DESY inFORM.

10|13
Newsletter of the
Research Centre DESY

Groundbreaking

A globally unique Centre for Infection Research is being built at DESY

Groundbreaking ceremony on the DESY campus: DESY director Helmut Dosch, Hamburg's Science Senator Dorothee Stapelfeldt, the German Federal Minister for Research Johanna Wanka, Rüdiger Eichel of Lower Saxony's Science Ministry and the head of the CSSB task force, Chris Meier from the University of Hamburg (from left to right). Photo: Lars Berg

In a groundbreaking ceremony Germany's Federal Minister for Research Johanna Wanka has formally opened the construction work for the Centre for Structural Systems Biology CSSB on the DESY campus in Hamburg. A consortium of nine research institutions has joined forces for this worldwide unique centre for infection research. Starting in 2016, viruses, bacteria and parasites will be analysed on the molecular level using X-ray radiation, with the aim to unveil their attack mechanisms and design tailor-made medication against them.

"The importance of infection research constantly increases in our globalised environment, because of travelling activities or intensive exchange of goods," Wanka emphasised. "Today, bacteria and viruses have much more and quicker contact and propagation possibilities. Only when we learn how these pathogens function will we be able to protect ourselves effectively." The new 50-million-euro research building will create the best research conditions. The German government will bear 73 percent of the investment costs for CSSB, Hamburg 17 percent and Lower Saxony 10 percent. The CSSB is a joint venture of the University of Hamburg, the Bernhard Nocht and the Heinrich Pette institutes, the University Medical Center Hamburg-Eppendorf, the Helmholtz Centre for Infection Research, Braunschweig, Forschungs-

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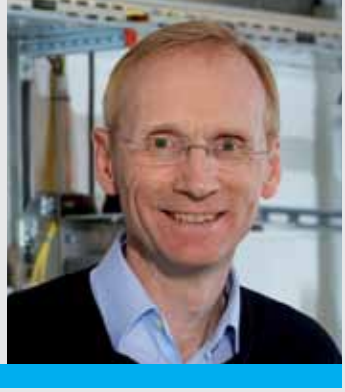


DIRECTOR'S CORNER

Dear Colleagues,

On 4 September, the construction of the Centre for Structural Systems Biology CSSB was launched with the traditional groundbreaking ceremony on the DESY campus in Hamburg, with the active support of the German Federal Minister of Education and Research Johanna Wanka. Up to 180 researchers will work in the new laboratory and office building.

The CSSB will focus on infection research. Access to new insights will be provided mainly by a comparatively young branch of biology, structural systems biology. The main objective of this research area is to unravel the intricate interplay of all molecular components and processes in a living organism, here during the early stages of infection. For example, bodies of humans and animals react with multiple interactions at the molecular and atomic level to the intrusion of bacteria, viruses or parasites. The exploration of such complex biological systems is only possible using state-of-the-art experimental and computer-based methods as well as the interdisciplinary knowledge of all the natural sciences.
DESY therefore provides the ideal environment for the CSSB. In cooperation with eight leading German institutes, the multidisciplinary experience in the field of infection research will be bundled and elaborate research instruments, such as cryo electron microscopes, will be shared. The close proximity to DESY's unique photon sources PETRA III and FLASH is essential for all structural studies at the atomic level. In the future, FLASH II will also be available for research. Its construction will be completed by the end of this year, and user operation is planned to begin in 2014.

And there's a novelty: for the first time, a research group for infection biology will be set up at DESY. The leading position is about to be filled. This group will lead to a close cooperation with CFEL researchers on the DESY campus, who are already testing new methods for the structure determination of biomolecules using X-ray lasers.
The CSSB adds to the exciting research facets at DESY, which you can see for yourself on our open day on 2 November.

Yours,
Edgar Weckert

zentrum Jülich, the European Molecular Biology Laboratory, the Hannover Medical School and DESY. The foundation of an own, in-house infection biology research group is a novelty for DESY.

