UVSOR

Appendix

Dear Professor Kosugi ,

It is just over ten years since I was last privileged to work at I.M.S. - and at UVSOR -for any substantial period of time . During the intervening period and particularly for the past four or five years . I have watched and appreciated a very significant growth in the scale and the quality of the science program supported by the UVSOR facility .

The Facilty : UVSOR now has 20 user stations (including 2 undulators and 1 superconducting wiggler) operating for periods of up to 3000 hours per year and a total user community of between 600 and 1000 scientists . This is , in itself , a very considerable achievement given the extremely small number , compared with staff numbers at synchrotron radiation user facilities elsewhere, of dedicated and extremely hardworking scientific and technical staff who support the UVSOR machine, beamlines and stations . In this context , the level of machine improvements including the unique short wavelength FEL and the characterization of the UVSOR operating modes during recent years are a worthy "Highlight" . *Future for the Facility* : These achievements of course maintain a challenge for the future since the primary objective of every facility must be to provide at all times , a functioning , reliable and predictable synchrotron radiation source . To be scientifically (and cost) effective it has to provide the maximum possible number of hours per year of photon beams with the optical properties matched to the needs of each different experiment . This is particularly important since many users travel significant distances to use the facility and now that the demand for beamtime exceeds the supply . One solution for the future would be to increase the supply of beamtime, although the total number of user stations at least , is probably already at or close to the maximum .

In order to maintain the current position and certainly to generate fresh scientific initiatives . resources of extra staff and money are needed by the UVSOR to continue the sound " scrap and build " policy which has already begun . That is , to replace older , less scientifically competitive stations and replace them with new and (usually !) more expensive ones.

Future growth should be achieved wherever feasible by support from sources *external* to I.M.S. For example outside Research Institutes or Universities , perhaps sometimes with support from researchers based in industry , could be encouraged to provide their own "private" beamlines or stations (a successful policy called PRT's and CRT's in USA and Europe respectively) . Beamlines or stations on UVSOR which are the property of outside Universities or Institutes would be an alternative way in which the level of exploitation and use of the UVSOR could be increased - and this mechanism also gives a very good signals about the competitiveness and merits of the UVSOR facility .

The Research Program: The overall scientific research output from UVSOR is extremely impressive. Over the past few years the number of reports has increased to more than 110 per year (in 1996) and the number of refereed publications has risen to around 80. The published science in 1996 showed that about one third of the overall programme was related to solid state research . The research on organic conductors , superconductors and ionic solids , together with a substantial number of publications on photoemission and exciton-luminescence studies and also work on glassy materials and catalysts often using XANES for low Z structural information are notable . Some of the work in this area, for example on angle resolved resonant photoemission has been very highly cited in the literature . Around one third of the research publications relate primarily to surface studies and the study of surface chemical reactions, surface structures , thin films , overlayers , interfaces and buried layers . This research incorporates infra-red and soft x-ray spectroscopies and also includes research on the physics and chemistry of surface processing and on photon assisted reactions at surfaces . Many of these activities have considerable relevance to future manufacturing and processing technologies and must be seen as important areas for future investment and growth . Approximately *one quarter of the UVSOR programme focuses on basic studies in the gas phase* - an area for which the work at I.M.S, has justly achieved world-wide recognition using both laser and synchrotron radiation photo-excitation. Much of this research exploits to the ful1 the great advantage to IMS of " owning " a synchrotron radiation facility . It permits the inclusion of experimental stations of considerable complexity and gives an opportunity to conduct experiments where the timescales involved for data collection are very long . Notable work in this area includes molecular spectroscopy and the study of molecular dynamics , excitation , ionisation and fragmentation using a wide variety of angle and energy resolved methods and time of flight studies .

In this work , the links within I.M.S. between theoreticians and experimentalists help play a vital role in defining the good quality of the research programme . Wherever possible , this excellent combination of the oretical and experimental skills within I.M.S. should be further strengthened and increased beyond the Department of VUV Photochemistry to cover other areas such as magnetic materials , nano assemblies , molecules at surfaces etc..

