



北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

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Abstract

Magnetoelectric (ME) coupling in condensed matter has been attracting increasing attention including the fields of topological insulator, spintronics and multiferroics [1]. The ME coupling provides the electric field or electrical current controls of the magnetism as well as the magnetic control of the electric polarization, leading to the novel functionalities of matter. Furthermore, the ME coupling can be expanded to the ac responses as demonstrated by the optical ME effects, in which the both electric and magnetic fields of light are responsible for the optical transitions. As a result, the optical ME effect leads to the nonreciprocal properties of matter, i.e. the different optical responses to the counter-propagating light.

The multiferroic helical magnets always show the spin-driven ferroelectricity as well as the concomitant spin excitation endowed with electric-transition dipole, which is referred to as electromagnon [2,3]. Since the electromagnon excitation possesses the inherent strong ME coupling, we have been investigating the versatile optical ME effects on the resonance of the electromagnons in terahertz region. In fact, the gigantic nonreciprocal directional dichroism, which is the k^{ω} -dependent optical absorption in matter, has been observed for the electromagnon resonance in the cycloidal helical spin phase of the perovskite rare-earth manganites [3,4]. We will show the ubiquitous optical ME properties of the helical magnets including recent experimental results obtained by the terahertz spectroscopy and will discuss the possible mechanisms with the symmetrical argument.

References

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- [3] Y. Takahashi, R. Shimano, Y. Kaneko, H. Murakawa and Y. Tokura, Nat. Phys. 8, 121 (2011).
- [4] Y. Takahashi, Y. Yamasaki, and Y. Tokura, Phys. Rev. Lett. 111, 037204 (2013).

About the Speaker

Current research topics: Optical properties of magnetoelectric materials, terahertz spectroscopy and ultrafast optics.

Workplaces:

- 2014-present Unit Leader, CEMS, RIKEN
- 2014-present Associate professor, University of Tokyo
- 2011-2014 Lecturer, University of Tokyo
- 2007-2011 Postdoctoral fellow, ERATO, JST.