ISSN 0911-5730
UVSOR-23
April 1996

UVSOR

ACTIVITY REPORT

1995

UVSOR

Ultraviolet Synchrotron Orbital Radiation Facility
Institute for Molecular Science

UVSOR

CONTENTS

Appendix

PREFACE

This is the Activity Report for 1995 reporting the research activities at the UVSOR facility in the Institute for Molecular Science (IMS).

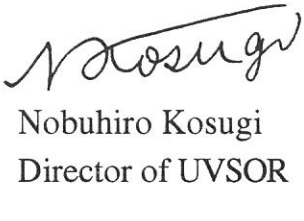
UVSOR has reached its limit of capacity. We have started to discuss the next 10 years and recently have reached four future plans as follows:

(1) Development of highly competitive beamlines to focus on the strengths of UVSOR
(2) Development of new molecular sciences by combining two powerful light sources in chemistry, synchrotron radiation and laser
(3) Construction of new instruments using 3rd generation light sources outside of UVSOR
(4) Construction of a next ("4th") generation storage ring named UVSOR II

Some of activities towards these futures will be found in the present issue. Especially, the plan (1) is now going on well with financial support of the Ministry of Education, Science, Sports and Culture (Monbusho). The plan (2) is just started by some research groups of the UVSOR facility and the Department of Vacuum UV Photoscience in IMS. The plans (3) and (4) are not yet settled. We are making further efforts to confirm and realize the future plans. The future of UVSOR is also heavily dependent on support and understanding by the communities of synchrotron radiation science and molecular science.

In October 1995 Mr. Kusuo Sakai of the technical division was promoted to a technical division head of all the technical staff in IMS, and we could have Dr. Masahito Hosaka as a new research associate of the light source division after Dr. Hiroyuki Hama was promoted to an associate professor, but Dr. Atsunari Hiraya of the beamline division moved as an associate professor to the Hiroshima University to join in the HiSOR project. Fortunately, in April 1996, we will have Dr. Tatsuo Gejo as a new research associate of the beamline division.

January 1996



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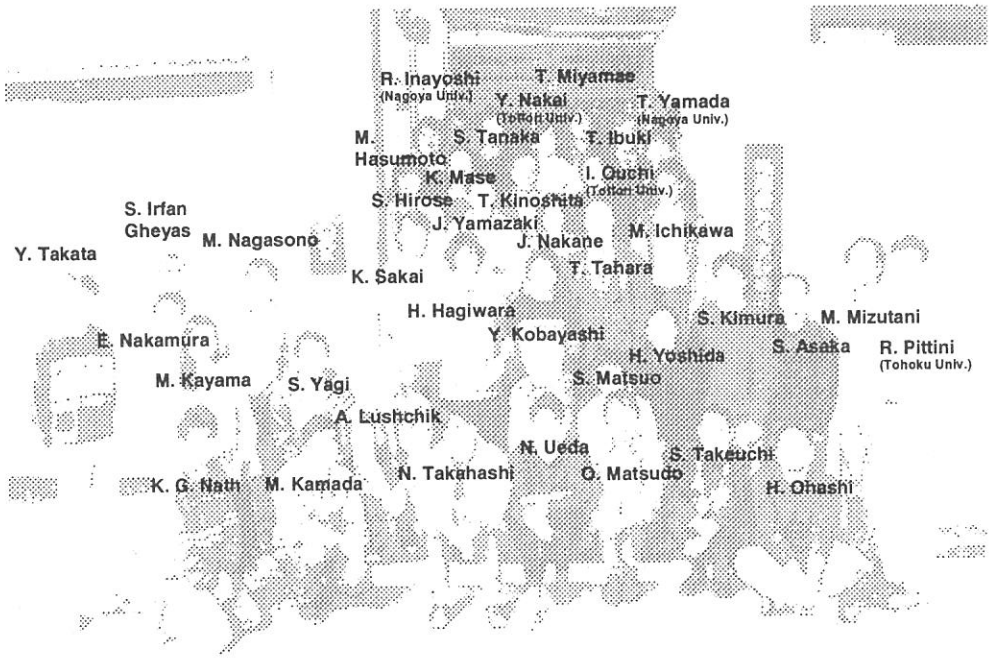
ACKNOWLEGEMENT

The editors would like to thank Ms. Hisayo Hagiwara, staff and beam line masters of the UVSOR facility for their help in editing this issue.



UVSOR members and users.

Current Status of Light Source and Beam Lines

Status of the UVSOR Accelerator Complex in 1995

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

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1. General

In spite of long shut-off for one month in Spring, 1995, the UVSOR accelerator complex has been running without fatal trouble, and scheduled machine times were consumed properly. As shown in Fig. 1(upper), total operation time has reached 2300 hours in end of December, and is expected to be over 3000 hours in end of the fiscal year 1995. In the long shut-off term, vacuum valves were put in the storage ring chamber and most of parts of it replaced with new ones that were made for convenience of baking system. Those modifications will assist future minor changes of the storage ring. Re-commissioning of whole system was started in end of March, and it took more than one month to recover the operation condition of the light source. However the vacuum had recovered quickly, and reached 2×10^{-9} torr in beam storage of 150 mA as shown in Fig. 1(lower). The user machine time commenced on May-16, and then in Summer season, the storage ring got back almost same performance as before shut-off. The partial filling operation (among 16 harmonics, 14 bucket are filled) was started in end of July. Although the vacuum had not recovered completely, the beam size variation due to ion-trapping effect became to be almost eliminated by this operation mode. In December, the full bunch operation was again applied because of specific reason of one of user experiments.

The wiggler operation has started from the last week of December. The beam injection scheme was a bit improved by modifying bump orbit and transport orbit, then we obtain the injection rate of 2 times faster than previous operation. There has been no serious trouble in the 750 MeV normal operation with the wiggler at 4 T excitation. However because of the beam orbit change mentioned in followings, additional machine study time for complicate orbit correction was required. Precise report on the investigation of lattice distortion and other problems in the wiggler operation is able to be found in this issue.

2. COD correction

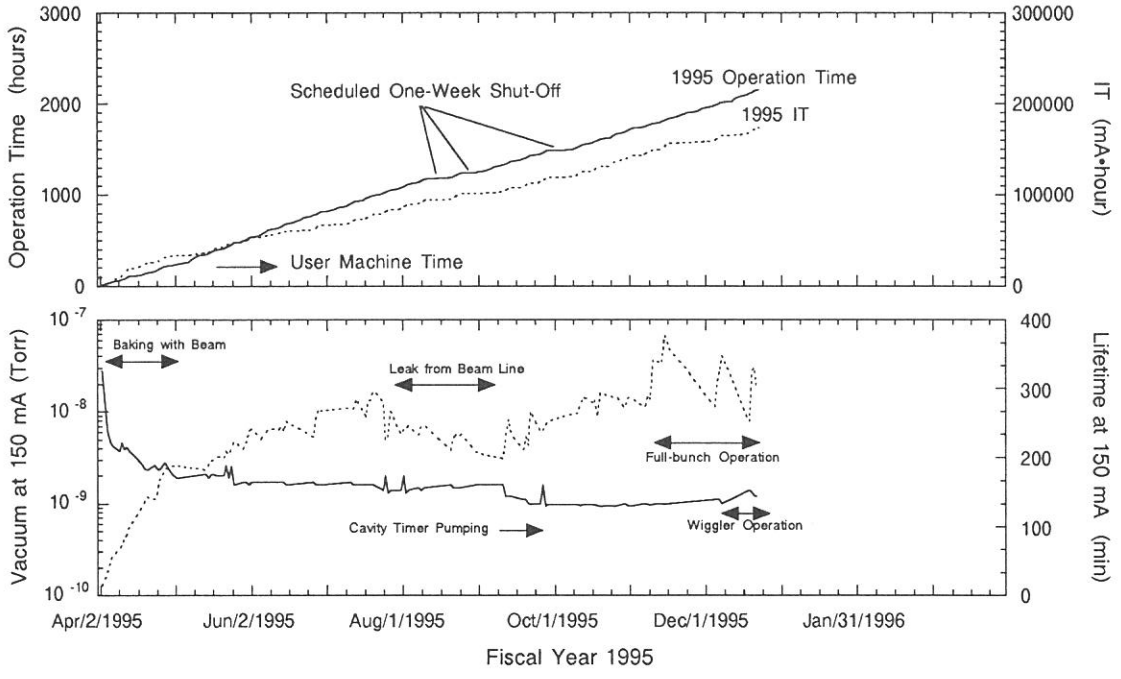


Fig. 1. Progress of operation time of the storage ring, and integrated beam current (IT) in fiscal year 1995 (upper). Progresses of vacuum recovery and beam lifetime at 150 mA storage are shown in lower figure.

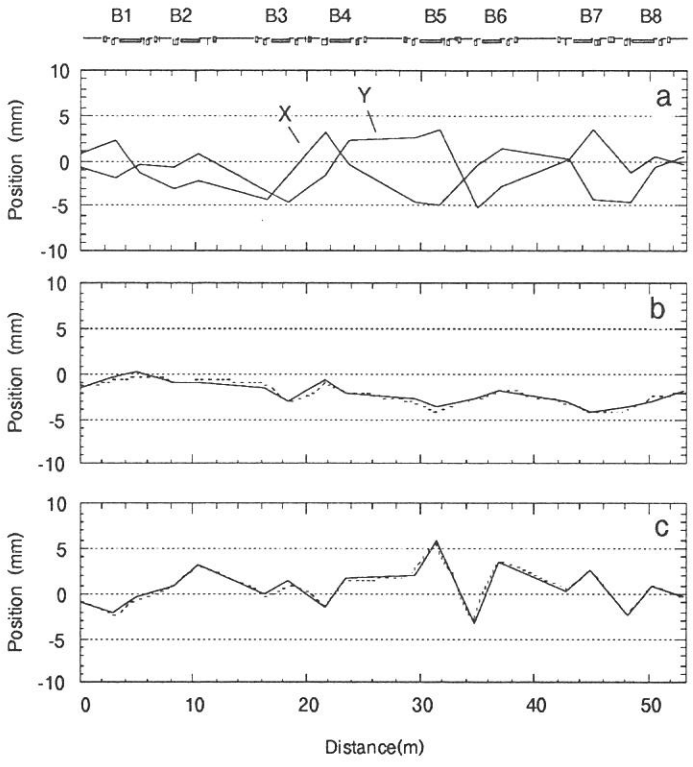


Fig. 2 Beam orbits at 750 MeV operation. a) the previous orbit before shut-off, b) present orbit in horizontal plane and c) that in vertical plane. Dotted line in b) and c) represents corrected orbit for 4 T wiggler operation.

The biggest change should be reported is the beam orbit correction. Because whole multipole magnets in the storage ring were removed and re-installed to change the vacuum pipes, then alignment of the magnets was slightly deviated from that before shut-off. The default orbit was therefore renewed as shown in Fig. 2b and c. In the wiggler operation, because the distortion of the beta function is very large (particularly in vertical plane), the orbit was much changed. It had to be measured the transfer matrix of the beam orbit in the wiggler operation for every steering magnet and trim coil in the dipole magnet. Then the orbit was successfully corrected as shown in Fig. 2.

Since a large amount of the COD may spoil the beam quality such as the lifetime and radiation from insertion devices, study of orbit correction will be continuously carried out. Radiation from a new helical undulator, which will be installed in March, 1996, is expected to be very sensitive to the beam orbit because a good region of helical magnetic field in the undulator is vary limited. An on-line software for beam correction is, therefore, highly desired.

3. Troubles

Hardware troubles on the synchrotron are always bothering stable operation of the accelerator complex. Because of very old electrical devices of the synchrotron controller, the acceleration pattern of the dipole magnets of the synchrotron had been slipped from the reference pattern. Fortunately the beam was able to be accelerated by adjusting the timings to appropriate beam energies of the injection and the extraction. However it took about one month to fix this trouble. Counter-plan against deterioration of old electrical parts is continuously under way. We hope to sweep this kind of troubles away in 1996.

Another big trouble occurred on a power supplier of a kicker (bumper) magnet in the storage ring. An electrical switching circuit for production of high voltage short pulse was misfired due to defective parts. It was fixed by replacing it with an used one. Because everything has become old, it is very difficult to obtain specific parts of such devices. Along with making effort to secure such parts, those devices should be replaced by manufacturing new ones.

4. Summary

The 13-year-old machine is still working very well. Many devices have been improved and also unique systems have been introduced such as the double-cavity system and the superconducting wiggler. Basic research work of free electron laser on the storage ring is also developed. In addition to those, investigation of the storage ring in view of the accelerator physics is also developed. Local beta functions was measured recently, and linear lattice functions of various operating points and energies have become to be calculable properly. These works are believed to be very important to keep competitive performance and continuous development of the UVSOR.

ACCELERATOR COMPLEX

Injection Linac

Energy	15 MeV
Energy Spread	~ 1.6 MeV
Frequency	S-band 2.856 Hz
Acceleration	$2\pi/3$ 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

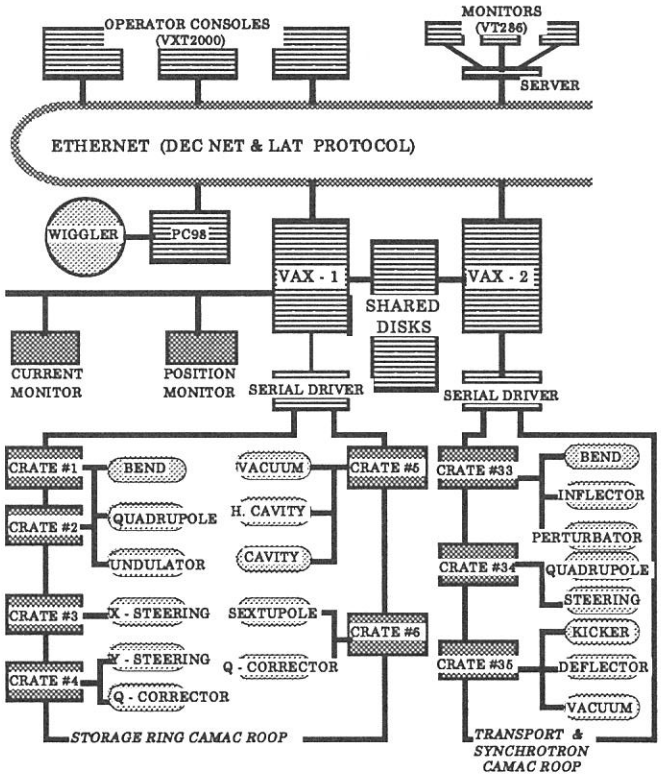
Higher - Harmonic Cavity	3 × 90.115 Mhz
Superconducting Wiggler	4 T (maximum)
Undulator	for SR
Optical Klystron	for FEL

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
	GPIB for Beam Monitors
	RS232C for Host CPU of Wiggler
Languages	FORTRAN, C, Pascal



Scheme of Accelerator Control System "UCOSS"

Beam Lines in 1995

Masao Kamada

UVSOR Facility, Institute for Molecular Science

In 1995, nineteen beam lines were operational. The open beam lines (1B, 2B1, 3A1, 3A2, 5B, 6A1, 7A, 7B, 8A, and 8B1) were used by 110 outside groups and 21 users in IMS. The in-house beam lines (1A, 2A, 2B2, 3B, 4A, 4B, 6A2, 6B, and 8B2) were used by the groups in IMS and 24 outside groups. The beam line schedules in 1995 are listed in the following tables shown in Japanese.

