Visiting Professors

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

Surface Dynamic Processes Studied by Soft X-Ray Spectroscopy

Surface physics and surface chemistry have made significant progress in understanding of surface static structures but much less progress has been made with respect to understanding of surface dynamic processes. We have been interested in surface dynamic processes such as catalytic reactions at surfaces of metals and oxides. Recently we have been working on oxide photocatalysts using synchrotron radiation in a soft-x-ray region. In particular, we studied the geometric and electronic structures of N-doped TiO_2 at BL3U and BL6U in the UVSORII and determined the local structure of the doped nitrogen that induces the visible-light response of the photocatalyst. Another research subject concerns understanding of catalytic reactions on metal nanoparticles which proceed under practical working conditions. A soft x-ray absorption spectroscopy with the transmission mode has been developed at BL3U in such a way that real-time observations of catalytic processes under gas flow with ambient-pressure conditions can be conducted. Catalytic reactions over metal nanoparticles that are enhanced by absorption of the gas molecules inside the particles will be studied with this technique.

Visiting Professor
NODA, Susumu *(from Kyoto University)*

Strong Coupling of Single Atoms to Photonic Crystal Cavity Field

We have investigated photonic crystal structures which enable modification of propagation properties of an electromagnetic field and also tight confinement of the field to a tiny resonator. Accordingly the field strength inside the resonator is much enhanced and therefore the field can be strongly coupled to a quantum emitter such as a quantum dot even at a single photon level. Such a nanostructure device would be suitable for applications in optical communication and future quantum information processing in terms of its scalability. We have studied the strong coupling of the cavity field with a quantum dot and also the Purcell effect. Recently we have been interested in adopting a single cold atom as a quantum emitter, which shows much longer coherence time and therefore would be desirable for future application. Cold atoms are first loaded into a magneto-optical trap and then one of them is captured in tightly-focused optical tweezers. A movable lens-positioner can translate the position of the focal point, thereby transferring the trapped atom to the vicinity of the photonic crystal cavity. With this technique, the strong coupling of the single atom with the cavity field will be studied.

Visiting Professor
ITO, Atsushi *(from Tokai University)*

X-Ray Spectromicroscopy of Biomedical Specimens

Soft X-ray microscopy has a great advantage over other microscopies in the mapping of light elements or molecules containing such elements at high resolution. The mapping is realized by X-ray spectromicroscopy which utilizes unique spectral features of elements and molecules, that is, absorption edges and XANES profiles observed in the vicinity of the absorption edge. Our effort to apply spectromicroscopy to biomedical specimens has been focused on the mapping of sulfur oxidation state in human hair, because hair consists of mainly cystine, a sulfur-rich amino acid. Cystine is oxidized to cysteic acid by oxidative damage. Both products were found to have significantly different XANES peaks at the S-K absorption edge. Spectromicroscopy in combination with an electronic zooming tube as a two dimensional detector revealed that the oxidative damage was preferentially generated in the outer part of hair called cuticle. Furthermore a bleaching treatment of hair also increased the content of cysteic acid.

Visiting Associate Professor
TSUBOUCHI, Masaaki *(from Japan Atomic Energy Agency)*

Development of THz Tomography of Photo-Induced Carrier

We are developing a new technique for the THz tomography of photo-induced carriers in a semi-conductor based on the optical-pump THz-probe reflection spectroscopy. Since the photo-induced carrier strongly interacts with the THz light, the measurement and control of the carrier distribution and dynamics are significantly important to design THz optics using semi-conductors. Our THz tomography is a noncontact technique which determines both the dynamics and the spatial distribution of photo-induced carrier, simultaneously. We are demonstrating the THz tomography using photo-excited silicon (Si), and comparing the experimental results with the exact solutions of Maxwell's equations.