ISSN 0911-5730
UVSOR-24
April 1997

# UVSOR
## ACTIVITY REPORT
## 1996

Ultraviolet Synchrotron Orbital Radiation Facility
Institute for Molecular Science

## *Contents*

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edited by
M. Kamada, M. Hosaka, T. Gejo, H. Hagiwara

# PREFACE

This is the new Activity Report reporting the research activities which were done at the UVSOR facility in 1996.

As briefly mentioned in the last Activity Report, we are now discussing the next 10 years and have the four future plans:

(1) Improvement and development of the light source and beam lines to enhance the research activities at the UVSOR facility by taking full advantage of the UVSOR in the Institute for Molecular Science (IMS).
(2) Development of new fields in molecular science by combining various detection systems and light sources, such as synchrotron radiation, laboratory laser and FEL (free electron laser).
(3) Access to 3rd generation VUV and soft X-ray facilities for very advanced experiments in molecular science which cannot be achieved at either the present UVSOR or the future UVSOR II.
(4) Realization of the UVSOR II project to construct a next ("4th") generation storage ring including UV FEL and very short pulse abilities in the present IMS campus.

The plans (1) and (2) are now in progress. Especially in the plan (2), we have had some technological successes as shown in the present Activity Report; for example, the shortest wave length of the UV FEL in the world, 239 nm, and the perfect 90 MHz synchronization of the VUV/VIS/IR synchrotron radiation and UV/VIS/IR picosecond laser pulses.

Last October the UVSOR facility was evaluated by Dr. Iréne Nenner, CEA Saclay, who was invited by Director General Mitsuo Ito of IMS to evaluate individual research activities in the Department of Vacuum UV Photoscience. Her recommendations on the future plans and related activities of the UVSOR are extracted from her Evaluation Report as shown below.

> Continue to develop a large variety of pump-probe *in situ* experiments. This includes for example, SR/laser combination (synchronized or not), SR/Laboratory probes or FEL/laser as well as SR/IRAS, SR/STM, SR/UPS or XPS etc.... Encourage the use of FEL in a one photon mode and two photon mode in combination with SR, which is naturally synchronized, or with laboratory lasers. This means for simultaneous use of FEL with SR that efforts should be made to operate the FEL at the nominal energy of the machine, with a reasonable current and high stability. Explore also the same SR/FEL combination at lower particle energy.
>
> (continued)

Promote the development of the UV FEL and the machine development. This action should be accompanied by reinforcing the technical staff in the machine group which is in charge of both the development and maintenance of UVSOR, insertion devices and FEL. This is the heart of the facility to assure to the users the best photon source. The present number of technicians and engineers is quite inferior by far compared to most facilities in the world. It should be increased, independently of the number of beam lines or users.

Elaborate a project along the lines of UVSOR II, i.e. including the UV FEL but with more ambition on the existence of additional coherent and pulsed IR and far IR FELs sources. Extensive many sources for multi-color experiments, should be offered to the users in molecular and material sciences in the near future. Along this line, the growing needs for *in situ* studies combining (but not necessarily synchronizing) X-rays with other spectroscopies, imply that the existence of one wiggler and a conventional X-ray line on UVSOR II, without increasing the nominal energy of the particles. If synchronization of SR with lasers are being developed for time resolved pump-probe experiments, the operation of the machine with a small number of bunches should be optimized. The UVSOR II project should be quite original or specialized compared to other existing machines or those in project in Japan, and should be supported by a larger community than the present one.

We are very grateful to Dr. Nenner for heavy tasks to evaluate the UVSOR facility as well as the Department. We will further elaborate our future plans by taking into account her recommendations.

February, 1997

N. Kosugi

Nobuhiro Kosugi
Director of UVSOR

# Status of the UVSOR Accelerator Complex in 1996

Hiroyuki HAMA, Masahito HOSAKA, Toshio KINOSHITA and Jun-Ichiro YAMAZAKI

*UVSOR Facility, Institute for Molecular Science, Okazaki 444 Japan*

## 1. General

Beside scheduled shut-off term at each four-season, some unexpected beam-time losses were caused by malfunctions of many devices. Most of those losses were compensated by additional beam supply in the night. However the troubles have gotten occurred frequently because of the wornout. In these years, many devices, particularly old power supplies for pulse magnets, have been replaced by new one. Basic equipments like a cooling water system and electricity system have become suffering troubles.

Operation time is going to reach the usual level and integrated beam current seems to be a bit higher than that of last year because the beam lifetime is getting longer due to optimization of the storage ring operation and maybe an improvement of the vacuum. As the average ring vacuum in the operation has been gradually improved, the lifetime is obviously increased as shown in Fig. 2. Although, the lifetime was shortened by 20 % in December because of the operation of the superconducting 4T wiggler, the lifetime has improved to 10 hours at 100 mA at the usual multibunch operation. A typical variations of the beam current and the lifetime in a day are shown in Fig. 2. One can see that synchrotron radiation is mostly supplied with the beam current higher than 100 mA.

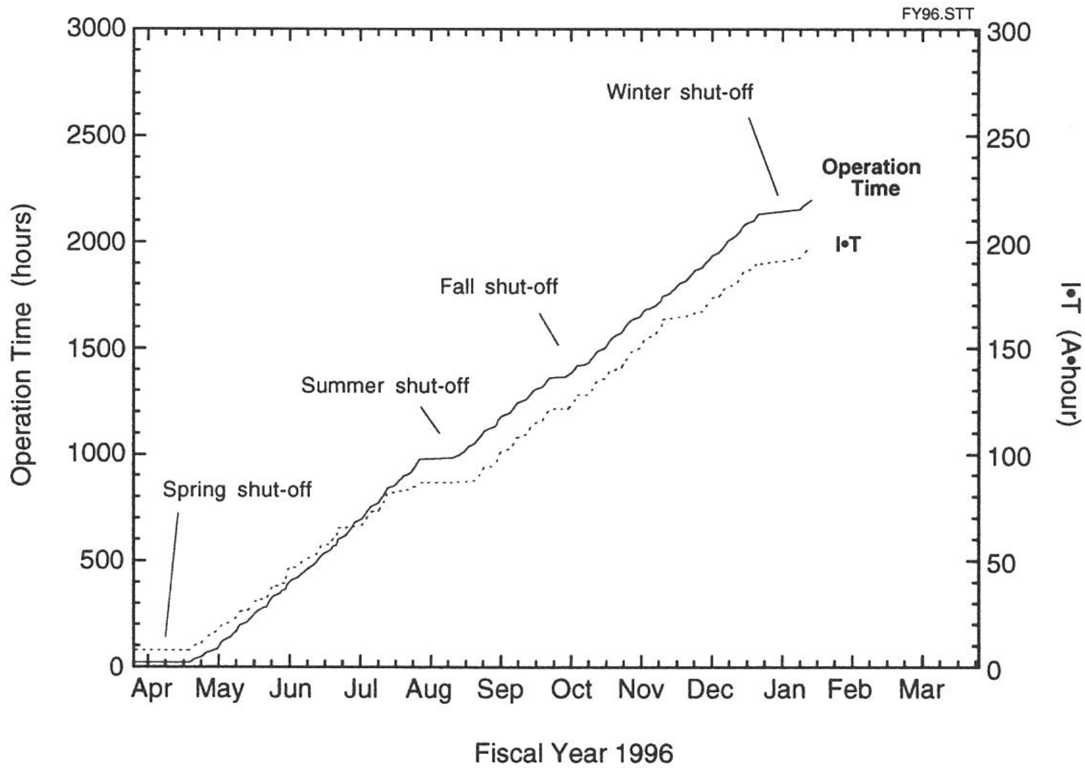



Fig. 1 Progress of operation time of the storage ring, and integrated beam current (IT) in fiscal year 1996.

## 2. New equipments

A new helical undulator in optical klystron mode was installed in the spring shut-off term. At the moment, the optical klystron-type undulator is used for free electron laser (FEL) experiments. However it was designed to be switched to the helical undulator by replacing the magnets at the dispersive section. Correction of the magnetic field had been already done for the both mode. At the same time a new beam pipe for the undulator straight section was installed. The chamber made of aluminum is a so-called "ante-chamber" type and contains NEG (non-evaporation getter pump) strips to improve the vacuum. The NEG pump is extremely easy to be operated because no power supply is required after an activation.

RF power amplifiers for the acceleration cavities in the storage ring and the synchrotron were also replaced by new ones completely composed of many transistor amplifiers. Each identical unit of transistor amplifier generates power of 600 W maximum. In case of a couple of units are in failure, the whole system can, however, continue to run without any fatal errors. Consequently the maintenance of the system is expected to be easy.

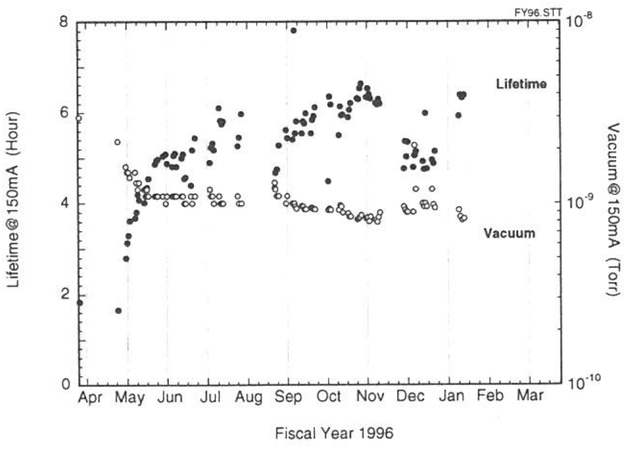



Fig. 2 Progresses of the beam lifetime and the average ring vacuum at 150 mA-beam storage.

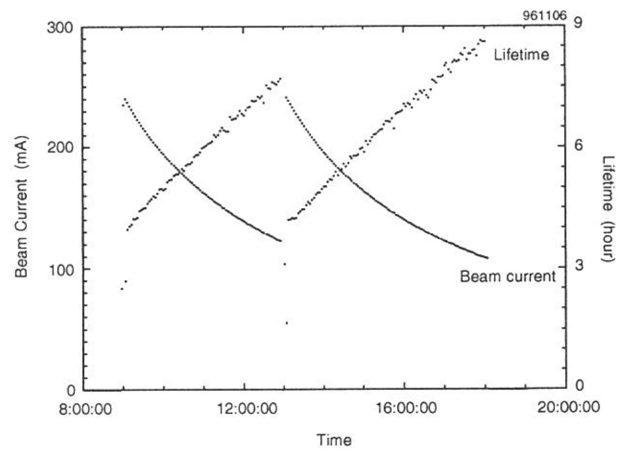



Fig. 3 Typical one-day variations of the beam current and the lifetime at the usual multi-bunch operation.

An old pulse high-voltage power supply for the synchrotron inflector was replaced. Because improper discharge was occurred frequently in the old one, the new one has been specially designed for the electrical insulation.

Fast-switching pulsers for bump-orbit magnets (perturbator) in the storage ring have been getting frequently failed too. As a test module, one pulser was fabricated using a transistor switching circuit (IGBT). A very smooth and fast pulse discharge (1.5 μs in rise time) were obtained, and then the pulser has been put into practice since last December. Although there were some minor troubles, it works very well at the moment. We are going to replace the whole system for the bump-orbit in the next year, if there will be no serious trouble in the test run.

## 3. Troubles

Beside hardware troubles on the accelerator complex, we have experienced a lot of serious errors on the basic equipments. Particularly the cooling water system has damaged so much. This is also due to exhausted parts. In addition to water leakage and quick degradation of water, an extremely abnormal pressure was discovered in the piping for secondarily circuit going round cooling towers.

It is still under investigation. Moreover on a very cold day in last January, some parts of water circuit in a cooling tower exploded probably due to frozen out. There are two sets of cooling towers, it is able to be managed by one cooling tower. However as it gets warm, heat load may exceed the capacity. It is apparent that these elementary equipments have been also very old and not perfectly maintained. Although most of troubles on the system fill be fixed soon, a management system including crew members should be established for the next ten years.

The superconducting wiggler stopped to run in the beginning of 1997 because of a trouble on the 4 K refrigerator. We found an oddly transformation of the Joule-Thomson valve, however cause of the trouble has not been completely identified yet. We are still trying to find it and hope to fix it in very near future.

The electron gun of the linac is also in an unusual state after exchanged to re-assembled one in December. Assembling of the cathode and the grid was probably wrong. The electron beam was not able to be extracted by the normal bias voltage between the cathode and the grid mesh. Because there was not another electron gun available, we tried to extract the beam by changing the bias voltage and focusing field and finally succeeded to extract ~ 50 % intensity of normal current of the beam. The gun is still used because the electron current is enough for the booster synchrotron. However this type of the gun is also much antiquated, and only two facilities remain to use it. To secure a possibility to procure when the gun fails, it had better to remodel the linac system if possible.

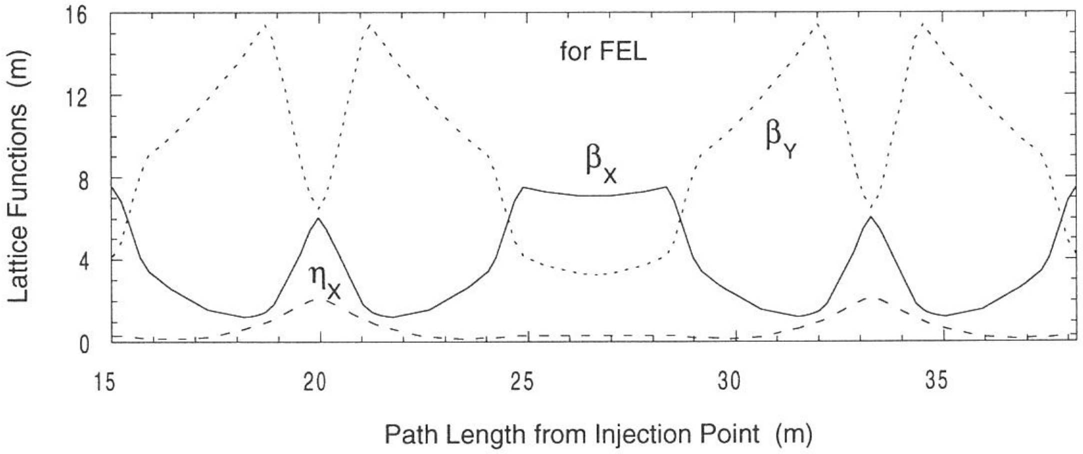



Fig. 4 A new lattice function for the FEL experiment with the helical optical klystron. Betatron tune numbers are 3.2 and 1.2 for horizontal and vertical planes, respectively.

## 4. Summary

The machine time was consumed almost properly in spite of many troubles. Performance of the storage ring itself has been still improved. For instance, a global orbit correction software for various operation modes has been completed. A new operating point with a different lattice function has been developed to optimize the ring to the helical optical klystron (see Fig. 4), and an FEL oscillation at the shortest wavelength of the world record (239 nm) was obtained. Nevertheless we emphasize an importance of care in the background. In these years many old devices have been replaced. However the number of troubles happened on the facility seems to go beyond our effort. To keep competitive performance and continuous development on the UVSOR, a reliable maintenance program for a long term range should be confirmed.

# ACCELERATOR COMPLEX

## Injection Linac

| | |
|---|---|
| Energy | 15 MeV |
| Energy Spread | ~ 1.6 MeV |
| Frequency | S-band 2.856 GHz |
| Acceleration | 2π/3 Traveling Wave |
| Length | 2.5 m |
| Klystron Power | ~ 1.8MW |

## Booster Synchrotron

| | |
|---|---|
| Lattice Type | FODO |
| Energy | 600 MeV |
| Beam Current | 32 mA (8-bunch filled) |
| Circumference | 26.6 m |
| Super Cell | 6 |
| Bending Radius | 1.8m |
| Betatron Number | 2.25 (horizontal) |
| | 1.25 (vertical) |
| Momentum Compaction α | 0.138 |
| Harmonics | 8 |
| RF Frequency | 90.115 MHz |
| Repetition Rate | 2.6Hz |

## Storage Ring

| | |
|---|---|
| Lattice Type | Chasman-Green |
| Energy | 750 MeV |
| Critical Energy | 425 eV |
| Circumference | 53.2 m |
| Super Cell | 4 |
| Bending Radius | 2.2 m |
| Betatron Tune | 3.16 (horizontal) |
| | 2.64 (vertical) |
| Momentum Compaction α | 0.032 |
| Harmonics | 16 |
| Emittance | 1.15 $10^{-7}$ m rad (horizontal) |
| | 1.15 × $10^{-8}$ m rad (vertical) |
| Beam Size | 0.39 mm (horizontal) |
| | 0.26 mm (vertical) |
| Bunch Length | 170 ps (at zero current) |
| Beam Current | Multi-Bunch 200 mA |
| | Single-Bunch 50 mA |
| Lifetime | 4 h at 200mA |
| | 9 h at 100mA |

## Additional Equipment

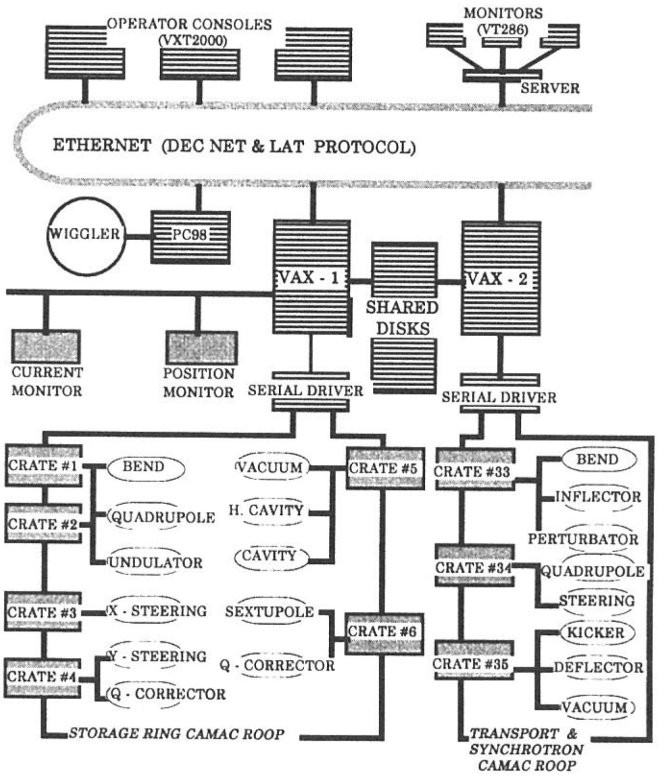
| | |
|---|---|
| Higher - Harmonic Cavity | 3 × 90.115 Mhz |
| Superconducting Wiggler | 4 T (maximum) |
| Undulator | for SR |
| Helical Optical Klystron | for FEL |

