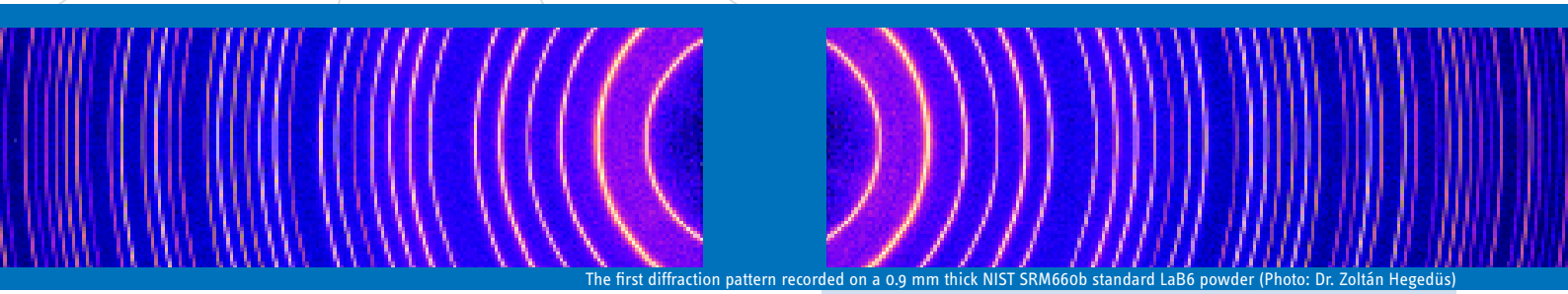
Röntgen Ångström Cluster

NEWSLETTER 16 | DECEMBER 2018



The first diffraction pattern recorded on a 0.9 mm thick NIST SRM660b standard LaB6 powder (Photo: Dr. Zoltán Hegedüs)

NEWS

First diffraction pattern from the Swedish Beamline at PETRA III

September 5, 2018, was the day: Commissioning started at the Swedish Materials Science Beamline (SMS, P21.2) at PETRA III on the DESY campus in Hamburg. The first diffraction pattern recorded on a 0.9 mm thick NIST SRM660b standard LaB6 powder at an energy of 87.95 keV (= 0.14097 Å) with two detectors placed 2 meters away from the specimen. The beam size was 1 mm² and the outermost diffraction rings correspond to a d-spacing of 0.6 Å.

'Strategy 2030': DESY sets course for the future

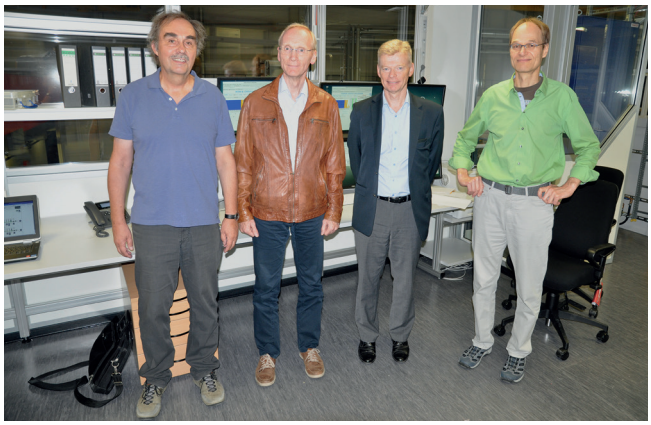
DESY is an internationally renowned research facility for the investigation of the structure and function of matter. To take this cutting-edge science into the future, DESY presented its "Strategy 2030" in spring 2018, outlining the research center's future with its two locations in Hamburg and Zeuthen, Germany. And DESY's goals are indeed ambitious: At its location in Hamburg, DESY plans to evolve into an "international port for science". For this purpose, DESY is partnering with national and local governments, the University of Hamburg and other research institutions. An innovative research focus and the future development of its large-scale research facilities have a top priority and will ensure its excellence in scientific research. "This could involve investments worth billions over the next 15 years, to set up new research centres and facilities," says Helmut Dosch, the chairman of DESY's Board of Directors. DESY's top priorities for the next years include building the world's best 3D X-ray microscope, expanding the X-ray laser European XFEL, constructing a new Centre for Data and Computing Science and consolidating technology transfer and innovation. The DESY Zeuthen site in the outskirts of Berlin is undergoing a similarly spectacular development by expanding it into an international centre for astroparticle physics. "As one of Germany's largest research centres, DESY is producing new insights and new approaches every day. This is the basis for meeting the challenges facing society in the future. However, it calls for long-term thinking, sustainable solutions and new technologies," as Dosch points out. "The strategy 'DESY 2030' takes these various goals into account. At the same time the centre is thereby also strengthening its leading role within the international scientific research community."

