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Properties of in-situ back-gated two-dimensional electron gases in GaAs/AlGaAs for the study of electron correlations in the 2^{nd} Landau level JOHN WATSON, Department of Physics and Birck Nanotechnology Center, Purdue University, MICHAEL MANFRA, Department of Physics, Birck Nanotechnology Center, Schools of Electrical and Computer Engineering and Materials Engineering, Purdue University — We report on growth and processing optimization of in-situ back-gated two-dimensional electron gases in GaAs/AlGaAs quantum wells. We find that gate leakage currents as small as 4 pA can cause noticeable heating of the electrons if the lattice is not properly thermally anchored to the cryostat. However, we also show that when the devices are properly optimized gate voltages as large as 4V can be applied before leakage turns on, allowing the density to be tuned over a large range from near depletion to over 4 x 10^{11} cm^{-2}. In these optimized devices heating effects at dilution refrigerator temperatures are negligible and the gap at $\nu = 5/2$ can be tuned continuously with density to a maximum >400 mK. Such devices should prove useful for the study of electron transport in nanostructures in the 2^{nd} Landau level.

John Watson
Purdue University

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