Contribution ID: **126** Type: **Invited**

Determination of the electromagnon origin in the multiferroic TbMnO3 by Raman scattering

Monday 23 July 2012 11:15 (25 minutes)

P. Rovillain, M. Cazayous, Y. Gallais, M-A. Measson, A. Sacuto
Laboratoire Materiaux et Phenomenes Quantiques Universite Paris 7 France,

H. Sakata,
Department of physics University of Science Tokyo Japan

M. Mochizuki
Department of Applied Physics, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

Magnetoelectric multiferroics possess coexisting magnetic and ferroelectric phases, with cross-correlation effects between magnetic and electrical degrees of freedom. As such, they can potentially be used to control spin-based properties by electric fields, with very low associated power dissipation [1]. Indeed, just as coupling between magnetic and ferroelectric order parameters exists in multiferroics, coupled spin and lattice excitations termed electromagnons have also been demonstrated. Such mixed excitations have been evidenced at low temperature in multiferroic manganites (TbMnO3, ..) and suspected at room temperature in BiFeO3. Such novel excitations are directly related to electromagnetic coupling and reflect the intimate relationship between magnetic and ferroelectric magnetic orders. However, the exact magnetic and the polar components of the electromagnons has not been yet identified. Electromagnons probably belong to the most challenging open questions in the field and are currently under intense investigation
We show using Raman scattering that in multiferroic TbMnO3 a c-axis magnetic field strongly impact the electromagnons excitations [2]. The electrical polarization of the electromagnons is strongly altered under magnetic field whereas their magnetic part is preserved. Entering the paraelectric phase the spectral weight of the electromagnons is transferred to the magnon excitations. The effect of the phase transition on the phonon modes shows that the Mn-O distance is the key that controls the polar character of the electromagnons. The magnetic excitation and the polar activity at the origin of the electromagnons are discussed under the light of Heisenberg simulations.

[1] P. Rovillain et al. Nature Materials 9, 975 (2010)
[2] P. Rovillain et al., Phys. Rev. Lett. 107, 027202 (2011)

Author: CAZAYOUS, Maximilien (Laboratoire Matériaux et Phénomènes Quantiques (UMR 7162) Université Paris Diderot Paris 7)

Presenter: CAZAYOUS, Maximilien (Laboratoire Matériaux et Phénomènes Quantiques (UMR 7162) Université Paris Diderot Paris 7)

Session Classification: Metal-Insulator Systems

Track Classification: Spin Phenomena