During a Spring shutdown, the first Front-end manual valve at beam lines (3B, 5A, 5B, 6B, 7A, 8A, and 8B) was replaced by a new one, since it could not keep the pressure of the first pre-mirror chamber in the low of 10^{-6} Torr range when the storage ring was in the atmosphere.

Users introduced an air into a Seya-Namioka monochromator chamber at BL1B in July. Also, post-mirrors have been contaminated by user's samples. Then, gratings and a post-mirror were replaced by new ones during a tight schedule of this beam line.

There were a few accidents about air-leak at BL5B in 1993-1994, and then the slide bearings of the grating and mirrors in a plane-grating monochromator were destroyed completely. The gratings and mirrors as well as bearings were replaced by new ones in 1995. The output from the PGM became intense as same as that obtained just after the construction.

There was a big energy gap between far-infrared and visible regions in UVSOR beam lines. This gap has restricted users to get useful spectra in a wide energy region. In 1995, a new FT-IR interferometer was purchased from a Brucker Co. Ldt. An additional beam line system including diamond windows and mirrors was constructed at BL6A1. The combinational use of the new FT-IR and a present FT-FIR systems provides good performance in the wide wavelength region from 1 mm to 1μm. The time-resolved spectroscopy is now available in IR region.

The gratings of a Seya-Namioka monochromator at BL7B became dirty due to contaminations, and were replaced by new ones. The post-mirror mechanism was also improved to exchange two different focusing mirrors. However, the exchange mechanism of the gratings didn't work well in recent years, and then the output performance became worse for users. According to the conclusion of the hot discussion about the future plans of VUV science in the 1994 workshop, the Seya-Namioka monochromator at BL7B, which is one of the oldest monochromators in UVSOR, is going to be scrapped and be replaced by a 3-m Normal-Incidence Monochromator this year.

A double-crystal monochromator (BL7A) was moved to a Wiggler line in December to use soft x-rays up to 5.5 KeV. A TMP system was installed to the monochromator chamber to make it easier to exchange crystals. A 15-m CDCL-SGM at BL8B1 was finely adjusted to get high-resolution spectra in gas phase and was opened for users. The driving guide to exchange three gratings was also improved. All of gratings and mirrors as well as driving motors were renewed at BL8B2.

A new beam line for the use of circularly polarized lights from a new helical undulator was constructed at BL5A, where the first output was obtained this January. Besides, two construction plans started at BL4A and 7B, and one more plan is ready to start at BL2B2.

Since Dr. Hiraya moved to Hiroshima Univ. and Mr. Sakai became a head of technical division in IMS, organization of the station master at open beam lines changed as shown in the followings. The persons who wish to use the open and in-house beam lines are recommended to contact with the station master or supervisor and the representative, respectively.

Table I. List of station masters at 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	S. Kimura	T. Kinoshita
5B	S. Kimura	H. Hasumoto	T. Kinoshita
6A1	O. Matsudo	S. Kimura	M. Kamada
7A	O. Matsudo	T. Kinoshita	T. Kinoshita
7B	T. Kinoshita	M. Hasumoto	T. Kinoshita
8A	T. Kinoshita	E. Nakamura	T. Kinoshita
8B1	E. Nakamura	T. Kinoshita	T. Kinoshita

Table II. List of representatives at 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

Beam lines of UVSOR

Beam Line	Monochromator, Spectrometer	Wavelength Region	Acceptance Angle (mrad) Horiz.	Vert.	Experiment
BL1A	Double Crystal	2.1 - 0.3 nm	4	1	Solid (photoemission)
BL1B	1-m Seya-Namioka	650 - 30 nm	60	6	Solid (absorption)
BL2A	1-m Seya-Namioka	400 - 30 nm	40	6	Gas (absorption)
BL2B1	2-m Grasshopper	60 - 1.5 nm	10	1.7	Solid & surface (photoemission)
BL2B2	1-m Seya-Namioka	200 - 30 nm	20	6	Gas (photoionization, photodissociation)
BL3A1	None (Filter, Mirror)		(U) 0.3	0.3	Solid & irradiation (photodissociation)
BL3A2	2.2-m Constant Deviation Grazing Incidence	100 - 10 nm	10 (U) 0.3	4 0.3	Gas & solid (photoionization & photodissociation)
BL3B	3-m Normal Incidence	400 - 30 nm	20	6	Gas (photoemisison)
BL4A	None		6	6	Irradiation
BL4B	None		8.3	6	Irradiation
BL5A	None SGM-TRAIN	 250 - 5 nm	(OK) 10	 3	FEL Solid (photoemission)
BL5B	Plane Grating	200 - 2 nm	10	2.2	Calibration, gas (photodissociation) & solid (absorption)
BL6A1	Martin-Puplett FT-IR Michelson FT-IR	3000 - 30 μm 100 - 1 μm	80 80	60 60	Solid (absorption)
BL6A2	Plane Grating	650 - 8 nm	10	6	Solid & surface (photoemission)
BL6B	FT-IR	200 - 1.7 μm	70	25	Solid (absorption)
BL7A	Double Crystal	1.5 - 0.8 nm 1.5 - 0.2 nm	2 (W) 1	0.3 0.15	Solid (absorption)
BL7B	1-m Seya-Namioka	650 - 30 nm	40	8	Solid (absorption)
BL8A	None (Filter)		25	8	Irradiation & user's Instrum.
BL8B1	15-m Constant Deviation Grazing Incidence	40 - 2 nm	10	1.5	Gas & solid (absorption)
BL8B2	Plane Grating	650 - 8 nm	10	6	Solid (photoemission)

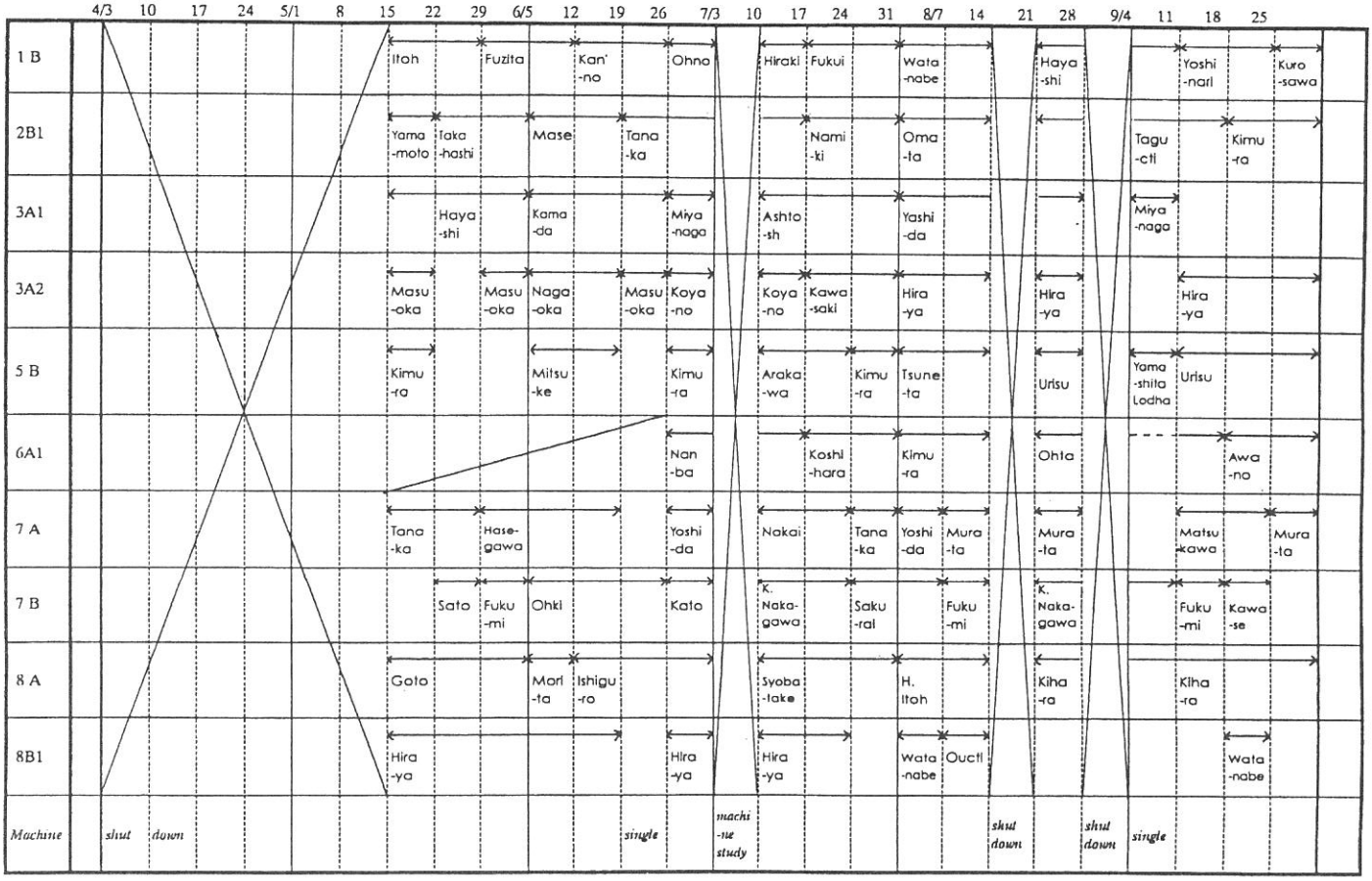
SGM-TRAIN: spherical grating monochromator with translating and rotating assembly including normal incidence mount