## Control System

Preface: Based on Dual-Host system with CAMAC loop and friendly man-machine interface

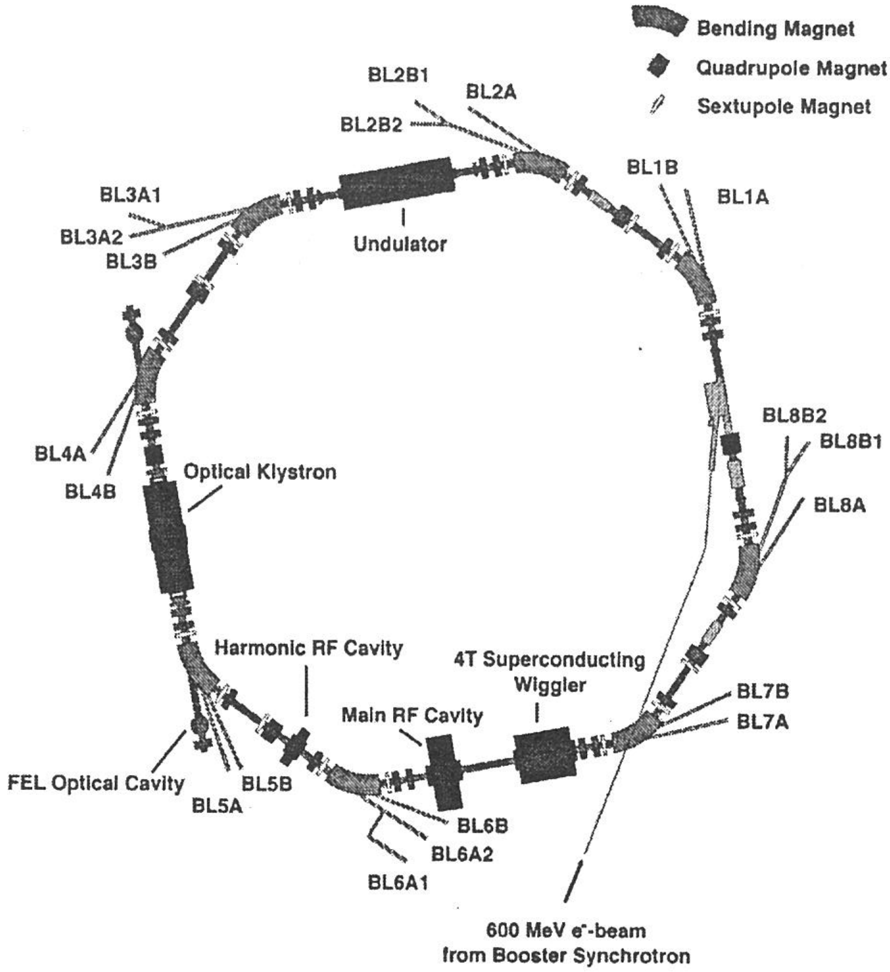
Architecture

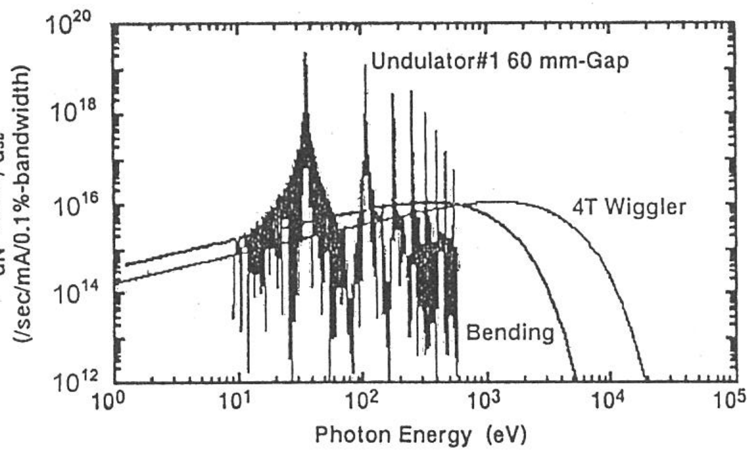
| | |
|---|---|
| CPU | VAX4000 (× 2) |
| OS | VMS |
| Connection | DECNET & Local Cluster |
| Operator Console | X - Servers (VXT200 × 3) |
| Status Monitors | VT286s + Macintosh |
| Interfaces | CAMAC serial loop<br>GPIB for Beam Monitors<br>RS232C for Host CPU of Wiggler |
| Languages | FORTRAN, C, Pascal |




**Scheme of Accelerator Control System "UCOSS"**

## The UVSOR 750 MeV Storage Ring




On-Axis Photon Intensity with 750 MeV-Electrons

## Beam Lines in 1996

Masao Kamada

UVSOR Facility, Institute for Molecular Science

In 1996, sixteen beam lines were operational. The open beam lines (1B, 2B1, 3A1, 3A2, 5B, 6A1, 7A, 8A, and 8B1) were used by 105 outside groups and 41 users in IMS. The in-house beam lines (1A, 2A, 3B, 4B, 6A2, 6B, and 8B2) were used by the groups in IMS and 24 outside groups. The joint programs consisted of 3 special projects, 24 cooperative researches, and 146 facility uses were conducted. The number of users was about 600 including scientists from foreign countries.

The beam lines of UVSOR are on the way to renewal. The upgrade proposals of the beam lines have been discussed on the UVSOR Workshops. About one third of beamlines are being upgraded in recent years. A Seya-Namioka monochromator at BL 7B is under replacement by a normal-incidence monochromator to improve a resolving power and spectral range for solid state spectroscopy. Another Seya-Namioka monochromator was removed from BL2B2 and then a Dragon-type monochromator is under construction for gaseous experiments in VUV and EUV ranges. A multi-layer monochromator was constructed and is now under installation to BL 4A for photo-chemical reaction experiments. A glancing-incidence monochromator at BL 8B1 has been replaced by a 15 m SGM monochromator. This new monochromator having a resolving power of 4,000 at 400 eV is used for solid and gaseous experiments in EUV region. A Bruker FT-IR interferometer has been installed to BL 6A1 besides the old FT-FIR of a Martin-Puplett type, and then the improved system can cover the wide wavelength range from 1 μm to 3 mm. A new monochromator (SGM-TRAIN) has been constructed at beamline 5A for the use of cirlularly polarized lights from the helical undulator.

Several trials with lots of efforts have been carried out in recent years to achieve new scientific and experimental findings. Combination experiments by use of laser and synchrotron radiation for pump-probe and double resonance is one of the research high lights in UVSOR in 1996. Laser-induced-fluorescence experiment was successfully carried out on ground-state alkali atoms desorbed from SR-irradiated potassium halide surfaces at BL 3A1. The SR-photon ionization of Iodine atoms produced by laser photodissociation of Methyl Iodide molecules was observed with the combination of Ti-sapphire laser and undulator radiation at BL 3A2. The two-photon experiment by using both of SR and Laser was also succeeded on BaF2 at BL 1B. New experiments with an electron-ion coincidence (EICO) method showed lots of fruitful data about SR-induced desorptions at BL 2B1.

A high-sensitive detection system consisting of a conventional analyzing monochromator and a CCD detector has been available at BL 1B to observe luminescence in organic and inorganic materials including halides, fullerens, and oxides. Interesting subjects such as photo-chemical reaction experiments on Si, Diamond, and halides, soft x-ray microscopy on biospecimens, and incoherent photon-echo experiment have been successfully carried out at a free-port BL 8A. The photoelectron spectroscopy combined with SR is one of the powerful techniques to investigate electronic stuctures. Several kinds of photoelectron spectrometers are working or ready to work in UVSOR: High-performance electron analyzer SES-200 at soft x-ray beam line BL 1A, Two-dimensional spectrometer at VUV beamlin BL 3B, A angle-resolved spectrometer at EUV beamlines BL 6A2 and 8B2, Photoelectron microscopy system at a wiggler beamline BL 7A, and A spin- and angle-resolved photoelectron spectrometer at helical undulator beamline BL 5A.

There were lots of troubles in 1996. The biggest one is the accidental air-leakage from the differencial pumping system at BL 8A to the storage ring. The other air-leakage accidents happened from a monochromator chamber to a first-mirror chamber at BL 8B1 and also from a sample chamber to a monochromator chamber at BL 7A. Therefore, **the UVSOR facility strongely asks all users to make sure of their experimental procedures according to the beam line manuals.**

A TOF tube, a sealing o-ring, and a beam line valve at BL 3A2 were replaced by the new ones in last autumn. The sample chamber at BL 1B was cleaned up to eliminate contamination due to unknown materials from the vaccum component. The first mirror at BL 8A was replaced by a new one too.

The persons who wish to use the open and in-house beam lines of UVSOR are recommended to contact with the following station master or supervisor and the representative, respectively.

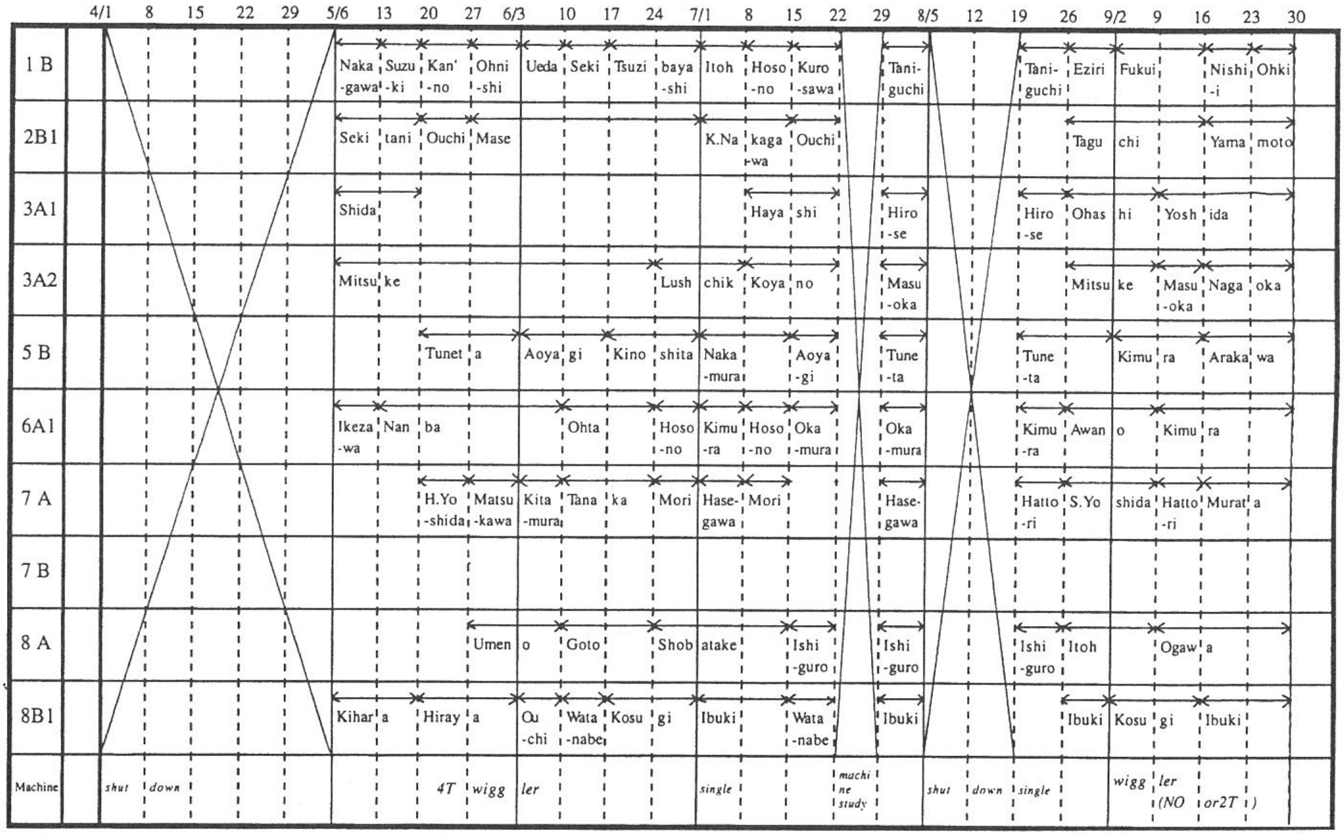
Table I. Station masters and supervisors of open beam lines.

| Beam Line | Station Master | Sub Master | Supervisor |
|---|---|---|---|
| 1B | M. Hasumoto | S. Tanaka | M. Kamada |
| 2B1 | S. Tanaka | M. Kamada | M. Kamada |
| 3A1 | M. Kamada | M. Hasumoto | M. Kamada |
| 3A2 | E. Nakamura | T. Gejo | T. Kinoshita |
| 5B | S. Kimura | H. Hasumoto | T. Kinoshita |
| 6A1 | S. Kimura | O. Matsudo | M. Kamada |
| 7A | T. Kinoshita | O. Matsudo | T. Kinoshita |
| 7B | T. Kinoshita | M. Hasumoto | T. Kinoshita |
| 8A | E. Nakamura | T. Gejo | T. Kinoshita |
| 8B1 | T. Gejo | E. Nakamura | T. Kinoshita |

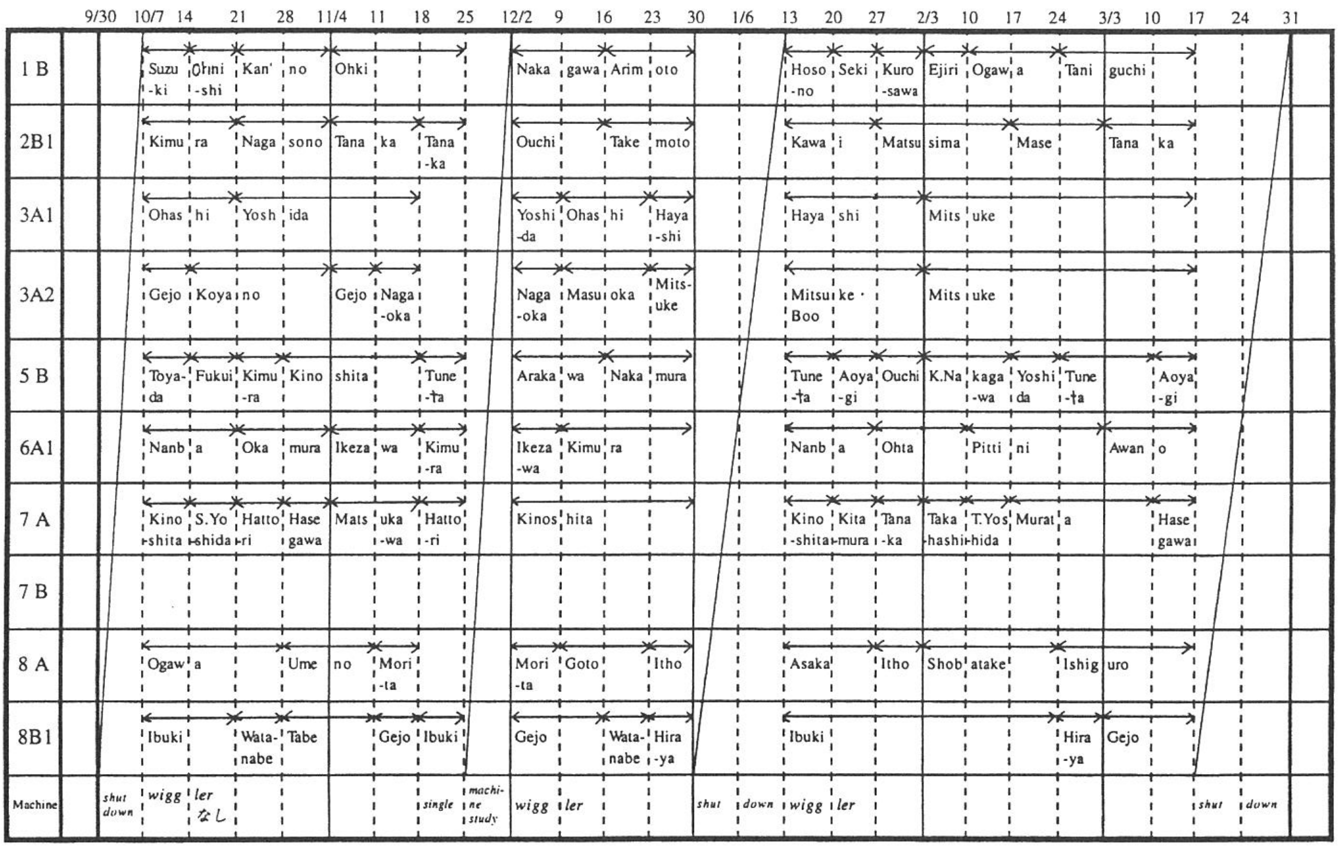
Table II. Representatives of in-house beam lines.

| Beam Line | Representative |
|---|---|
| 1A | N. Kosugi |
| 2A | T. Ibuki |
| 2B2 | K. Mitsuke |
| 3B | K. Mitsuke |
| 4A | T. Urisu |
| 4B | T. Urisu |
| 6A2 | M. Kamada |
| 6B | K. Yakushi |
| 8B2 | T. Ibuki |

