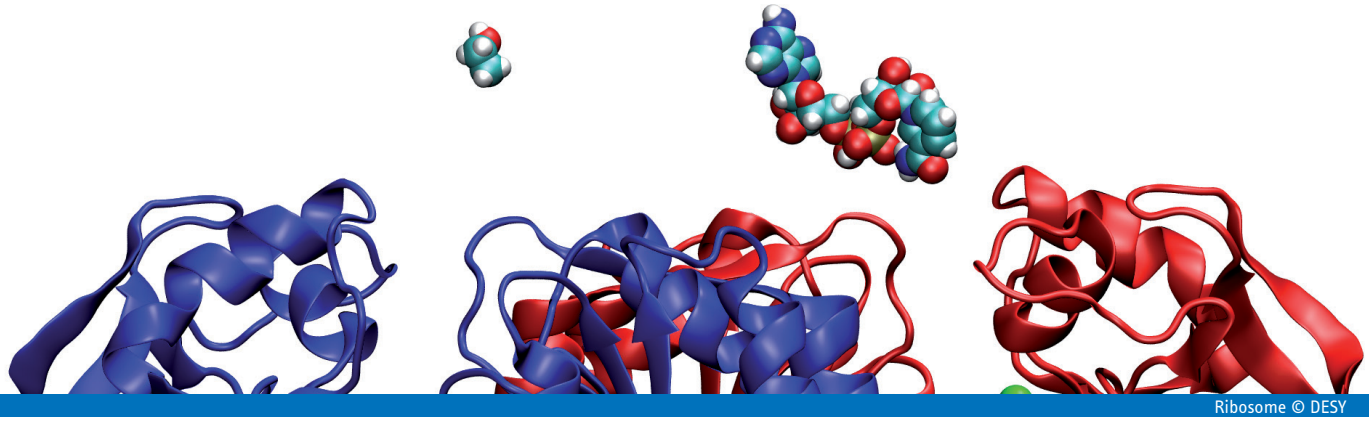
Röntgen Ångström Cluster

NEWSLETTER 04 | APRIL 2012



Ribosome © DESY

EXCLUSIVE INTERVIEW

RÖNTGEN-ÅNGSTRÖM-CLUSTER: INTERNATIONAL POWERHOUSE AND A MODEL FOR EUROPE

In a first ever interview together, Helmut Dosch, Chairman of the DESY Board of Directors, and Ulf Karlsson, Professor at the KTH Royal Institute of Technology, talk about the purpose and aims of the German-Swedish collaboration.

What is the purpose of the Röntgen-Ångström-Cluster?

Helmut Dosch: In view of the excellent research infrastructure such as the brilliant X-ray sources and the neutron sources that are put in place in Hamburg and in Lund, it became evident that both countries, Germany and Sweden, have to work much closer together. After there has been prominent focus on the infrastructures in the past, the Röntgen-Ångström-Cluster allows us now to better emphasize research. By joining forces we will make the best scientific use out of these outstanding facilities.

Ulf Karlsson: I personally have come to Hamburg since 1980 to pursue research. There has been a long tradition by Swedish scientists to use DESY's research facilities. Now we want to broaden and deepen this collaboration in a structured way by working together very closely on utilizing synchrotron radiation and neutron sources in the fields of materials research and structural biology – fields where our research facilities offer excellent research opportunities.

Would you say the Röntgen-Ångström-Cluster stands out from other collaborations?

Ulf Karlsson: It was a rather unusual decision for Sweden to collaborate with one specific country only and one has to give credit to the Swedish government to establish this novel collaboration structure. The Röntgen-Ångström-Cluster is indeed very unique and we have already received many applications and project proposals from German-Swedish research teams.

Helmut Dosch: The Röntgen-Ångström-Cluster is a whole new strategic cooperation. It demonstrates that something has changed on the governmental level. It shows that ministers understand that any future development requires the promotion of science and research at the core level and strategic cooperation with partner countries on a bilateral or multilateral level.

