第 62回フロンティア材料研究所講演会

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2月28（水）　10時～12時　R3棟1階会議室にて

演題：**Magnetoelectricity in Hexagonal Lattice**

Transitional Metal Oxides (TMOs) have always captivated the imagination of the researchers in the field of condensed matter physics and materials science because of their fascinating physical phenomena and tremendous utilitarian worth for the next generation energy and information technologies. This class of materials displays a wide range of physical phenomenon, which includes ferromagnetism, ferroelectricity, colossal magneto resistivity, high temperature superconductivity, magneto optics. The key to the discovery of what other interesting properties do these materials exhibit and in how many more ways their potential can be harnessed in device applications lies in the development of microscopic understanding of the properties of known materials, which is one of the primary focuses of my field of research. The focus of this discussion will be the materials that exhibit simultaneous order in their electric and magnetic ground states and our proposed non-trivial microscopic mechanisms that govern the electric field control over magnetism within these systems. I will discuss the remarkable origin of the magnetoelectric (ME) coupling in the hexagonal manganite and ferrite systems, as revealed in the course of our research based on material specific spin Hamiltonians constructed through Density Functional Theory (DFT) based first-principles electronic structure calculations and followed by finite temperature simulations[1,2]. We showed how the geometric origin of ferroelectricity not only induced a net magnetization but also a strong bulk ME coupling. We were led to propose the existence of a bulk linear ME vortex domain structure or a bulk ME coupling such that if the direction of the polarization was reversed so did the direction of magnetization. Our recent findings showed how these geometric ferroelectrics could be used to construct near room temperature multiferroic superlattices with strong magnetization and ME coupling[3]. It was revealed to us that the geometric ferroelectricity enhanced magnetic transition temperature by reducing the geometric frustration at the triangular TM layer, which directed a wide compositional space to find new room temperature magnetoelectric multiferroic hexagonal TMOs.

[1] Hena Das et. al. Nature Communications 5, 2998 (2014).
[2] Yanan Geng, Hena Das et. al. Nature Materials 13, 163-167 (2014).
[3] Julia A. Mundy, …, Hena Das et. al. Nature 537, 523 (2016)

連絡先：東　研究室（5315）