Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Electrically controlled magnetization in a tricolor superlattice[1]
ALEX DEMKOV, JAEKWANG LEE, NA SAI, UT Austin — With recent breakthroughs in fabricating high-quality oxide films, ultra thin ferroelectric (FE) films have attracted significant attention. Many FE-based electronic devices proposed to date have a capacitor configuration, where a FE layer is inserted between two identical metal electrodes. We consider theoretically so-called tricolor structures or asymmetric capacitors with one electrode being ferromagnetic and other normal metal. An interesting aspect of a tricolor structure is breaking of the inversion symmetry which is expected to generate new properties. Of particular interest is the control of the magnetization in a ferromagnetic layer without using an external magnetic field. The effect may find applications in low-power and high-density integration in future spintronics devices. To investigate the polarization-dependent magnetization change in the iron layer we construct the tricolor superlattices comprised of Fe/$BaTiO_3$/Pt, Fe/$PbTiO_3$/Pt and perform first principles calculations at the LSDA+U level. We find the electrode magnetization sensitive to the polarization direction in the FE layer, which suggests a multiferroic character of the structure. The effect is much stronger than in the analogous symmetric structures. We also investigate the change of the depolarization field and screening length due to the lattice relaxation.

[1]Supported by the ONR under grant N000 14-06-1-0362 and TACC.

Alex Demkov
UT Austin

Date submitted: 07 Dec 2009 Electronic form version 1.4