Continued on page 4

(photo: Helmut Dosch (l.) and Ulf Karlsson, © K. Strobel)

Editorial

An exciting year has begun for everyone involved in the Röntgen-Ångström-Cluster. Eight Swedish scientists have been selected and given funding to carry out research using the excellent facilities in place in Southern Sweden and Northern Germany. For more details on the projects, go to page 3.

The exciting news doesn't stop there. In their first ever interview together (see this page), Helmut Dosch, Chairman of the DESY Board of Directors, and Ulf Karlsson, Professor at the KTH Royal Institute of Technology, both coordinators within the Steering Committee of the Röntgen-Ångström-Cluster, talk about their high ambitions for the Röntgen-Ångström-Cluster, reaching far beyond Germany and Sweden. It's not surprising that the Cluster attracts new people with impressive biographies. More about them on page 2.

Enjoy reading! The editors

Please note: This is the last printed version of this quarterly newsletter. To sign up for the e-mail version, please go to www.rontgen-angstrom.eu.

News

MAX IV: ELECTRON BEAM IN THE GUN

A technological breakthrough was made at the MAX IV project earlier this year. For the first time an electron beam found its way from the new photo cathode radio frequency (RF) gun to the first Yttrium Aluminium Garnet screen (YAG) in the radio frequency test bed. The photo cathode RF gun shall be used in the MAX IV 3 GeV ring's injector, and it will give an electron beam for the short pulse facility and free electron laser applications. (www.maxlab.lu.se)

EUROPEAN XFEL: ACCELERATOR TUNNEL CONSTRUCTION COMPLETED

Construction of the more than 2 kilometre long accelerator tunnel of the European XFEL facility has been completed. At the end of February, the construction company ARGE Tunnel XFEL officially handed over the tunnel to Deutsches Elektronen-Synchrotron (DESY), which is acting as the building contractor on behalf of European XFEL. (www.xfel.eu)

The accelerator tunnel © DESY

New Faces

WINFRIED HINRICHS JOINS STEERING COMMITTEE

Winfried Hinrichs, professor of biochemistry at the University of Greifswald, is new to the Steering Committee of the Röntgen-Ångström-Cluster.

Hinrichs, born in 1950 in Hamburg, served an apprenticeship as laboratory chemist and then studied chemical engineering (1973). He studied general chemistry at the University of Hamburg, got his Ph.D. in 1983 and spent his postdoc period at the University of Leyden (with J. Reedijk). In 1996 he qualified as university lecturer at the Free University of Berlin (with W. Saenger). After a year at the IGBMC in Strasbourg (with D. Moras) he followed in 1999 the offer of the University of Greifswald. His research relies on the use of X-ray diffraction analyses.

One of his special areas of interest is the structure-function relationships of biological macromolecules. In 2011 the team headed by Hinrichs succeeds a crucial breakthrough: in collaboration with scientists of the Helmholtz-Zentrum Berlin and EMBL-Hamburg, using synchrotron radiation sources BESSY II and DORIS III, respectively, the structure analysis of the Monooxygenase TetX was successful.

The group at the University of Greifswald decoded the structure of this enzyme which represents a new resistance mechanism against Tetracycline antibiotics. Therefore, for the first time a key at atomic resolution was found to understand a resistance mechanism, even before the clinical medication of an antibiotic becomes ineffective.

Read more about Winfried Hinrichs at www.rontgen-angstrom.eu

ULRICH LIENERT: NEW MANAGER OF SWEDISH BEAMLINE AT DESY

Ulrich Lienert's new job as a manager of the Swedish High-Energy Materials Science Beamline at DESY represents a homecoming. The 47-year-old, who took up his position in January 2012, returned to his native Germany after 11 years in the USA and ten years in France. DESY and PETRA III, however, are new ground for the physicist.

