Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Tunneling Between a Quantum Wire and a Two-Dimensional Electron Gas[1] DOMINIQUE LAROCHE, McGill University and Sandia National Laboratories, JOHN RENO, Sandia National Laboratories, GUILLAUME GERVAIS, McGill University, MIKE LILLY, Sandia National Laboratories — We study 1D-2D tunneling between a quantum wire and a 2D electron gas as a function of magnetic field, source drain bias, temperature and 1D subband occupation. The transition from 2D-2D to 1D-2D tunneling is clearly observed through a sharpening of the tunneling resonance, confirming that the measurements are performed in a 1D-2D state. The device used is fabricated in a GaAs/AlGaAs parallel double quantum well heterostructure with an 11 nm wide $Al_{0.9}GA_{0.1}As$ barrier separating the quantum wells. Quantum wires are created via electron beam lithography defined split gates fabricated on both sides of the sample, albeit only one of the wires is used in the experiment.. The design is such that the 1D density can be independently controlled over a large conduction range and is uniform over the length of the quantum wire. Both wires show non-ballistic quantum steps up until a conductance of $10 \times 2e^2/h$. Magnetotranpsport results are compared to tunneling in the 1D-1D and 2D-2D regimes.

[1]Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract No. DE-AC04-94AL85000.

Dominique Laroche
McGill University and Sandia National Laboratories

Date submitted: 21 Nov 2008 Electronic form version 1.4