EDITORIAL

The year 2018 was a particularly exciting year for the RÅC, as more projects applied for funding while the RÅC summer schools are also gaining in popularity. The RÅC newsletter is pleased to announce many new opportunities in the coming year 2019. We will see the continuation of funded RÅC projects. This year's summer schools allowed young scientists to gain plenty of new insights in a number of ways – be it scientific, cultural or personal. And there are good news for every aspiring scientist interested in participating: The summer schools will continue in 2019 as well.

As one European member state is pursuing the path of exiting the European Union, therefore reducing integration, German and Swedish scientists are witnessing the increasing advantages of multinational cooperation. This holds especially true with very costly large-scale research infrastructures like the ESS, which are best financed amongst a number of partners. In this spirit, we will continue to move forward next year, keeping you up to date with RÅC newsletter.
Enjoy reading.

The Editors



From left: Wolfgang Drube until recently Project Leader PETRA III Extension Beamlines DESY, Edgar Weckert, Director in Charge of Photon Science DESY, Johan Holmberg, Swedish Research Council, and Ulrich Lienert, Beamline Scientist in charge.

NEWS

Twelve Million Euros in funding for German-Swedish cooperation on large scale-research facilities

The German Federal Ministry of Education and Research (BMBF) and the Swedish Research Council have renewed their funding for German-Swedish cooperation on large-scale research facilities in the field of material science and structural biology. Granted projects are expected to deliver fundamental insights leading to the development of new medication and materials. Many of the tools we use in our daily lives - from personal computers, to the telephone or the internet – are built upon the knowledge derived from fundamental research. This holds equally true for medicine or building materials.
During the ongoing funding period, Germany and Sweden are funding a total of nine collaborative projects having started on the 1st of July 2018 and lasting up to four years. Some projects address new methods of protein crystallography and others are developing new methods for studying thin layers of materials and new instruments for time-resolved material analysis. The scientific results serve as vital basis for the development of new medications but also for biocompatible surfaces of the future, such as artificial skin for example, or for high performance cutting tools.

Which topics are being supported?

1. New methods in protein crystallography are being developed. This will lead to more efficient methods of determining the structure and function of biomolecules. In return, researchers hope that this will enhance our understanding of biological processes in living things and eventually lead to the development of new medicines.
2. Improved combined methods for the study of therapeutically relevant nanoparticles are being tested. This can be used as multifunctional carrier systems for drug delivery in the human body.
3. New methods and instruments are being developed that can be used to investigate various challenges in the materials science of dynamic structural development. This allows rapid changes to be visualized in 3D, for example in materials of new electronic components.
4. New methods based on spectroscopic X-ray techniques which are in development will enable the technological usability of sustainable chemical reactions.
5. The genetic growth of herpesviruses is being investigated using a combination of imaging techniques. This lays the foundation for the development of new drugs against herpes virus infections.
6. New instruments for time-resolved material analysis are being developed. This will allow for the development of next-generation high-performance cutting tools.
7. Improved investigation of thin material layers by means of instrument-based developments. Their fields of application range from biocompatible surfaces over artificial skin and molecular machines to organic semiconductors.

2nd German-Swedish Call for Proposals for joint R&D projects by Small and Medium-sized Enterprises (SMEs)

Germany and Sweden are announcing a call for proposals for joint R&D projects, focusing on developing innovative products and applications in all technological and application areas. Applicants are expected to develop products, technology-based services or methods which will in subsequent steps generate sustainable solutions with market potential and potential to address societal challenges.