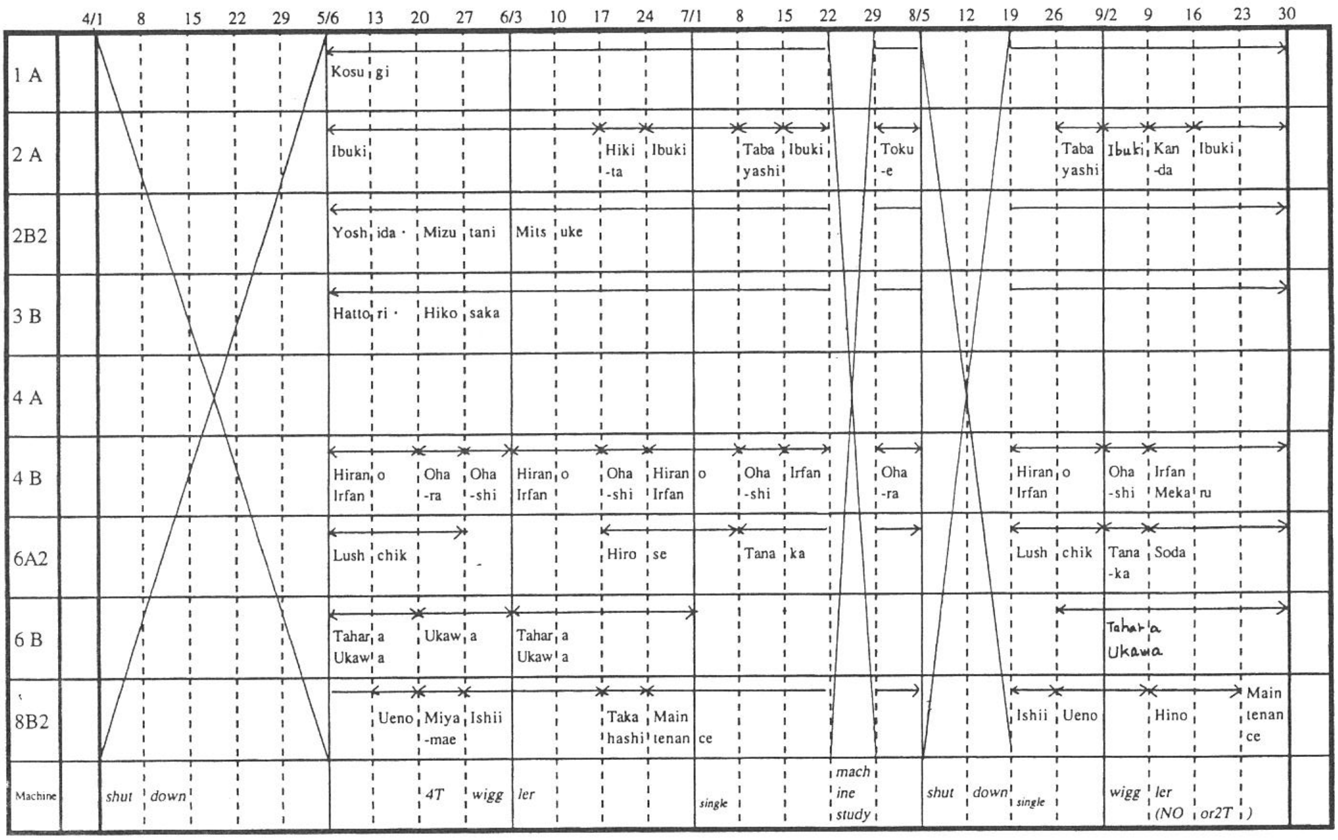
Open beam lines



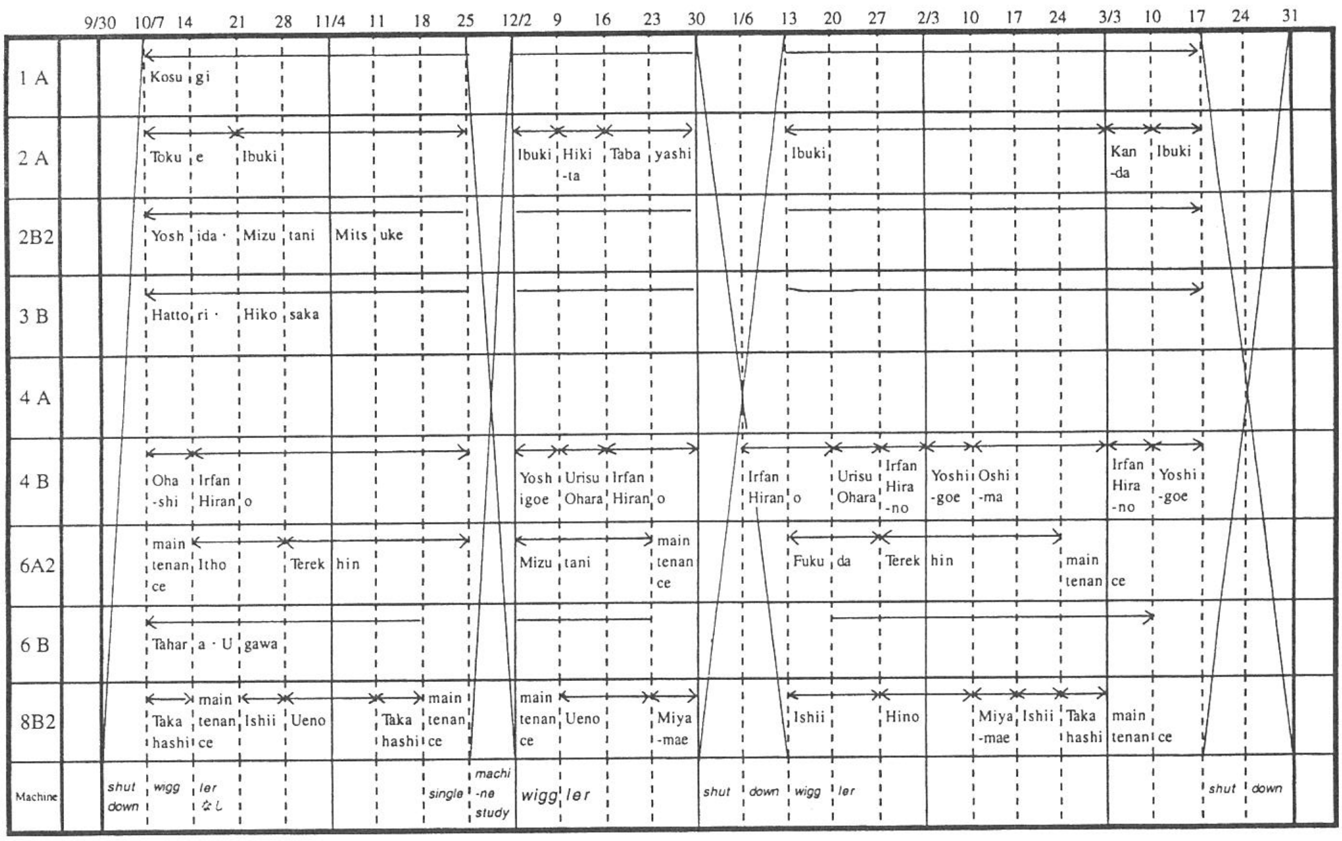

Open beam lines



In-house beam lines




In-house beam lines



# *BL1A*

## Soft X-Ray Beamline for Photoelectron-Photoabsorption Spectroscopy

BL1A is a soft x-ray beamline for photoelectron-photoabsorption spectroscopy. The beamline is equipped with a focusing premirror and a double crystal monochromator[1]. The monochromator serves soft x-rays in the energy range from 585 to 4000 eV by using several kind of crystals such as β-alumina, beryl, quartz, InSb and Si crystals. The throughput spectra of the beryl $(10\bar{1}0)$ and InSb (111) crystals are shown in Fig.1. Typical energy resolution ($E/\Delta E_{h\nu}$) of the monochromator is about 1500 when we use a pair of beryl or InSb crystals.

For photoelectron-photoabsorption spectroscopy, an ultra-high-vacuum (UHV) apparatus is connected. The top view of the apparatus is shown in Fig 2. It is equipped with a high-performance electron analyzer (SES-200, SCIENTA Co.). The pass energy ($E_P$) can be varied between 1 and 500 eV and typical resolving power ($E_P/\Delta E_{elec.}$) is more than 1000. Using the apparatus, resonant photoelectron spectra for solid samples can be obtained with the total energy resolution ($\Delta E_{total}$) of ~0.7 eV around hv=1000 eV.


**Reference**

[1] A.Hiraya et al., Rev. Sci. Instrum.,**63** (1992) 1264.

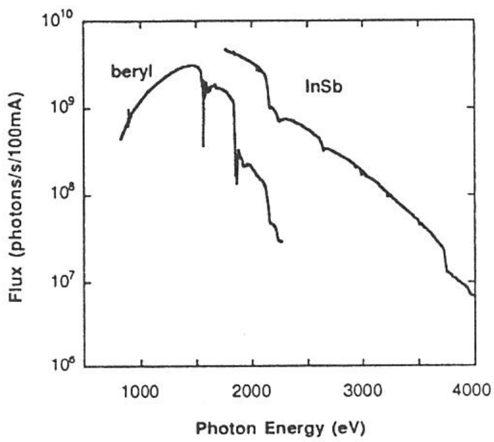




Figure 1. Throughput spectra of the double crystal monochromator at the BL1A.

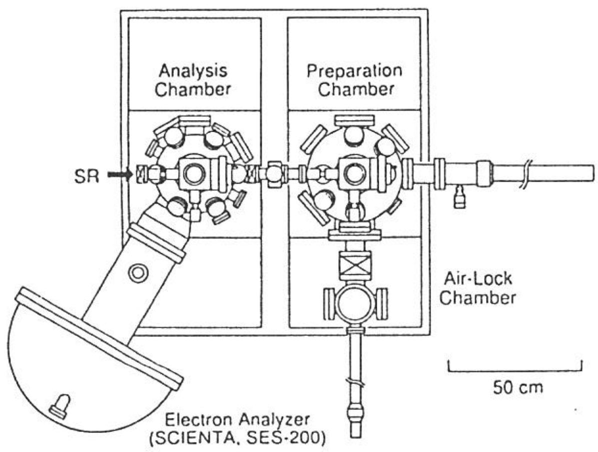



Figure 2. Top view of the UHV apparatus for photoemission-photoabsorption spectroscopy.

### Specification

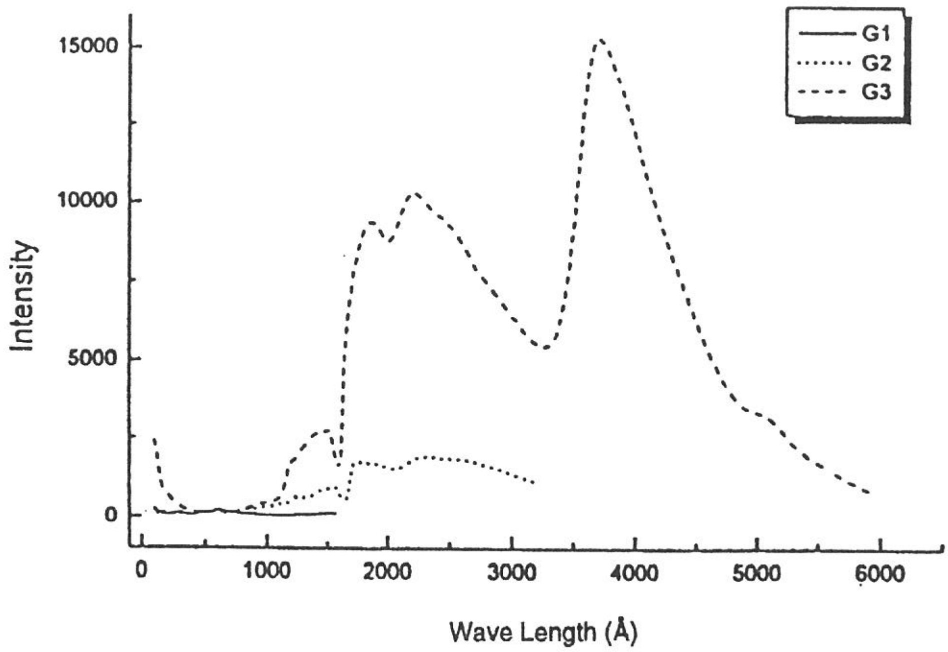
| | |
|---|---|
| Monochromator | : double crystal monochromator ($\theta_B$=70-20°) |
| Monochromator crystals (2d value, energy range) | : β-alumina (22.53Å, 585-1609eV), beryl (15.965Å, 826-2271eV), quartz (8.512Å, 1550-4000eV), InSb (7.481Å, 1764-4000eV), Si (6.271Å, 2104-4000eV) |
| Resolution | : E/ΔE=1500 for beryl and InSb |
| Experiment | : photoelectron-photoabsorption spectroscopy for solid |

# *BL1B*

## Seya-Namioka Monochromator for General Purpose in VUV Region

The beam line 1B has been used for many experiments such as absorption, reflectivity, photo-ionization, and luminescence in condensed phase. The system consists of a pre-mirror, a 1-m Seya-Namioka type monochromator, and a post-mirror. Three gratings with 600, 1200, and 2400 gr/mm can cover the wavelength range from 40 nm to 650 nm, and two post mirror make it possible to change the focus point. A long-focus mirror is usually used with a LiF window to separate a main chamber for spectroscopy in liquids and biospecimens, while a short-focus mirror is suited to solid-state spectroscopy. The output flux from this monochromator is about $10^{10}$ phs/s around 200 nm with 0.1 mm slits. The spectral distributions obtained with three gratings are shown in the figure, although they are not the best data because of the contamination of the mirrors and gratings due to the recent careless accident.

A second monochromator (Spex 270M) and a LN-cooled CCD detector (Princeton Inc.) are available for luminescence experiments, together with a liquid helium-flow type cryostat. A time-resolved system to observe luminescence and excitation spectra with three time-gates is also possible. The decay measurement is one of the highlights of this station. A couple of weeks are supplied for the decay measurements under single bunch operation. A TAC system is therefore one of the standard instruments at this beam line.



# BL2A

## Gas Phase Photoabsorption and Fluorescence Spectroscopy

Photoabsorption cross section and fluorescence excitation spectra of gaseous sample are simultaneously measured in a vacuum cell or effusive jet condition. The primary photons in the 30-400 nm region are dispersed by a 1-m Seya monochromator. Higher order light in the 80-120 nm range is suppressed by using a long channel with a cross section 2.5 × 5.0 × 170 mm long filled with argon gas at a pressure ≅0.3 Torr as shown in fig. 1. No filter is used between 30 and 80 nm since the photon flux at λ<40 nm is very weak (see fig. 1). The gas filter and cell are placed in a main chamber which is evacuated by a 5000 *l*/s diffusion pump (Varian, Model VHS10). A LiF window is used for the measurement at the 105<λ<210 nm range as usual. Thus, the total photo-absorption cross section and fluorescence excitation spectra are available in the wide wavelength region 30-210 nm without or with little contamination by the higher order light.

Dispersed fluorescence and polarity of emission from the excited fragment are also measurable in addition to the total photoabsorption and emission cross sections. In the single bunch operation of synchrotron radiation with the period of 178 ns, a radiative life time can be measured.

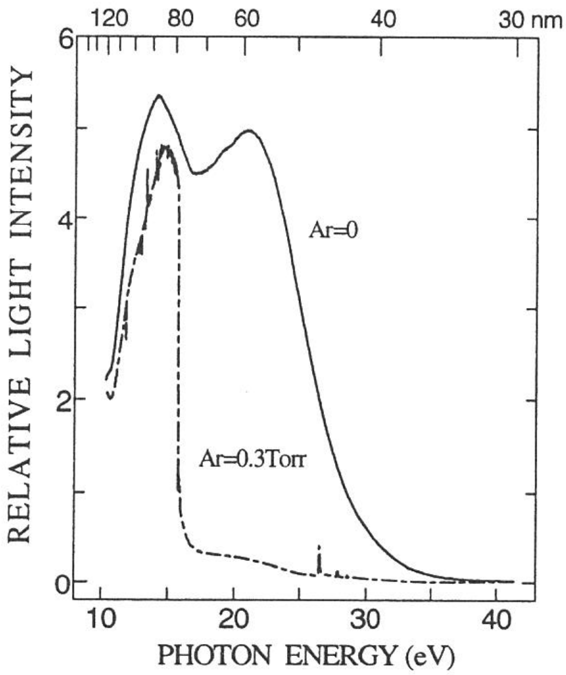



**Fig. 1. Transmitted $I_0$ intensity with and without an Ar gas filter.**

### Specification

| | |
|---|---|
| Monochromator : | 1-m Seya |
| Wavelength range : | 30-400 nm |
| Resolution : | $\Delta E/E \cong 10^{-3}$ at 100 nm |
| Grating : | 1200 *l*/mm blazed at 96 nm |
| Experiments : | |
| | •Vacuum cell or effusive jet |
| | •Total photoabsorption cross section |
| | •Fluorescence cross section |
| | •Dispersed fluorescence |
| | •Radiative lifetime |
| | •Emission polarity |

# *BL2B1*

## Soft-X ray beamline for solids and solid surfaces

BL2B1 is a beamline in order to study solids and solid surfaces by the use of photoabsorption and photoelectron spectroscopy. A 2-meter grazing incidence monochromator ( 'Grasshopper' type, Mark XV; Baker Manufacturing Co.) is installed. A 2400 l/mm grating has been installed since April 1994, and was replaced by a 1800 l/mm grating at March 1997. The resolving power is better than 600 at C-K edge (about 290 eV). Figure 1 shows the photoelectron yield from the Au mesh (10%-transmission) located near the position of a sample by the use of the 2400l/mm grating. The dip around 300 eV is due to carbon contamination of optical elements.

The analyzing chamber is installed at the focusing point of the monochromized light. The pressure is less than $1 \times 10^{-10}$ Torr. A double-pass CMA, a LEED optics, an ion-gun for sputtering, and a sample holder which can be cooled with liquid nitrogen and heated, etc. are equipped for the 'in-situ' measurements. The photoelectron spectroscopy including CIS (Constant initial state spectroscopy), CFS (Constant final state spectroscopy) can be measured using CMA which is controlled by a personal computer. Samples can be transferred to the analyzing chamber from the air, through the preparation chamber in which sample treatments (e.g. cleaving, filing, and deposition) can be made.

