Abstract Submitted
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Theory for the Spectroscopic Mode Frequencies and THz Absorption of Multiferroic $BiFeO_3$[1] RANDY FISHMAN, JUN HEE LEE, Oak Ridge National Laboratory — A microscopic model for $BiFeO_3$ that includes two Dzyaloshinskii-Moriya interactions and easy-axis anisotropy along the ferroelectric polarization predicts both the zero-field spectroscopic modes as well as their splitting and evolution in a magnetic field [1]. Due to simultaneously broken time-reversal and spatial-inversion symmetries, the absorption of light changes slightly as the magnetic field or the direction of light propagation is reversed. We discuss three sets of physical mechanisms that contribute to the THz abosorption and directional dichroism (DD) of $BiFeO_3$: spin current, magnetostriction, and anisotropy. First-principles calculations are used to obtain relationships among some of the polarization matrix elements induced by broken inversion symmetries in R3c structure. While our model nicely describes the DD along the magnetic field direction [1,-1,0], it fails to predict the weak DD observed for field along [1,1,0].

[1] U. Nagel, R.S. Fishman, T. Katuwal, H. Engelkamp, D. Talbayev, H.T. Yi, S.-W. Cheong, and T. Room, *Phys. Rev. Lett.* **110**, 257201 (2013).

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