Stefano Chesi

Spin polarized transmission of holes in quantum point-contacts with strong spin-orbit coupling

Abstract

We investigate quantum point contacts (QPCs) fabricated from two-dimensional hole gases. We show that several surprising aspects of magnetic focusing experiments can be understood form the presence of a crossing point at finite momentum of the lowest two spin subbands. The crossing point originates in one-dimension from the strong two-dimensional spin-orbit interaction of holes in asymmetric quantum wells. We also discuss how a magnetic field parallel to the channel, or an asymmetry in the QPC lateral potential, can remove the degeneracy at the crossing point. These features allow us to explain the anomalous sign of the spin polarization filtered by the QPC, as well as a surprising dependence of spin-polarization on magnetic field. Controlling the magnitude of the spin-splitting affords a novel mechanism for inverting the sign of the spin polarization.