

Spin Filtering

Amnon Aharony

Ben Gurion University, Israel

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 networks (made of quantum wires or of arrays of quantum dots). Combining spin-orbit interactions, whose strength can be tuned by external gate voltages, and the Aharonov-Bohm flux, which can be tuned by an external magnetic field, one can manipulate the properties of such networks, so that the outgoing electrons are polarized along a desired direction. This amounts to '*writing*' the desired information on the spinor of the electrons. Given a beam of polarized electrons, the *charge conductance* of the same network depends on their polarization, allowing '*reading*' the qubit information. Specific results will be presented for a simple closed interferometer. [1] The talk will also report on more recent work: (a) The above filtering is robust against leaking of electrons, in an open interferometer. [2] (b) Filtering can also be achieved for a single one dimensional chain which has spin-orbit interactions, when the chain vibrates in the transverse direction. [3]

[1] A. Aharony, Y. Tokura, G. Z. Cohen, O. Entin-Wohlman, and S. Katsumoto, *Filtering and analyzing mobile qubit information via Rashba-Dresselhaus-Aharonov-Bohm interferometers* [Phys. Rev. B **84**, 035323 \(2011\);\(arXiv:1103.2232\)](#)

[2] Work with S. Mattityahu and O. Entin-Wohlman.

[3] Work with R. I. Shekhter and O. Entin-Wohlman.