The final group of research publications from the UVSOR facility include *the technicai and experimental developments* . This category includes machine instrumentation (eg., the helical undulator and UV FEL) , novel research instrumentation (eg. the potentially very important new combined synchrotron radiation /laser research activities) and "multi technique" research where synchrotron radiation is combined with a range of characterisation methods (such as STM and perhaps AFM, RAS etc.) . The vitality of the UVSOR facility will always depend importantly upon the development of new techniques and equipment such as monochromators and detectors . Whenever possible , the instrumentation resources within other Centres and Departments in I.M.S. should be pooled to achieve some kind of a "critical mass " in this area , when required , in order to ensure the most rapid completion of new projects .

Genera Comments : UVSOR was built about 15 years ago to help create new fields in Molecular Science. It is now a reliable and productive Facility - of medium to large size - with a science programme which has derived largely from the excellent skills and interests of the staff of the VUV Photochemistry Department and the UVSOR facility within I. M. S. There is now an opportunity to capitalise further on this substantial long term investment by seeking wider usage within I.M.S. . Staff in almost all IMS Departments could and should be users and certainly must take the lead in stimulating new collaborations with (chemistry orientated) molecular science outside user groups . New broad objectives for example in the areas of new materials , combined laser with synchrotron radiation experiments , surface chemical reactions and thin film studies are well chosen and offer excellent and realistic targets for the medium term . I think that within UVSOR the level of activity in the area of molecular biological and biochemical spectroscopy and imaging is a little low . Outside Japan, bio-science represents - from 15% to 20% of al1 SR activity (~ 25% in the UK) and is predicted to rise to around 30% within 5 years or so across Europe and the USA. Much of this activity is linked to crystallographic structure studies and small angle diffraction and scattering mainly at around 12keV using high energy (> 2 GeV) storage rings but there is significant interest - and potentially growth - in the use of SXR and VUV radiation for biological spectroscopy and imaging .

In any case , the proximity on the same site as UVSOR of two world class bio-science Institutes (i.e. of N.I.B.B. and N.I.P.S.) - in addition to IMS itself , obviously offers a unique opportunity to create a good bio-molecular science program. There are many potential areas of research using VUV/SXR from UVSOR including, for example , low Z XAFS , VUV/SXR absorption, polarisation and fluorescence spectroscopies, laser/synchrotron radiation time resolved studies , radiation damage and VUV confocal and SXR biological imaging etc. . The study of wet samples in the VUV / SXR is feasible in principle and could give quite new information to the biologist , The use of far I.R. radiation and future exploitation of I.R. FELs Will probably also find many important applications in the study of wet biological samples .

The long term plan ------UVSOR 2 ?

In the long term , the proposal for any new Facility and, certainly the achievement of a successful outcome will require at least as much "political " as scientific insight. Any new Facility will have to come with an "operational and reliability guarantee"-like SPring 8, ESRF, APS etc.. In the USA and Europe at least , the days of hoping that new science might somehow emerge from an expensive and often not fully tested technology have essentially disappeared .

The Okazaki Institutes may be unique in world terms in their concentration of science expertise in the area of the molecular sciences . There are probably more opportunities now to carry out " ground breaking" molecular science using synchrotron radiation than ever before . For the past few years there has been an increasing convergence of attention on the behaviour of all systems at a molecular level .This has undoubtedly been stimulated by the great ease with which the atomic structures of exceedingly complex " molecules " (chemical or biological) can be measured by using SR for diffraction and scattering studies .
However it is also driven by the desire to understand and to manipulate large molecular assemblies to carry out new functions -for the greater benefit of mankind and no doubt also of industry . This emphasis on "molecular microscrence" has been further enhanced by the recent discovery of many new materials . The desire to fabricate new structures implies working at the interface between small molecule and solid state science . It will be crucial to understand at a theoretical and an experimental level all that science needed to underpin the electronic and communication devices likely to shape human activity in the next century. This will include Si ULSI mesoscopic single electron devices , nanoparticle based lasers , display materials , all types of quantum device ,thin layer research , lithography of all kinds , nanofabricated catalysts and no doubt many others .