The three-storey CSSB laboratory and office building designed by hammeskrause architects provides 13 000 square metres of space for 180 scientists. The laboratories, with a total area of about 2800 square metres, will boast the most modern equipment, such as cryo electron microscopes. About one third of the CSSB area will be reserved for junior scientist groups and guest scientists. Illustration: hammeskrause

"On the basis of the newest radiation sources, CSSB will build a bridge between fundamental physics research, as has been carried out jointly since 1959 by DESY and the University of Hamburg, and basic research in the life sciences," said Dorothee Stapelfeldt, Senator of Science and Research of Hamburg. "The message is clear: we want to further establish Hamburg and the Bahrenfeld research campus as an international centre for structural research."
Gabriele Heinen-Kljajić, Minister for Science and Culture of Lower Saxony, also emphasised, structure and systems biology and infection research would benefit from access to DESY's state-of-the-art radiation sources: "The already existing excellent infrastructural facilities at DESY and their extension with the CSSB will offer an unparalleled opportunity to bring together leading research fields in Northern Germany."
"With CSSB, an interdisciplinary centre of international standing will be established in Hamburg," said DESY's Chairman of the Board of Directors, Helmut Dosch. "Under its roof, eleven research groups will study the causes of infectious diseases and investigate fundamental cell biology processes on the molecular level. With its direct access to DESY's unique sources of extremely intense X-ray light, PETRA III and FLASH, and to the European XFEL X-ray laser, which will also take up operation in 2016, the centre will provide exceptional opportunities." *(tim)*

INFO
www.cssb-hamburg.de

Japan has decided

How does the ILC site recommendation influence the project?

23 August was election day in Tokyo: at a press conference, a selection committee announced that the Kitakami region located 500 kilometres north from Tokyo should be the site for the International Linear Collider ILC. This statement represents a decisive step forward for the next large-scale international particle physics project. “As from now, we are able to plan our accelerator, detectors, construction and logistics specifically for this site,” said Karsten Büßer from the DESY FLC group working at a concept for the ILD (International Large Detector), one of the proposed detectors for the ILC.

A central concrete wall runs between the planned accelerator and the supply systems. Illustration: Rey Hori/KEK

For about five years, Japan has been seeking an appropriate site for the international project with a 50-kilometre-long linear accelerator and a corresponding research centre, easily accessible for participating scientists from all over the world and – above all – with suitable geological preconditions in a seismically active area as Japan. From about ten sites that were presented at first, two possible sites remained; one in the Sefuri mountains in the south of the country and the other in Kitakami which was now chosen.

Both sites cross prefecture boundaries and are located in mountainous regions. The prefectures of both sites made intensive efforts to win the bid; they printed brochures, made YouTube videos, sent delegations to other research centres like DESY and CERN and collected hundreds of thousands of signatures. At the same time, a scientific panel compared the sites to find out which was the best one from the point of view of science and technology. This evaluation assessed the Kitakami region as more convenient to host the ILC for technological and socio-economic reasons.

“Both sites are almost equally good but Kitakami is more appropriate to fulfil the seismological and geological requirements,” said Karsten Büßer. “Here, the ILC would be completely built in a horizontal granite layer.” As known from seismic measurements, this layer is shaken in one bloc during earthquakes and does not break apart. When in 2011 the devastating tsunami hit Japan and the Kitakami region was severely affected, the seismometers in the granite layer showed five times smaller acceleration values than on the surface. “Nonetheless, we must include earthquake resistance in our planning for all components of our 15 000 tons detector; for both, operation and maintenance,” said Büßer. Physicists can now directly adapt this property to the operating site.

This is also true for the tunnel building technology: “The Japanese are extremely good tunnel building experts,” said Büßer. “There are lots of tunnels throughout Japan for roads and high-speed rail tracks.” The planned Kitakami ILC tunnel is designed as a self-sustaining eleven-metre wide tube, blasted into the mountain and subsequently equipped with a concrete wall in the centre. The accelerator will run on one side and all supply systems will be on the other side of the wall – an ideal scenario for a possible exchange during beam operation.

The fact that mountains of up to 700 metres are on top of the accelerator tunnel does not bother the planners. They just provide for lateral access to the tunnels to introduce all single components into the caverns – some of them weighing more than 100 tons. Simultaneously, optimisation programmes will be initiated to minimise the number of extremely heavy detector components. Thus, the site selection was something like an internal starting shot to combine global planning for the ILC with the framework data of the Japanese site and to create a building plan.

