Electromagnons and non-reciplocal directional dichroism in $Ba_2CoGe_2O_7$

N. Furukawa[a] and S. Miyahara[b]

[a]Department of Physics, Aoyama Gakuin University, Sagamihara, Japan
[b]ERATO-MF, JST, c/o Department of Applied Physics, U. Tokyo, Tokyo, Japan

We propose a new mechanism to induce non-reciprocal linear directional dichroism in elctromagnon absorptions. In multiferroics material, electric polarization and magnetism are strongly coupled, and in some cases, magnetic excitation can be an electric-active mode through the magnetoelectric couplings. Such an excitation mode is called *electromagnon*. When both electric and magnetic components of electromagnetic wave excite an identical mode, the interference between electric and magnetic responses emerges as a cross correlated effects. Such a cross correlated effect can be detected as a non-reciprocal linear directional dichroism, where absorption intensity strongly depends on the propagation directions of the electromagnetic wave. As a typical example, we discuss the magnetic excitation process in an $S = 3/2$ Heisenberg model for two-dimensional antiferromagnet $Ba_2CoGe_2O_7$.[1] We indicate that, via a spin-dependent metal-ligand hybridization mechanism, one of the magnetic excitations is an electromagnon mode which explains the non-reciprocal linear directional dichroism observed experimentally.[2]

[1]S. Miyahara and N. Furukawa, arXiv:1101.3679 (2011).
[2]I. Kezsmarki et al., Phys. Rev. Lett. 106 (2011) 057403.