In Europe and the USA , the current message to potential researchers is that the intellectual challenge to study "real" systems is at least as great as any other . Resources are a little more likely to be given to projects which are applied or strategic rather than basic (which is sometimes mistakenly equated with open ended and uncontrolled .) Inside Japan there are other (new) storage ring facilities which are capable of undertaking molecular studies but non of which has made it their exclusive objective .
There is a niche now - in world terms - for an insertion device storage ring with small source size , high fiux , primary photon range from - 6eV to 1 keV and with perhaps a superconducting magnet array to give some access to ~ 10 - 20 keV radiation) to be exploited

primarily for “Applied Molecular Science” , “Molecular Microscience” or “Molecular Materials Science” . The research agenda should include molecuiar science associated with industrial , environmental and biological fields . It would require the support ofresearchers in the fields of molecular and material science , coordination chemistry , biochemistry and applied and industrial molecular science (for example , in the areas of surface modification , thin film studies , photo processing , bonding in solids etc.). The reputation and experience of the Okazaki Institutes combined with their location in Chubu / Aichi would perhaps be a significant point in this debate . The ring could specialise on "two color " experiments and exploit to the full these new activities started at IMS . There could be some growth stimulated now in the area of materials science covering magnetism and magnetic structures , disordered systems buried interfaces etc , and perhaps in the use of SR for routine analysis . " UVSOR 2" should support all spectroscopies in VUV/SXR range and would be capable of low Z XAFS and some diffraction and scattering .
The strength of such a Facility would lie in its incorporation of interdisciplinary research efforts beyond the traditional boundaries of chemistry and biology and could include for example pharmaceutical science material science and medicine .

In conclusion , whatever the long term plans might be for the future of UVSOR and IMS , it is quite clear that the UVSOR facility is already a major player both in Japan and at world level as a source for synchrotron radiation science and technology and that it will continue remain so for a very considerable time to come .

Yours sincerely .

Ian H. Munro

(Professor Ian Munro)

September 28, 1997

Dear Professor Kosugi :

Thank you for your invitation to comment on my visit to IMS and UVSOR earlier this month (Sep 4,5, 1 997). First I would like to thank you and the members of your group for the outstanding hospitality during my brief stay. It was a real pleasure to share social as well as scientific activities. The guest house was very comfortable. From my experience working at many synchrotron radiation facilities, I can say this is a real asset to IMS and UVSOR.

During the short period I was at IMS, in addition to the discussion I had with you and your group about mutual research interests, I had very fruitful discussions with Dr. Mase and his student about their very interesting program of using Auger-ion coincidences to study mechanisms of ion desorption from surfaces. As you know this is an area where my group hopes to get involved in the near future so it was very helpful to discuss practical issues as well as see their recent results. In addition I had an interesting discussion - over a very pleasant breakfast in the facility - with Toshio lbuki (Kyoto) concerning gas phase fragmentation of trifluoroacetonitrile. Another useful scientific exchange was with Professor Kinoshita and his group. It was good to see their photoelectron microscope and discuss mutual interests in that area.

Over all I was tremendously impressed with the number and vigour of the scientists working at UVSOR - especially since it was quite late in the evening when I was touring the beam lines. Clearly there is an exceptional cadre of dedicated and enthusiastic young scientists -both from IMS and from other institutions - using UVSOR. I was very interested in the organization of the synchrotron facility, in particular the existence of both in-house lines dedicated to a small number of experiments and mainly used by IMS staff, as well as more general beam lines with a wider range of experiments and greater outside access. The in-house lines appear to have significant advantages in terms of allowing more extensive experimentation than is typically possible on a more heavily multiplexed beam-line. The in-house lines and programs that I saw all seemed to be running very well, with adequate equipment and staffing to make proper use of the enhanced beam time access. This approach is one which the future Canadian Light source may wish to emulate.

UVSOR is a dynamic facility which is known world-wide for its exceptional contributions to applying synchrotron radiation to molecular and materials science. Ongoing development of new beam lines, end stations and new experiments, as well as planning for a new facility, are all necessary steps for UVSOR to maintain its high standing in the community of synchrotron research facilities. From my visit it is clear that these steps are all taking place. I wish you all the best in future activities at IMS and UVSOR.

