be achieved by tuning two gate voltages. [3] (d) Filtering can also be achieved for a single one-dimensional chain which has spin-orbit interactions, when the chain vibrates in the transverse direction. [4] (e) (e) Such a single wire can also change the Josephson current between two superconductors. [5] (f) Transient time-dependent polarizations can be generated even without a magnetic flux. [6] (g) Similar considerations explain the spin splitting of electrons going through helical organic molecules [7].

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