Deadline for proposal submissions: **March 13th, 2019**
For more information https://www.zim.de/international

News from the ESS site in Lund: Swedish King and Italian President inaugurate first major technical components

High-level Swedish and Italian delegations, led by King Carl XVI Gustaf of Sweden and President Sergio Mattarella of Italy came together at the ESS construction site in Lund to inaugurate the first major technical components to be commissioned at the European Spallation Source: the Accelerator's Ion Source and LEBT (Low-Energy Beam Transport Line).

Also in Lund for the ceremony were Queen Silvia of Sweden and Mrs. Laura Mattarella, the president's daughter and First Lady of Italy. Furthermore the Swedish Minister of Higher Education and Research, Helene Hellmark Knutsson, and Ricardo Antonio Merlo, Secretary of State of the Italian Ministry of Foreign Affairs and International Cooperation, were also present. The Italian president spent a total of three days for his state visit to Sweden.

The Ion Source and LEBT are components of the ESS linear proton accelerator, or LINAC, and were designed, built and delivered as a €4.5 million in-kind contribution from Italy which is one of the 13 founding members of the European Spallation Source ERIC (European Research Infrastructure Consortium).

President Sergio Mattarella of Italy (l) and King Carl XVI Gustaf of Sweden (r) at the inauguration of the first major technical components to be commissioned at the European Spallation Source: the Accelerator's Ion Source and LEBT.
photo: Annika Persson, Precious People

PROJECTS

Reiner Dahint
University of Heidelberg, Germany

Thomas Ederth
Linköping University, Sweden

A mobile set-up for simultaneous and in situ neutron reflectivity, infrared spectroscopy, and ellipsometry studies: Design, implementation and pilot experiments

Observing surface reactions in situ is one of the major challenges for today's scientists - a challenge that an international team of scientists from the University of Heidelberg and the Linköping University under the lead of Reiner Dahint are currently facing. And they even want to take the process one step further: They are not only working on the development of a set-up for in situ measurements, but also this set-up will be transportable and usable for different experiments simultaneously.

If successful, this set-up will merge several different measurement techniques in one and the same device. It uses neutron reflectivity to analyze thicknesses, density, roughness and layer compositions of structures. Simultaneously, it makes use of infrared spectroscopy in order to determine the molecular composition, conformation and ellipsometry to investigate adsorbates at the interfaces. Being so multifunctional makes this innovative set-up highly interesting for being used at neutron sources such as the European Spallation Source ESS in Lund.

In order to reach that goal, the scientists will work on four pilot projects: They will study nanoparticles – in particular, if and how metal nanoparticles may harm biomaterials and how biomaterials deform with a changing environment. The pilot projects will also how big molecules – either natural or artificial ones – change, how membranes couple to each other and how liquid crystal (LC) films form in detail.
Altogether, this project will be a milestone for the research in high-impact fields such as biophysics and modern technologies by being able to solve different scientific questions with one single device and combining different scientific methods. It will shed light on how cell membranes interact with drugs, how artificial materials can be made more compatible with biological material such as blood and tissue and how the conversion of energy of the future can be made more efficient and reduce pollutants – several questions that have the potential to reveal groundbreaking knowledge and lead to technologies of the future.

In operando cutting edge research: In-situ X-ray scattering studies of tool synthesis and metal cutting process (X-cut)

Jens Gibmeier (Karlsruhe Institute of Technology) and Magnus Odén (Linköping University) have started a new initiative to develop a new generation of cutting tools. From 2018 until 2022 they will design, fabricate and investigate innovative high-performance tools. High-performance cutting tools are of significant use and of high importance in today's industry. The biggest challenge: they need to fulfill several conditions. They should be environmentally friendly and economically competitive by featuring high cutting speeds and thus high production rates. One key factor for them is the metal coating.

The researchers of this project will work intensively on this particular issue. By using the excellent research facilities of the Linköping University and the Karlsruhe Institute of Technology, they are able to fabricate high performance and tailored thin films for the purpose of coating cutting tools. In previous studies, the team already showed how these layers form nanostructured films while being deposited and how they interact with workpieces. In this project, they will take the next step. The X-ray scattering technique plays a significant role on this path.

The international team of researchers will use this technique at the synchrotron radiation source PETRA III in Hamburg, Germany in order to conduct time-resolved in situ material analysis of the coatings. By this method, they can observe phase stability during and after the film growth under different conditions. Exemplary properties, the studies focus on, are high pressures and temperatures, different materials, stress, wear and phase transformations.

