Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Coherent magnon and acoustic phonon dynamics in rare earth doped BiFeO3 multiferroic thin films KATHLEEN DOIG, University of Oxofrd, FREDERIC AGUESSE, ANNA-KARIN AXELSSON, Imperial College London, SAM JONES, University of Oxofrd, RON SYNOWICKI, J. A. Woollam , NEIL ALFORD, Imperial College London, JAMES LLOYD-HUGHES, University of Oxofrd — Magnetoelectric (ME) multiferroics, with coupled electric and magnetic order parameters, exhibit novel physics and have applications in information storage, spintronics and photovoltaics. BiFeO3 is one of the few room temperature multiferroics, but suffers from weak ME coupling. Lanthanide substitution on the Bi site enhances the remnant polarization, saturation magnetization and ME coupling. We investigated the dynamics of ME coupling in the time domain via ultrafast spectroscopy. Coherent magnons and acoustic phonons are impulsively excited and probed in BiLaDyFeO3 thin films using femtosecond laser pulses. Coupling to distinguishable acoustic phonon modes in the film and substrate yields the elastic constants in conjunction with spectroscopic ellipsometry. After substitution of Bi with Dy a rapid magnetoelectric coupling to weak ferromagnetic order creates a magnon oscillation at 75GHz, indicative of a Dzyaloshinskii-Moriya interaction energy of 0.31meV. Additional substitution with non-magnetic La suppresses this mode. The behaviour under a magnetic field and correlation with magnetisation studies confirms the assignment of the magnon mode. Our optical approach allows the extraction of parameters otherwise difficult to recover experimentally.

Kathleen Doig
University of Oxofrd

Date submitted: 09 Nov 2012 Electronic form version 1.4