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Electrostatic and Quantum Transport Simulations of Quantum Point Contacts in the Integer Quantum Hall Regime[1] HARSHAD SAHASRABUDHE, SAEED FALLAHI, JAMES NAKAMURA, MICHAEL POVOLOTSKYI, BOZIDAR NOVAKOVIC, RAJIB RAHMAN, MICHAEL MANFRA, GERHARD KLIMECK, Purdue University, West Lafayette — Quantum Point Contacts (QPCs) are extensively used in semiconductor devices for charge sensing, tunneling and interference experiments. Fabry-Pérot interferometers containing 2 QPCs have applications in quantum computing, in which electrons/quasi-particles undergo interference due to back-scattering from the QPCs. Such experiments have turned out to be difficult because of the complex structure of edge states near the QPC boundary. We present realistic simulations of the edge states in QPCs based on GaAs/AlGaAs heterostructures, which can be used to predict conductance and edge state velocities. Conduction band profile is obtained by solving decoupled effective mass Schrödinger and Poisson equations self-consistently on a finite element mesh of a realistic geometry. In the integer quantum Hall regime, we obtain compressible and in-compressible regions near the edges. We then use the recursive Green's function algorithm to solve Schrödinger equation with open boundary conditions for calculating transmission and local current density in the QPCs. Impurities are treated by inserting bumps in the potential with a Gaussian distribution. We compare observables with experiments for fitting some adjustable parameters.

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