MAR12-2011-020205

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

New material design strategies to realize strong coupling in multiferroics and beyond[1]

CRAIG FENNIE, Cornell University, School of Applied & Eng. Physics

Perovskite ABO_3 oxides display an amazing variety of phenomena that can be altered by subtle changes in the chemistry and internal structure, making them a favorite class of materials to explore the rational design of novel properties. In this talk I will review a recent advance in which rotations and tilts of the BO_6 octahedra give rise to a novel form of ferroelectricity. Octahedral rotations strongly influence other structural, magnetic, orbital, and electronic degrees of freedom in perovskites and related materials. Thus, I want to discuss the idea that octahedral rotation-driven ferroelectricity has the potential to robustly control emergent phenomena with an applied electric field. As one example, I will show from first principles how these "functional" octahedral rotations simultaneously induce ferroelectricity, magnetoelectricity, and weak ferromagnetism in a class of naturally occurring Ruddlesden-Popper (RP) $(ABO_3)_2(AO)$ layered perovskites and discuss the challenges to realize electric field switching of magnetism in these RP and in $(ABO_3)/(A'BO_3)$ perovskite superlattice novel multiferroics.

N. A. Benedek and C. J. Fennie, *Phys. Rev. Lett* **106**, 107204, 2011;
J. M. Rondinelli and C. J. Fennie, arXiv 2011; N. A. Benedek and C. J. Fennie, arXiv 2011.

[1]CJF was supported by the DOE-BES under Award Number DE-SCOO02334.