U: with an undulator

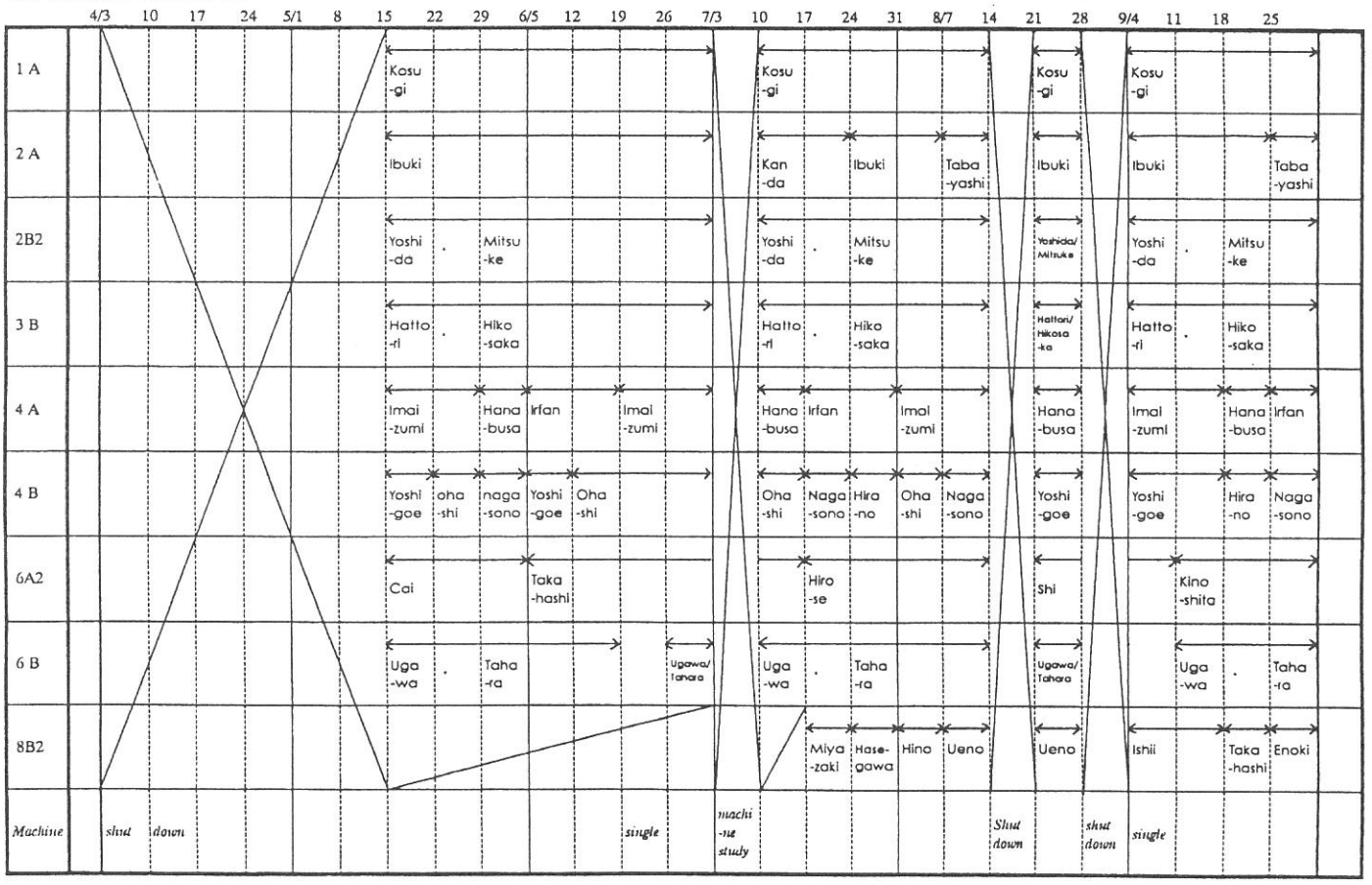
W: with a wiggler

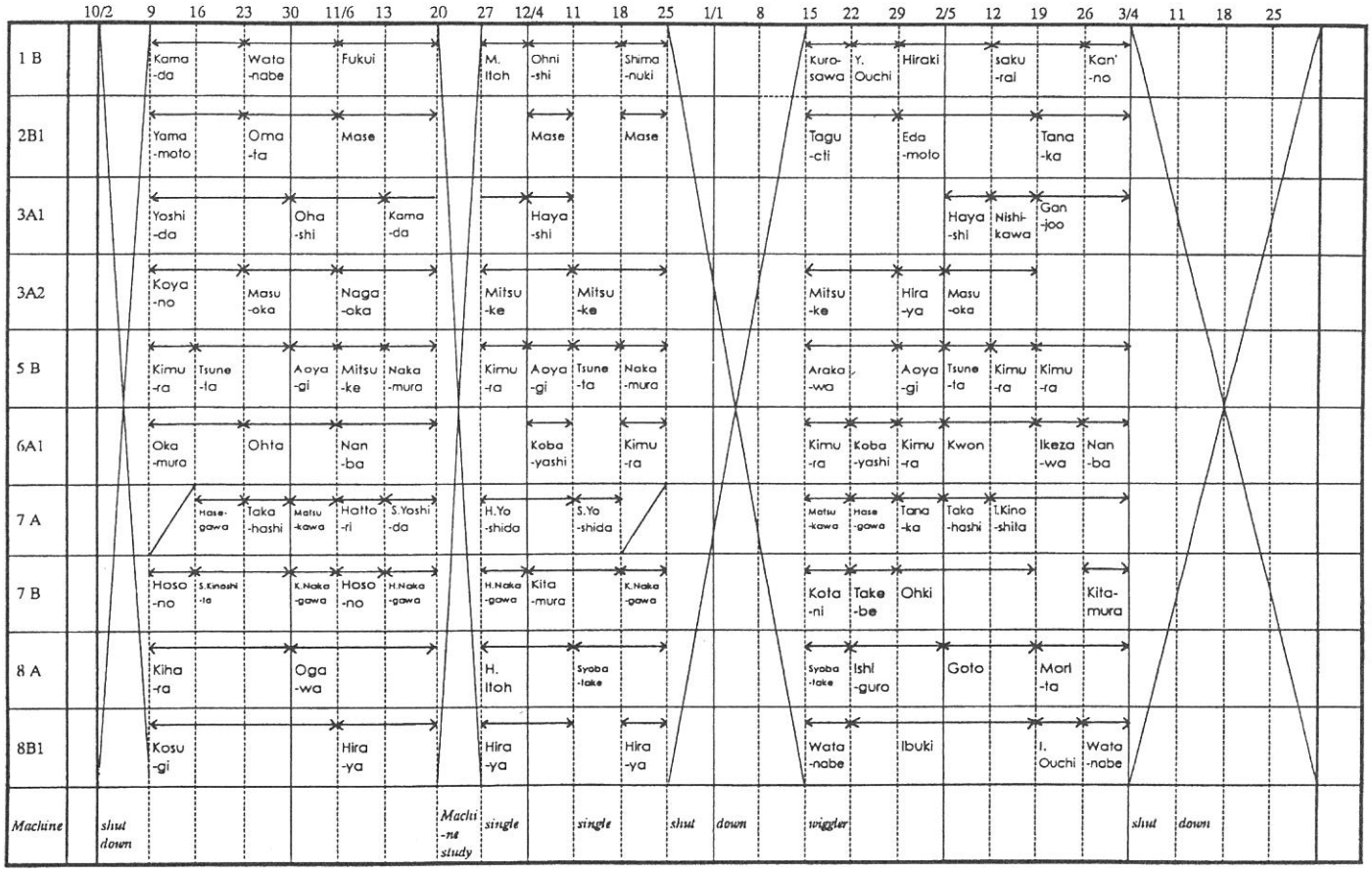
OK: with an optical klystron

Open beam lines



In-house beam lines

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1 B
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Wata -nabe
Fukui
M. Itoh
Ohni -shi
Shima -nuki
Kuro- sawa
Y. Ouchi
Hiraki
saku -rai
Kan' -no
2B1
Yama -moto
Oma -ta
Mase
Mase
Mase
Tagu -chi
Eda -moto
Tana -ka
3A1
Yoshi -da
Oha -shi
Kama -da
Haya -shi
Haya -shi
Nishi- kawa
Gan -joo
3A2
Koya -no
Masu -oka
Naga -oka
Mitsu -ke
Mitsu -ke
Mitsu -ke
Hira -ya
Masu -oka
5 B
Kimu -ra
Tsune -ta
Aoya -gi
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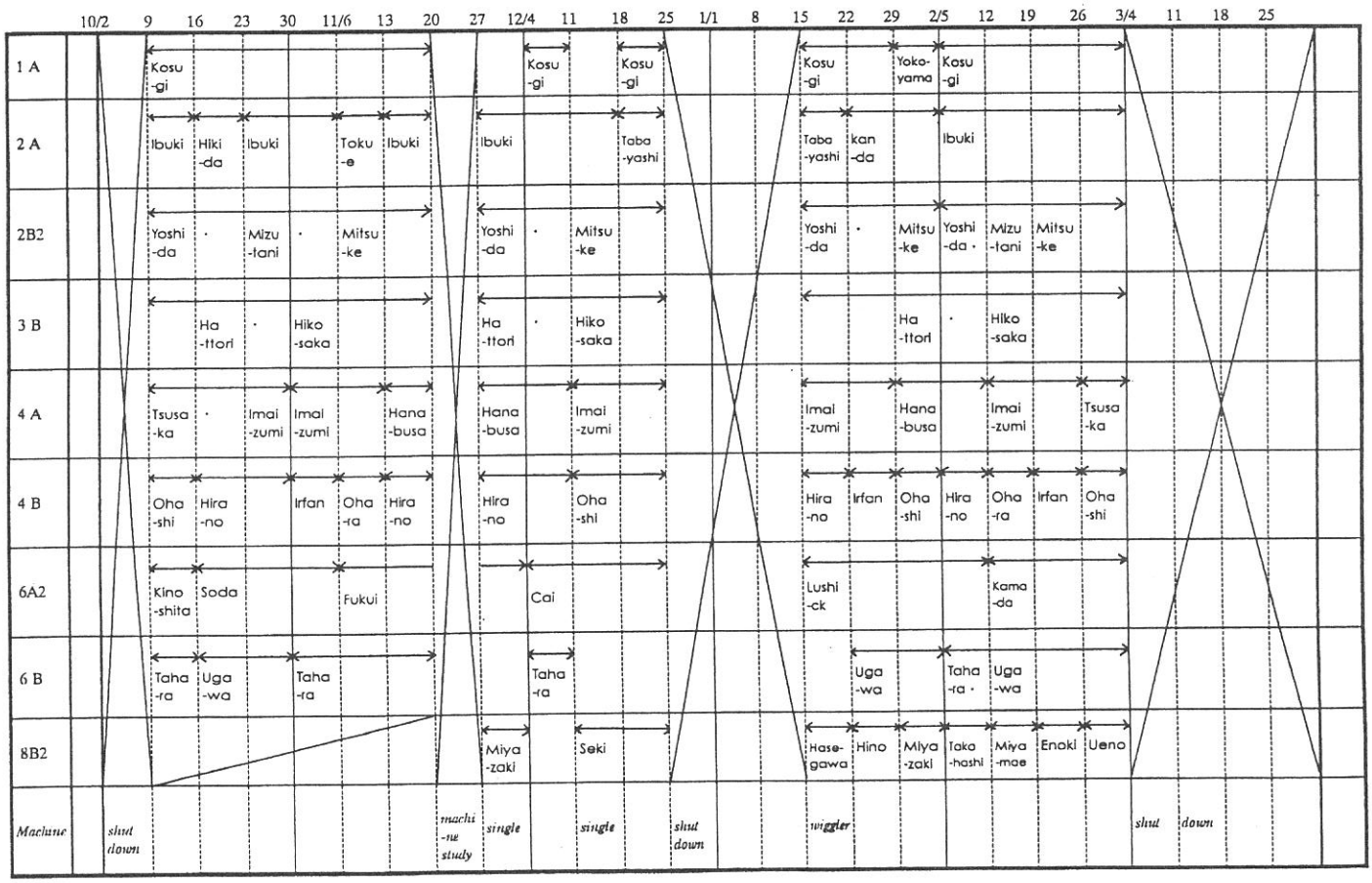
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Taka -hashi
Miya -mae
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BL1A Soft X-Ray Beamline for Photoemission-Photoabsorption Spectroscopy

BL1A is a soft x-ray beamline for photoemission-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. The throughput spectra of the beryl ($10\bar{1}0$) and InSb (111) crystals are shown in Fig.1. In the energy range from 830 to 1800 eV, a pair of beryl crystals is used with the typical energy resolution ($E/\Delta E$) of 1500. Beryl is known to be damaged easily by x-ray irradiation. The beam intensity from fresh beryl crystals is reduced to about 60% of the initial value and the energy width is broadened by about 20 % after 8 hours irradiation. In order to obtain reliable spectra, the irradiation area on the first monochromator crystal is changed every day by moving the crystal position, and a fresh crystal surface is obtained by polishing every week.

For photoemission-photoabsorption spectroscopy, an ultra-high-vacuum (UHV) apparatus is connected. The apparatus is equipped with a high-performance electron analyzer (SES-200) manufactured by SCIENTA. The detailed design and performance have been described elsewhere[2]. Using the apparatus, resonant photoemission spectra for solid samples can be obtained. The soft x-ray absorption spectra can be measured in the electron and fluorescent x-ray yield modes.

References

[1] A.Hiraya et al., Rev. Sci. Instrum.,**6 3** (1992) 1264.

[2] Y.Takata et al., UVSOR Activ. Rep., (1995) 24.

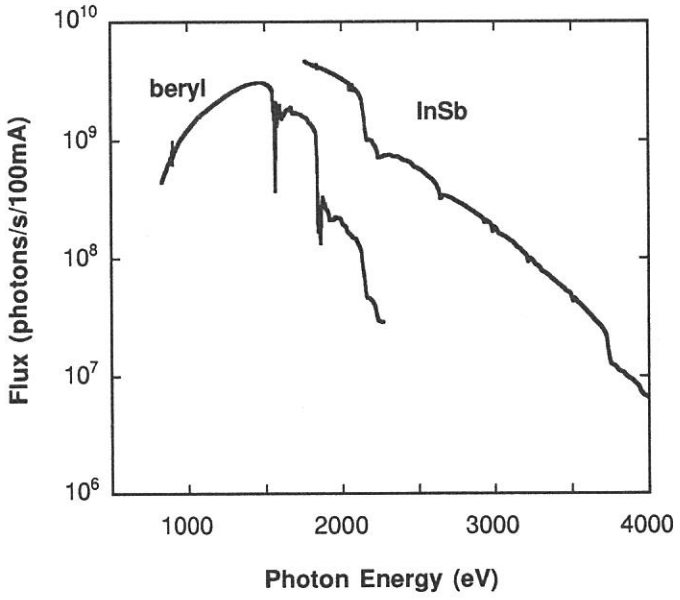


Fig.1. Throughput spectra of the double crystal monochromator at the BL1A measured by using a Si photodiode.

BL1B and BL7B: Seya-Namioka Monochromator

BL1B and 7B are beamlines for standard optical measurements in the visible to vacuum ultraviolet region. There in no particular difference among these two beamlines. The multipurpose UHV chamber is nstalled at the focal point of the Seya-Namioka monochromator. It is easy to handle and obtain optical spectra (absorption, reflection, emission, and excitation, etc.). Samples usually measured are solids, but it is possible to measure the liquid, gases, and biological samples with a LiF window.

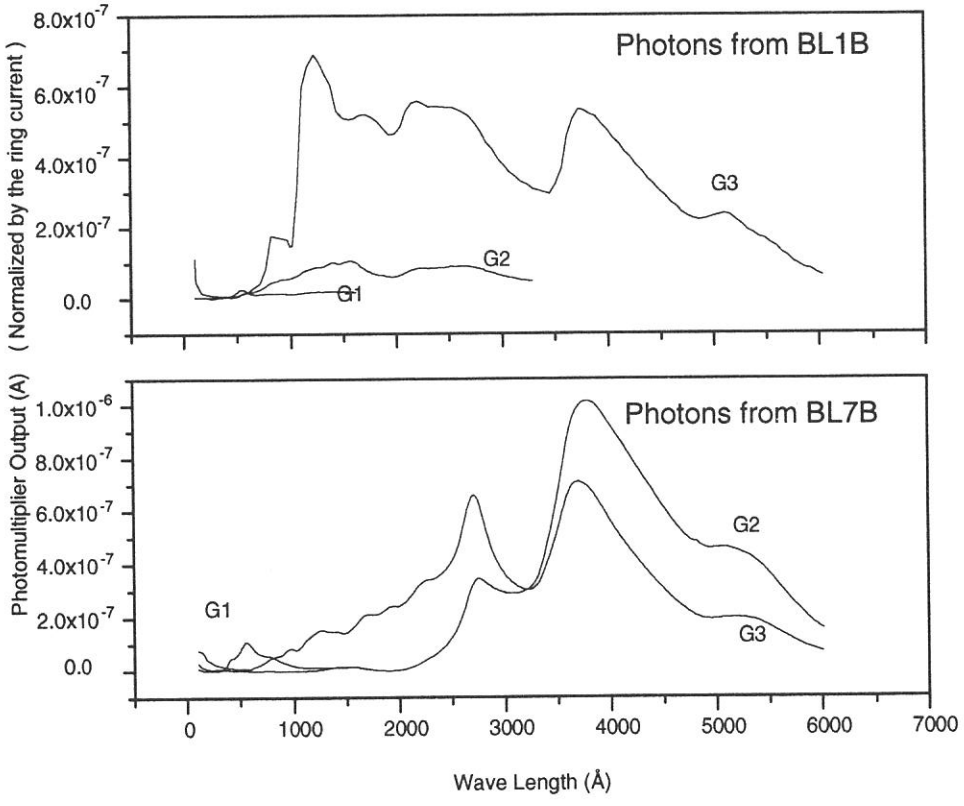
These can also be used for the time-resolved measurements, for instance, an investigation about lifetime of luminescence, when the UVSOR storage ring is operated in the single-bunch mode.

Gratings	:G1;2400, G2;1200, G3;600 /mm
	(Changeable in the vacuum)
Spectral range	: 300 ~ 6500 Å
Resolution	: ~1 Å
Period	: 178 ns (Single bunch operation)
Bunch length	: 0.4 ns (Single bunch operation)

Table 1

Summary of the specification are listed in Table 1. It is noted that the No.2 grating (G2) in BL7B have been 600 /mm in spite of 1200/mm since January 1994.

The overall spectra from the monochromators are shown below.



BL2A Gas Phase Photoabsorption and Fluorescence Spectroscopy

Gaseous sample in a cell or effusive jet can be measured. The primary photons of 40-200 nm are dispersed by a 1-m Seya monochromator with a grating blazed at 96 nm. The spectral resolution is $E/\Delta E \approx 1000$ at 100 nm. Higher order light in the 80-120 nm region is suppressed by employing 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. At the $105<\lambda<200$ nm range a LiF window is used (fig. 2). Absolute photoabsorption cross section, fluorescence excitation spectra, dispersed fluorescence, and emission polarity are measured on BL2A beamline. A typical experimental results obtained are shown in fig. 3.

