

ABSTRACT

THESIS: Electron Spin-Polarization Via Zeeman and Aharonov-Bohm Effects in a Double Quantum Dot Ring

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PAGES: 119

A nanoscale Aharonov-Bohm (AB) ring with a quantum dot (QD) embedded in each arm is investigated analytically to provide electron transmission characteristics. A parallel magnetic field provides Zeeman splitting of the QD energy levels. Combined Zeeman energy level splitting and AB-effects occur with a perpendicular field. In our device, the AB-ring interferometer, Zeeman splitting of the QD energy levels creates regions of parameter space in which the electron transmission is highly spin-polarized. In addition to Zeeman splitting caused by a parallel magnetic field, combined Zeeman energy level splitting and AB-interference effects occur with a perpendicular field. The weighted spin-polarization function is calculated and presented as a function of magnetic field and electron energy. Due to a unique parameter regime in which the AB-oscillations show extreme sharpening [1], the electron transmission can be tuned to produce spin-polarized currents which can be switched and controlled by small changes of external fields.