Spin-Selective Equilibration among Integer Quantum Hall Edge Channels

Thomas Ihn*[1], Klaus Ensslin[2], Giorgio Nicoli[2], Christoph Adam[2], Mark Röösli[2], Peter Märki[2], Jan Scharnetzky[2], Christian Reichl[2], and Werner Wegscheider[2]

[1]Solid State Physics Laboratory, ETH Zürich – 8093 Zurich, Switzerland
[2]Solid State Physics Laboratory, ETH Zürich – Switzerland

Abstract

The equilibration process of quantum Hall edge modes is affected by the disorder potential and the steepness of the edge. With the advent of modern samples featuring higher mobilities and setups with lower electron temperatures, there is a need for further exploration of this topic. In this study, we have developed a framework to systematically measure and analyze the equilibration of up to 8 integer edge modes. Our results indicate that spin-selective coupling is the dominant factor, even for non-neighboring channels with parallel spin. By manipulating the magnetic field and bulk density, we were able to control the equilibration process until it was almost entirely suppressed and dominated only by individual microscopic scatterers. Our methodology could serve as a valuable tool for investigating and designing improved devices, as well as for studying fractional and other exotic states.

*Speaker