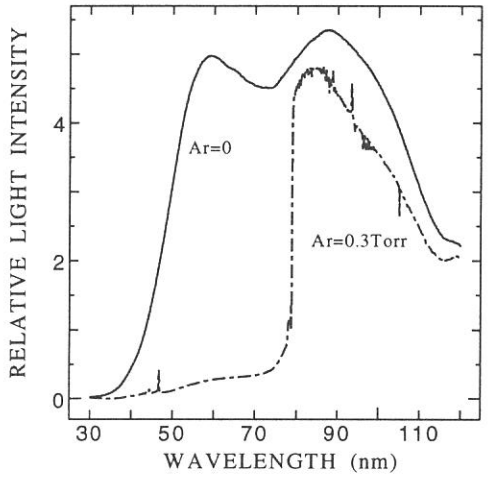


Fig. 1 Transmitted I_0 intensities with and without Ar.

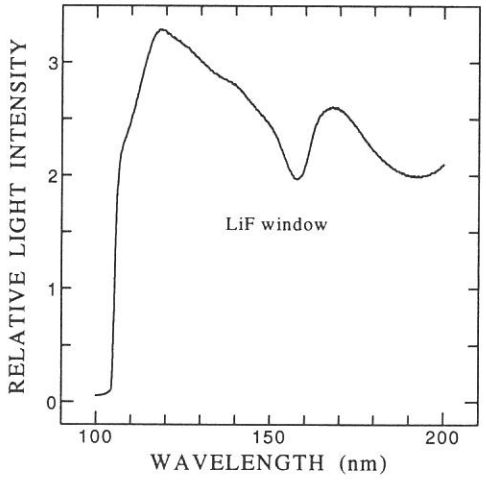


Fig. 2 Transmitted I_0 intensity through a LiF window.

In the single bunch mode operation of synchrotron radiation with the period of 178 ns, a radiative lifetime is measurable.

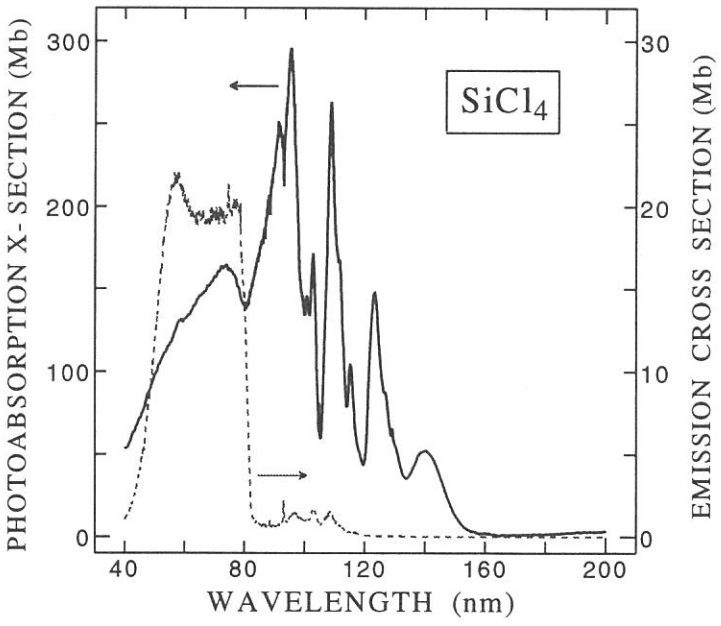
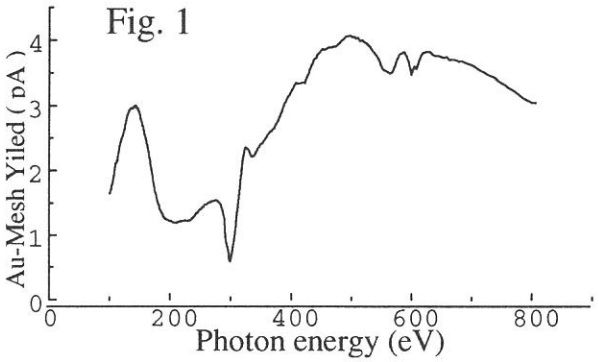


Fig. 3 Total photoabsorption and fluorescence cross sections of $SiCl_4$.

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. Three kinds of grating are prepared (600, 1200, 2400 l/mm), and 2400 l/m has been installed since April 1994. The energy range for this grating is from 95 eV to 1000 eV. 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. The dip around 300 eV is due to carbon contamination of optical elements.

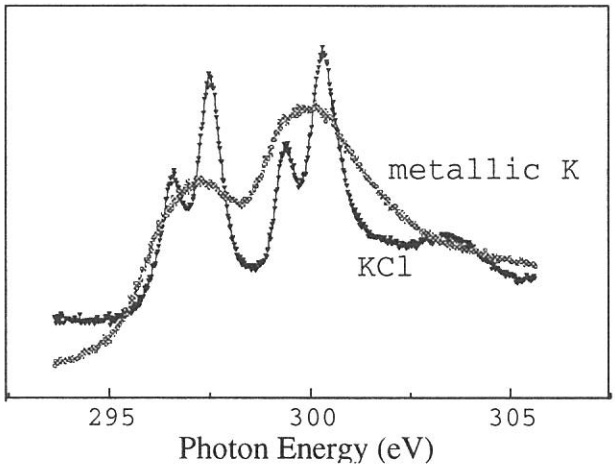
Fig. 1



The analyzing chamber is installed at the focusing point of the monochromized light. The pressure is less than $1x10^{-10}$ Torr. A double-pass CMA with a coaxial electron gun, 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 'in-situ' measurements in the analyzing chamber. 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 treatment (e.g. cleaving, filing, and deposition) can be made.

Figure 2 shows an example of spectra measured at BL2B1. These are K-$L_{2,3}$ edge absorption spectra of KCl and metallic K films deposited on the sample holder made of Mo. Spectra are measured via a partial photoelectron yield by the use of the CMA. The spin-orbit splitting (L_2 and L_3) of the initial state of metallic K and KCl are clearly observed, and the splitting due to the final state of KCl are also clearly observed.

Fig.2 K-$L_{2,3}$edge



BL2B2 Vacuum UV Beamline with Seya-Namioka Monochromator for Photoionization and Photodissociation Spectroscopy

A 1m Seya-Namioka Monochromator is installed at the bending-magnet beamline BL2B2 for the study of photoionization and photodissociation of molecules and clusters [1]. A schematic layout of the monochromator is shown in Fig. 1. The optical system consists of three prefocussing mirrors, a monochromator, and a refocussing mirror. The monochromator covers the energy range of 8-40 eV with a Pt-coated 2400 lines/mm grating (a blaze wavelength of 380 Å). Typical wavelength resolution is 0.8 Å (FWHM). Figure 2 shows the throughput spectrum of the monochromator measured by using a sodium-salicylate phosphor/photomultiplier combination. A sample gas is expanded from a nozzle of 100-μm diameter and a molecular beam is introduced through a skimmer into photoionization chamber. The beam intersects at 90° with the monochromatized photon beam. Produced ions are mass analyzed by a time-of-flight or a quadrupole mass spectrometer. Threshold electrons are detected through a threshold-electron analyzer. We can perform several coincidence spectroscopy such as TPEPICO (Threshold-photoelectron-photoion coincidence) [2] and PINICO (Positive ion-negative ion coincidence) [3,4]. This beamline will be rebuilt as a VUV and soft X-ray type which is equipped with an 18m spherical grating monochromator (SGM) within a few years [5].

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[1] K. Kimura, Y. Achiba, and H. Shiromaru, Rev. Sci. Instrum. 60, 2205 (1989).
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[3] K. Mitsuke, H. Yoshida, and H. Hattori, Z. Phys. D 27, 267 (1993).
[4] H. Yoshida and K. Mitsuke, J. Chem. Phys. 100, 8817 (1994).
[5] H. Yoshida and K. Mitsuke, UVSOR Activity Report 1995 (1996).

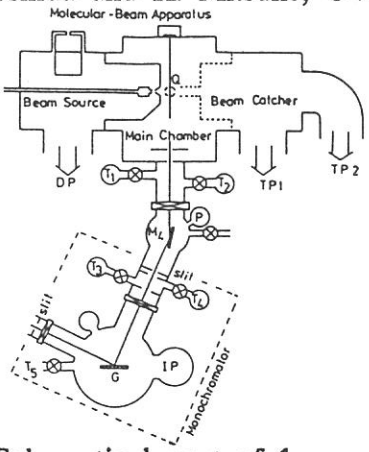


Fig. 1 Schematic layout of 1m Seya-Namioka monochromator.

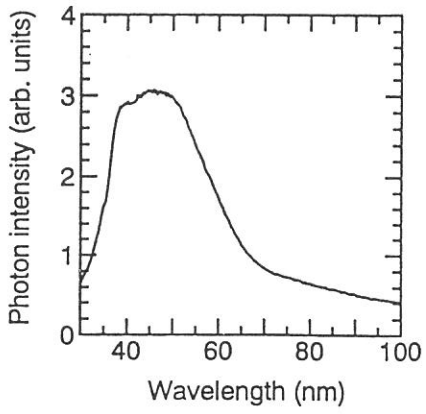


Fig. 2 Throughput spectrum of the monochromator.

BL3A1 Irradiation Port with Undulator Radiation

A planar-type undulator installed in a long straight section of the UVSOR storage ring provides an intense quasi-monochromatic radiation to the beam line 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 50 eV can be covered by the fundamentals, although the large amounts of higher harmonics are mixed into the spectral distribution with increasing the K-value. The beam line 3A1 has no monochromator between the undulator and a sample chamber. The undulator radiation is introduced into samples through a pinhole (1 or 2 mm in diameter before the premirror chamber), a toroidal focussing mirror, another pinhole(1 mm in diameter near the sample chamber), and filters (Al, Sn, and In). A three-stage differencial pumping system is available to be installed for the experiments such as etching and CVD. A typical spectrum distribution measured at BL 3A2 is shown in Fig. 2, where the undulator gap is 60 mm and the value of photon flux is 10^{14}-10^{15} phs/s/mm^2.

A variety of experiments by using the intense undulator radiation such as photo-desorption, SR-CVD, photo-etching, and light-amplification induced by core-level excitation have been carried out in recent years. The irradiation effects of vacuum ultraviolet radiation to useful semiconductors and amorphous materials have also been measured at this station. The luminescence from high-T_c superconductors, the fluorescence yield of which is very low, can be obtained with the undulator radiation. The decay time measurements of luminescence have also been carried out on many samples under single-bunch operation.

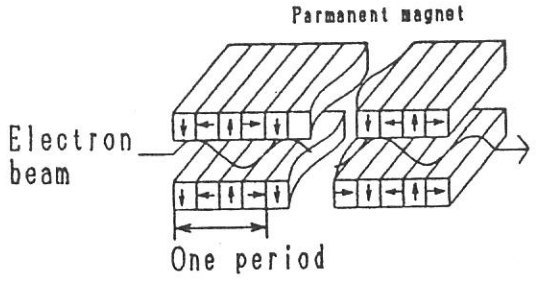


Fig. 1 Schematic drawing of undulator

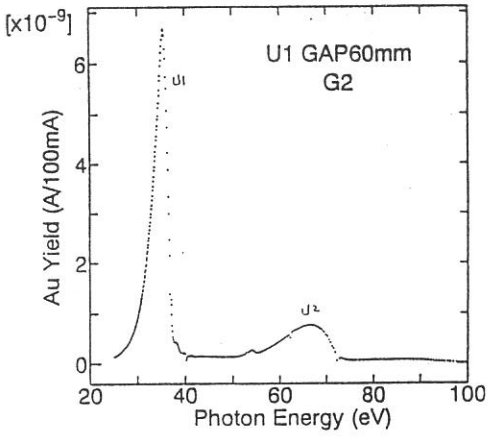
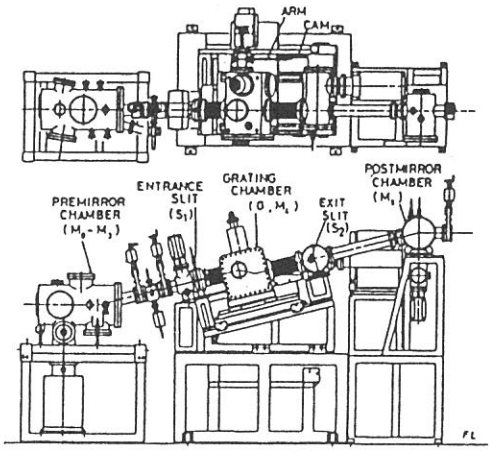


Fig. 2 Typical spectrum of undulator

BL3A2 Gas-Phase Dissociative Photoionization Apparatus

This machine has been constructed to study the formation of multiply-charged ions and thier dissociation processes. The monochromator is constant-deviation grazing-incidence type with 2.2 m focal length and covers wide wavelength range from the region around the first ionization potentials of almost all molecules (~ 100 nm) to the region where multiply-charged ions are effectively produced (~10 nm). 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 (TOFMS) equipped with automatic data acquisition system for photoion-photoion coincidence measurements. For full understanding of dissociative multiple photoionization, we detcet 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.



Application

This apparatus allows us to measure the partial cross sections for the multiple ionization of polyatomic molecules and the branching ratios for various fragment channels. On the basis of the kinetic energy distribution of the fragment ions, we have discussed the detail of dissociative potential energy surfaces relating to double photoionization.

Specifications

Monochromator	: 2.2 m constant-deviation grazing-incidence
Spectral range	: 10 - 100 nm
Resolution	: 0.009 nm at 13 nm
Mass spectrometer	: double-field time-of-flight type
Mass Resolution	: 300
Length of the drift tube	: 0.2 - 1 m
Rotatable Angle	: 0 - 90° with respect to the photon beam

BL3B Versatile Photoionization Spectrometer for Gaseous Molecules

This beam line is devoted to studies of elementary atomic and molecular processes induced by excitation of valence electrons. The main components of the apparatus are a spherical sector electrostatic energy analyzer and a double-field type time-of-flight mass spectrometer as shown in Fig.1. This machine is designed and setup for photoelectron spectroscopy and photoionization mass spectrometry, and electron-ion coincidence measurements. The 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.