"This new challenge very much appealed to me. Sweden has a strong materials science community and will have a world class medium-energy synchrotron facility with MAX IV. The Swedish Beamline at the DESY Petra III facility will add world-class high-energy diffraction capability", says Lienert, who gave up his post as Staff Physicist at the Advanced Photon Source at the Argonne National Laboratory in Illinois, USA, to come back to Germany.

Lienert's previous experience seems perfectly tailored to his new job. His first contact with high-energy synchrotron radiation was in the early 1990s, when he researched his PhD thesis at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, during the construction phase of the high-energy beamline.

He later completed a postdoctoral assignment at the ESRF optics beamline and became interested in high-energy micro-focusing. He became involved in the single grain characterization of polycrystalline materials by means of focused high-energy X-rays and was responsible in this role for the implementation of a first dedicated instrument at the ESRF ID-11 materials science beamline. At the Advanced Photon Source in the USA, Lienert's role was to build up a single grain diffraction programme. This now has an independent user group and, as the scientist explains, "is breaking new ground by involving the strong US modeling community."

In his new job he is aiming at just that: establishing a strong and efficient user group so that the Swedish Beamline at DESY can reach its full potential. "My next step", explains Ulrich Lienert, "will be to visit user groups that have been identified at various universities in Sweden and to find out how the beamline should be tailored to best serve their common interests." He is more than happy to be contacted by potential users: ulrich.lienert@desy.de.

The construction on the Swedish Beamline at PETRA III at DESY will start in the first quarter of 2013.

Röntgen-Ångström-Cluster Research

The Swedish projects to be funded in the context of the Röntgen-Ångström-Cluster have been selected. But what will the scientists investigate? Here's an overview.

Inger Andersson, Sveriges Lantbruksuniversitet
Coherent diffractive imaging and nanocrystallography: Structure of intact carboxysomes and components
Our aim is to use recent developments at free-electron lasers (FLASH, European XFEL) and conventional synchrotron facilities (PETRA III and the MAX facilities) to study marine photosynthetic carbon fixation as a system. In particular, we plan to determine the structure, supramolecular organization and function of the specialised organelles, carboxysomes, that compartmentalise CO_2 fixation in photosynthetic picoplankton.

Kristina Edström, Uppsala Universitet
The Consortium for Chrystal Chemistry, C3
The goal is to perform cutting edge crystal chemistry science for dynamic systems in technical relevant materials as well as for complex crystal structures for a number of different materials with the use of synchrotron radiation or neutron scattering.

Richard Neutze, Göteborgs Universitet
High brilliance X-ray probes for membrane protein structure, interactions & dynamics
Membrane proteins sit in the cell membrane and perform a wide variety of essential biological tasks such as detecting the physical environment of cells, signalling between cells, controlling the flow of food into and waste out of cells, and converting chemical energy and light into a form used throughout the cell. Despite their key importance within all cells, there is currently only limited knowledge concerning the structure, interactions and structural dynamics of membrane proteins. This lack of knowledge is mainly due to the large technical challenges associated with working with membrane proteins.
Read more about Richard Neutze at www.rontgen-angstrom.eu

Martin Hällberg, Karolinska Institutet
Structural basis of mitochondrial RNA biogenesis
Mitochondria are the main power plants of the eukaryotic cell. Deficiency or reduced function of mitochondria cause a wide range of genetic diseases and is heavily implicated in age-associated disease and ageing. The regulation of gene expression from mammalian mitochondrial DNA is of key importance for maintaining mitochondrial function but the molecular basis for this has been largely unexplored. We will use a structural-functional biology approach that will be an important step towards understanding these fundamental processes and their regulation on the molecular level. Ongoing and starting research directions in our lab will transform the way we think about gene regulation in mitochondria and open up new research possibilities and new avenues for cures for several mitochondrial disorders.

