Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Using ultrafast optical pump-probe spectroscopy to reveal coexisting magnetic orders in epitaxial $R\mathbf{MnO_3}$ films JINGBO QI, LI YAN, STUART TRUGMAN, JIAN-XIN ZHU, QUANXI JIA, ANTOINETTE TAYLOR, ROHIT PRASANKUMAR, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, CENTER FOR INTEGRATED NANOTECHNOLOGIES, LOS ALAMOS NATIONAL LABORATORY TEAM — Recent discoveries of spin-driven ferroelectricity in perovskite manganites, $R\mathrm{MnO_3}$ (R=rare-earth ions), have attracted enormous interest in the research of multiferroics. Although extensive experimental and theoretical studies have already been done on single crystal $R\mathrm{MnO_3}$, there are only a few reports describing the properties of $R\mathrm{MnO_3}$ thin films. Here, we choose two typical materials in $R\mathrm{MnO_3}$ manganites as examples: $\mathrm{SmMnO_3}$ and $\mathrm{TbMnO_3}$. Previously, ultrafast optical pump-probe spectroscopy has proven to be an ideal technique for unraveling the interplay between different orders in the time domain. In this work, we used this technique to study ultrafast dynamics in epitaxial $\mathrm{SmMnO_3}$ and $\mathrm{TbMnO_3}$ films grown on $\mathrm{SrTiO_3}$ substrates. At low temperatures, we observed an extraordinarily slow rising process, with a timescale of tens of picoseconds, followed by another decay process with a relaxation time of hundreds of picoseconds. Analysis of the time constants associated with these two processes as a function of temperature reveals that antiferromagnetic, ferromagnetic, and ferroelectric orders can coexist in these materials.

Jingbo Qi
Center for Integrated Nanotechnologies,
Los Alamos National Laboratory

Date submitted: 23 Nov 2011 Electronic form version 1.4