A major asset of this project is the fact, that the scientists are able to observe these parameters in real-time in operando. This will give them a much better insight into how tools and coatings behave and how they can be improved – while other material analysis can't reveal the influence of abrasion and chemical reactions while the tool is operating. The new results will enlarge the knowledge about processes cutting tools undergo prior to, during and after being used. The results will lead to optimized high-performance cutting tools and open up the door towards totally new innovative cutting tool coatings.

SCHOOLS

Photo: HZG/Jan-Rasmus Lippels

MATRAC 1 Summer School – an annual highlight for young material scientists

From 2 to 7 September 2018, 35 Students from Europe and beyond came together for an annual highlight in the world of engineering materials science: The MATRAC 1 Summer School offered students a week full of new insights on state-of-the-art scattering and imaging techniques. The strategic goal of the MATRAC Summer Schools is to strengthen research at synchrotron and neutron radiation sources. To achieve this, the format has been persistently adapted to the educational requirements of the Röntgen Ångström Cluster (RÅC).

This year, MATRAC 1 consisted of a three-day course complemented by a two-day practical training at the instruments of the HZG German Engineering Materials Science (GEMS) Centre and of DESY at the PETRA III synchrotron source in Hamburg. The renowned summer schools take place once a year, with alternating focuses on photons (MATRAC 1) and neutrons (MATRAC 2). Therefore, this year's MATRAC 1 School was the sixth of its kind since 2005.

It was hosted at the youth hostel "Zündholzfabrik" in Lauenburg, Germany, a small town in the south of Schleswig-Holstein. Its close proximity (40 Km) to the metropolitan region of Hamburg allowed for good connections and infrastructure, while at the same time offering the charm of a historical German small-town to MATRAC 1 participants. 17 talks of internationally renowned experts were at the heart of MATRAC 1. Amongst others, topics included "scattering theory", "structure determination", "engineering materials science", "experimental techniques" and "applications". Poster sessions offered Ph.D. students the opportunity to present their research projects and gain vital feedback. The two-day practical training at DESY in Hamburg included visits to the PETRA III synchrotron source as well as the European XFEL, providing students with insights on the vast possibilities these large-scale research facilities have to offer: In both short and more extensive experiments, participants of MATRAC 1 investigated the short-to long-range order of materials characterized by total scattering based on high-energy X-ray diffraction. Furthermore, they performed texture analysis of an ECAP sample and measured residual stresses in thin films using nanodiffraction for high-resolution mapping. With microtomography complex multi-hierarchical biomaterials were characterized and with temperature dependent high-resolution powder X-ray diffraction the structure of pyrochlores & other materials was determined. Finally, the new materials science beamline P21.2 was presented, including the analysis of diffraction data for quantitative phase analysis.

On the sidelines, participants had plenty of time for scientific discussions with their lecturers. The summer school was rounded off by various social gatherings. Next year's summer school will be MATRAC 2 with a focus on neutrons, therefore taking place at Herrsching/ Ammersee and at the FRM II in Garching close to Munich from 31 March to 5 April 2019. The next MATRAC 1 School will take place in Lauenburg and at DESY in September 2020.

Further information about MATRAC Schools can be found at https://www.hzg.de/ms/summerschool/index.php.en

