Visiting Professors

Visiting Professor
MIDORIKAWA, Katsumi *(from RIKEN)*

XUV Nonlinear Optics and Attosecond Dynamics in Atoms and Molecules

Nonlinear optical process in the XUV region is of paramount importance not only in the field of quantum electronic but also in ultrafast optics. From the viewpoint of quantum electronics, new features of the interaction between intense XUV photons and matters are expected to be revealed through observation of those nonlinear phenomena. On the other hand, those nonlinear processes in the XUV region is indispensable for progress of attosecond science including attosecond atomic/molecular physics and chemistry, because it is very useful for investigating ultrafast phenomena directly in attosecond time scale. Using high harmonic generation by intense femtosecond lasers, we are pursuing extreme optical science including XUV nonlinear optics and attosecond physics/chemistry.

Visiting Professor
TOMINAGA, Keisuke *(from Kobe University)*

Molecular Dynamics in Condensed Phases Studied by Ultrafast Laser Spectroscopy

Molecules in liquids interact with each other in a complex manner, and this complicated interaction yields a variety of aspects in the dynamical behaviors of liquids. We have investigated fluctuations of vibrational frequencies of solute in aqueous solutions by infrared three-pulse photon echo experiments. The time-correlation function of the frequency fluctuation can be expressed by a bi-exponential function with a time constant of about 100 fs and that of 1 ps. The temperature dependence experiment shows that the picosecond component is very weakly temperature dependent. In order to compare the vibrational fluctuation with the fluctuation of the electronic state, we have also performed fluorescence dynamic Stokes shift experiment in aqueous solutions. It is found that the different dynamics and interactions are important for the fluctuations of the vibrational and electronic states.

Visiting Associate Professor
AMEMIYA, Kenta *(from High Energy Accelerator Research Organization)*

Development of Soft X-Ray Optics and X-Ray Absorption Techniques

We have developed a high-resolution soft X-ray beamline in UVSOR, where the X-ray absorption spectroscopy (XAS) technique is available in order to investigate the atomic and electronic structures. Since the soft X-ray region includes the K edge of light elements such as carbon, nitrogen and oxygen, as well as the L edges of 3d transition metals, one can study various materials such as organic molecules and complexes by using this new beamline. We are also trying to develop a novel experimental technique, three-dimensional XAS, by combining the soft X-ray microbeam with the depth-resolved XAS technique, in which the probing depth of the electron-yield XAS spectrum is controlled by the electron emission angle. The lateral and depth profiles of the atomic and electronic structures can be determined with lateral and depth resolution of several micron and sub nanometer, respectively.

Visiting Associate Professor
KERA, Satoshi *(from Chiba University)*

Electronic Structure of π-Conjugated Organic Thin Film by Photoelectron Spectroscopy

To clarify the charge transport and injection mechanism in weakly-interacting organic molecular solids, ultraviolet photoelectron spectroscopy (UPS) is considered a conventional and novel powerful technique. Hole-vibronic coupling as well as intermolecular energy-band dispersion is important fundamental properties to reveal mysterious electric properties of organic molecular solids. Moreover, a quantitative analysis of the intensity distribution from angle-resolved UPS using photoelectron scattering theory gives us information on the molecular orbital character as well as bonding nature, leading important aspects on intermolecular and molecule–substrate interaction to electronic/spin configuration. Photoemission related phenomena, *e.g.* scattering, interference and lifetime effect of photogenerated hole on a discrete and delocalized state of molecular orbital, are hot issues.