Indeed, a bit of urgency is recommended because currently there is much public support in Japan. In parliament, an ILC implementation committee has formed across party boundaries and Japanese technology and construction industries signal: we are ready to start. *(tz)*

Racy!
A highlight of the joint Hamburg and Zeuthen DESY company outing was the soapbox derby, with eleven pilots competing in five self-built vehicles.
Photo: Lars Berg

October

7-9 Workshop (www.terascale.de/lcschool2013)
4th Linear Collider Physics School
DESY, Hamburg

7-9 Workshop (http://tinyurl.com/gisaxs13)
GISAXS 2013
DESY, Hamburg

15 Lecture series „Gesund bleiben"
Angehörigenpflege
DESY, Hamburg, bldg. 1b, seminar room 4b, 16:00 h

15 Veranstaltung (https://indico.desy.de//event/KleinerGesundheitstag)
Kleiner Gesundheitstag
DESY, Zeuthen, SR 1 & 3, Foyer, 13:00-17:00 h

17 Lecture within the framework of HGF Exchange of experience "Betriebliches Gesundheitsmanagement"
Gesunde Führung und Spitzenleistung in der Forschung
DESY, Hamburg, bldg. 99, seminar room 2 + 3, 16:00 h

23 Science Café DESY (http://sciencecafe.desy.de)
Die dunkle Seite der Wissenschaft – Betrug und Fälschung in der Forschung
Ilja Bohnet, DESY, Hamburg, DESY Bistro, 17:00 h

24-25 Meeting
Physics Research Committee (PRC)
DESY, Hamburg

29 PIER-Helmholtz-Graduate-School Kick-off
Verleihung der Stipendien
DESY, Hamburg, auditorium, 16:00 h

30 Jentschke Lecture
How to simulate without a Computer – A physics approach to the brain
Karlheinz Meier, University of Heidelberg
DESY, Hamburg, auditorium, 17:00 h

November

2 DESY Open Day
DESY TOUR – Tag der offenen Tür und Nacht des Wissens
DESY, Hamburg, 12:00 - 24:00 h

4-5 Workshop
APPEC towards Horizon 2020
DESY, Zeuthen

6 Klavierkonzert
Die drei großen B - Vaterfiguren der deutschen Musik: Bach, Beethoven, Brahms
DESY, Hamburg, auditorium, 19:00 h

11-15 MINT-EC Schülercamp
Messung kosmischer Teilchen
DESY, Zeuthen, SR2

25 Lehrerfortbildung (www.desy.de/higgs-lehrerfortbildung)
Higgs-Entdeckung – Neue Erkenntnisse der Teilchenphysik
DESY, Zeuthen

27 Science Café DESY (http://sciencecafe.desy.de)
Was macht ein theoretischer Physiker in der Praxis?
Robin Santra, DESY, Hamburg, DESY Bistro, 17:00 h

Iron in the sun – a greenhouse gas for X-rays

Novel spectroscopic method provides valuable data for astrophysics

Scientists from the Heidelberg Max Planck Institute for Nuclear Physics (MPIK) in cooperation with DESY have investigated for the first time X-ray absorption of highly charged iron ions at the light source PETRA III. A transportable ion trap developed at MPIK was used for generation and storage of the ions. The high-precision measurements provide important new insight into the role of highly charged ions in astrophysical plasmas, e.g. for radiation transport inside stars.

Highly charged ions – that is, atoms which have been stripped off most of their electrons – play an important role in astrophysics. In many astrophysical environments like stellar atmospheres as well as in the interior of stars, where temperatures reach several million degrees Celsius, the highly charged state is the natural one.

X-rays determine the energy transport inside the sun and other stars. At its core temperature of 15 million degrees, a natural fusion power plant runs. If the solar core would freely radiate X-rays at those temperatures, it would quickly cool down and the fusion would stop. The sun works because the radiation transport to the outside is inhibited, thus maintaining the high core temperature. For this opacity, as scientists call it, iron plays an important role as a greenhouse gas for X-ray radiation.