Yours sincerely,

Adam P. Hitchcock
Professor of Chemistry
Brockhouse Institute for Materials Research
McMaster University
Hamilton, Ont. L8S 4Ml CANADA

ORGANIZATION

Director

Nobuhiro Kosugi	Professor	kosugi@ims.ac.jp

Light source division

Hiroyuki Hama	Associate Professor	hama@kekvax.kek.jp
Masahito Hosaka	Research associate	hosaka@ims.ac.jp
Toshio Kinoshita	Unit Chief Engineer	kinosita@ims.ac.jp
Jun-ichiro Yamazaki	Engineer	yamazaki@ims.ac.jp

Beam line division

Masao Kamada	Associate Professor	kamada@ims.ac.jp
Toyohiko Kinoshita	Associate Professor	toyohiko@ims.ac.jp
Shin-ichiro Tanaka	Research Associate	stanaka@ims.ac.jp
Shin-ichi Kimura	Research Associate	kimura@ims.ac.jp(-Mar. 98)
Tatsuo Gejo	Research Associate	gejo@ims.ac.jp
Osamu Matsudo	Section Chief Engineer	matsudo@ims.ac.jp
Masami Hasumoto	Unit Chief Engineer	hasumoto@ims.ac.jp
Eiken Nakamura	Engineer	eiken@ims.ac.jp (-May 97)
Tadanori Kondo	Engineer	kondo@ims.ac.jp
Kenji Hayashi	Engineer	h-kenji@ims.ac.jp(Jun. 97-)
Suekichi Matsuo	Supporting Engineer	matsuo@ims.ac.jp
Bunichi Kamimoto	Supporting Engineer	kamimoto@ims.ac.jp

Guest Scientists

Hitoshi Tanaka	Associate Professor	tanaka@spring8.or.jp
Michael Terekhin	Associate Professor	terekhin@ims.ac.jp (- Dec. 97)
Yuichi Haruyama	IMS fellow	haruyama@ims.ac.jp

Secretary

Hisayo Hagiwara		hagiwara@ims.ac.jp
Naoko Onitake		onitake@ims.ac.jp

Students

Krishna G. Nath		nath@ims.ac.jp
Shigeki Fujiwara	(Okayama Univ.)	fuziwara@ims.ac.jp (-Mar. 98)
Jun-ichi Murakami	(Shinshu Univ.)	murakami@ims.ac.jp(-Mar. 98)

STEERING COMMITTEE

(April 1997- March 1998)

Nobuhiro Kosugi	UVSOR IMS	Chairperson
Masao Kamada	UVSOR IMS	
Hiroyuki Hama	UVSOR IMS	
Toyohiko Kinoshita	UVSOR IMS	
Hitoshi Tanaka	UVSOR IMS (RIKEN)	
Shuji Saito	IMS	
Kyuya Yakushi	IMS	
Koichiro Mitsuke	IMS	
Toshinori Suzuki	IMS	
Toshiaki Ohta	Univ. of Tokyo	
Inosuke Koyano	Himeji Inst. of Tech.	
Makoto Waranabe	Tohoku Univ.	
Kazuhiko Seki	Nagoya Univ.	
Motohiro Kihara	KEK	
Yukihide Kamiya	Univ. of Tokyo	
Takatoshi Murata	Kyoto Univ. of Edu.	

