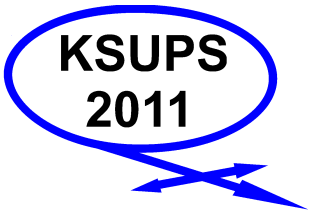
Proceedings of the 9th National Symposium of Synchrotron Radiation Users

Warsaw, September 26–27, 2011



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Recent Trends in Experimental Studies at Synchrotron Facilities (instead of preface)

In recent years we witness evolution of traditional experimental techniques spurred by technological development (some illustrativee exaples are given in the Table below). At the forefront of these changes there are experimental techniques developed on synchrotron rings offering abundant photon intensity, tunability and spatial resolution permitting to reveal subtle effects and offering deeper insight into properties of matter. A fast progress led to construction of third and next generation radiation sources. Profiting on the development most traditional experimental disciplines undergo deep change. Traditional crystallography across recent decades evolved to state of classical structure solving becoming mostly routine task offered to non-specialists via software integrated with modern diffractometers. Public interest and financial support moved to crystallography of biological macromolecules (protein crystallography) that bases mostly on synchrotron sources and uses highly developed Laue technique. During recent years we witness birth and maturing of new nanocrystallography targeting structure of non-crystalline biological molecules via analysis of femtosecond free electron laser diffraction images still before the molecule Coulomb explosion. At the same time, new techniques have been proposed to address structure of nanocrystals and nanomaterials. To this end the existing and planned synchrotron microbeams and nanobeams are important developments. Synchrotrons served as an environment promoting development of x-ray optics and detectors what resulted in perfectioning of the existing experimental methods and appearance of new ones like x-ray microscopy. Various spectroscopic techniques have been perfected employing highly focused beam giving unprecedented spatial resolution and mapping of large sample areas via scanning.

New trends are observed in organization of measurements at synchrotron beamline. They involve automation, remote control, and in absentio measurement schemes. Time saving due to a high degree of automation, leads to better beamline efficiency. With the remote control scheme, the user can interact with the experiment from any location in the world, having access to the internet. One application of this idea already works in protein crystallography. Another system, mail-in scheme, consists in sending the sample to a selected beamline and getting the results without physical presence there. These ideas are not widely used yet, but the trends enable massive, standardized and less costly experiments at synchrotron beamlines.

The new opportunities in experimental research offered by synchrotron facilities merit wider broadcasting and popularization. New techniques are usually not yet described in textbooks and researchers suffer lack of easily available suitable information. Such reasons stay behind organization by Polish Synchrotron Society of cyclical conferences on the use of synchrotron radiation in natural science. During these meetings community of less experienced researchers has an opportunity to listen about new experimental possibilities and interesting applications of well established methods. It serves a specially important purpose in view of a constructed currently in Kraków Polish synchrotron source aiming at serving Polish community and offering to Polish laboratories most of the advantages of a powerful photon beam.

The following part of this journal issue presents selected contributions presented during 9th National Meeting of Synchrotron Radiation Users held in the Institute of Physical Chemistry (Warsaw, Poland) on 26-27th September 2011. The national meetings are organized biennially interlaced with International Schools and Symposia on Synchrotron Radiation in Natural Science. It gathered 80 participants who presented 13 invited lectures, 9 oral presentations and 37 posters (see a photography of the gathered attendants). Most participants came from Polish scientific institutions although some represented foreign centers (Canada, Sweden, France). During the meeting two workshops were organized: one devoted to interpretation of XANES data "X-ray Absorption Near Edge Structure- Muffin Tin Model and beyond" (Dr. Keisuke Hatada, Laboratori Nazionali di Frascati dell'INFN), the other was a tutorial to a popular crystallographic software JANA2006 (prof. Vaclav Petriček, Institute of Physics, Praha, Czech Republic).

Among the invited lectures, the participants had an opportunity to listen about recent progress in construction of the first Polish synchrotron in Kraków (SOLARIS – the National Synchrotron Radiation Center at Jagellonian University) as well as about a new Polish initiative POLFEL – a free electron VUV laser. A number of review lectures covering e.g. x-ray absorption, magnetic spectroscopy/microscopy or presentations of interesting applications of diffraction experiments could serve as a valuable guide for students and less experienced researchers. An additional outcome of the conference was a textbook in Polish covering principal synchrotron techniques written by a number of experienced beam users ("Synchrotron Radiation in Spectroscopy and Structural Studies"). A regular book edition is in preparation. The Meeting has received financial support from the Polish Ministry of Science and Higher Education as well as material support from Prevac and Bruker.

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The topics of the Symposium covered in the present proceedings vary from protein crystallography and application of a concerted set of diffraction and spectroscopic techniques in characterization of interesting materials, to revealing a defect structure of technologically important single crystals and insight into nanostructure of a technologically interesting surfactants.

The Polish Society of Synchrotron Radiation organizes the next International School and Symposium on Synchrotron Radiation in Natural Science from 20th to 25th of May 2012 in Kraków-Tyniec (Poland) (see `http://issrns2012.ifj.edu.pl/`). The meetings scope and goals are analogous to currently described. All interested readers are cordially welcome to participate in this event.

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