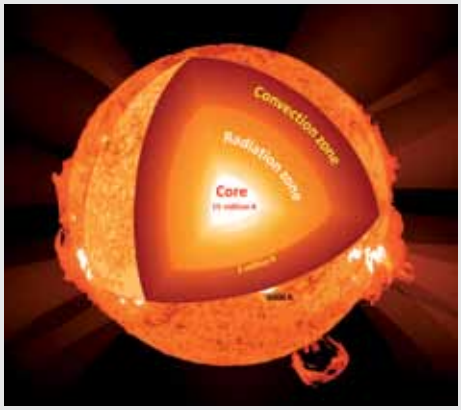


Illustration of the inner structure of the sun: The energy released by nuclear fusion in the sun's core is first transported outwards via radiation, while the energy transport in the outer shell is dominated by convection.
Graphics: Kelvinsong, modified by MPIK

At PETRA III, the team of José R. Crespo López-Urrutia from MPIK have prepared highly charged iron ions in eight different charge states and studied them systematically. This way, the absorption of the X-ray radiation by the iron ions could be measured for the first time, and with high precision. Among other things, the scientists determined the maximum radiant power which a single iron ion can handle. It amounts to almost one Watt per ion for the observed X-ray transitions.

The new data provide valuable insights for the opacity calculations that can be used as the basis of stellar models. In addition, they also help in the diagnostics of astrophysical plasmas, such as those surrounding active galactic nuclei.

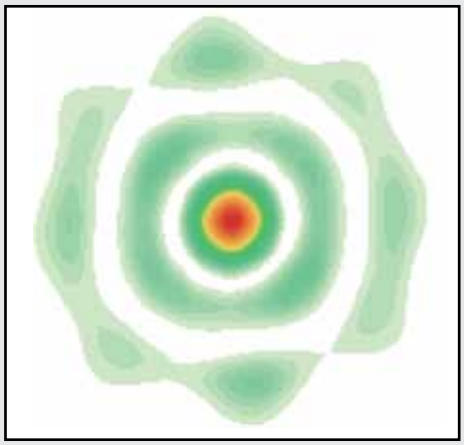
Reference: "X-Ray Resonant Photoexcitation: Line-widths and Energies of Kα Transitions in Highly Charged Fe Ions"; Physical Review Letters 111, 103002 (2013); DOI: 10.1103/PhysRevLett.111.103002

The world's sharpest X-ray beam

Researchers substantially increase resolution at PETRA III

The world's sharpest X-ray beam shines at PETRA III. At DESY's light source, scientists from Göttingen generated a beam with a diameter of barely five nanometres – this is ten thousand times thinner than human hair. The research groups of Tim Salditt and of Hans-Ulrich Krebs from the University of Göttingen published their work in the research journal Optics Express.

High-energy (hard) X-ray light cannot be focused as easily as visible light by using a burning glass. "Instead of a common lens, we use a so-called Fresnel lens which consists of several layers," explained co-author Markus Osterhoff. For this, nanometre-thin silicon and tungsten layers are deposited on a fine wire. The physicists then cut a thin slice from the coated wire that works as a lens. However, it does not diffract light like a glass lens but scatters it like an optical grid generating a pattern of bright and dark patches.



Two-dimensional reconstruction of the X-ray focus.
Image: University of Göttingen

The thickness of the layers is selected in such a way that the bright areas of the diffraction pattern coincide at the same spot. This way the physicists obtained an X-ray beam of 4.3 nanometres (millionth of a millimetre) diameter in horizontal direction and 4.7 nanometres diameter in vertical direction. Until recently it was even debated whether fundamental limits of X-ray optics would stand against such small focal widths.

The fine X-ray beam opens up new possibilities for materials science, e.g. the investigation of nano wires to be used in solar cells. "Usually, when investigating the chemical composition of a sample, the beam size limits the sharpness of the image. Before this experiment, this limit was at about 20 nanometers", said DESY researcher Michael Sprung, responsible scientist for the PETRA III measuring station P10, where the experiments were carried out.

