Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Resonant Tunneling Through a Two-Dimensional Electron Gas in All-Oxide Heterostructure Tunnel Junctions J.D. BURTON, E.Y. TSYMBAL, University of Nebraska, Lincoln, USA, J.P. VELEV, University of Puerto Rico, San Juan, USA — Oxide heterostructures exhibit a variety of very interesting physical properties and have tremendous potential for new types of multifunctional device applications. For example, very recently it was discovered that a two-dimensional electron gas (2DEG) is formed at the (001) interface between two perovskite oxides that are otherwise insulating in the bulk. We examine, within the framework of first-principles density functional theory, the effect of a complex SrTiO3-LaO-SrTiO3 barrier forming a 2DEG on conductance and TMR in all-oxide magnetic tunnel junctions. The replacement of one SrO atomic layer by LaO in the otherwise pure SrTiO3 barrier can be understood as precision substitutional doping of trivalent La for divalent Sr, leading to the formation of a 2DEG. Such precision atomic layering is within the reach of current experimental fabrication techniques. Our calculations reveal that compared to the pure SrTiO3 barrier, the tunneling conductance can be substantially enhanced due to resonant tunneling through the 2DEG. However, this effect is sensitive to lattice polarization effects in the SrTiO3 barrier as well as the choice of electrode material. We will discuss these effects with the goal of stimulating experimental studies.

J. D. Burton
University of Nebraska - Lincoln

Date submitted: 25 Nov 2008 Electronic form version 1.4