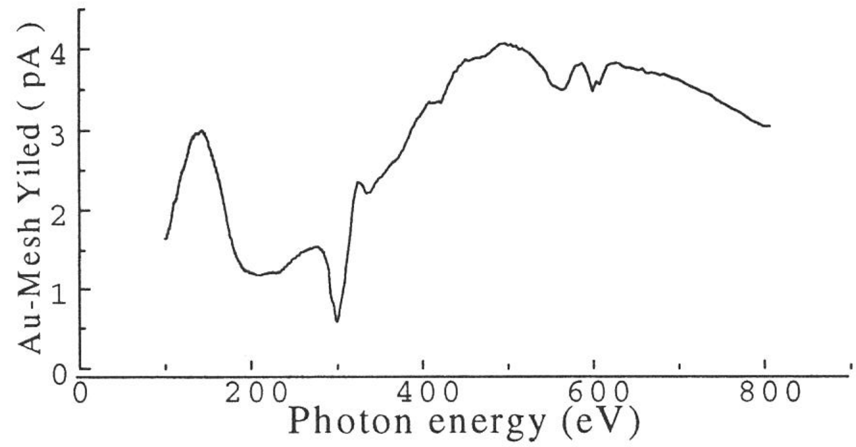



Figure 1. Photoelectron yield measured by the use of the Au mesh

**Specification**

Monochromator :2m grasshopper type
Energy range :95-1000 eV ( 2400 l/mm)
Resolution of photon :<0.4eV at 300eV (2400 l/mm)
Resolution of photoelectron :<0.3eV (hv=150eV)
Experiment : Photoelectron spectroscopy, X-ray absorption spectroscopy,

# *BL3A1*

## Irradiation Port with Undulator Radiation

The beam line 3A1 has been used for various kinds of experiments need intense undulator radiation. In recent years, photo-desorption, photo-chemical reaction, SR-CVD, photo-etching, irradiation damage effects in condensed phase, light amplification induced by core-level excitation, and so on have been carried out at this beam line. The luminescence from High-Tc superconductors and fullerens, the fluorescence yield of which is not high enough at beam lines for bending radiation, has been observed. A combination experiment with undulator radiation and a diode laser has been successfully conducted for time-response measurement of SR-induced desoprtion.

A planar-type undulator installed in a long straight section of the UVSOR storage ring provides an intense quasi-monochromatic radiation to beam lines 3A1 or 3A2. The undulator consists of 24 sets of magnets, a period length of which is 80 mm. The photon-energy range from 8 to 52 eV can be covered by the fundamentals with a K-value from 0.62 to 3.6, although higher harmonics are mixed into the spectral distribution in case of high K-values.

The beam line 3A1 has no monochromator between the undulator and a sample chamber. The radiation is introduced by a toroidal focusing mirror into sample chamber through a pinhole of 1 mm in diameter and metallic filter (Al, Sn, and In). A gold mesh is always installed in the sample chamber to monitor the incident photons. A typical spectrum distribution measured by the monochromator at BL 3A2 is shown in the figure, where the undulator gap is 60 mm and the photon flux is estimated to be about $10^{14}$-$10^{15}$ phs/s on the samples.

A differential pumping system can be provided for the users who want to use gaseous materials. A second monochromator (Jobin-Yvon HR-320), another VUV monochromator ( home-made one of normal-incident type), and a helium storage-type cryostat are available for luminescence experiments. A TAC system is also one of the standard instruments of this beam line. For liquid- or gaseous-phase experiments, $MgF_2$ windows can be installed to separate the sample chamber from the beam line.

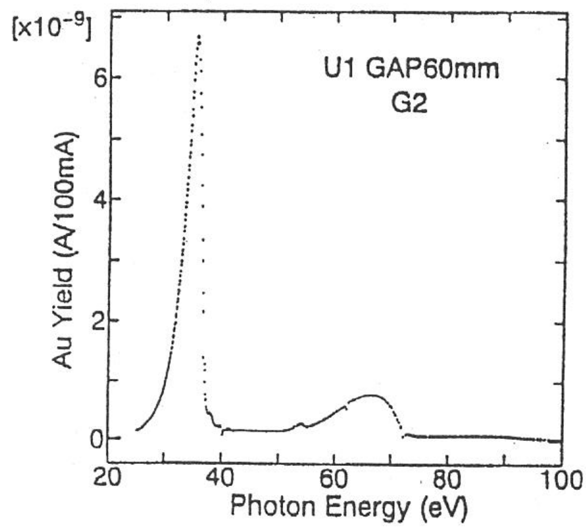



Fig. 2 Typical spectrum of undulator

# *BL3B*

## Beam Line for Gas Phase Two-Dimensional Photoelectron Spectroscopy

This beam line is devoted to studies of elementary atomic and molecular processes induced by excitation of valence electrons. A monochromator is a vertically dispersed normal incidence type with 3m focal length and 10° angle between the incident and diffracted photon beams. The maximum wavelength resolution of 0.007nm is narrow enough to separate vibrational levels of excited states for various molecules. The main component in an experimental chamber is a spherical sector electrostatic energy analyzer which has been designed and setup for photoelectron spectroscopy. In 1994, great improvement in detection efficiency for photoelectrons was realized by introducing a position sensitive detector. This allows us to perform two-dimensional photoelectron spectroscopy with good resolution (~ 30meV) in which the photoelectron yield is measured as a function of both photon energy and electron kinetic energy (binding energy). A two-dimensional spectrum, usually represented as a contour plot (*e.g.* Fig. 1), contains rich information on photoionization dynamics and properties of superexcited states. A great variety of interesting high-lying states involved in autoionization have been studied as follows:
(1) the $(3\sigma_g)^{-1}(3\sigma_u)^1$ valence state of acetylene which dominates photoionization cross section and leads to strong vibrational excitation,[1) ] (2) a bound valence state of nitric oxide whose autoionization gives rise to a number of irregularly spaced peaks in its photoionization efficiency curve,[2)] (3) Rydberg states of nitric oxide which undergo dissociation into N** + O($^1D^e$, $^3P^e$) followed by autoionizing transitions of the superexcited nitrogen atoms.[3)]

**1)** H. Hattori and K. Mitsuke, *J. Electron Spectrosc. Rel. Phenom.* **80**, 1 (1996); H. Hattori *et al.*, *J. Chem. Phys.*, in press.
**2)** K. Mitsuke *et al.*, *J. Electron Spectrosc. Rel. Phenom.* 79, 395 (1996).
**3)** Y. Hikosaka *et al.*, *J. Chem. Phys.* **105**, 6367 (1996).

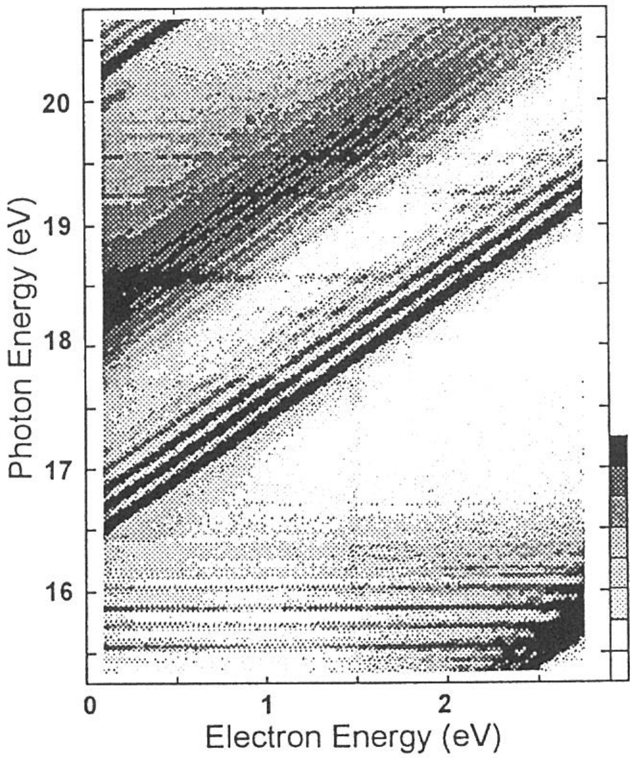



**Figure 1.** Two-dimensional photoelectron spectrum of $N_2O$ taken at the photon energy range from 15.35 to 20.65eV. The electron yield is presented by the plots with eight tones from light to dark on a logarithmic scale.

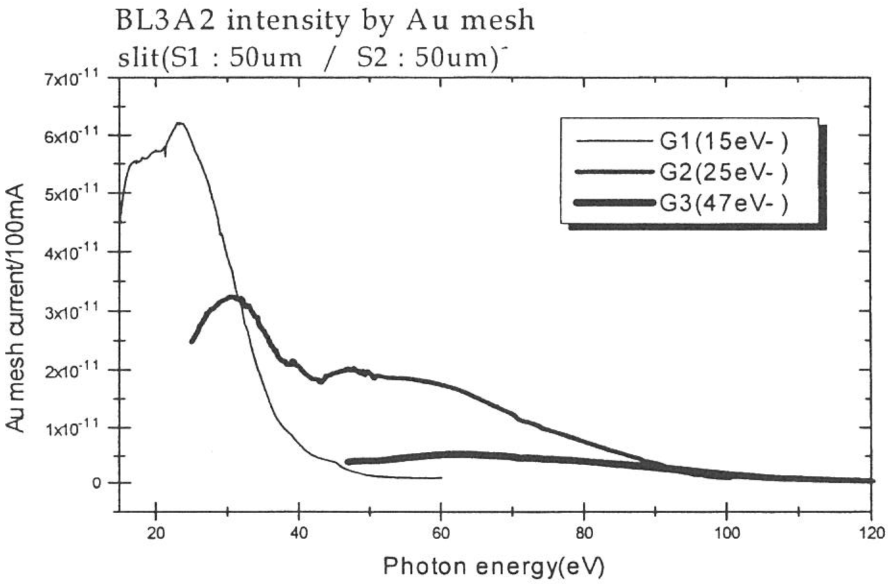
### Specification

Monochromator : 3 m normal incidence
Wavelength range : 30 - 200 nm
Resolution : 0.007 nm at 100 nm

# *BL3A2*

## Gas-Phase Dissociative Photoionization Apparatus

This machine has been constructed to study the formation of multiply-charged ions and their dissociation processes. The monochromator is constant-deviation grazing-incidence type with 2.2m focal length and covers wide wavelength region(10-100nm) where many kinds of molecules and multiply-charged ions are effectively measured. High intensity photon beam is available by introducing the radiation emitted from the undulator to the monochromator. The apparatus contains an angle-resolved time-of-flight mass spectrometer (TOFM) equipped with automatic data acquisition system for photoion-photoion coincidence measurements. For full understanding of dissociative multiple photoionization, we detect the coincidence signals of two fragment ions produced from a parent ion, evaluate the kinetic energy release in "Coulomb explosion", and measure the angular distributions for the fragment ions. The sensitivity with respect to high-speed ions (several tens of electron volts) is much improved in comparison with commercial TOFMS.




**Specifications**

| | | |
|---|---|---|
| monochromator | : | 2.2m Constant-Deviation Grazing-incidence |
| Spectral range | : | 10 - 100nm (15eV - 120eV) |
| Resolution | : | 550 - 800 (0.03eV - 0.18eV) |
| Mass spectrometer | : | 300 |
| Length of the drift tube | : | 0.2 - 1m |
| Rotatable angle | : | 0 - 90° with respect to the photon beam |

# *BL4A*

## Multi-Layered Mirror Monochromator Beam Line for Synchrotron Radiation Stimulated Processing Study

This beam line is now under construction. Synchrotron radiation stimulated reaction has been studied actively during the last decade. The excitation energy dependence of the reaction, however, is a difficult data to obtain, due to that it requires a large number of monochromatised photons which is not supplied by the conventional monochromator beam lines. This beam line is designed to supply $10^{13}$ to $10^{14}$ monochromatised tunable photons/s with 3–5 % resolutions, by using a double crystal type multi-layered mirror monochromator. The multi-layered mirrors now considered are Mo/Si for 50–90 eV and Mo/C or Mo/$B_4C$ for 90–150 eV ranges. The calculated reflectivities for a Mo/Si mirror is shown in Fig. 1. The background photons of the lower energy region can be removed by a metal thin film filter.The beam spot size at the focussed point (sample surface in the reaction chamber) is about 2x3 $mm^2$. For the energy range of 200–500 eV which is covered by this beam line, however, the reflectivity of the multi-layered mirror is generally low, and development of the high efficiency mirror is required.

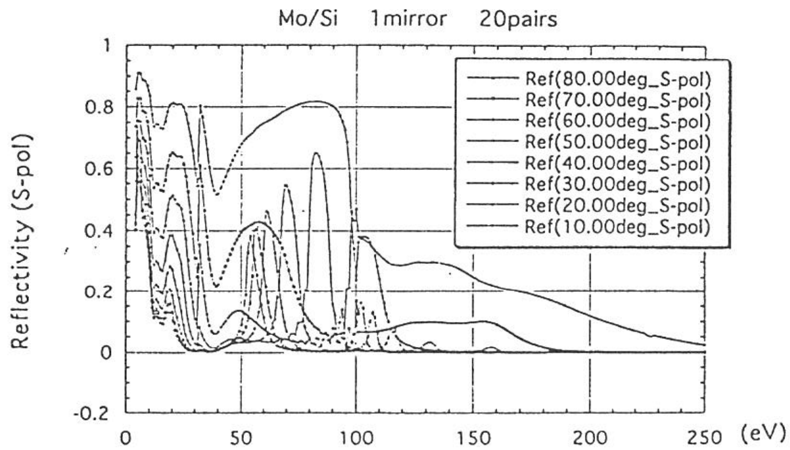



Fig. 1 Calculated reflectivities of the Mo/C multi-layered mirror.

### Specifications

| | |
|---|---|
| Monochromator | :Multi-layered mirror monochromator |
| Wavelength range | :50–150 eV |
| Resolution | :3–5 % |
| Experiments | :Excitation energy dependence of the SR processing |

# *BL4B*

## Synchrotron Radiation Stimulated Processing Beam Line

Several kinds of synchrotron radiation stimulated processing experiments can be conducted using this beam line. The reaction gases up to about 0.1 torr can be used by the differential vacuum pumping. Reaction apparatus shown in Fig. 1 is consisted of four ultra high vacuum chambers, which is used for etching and chemical vapor deposition (CVD) experiments, Si gas source molecular beam epitaxy (MBE) experiments, sample storage, and air-locked sample introduction. The infrared reflection absorption spectrum measurement system is equipped to the reaction chambers to monitor the surface reaction *in situ*. The SR stimulated chemical reaction of surface submonolayer hydrogen on Si(100) have been successfully monitored recently [1].

[1] A.Yoshigoe, K.Mase, Y Tsusaka, T.Urisu, Y.Kobayashi, and T.Ogino, Appl. Phys. Lett. 67 (1995) 2364.

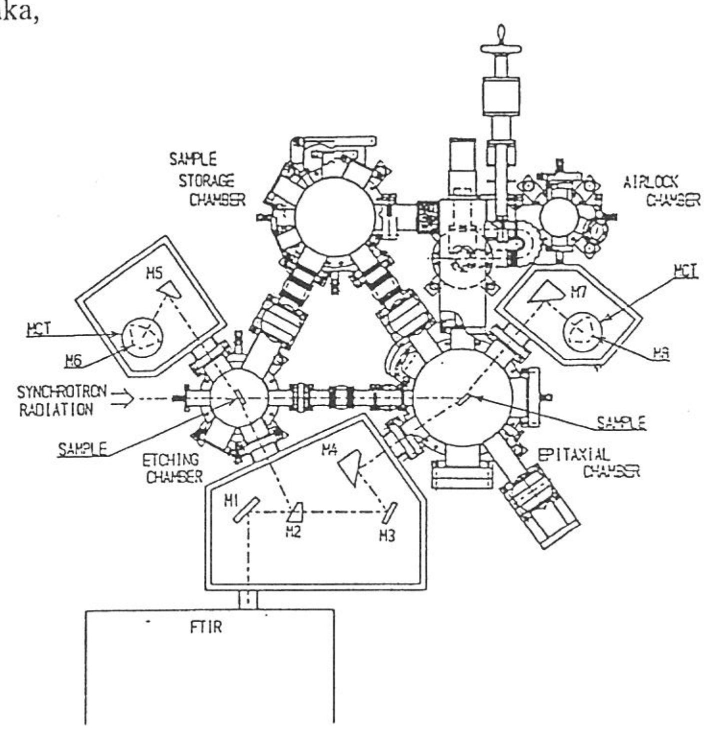



Figure 1. Reaction apparatus

**Specification**

| | |
|---|---|
| Monochromater | : white beam reflected by bent-cylindrical mirror with grazing incidence angle of 2 degrees. |
| Wavelength range | : 1–100nm |
| Experiments | : SR-stimulated processing |

# *BL5B*

## Calibration Apparatus of Optical Elements

BL5B has been constructed to calibrate optical elements. The beam line consists of a plane grating monochromator (PGM) and three chambers (Fig. 1). The chamber A is used for calibration of optical elements, the camber B for optical measurements of solids and the chamber C for photo-stimulated desorption (PSD) experiments. The chamber C is sometimes changed to a chamber for photoemission microscopy.

The calibration chamber is equipped with a goniometer. The goniometer, which was installed for the characterization of optical components, has six degrees for freedom; X-Y translation of a sample, and interchange of samples and filters. They are driven by vacuum pulse motors. Since the polarization of SR is essential for such measurement, axis of the rotation can be made in either horizontal or vertical direction (s- or p-polarization).

