Visiting Professors

Visiting Professor
KISHINE, Jun-ichiro *(from The Open University of Japan)*

Theoretical Studies on Chiral Material Science

The concept of chirality is ubiquitous in natural sciences. However, until only recently, research fields on chirality had been fragmented into separated branches of physics, chemistry and biology. Even inside physics, a term "chiral" has been used in different meanings in condensed matter and high-energy physics. One of the most important mission of our project, on which the present workshop is based, is to integrate the scattered concepts of chirality and make a roadmap toward an attempt at synthesis of chiral material sciences. Let us remind the Laurence Barron's definition of the true chirality, *i.e.*, true chirality is shown by systems existing in two distinct enantiomeric states that are interconverted by space inversion, but not by time reversal combined with any proper spatial rotation. The space inversion is a matter of geometrical symmetry, while time reversal is a matter of dynamical motion. This unambiguous definition clearly indicates that the concept of chirality ties geometry and dynamics. Conversion of geometry into dynamics naturally leads to material functionalities. The main purpose of this research project is to integrate these concepts in a unified manner.

Visiting Associate Professor
FURUKAWA, Ko *(from Niigata University)*

Electron Spin Dynamics of the Functional Materials

To develop the high-efficiency molecule-based device, it's vital to clarify the mechanism of the functional molecules/materials. We investigate the mechanism of the solid-state functional materials in terms of the advanced electron spin resonance (ESR) spectroscopy such as high-field/high-frequency ESR, pulsed-ESR, time-resolved ESR, and so on. In recently, my main targets are the photo-induced conductivity/magnetic materials composed of a donor–acceptor (D–A) dyad. The charge-separated (CS) state induced by the electron transfer from the donor to the acceptor after the photolysis plays an important role of the functional efficiency of the photo-induced conductivity/magnetic properties. We investigated the CS state in the D–A dyad in terms of the spin dynamics by using the time-resolved ESR spectroscopy.

Visiting Associate Professor
OSHIMA, Yugo *(from RIKEN)*

Electron Spin Resonance Studies of a Bilayer-Type Molecular Ferromagnet (Et-4BrT)$[Ni(dmit)_2]_2$

Recently, several novel bilayer-type molecular magnets $X[Ni(dmit)_2]_2$, where dmit is 1,3-dithiol-2-thiole-4,5-dithiolate and X is a monovalent cation, have been developed by Kusamoto Group and Yamamoto Group in IMS. By taking the advantages of molecular design and the degree of freedom of the molecular arrangements, these novel molecular magnets take a bilayer structure, and the intralayer exchange interactions can be controlled by just substituting the asymmetric cation X. (Et-4BrT)$[Ni(dmit)_2]_2$ is one of these novel bilayer molecular magnets, which becomes a ferromagnet below 1 K. However, the magnetic moment only shows the half of the full saturation, and the mechanism of the ferromagnetism in this system is still under debate. In collaboration with Kusamoto Group and Yamamoto Group, we have studied the microscopic magnetic properties of (Et-4BrT)$[Ni(dmit)_2]_2$ by means of ESR spectroscopy. We have found that the ESR origin is only from one of the two layers and the other layer remains non-magnetic up to 24 T.