Visiting Professors

Visiting Professor
NAKAMURA, Masakazu *(from Nara Institute of Science and Technology)*

Giant Seebeck Effect in Pure Fullerene Thin Films

The small thermal conductivity of molecular solids is beneficial for their thermoelectric applications. If Seebeck coefficients were sufficiently large to compensate for the relatively small electrical conductivity, these materials would be promising candidates for thermoelectric devices. In this work, the thermoelectric properties of C_{60} were studied by in situ measurements under ultrahigh vacuum after the deposition of a pure C_{60} thin film. An exceptionally large Seebeck coefficient of more than 150 mV/K was observed as a steady-state thermoelectromotive force. Even considering several extreme but realistic conditions, conventional semi-classical thermoelectric theories cannot explain this giant Seebeck effect.

Visiting Associate Professor
YOSHIKAWA, Hirofumi *(from Kwansei Gakuin University)*

Development of High Performance Rechargeable Batteries Using Various Molecular Materials

Recently, much attention has been focused on development of high-performance rechargeable batteries due to the global energy and environmental crises. Our research interest is to find novel cathode materials toward the next-generation rechargeable battery. In order to realize a high capacity, a stable cycle performance, a rapid charging, and so on, we examine battery performances of various materials such as organic and inorganic compounds, nanomaterials *etc.*, which can take the place of the present general cathode materials, transition metal oxides. We also try to nano-hybridize these materials with nano-carbons such as single-walled carbon nanotubes, graphenes, and mesoporous carbons, to increase electrochemical performances by utilizing electrical double layer capacitance of nanocarbons. Finally, we reveal these electrochemical reaction mechanism by using operando XAFS, XRD, solid-state NMR *etc.* and it is utilized to investigate new materials with high battery performances.

Visiting Associate Professor
TAJIMA, Naoya *(from Toho University)*

Quantum Transport Phenomena in Molecular Massless Dirac Fermion Systems

Two dimensional (2D) massless Dirac fermion systems was realized in an organic conductor α-(BEDT-TTF)$_2$I$_3$ under pressure. This material with layered structure and tilted Dirac cones belongs to a broad category of 2D massless Dirac fermion systems. Moreover, the interaction between Dirac particles are strong. Thus, this system provides us with a testing ground for the quantum transport of multilayered massless Dirac fermion systems. In this work, we develop the field effect transistor channeled by this system and then aim at the detection of (fractional) quantum Hall effect.