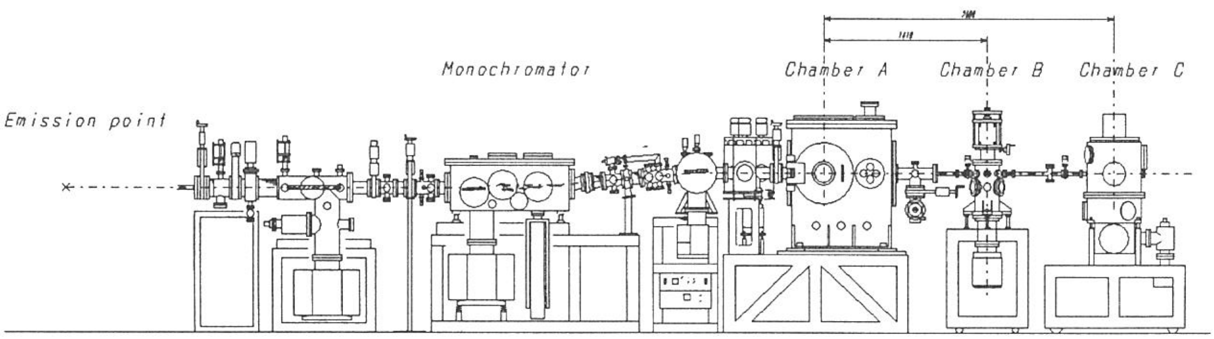



**Figure 1.** Schematic figure of BL5B spectrometer system.

**Specification**

Monochromator: Plane grating

Wavelength range: 2 - 200 nm (Fig. 2)

Resolution: $\lambda / \Delta\lambda = 300 \sim 500$

Experiments: Calibration of optical elements, absorption of solids, photo-stimulated desorption from rare gase solids, photoelectron microscopy.

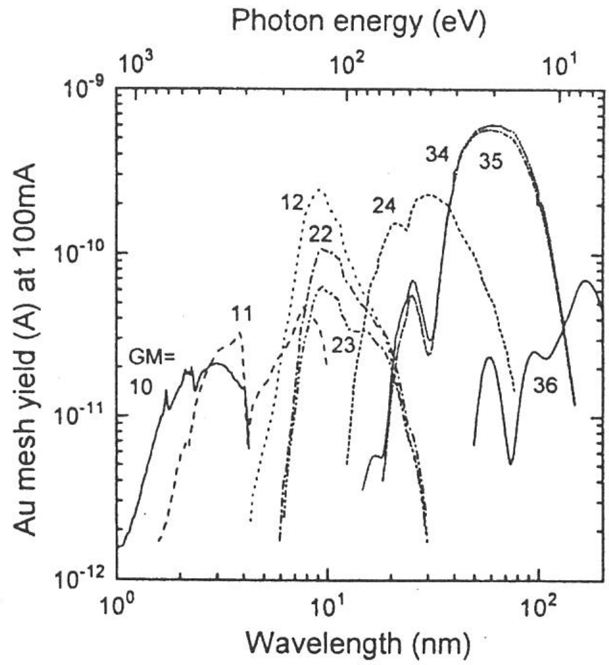



**Figure 2.** Throughput spectra of BL5B detected by a gold mesh (84% transmission).

# *BL6A1*

## Fourier-Transform Middle- and Far-Infrared spectrometers for Solids

UVSOR covers very wide energy range from soft x-ray to millimeter wave. BL6A1 was constructed in order to cover a long wavelength part in the spectral distribution of UVSOR from near-infrared to millimeter wave. Beam line is composed of two kinds of interferometers, a Martin-Puplett type (SPECAC) and a rapid-scan type (Bruker).

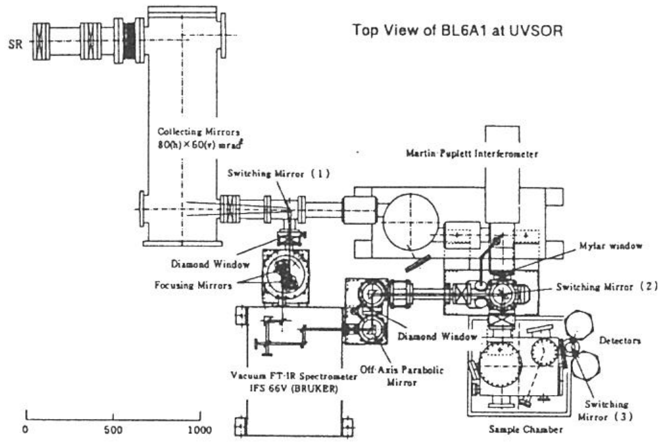



**Figure 1.** Top view of BL6A1.

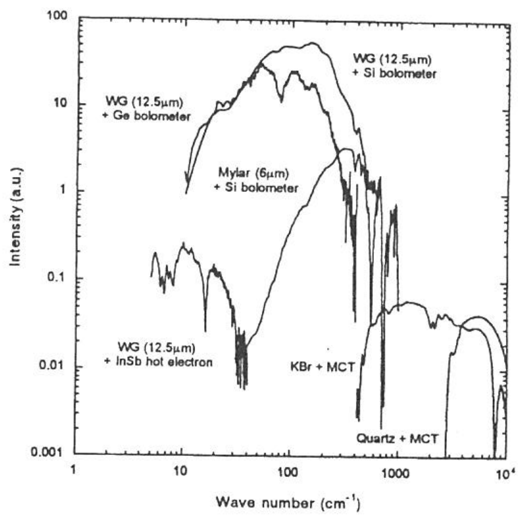



**Figure 2.** Throughput spectra of BL6A1.

**Specification**

Monochromator: Martin-Puplett type and rapid-scan type interferometers

Detectors: Si bolometer (20 - 1000 $cm^{-1}$)
Ge bolometer (with polyethylene window, 30 - 300 $cm^{-1}$)
Ge bolometer (with quartz window,10 - 200 $cm^{-1}$)
InSb hotelectron bolometer (2 set, 5 - 50 $cm^{-1}$)
MCT (400 - 10000 $cm^{-1}$)
Photovoltaic type MCT (400 - 4000 $cm^{-1}$, time response: 10 nsec)

Wavelength range: 0.5 mm - 33 μm (5 - 300 $cm^{-1}$) by Martin-Puplett interferometer
20 - 1 μm (50 - 10000 $cm^{-1}$) by rapid-scan interferometer

Resolution: $\lambda / \Delta\lambda$ = 500 - 20000

Experiments: Temperature dependence of reflectivity and transmission spectra, absorption under high pressure (up to 20 GPa), reflectivity under magnetic field (up to 8 T), time-resolved spectroscopy.

# *BL6A2*

## Photoelectron Spectrometer for Solids and Surfaces

A Plane Grating Monochromator (PGM) consists of pre-mirrors, a plane grating, focusing mirror, and a post-mirror, with an exit slit only. It covers the wide spectral range from 2 to 130 eV with exchanging two gratings and 5 focusing mirrors. A typical spectral distribution is shown in the figure, where the numbering indicates the combination of the grating and the mirror. A typical photon flux is about $10^{11}$ phs/s/100 mA at 90 eV with a resolving power of 700. Angle-integrated and angle-resolved photoelectron spectrometers are available. The overall resolution of the integrated type analyzer is about 0.3 eV, while the angle-resolved hemispherical analyzer has a resolving power of 100 with an angular resolution of 1.1° in two axes. The optical system including an ICCD detector can be installed. The standard instruments for surface analysis such as Auger, LEED, Ion gun, and gas doser are installed in the analyzing chamber, the base pressure of which is $1.2 \times 10^{-10}$ Torr. The samples are transferred from an air-lock chamber to the analyzing chamber through a preparation chamber.

**Specifications**

1) Monochromator

Type: Plane Grating Monochromator (no entrance slit)

Range: 2-130 eV

Resolution: 0.015-0.3 eV with slit of 0.3 mm

Flux: $10^{11}$ phs/s/100 mA at 90 eV with 0.1mm slit

2) Main Instruments

Angle-integrated Cylindrical Analyzer

(home made, ΔE=0.3 eV)

Angle-Resolved Hemi-Spherical Analyzer

(home made, E/ΔE=100 Δθ=1.1° Two-axes)

Second Monochromator (Jobin-Yvon HR-320)

ICCD (Princeton Instrum.)

Preparation Chamber

Air-lock chamber for quick insertion

LEED of Reverse type (OMICRON)

Ion-gun of Differential type (ULVAC-Phi)

Auger (ULVAC-Phi)

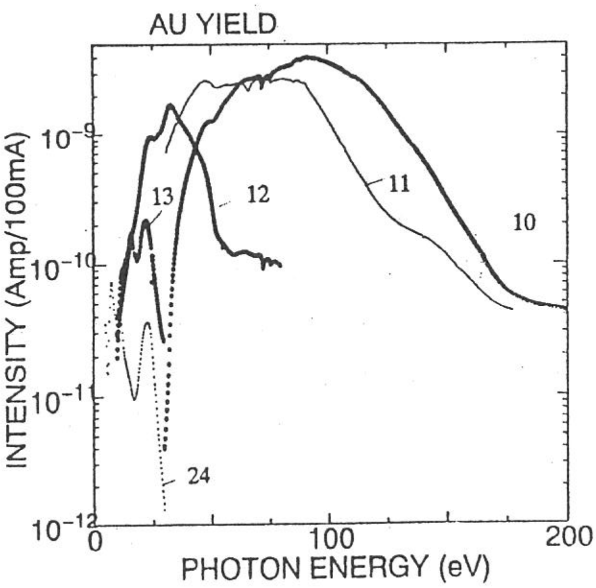



Fig. 1 Typical spectral distribution

# *BL6B*

## Fourier-Transformed Far-Infrared Spectrometer

BL6B has been designed to measure reflectance on small samples with high precision over FIR-IR regions. The optical system of BL6B consists of the following three parts: (1) beamline optics in ultrahigh vacuum ($1\times10^{-9}$ Torr), equipped with interchangeable four kinds of exit-window without breaking the vacuum, (2) adjusting optics between the beamline and a spectrometer, (3) a Bruker IFS-113v spectrometer, which offers automatic change of six beam-splitters under vacuum (~5 Torr). A reflectance unit is placed into a sample compartment of the spectrometer, also in the vacuum atmosphere. Temperature dependence can be traced with a LHe flow-type cryostat from room temperature down to 4 K. An infrared microscope is applied, if necessary, to obtain accurate reflectivity on samples smaller than millimeter size.

BL6B is specially suitable for the study of optical properties of organic conductors because available size of the crystals is usually very small. We are now investigating the electronic structure of organic conductors that have a single-particle gap appeared in far-infrared region, caused by SDW, CDW, or superconducting transition. The superconducting character is also discussed through the change of reflectivity versus the temperature around the $T_c$.

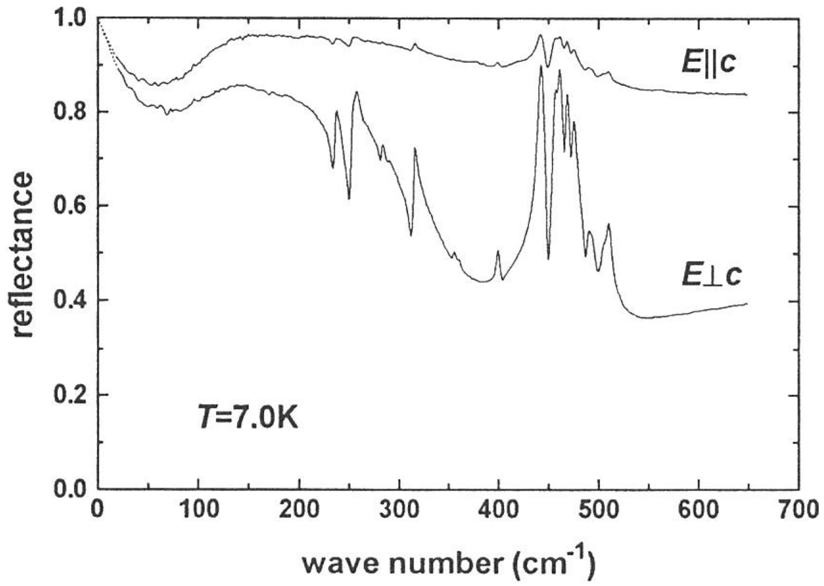



Figure 1. Polarized reflectance of β"-$(BEDT\text{-}TTF)_2AuBr_2$ measured at 7.0 K.

**Specification**

| | |
|---|---|
| Interferometer | : Michelson type |
| Spectral range | : 6 - 10,000 $cm^{-1}$ |
| Resolution | : better than 0.1 $cm^{-1}$ |
| Experiment | : reflectance and transmittance of solid state |

# *BL7A*

## Soft X-ray Spectrometer for Solids

The beam line BL7A equipped with a double crystal monochromator (DXM) was constructed for the spectroscopic research of solids in the soft X-ray region, where both the bending magnet and the 4T wiggler radiations are provided. The schematic drawings of the beam line and scanning mechanism of the double crystal monochromator are shown in Figure 1. When we use the relatively lower photon energy light (less than 1.7keV), we use the bending magnet line whereas the wiggler line is used for higher energy experiments. Recently, we have succeeded to measure soft X-ray spectra by using YB66 monochromator crystal, which is known to be one of the best monochromator crystals covering soft X-ray region from 1.1 to 2keV with higher performance. The detail of the use of YB66 is described in the part of the BL7A in this activity report.

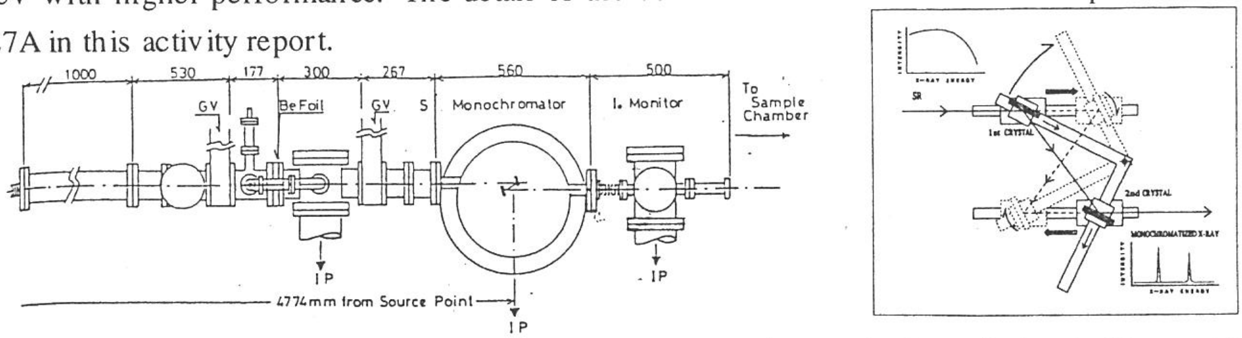



Figure 1. The schematic drawings of the beam line and scanning mechanism of the double crystal monochromator at the BL7A.

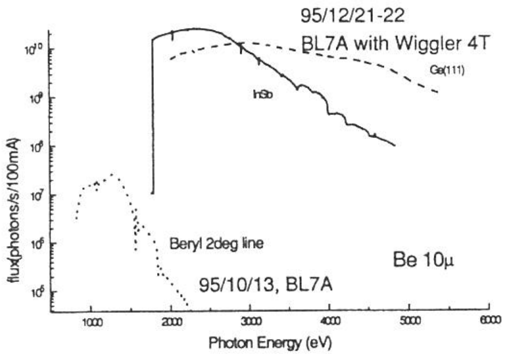



Figure 2. Throughput from the double crystal monochromator with typical monochromator crystal.

### Specification

Monochromator : Double Crystal Monochromator

Monochromatar crystals and covered photon energy:

$\beta$-$Al_2O_3$ (0.58-1.74keV), Beryl (0.82-2.27keV), YB66(400) (1.12-3.08keV), Quartz-Y(1010) (1.53-4.26keV), InSb(111) (1.74-4.85keV), Ge(111) (2.00-5.55keV).

Typical resolution : 0.46eV (Beryl Crystal, E=860eV)

Experiments : X-ray absorption spectroscopy (by photoelectron total yield and/or fluorescence)

# *BL7B*

## 3m Normal Incidence Monochromator for UV, VIS and IR Spectroscopy of Solids

The beamline BL7B is now under reconstruction. The 1m Seya-Namioka type monochromator is replaced to the 3m normal incidence monochromator (3m NIM; McPherson upgrade model of 2253) for the extended researches of the highest level with the higher resolution and intensity, the wider wave-length region available and so on. It will be also possible to utilize the linear and circular polarization inherent in synchrotron radiation (SR) and to realize some combined experimental systems, for example, with the synchronized laser to SR pulse or with the extended field. The outline of the new beamline is shown in Figure 1. The main parts of the system are a pre-mirror focusing system, a 3-m NIM and a post-mirror focusing system. The light from 50 to 1000 nm wavelength region is covered by changing three gratings *in situ*. Each spherical grating is original laminar type fabricated on $SiO_2$ and has effective grooved area of 120x40mm$^2$. The 2 focusing positions are available for the experiments. At the position between 2 positions, LiF or MgF2 window valve is installed. Therefore, the measurements for the organic materials, liquid and biochemical ones are possible at the 2nd focal position.

After the final adjustment and test run, this beamline will be used for absorption, reflection and fluorescence measurements on various materials with higher performance (high energy resolution, high intensity, well-polarized light, short repetitive pulse light) not only in the VUV region but also in the near UV, VIS and near IR region.

