Ultraviolet Synchrotron Orbital Radiation Facility

VIII-M Development of the UVSOR Light Source

VIII-M-1 New Lattice for UVSOR

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New magnetic lattice has been designed for UVSOR. It can be realized without changing the circumference and the overall shape of the ring. An emittance of 27 nm-rad can be achieved, which is smaller by a factor of 6 than the present value. The number of straight sections will be doubled. Six straight sections will be available for insertion devices. All of them have small betatron function in vertical and are suitable for short period and narrow gap undulators, which are able to produce high brilliance soft X-rays. The new lattice has a dynamic aperture sufficiently large for injection and storage. An improvement on the main RF cavity as well as the use of the existing third harmonic RF cavity for bunch lengthening will make beam lifetime sufficiently long against strong Touschek effect.

VIII-M-2 Development of Longitudinal Feedback System for a Storage Ring Free Electron Laser

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A longitudinal feedback system for a storage ring free electron laser has been developed at the UVSOR. Instantaneous temporal deviation of the FEL optical pulse with respect to the electron bunch is measured in the frequency domain by detecting a phase between higher harmonic components of respective revolution frequencies. The phase deviation is fed back to control the storage ring rf frequency so as to readjust effective length of the optical cavity. Compensating temporal drift with the feedback system, synchronism between the FEL micropulse and the electron bunches was successfully maintained for reasonably long time.

VIII-N Researches by the USE of UVSOR

VIII-N-1 Photoelectron Spectroscopic Study on Photo-Induced Phase Transition in a Spin Crossover Complex $[Fe(2\text{-}pic)_3]Cl_2EtOH$

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The purpose of the present study is to investigate the photo-induced phase transition using photoelectron spectroscopy. A single crystal of $[Fe(2\text{-}pic)_3]Cl_2EtOH$ was grown at Kyoto university and was filed in a preparation chamber. It was found that the N-1s spectra are shifted to lower binding-energy side with cooling the sample and laser excitation causes the shift of N-1s to higher binding-energy side. The present experimental results indicate that the photo-induced phase transition of $[Fe(2\text{-}pic)_3]Cl_2EtOH$ is closely related to both Fe and N ions and is more complicate and interesting co-operative phenomenon.

VIII-N-2 Photo-Induced Change in Semi-conductor-Vacuum Interface of p-GaAs(100) Studied by Photoelectron Spectroscopy

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The photo-induced change in the semiconductor-vacuum interface on GaAs (100) and Cs/GaAs(100) has been investigated with core-level photoelectron spectroscopy using synchrotron radiation and a mode-locked Nd:YAG laser. Both Ga-3d and As-3d photoelectron peaks showed transient energy shifts under the laser irradiation without any spectral change. The amounts of the energy shifts were strongly dependent on the sample temperature and the laser photon flux. It is shown that the experimental results can be fitted to a theoretical curve which was derived from the photo-induced band bending scheme in the surface layer of the semiconductor.

VIII-N-3 Excitation Spectra of a Long-Persistent Phosphor $SrAl_2O_4$:Eu,Dy in Vacuum Ultraviolet Region

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This work has been carried out to know the phosphorescence mechanism of the new-type long-persistent phosphor $SrAl_2O_4$:Eu,Dy. Luminescence and excitation spectra were obtained by using vacuum ultraviolet (vuv) light as excitation source. It is suggested that the 450-nm and 520-nm luminescence

bands in $SrAl_2O_4$:Eu,Dy excited with the vuv light may be produced by a kind of host-sensitization mechanism. Creation spectrum of the long-persistent phosphorescence in the vuv region was firstly measured by observing the after-glow luminescence. A prominent peak was observed around 200 nm, namely in the low-energy tail of the fundamental absorption edge of $SrAl_2O_4$. Therefore, it is suggested that the phosphorescence mechanism in $SrAl_2O_4$:Eu,Dy may be closely related to the defect formation.

