

MAR09-2008-006374

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Electromagnon spectra in multiferroic manganites $RMnO_3$

NOBUO FURUKAWA, Dept. of Physics, Aoyama Gakuin Univ., and ERATO-Multiferroics, JST

The magnetoelectric (ME) effect, in which electric polarization (magnetization) are controlled by magnetic (electric) field, have recently attracted intensive attention. One of the materials which exhibits large ME effects is the manganites $RMnO_3$. In this presentation I focus on *electromagnon* excitations (in a wide sense). In those manganites, cycloidal spin structures create ferroelectricity through spin-orbit couplings. Originally, electromagnon is defined as a collective excitation of spins in such a way that rotation of the cycloidal plane is driven by the *electrical field* of light coupled to the ferroelectric moment. Spectra for electrically excited magnons are indeed reported in $TbMnO_3$, $GdMnO_3$, $(Eu,Y)MnO_3$ and $DyMnO_3$. However, the selection rule observed in these compounds ($E^\omega \parallel a$, irrespective of the cycloidal planes) is inconsistent with the theoretical prediction. Alternatively, couplings between electric field and spins through spin-dependent local polarizations have been proposed. I show both one- and two-magnon excitation spectra, and clarify consistencies and discrepancies of the model with experimental data. Roles of phonons and orbital orders in these compounds are also discussed.

References: Y. Takahashi *et al.*, PRL**101**, 187201 (2008). Also, Katsura *et al.*, PRL**98**, 027203 (2007); A. Pimenov *et al.*, Nature Phys. **2**, 97 (2006); R. Valdes Aguilar *et al.*, PRB**76**, 060404(R) (2007); Kida *et al.*, PRB**78**, 104414 (2008); R. Valdes Aguilar *et al.*, arXiv:0811.2966.