Visiting Professors

Visiting Professor
NAKAZAWA, Yasuhiro *(from Osaka University)*

Low-Temperature Calorimetric Studies of Organic Conductors and Organic Magnets

The calorimetry system equipped with the dilution refrigerator of instrument center (Kelvinox300 Oxford Instruments) is under construction at IMS. We have prepared a Ag-based relaxation calorimetry cell which are consisting of tiny film heater and a chip type ruthenium oxide sensor. The magnetoresistance of the sensor has been measured and we have confirmed that the sensor is available up to 16 T. The heat capacity measurement of a 45 μg single crystal of κ-$BETS_2FeCl_4$ has been succeeded in a temperature range between 100 mK and 2 K. This compound is known as an organic magnetic superconductor in which superconductivity and magnetic order coexists below about 120 mK. A large thermal anomaly due to the long range ordering of Fe^{3+} has been observed at 500 mK. The application of weak magnetic fields reduces the peak temperature which is consistent with the behavior of typical antiferromagnetic system. The experiment to clarify relationship between magnetism and superconductivity is in progress now. The microchip calorimetry devices obtained by the micro-fabrication technique will be installed in the dilution refrigerator in order to study μg class single crystal samples with high resolution.

Visiting Professor
SEKIYA, Hiroshi *(from Kyushu University)*

Spectroscopic Study on Intermolecular Interactions and Dynamics in Hydrogen-Bonded Clusters and Coordination and Solvation Structures of Transition Metal Ions

We investigate the structures, intermolecular interactions, and dynamics associated with hydrogen-bonded networks in crystals as well as in the gas phase. These studies provide insights into dynamics of hydration water on the surface of proteins. Rearrangement of water networks has been observed for model hydrated amino groups in the gas phase. In molecular crystals, cooperative multiple-proton transfer along one-dimensional hydrogen-bond networks has been investigated. We also investigate the coordination and solvation structures of transition-metal ions. $Co^+(NH_3)_n$, $Ag^+(NH_3)_n$ and $Ni^+(NH_3)_n$ are studied by infrared spectroscopy and quantum chemical calculations. Ag^+ and Ni^+ adopt tetrahedral and square-planar coordination, and a distorted tetrahedral coordination, respectively. The results demonstrate a close relationship between the d-electron configurations of the metals and the geometric structures of the solvated complexes.

Visiting Professor
OHTA, Nobuhiro *(from Hokkaido University)*

Photoirradiation Effects on Magnetic Property of Organic Conductors and Ionic Conductors

Photoinduced change in the electrical conductivity of organic conductor or ionic conductor has been examined with the time-resolved measurements of the change in resistance following photoirradiation or with the impedance spectroscopy in the absence and presence of photoirradiation. In the photoirradiated organic crystals, conductivity switching and bistability of current over certain ranges of applied voltages have been observed. In organic superconductors, photoinduced change in the electrical conductivity has been also examined at temperatures in the vicinity of the metal–superconductor (M–S) phase transition temperature, and unconventional asymmetry of critical slowing down about the M–S transition temperature has been found. In ionic conductor such as silver iodide, photoirradiation effect on ionic conductivity has been observed, depending on the excitation wavelength. To understand the photoirradiation effect as well as the synergy effect of photoirradiatin and applied electric field on electrical conductivity, photoirradiation effects not only on the electrical conductivity but also on the magnetic property will be examined.