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Waveguide Effects in Quantum Wires with Double−bend Discontinuities

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Abstract

Quantum waveguide structures with double−bend discontinuities were fabricated in modulation−doped AlGaAs/GaAs heterojunctions using a split−gate technique. The low field ac−conductance measurements at 50 mK show resonant peaks in the lowest quantized conductance plateau. The number of peaks increases with the effective cavity length of the double bend. This observation may be explained in terms of the allowed standing waves in the bend cavity, which is consistent with the theoretical predictions of a generalized mode−matching theory. Beyond the simple waveguide behavior, we find that the measured peak conductivity decreases as the channel length increases, which is believed to be associated with elastic scattering due to channel inhomogeneities. Magnetic field studies show that the resonance features are suppressed as the cyclotron radius approaches the one−dimensional channel width.