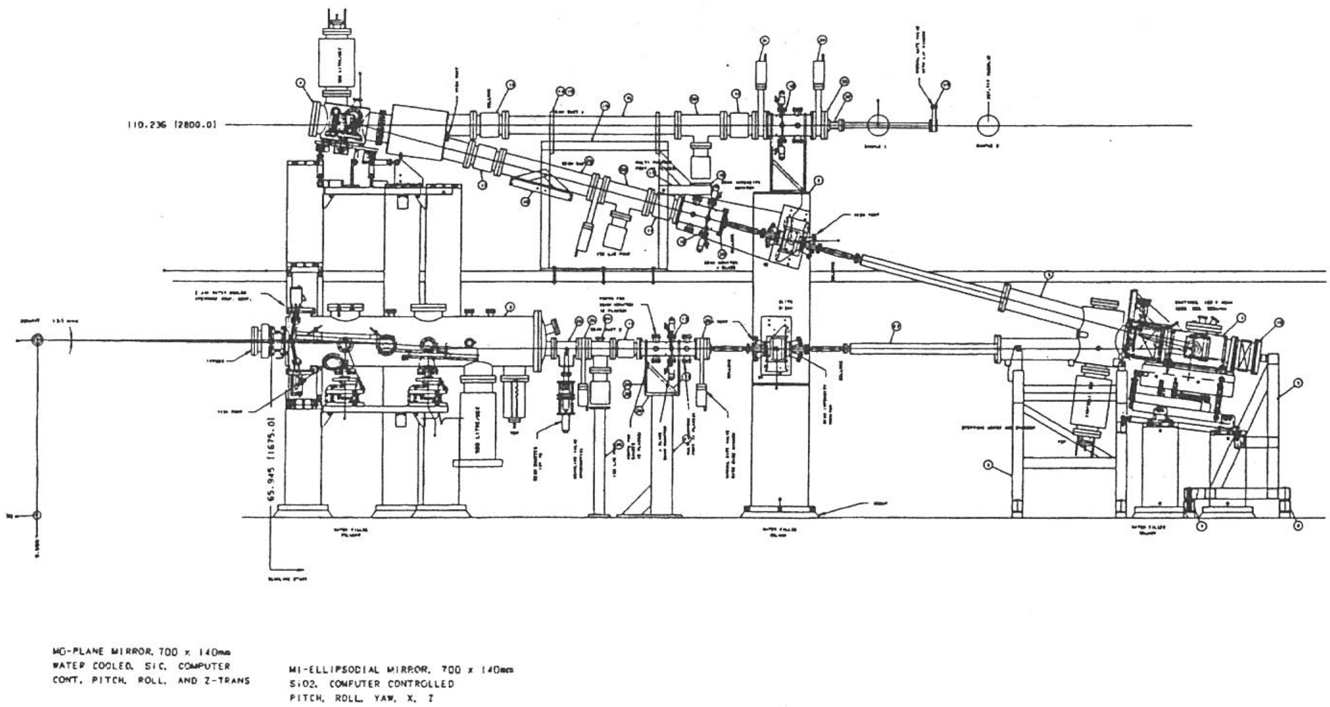



Figure 1. The outline of the side view of the new beamline BL7B.

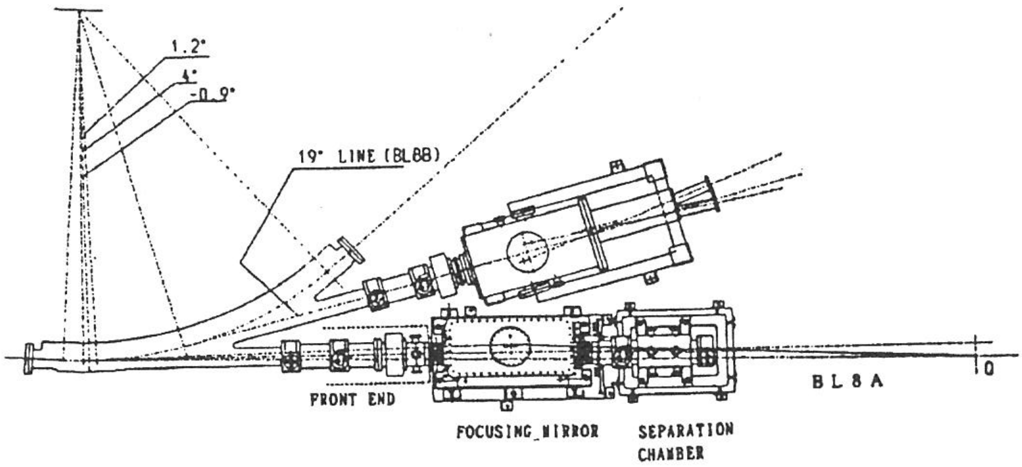
### Specification

| | |
|---|---|
| Monochromator | : 3m Normal Incidence Monochromator |
| Wavelength range | : 50nm-1000nm |
| Typical resolution | : E/ΔE=4000-23000 for 0.01mm slit |
| Experiments | : Absorption, reflection, fluorescence spectroscopy mainly for solids |

# *BL8A*

## Free Port

This beamline was constructed as a free port to which user can connect their own instruments. The beamline consists of a front end, a focusing premirror chamber and a separation chamber. Both focused and unfocussed beam can be used. A general purpose reaction chamber and a two (or three) stage differential pumping system are available for the experiments that use gas samples without window. With using three stage differential pumping system, gas pressure at the reaction chamber upto 0.5 torr can be used while keeping ultra high vacuum at the premirror chamber.




|← 2500mm →|← 2807mm →|

UP VEW OF BL8A

**Specification**

Spectral range : whole range of synchrotron radiation from UVSOR

Acceptance angle

Unfocused beam : 25 mrad (horizontal) × 8 mrad (vertical)
0.6 mrad (horizontal) × 0.6 mrad (vertical)
(with $\phi$ 3 mm aperture before sample)

Focused beam : 7.7 mrad (horizontal) × 8 mrad (vertical)

Beam spot size at focu : 3 mm (horizontal) × 2 mm (vertical)

Source - mirror distance : 2500 mm

Mirror - focus distance : 2807 mm

# *BL8B1*

## Photoabsorption and Photoionization Spectrometer

Last year a new beam line BL8B1 was constructed for observation of high resolution photoabsorption and photoionization experiments in the photon energy range from 30 to 800 eV, which includes the 1s core excitation energy of C, N and O atoms. For high resolution measurement among these energy, a constant-deviation constant-length spherical grating monochromator (CDCL-SGM) with three gratings (G1: R = 15 m; 1080 l/mm, G2: R = 15 m 540 l/mm, G3: R = 7.5 m; 360 l/mm) has been employed, whose entrance and exit slit positions and directions of incident and exit photon beams do not change during its scan. Consequently, it provides us with an resolution (E/ΔE) of 4000 at 400 eV and of 3000 at 245 eV. A drain current of gold foil reveals the absolute photon flux normalized by an ring current when two slit widths are 10 μm (Fig. 1).

Being Equipped at the downstream of the mono - chrometer, an chamber with a time-of-flight ion detector and a photoelectron detector allows us to measure photoelectron - photoion coincidence (PEPICO) and photoion - photoion coincidence (PIPICO) spectra. Measurements of absorption, electron yield and emission spectra of solid samples are also available.

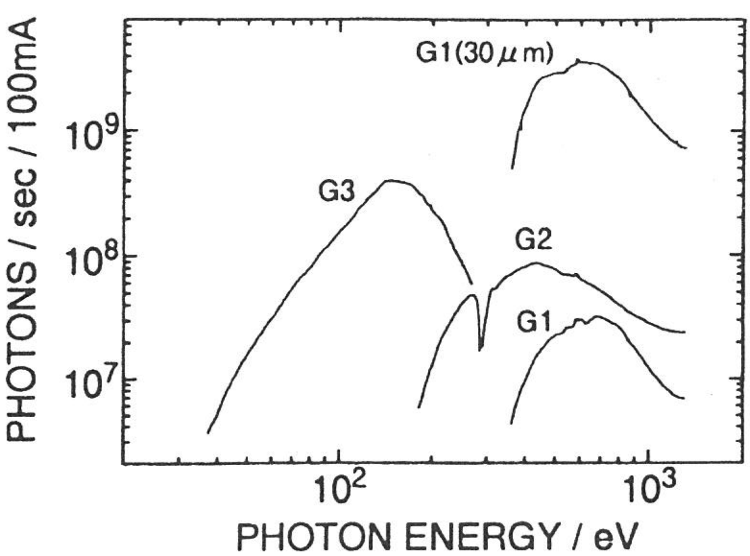



**Figure 1.** Absolute photon fluxes measured by a drain current of gold foil

**Specification**

| | |
|---|---|
| Monochrometer | : 2.2 m constant-deviation grazing incidence |
| Wavelength range | : 30 to 800 eV |
| Resolution | : E/ΔE = 4000 at 400 eV and 3000 at 245 eV |
| Available Experiments | : Measurement of photoabsorption and photoionization spectra for gas and solid sample |

# *BL8B2*

## Angle-Resolved Ultraviolet Photoelectron Spectrometer for solids

BL8B2 is a beamline for angle-resolved ultraviolet photoemission spectroscopy (ARUPS) system which is designed for measuring various organic solid such as molecular crystals, organic semiconductor, and conducting polymers. The beamline consists of a plane-grating monochromator (PGM), a sample preparation chamber with a fast entry Load-Lock chamber, a measurement chamber with an accurate manipulator for temperature dependence (base pressure $3\times10^{-10}$ Torr), a cleaning chamber (base pressure $2\times10^{-10}$ Torr), and a sample evaporation chamber (base pressure $3\times10^{-10}$ Torr). The cleaning chamber is equipped with back-view LEED/AUGER, $Ar^{+}$ gun and an infrared heating units. The PGM consists of pre-mirrors, a plane grating, focusing mirror, and a post-mirror, with an exit slit. It covers the wide range from 2 to 150 eV with exchanging two gratings (G1; 1200 l/mm, G2; 450 l/mm) and five cylindrical mirrors. The toroidal mirror focuses the divergent radiation onto the sample in the measurement chamber. The spot size of the zeroth-order visible light at the sample surface is about $1\times1mm^2$. The energy resolution at a slit width of 100 μm was found to be 0.004 - 0.3 eV in the wavelength range from 2 to 130 eV. A hemispherical electron energy analyzer of 25 mm mean radius with an angular resolution of 2° can be rotated around vertical and horizontal axes. The sample mounted on a manipulator can be also rotated around two axes.

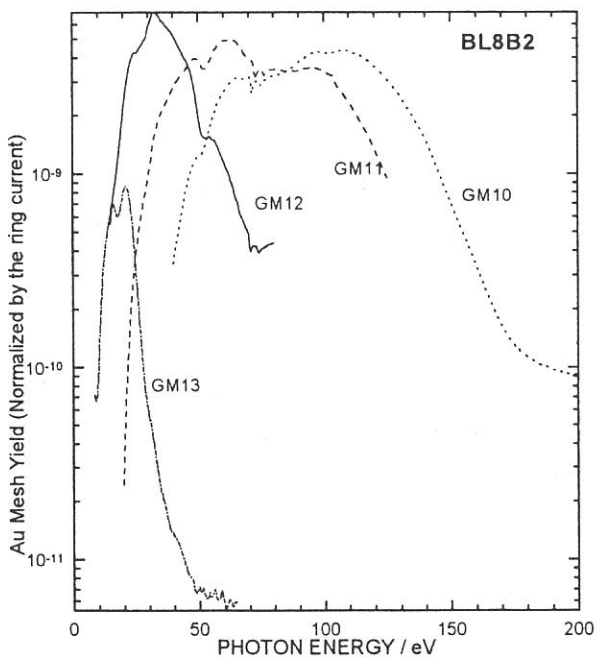



Figure Throughput spectra of plane-grating monochromator at BL8B2 with 100 μm exit slit.

### Specification

| | |
|---|---|
| Monochromator | : plane grating monochromator |
| Spectral range | : 2 - 130 eV |
| Resolution | : 0.25 eV at 40 eV, as determined by the Fermi edge of gold. |
| Experiment | : Ultraviolet Photoelectron Spectroscopy for various organic solids |
| Polarization | : 85~91 % at 5000 Å |

# List of Publication

## LIST OF PUBLICATIONS (1996)

M. Abe and K. Kan'no
*Decay Kinetics of Exciton Luminescence from Two Coexisting Off-center Configurations in KCl:I*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 167.

T. Abe, Y. Mizutani, M. Asano, T. Harada, M. Kawase, S.-I. Tanaka and M. Kamada
*Carbon K Edge XANES Spectra of Stage 2 $FeCl_3$-graphite Intercalation Compound*
Carbon , **34** (1996) 1160.

I. Arakawa, D.E. Weibel, T. Nagai, M. Abo, T. Hirayama, M. Kanno, K. Mitsuke and M. Sakurai
*Angular and kinetic energy distributions of the desorption of Ne metast able induced by excitons at the surface of solid Ne*
Nucl. Instrum. Meth. Phys. Res. , **B101** (1995) 195.

H. Aritani, T. Tanaka, T. Funabiki, S. Yoshida, M. Kudo and S. Hasegawa
*Structure of Mo-Mg Binary Oxides in Oxidized/Reduced States Studied by X-ray Absorption Spectroscopy at the Mo K Edge and Mg K Edge*
J. Phys. Chem. , **100** (1996) 5440.

H. Aritani, T. Tanaka, T. Funabiki, S. Yoshida, K. Eda, N. Sotani, M. Kudo and S. Hasegawa
*Study of the Local Structure of Molybdenum-Magnesium Binary Oxides by Means of Mo $L_3$-Edge XANES and UV-Vis Spectroscopy*
J. Phys. Chem. , **100** (1996) 19495.

S. I. Gheyas, T. Ogata, M. Nishio, T. Urisu and H. Ogawa
*Synchrotron-Radiation-Assisted Surface Processes of Diethylzinc on GaAs(100)*
Jpn. J. Appl. Phys. , **34** (1995) 6886.

A. Ejiri, S. Kubota, A. Hatano and K. Arakaki
*Vacuum UV Photoelectron Dynamics in Alkali Earth Fluorides:Yied, Auger Effect, and Luminescence*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 151.

M. Fujita, K. Hayakawa, K. Fukui, M. Kitaura, H. Nakagawa and T. Miyanaga
*Optical Spectra of $SnI_2$ Crystal*
J. Phys. Soc. Jpn. , **65** (1996) 606.

M. Fujita, N. Ohno, Y. Kiyama and K. Nakamura
*Optical Spectra of Thallous Halides in 5d Core Exciton Region*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 59.

H. Hama, K. Kimura, J. Yamazaki, S. Takano, T. Kinoshita, M-E. Couprie
*Microscopic Study on Lasing Characteristics of the UVSOR Storage Ring Free Electron Laser*
Nucl. Instr. and Meth. in Phys. Res. , A **375** (1996) 32.

H. Hama
*A Helical Optical Klystron for an UV-FEL Project at the UVSOR*
Nucl. Instr. and Meth. in Phys. Res. , **A375** (1996) 57.

H. Hattori and K. Mitsuke
*Autoionization of Acetylene Studied by Two-dimensional Photoelectron Spectroscopy*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 1.

C. Hwang, C.-S. Hwang, C. Lee, S. W. Lee, I.-S. Jeong, H. H. Park, S. Tanaka and M. Kamada
*Fermi-level pinning of Ag on Si(111)-(7×7)*
Phys. Rev. , **B52** (1996) 16325.

K. Hayashi, D. Kato and K. Shimakawa
*Photoinduced Effects in Amorphous Chalcogenide Films by Vacuum Ultra-Violet Light*
Journal of Non-Crystalline Solids , **198-200** (1996) 696.

Y. Hikosaka, H. Hattori, T. Hikida and K. Mitsuke
*Formation of Autoionizing Atomic Nitrogen from Superexcited States of Nitric Oxide*
J. Chem. Phys. , **105** (1996) 6367.

S. Hino, K. Iwasaki, K. Umishita, T. Miyazaki, K. Kikuchi and Y. Achiba
*Photoelectron Spectra of Metal Fullerenes: Are Metal Fullerenes Molecular Crystals or not?*
J. Electron Spectrosc. Relat. Phenom. , **78** (1996) 493.

S. Hino, K. Umishita, K. Iwasaki, T. Miyazaki, K. Kikuchi and Y. Achiba
*Ultraviolet Photoelectron Spectra of $C_{86}$ and $C_{90}$*
Phys. Rev. , **B53** (1996) 7496.

T. Hirayama, T. Nagai, M. Abo, I. Arakawa, K. Mitsuke and M. Sakurai
*Excitonic energy transfer process in Ne-Kr alloy studied by photon stimulated desorption of metastable atoms*
J. Elect. Spectr. Rel. Phen. , **80** (1886) 101.

S. Hirose and M. Kamada
*Photon-Stimulated Desorption of Excited-State Sodium Atom from NaF and NaCl under Valence-Band and Core-Level Excitations*
J. Phys. Soc. Jpn. , **65** (1996) 1849.

S. Hirose and M. Kamada
*Photon-Energy Dependence of Excited-State Na Desorption from Na Halides by Synchrotron Radiation*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 113.

H. Hosono, M. Mizuguchi, H. Kawazoe and J. Nishii
*Correlation between Ge E' Centers and Optical Absorption Bands in $SiO_2$:$GeO_2$ Glasses*
Jpn. J. Appl. Phys. , **35** (1996) L234.

S. Hosokawa, T. Kouchi, I. Ono, M. Taniguchi, Y. Takata and N. Kosugi
*A Soft-x-ray Core Absorption Study on the Electronic States in Ag- and Cu-Photodissolved Amorphous $GeSe_2$ Using Synchrotron Radiation*
J. Phys.: Condens. Matter **8** (1996) 1607.

T. Ibuki, A. Hiraya, T. N. Olney and C. E. Brion
*Ionic Photofragmentation (11.5-160eV) and PIPICO Spectroscopy (40-130eV) of BrCN in the Valence Shell and Bromine 3d Regions*
Chem. Phys. , **203** (1996) 359.

T. Ibuki, A. Kamamoto
*Photoabsorption cross section and Radiative Processes of $GeCl_4$ in the Valence Region of 6-31 eV*
Chem. Phys. Lett. , **260** (1996) 314.

T. Ibuki, K. Okada
*Photoabsorption and Fluorescence Excitation Spectra of $CF_3CN$ in the Region of 6-41 eV*
Chem. Phys. Lett. , **263** (1996) 173.

H. Ishii, A. Yuyama, S. Narioka, S. Hasegawa, M. Fujino, H. Isaka, M. Fujiki, K. Furukawa, N. Matsumoto and K. Seki
*Electronic Structures of Silicon-based Organic Compounds Studied by UV Photoemission*
Mol. Cryst. Liq. Cryst. , **285** (1996) 205.

H. Ishii, S. Narioka, K. Edamatsu, K. Kamiya, S. Hasegawa, T. Ohta, N. Ueno and K. Seki
*Angle-resolved Ultraviolet Photoelectron Spectroscopy of Oriented film of Model Compound of Poly(p-Phenylene): Wave Number (k) Conservation and k Blurring in a System with Small Number of Repeating Units*
J. Electron Spectrosc. Relat. Phenom. , **76** (1996) 553.

H. Ishii, A. Yuyama, S. Narioka, K. Seki, S. Hasegawa, M. Fujino, H. Isaka, M. Fujiki and N. Matsumoto
*Photoelectron Spectroscopy of Polysilanes, Polygermanes and Related Compounds*
Synthetic Metals , **69** (1995) 595.

