Abstract Submitted
for the OSS11 Meeting of
The American Physical Society

Study of the dielectric and magnetic properties of Multiferroic $Ca_3Mn_2O_7$ EHAB ABDELHAMID, AMBESH DIXIT, GAVIN LAWES, Wayne State University — Materials exhibiting simultaneous magnetic and ferroelectric order are widely studied because of the strong spin-charge coupling that can arise in these systems together with their applications to novel magnetoelectric devices. While it has long been recognized that $Ca_3Mn_2O_7$ develops magnetic order below 120K, recent theoretical calculations suggest that this system may undergo a structural transition to a ferroelectric state above this temperature. $Ca_3Mn_2O_7$ is a member of the Ruddlesden Popper series $A_{n+1}B_nC_{3n+1}$ with n=2, which has a tetragonal crystal structure at high temperatures but undergoes a transition to an orthorhombic structure at lower temperatures. We prepared a powder sample of $Ca_3Mn_2O_7$ using a conventional ceramic technique and investigated the structure using X-ray diffraction and temperature dependent Raman spectroscopy. We measured the temperature dependent magnetization, which shows the development of weak ferromagnetism near 120K, together with evidence for some Mn3O4 impurity phase. We find marked shifts in the Raman peaks near the magnetic ordering temperature, suggesting significant spin-lattice coupling in $Ca_3Mn_2O_7$. Finally, measurements of the temperature dependent dielectric response and pyroelectric current find anomalies consistent with a ferroelectric transition just below room temperature showing a polarization of 1μC cm^{-2} developing below 280K.

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Date submitted: 11 Mar 2011 Electronic form version 1.4