Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Internal Charge Transfer and Quasi-Two Dimensional Electron Gases at $NdTiO_3/SrTiO_3$ interfaces[1] PENG XU, Univ of Minnesota - Twin Cities, TIMOTHY C. DROUBAY, Pacific Northwest National Laboratory, JONG SEOK JEONG, K. ANDRE MKHOYAN, Univ of Minnesota - Twin Cities, PETER V. SUSHKO, SCOTT A. CHAMBERS, Pacific Northwest National Laboratory, BHARAT JALAN, Univ of Minnesota - Twin Cities — Two-dimensional (2D) ultra-high carrier densities are of considerable current research interest for novel plasmonic and high charge-gain devices. However, the highest 2D electron density obtained is thus far limited to $3x10^{14}$ cm^{-2} (electron/unit cell/interface) at $GdTiO_3/SrTiO_3$ interfaces, and is typically an order of magnitude lower at $LaAlO_3/SrTiO_3$ interfaces. In this work, we will present detailed study that carrier densities much higher than expected based on resolution of the polar discontinuity at perovskite oxide heterojunctions can be achieved via band engineering and internal charge [1]. The $SrTiO_3$(8 u.c.)/$NdTiO_3$(2 u.c)/$SrTiO_3$(8 u.c.)/LSAT(001) heterostructure shows the expected electronic reconstruction behavior starting at t = 2 u.c., but then exhibits a higher carrier density regime at t $\geq$ 6 u.c. due to additional charge transfer from band alignment. Combining DFT modeling and experiments using x-ray photoelectron spectroscopy, scanning transmission electron microscopy, electron energy loss spectroscopy, energy dispersive x-ray spectroscopy and electronic transport measurements, we will discuss the origin of these carriers, dimensionality and transport mechanisms. [1] Peng Xu, et al. Advanced Material Interface (2015), in press.

[1]This work at UMN is supported primarily by NSF through the MRSEC.

Peng Xu
Univ of Minnesota - Twin Cities

Date submitted: 06 Nov 2015 Electronic form version 1.4