

Fractional Quantization of Conductance in Semiconductor Nanostructures - Length Scales, Disorder and Interactions.

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All states in a 1D or quasi 1D system are localized due to progressive back scattering of carriers. However when the disorder is very weak, (high mobility), conductance quantization occurs producing plateaus, or features, at $2n e^2/h$, where the factor of 2 is due to spin degeneracy and n is the number of 1D quantized subbands below the Fermi energy. With decreasing disorder a plateau is observed near the value of $0.7(2e^2/h)$ which arises from repulsion between the spins and a tendency to spin alignment.

There has been much less investigation of the regime when the confinement is reduced and electrons are allowed to relax in the second dimension. When the channel is wide the quantized energy levels disappear and increasing the width, and decreasing the confinement, has shown that just before the transition to 2D a number of fractional plateaus of conductance, typically $2/5, 1/5, 1/6$, are found in the absence of a magnetic field. This has been observed in Ge, GaAs, InAs, InGaAs, possibly enhanced by the Spin-Orbit Interaction. The dependence of the quantization on the disorder will be discussed as will the progressive appearance of both odd and even denominator fractions. Theories of the effect will be discussed as well as the limits of observation.

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