Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Memristive Switching and Interfacial Magnetoelectricity in LCMO/PBCO Heterostructure XIAO SHEN, Vanderbilt University, TIMOTHY J. PENNYCOOK, Oxford University, DAVID HERNANDEZ MARTIN, ANA PÉREZ, MARIA VARELA, Universidad Complutense de Madrid, YEVGENIY S. PUZYREV, Vanderbilt University, CARLOS LEON, ZOUHAIR SEFRIOUI, JACOBO SANTAMARIA, Universidad Complutense de Madrid, SOKRATES T. PANTELIDES, Vanderbilt University — New phenomena emerge at the interfaces of transition metal oxides. Here we report memristive switching in a $La_{0.7}Ca_{0.3}MnO_3PrBa_2Cu_3O_7$ bilayer structure with an On/Off ratio greater than 10^3 that originates from a new type of interfacial magnetoelectricity. Using DFT calculations, we show that at the LCMO/PBCO interface, a "magnetic dead layer (MDL)"[1] can be switched on and off by a small displacement of the interfacial Mn atoms generated by an external voltage. Initially, the LCMO is ferromagnetic with no MDL. This is the Low Resistance State (LRS) as majority-spin carriers tunnel through the PBCO. A negative voltage creates an electric field that displaces the interfacial Mn atoms towards the bulk LCMO by a few hundredths of an Angstrom. In such position, the interfacial Mn layer is coupled anti-ferromagnetically to the bulk LCMO, whereby a MDL is present, adding a barrier for the majority-spin carriers to tunnel and thus the bilayer is at High Resistance State (HRS). A positive bias drives the Mn atoms back to their original positions that favor ferromagnetic coupling, thus destroying the MDL and switching the bilayer back to LRS.

[1]W. Luo, S. J. Pennycook, S. T. Pantelides, Phy. Rev. Lett. 101, 247204 (2008)

Xiao Shen
Vanderbilt University

Date submitted: 13 Nov 2014 Electronic form version 1.4