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Charge Configuration of a Quantum Point Contact near pinchoff

LINDSAY MOORE, Stanford University, S. LUESCHER, Stanford University, D. GOLDHABER-GORDON, Stanford University, H. SHTRIKMAN, Weizmann Institute of Science — Over the last decade, there has been great interest in how electrons flow through a quantum point contact (QPC) as it is just opened up, before a fully transmitting 1D channel is available. Remarkably, there does not seem to be a smooth transition from tunneling to ballistic transport. Instead, a shoulder appears in the conductance versus channel width, at a conductance of roughly 0.7 times that of an open spin-degenerate channel. Experiments have built a consensus that this so-called “0.7 structure” is related to electron spin and electron-electron interaction, but the detailed description remains controversial. To study this system, we have made devices with two QPC’s which share a thin central gate, fabricated on a high mobility GaAs/AlGaAs heterostructure. In this experiment, one QPC acts as sensitive charge detector for the other, neighboring quantum point contact. Measurements of the changing capacitive coupling between the detector QPC and other gates on the device have provided new insight into the charge configuration of the second QPC as it is opened from pinchoff through several conductance plateaux. We acknowledge support from the ONR Young Investigator Program, Award No. N00014-01-1-0569 and a Research Corporation Research Innovation Award, No. RI1260.

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