

Nonreciprocal Directional Dichroism and Toroidal Magnons in Multiferroic Materials

Shin Miyahara^{1,2} and Nobuo Furukawa^{2,3}

¹*Asia Pacific Center for Theoretical Physics, Korea*

²*ERATO-MF, Japan Science and Technology Agency (JST), Japan*

³*Department of Physics and Mathematics, Aoyama Gakuin University, Japan*

In magneto-electric multiferroic materials, there is a strong coupling between magnetization \mathbf{M} and electric polarization \mathbf{P} . Through the coupling, cross correlated effects, e.g., electric field control of magnetic properties and magnetic field control of electric polarizations, appear prominently. One of the hot topics in the field is dynamical effects, e.g., electro-active magnetic excitation (*electromagnon* process) [1].

We investigate the electromagnon process in multiferroic materials $RMnO_3$ and $Ba_2CoGe_2O_7$ and clarify that a *toroidalmagnon*, i.e., a magnon which accompanies a dynamical toroidal moment $\Delta\mathbf{P} \times \Delta\mathbf{M}$, shows nonreciprocal directional dichroism (see Fig. 1) [2,3]. The results are reasonably consistent with the experimental observations [4,5].

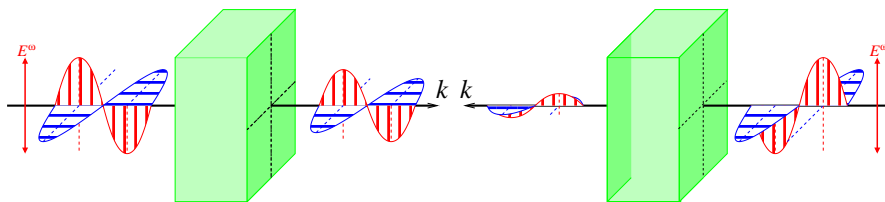


Figure 1: Nonreciprocal directional dichroism. Absorption intensity depends on the sign of the electromagnetic propagation direction.

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