

凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: **Room 413**, School of Science Bldg. 5 (理学 5 号館 413 号室)

Date: 13:30-15:00, Wednesday, 18 January 2017

Magnetoelectric Response in Electric Octupole Ordered State

Speaker:

Mr. Takanori Hitomi (Condensed Matter Theory Group)

Abstract:

Recently, the odd-parity multipole in locally non-centrosymmetric system has been investigated with a lot of attention. In the system, a sublattice-dependent antisymmetric spin-orbit coupling (ASOC) emerges due to the local parity violation at each atomic site. The entanglement of the spontaneous inversion symmetry breaking due to the odd-parity multipole and the sublattice-dependent ASOC leads to exotic magnetoelectric response, e.g, magneto-electric effect by magnetic quadrupole order in zigzag chains[1] and magnetic toroidal order in honeycomb lattice[2].

In this work, we focus on the magnetoelectric response in the odd-parity electric octupole (EO) state, and investigate the magneto-electric effect and spin Hall effect in a bilayer Rashba system. We construct the forward scattering model by considering a layer-dependent Rashba ASOC. By analyzing the model on the basis of the mean-field theory, we calculate the magnetic-electric coefficient and spin Hall conductivity by using the Kubo formula. We obtain following results: (1) the magnetic moment characterized by the symmetry of the EO moment emerges by the electric field, (2) the spin Hall conductivity is enhanced in the EO state.

Furthermore, we study the bilayer cuprates, $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ (YBCO), which is categorized into the high- T_c superconductors. The slight change of nematicity has been detected by the magnetic torque measurement at a temperature higher than the onset temperature of CDW state[3]. Motivated by the experimental results, we examine the possibility of the EO order by calculating the spin susceptibility, and discuss the magnetoelectric response.

References: [1] Y. Yanase, JPSJ, **83**, 014703 (2014). [2] S. Hayami, H. Kusunose, and Y. Motome, PRB, **90**, 024432 (2014). [3] Y. Matsuda, private communication.