# Visiting Professors

Visiting Professor
**KODAMA, Ryosuke** *(from Osaka University)*

High Energy Density Sciences

Now it is relatively easy to realize high energy density states with high power lasers. The states would have a variety of attractive fields of sciences and technologies such as particle acceleration, laboratory astrophysics, and material science, nuclear science including medical applications and laser fusion, which is "High Energy Density Science: HEDS." One of the advantages of the HED states is its energy density, which is much higher than that of the solid state matter. He is now exploring high energy density sciences in methods of introducing a Plasma Photonics concept to control intense light and high energy charged particles with high energy density plasmas. Nonlinear interaction of intense light with vacuum or nonlinear optics in vacuum will be significantly enhanced with the focusing angle of the interaction laser light, which must be realized by applying the novel geometry with plasma photonic devices. As his other important topics, he is interested in creation of high pressure condensed matter such as metallic solid hydrogen with high power lasers. Freezing of a higher energy density state or metallic Si have been already realized, extending the new scheme to more number of materials to have novel materials in hand, which have never seen on the earth.

Visiting Professor
**KONDOH, Hiroshi** *(from Keio University)*

Surface Dynamic Processes Studied by Soft X-Ray Spectroscopy

We have been working on surface dynamic processes such as charge transfer from a molecule to a substrate and surface catalytic reactions using synchrotron-based soft x-ray spectroscopies. Recently we have studied the time scale of the charge transfer from organic molecules to metal substrates by means of the core-hole decay spectroscopy. For instance, the Coster-Kronig autoionization accompanying the S 2s–3p transition was used for estimation of the time constant for the charge transfer from a sulfur-containing molecule to a metal substrate at BL-6U in the UVSORII. The resultant time constant were found to be of the order of sub-femtosecond. Another research subject regarding the surface dynamic process is the understanding of surface catalytic process which proceeds under ambient pressure conditions. In particular, applying the soft x-ray absorption spectroscopy with the transmission mode to real-time observation of catalytic processes will allow us to understand the reaction mechanism under the practical working condition of the catalyst.

Visiting Associate Professor
**UENO, Kosei** *(from Hokkaido University)*

Near-Field Intensity Profile of Metallic Nanostructures Using Near-Field Optical Microscope

The global problems relevant to the environment and energy are attracting attention, so that it is considered that the construction of efficient light-energy conversion devices serves as an important subject of the scientific research. Thus far, the interaction between photons and molecules has not received much attention in photochemistry. However, the creation of a progressive methodology that allows an increase in the excitation probability is necessary. Namely, to create a low-carbon-emitting society by utilizing light energy, it is necessary to introduce the concept of "effective utilization of photons" to photochemistry. We develop photochemical reaction fields, in which make it possible to increase the interaction between photons and molecules. Metallic nanostructures showing localized surface plasmon resonance are a promising approach for the development of photochemical reaction fields. Therefore, we study the optical properties of the metallic nanostructures which are prepared with nanometric accuracy and elucidate its near-field intensity profile according to using a near-field optical microscope developed by Prof. Okamoto in IMS to investigate fundamental mechanisms of the concept of "effective utilization of photons" induced by metallic nanostructures.

Visiting Associate Professor
**TAKAHASHI, Toshiharu** *(from Kyoto University)*

Development of New Spectroscopic Methods Using THz Coherent Synchrotron Radiation

We are developing new spectroscopic techniques with coherent synchrotron radiation (CSR) in the THz-wave region. One is the technique of the scanning near-field transmission and reflection microscopy using broadband CSR, where the high spatial resolution below the diffraction limit is available. Second, the method of the monochromatic THz-wave pump–photoemission probe spectroscopy (PES) is also developing. Since the VUV radiation by the coherent harmonic generation (CHG) can be emitted using the laser pulse in UVSOR, the jitter-free pump-probe spectroscopy is possible with the THz-CSR. In order to perform these spectroscopic techniques, we are constructing a new CSR beamline (BL1B) in UVSOR.