In 1994, great improvement in detection efficiency for photoelectrons was realized by introducing a position sensitive detector.[1] This allows us to perform two-dimensional photoelectron spectroscopy with good resolution (~40meV) in which the photoelectron yield is measured as a function of both photon energy and electron kinetic energy (binding energy). The spectrum, usually represented as a contour plot (*e.g.* Fig.2), 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,[2] (2) a bound valence state of nitric oxide whose autoionization gives rise to a number of irregularly spaced peaks in its photoionization efficiency curve,[3] (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.[4]

1) K. Mitsuke, Y. Hikosaka, H. Hattori, and T. Hikida, *UVSOR Activity Report*, **22**, 106 (1994).
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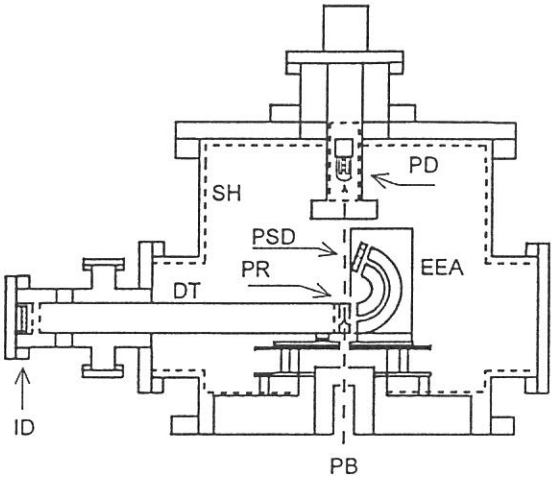


Figure 1: Schematic diagram of the photoionization spectrometer. *PB*: monochromatized photon beam, *PR*: photoionization region, *DT*: drift tube for ions, *EEA*: electron energy analyzer, *ID*: ion detector, *PSD*: position sensitive detector for electrons, *PD*: photon detector, *SH*: μ-metal shield. The sample gas is introduced into *PR* perpendicularly to both *PB* and the symmetric axis of DT.

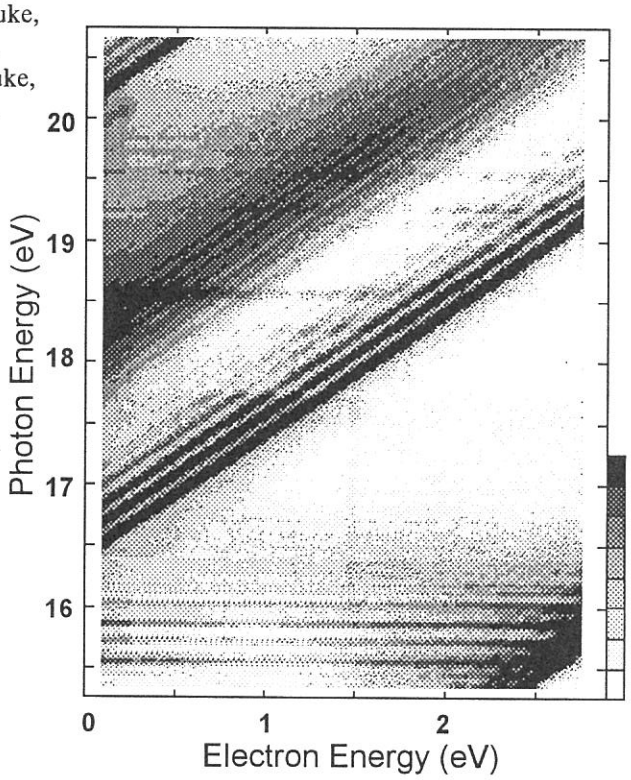
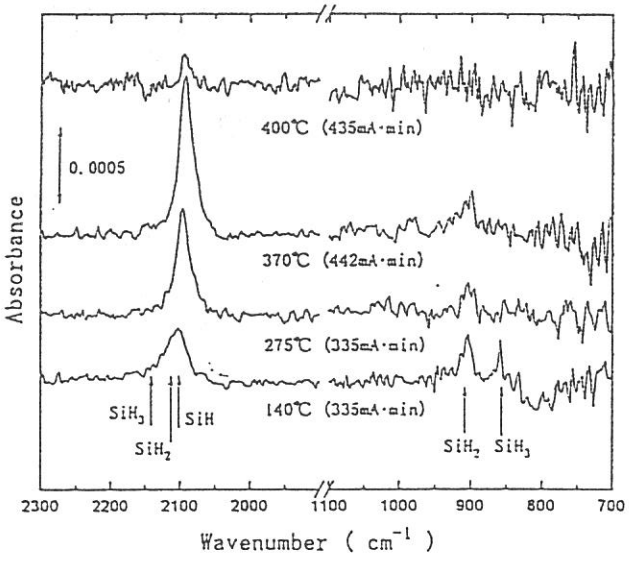


Figure 2: Two-dimensional photoelectron spectrum of N_2O taken at the photon energy range from 15.35 to 20.65eV. The electron yield is presented by the plots with eight tones from light to dark on a logarithmic scale.

Synchrotron Radiation Stimulated Chemical Reaction Beam Lines 4A and 4B

Beam line 4B is now mainly used for the study of the SR stimulated semiconductor process experiments using a white beam which is reflected and focussed by the bent-cylindrical mirror with 2.2 degree grazing incidence angle and 8.3 mrad horizontal acceptance angle. The two tandem reaction chambers for etching and gas source molecular beam epitaxy experiments, respectively , are set at the end of the beam line. Reaction gases, SiH_4, Si_2H_6, GeH_4 and several doping and etching gases can be supplied to the reaction chamber. For both reaction chambers, optical systems for *in situ* observation of infrared reflection absorption spectroscopy (IRAS) are equipped. Observation range is 3000–800 cm^{-1}. The lower wave number side is limited by the ZnSe viewing port transmission . Figure 1 shows an example of the *in situ* observed IRAS spectra of SiH_n on the Si(100) surface during the Si gas source MBE using Si_2H_6.[1)] The apparatus of the reflection high energy electron diffraction is also equipped to the gas source MBE chamber for the *in situ* observation of the surface crystallinity.

The white beam line BL4A is going to be scrapped at February of 1996, and the new beam line equipped with a multi-layered mirror monochromater is scheduled to be constructed until July 1996. SR stimulated chemical reaction using monochromatized beam can be made using this beam line. The white beam containing photons of energy lower than 300 eV can also be used. The reaction chamber equipped with XPS, IRAS and STM apparatuses for *in situ* observation are going to be set at the end station.



1)A.Yoshigoe, K.Mase,Y.Tsusaka,T.Urisu,Y.Kobayashi, and T.Ogino, Appl. Phys. Lett. 67 (1995) 2346.

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 chamber B for optical measurements of solids and the chamber C for photo-stimulated desorption (PSD) experiments.

The PGM has three gratings and seven focusing mirrors for the purpose of a wide wave length region. The spectral range of the PGM is 1 - 200 nm (Fig. 2) and the resolution is 500 ± 200 in the range. Almost all the optical elements were changed to new ones at the beginning of the fiscal year 1995. The throughput photon number and the available wave length region are improved as seen in Fig. 1.

The calibration chamber is equipped with a goniometer. The beam line is able to accommodate an additional experimental apparatus downstream after the chamber. The volume of the calibration chamber is ~ 0.5 m^3, and the pumping system evacuates the chamber to a operating pressure (less than 3×10^{-6} torr) from the atmosphere during ~ 1 hour. The goniometer, which was installed for the characterization of optical components, has six degrees of freedom: coaxial rotations of sample and detector, 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).

By using the apparatus, various researches shown below are carried out.

1) Calibrations optical components for use of VUV monochromator and soft x-ray astronomy.
2) Measurements of reflectivity, transmission and total electron yield spectra of solids in the photon energy range of 6 - 1200 eV at the temperature of 20 - 350 K.
3) Measurements on PSD from solid rare gases condensed on a cryogenic surface.

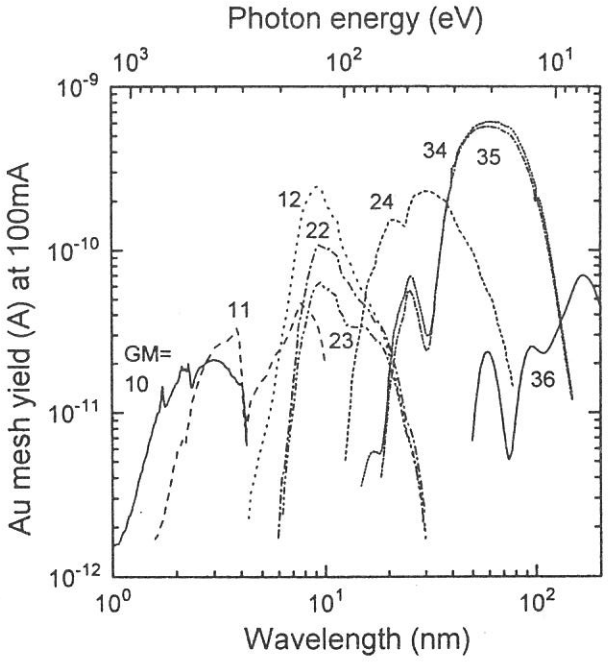


Fig. 2. Throughput spectra of BL5B detected by a gold mesh.

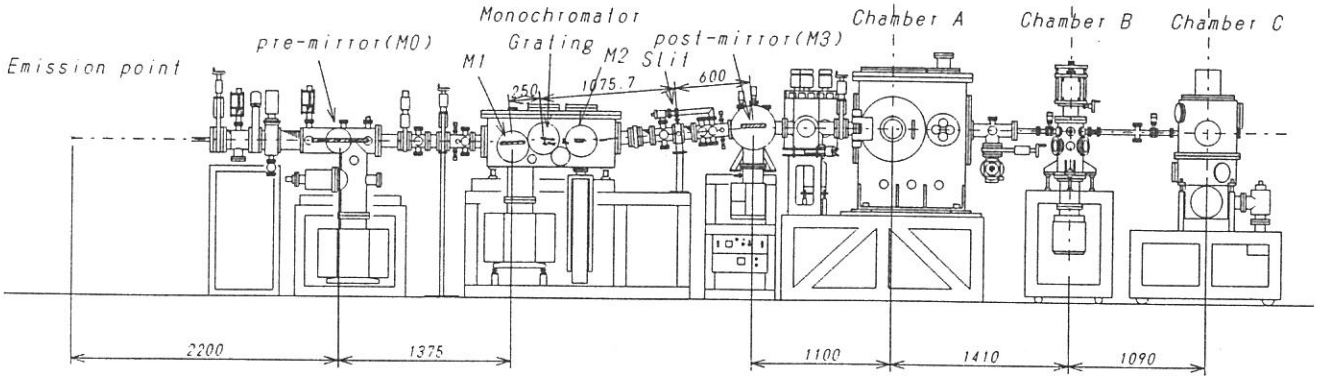


Fig. 1. Schematic figure of BL5B spectrometer system.

BL6A1 Fourier Transform Middle- and Far-Infrared Spectroscopy

UVSOR covers a very wide energy region from a soft-X ray to a millimeter wave. BL6A1 was constructed in order to cover a long wavelength part in the spectral distribution of UVSOR from a near infrared to a milli-meter wave. Beam-line are composed of two kinds of interferometers, a Martin Puplett type and a Bruker-IFS66v. The spectrum from 1 μm to 3 μm regions is measureable by changing of three kinds of detectors, MCT, Si-bolometer and InSb hot electron detector, according to each available region. Owing to the high brightness of the SR in the long wavelength region, the present spectroscopic system is specially favorable to the transmission and reflection measurements on so tiny specimens. The background spectra of the UVSOR are shown in Fig 1.

Specification

method	:transmission and reflection
spectral range	: 1 μm to 100 μm (10000 to 100 cm^{-1}) by a Bruker-IFS66v 30 μm to 3 mm (300 to 3.3 cm^{-1}) by a Martin Puplett
resolution	:0.1 cm^{-1}
temperature	:9-350 K
pressure	:up to 20 GPa

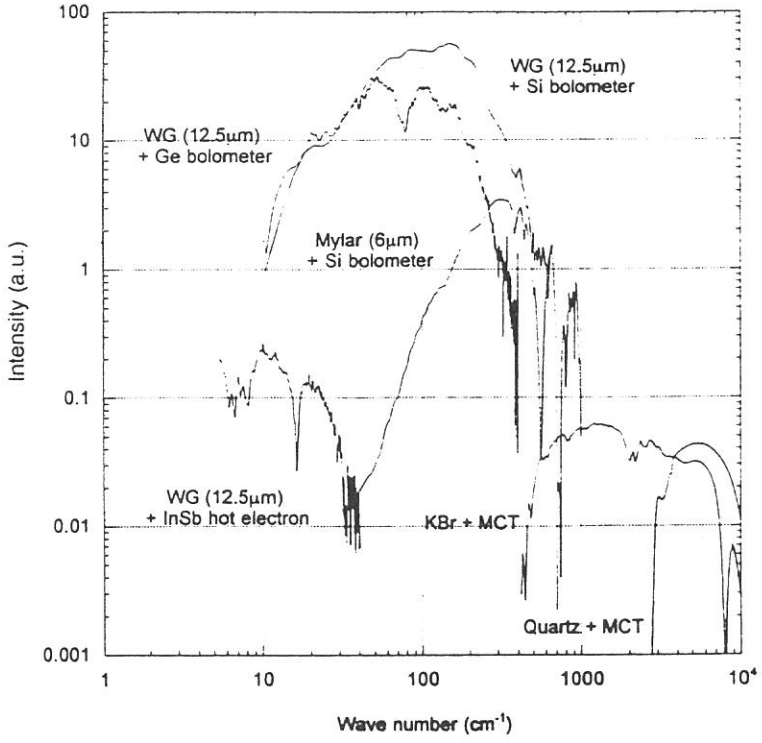


Fig.1 Spectral distribution of UVSOR at BL6A1 by different detectors.

BL6A2 Photoelectron Spectrometer for Solids and Surfaces

A Plane Grating Monochromator (PGM) consists of pre-mirrors, a plane grating, focussing mirror, and a post-mirror, with an exit slit. It covers the wide spectral range from 2 to 130 eV with exchanging two gratings and 5 focussing mirrors. 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 at BL6A2. The overall resolution of the angle-integrated cylindrical retarding-field analyser is fixed to be 0.3 eV, while the angle-resolved hemispherical analyser has a resolving power of 100 with an angular resolution of 1.1°. The optical system including an ICCD system can be installed to detect the fluorescence from the samples through a quartz lenze and a sapphire window. The standard instruments for surface analysis such as Auger, LEED, Ion gun, and Gas doser are installed in the analysing chamber, the base pressure of which is 1.2×10^{-10} Torr. The samples are transfered from an air-lock chamber to the analysing chamber through a preparation chamber.

The photoelectron spectroscopy is a powerful method to know the occupied states of many materials. The III-V semiconductors, layered materials, dielectric films, and metallic substances have been investigated at BL6A2, as well as the clean and adsorbed surfaces of semiconductors (Si, Ge, and GaAs). The angle-resolved photoelectron spectra have also been observed to know the band dispersion. Moreover, the time response of the photo-desorption of excited-state alkali atoms from alkali halides has been observed by using the TAC system under a single-bunch operation.

