Abstract Submitted
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Optical spectroscopy of magnons, electromagnons, phonons, and crystal field excitations in orthoferrites RFeO$_3$[1] T. N. STANISLAVCHUK, V. A. MARTINEZ, A.A. SIRENKO, NJIT, Y. JANSSEN, G. L. CARR, BNL, Y. WANG, S-W. CHEONG, Rutgers U. — Mueller matrix ellipsometry and transmission polarimetry were used at Brookhaven National Lab to study multiferroic orthoferrites RFeO$_3$ (R =Tb and Dy) in the far-IR range (10 - 2000 cm^{-1}) and low temperatures and magnetic fields up to 10 T. Magnetic properties of RFeO$_3$ are due to interplay of two magnetic subsystems: R^{3+} and Fe^{3+}. Spectra of magnons, electromagnons, and optical phonons have been investigated and described in terms of the temperature and field dependencies of their frequency, damping, and oscillator strength. Below the magnetic ordering of R^{3+} spins $T_{\rm N}(R^{3+})$, we observed hardening of the magnon frequencies and modification of the magnon selection rules. In TbFeO$_3$ the quasi-AFM magnon gains electric-dipole activity below $T_{\rm N}$(Tb) and behaves as a hybrid mode. In addition to quasi-AFM and quasi-FM magnons in RFeO$_3$, we discovered electromagnons which are electric-dipole active along the c-axis. The oscillator strength of electromagnon in DyFeO$_3$ at 20 cm^{-1} provides a significant contribution of about 50% to the static magnetodielectric effect. In contrast, the electromagnon in TbFeO$_3$ at 27 cm^{-1} has a weaker strength and it appears only in a narrow temperature range $2.7 - 3.3$ K at H =0 and in a narrow range of magnetic fields of 2.4 - 2.7 T applied along the b-axis at T =1.5 K. Spectra of the ir-active optical phonons and crystal field excitations were measured for all three orthorhombic axes of RFeO$_3$.

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