Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Phase competition by design in $\mathbf{R_{0.5}Ba_{0.5}MnO_3}$ ELIZABETH NOWADNICK, Cornell University, JIANGANG HE, Northwestern University, CRAIG FENNIE, Cornell University — Phase competition between distinct ground states can arise from interactions on similar energy scales between the spin, charge, lattice, and orbital degrees of freedom. This competition can result in large responses to external perturbations. For example, the colossal magnetoresistance effect in the rare-earth manganites $R_{1-x}A_xMnO_3$ arises out of competing ferromagnetic metallic and charge/orbital-ordered antiferromagnetic insulating states. Phase competition between polar and magnetic ground states is a promising strategy to realize polarization (magnetization) control with a magnetic (electric) field, which is major goal in multiferroics research. In this regard, the half-doped A-site ordered manganite $Sm_{0.5}Ba_{0.5}MnO_3$ is of particular interest, because the charge/orbital-ordered antiferromagnetic insulating state in this material is polar. We use a combination of group theoretic methods and first-principles calculations to elucidate the origin of this polar state, and show that epitaxial strain can tune the material to a regime where there is a strong competition between the polar insulating state and the ferromagnetic metallic state. We then explore how to achieve electric and magnetic field control of the order parameters in this system.

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Date submitted: 11 Nov 2016 Electronic form version 1.4