Spin-polarized currents in parallel coupled double quantum point contacts

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We investigate the transport properties of spin-polarized currents through two parallel quantum point contacts (QPCs) formed by embedding an artificial obstacle into a rectangular quantum wire. Under zero magnetic field, the linear conductance G is roughly equal to the sum of the linear conductance of the individual QPCs, as expected from the noninteracting single-particle theory. While the currents through the two QPCs are spin polarized by applying an in-plane magnetic field B, the additivity rule breaks down, strongly suggesting a coherent correlation between the spin-polarized currents. Furthermore, extra plateaus that are associated with the formation of zero-bias anomalies are observed as $G < 2e^2/h$. Our data suggest that coupled spin-polarized currents give rise to intriguing states, which may help to elucidate the nature of interacting electrons in one-dimensional systems.