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Quantum Hall effect near the cyclotron resonance of a two-dimensional electron gas

Although the fundamental nature of quantum Hall effect (QHE) involves a constant flow of carriers in topologically-protected edge states where backscattering is supressed, the QHE has been found to persist at terahertz (THz, ~4 meV) frequencies in various 2D systems such as graphene and semiconductor 2D electron gases. We measure the Hall conductivity of a two-dimensional electron gas formed at a GaAs/AlGaAs heterojunction in the THz regime close to the cyclotron resonance (CR) frequency using highly sensitive Faraday rotation measurements. The sample is electrically gated, allowing the electron density to be changed continuously by more than a factor of 3. We observe clear plateau like and steplike features in the Faraday rotation angle vs. electron density and magnetic field (Landau-level filling factor) even at fields or frequencies within half a linewidth of the CR absorption. It is surpising to see QHE plateaus where the conductivity is dominated by inter-Landau level optical absorption. We have also looked for signatures of the QHE near CR in graphene at mid-infrared energies (~100 meV).

Biography

John Cerne completed his Batchelor's degree in Physics at Princeton University and his PhD in Condensed Matter Experimental Physics at the University of California, Santa Barbara. He is a Physics Professor at the University at Buffalo, where is also the Director of Undergraduate Studies for the Physics Department. He has published 60 papers in refereed journals.

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