VIII-N-4 Two-Dimensional Imaging Technique for Measuring Translational Energy and Angular Distribution of Ionic Photofragments

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During the last decade, the dynamics of molecules in the valence energy regime has been investigated by preparing excited state at well-defined energy, and analyzing photoelectron energy and angular distribution of ionic photofragments involved. Two-dimensional (2D) imaging technique is one of the most powerful tools for obtaining this information because 2D data and its simple calculation on the basis of momentum conservation law, provide Newton diagram of photofragments, which leads to dynamical process involved immediately.

The system mainly consists of an accelerator lens, a position sensitive detector (PSD) (Roendek) and an electronic system for data analysis and a computer. After the gas passes synchrotron radiation (SR) region, less than one molecule per one photon beam on the average undergoes ionization and/or dissociation. The direction of polarization of SR is parallel to the axis of TOF tube (10 cm). After the acceleration by the ion lens, ionic fragments fly through the TOF tube and hit the PSD. The determination of the impact position on the detector is based on the time delay between the two signals from each end of the wire behind the MCP. The position is obtained by the subtraction of time when both two signals arrive, providing us its velocity and direction in the center-of-mass frame. The 2D images of N_2^+ after the excitation of the valence electrons were successfully obtained. With this technique, we will try to perform the triple coincidence in the ionic fragmentation following inner-shell excitation.

VIII-N-5 Angular Distribution Measurement of Auger Electrons from Fixed in Space Molecules

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A new experimental setup for the measurement of the angular distribution of energetically selected Auger electrons emitted from fixed in space molecules is presented. The system is based on two identical ion detectors with a small angular acceptance placed respectively at 0° and 90° of the polarization axis of the incident radiation, and a large acceptance double-toroidal electron analyzer combined with a position sensitive detection. It allows to select the molecular alignment for s and p ionization channels in parallel and provides an energy and angle measurement of the outgoing electron. The energy and angular performances as well as the calibration procedure are discussed. Samples of results obtained on the carbon monoxide ionized above the C 1s threshold are presented.

VIII-N-6 Construction of a Varied-Line-Spacing Plane Grating Monochromator at BL-4B

SHIGEMASA, Eiji; GEJO, Tatsuo

In order to realize various spectroscopic investigations in the soft X-ray region (100~1000 eV) with high resolution at UVSOR, a new Varied-line-spacing Plane Grating Monochromator (VPGM) at BL-4B was designed in 1999. The beamline is composed of two pre-focusing cylindrical mirrors (M_0 and M_1), the monochromator (M_2 and G), and a post-focusing toroidal mirror (M_3). The schematic drawing of the whole beamline is presented in Figure 1. Synchrotron radiation is deflected horizontally and focused vertically onto the entrance slit S_1 by M_0. M_1 deflects the radiation vertically and focuses it horizontally. The radiation passing through S_1 is converged by the spherical mirror M_2 on a virtual source at a 4-m distance away from the grating center. Two varied-line-spacing plane gratings G with different groove densities (800 and 267 lines/mm) are interchangeable by a linear-translation mechanism without breaking the vacuum. The grating rotation for scanning wavelength is performed with a sine-bar mechanism. The monochromatized radiation passing through the exit slit S_2 is focused onto the sample position by toroidal mirror M_3. The fabrication of all the optical elements and beamline components has been successfully completed and the practical construction is just beginning to be carried out.

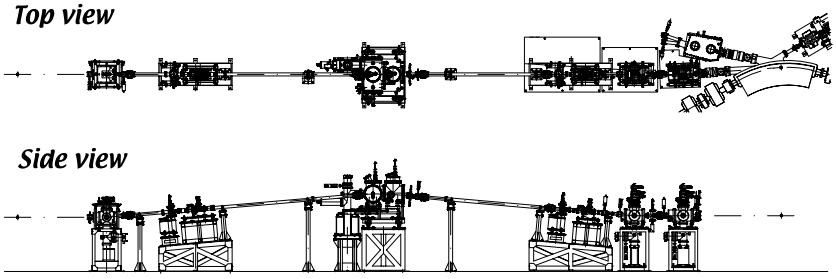

Figure 1. Schematical drawing of the VPGM on BL4B at UVSOR.