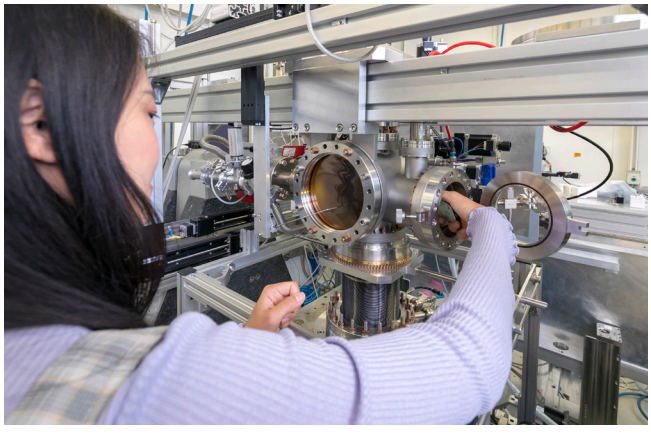


Photo: HZG/Jan-Rasmus Lippels

Photo: Claas Abraham

SCHOOLS

RACIRI on Rügen: Material scientists meet on Baltic island

Another year, another opportunity for young researchers in the field of material science to mingle, network and learn: This year's RACIRI Summer School took place on the beautiful German island of Rügen at the local Cliff Hotel from the 25th of August - 1st of September 2018. In the past years the RACIRI Summer School has become a well-established annual event in the field of material science, with the goal of strengthening the Baltic science and innovation area. For this purpose, RACIRI has taken on an important role in fostering connections to the excellent research infrastructures in the region. By enhancing their fundamental understanding in advanced materials design, RACIRI provides young researchers with the necessary tools to successfully tackle scientific challenges of today and tomorrow.

The picturesque island-setting on Rügen not only offers participants a stimulating learning environment. Additional time for social and cultural activities, like excursions to some of Rügen's most typical sites, round off the traditional RACIRI-experience. Over the course of the past six years, this trilateral German-Swedish-Russian format has evolved into the leading summer school for material science at large-scale research infrastructures around the Baltic Sea Region. Organized by DESY, based on an annual rotation scheme, this year's RACIRI Summer School focused on the theme: "From Basic Science and Applications to Technologies inspired by Nature".

In 2018, a total of 71 Students participated (Masters, PhD, Postdocs), 21 of which came from German-, 23 from Russian-, 14 from Swedish- and seven from third country institutions. In addition, a total of 26 international scientific lecturers were present to share their knowledge. In a total of six organized tutorial sessions, the students had the chance to exchange views with their lecturers. Other activities on the agenda included two poster sessions as well as a science slam.

More information is available at www.rontgen-angstrom.eu and www.raciri.org

Photo: Claas Abraham

ANNOUNCEMENT

DESY Photon Science Users' Meeting 24-25 January 2019

All users, cooperation partners and scientists who are interested in using photon sources for their research, are invited to attend the annual DESY Photon Science Users' Meeting „Research with Synchrotron Radiation and FELs" which is held on the last Thursday and Friday in January:
DESY is looking forward to welcoming interested scientists from many different disciplines for poster presentations and discussions of the current and future research at the DESY light sources.

MATRAC 2 will take place from 31 March to 5 April 2019 in and near Munich

The school MATRAC 2 "Application of Neutrons and Synchrotron Radiation in Materials Science with special focus on Fundamental Aspects of Materials" will provide a systematic overview of the application of neutrons and synchrotron radiation to the structural analysis of engineering materials and will focus on neutron scattering and imaging experiments. Students and young European scientists from research- and industry-backgrounds interested in this field are welcome to participate.

This school starts with the fundamentals of synchrotron radiation and neutron scattering. In contrast to MATRAC 1, the focus is subsequently shifted towards neutron techniques and their application on specific problems in materials science. Different classes of modern materials are presented and it will be shown how neutron scattering, on the one hand, and synchrotron radiation, on the other hand, can be used to explore the microscopic mechanisms that are responsible for their properties. While fundamental aspects are dominating, application related phenomena will be covered as well.

MATRAC 2 will take place from 31 March to 5 April 2019 in Herrsching/Ammersee (near Munich) and at the FRM II in Garching/Munich. The focus of the practical training will be on neutron experiments. Therefore, the participants will spend two days doing experiments at the FRM II. The School is significantly supported by German and Swedish funding bodies for their respective students. Furthermore, applications are underway for financial support for students from other EU countries in the frame of the SINE2020 Neutron and Muon Advanced Schools.
Further information about MATRAC Schools can be found at https://www.hzg.de/ms/summerschool/058653/index.php.en

THE OTHER NEWS

The General Data Protection Regulation (GDPR) is a regulation in EU law on data protection and privacy for all individuals within the European Union (EU). It also addresses the export of personal data outside the area, and it aims primarily to give control to individuals over their personal data and to simplify the regulatory environment for international business by unifying the regulation within the EU.
Since May this year, when the regulation became enforceable, companies and institutions have worked on how to best implement it in their routines. However, we truly hope that you will never need to meet an invitation like this...
God Jul! Frohe Weihnachten!

The editors

Imprint

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GDPR

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