Visiting Professors

Visiting Professor
FUKUI, Ken-ichi *(from Osaka University)*

Ionic Liquid/Organic Semiconductor Interfaces for Efficient Carrier Transport

Local analyses of electrolyte/organic semiconductor electrode interfaces at controlled electrode potentials are of fundamental importance to understanding the origin and properties of the electric double layer (EDL) at the interfaces, which is necessary for their application to EDL-organic field effect transistors (OFETs). Ionic liquids (ILs) gated EDL-OFETs can be operated with ultralow voltage (~0.1 V), however, ILs sometimes cause operational instability due to their unusual interface structuring. By using an IL (EMIM-FSA) and ruburene crystal, IL-derived bias stress was observed, which increased operational voltage of the EDL-OFET by 33% in 2 h. Electrochemical FM-AFM and molecular dynamics (MD) simulation revealed that the formation of structured IL layer on the surface of hole-injected rubrene; anions in the IL monolayer probably trapped hole carriers by orienting their polar parts. Application of higher magnitude of OFF-state gate voltage reset the IL-derived bias stress immediately by separating the anion–hole pairs, but the same shift occurred in the same time scale by the local structural change of the interface.

Visiting Associate Professor
KANEYASU, Tatsuo *(from SAGA Light Source)*

Generation and Application of Structured Light in Synchrotron Light Sources

Novel undulators in synchrotron light sources can provide energy-tunable structured light at short wavelengths. We have been investigating the generation and application of structured light, such as vortex beams and vector beams, in the extreme ultraviolet (XUV) wavelength region in the UVSOR synchrotron facility. In exploring new applications of the structured light, a fundamental understanding of the light-matter interaction is crucial. We have investigated the characteristics of the structured light by using interference measurements and have applied it to the photoionization and photoexcitation study of rare-gas atoms. In addition, we started to study the potential of undulator radiation as longitudinally coherent wave packets suitable for the coherent control at short wavelengths. We are currently performing the coherent control experiments in photoexcitation of atoms using the undulator radiation in the XUV to soft x-ray range.

Visiting Associate Professor
KATSUKI, Hiroyuki *(from Nara Institute of Science and Technology)*

Coherent Control in Condensed Systems

Coherent control is a technique to manipulate quantum states of a target system utilizing the interference of wavefucntions. My research is focused on the coherent control in organic crystals and in strongly coupled systems. In the first case, we have recently demonstrated the control of multiple THz intramolecular oscillatory modes in a rubrene crystal. We are planning to apply this technique for the electronic excited states in which the electron–phonon interaction plays a key role in various physical properties such as carrier transportation and photoemission. In the second case, a typical example of the strong coupled system is a cavity exciton–polariton system, which is a mixture of cavity photons and atomic/molecular excitons. Cavity exciton–polaritons have gathered much attention due to its spontaneous formation of quantum coherence in the lowest energy ($k = 0$) state and succeeding coherent emission called polariton lasing, when the excitation fluence is above the threshold. We are now trying to artificially regulate the polariton flow towards the $k = 0$ state utilizing the stimulated scattering process.