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Interaction Effects in the Conductance of Quantum Wires: Crossover from weakly-disordered Fermi liquid to Luttinger liquid¹ MATTHEW BELL, Department of Physics and Astronomy, Rutgers University, ANDREI SERGEEV, JONATHAN BIRD, VLADIMIR MITIN, Electrical Engineering Department, University at Buffalo, ALEKSANDR VEREVKIN, Department of Physics and Astronomy, Rutgers University — We investigate the electrical conductance of long, high-mobility quantum wires and observe a crossover from the weakly-disordered multi-channel Fermi liquid to a Luttinger liquid when the width of the channel is adjusted such that the number of electron subbands n in the quantum wire is less than 3. The quantum wires with adjustable widths were formed from an AlGaAs/GaAs heterostructure using the split-gate technique. In the range of channel widths where $3 \le n \le 8$, a logarithmic temperature dependence of the conductance is observed for 1 < T < 10 K. This dependence is adequately explained by effects of electron-electron interaction in weakly-disordered quasi-one dimensional (with respect to the interaction) Fermi liquid. In more narrow wires the logarithmic dependence changes to a power-law variation. These observations are shown to be in good agreement with recent theoretical works that attribute the logarithmic term to the interaction effects in a weakly disordered quasi-one-dimensional conductor and associate this interaction correction with the beginnings of a crossover to the multi-channel Luttinger liquid.

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