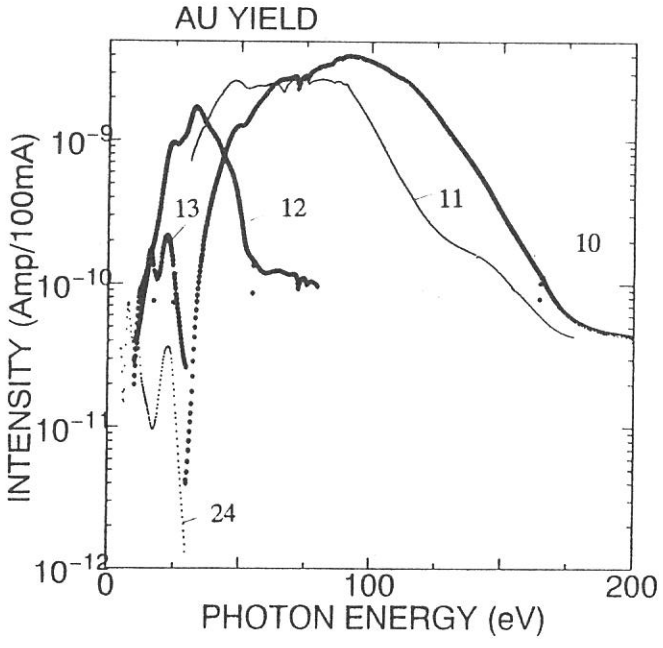


Fig. 1 Typical spectral distribution

BL6B Fourier-Transformed Far-Infrared Spectrometer

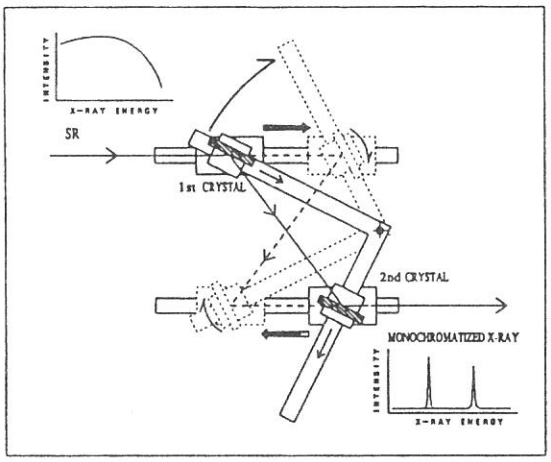
BL6B has been designed to measure reflectance on small samples with high precision over FIR-IR regions. The optical system of BL6B consists of the following three parts: (1) beamline optics in ultrahigh vacuum (1×10^{-9} Torr), equipped with interchangeable four kinds of exit-window without breaking 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. Table 1 summarizes the optical elements used in each wave-number range.

range (cm-1)	source	beam-splitter	optical filter (cut-on)
2000-10000	Tungsten	Si on CaF_2	none
500-5000	Globar	Ge on KBr	none
150-650	Hg lamp	Mylar 3.5μ	700 cm^{-1}
70-220	Hg lamp	Mylar 12μ	700 cm^{-1}
20-80	Hg lamp	Mylar 23μ	100 cm^{-1}
6-30	SR	Mylar 125μ	35 cm^{-1}

Table 1. Optical elements.

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.

BL7A Soft X-ray Spectrometer for Solids



In the soft X-ray region from 0.5 to 5 keV, there exist 1*s* core absorptions of light atoms from oxygen to calcium which take important role in the various fields of chemistry (organic, inorganic, catalytic, and biological) and other core absorptions of heavier atoms. By measuring the X-ray absorption, and the emission of electrons, X-ray fluorescence, and UV-visible light after the excitation of 1*s* or other core electrons of these atoms, structural and dynamical information of molecules, solids and catalysts, can be obtained. The soft X-ray beam line BL7A equipped with a double crystal monochromator (DXM) was constructed for the spectroscopic research in the soft X-ray region. The DXM at BL7A was designed to realize the constant offset and constant direction during the scanning of the X-ray energy. As shown in the figure two crystals move along each arm of an L-shaped base. The first crystal's surface is mounted parallel to one arm while the second crystal's surface is mounted perpendicular to another arm so that two surfaces should be parallel. The reflection points of the first crystal and second crsytal move along the incident SR beam axis and along the monochromatized X-ray beam axis, respectively. The rotation center of the L-shaped base (cross point of the extension line of the first crystal's surface and the normal line of the second srystal's surface at the reflection point) is fixed on the bisectional level of the incident SR beam and the monochromatized X-ray beam. By rotating the L-shaped base, incident angle to the crystal's that is, X-ray energy can be changed with keeping the offset and direction of the X-ray constant.

Specification

Scanable energy range :

CRYSTAL (MULTILAYER)	2*d*/Å	energy range 1 2 3 4 5
KAP	26.64	0.49 – 1.36
(W/B_4C)	25.7	0.51 – 1.41
Mica	19.8	0.66 – 1.83
Beryl	15.965	0.82 – 2.27
Quartz-Y(10$\bar{1}$0)	8.512	1.53 – 4.26
InSb-111	7.481	1.74 – 4.85
Ge-111	6.532	2.00 – 5.55

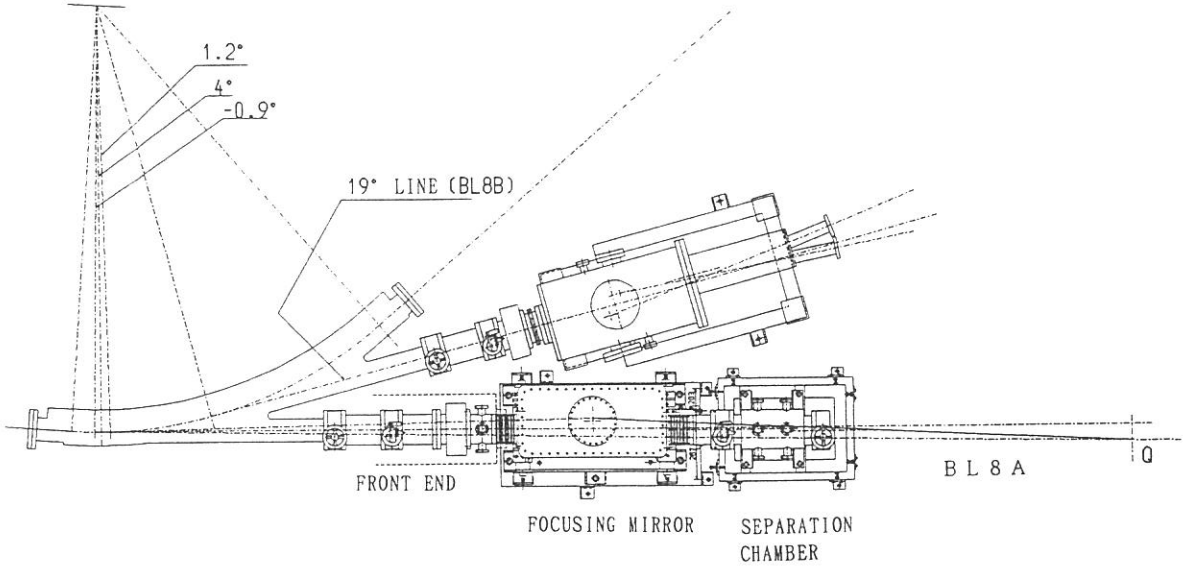
Resolution : 0.46 eV (Crystal = Beryl, E = 860 eV)

Measurements : Transmission, total photoelection yield

Sample : Gas, solid (room temp. - 20 K)

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 unfocused 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 diffrential pumping system, gas pressure at the reaction chamber upto 0.5 Torr can be used while keeping ultra high vacuum at the premirror chamber.



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 3mmϕ aperture before sample)

Focused beam: 7.7 mrad (horizontal) × 8 mrad (vertical)
- Beam spot size at focus : 3 mm (horizontal) × 2 mm (vertical)
- Source - mirror distance: 2500 mm
- Mirror - focus distance: 2807 mm

Application

SR assisted Chemical Vapor Deposition

SR assisted Etching

Radiation damage

Soft X-ray microscopy

Accumulated photon echo

BL8B1 Photoabsorption and Photoionization Spectrometer

BL8B1 is the beamline for high resolution photoabsorption and photoionization experiments mainly in the photon energy range from 200 to 800 eV where the 1s core absorption of C, N, O atoms exist. For this purpose a constant-deviation constant-length spherical grating monochromator (CDCL-SGM) with three interchangeable gratings was constructed at this beamline. The CDCL-SGM has simple scanning mechanism with fixed position of both the entrance and exit slits, as well as fixed direction of incident and exit photon beams. The monochromator covers 30 ~ 800 eV by using three gratings (G1: R=15m; 1080 l/mm, G2: R=15m; 540 l/mm, G3: R=7.5m; 360 l/mm) with photon flux of 10^8 - 10^9 photons/sec for 10 μm slits and at 100 mA ring current (Fig. 1). Absolute photon flux was evaluated from drain current of gold foil with assuming constant quantum efficiency of 0.073. In the photon energy range from 180 to 800 eV, observed resolutions ($E/\Delta E \approx 4000$ at 400 eV, $E/\Delta E \approx 3000$ at 245 eV) with 10μm slits agree well the calculated values (Fig. 2).

Several types of gas phase experiments are possible with using an experimental chamber equipped with a photoelectron detector (total- or threshold-), a time-of-flight ion detector, and a built-in VUV monochromator for emission detection (under preparation). An example of fragment-ion mass spectrum of core-excited molecule is reported in this issue (BL8B1). It is also possible to measure absorption, electron yield, and emission spectrum of solid samples.

1. Absorption spectrum with transmission mode
2. Total electron yield and/or total ion yield spectrum
3. Emission spectrum (Visible to VUV) and emission excitation spectrum
4. Time-of-flight mass: photoelectron-photoion coincidence (PEPICO)
5. Photoion-photoion coincidence (PIPICO)

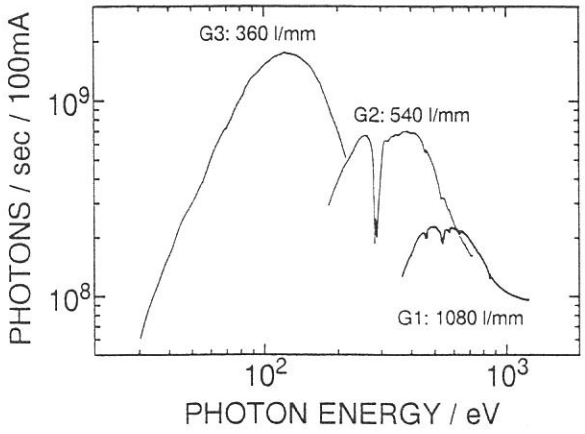


Fig. 1. Throughput spectra (absolute photon flux) of CDCL-SGM for three gratings with 10μm slits and at 100mA ring current.

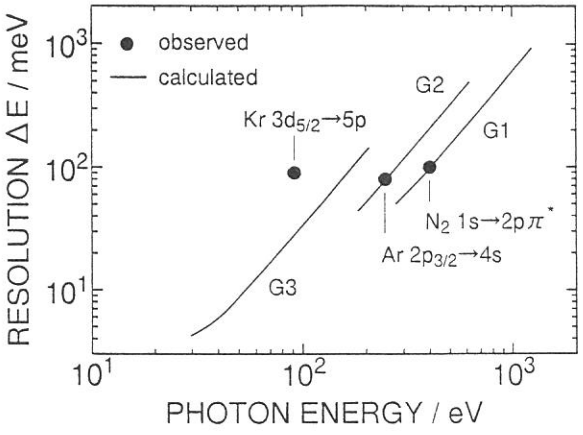


Fig. 2. Energy resolution of CDCL-SGM for three gratings with 10 μm slits. Solid lines: calculated values, filled circle: observed values.

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 and conducting polymers. The beamline consists of a plane-grating monochromator (PGM), a sample preparation chamber with a vacuum glove box, a measurement chamber with an accurate manipulator for temperature dependence (base pressure 2×10^{-10} Torr), a cleaning chamber (base pressure 3×10^{-10} Torr), and a sample evaporation chamber (base pressure 3×10^{-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 $< 1\times1\text{mm}^2$. The resolution at a slit width of 100 μm was found to be 0.004 - 0.3 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. The total resolution at the photon energy $h\nu$=20 eV is less than 0.2 eV, as determined by measuring the Fermi edge of gold.

Recently, mirrors and gratings in the PGM have been renovated. Also a new apparatus for using circularly polarization has been constructed at the beamline. Typical spectral distribution is shown in Fig. 1.

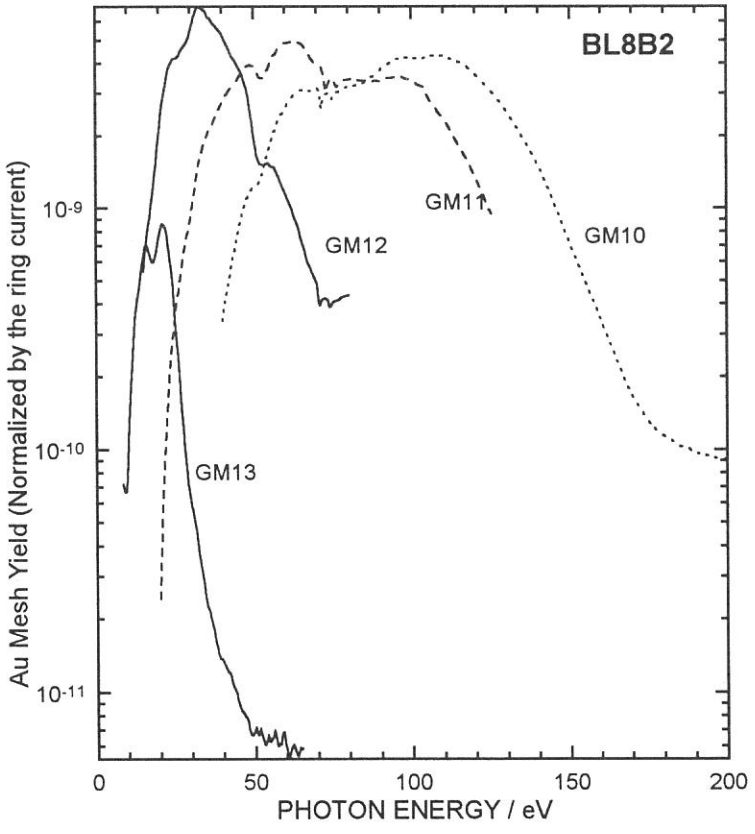


Fig. 1 Throughput spectra of plane-grating monochromator at BL8B2 with 100μm exit slit.