M. Itoh, N. Ohno, H. Yoshida, S. Hashimoto, K. Kan'no and M. Kamada
*Auger-free Luminescence in Mixed Alkali Halides*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 117.

M. Kamada, N. Takahashi, S. Hirose, S. Ohara, M. A. Terekhin, S. S. Galaktionov and S. S. Galaktionov
*Photoelectron and Luminescence Spectra of BaFCl, BaFBr, and $CsTaF_6$*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 143.

K. Kan'no
*Time-Resolved Luminescence Study on Relaxation Dynamics and Morphology of Self-Trapped Excitons in Ionic Crystals*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 33.

T. Kawai, K. Risai and S. Shimanuki
*Oblique-Incidence Reflection Spectra of Exciton Polariton in $(CH_3NH_3)_3Bi_2Cl_9$ Single Crystals*
Excitonic Processes in Condensed Matter, (1996) 175.

J. W. Kim, S. Kim, J. M. Seo, S. Tanaka and M. Kamada
*Angle-resolved Photoemission of InSb(111)-2×2*
J. Phys.:Codens. Matter **8** (1996) 4189.

J. W. Kim, S. Kim, J. M. Seo, S. Tanaka and M. Kamada
*Surface Core-level Shift of InSb(111)-2×2*
Phys. Rev. B **54** (1996) 4476.

K. Kimura, J. Yamazaki, S. Takano, T. Kinoshita, H. Hama
*Gain Narrowing of Spectral and Temporal Widths in the UVSOR-FEL*
Nucl. Instr. and Meth. in Phys. Res. , **A375** (1996) 62.

S. Kimura, M. Kamada, H. Hama, X. M. Marechal, T. Tanaka and H. Kitamura
*Design of a Helical Undulator for UVSOR*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 437-440.

S. Kimura
*Optical Study of Low Carrier Concentration Sytems*
J. Phys. Soc. Jpn. , **65** (1996) Suppl. B 109.

S. Kimura, M. Ikezawa, A. Ochiai and T. Suzuki
*Optical Study on Heavy Fermion and Mixed Valence in $Yb_4As_3$*
J. Phys. Soc. Jpn. , **65** (1996) 3591.

S. Kimura, F. Arai and M. Ikezawa
*Mixed Valence of Praseodymium Oxides*
J. Electron Spectrosc. Relat. Phenom. , **78** (1996) 135.

T. Matsumoto, K. Kan'no, M. Itoh and N. Ohno
*Lattice Relaxation Effect Associated with Core Holes in Ionic Crystals Studied by Time-Resolved Luminescence Spectroscopy*
J. Phys. Soc. Jpn. , **65** (1996) 1195.

T. Masuoka, E. Nakamura and A. Hiraya
*Kinetic-Energy Release in the Dissociation of* $CO_2^{2+}$
J. Chem. Phys. , **104** (1996) 6200.

T. Masuoka and S. Nagaoka
*Dissociation Dynamics of Multiply Charged Molecular Ions Following Valence and Core-Level Photoexcitation and Photoionization*
Trends in Chemical Physics, **3** (1994) 13.

T. Miyamae, D. Yoshimura, H. Ishii, Y. Ouchi, T. Miyazaki, T. Koike, T. Yamamoto and K. Seki
*Photoemission Study on Poly(pyridine-2,5-diyl), Poly(2,2'-bipyridine-5,5'-diyl), and their K-doped States*
J. Electron Spectrosc. Relat. Phenom. , **78** (1996) 399.

K. Mitsuke, Y. Hikosaka, T. Hikida and H. Hattori
*Autoionization of NO in an Excited Valence State Affected by Perturbations from Valence-Rydberg Mixing*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 395.

K. Mitsuke, H. Hattori
*Autoionizing Resonance in Photoionization from the* $1\pi_u$ *Level of Acetylene*
J. Chem. Phys. , **102** (1995) 5288.

S. Nagaoka, T. Fujibuchi, U. Nagashima, S. Kato, K. Takano and I. Koyano
*Si:2p Core-Level Photoexcitation and Photoionization of Organosilicon Molecules*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 499.

E. Nakamura, H. Hama, J. Yamazaki, T. Kinoshita, O. Matsudo, H. Yonehara, T. Kasuga, G. Isoyama and M. Watanabe
*Construction and Commissioning of a Superconducting Wiggler for the UVSOR Storage Ring*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 421.

M. Nakamura, Y. Takata and N. Kosugi
*Resonant Ni 3p and 3s Photoemission for the Ni 2p Core-excitation in NiO*
J. Electron Spectrosc. Relat. Phenom. , **78** (1996) 115.

S. Narioka, H. Ishii, K. Edamatsu, K. Kamiya, S. Hasegawa, T. Ohta, N. Ueno and K. Seki
*Angle-resolved Photoelectron Spectroscopic Study of Oriented p-sexiphenyl: Wave-number Conservation and Blurring in a Short Model Compound of Poly(p-phenylene)*
Phys. Rev. , **B52** (1996) 2362.

S. Narioka, H. Ishii, D. Yoshimura, M. Sei, Y. Ouchi, K. Seki, S. Hasegawa, T. Miyazaki, Y. Harima and T. Yamashita
*The Electronic Structure and Energy Level Alignment of Porphyrin/Metal Interface Studied by Ultraviolet Photoelectron Spectroscopy*
Appl. Phys. Lett. , **67** (1996) 1899.

H. Ohashi and K. Shobatake
*Synchrotron Radiation Excited Etching of Silicon Surface Studied by Velocity Distribution Measurements of Desorbed Species*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 73.

H. Ohashi, E. Ishiguro, T. Sasano, K. Shobatake
*Synchrotron Radiation Excited Etching of Diamond*
Appl. Phys. Lett. , **68** (1996) 3713.

A. Ohnishi, K. Kan'no, Y. Iwabuchi and N. Mori
*Luminescence from Self-Trapped Excitons in BaFCl-BaFBr Solid Solutions*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 159.

A. Ohnishi. T. Yamada, T. Yoshinari, I. Akimoto, K. Kan'no and T. Kamikawa
*Emission Spectra and Decay Characteristics in Photo-Stimulated* $(CnH_{2n+1}NH_3)_2CdCl4:n=1,2,3$
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 163.

I. Ouchi, I. Nakai, M. Kamada, S. Tanaka and T. Hagiwara
*On the Assignment of Core Electron Absorption Spectra of the Films of Polyethylene Terephthalate and Polysethylene Naphthalate by Means of Total Electron Yield Method*
Reports on Progress in Polymer Physics in Japan , **39** (1996) 505.

I. Ouchi, I. Nakai, M. Kamada and S. Tanaka
*Polarized Absorption Spectra of Polyethylene Terephthalate and Polyethylene Naphthalate Films in Soft X-ray Region*
J. Electron Spectrosc. Relat. Phenom. , **78** (1996) 363.

M. Sakurai, T. Nagai, M. Abo, T. Hirayama and I. Arakawa
*Angular distribution of Ne metastable desorption induced by exciton formation at the suface of solid Ne: Measurement and computer simulation*
J. Vac. Soc. Jpn. , **38** (1995) 414.

S. Sato, S. Minoura, T. Urisu and Y. Takasu
*IRAS and TDS Study on the Photolytic Decarbonylation of Iron Pentacarbonyl Absorbed on a $SiO_2$ Film with a Buried Metal Layer*
Applied Surface Science , **90** (1995) 29.

K. Seki, A. Yuyama, S. Narioka, H. Ishii, S. Hasegawa, H. Isaka, M. Fujino, M. Fujiki and N. Matsumoto
*UV Photoelectron Spectroscopy of Polysilanes and Polygermanes*
ACS Symposium Series No. 579 Polymeric Materials for Microelectronic Applications: Science and Technology (1994) 398.

K. Seki, T. Tani and H. Ishii
*Electronic Structures of Organic-inorganic Interfaces Studied by UV Photoemission*
Thin Solid Films, **273** (1996) 20.

K. S. Seol, A. Ieki, Y. Ohki, H. Nishikawa and M. Tachimori
*Photoluminescence Study on Point Defects in Buried $SiO_2$ Film Formed by Implantation of Oxygen*
J. Appl. Phys. , **79** (1996) 412.

C. Shao, S. Morita, T. Soga, R. Inanami and S. Hattori
*Synchrotron-Radiation-Induced Deposition of Etch-Protecting Film on Si in $CF_4$ Plasma*
Jpn. J. Appl. Phys. , **35** (1996) 765.

K. Shibuya, S. Suzuki, T. Imamura and I. Koyano
*Dissociation of State-Selected $NO_2^+$ Ions Studied by Threshold Photoelectron-Photoion Coincudence Techniques*
J. Phys. Chem. A, **101** (1997) 685.

K. Sugiyama, D. Yoshimura, E. Ito, T. Miyazaki, Y. Hamatani, I. Kawamoto, Y. Ouchi, K. Seki and H. Ishii
*UV Photoemission Study of 8-hydroxyquinoline Aluminum ($ALQ_3$)/metal Interfaces*
Mol. Cryst. Liq. Cryst. , **286** (1996) 239.

N. Takahashi, S. Tanaka, M. Ichikawa, S. Ohara, Y. Fujii, K. Nakanishi and M. Kamada
*Construction of a Compact Spin- and Angle-Resolved Photoelectron Spectrometer*
Jpn. J. Appl. Phys. , **35** (1996) 6314.

Y. Tamenori, K. Inaoka and I. Koyano
*Dissociative Photoionization of Hexacarbonyl Tungsten in the Range 30-120eV*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 503.

M. Taniguchi, K. Tani and M. Katou
*Spectroscopic and Dynamic Aspects on Luminescence of Tryptophan Powders*
J. Electron Spectrosc. Relat. Phenom. , **87** (1996) 427.

T. Urisu, Y. Zhang, M. Nagasono, A. Yoshigoe, Y. Imaizumi, H. Ohshima, T. Hattori and S. Sato
*Molecular Orientation and Photochemical Reaction of Organoaluminum Compounds Investigated by Buried Metal Layer Infrared Reflection Absorption Spectroscopy*
Jpn. J. Appl. Phys. , **33** (1994) 7123.

D. E. Weibel, T. Nagai, T. Hirayama, I. Arakawa and M. Sakurai
*Electronic energy transfer in rare-gas solid alloys studied by photon stimulated desorption*
Langmuir, **12** (1996) 193.

T. Yamanaka, T. Matsushima, S. Tanaka and M. Kamada
*Orientation of Oxygen Admolecules on a Stepped Platinum (113) Surface*
Surface Science , **349** (1996) 119.

T. Yamanaka, T. Matsushima, S. Tanaka and M. Kamada
*Orientation and Desorption of Oxygen Admolecules on a Pt(113) Stepped Surface*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 105.

A. Yoshida, K. Maeda, S. Ukeda and A. Ganjoo
*Preparation of ZnO thin Films using Undulator and ArF Excimer Laser*
J. Electron Spectrosc. Relat. Phenom. , **80** (1996) 97.

H. Yoshida and K. Mitsuke
*Positive Ion-negative Ion Coincidence Spectroscopy of $CO_2$ for Observation of Doubly Excited Rydberg States*
J. Electron Spectrosc. Relat. Phenom. , **79** (1996) 487.

A. Yoshigoe, M. Nagasono, K. Mase and T. Urisu
*Synchrotron Radiation Irradiation Effects for $SiH_n$ on Si(100) Surface in the Synchrotron Radiation Stimulated Si Gas Source Molecular Beam Epitaxy*
Jpn. J. Appl. Phys. , **34** (1995) 6894.

A. Yoshigoe, K. Mase, Y. Tsusaka, T. Urisu, Y. Kobayashi and T. Ogino
*In Situ Observation of Silicon Hydrides on Si(100) Surfaces During Synchrotron-Radiation-Stimulated $Si_2H_6$ Gas Source Molecular Beam Epitaxy*
Appl. Phys. Lett. , **67** (1995) 2364.

A. Yoshigoe, M. Nagasono, K. Mase, T. Urisu, S. Seki and Y. Nakagawa
*In Situ Detection of Surface $SiH_n$ in Synchrotron-Radiation-Induced Chemical Vapor Deposition of a-Si on an $SiO_2$ Substrate*
J. Synchrotron Rad. , **2** (1995) 196.

D. Yoshimura, H. Ishii, S. Narioka, M. Seki, T. Miyazaki, Y. Ouchi, S. Hasegawa, Y. Harima, K. Yamashita and K. Seki
*The Electronic Structure of Porphyrin/metal Interfaces Studied by Ultraviolet Photoelectron Spectroscopy*
J. Electron Spectrosc. Relat. Phenom. , **76** (1996) 559.

Y. Zhang, S. Sato, H. Ohshima, T. Hattori and T. Urisu
*Buried Metal Layer Enhanced Infrared Reflection Absorption Spectroscopy for Photoreactions Induced by Synchrotron Radiation on $SiO_2$ Surfaces*
Applied Surface Science, **79/80** (1994) 422.

(Japanese)
M. Kobayashi
*Phonon Spectrosopy under High Pressure at Low Temperature*
Kotaibuturi, **30** (1996) 127.

H. Ohashi, E.Ishiguro, T. Sasano, T. Oguri, M. Kamada and K. Shobatake
*Diamond Etching by Syncrotron Orbital Radiation*
New Diamond, **12** (1996) 26.


Photo shows Director-General of IMS, Prof. M. Ito( right back), Director of UVSOR facility, Prof. N. Kosugi(left back), Mrs. Ito (left front), and Prof. I. Nenner(Lure: right front).

UVSOR

# Workshop

# UVSOR Workshop III
## ----Applications of SR in Infrared and Far-Infrared Regions----

November 8 and 9, 1996
Room 101, IMS

Nov. 8 (Fri)

1. Present and Future of UVSOR (14:00-14:45) — Chairman: T. Nanba (Kobe Univ.)
   - Opening remark---Present and Future Plan of UVSOR — N. Kosugi (IMS)
   - Present Status of Accelerator — H. Hama (IMS)
   - Present Status of the Beamlines — T. Kinoshita (IMS)

2. Technique in Infrared Spectroscopy (14:45-15:30) — Chairman:T. Awano (Tohoku Gakuin Univ.)
   - Interferometric Method and Step-Scan Technique of FT-IR — K. Furuto(Bruker)
   - On the Available Infrared Detectors — T. Kondo (Tohoku Univ.)

   Coffee break (15:30-15:45)

(15:45-16:45) — Chairman: M. Kobayashi (Osaka Univ.)
   - High-pressure technique for infrared-absorption measurement to 100 GPa — K. Aoki (Nat. Inst. Materials and Chemical Research)
   - Principle and Experience of Time-Resolved IR Spectroscopy — S. Ozaki (Kansai Gakuin Univ.)

   Coffee break (16:45-17:00)

3. Light Source (17:00-18:15) — Chairman: M. Sakurai (Kobe Univ.)
   - Synchrotron Radiation in Infrared and Far-Infrared Region — T. Nanba (Kobe Univ.)
   - Coherent Radiation in the Millimeter-Wave Region at the KURRI-LINAC — T. Takahashi (Kyoto Univ.)
   - Development of the Ultra High Intensity Far-Infrared Light Source; The Photon Storage Ring for Studying the Phenomena of Life — H. Yamada (Ritsumeikan Univ.)
   - IR-FEL — T. Tomimasu (FEL Lab.)

   Party (18:30- room 304 in UVSOR Bldg.)

Nov. 9 (Sat)

4. Present and Future of IR and FIR Experiments (9:00-10:20) — Chairman:T. Kinoshita (IMS)
   - Present Status of BL-6A1 at UVSOR — M. Kamada (IMS)
   - Present Staus of Infrared Beamline in World and New Project at Spring-8 — T. Nanba (Kobe Univ.)
   - Present and Future IR and FIR experiments at ETH — R. Pittini (Tohoku Univ.)
   - IR and FIR Experiments under Magnetic Fields at UVSOR — S. Kimura (IMS)

   Coffee break (10:20-10:35)

(10:35-10:50) — Chairman: T. Tahara (IMS)
   - Millimeter Wave Spectroscopy at UVSOR — T. Awano (Tohoku Gakuin Univ.)
   - Electromagnetic Responses of High-Tc Superconductors in the Millimetr- and Submillimeter-Wave Regions — M. Hangyo (Osaka Univ.)

Infrared Spectroscopy under High Pressure at UVSOR — M. Kobayashi (Osaka Univ.)
Far-Infrared Reflection Spectrum under High Pressure at UVSOR — N. Hiraoka (Kobe Univ.)

Lunch (11:50-13:00)

(13:00-14:15) Chairman:T. Kondo (Tohoku Univ.)
Desire for High-Resolution Infrared SR-Spectroscopy — H. Nakagawa (Fukui Univ.)
Future Time-Resolved IR Experiments at UVSOR — E. Okamura (Kobe Univ.)
Time-Resolved Measurement in The Far-Infrared Region Using Synchrotron Radiation — T. Tahara (IMS)
Design and Testing of Tunable Diode Laser-Based IR Spectrometer for Protein Studies — T. Iwase, T.Ogura and T. Kitagawa (IMS)

Coffee break(14:15-14:30)

(14:30-15:50) Chairman: M. Kamada (IMS)
IR Application to Surface Science — M. Kawai (Riken)
EELS and IR at UVSOR — M. Sakurai (Kobe Univ.)
Spectroscopic Studies on Organic Superconductors — K. Yakushi (IMS)
Proposal of the Solid-State Spectroscopy by Combinational Use of SR and Laser-Induced FIR lights — N. Sarukura (IMS)

5.Free Discussion (15:50-16:30) Chairman: S. Kimura (IMS)
Remarks — M. Ikezawa (Tohoku Univ.)
S. Okuda (Osaka Univ.)

