X-ray resonant magnetic scattering study of multiferroic RMnO$_3$($R =$ Dy, Ho, Er) compounds
A.I. GOLDMAN$^1$, S. NANDI$^1$, A. KREYSSIG$^1$, L. TAN$^1$, J.W. KIM$^1$, J.Q. YAN$^1$, M.D. VANNETTE$^1$, J.C. LANG$^3$, D. HASKEL$^3$, T.A. LOGRASSO$^2$, R.J. MCQUEENEY$^1$, 1 Dept. of Physics and Astronomy, Iowa State University, Ames; 2Ames Laboratory US DOE, Ames; 3Advanced Photon Source, Argonne — Element specific x-ray resonant magnetic scattering (XRMS) investigations were undertaken to determine the magnetic structure of multiferroic hexagonal RMnO$_3$ compounds. In the intermediate temperature phase (ITP) (8-68 K for the Dy$^{3+}$ and 4.5-40 K for Ho$^{3+}$) the moments are aligned and antiferromagnetically correlated in the $c$ direction according to the same magnetic representation $\Gamma_3$. Below the ITP, the Dy$^{3+}$/Ho$^{3+}$ moments order differently and according to the magnetic representations $\Gamma_2/\Gamma_1$. The temperature dependence of the observed intensity in the ITP can be modeled assuming the splitting of ground-state doublet/quasi-doublet crystal-field levels of Dy$^{3+}$/Ho$^{3+}$ by the exchange field of Mn$^{3+}$. No resonant signals could be found for Er$^{3+}$ from 2-80 K. Specific magnetic representations can be excluded for the magnetic order of Er$^{3+}$ moments but can not be uniquely determined within the sensitivity of XRMS. — The support by U.S. DOE (DE-AC02-07CH11358 and DE-AC02-06 CH11357) is acknowledged.

S. Nandi$^1$

Date submitted: 02 Dec 2008 Electrical form version 1.4