Current Distribution in Two-dimensional Electron Systems under QHE Condition

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The quantum Hall effect (QHE) is characterized by an energy gap at the Fermi energy of a 2-dimensional electron gas (2DEG) in strong magnetic fields. This correlates with an incompressible electron liquid characterized by a vanishing conductivity σ_{xx}. However the boundary of the 2DEG represents a region with varying carrier density so that normally compressible and incompressible stripes are formed. In addition, metallic contacts modify the carrier density of the 2DEG close to the electron reservoirs due to differences in the work function so that QHE devices should be described as a very inhomogeneous electrical conductor with complicated current distributions.

Spatially resolved measurement of the current induced change in the electrostatic potential allows a reconstruction of the current distribution in QHE devices and measurements on graphene monolayers are compared with experimental findings on GaAs/AlGaAs heterostructures.