Ferroelectricity in $Mn_{0.9}Fe_{0.1}WO_4$ induced by magnetic fields: A simple model calculation B. LORENZ, R. P. CHAUDHURY, C. W. CHU[1], TC-SUH and Department of Physics, University of Houston — Replacing Mn^{2+} by Fe^{2+} in multiferroic $MnWO_4$ results in the complete loss of ferroelectricity at zero magnetic field. However, it was shown that in $Mn_{0.9}Fe_{0.1}WO_4$ an external magnetic field restores the ferroelectric state. We present a simple mean field calculation of the Heisenberg model with ferromagnetic nearest and antiferromagnetic next nearest neighbor interactions and uniaxial anisotropy in an external magnetic field. The various commensurate and incommensurate magnetic phases in $Mn_{1-x}Fe_xWO_4$ are well described by the model. The loss of the non collinear helical spin structure (which is associated with the ferroelectric order) with increasing Fe substitution is explained by the enhancement of the anisotropy. We show that the external field does indeed restore the helical spin structure in $Mn_{0.9}Fe_{0.1}WO_4$ and that the observed field-induced ferroelectricity can be explained.

[1]also at LBNL Berkeley and HKUST Hong Kong

Bernd Lorenz
University of Houston

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