JOINT STUDIES

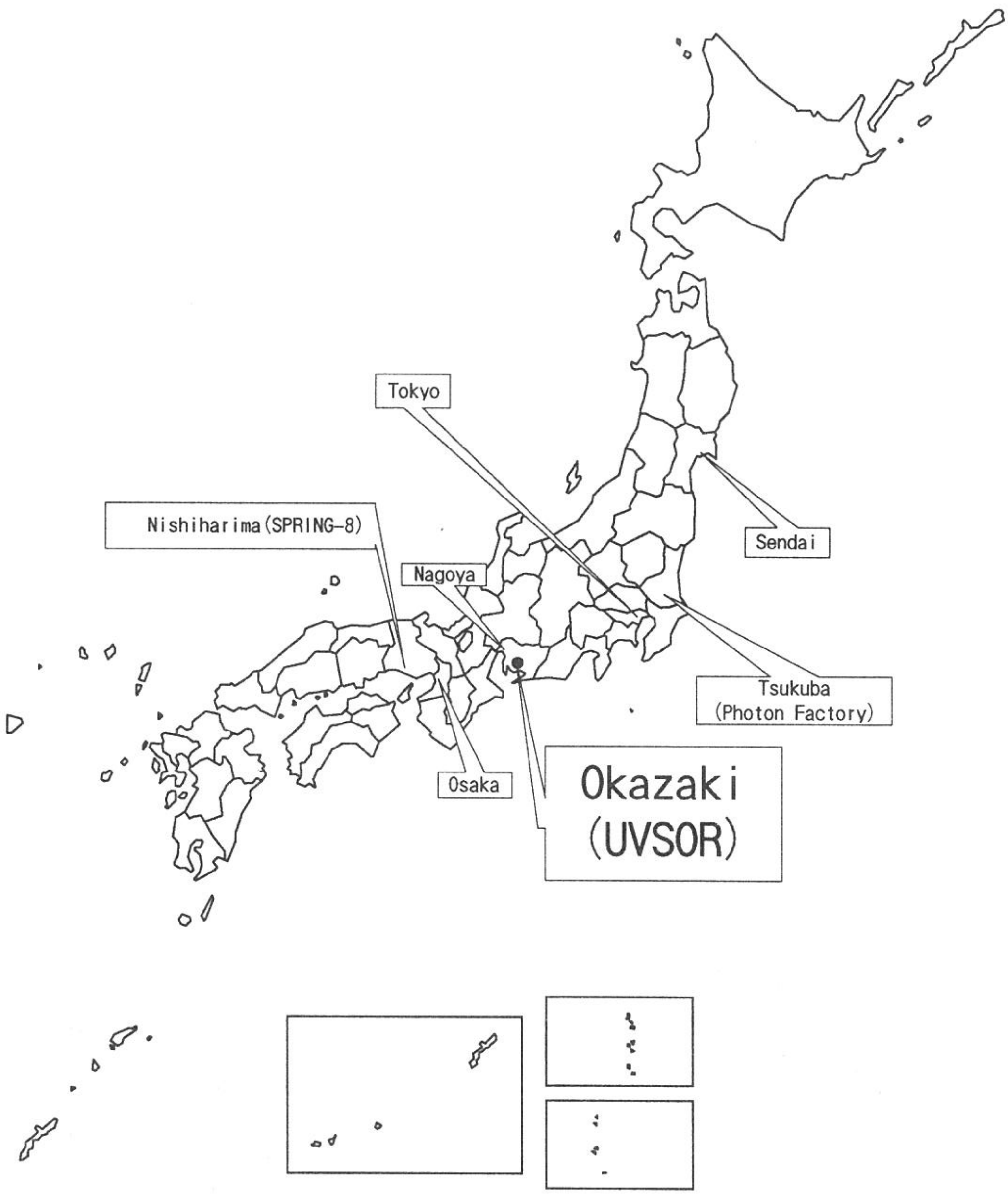
(Financial Year 1997)

Special Projects	3
Cooperative Research Projects	22
Invited Research Projects	1
Use-of-UVSOR Projects	149
Workshop	1
Machine Time for Users	39 weeks