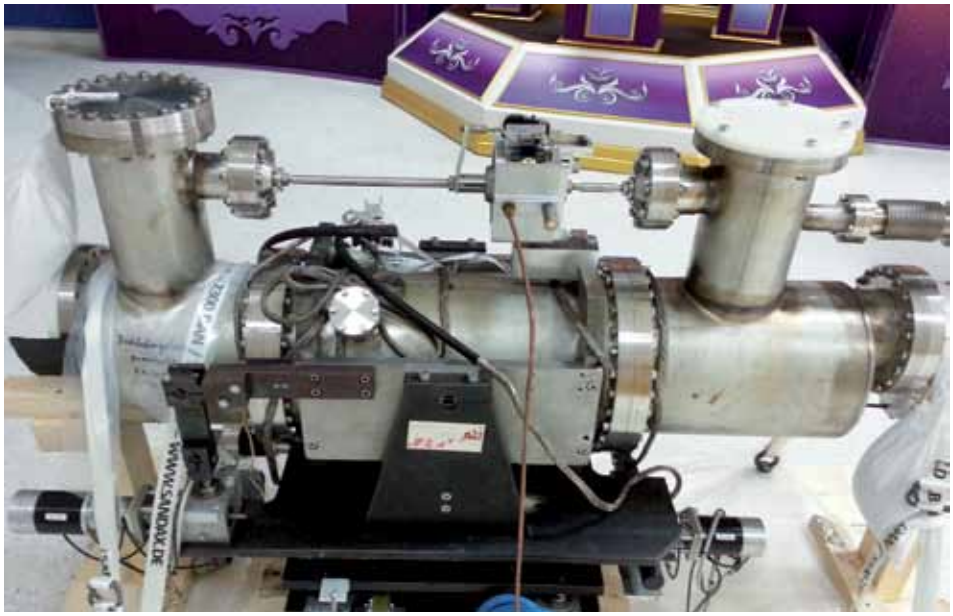
Reference: "Sub-5 nm hard x-ray point focusing by a combined Kirkpatrick-Baez mirror and multilayer zone plate"; Optics Express, Vol. 21, No. 16, (2013); DOI: 10.1364/OE.21.019311

DORIS technology for Thailand

X-ray mirrors shipped to Thailand's Synchrotron Light Research Institute

By Jonathan Lehmann

The container vessel Essen Express left Hamburg harbour with a special freight at the beginning of July: apart from other containers, there were several components of former DORIS beamlines on board, bound to Bangkok. The consignment included five X-ray mirror chambers and additional components. Within the framework of the DESY-Thai cooperation, these are to be installed in Thailand's synchrotron radiation source of the Synchrotron Light Research Institute (SLRI) located in Nakhon Rachasima (Khorat) in the northeast of Thailand.



The DORIS X-ray mirrors are destined for Thailand's Synchrotron Light Research Institute. Photo: SLRI

Currently, the SLRI owns three beamlines in the X-ray range; however, they do not include focusing elements. The installation of the DORIS components will increase the photon flux. "The DESY X-ray mirror chambers will significantly speed-up the extension of the existing and the implementation of new beamlines at SLRI," SLRI director of research Supagorn Rugmai emphasizes.

"This way, part of DESY's long-standing synchrotron radiation source DORIS will be re-used in Thailand," said Frank Lehner, one of the coordinators of the cooperation with Thailand. "This delivery is another milestone in our scientific cooperation."

DESY cultivates a long cooperation with Thai scientists. Apart from SLRI, DESY also works together with the Thailand Center of Excellence in Physics (ThEP Center) in Chiang Mai within the framework of PITZ. Moreover, since the first DESY visit of Thailand's Princess Maha Chakri Sirindhorn in August 2002, Thailand participates in the DESY summer students' programme.

"Since then, every year two Thai students receive a scholarship from the princess and are sent to Hamburg for a study period of eight weeks," said Pairash Thajchayapong, scientific counselor of the princess and member of the scholarship committee forwarding the applications of the best students to the princess. She then decides on who will take part in the DESY summer students' programme. Last year, the scholarship programme was extended to four students. This award and the foreign experience in Germany are a stepping stone for the students, said 28-years old Nirawat Thammajak, who completed his bachelor in chemistry at the Chiang Mai University before participating in the summer students' programme at DESY in 2007, and obtained a doctoral degree at Oxford University.

NEWS

Topping out at FLASH II

On 25 September, topping out was celebrated at the new FLASH II experimental hall. The shell construction of the new hall on the outside of the PETRA III storage ring is now complete. On the inside of the PETRA III ring, the undulator tunnel and the logistics buildings for a seeding laser, cooling and magnet power supply have already been erected. In January 2014, the new experimental hall will be "waterproof". After handover to DESY, it will be equipped with the first beamlines. Experiments with light from FLASH's second undulator line are expected to start in autumn 2014.

