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Gated Magnetotransport in a Very-High Mobility GaAs/AlGaAs Quantum Well[1] GUANGTONG LIU, D.C. TSUI, L.N. PFEIFFER, K.W. WEST, Princeton University, IVAN KNEZ, CHI ZHANG, KRISTJAN STONE, R.R. DU, Rice University — The ability to control electron density and potential profile in a very-high mobility, modulation-doped GaAs/AlGaAs 2D electron system by potential gates is a key ingredient in realizing confinement of quasiparticles in the fractional quantum Hall effect. In this study, top-gated Hall bar samples were constructed on a 20-nm GaAs/AlGaAs 2D electron gas quantum well (QW) using a Si_3N_4 dielectric layer. Before the gate was processed, the wafer had an electron density $n = 6.3 \times 10^{11}$ cm^{-2} and a mobility $\mu = 1 \times 10^7$cm^2/Vs at 300 mK. By magnetotransport measurements in the quantum Hall region we found that electrons can be depleted uniformly (from 5.64 to 0.6×10^{11}cm^{-2}), and the n vs. gate-potential shows simple capacitive characteristics in this range. The μ vs. n can be described by a power law, $\mu = A \cdot n^{1.9}$. We discuss the applications of the gate technique for quantum transport studies in very-high mobility QWs at ultralow temperature region produced by nuclear demagnetization refrigerator. Ref. R. L. Willett, et al, Appl. Phys. Lett. 89, 242107 (2006)

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