Appendix

ORGANIZATION

Staff

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Director			
Nobuhiro	KOSUGI	Professor	kosugi@ims.ac.jp
Scientific Staff			
Accelerator			
Hiroyuki	HAMA	Associate Professor	hama@kekvax.kek.jp
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Beam Line			
Masao	KAMADA	Associate Professor	kamada@ims.ac.jp
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Guest Scientist

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Yong Q.	CAI	JSPS Foreign Research Fellow (- January 1996)	ycai@ims.ac.jp
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Krishna G.	NATH	(January 1996 -)	nath@ims.ac.jp
Masatake	ICHIKAWA		ichikawa@ims.ac.jp

Representative of Beam Line (January 1996)

BL1A	Nobuhiro	KOSUGI	Dept. Vacuum UV Photoscience
BL2A	Toshio	IBUKI	Dept. Vacuum UV Photoscience
BL2B2	Koichiro	MITSUKE	Dept. Vacuum UV Photoscience
BL3B	Koichiro	MITSUKE	Dept. Vacuum UV Photoscience
BL4A	Tsuneo	URISU	Dept. Vacuum UV Photoscience
BL4B	Tsuneo	URISU	Dept. Vacuum UV Photoscience
BL6A2	Masao	KAMADA	UVSOR
BL6B	Kyuya	YAKUSHI	Dept. Molecular Assemblies
BL8B2	Toshio	IBUKI	Dept. Vacuum UV Photoscience
Others	Masao	KAMADA	UVSOR
	Toyohiko	KINOSHITA	UVSOR

Steering Committee (April 1995 - March 1996)

Nobuhiro	KOSUGI	IMS Chairman
Makoto	WATANABE	Tohoku Univ.
Akito	KAKIZAKI	Univ. of Tokyo
Toshio	KASUGA	KEK
Tadashi	MATSUSHITA	KEK
Toshiaki	OHTA	Univ. of Tokyo
Inosuke	KOYANO	Himeji Inst. of Technology
Kazuhiko	SEKI	Nagoya Univ.
Kazutoshi	FUKUI	Fukui Univ.
Norio	MORITA	IMS
Yoshiyasu	MATSUMOTO	IMS
Koichiro	MITSUKE	IMS
Masao	KAMADA	IMS
Toyohiko	KINOSHITA	IMS
Hiroyuki	HAMA	IMS

JOINT STUDIES (fiscal year 1995)

Special Project	: 4
Cooperative Research	: 23
Cooperative Research (Invited)	: 3
Use of Facility	: 130
Use of Facility (Private Company)	: 1
Workshop on VUV beam lines	: 1
Workshop on Beam Dynamics and Free Electron Laser	: 1
Use's time	: 37 weeks

LIST OF REPRESENTATIVES OF UVSOR USERS (fiscal year 1995)

Chiba Univ. Hino, S. Ueno, N.

Ehime Univ. Nagaoka, S.

Fukui Univ. Fukui, K. Nakagawa, H. Yamamoto, A.

Gakushuuin Univ. Arakawa, I. Kotani, M.

Gifu Univ. Hayashi, K

Himeji Inst. of Technology Koyano, I.

Hiroshima Univ. Hiraya,A. Tanaka, K. Tabayashi, K.

Hokkaido Univ. Kawasaki, M.

Iwaki Meisei Univ. Kanda, K.

Kagawa Univ. Itoh, H. Kawase, M.

Kansai Medical Univ. Kihara, H.

Kanagawa Institute of Technology Omata, T.

Kobe Univ. Nakagawa, K. Nanba, T. Ohta, H. Okamura,E. Sakurai, M.

Kyoto Univ. Hayashi, T. Kan'no, K. Sato, N. Tanaka, T. Watanabe, M. Yoshida, S.

Kyoto Univ. of Education Murata, T.

Kyushu Univ. Takebe, H.

Maritime Safety Academy Fujita, M.

Miyazaki Univ. Kurosawa, K.

Nagoya Univ. Goto, T. Hattori,T. Morita, S. Ouchi, Y. Shobatake, K. Seki, K. Soda,K. Yamashita, K. Yoshida,H.

Naruto Univ. of Education Matsukawa, T.

Niigata Univ. Tokue, I

Osaka Univ. Hiraki, A. Kinoshita, S. Kobayashi, M. Takahashi, M.

Osaka City Univ. Masuoka, T.

Osaka Electro-Commun. Univ.	Ohno, N.				
Univ. of Osaka Prefecture	Taguchi,Y.				
Osaka National Research Inst.	Fukumi, S.	Kitamura, N.			
Osaka Women's Univ.	Shimanuki, S.				
Univ. of Ryukyus	Ishiguro, E.				
RIKEN	Aoyagi, K.				
Saga Univ.	Ogawa, H.	Tanaka, S.			
Shinshu Univ.	Itoh, M.				
Tohoku Univ.	Ikezawa, M.	Takahashi, T.	Watanabe, M.		
Tohoku Gakuin Univ.	Awano, T.				
Univ. of Tokyo	Nakamura, M.	Tsuneta, S.	Yokoyama, T.		
Tokyo Inst. of Technology	Edamoto, K.	Enoki, T.	Koshihara, S.	Hikida, T.	
Tokyo Gakugei Univ.	Hasegawa, S.				
Tokyo Metropolitan Univ.	Nishikawa, H.				
Tottori Univ.	Ouchi, I.				
Toyohashi Univ. of Technology	Ganjoo, A.	Hanabusa, M.	Namiki, A.	Yoshida, A.	
Toyama Univ.	Miyazaki, H.				
Utsunomiya Univ.	Nakai, S.				
Wakayama Univ.	Miyanaga, T.				
Waseda Univ.	Ohki, M.				
Yamagata Univ.	Onishi, A.	Yoshinari, T.			
IMS	Hasegawa, S.	Hosono, H.	Ibuki, T.	Ishii, H.	Kamada, M.
	Kinoshita, T.	Kimura, S.	Kosugi, N.	Mase, K.	Mitsuke, K.
	Miyamae,T.	Ohashi, H.	Tahara,T.	Tanaka, S.	Ugawa,A. Urisu, T.

UVSOR workshop on present status and future plans of beam lines for soft x-ray, chemical reaction and gas phases

October 3, 1995 (at room #101, IMS)

§ 1. General features (13:00-14:00)

1. Opening remark - Future plan of the UVSOR - — N. Kosugi (IMS)
2. Scrap and build of beam lines — M. Kamada (IMS)
3. Present status and future plan of accelerator — H. Hama (IMS)

§ 2. Soft x-ray beam line (14:00-17:30)

1. Opening remark - Problem of BL7A and future plan - — T. Kinoshita (IMS)
2. Present status of double crystal monochromator beam lines at the Photon Factory and performance of YB_{66} crystal — Y. Kitajima (KEK)

15:00-15:15 coffee break

3. Present status of BL7A — O. Matsudo (IMS)
4. Present status of BL1A — Y. Takata (IMS)
5. Suggestion to the research work by using wiggler — M. Watanabe (Tohoku Univ.)
6. Suggestion and wishes from a catalyst group — H. Yoshida (Nagoya Univ.)
7. Suggestion and wishes from a spectroscopy group — S. Nakai (Utsunomiya Univ.)
8. Free discussion (Remarks by N. Kosugi (IMS), S. Naoé (Kanazawa Univ.), T. Matsukawa (Naruto Univ. of Education) and M. Takahashi (Osaka Univ.))

§ 3. Scrap and build of BL7B (17:30-18:00) — H. Nakagawa (Fukui Univ.) and K. Fukui (Fukui Univ. & IMS)

§ 4. User's meeting (18:00-19:00)

19:00- Party (at room #304, UVSOR)

October 4, 1995 (at room #101, IMS)

§ 5. Study of photochemistry in the UVSOR and future plan of BL8A (9:00-12:20)

1. Present status and future plan of soft x-ray microscopy — H. Kihara (Kansai Medical Univ.)
2. Present status and future plan of study on photon echo — H. Itoh (Kagawa Univ.)
3. Diamond CVD, Micromachine and application of lithography — M. Hori and S. Morita (Nagoya Univ.)
4. Semiconductor process, atomic layer process, STM and use of BL3A1 — A. Yoshida (Toyohashi Univ. of Tech.), H. Ogawa, M. Nishio (Saga Univ.) and K. Hayashi (Gifu Univ.)

10:20-10:40 coffee break

5. Diamond process and reconstruction plan of BL8A — E. Ishiguro (Univ. of Ryukyus), K. Shobatake (Nagoya Univ. & IMS) and H. Ohashi (IMS)
6. Scrap and build of BL4A — T. Urisu and Y. Tsusaka (IMS)
7. Free discussion (Remarks by K. Mase (IMS) and M. Ishii (Riken))

§ 6. Present status and future plan of beam lines of gas phases in UVSOR (13:20-16:30)

1. BL2A — K. Tabayashi (Hiroshima Univ.) and K. Kanda (Iwaki Meisei Univ.)

2. BL3A2 — I. Koyano (Himeji Inst. of Tech.)
3. BL8B1 — A. Hiraya (Hiroshima Univ.)
4. BL2B2 and BL3B (in-house beam lines) — H. Yoshida and K. Mitsuke (IMS)
5. Free discussion (Remarks by Y. Tokue (Niigata Univ.), T. Hikida (Tokyo Inst. of Tech.), S. Nagaoka (Ehime Univ.) and T. Masuoka (Osaka City Univ.))

§ 7. Others
1. Plan of construction of SR in Hiroshima Univ. — T. Sekitani (Hiroshima Univ.)

General meeting of UVSOR USER'S GROUP*

8 January, 1996 (at room #101, IMS)

§1. Present status and future prospects of UVSOR Facility (13:00-14:00)
a. Overview about of UVSOR Facility and IMS
1. Future plans of UVSOR and IMS — N. Kosugi (IMS)
2. Present status of UVSOR - light source - — H. Hama (IMS)
3. Present status of UVSOR - beam lines - — M. Kamada (IMS)
b. Renewal and improvements of beam lines
1. BL7B — H. Nakagawa (Fukui Univ.)
2. BL7A — T Kinoshita (IMS)
3. Beam lines for gas phase — T. Ibuki (IMS)
4. BL8A — K. Shobatake (Nagoya Univ. & IMS)

14:00-14:05 coffee break

§2. General assembly of UVSOR USER'S GROUP* (14:05-14:50)
a. Reports — K. Seki (Nagoya Univ.) and K. Fukui (Fukui Univ. & IMS)
1. Activity report for 1995
2. Status of registration for membership of UUG
3. Publication of UVSOR Users News
b. Discussion
1. Future of the joint annual meeting of the Japanese Society for Synchrotron Radiation Research and synchrotron radiation facilities
2. Preparation for the Articles of UUG

§3. Others

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

LIST OF PUBLICATIONS (1995)

1) "Ultraviolet Photoelectron Spectroscopy of Alkali-Metal Doped Polyacetylene"
T. Miyamae, K. Kamiya, S. Hasegawa, K. Seki, C. Tanaka and J. Tanaka
Bull. Chem. Soc. Jpn. **68** (1995) 1897-1903.

2) "Optical Studies of Excitons in Mica Crystals"
N. Ohno, Y. Kiyama and M. Itoh
SPIE **2362** Excitonic Processes in Condensed Matter (1995) 202-211.

3) "Optical Properties of Gallium Iodide"
N. Ohno and M. Itoh
SPIE **2362** Excitonic Processes in Condensed Matter (1995) 212-218.

4) "The Investigation of Electronic Structure in FeSi by Optical Measurements"
H. Ohta, S. Kimura , S. V. Halilov, T. Nanba and M. Motokawa
J. Magn. Magn. Mater. **140-144** (1995) 121-122.

5) "Optical Spectra of CeAs and LaAs"
S. Kimura, F. Arai, Y. Haga, T. Suzuki and M. Ikezawa
Physica B **206&207** (1995) 780-782.

6) "Core Electron Absorption Spectra of Poly (ethylene terephthalate) and Poly (ethylene 2,6 - naphthalate) Films"
I. Ouchi, I. Nakai, M. Kamada, S. Tanaka and T. Hagiwara
Polym. J. **27** (1995) 127-135.

7) "Monochromator for Circularly Polarized Synchrotron Radiation in the Energy Range of 5-250eV"
M. Kamada, K. Sakai, S. Tanaka, S. Ohara, S. Kimura, A. Hiraya, M. Hasumoto, K. Nakagawa, K. Ichikawa, K. Soda, K. Fukui, Y. Fujii and E. Ishiguro
Rev. Sci. Instrum. **66** (1995) 1537-1539.

8) "Far Infrared Transmission of SmTe under High Pressure"
Y. S. Kwon, T.S. Park,J. M. Kim, K. S. An, I.S. Jeon, C. Y. Park, S. Kimura, T. Nanba, T. Matsumura and T. Suzuki
Physica B **206&207** (1995) 389-391.

9) "Observation of Micro-Macro Temporal Structure and Saturation Mechanism on the UVSOR Free Electron Laser"
H. Hama, J. Yamazaki, T. Kinoshita, K. Kimura and G. Isoyama
Nucl. Instrum. & Meth. in Phys. Res. A **358** (1995) 365-368.

10) "Site-Specific Fragmentation Following Si:2*p* Core-Level Photoexcitation of $F_3SiCH_2Si(CH_3)_3$ in the Vapor Phase"
S. Nagaoka, J. Ohshita, M. Ishikawa, K. Takano, U. Nagashima, T. Takeuchi and I. Koyano
J. Chem. Phys. **102** (1995) 6078-6087.

11) "Second-Harmonic Generation from Electrically Poled SiO_2 Glasses: Effects of OH Concentration, Defects, and

Poling Conditions"
H. Nasu, H. Okamoto, K. Kurachi, J. Matsuoka, K. Kamiya, A. Mito and H. Hosono
J. Opt. Soc. Am. B **12** (1995) 644-649.

12) "Status of the UVSOR Facility-1994"
M. Kamada and H. Hama
Rev. Sci. Instrum. **66** (1995) 2362-2364.

13) "Dissociative Photoionization of Bis (dimethyl - μ - isopropylamido - aluminum) and Bis (dimethyl - μ - t - butylamido - aluminum) in the Region $h\upsilon$ = 65 - 133eV by Mass Spectrometry"
S. M. Park, B. H. Boo, Y. Kim, J. Park and I. Koyano
Jpn. J. Appl. Phys. **34** (1995) L933-L936.

14) "Dissociative Double Ionization Following Valence and Si:2*p* Core Level Photoexcitation of $SiCl_4$ in the Range 38-133eV"
B. H. Boo, S. M. Park and I. Koyano
J. Phys. Chem. **99** (1995) 13362-13367.

15) "Study of Dehydration of Magnesium Hydroxide"
T. Yoshida, T. Tanaka, H. Yoshida, T. Funabiki, S. Yoshida and T. Murata
J. Phys. Chem. **99** (1995) 10890-10896.

16) "Adsorption of K on NbC(100): Photoemission and Thermal Desorption Study"
K. Ozawa, T. Anazawa, S. Tokumitsu, R. Sekine, E. Miyazaki, K. Edamoto, S. Tanaka and S. Otani
Surf. Sci. **336** (1995) 93-100.

17) "Gracefully-Degraded Operationable Control System for the UVSOR Synchrotron Radiation Source and Its Operational Experience"
N. Kanaya, H. Hama, J. Yamazaki, O. Matsudo and G. Isoyama
Nucl. Instrum. & Meth. in Phys. Res. A **352** (1994) 166-169.

