Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Successive magnetic field-induced phase transition in a multi-
ferroic hexagonal system up to 92 T J.W. KIM, E. MUN, M. JAIME, N.
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CHEONG, S. ARTYUKHIN, D. VANDERBILT, Rutgers University — We report
the observation of successive magnetic field-induced phase transitions in a multifer-
roic hexagonal system up to 92 T. We find unusually strong magnetoelectric cou-
pling at a hysteresis-free phase transition at low fields in which magnetization can
be switched by electric fields and electric polarization can be switched by magnetic
field. This transition is accompanied by a large magnetoelectric response that is due
to the very small energy barrier between the low and high field phase. We explore
this compound to high magnetic fields and observe another phase transition at ∼ 50
T in magnetization (M), electric polarization (P), and magnetostriction measure-
ments. The high field transition displays a relatively small jump in M but much
larger change in P compared to the low field one. Measurements to very high mag-
netic field in combination with modeling reveal the hierarchy of exchange and dipole
interactions that is relevant to the successive magnetic transitions in this compound
and suggests possible spin structures at each phases. Both field-induced transitions
in this material shows a sharp and large jump in magnetostriction which, in combi-
nation with the non-centrosymmetric structure, allow for significant changes in the
electric polarization.

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Date submitted: 15 Nov 2013

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