Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Interaction effects in conductance of quasi-1D channels formed from AlGaAs/GaAs 2DEG: Crossover from weakly-disordered Fermi liquid to Luttinger liquid[1] MATTHEW BELL, ANDREI SERGEEV, JONATHAN BIRD, VLADIMIR MITIN, ALEKSANDR VEREVKIN, University at Buffalo — We investigated the conductance of a long and narrow high-mobility channel and observed crossover from weakly-disordered multi-channel Fermi liquid [1] to Luttinger liquid with decreasing channel width to ∼100nm. Quasi-one-dimensional channels were formed from an AlGaAs/GaAs heterostructure using the split-gate technique. The lengths of the channels were 100 μm. The width of the channels were varied from a lithographic width of 500 nm to ∼50 nm by applying negative bias to the split-gate. The effective electron concentration and the channel widths were evaluated from magnetoresistance measurements. In the range of channel widths 500 - 100 nm, at temperatures 1-10 K we clearly observe the logarithmic temperature dependences of the conductance. These dependences are adequately explained by effects of electron-electron interaction in weakly-disordered quasi-one dimensional (with respect to the interaction) Fermi liquid [1]. When the width further decreases, the logarithmic dependences change to power-law dependences, which are typical for Luttinger liquid. This crossover takes place when the channel width corresponds to 2-3 one-dimensional subbands. [1] Sergeev et.al., Phys. Rev. B. 69, 075310 (2004).

[1]This research was supported by grants from NYSTAR and AFOSR

Matthew Bell
University at Buffalo

Date submitted: 07 Dec 2008 Electronic form version 1.4