People of UVSOR

Location

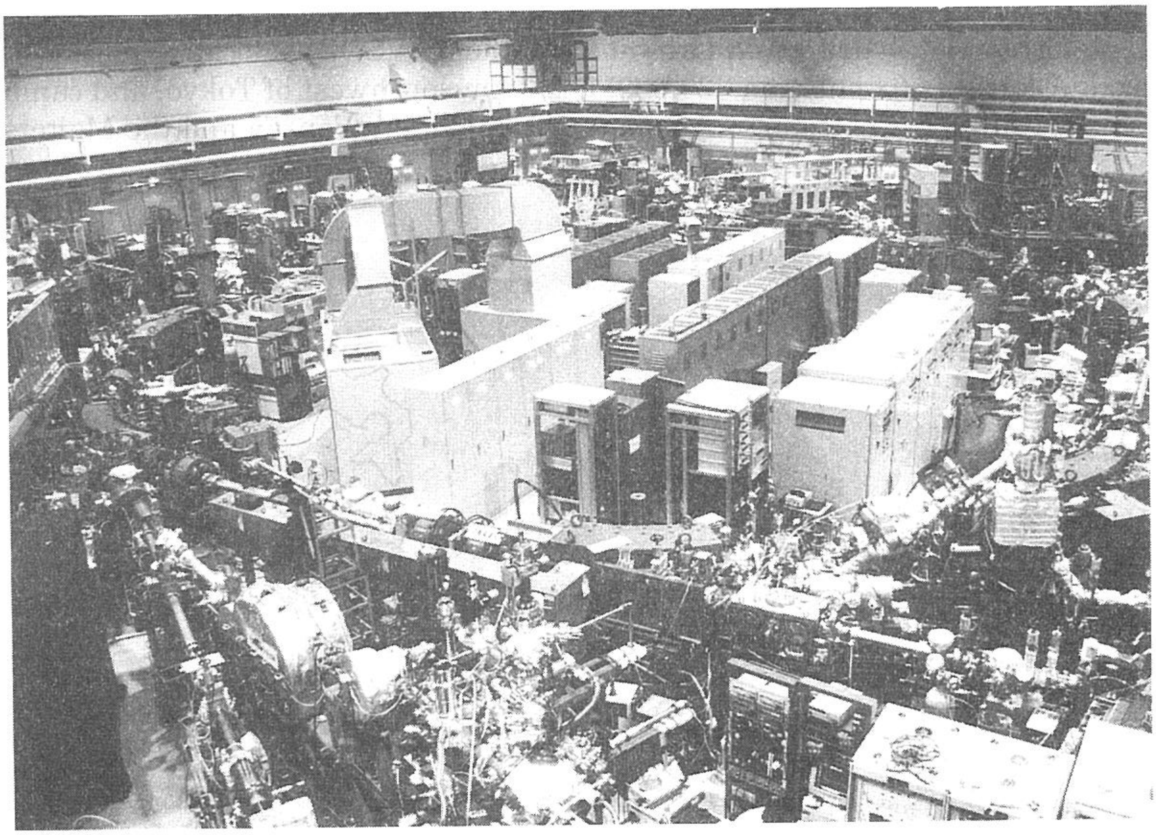
Ultraviolet Synchrotron Orbital Radiation (UVSOR) is located at Okazaki.Okazaki (population 320,000) is 260km southwest of Tokyo, and can be reached within 3 hours from Tokyo via the Tokaido Shinkansen and the Meitetsu line.



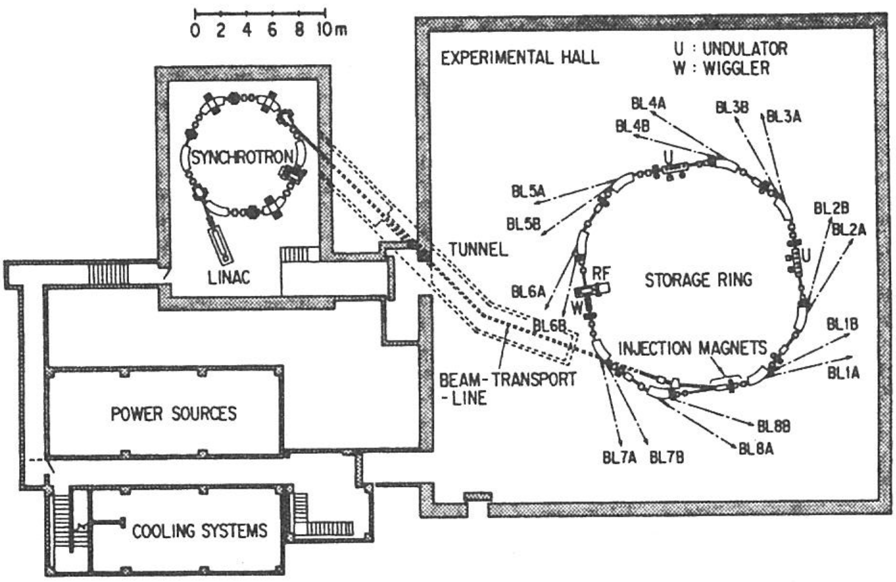
ADDRESS

UVSOR Facility
Institute for Molecular Science
Myodaiji, Okazaki, 444-8585, JAPAN

PHONE: +81-564-55-7402(Secretary)
+81-564-52-6101
FAX:+81-564-54-7079
Telex 4537475 KOKKEN J (IMS)
Homepage: http://www.uvsor.ims.ac.jp/



A picture of the experimental hall of the UVSOR facility.



Ground plan of the basement of the UVSOR facility.