UVSOR
ACTIVITY REPORT
1996

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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.
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> (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.

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