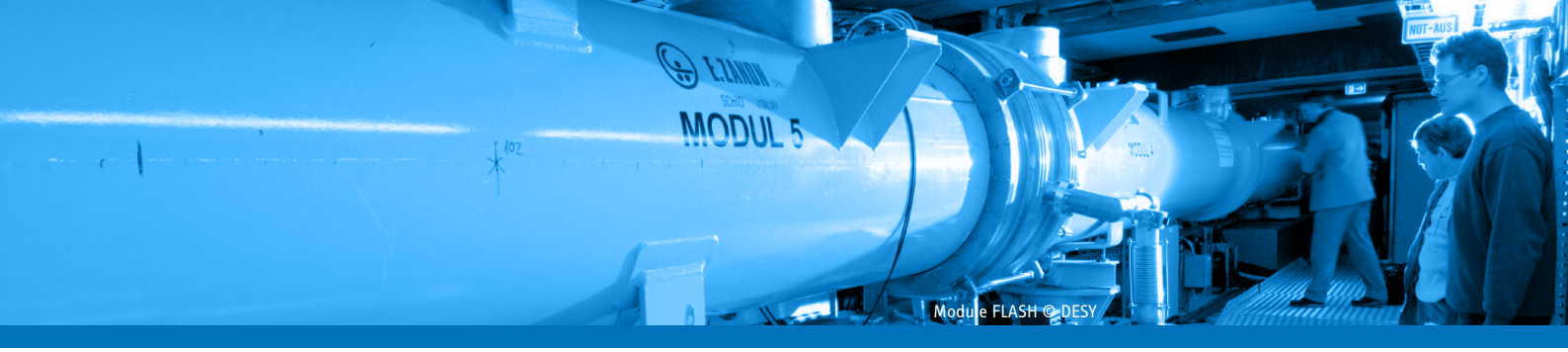
Hans Hertz, Kungliga Tekniska Högskolan
Resolution in Biological 3D Soft X-Ray Nano Imaging
Read more about Hans Hertz at www.rontgen-angstrom.eu

Edvin Lundgren, Lunds Universitet
Catalysis on the atomic scale
The purpose of this proposal is to facilitate the development of multifunctional catalytic coatings with enhanced activity and selectivity. We want to apply information from high energy in situ X-ray diffraction techniques, in situ high pressure X-ray photoelectron spectroscopy combined with theoretical modeling to:
1. Reduce NO_x emissions under lean combustion allowing for fuel-efficient and low-emitting combustion engines.
2. Reduce the temperature for catalytic methane oxidation for efficient combustion of biogas and natural gas.
3. Explore the partial oxidation, and CO_2 and steam reforming of methane over transition metal-MgO ternary oxides
4. Develop cheap and efficient bimetallic based catalysts for high selectivity in oxidation reactions.

Jens Birch, Linköpings Universitet
Materials Science of High Performance Cutting Tools Coatings by use of in-situ High Energy X-ray Scattering
Read more at www.rontgen-angstrom.eu

Janos Hajdu, Uppsala Universitet
Tomorrow's Biology at Advanced Photon Sources
This proposal brings together those who developed the scientific case in biology for building X-ray lasers (Uppsala) with the team that leads the world in synchrotron-based X-ray crystallography and the development of software for processing, interpreting and validating diffraction data in structural biology (EMBL, Hamburg). The planned work is linked to four facilities of the Röntgen-Ångström-Cluster: PETRA III, FLASH, European XFEL (Hamburg) and MAX IV (Lund). The laboratories will join efforts over the next five years to (i) work out procedures for dealing with the torrent of diffraction data from coherent X-ray sources, (ii) develop new software to improve the interpretation of results from coherent diffractive imaging experiments, (iii) advance the integration of sample environment for bringing a broad variety of biological objects within the scope of detailed structural studies with the large scale facilities available in Hamburg.
Uppsala and EMBL-Hamburg have highly complementary expertise in the relevant areas and are committed to put significant synergetic efforts into this project. The project is also necessary and timely, explains Hajdu. The results will benefit structural biologists at synchrotrons and X-ray lasers around the world.
An additional aim of this proposal is to prepare the scientists for an European XFEL-based user consortium jointly with the EMBL. The aim of the planned consortium is to establish an integrated biology infrastructure at European XFEL in response to a recent call for user consortia by European XFEL.

