

An incompressible state of a photo-excited electron gas

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Abstract

© 2015 Macmillan Publishers Limited. Two-dimensional electrons in a magnetic field can form new states of matter characterized by topological properties and strong electronic correlations as displayed in the integer and fractional quantum Hall states. In these states, the electron liquid displays several spectacular characteristics, which manifest themselves in transport experiments with the quantization of the Hall resistance and a vanishing longitudinal conductivity or in thermodynamic equilibrium when the electron fluid becomes incompressible. Several experiments have reported that dissipationless transport can be achieved even at weak, non-quantizing magnetic fields when the electrons absorb photons at specific energies related to their cyclotron frequency. Here we perform compressibility measurements on electrons on liquid helium demonstrating the formation of an incompressible electronic state under these resonant excitation conditions. This new state provides a striking example of irradiation-induced self-organization in a quantum system.

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