Helmholtz PhD Prize for Stefan Pabst

CFEL scientist Stefan Pabst is one of the winners of the first Helmholtz PhD Prize. The Helmholtz Association is honouring Pabst together with five other young scientists who are active in one of the Helmholtz research fields. In his award-winning PhD thesis, Pabst worked on two topics related to the research with free-electron lasers. He calculated the feasibility of aligning an ensemble of molecules by means of a laser pulse in order to subsequently image it using an X-ray laser. Experiments of this kind would make it possible to observe chemical reactions on their ultrafast time scale and would be an important step towards the imaging of single molecules.

The Helmholtz PhD Prize, which is endowed with 5000 Euro and awarded for first time this year, was created to support talented young scientists early on and encourage doctoral students to pursue a career in science.

Helmholtz Young Investigators' Group for María Aldaya Martín

Particle physicist María Aldaya Martín will establish a new Helmholtz Young Investigators' Group at DESY. Martín's group will work at the CMS experiment at the LHC to carry out ultimate precision measurements of top quarks and use them to search for new physics. Particularly now, after the discovery of the Higgs boson, the special status of the top quark as the heaviest elementary particle becomes more evident: it does not only interact very strongly with the Higgs field which gives mass to elementary particles, but recent theoretical calculations also revealed that the stability and, therefore, the ultimate fate of our universe depends very sensitively on the exact mass and the interaction of this quark. The group will also work on the development of the high-sensitive CMS tracking detector. For five years, the Helmholtz association and DESY provide financial support of 250 000 euros per year.

Highly focused – schoolgirls asked lots of questions to DESY role models. Photo: Marta Mayer

Concentrated girl power

Second MINT day for girls at DESY in Hamburg

"Go MINT" – with this slogan, DESY and the National Pact for Women in MINT Careers for the second time invited girls of grade 8 to 13 for one day to get extensive information about natural sciences and technology careers. Today, women still represent a minority in the field of mathematics, informatics, natural sciences and technology (MINT), and leading positions are a domain of men by almost 100 per cent.

"The promotion of young scientists is a central guiding principle of DESY," emphasises DESY equal opportunities officer Sylvie Faverot-Spengler who jointly organized the MINT day with the PR department. "In the first place, we want to encourage girls to deal with natural sciences and technology."

Evidently, this attracted a lot of interest. A large number of girls registered for this event but not all of them could be accepted. 190 participants from Hamburg and catchment area were finally welcomed in the auditorium by DESY Director of Administration Christian Scherf. "In the coming years, we will be searching for clever people who will advance our research. These are enormous opportunities which you should take," was his recommendation to the school girls.

In a short discussion, Scherf was asked among others about how many years it takes to become a director. He explained the various career steps and regretted that no woman managed to reach a leading position in the directorate during the time he has been working at DESY.

In discussions with smaller groups, the DESY role models answered numerous questions, especially concerning everyday work, the compatibility of family and career and job prospects. "Many of them also asked concrete questions about physics at DESY, for example about the Higgs particle and dark matter," said DESY physicist Isabell Melzer-Pellmann from the CMS group.

A DESY tour and helpful application advice from the DESY HR department completed the programme. A successful event, according to Scherf: "The great acceptance is wonderful; we will definitely plan to continue this." *(bl)*

INFO

http://mint.desy.de (in German)

HELMHOLTZ ASSOCIATION

New dosimeter with a large measurement range

A new radiation measuring instrument has been developed by a team of scientists from GSI Helmholtzzentrum für Schwerionenforschung GmbH in Darmstadt. Other than customary dosimeters, which are sensitive either to high-energy or low-energy radiation, the new instrument which has been introduced to the market is able to measure a larger range of energy.

Georg Fehrenbacher and his team used subdivided detector chips which are shielded to different extents. Special software exactly calculates the measuring data. This way, the measuring instrument can measure both, low-energy radiation of a few kilo electron volts and also high-energy up to about ten mega electron volts.

The dosimeter called DORIS („DOse Recording for Indoor and Outdoor Surveys") is an example for successful technology transfer from basic research in industry and economy.

http://www.helmholtz.de/perspektiven

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