Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Localization of the Two-dimensional Electron Gas in $LaAlO_3/SrTiO_3$ Heterostructures TOMAS HERNANDEZ, CHUNG WUNG BARK, CHANG-BEOM EOM, MARK S. RZCHOWSKI, University of Wisconsin-Madison — We use low temperature magnetotransport measurements to compare the quasi 2-dimensional electron gas (2DEG) at the $LaAlO_3/SrTiO_3$ interface in heterostructures grown on $(LaAlO_3)_{0.3}$-$(Sr_2AlTaO_3)_{0.7}$ (LSAT) substrates to the 2DEG at the $LaAlO_3$/single crystal $SrTiO_3$ interface. All heterostructures were grown by pulsed laser deposition with *in-situ* reflection high-energy electron diffraction. For the samples on LSAT, we find that increasing the carrier concentration by growing at lower oxygen partial pressures changes the conductivity mechanism, from strongly localized transport at low carrier concentrations to metallic conductivity with indications of weak localization at higher concentrations. We interpret this as an increasing occupation of Ti $3d$ bands of layers near the interface, changing the spatial extent of the conduction region and its susceptibility to localization by disorder and point defects at the interface. On the other hand, the 2DEG of similarly grown $LaAlO_3$ on single crystal $SrTiO_3$ shows metallic behavior and low temperature measurements display Kohler scaling of the out-of-plane magnetoresistance, consistent with classical orbital transport.

Tomas Hernandez
University of Wisconsin-Madison

Date submitted: 11 Nov 2011 Electronic form version 1.4