## General meeting of UVSOR USER'S GROUP*

16:00-19:00, 8 January, 1997 (at Tokyo University)

1. Present status and future prospects of UVSOR Facility
   (a) Overview about of UVSOR Facility and IMS
      i. Future plans of UVSOR and IMS .......................... N.Kosugi (IMS)
      ii. Present status of UVSOR -beam lines- ................. T.Kinoshita (IMS)
   (b) Renewal and improvements of beam lines
      i. BL6A1 ................................................................. H.Okamura (Kobe Univ.)
      ii. BL7B .................................................................. K.Fukui (Fukui Univ. & IMS)
2. General assembly of UVSOR USER'S GROUP
   (a) Reports
      i. Activity report for 1996
      ii. Status of registration for membership of UUG
   (b) Discussion
      i. about English name of this group
      ii. about preparation for the Articles of UUG
      iii. about next staffs of secretary board
      iv. about adoption system of proposals

* : The official English name of this group is not yet fixed.

A group of participants exercising the evacuation drill for a fire.

Dr. Michael Terekhin, Prof. M. Kamada, Dr. T. Gejo, Mr. S. Fujiwara, and Dr. Ufuktepe (left to right ) enjoying a welcome barbecue party.

# Organization and Users

# *Organization*

**Director**

| | | |
|---|---|---|
| N. Kosugi | Professor | kosugi@ims.ac.jp |

**Accelerator Staff**

| | | |
|---|---|---|
| H. Hama | Associate Professor | hama@kekvax.kek.jp |
| M. Hosaka | Research Associate | hosaka@ims.ac.jp |

**Beam Line Staff**

| | | |
|---|---|---|
| M. Kamada | Associate Professor | kamada@ims.ac.jp |
| T. Kinoshita | Associate Professor | toyohiko@ims.ac.jp |
| S. Tanaka | Research Associate | stanaka@ims.ac.jp |
| S. Kimura | Research Associate | kimura@ims.ac.jp |
| T. Gejo | Research Associate | gejo@ims.ac.jp |
| M. Watanabe | IMS fellow ( - Sep. 1996) | |

**Technical Staff**

| | | |
|---|---|---|
| O. Matsudo | SectionChief Engineer | matsudo@ims.ac.jp |
| T. Kinoshita | Unit Chief Engineer | kinosita@ims.ac.jp |
| M. Hasumoto | Engineer | hasumoto@ims.ac.jp |
| J. Yamazaki | Engineer | yamazaki@ims.ac.jp |
| E. Nakamura | Engineer | eiken@ims.ac.jp |

**Guest Scientist**

| | | |
|---|---|---|
| K. Fukui | Associate Professor | fukui@wbase.fuee.fukui-u.ac.j |
| A. Lushchik | Associate Professor | (- Sep. 1996) |
| M. A. Telekhin | Associate Professor | (Oct. 1996 - ) telekhin@ims.ac.jp |
| Y. Ufuktepe | Visiting Scientist | (Oct. 1996 - Feb. 1997) |
| S. Hirose | JSPS Research Fellow ( - Oct. 1996) | |

**Secretary**

| | | |
|---|---|---|
| H. Hagiwara | | hagiwara@ims.ac.jp |
| N. Onitake | | onitake@ims.ac.jp |

**Graduate Student**

| | | |
|---|---|---|
| N. Takahashi | | naoshi@ims.ac.jp |
| K. Kimura | | kmrkzhk@ims.ac.jp |
| K. G. Nath | | nath@ims.ac.jp |
| M. Ichikawa | | ichikawa@ims.ac.jp |
| S. Fujiwara | (October 1996 - ) | fujiwara@ims.ac.jp |

**Steering Committee (April 1996 - March 1997)**

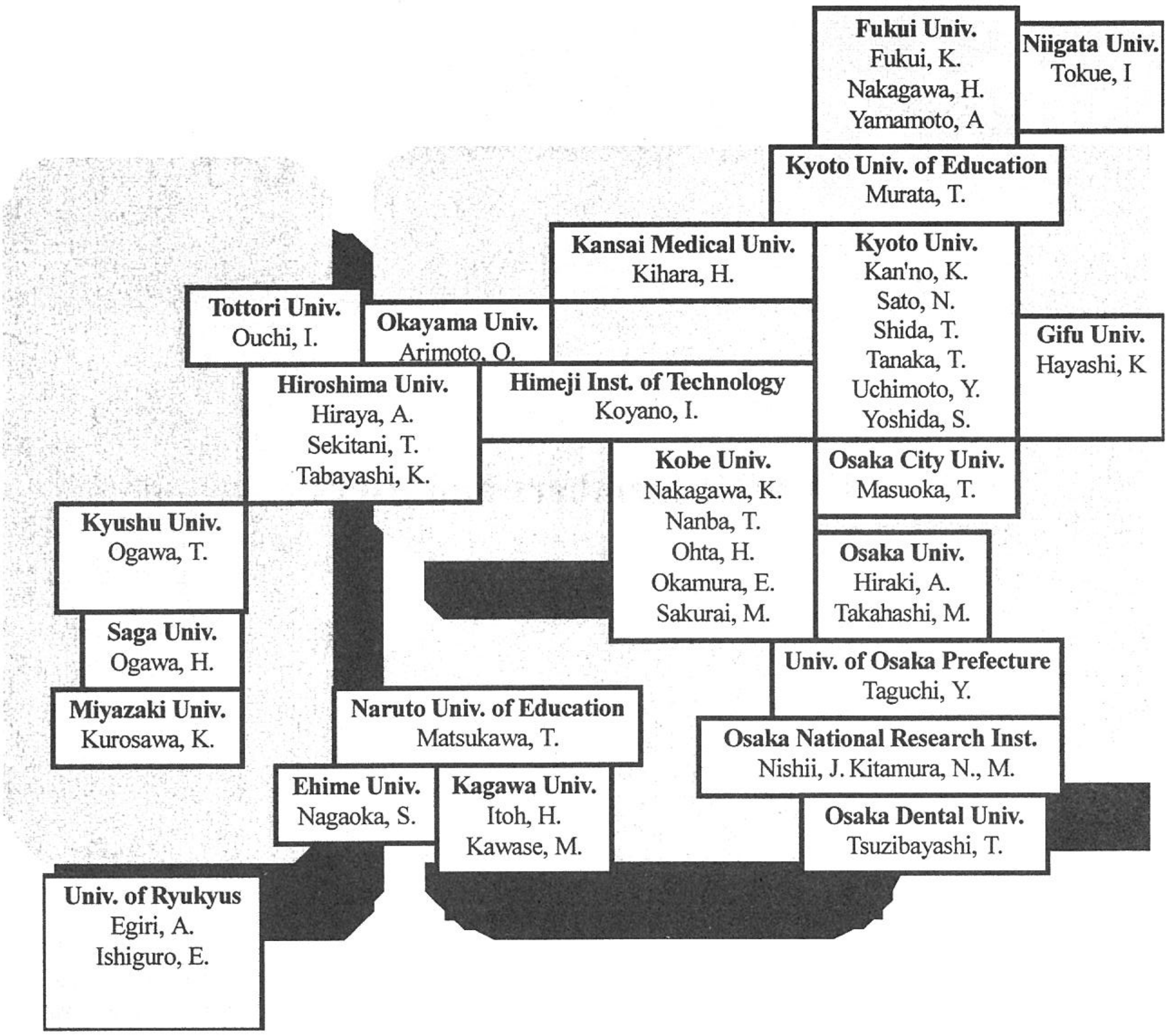
| | | |
|---|---|---|
| Nobuhiro | KOSUGI | IMS Chairman |
| Makoto | WATANABE | Tohoku Univ. |
| Motohiro | KIHARA | KEK |
| Yukihide | KAMIYA | Univ. of Tokyo |
| Toshiaki | OHTA | Univ. of Tokyo |
| Takatishi | MURATA | Univ. of Kyoto Edu. |
| Inosuke | KOYANO | Himeji Inst. of Technology |
| Kazuhiko | SEKI | Nagoya Univ. |
| Kazutoshi | FUKUI | Fukui Univ. |
| Shuji | SAITO | IMS |
| Yyuya | YAKUSHI | IMS |
| Toshinori | SUZUKI | IMS |
| Koichiro | MITSUKE | IMS |
| Masao | KAMADA | IMS |
| Toyohiko | KINOSHITA | IMS |
| Hiroyuki | HAMA | IMS |

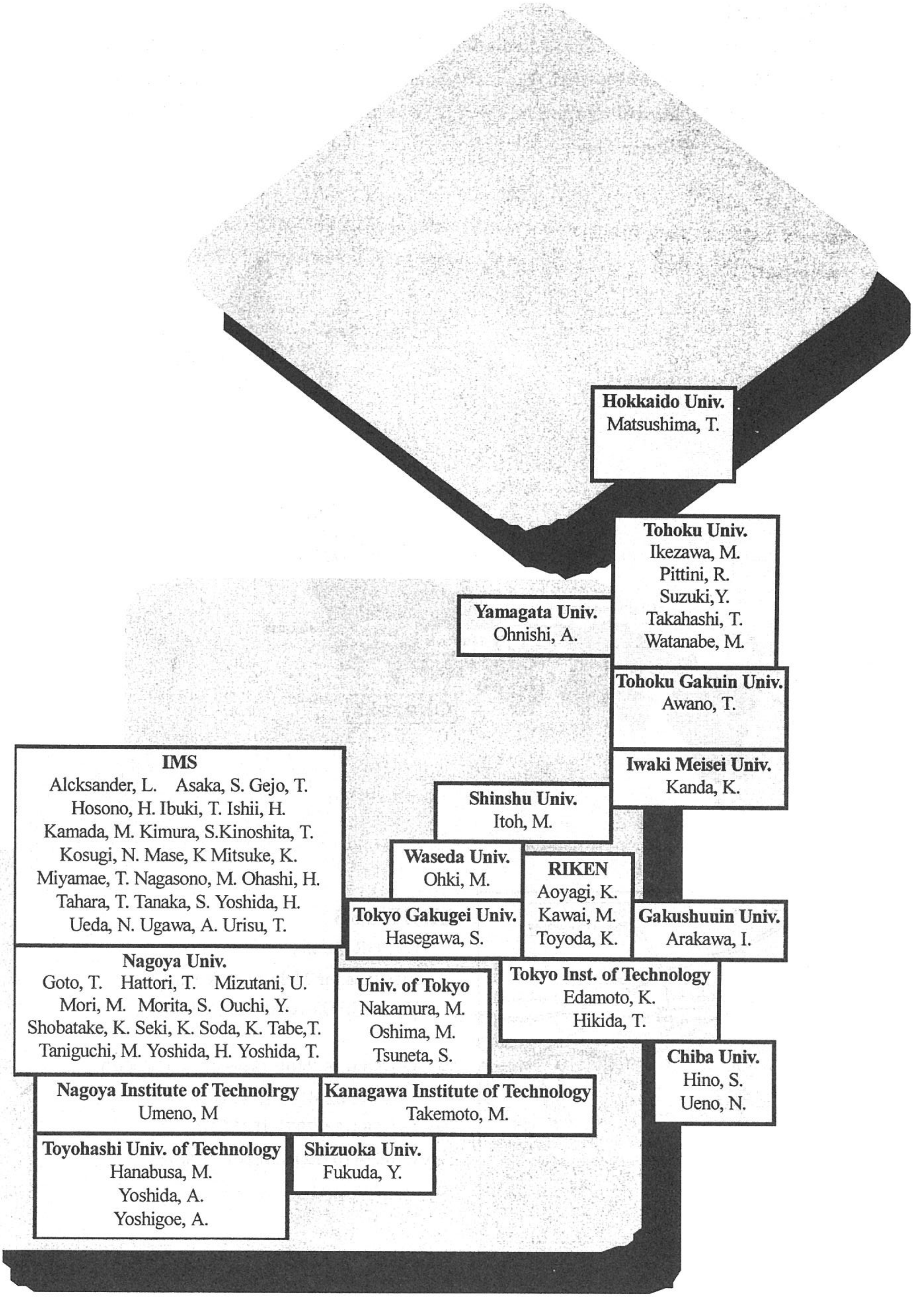
**Number of Joint Studies (fiscal year 1996)**

| | |
|---|---|
| Special Projects | : 3 |
| Cooperative Researches | : 23 |
| Cooperative Researches (Invited) | : 3 |
| User groups | : 149 |
| User groups from Private Company | : 1 |
| Workshops on beam lines | : 1 |
| Machine time for User | : 38 weeks |

**UVSOR members and users.**

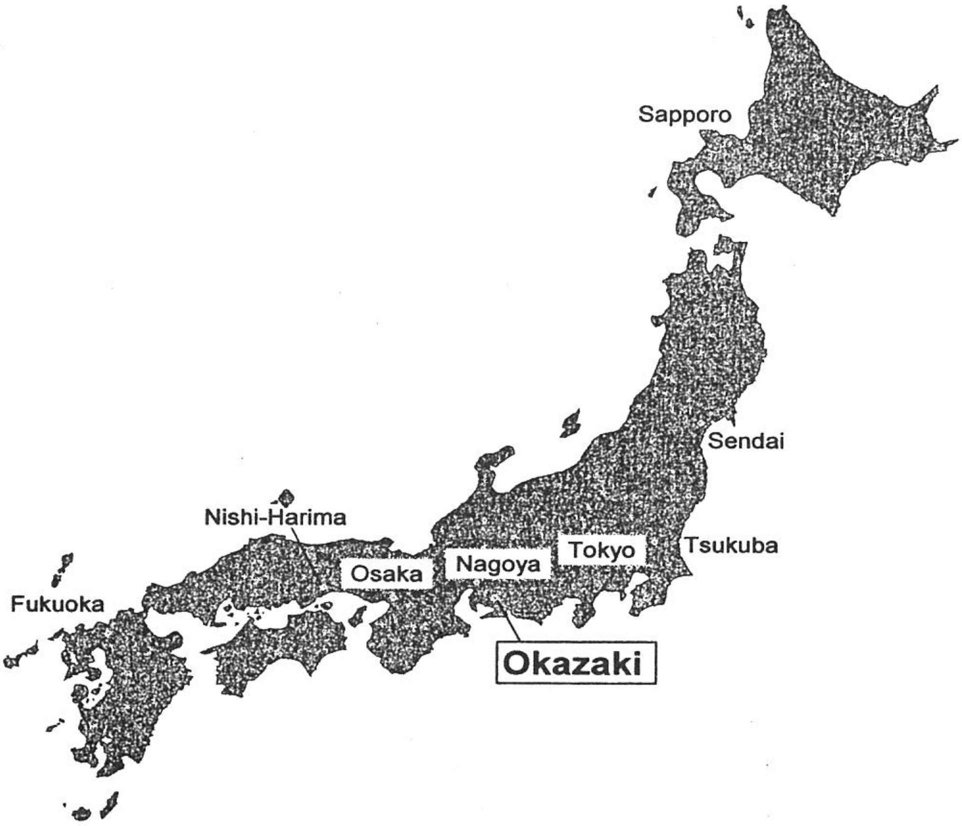
# *List of Representatives of UVSOR Users (Fiscal Year 1996)*

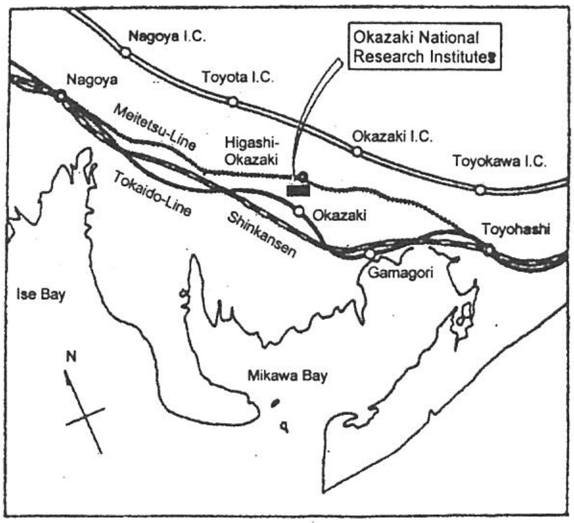



Hokkaido Univ.
Matsushima, T.
Tohoku Univ.
Ikezawa, M.
Pittini, R.
Suzuki,Y.
Takahashi, T.
Watanabe, M.
Yamagata Univ.
Ohnishi, A.
Tohoku Gakuin Univ.
Awano, T.
Iwaki Meisei Univ.
Kanda, K.
IMS
Alcksander, L. Asaka, S. Gejo, T.
Hosono, H. Ibuki, T. Ishii, H.
Kamada, M. Kimura, S.Kinoshita, T.
Kosugi, N. Mase, K Mitsuke, K.
Miyamae, T. Nagasono, M. Ohashi, H.
Tahara, T. Tanaka, S. Yoshida, H.
Ueda, N. Ugawa, A. Urisu, T.
Shinshu Univ.
Itoh, M.
Waseda Univ.
Ohki, M.
RIKEN
Aoyagi, K.
Kawai, M.
Toyoda, K.
Tokyo Gakugei Univ.
Hasegawa, S.
Gakushuuin Univ.
Arakawa, I.
Nagoya Univ.
Goto, T. Hattori, T. Mizutani, U.
Mori, M. Morita, S. Ouchi, Y.
Shobatake, K. Seki, K. Soda, K. Tabe,T.
Taniguchi, M. Yoshida, H. Yoshida, T.
Univ. of Tokyo
Nakamura, M.
Oshima, M.
Tsuneta, S.
Tokyo Inst. of Technology
Edamoto, K.
Hikida, T.
Chiba Univ.
Hino, S.
Ueno, N.
Nagoya Institute of Technolrgy
Umeno, M
Kanagawa Institute of Technology
Takemoto, M.
Toyohashi Univ. of Technology
Hanabusa, M.
Yoshida, A.
Yoshigoe, A.
Shizuoka Univ.
Fukuda, Y.

## LOCATION

Ultraviolet Synchrotron Orbital Radiation (UVSOR) Facility, Institute for Molecular Science (IMS) is located at Okazaki. Okazaki (population 320,000) is 260 km southwest of Tokyo, and can be reached by train in about 3 hours from Tokyo via New Tokaido Line (Shinkansen) and Meitetsu Line.




## ADDRESS

UVSOR Facilty
Institute for Molecular Science
Myodaiji, Okazaki 444, JAPAN

Tel +81-564-55-7402 (Secretary, UVSOR)
+81-564-52-6101 (UVSOR)
Fax +81-564-54-7079 (UVSOR)
Telex 4537475 KOKKEN J (IMS)