Detailed reviews of these projects can be found on our website www.rontgen-angstrom.eu.



Module FLASH © DESY

People

PROFILES

Following on from Newsletter 03, we will introduce members of the Steering Committee under this heading.

GÖTZ ECKOLD – PHYSICAL CHEMIST

Götz Eckold, Professor at the Institute of Physical Chemistry at the Georg-August-University Göttingen, is a member of the Röntgen-Ångström-Cluster Steering Committee. The Head of the Department Physical Chemistry of Solids and of the Isotope Laboratory at the Faculty of Chemistry has recently been awarded the Wilhelm-Jost-Memorial-Medal by the Göttingen Academy of Sciences and the German Bunsen Society for Physical Chemistry. It distinguishes him as a leading international physical chemist. Götz Eckold has devoted much of his attention to promoting neutron scattering in Germany and Europe. From 2008 to 2011 he was elected chairman of the German committee "Research with Neutrons" and the German delegate of the European Neutron Scattering Association.

His main scientific interests are the investigation of transformation and self-assembly processes in materials. Structure and dynamics of non-equilibrium systems and their real-time kinetics are studied with different microscopic methods in order to elucidate the basic atomic mechanisms. Research at large-scale facilities plays an important role due to the unique possibilities which differ entirely from laboratory experiments. New methods for time-resolved inelastic neutron scattering have been developed by Eckold that allow the detailed investigation of transient states in solids – an objective that is right along the strategic direction of the Röntgen-Ångström-Cluster.

Why neutrons? Götz Eckold knows the answer: „The neutron scattering is a powerful method which is ideally suited for deep insights into the structure as well as the dynamics of solids. As spies, neutrons penetrate deep into matter and provide detailed information about where atoms are and what atoms do – information which would otherwise be hidden."

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INTERVIEW continued from page 1

What are you hoping to achieve?

H. Dosch: We would like to become an international powerhouse and create a European Centre of excellence in Northern Europe. Eventually this German-Swedish collaboration of joint funding and joint programming could be a role model for other research-intensive regions in Europe.

U. Karlsson: In fact, we are also open to international partners. We have had talks with several other countries and the Röntgen-Angström-Cluster can be a model for the Baltic Science Link. Other countries can join as long as they participate in co-funding the research programmes. Science does not know any national borders.

To read the interview in full, please go to our website: www.rontgen-angstrom.eu.

The OTHER News

The Röntgen-Ångström-Cluster is not just a collaboration of scientists. The very term is a fusion of German, Swedish and English words. Here's an experiment of a different kind: try pronouncing it correctly. We have gathered a few pointers. While Germans list their letters from A to Z, Swedes list from A to Ö. That is, because after the Z, the Swedish alphabet features Å, Ä and Ö as independent letters. And, two of the single letters form words: "å" is the term for "river" and "ö" means "island". Here's how you pronounce the vowels:

O [o:]
U [u:]
Ü [ü:]
Ö [ö:]

Å [o:]
O [u:]
U [ü:]
Ö [ö:]

Admittedly, the Swedes are at an advantage. They know how to pronounce the ö but the Germans are at a loss when it comes to pronouncing A with a ball on top. Now you know: [Ongström:]

Announcement

Remember:
This quarterly newsletter appears in print only twice, and this is the second issue. Please make sure to subscribe to the e-mail version which will look the same. To subscribe, please go to www.rontgen-angstrom.eu.
Our website contains the full length interview with Helmut Dosch and Ulf Karlsson and many other highlights.