Orbital order, ferromagnetism, and ferroelectricity of BiMnO$_3$ and related compounds

CHANHO YANG, TAEYEONG KOO, YOON HEE JEONG, Dept of Physics, POSTECH — Multiferroic materials, where ferroelectricity and magnetism coexist, have been actively studied. This class of materials would offer a large application potential for new devices taking advantage of two coupled degrees of freedom based on local off-centered distortion and electron spin. Although most often the magnetic state in coexistence with ferroelectricity is antiferromagnetic, BiMnO$_3$ is an interesting exception with the simultaneous existence of ferromagnetism and ferroelectricity. However, the transition temperatures are in great disparity with $T_{FE} = 770$ K and $T_{FM} = 105$ K, and consequently its ME coupling is not large. In this talk, we will report on three aspects of BiMnO$_3$: (1) Long range ordering of 3d-orbital of Mn$^{3+}$ ions and its influence to the ferromagnetism and ferroelectricity (2) How to create a system to induce a large inter-property coupling by modifying BiMnO$_3$ (3) How to obtain a material with a large inter-coupling at room temperature

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