Magnetic Control of Electric Polarization in Magnetic Oxides with Non-collinear Magnetic Structures

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Recent observations of gigantic magnetoelectric and magnetocapacitive effects in rare-earth manganites, $TbMnO_3$ and $DyMnO_3$ [1,2], provide a novel approach to the mutual control of magnetization and electric polarization in magnetic ferroelectrics. We can control the magnitude and/or direction of the electric polarization vector by the application of magnetic field in these manganites. In comparing the results from the both manganites, we noticed that a characteristic common to the both materials is that they possess modulated magnetic structures with long wavelengths (as compared to the chemical unit cell) which arise from competing magnetic interactions. Ferroelectricity in these materials appears to originate from the competing magnetic interactions which cause lattice modulations through magnetoelastic coupling. In this talk, we show magnetic control of electric polarization in several magnetic oxides with non-collinear magnetic structures, which may provide new route to design magnetoelectrics.

[1] Kimura T., Goto T., Shintani H., Ishizaka K., Arima T., Tokura Y., *Nature,* 2003, **426**, 55. [2] Goto T., Kimura T., Lawes G., Ramirez A.P., Tokura Y., *Phys. Rev. Lett.,* 2004, **92**, 257201.

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