18) "Photoelectron Spectra of Higher Fullerenes and Their Potassium Complexes"
S. Hino, K. Kikuchi and Y. Achiba
Synthetic Metals **70** (1995) 1337-1340.

19) "Some Characteristics of a Solid State Detector in the Soft X-ray Region"
K. Torii, H. Tsunemi, E. Miyata and K. Hayashida
Nucl. Instr. & Meth. in Phys. Res. A **361** (1995) 364-371.

20) "Correlation between the Spin State and Structure of Self-Trapped Excitons in Alkali Halides"
T. Matsumoto, M. Shirai and K. Kan'no
J. Phys. Soc. Jpn. **64** (1995) 291-301.

21) "Time-Resolved Spectroscopic Study on the Type I Self-Trapped Excitons in Alkali Halide Crystals: II. Excitation Spectra and Relaxation Processes"
T. Matsumoto, M. Shirai and K. Kan'no

J. Phys. Soc. Jpn. **64** (1995) 987-1001.

22) "Photoluminescince Propertes of ZnTe Layers Grown by Photo-assisted Metalorganic Vapor Phase Epitaxy"
S. I. Gheyas, M. Ikejiri, T. Ogata, H. Ogawa and M. Nishio
J. Cryst. Growth **145** (1995) 576-581.

23) "Growth of Low-Resistivity n-Type ZnTe by Metalorganic Vapor Phase Epitaxy"
H. Ogawa, G. S. Irfan, H. Nakayama, M. Nishio and A. Yoshida
Jpn. J. Appl. Phys. **33** (1994) L980-L982.

24) "Optical and Photoelectrical Studies of Electronic Structure of $R_3Au_3Sb_4$ (R=La, Ce and Pr)"
S. Kimura Y. Sato, F. Arai, M. Ikezawa, M. Kamada, K. Katoh and M. Kasaya
J. Phys. Soc. Jpn. **64** (1995) 4278-4288.

25) "Photoemission Studies on Valence Band Structure of $AgSbO_3$"
M. Yasukawa, H. Hosono, N. Ueda and H. Kawazoe
Solid State Commun. **95** (1995) 399-403.

26) "Photoluminesence Study of Defects in Ion-Implanted Thermal SiO_2 Films"
H. Nishikawa, E. Watanabe, D. Ito, M. Takiyama, A. Ieki and Y. Ohki
J. Appl. Phys. **78** (1995) 842-846.

27) "Electronic States and Energy Transfer in PbI_2 Clusters Dispersed in CdI_2 Crystals"
P. Gu, M. Watanabe and T. Hayashi
J. Phys. Soc. Jpn. **64** (1995) 4450-4460.

28) "Dynamics of Photon-Stimulated Desorption of Excited-State Alkali Atoms from Alkali Halides"
S. Hirose and M. Kamada
J. Phys. Soc. Jpn. **64** (1995) 4434-4441.

29) "Ultraviolet-Radiation-Induced Chemical Reactions Through One- and Two- Photon Absorption Processes in GeO_2-SiO_2 Glasses"
J. Nishii, N. Kitamura and H. Yamanaka
Opt. Lett. **20** (1995) 1184-1186.

30) "High-Rate Anisotropic Ablation and Deposition of Polytetrafluoroethylene Using Synchrotron Radiation Process"
M. Inayoshi, M. Ikeda, M. Hori, T. Goto, M. Hiramatsu and A. Hiraya
Jpn. J. Appl. Phys. **34** (1995) 1675-1677.

31) "Synchrotron-Radiation-Excited Growth of ZnTe by Alternating Gas Supply Using Metalorganic Sources"
T. Ogata, S. I. Gheyas, H. Ogawa and M. Nishio
Jpn. J. Appl. Phys. **34** (1995) L841-L844.

32) "Synchrotron Radiation Excited Growth of ZnTe Using Metalorganic Sources"
T. Ogata, S. I. Gheyas, M. Ikejiri, H. Ogawa and M. Nishio

J. Cryst. Growth **146** (1995) 587-591.

33) "Construction of a System for Noxel Low-Temperature Growth of II-VI Compound Semiconductors Using Synchrotron Radiation"
T. Ogata, M. Ikejiri, S. I. Gheyas, H. Ogata and M. Nishio
Rev. Sci. Instrum. **66** (1995)1086-1089.

34) "Synchrotron-Radiation-Assisted Surface Processes of Diethylzinc on GaAs (100)"
S. I. Gheyas, T. Ogata, M. Nishio, T. Urisu and H. Ogawa.
Jpn. J. Appl. Phys. **34** (1995) 6886-6893.

35) "Low-Temperature Deposition of II-VI Compound Semiconductors by Synchrotron Radiation Using Metalorganic Soures"
T. Ogata, S. I. Gheyas, H. Ogawa and M. Nishio
Thin Solid Films **266** (1995) 168-172.

36) "Features of Valence Band of $TlAlF_4$"
H. Mizoguchi, T. Omata, H. Kawazoe, S. Fujitsu, H. Hosono and N. Ueda
J. Phys.: Condens. Matter **8** (1996) 303-312.

37) "Formation and Optical Absorption Spectra of Mixed Valence State of Tl in $Tl_2Nb_2O_{6+x}$ with Pyrochlore Structure"
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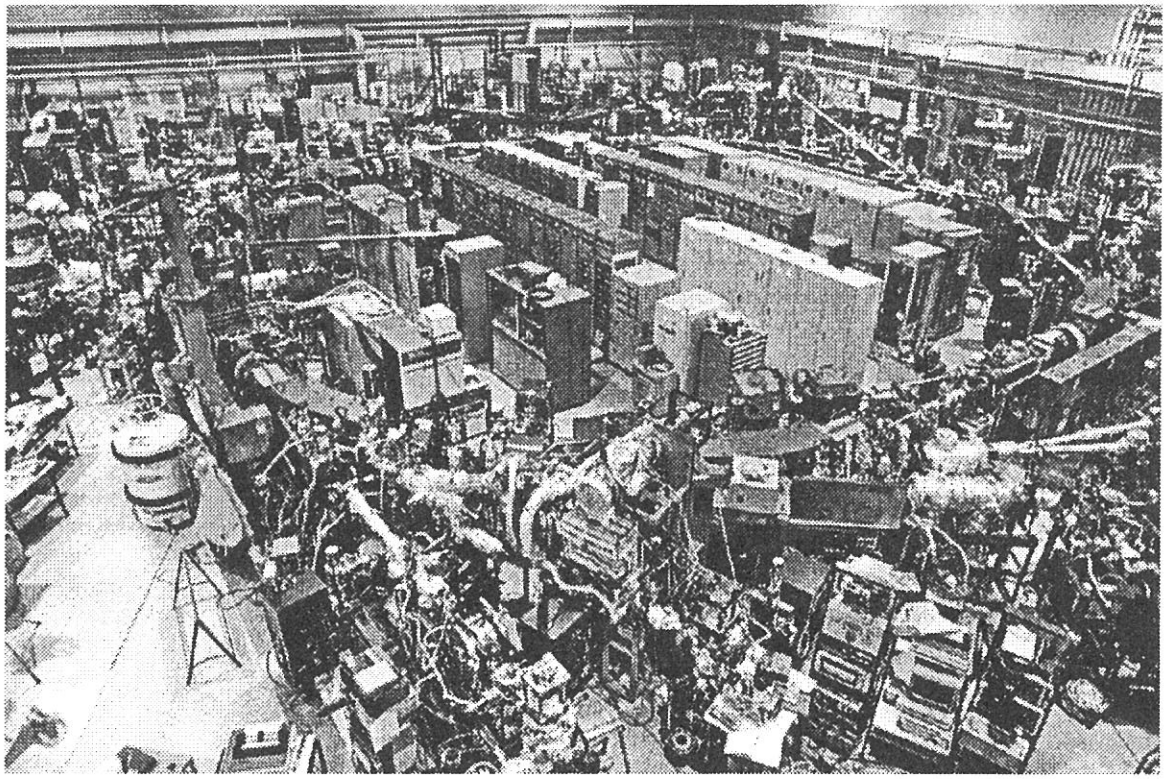
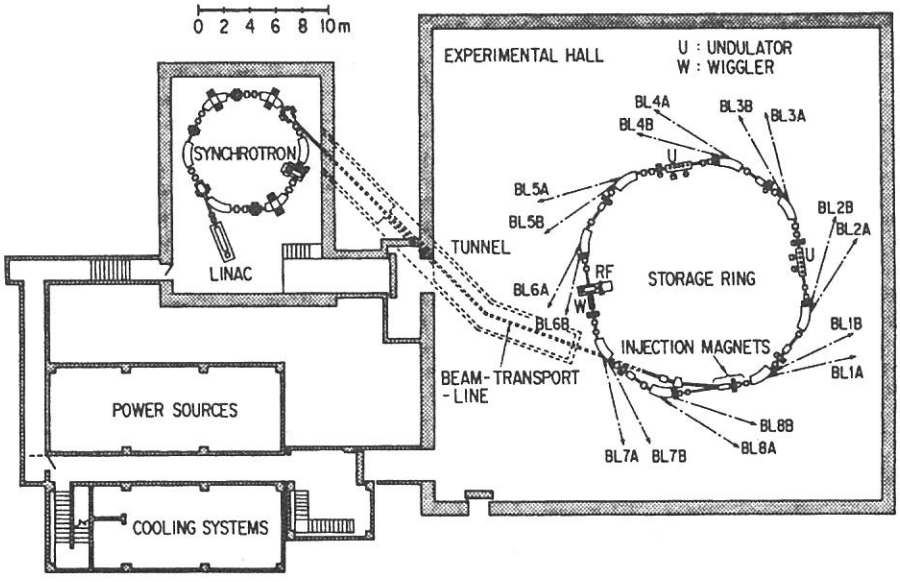
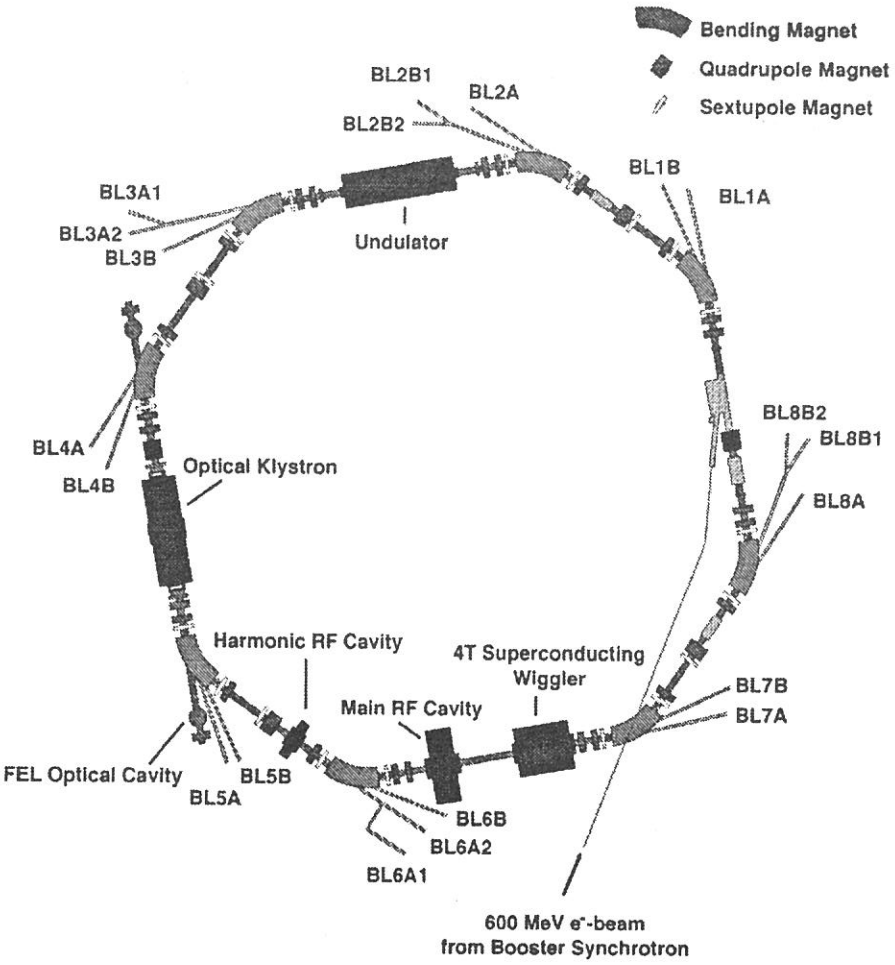


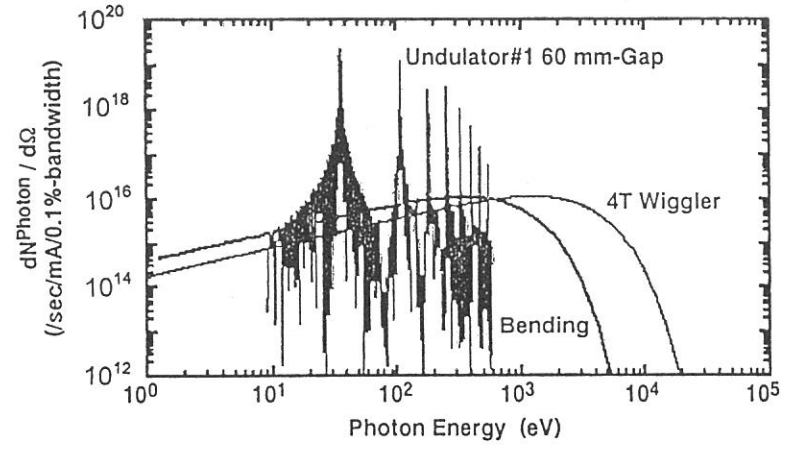
A picture of the experimental hall of the UVSOR facility.



Ground plan of the basement of the UVSOR facility.

The UVSOR 750 MeV Storage Ring

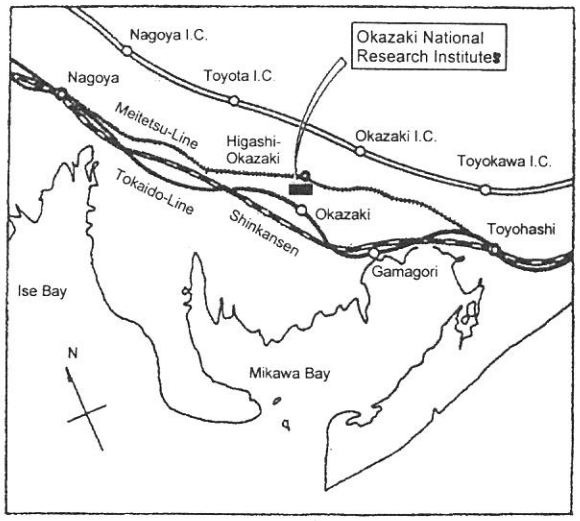




On-Axis Photon Intensity with 750 MeV-Electrons

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.



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