Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Emergence of a new order reconciling ferroelectric and antiferrodistortive instabilities in $EuTiO_3$ JONG-WOO KIM, PHILIP RYAN, Argonne National Laboratory, PAUL THOMPSON, SIMON BROWN, XMaS, European Synchrotron Radiation Facility, France, PETER NORMILE, Universidad de Castilla-la Mancha, Spain, ANKE WEIDENKAFF, University of Bern, Swiss — Control of magnetic moments with electric field or electric polarization with magnetic field can open new possibilies to develop future applications of low power sensors, data storages and spintronics. However, in general this magnetoelectric coupling is extremely small for device application. Although, a substantial change of the dielectric constant under magnetic field was observed in the $EuTiO_3$ system. This finding offers an insight into how the electric polarization couples with the magnetism through phonon modes to the spin of the Eu atoms. We present recent x-ray diffraction data on a single crystal $EuTiO_3$ providing the direct proof of antiferrodistortive (AFD) TiO^6 octahedral rotations correlated with the quantum paraelectric state. Forming an incommensurate AFD order mediates the competition between antiferroelectric and AFD order. We discuss the origin of magnetoelectric coupling based on the interplay of AFD order and antiferromagnetic interactions.

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Date submitted: 10 Nov 2011 Electronic form version 1.4