

Messengers from the high-energy universe

First CTA prototype starts tests in Berlin



In 2018, the CTA will be more sensitive than the existing gamma observatories. Illustration: DESY/Milde Science Comm./Exozet

Star explosions, black holes, giant maelstroms – the Cherenkov Telescope Array CTA will open a new window to a violent cosmos. On 22 May, at the Berlin Science Park Adlershof, the first medium-sized prototype of the planned three CTA telescope types enters the testing phase. It was designed and built by the DESY institute in Zeuthen.

“The universe is full of natural particle accelerators, for example in supernova explosions, binary star systems or active galactic nuclei,” said Christian Stegmann, head of the DESY institute in Zeuthen near Berlin. “So far, we know only about 150 of these objects and we begin to understand the physics of these fascinating systems. The Cherenkov

Telescope Array will observe thousands of these accelerators with unprecedented sensitivity. It will be the gamma astronomy observatory of the future.”

The CTA, developed in an international cooperation, will observe cosmic high-energy gamma rays and will consist of three different-sized telescope types with sensitivity for different energy ranges. DESY is the largest group within the international project and is responsible for design and construction of the medium-sized telescopes with a mirror diameter of about 12 metres. “These will be the ‘working horses’ of CTA covering the core area of gamma ray energy of 100 to 1000 Giga electronvolts,” said Stegmann.

An eye on the pulse 3

New concept saves power at detectors

Honorary member 7

DPG distinguishes Herwig Schopper

Helpers want 8

Open day in Hamburg

At the prototype in Berlin Adlershof, the mirror suspensions, the drive and safety system and the rest of the mechanical system will be tested in the coming months. In the coming year, an alternative mirror carrier will be mounted and tried

CONTINUED ON PAGE 2



DIRECTOR'S CORNER

Dear colleagues,

those who access the campus from the side entrance at Luruper Chaussee and proceed in direction of the FLASH II construction site may have noticed the open areas which emerge at DESY. Guest houses have been torn down, roads have been relocated and trees have been logged to make room for future photon science projects. Two new experimental halls of the PETRA extension, hall east neighbouring the physics institutes of the university of Hamburg and hall north adjacent to the FLASH experimental hall, will be coordinated and erected at the same time as the construction of the new building for the Centre for Structural Systems Biology (CSSB). Construction is supposed to start in July; if everything goes according to plan, the first ten new PETRA III beamlines in both halls could already be available to scientists at the beginning of 2015.

The construction work for FLASH II, which has been delayed a bit because of the long winter period, is now making good progress. Construction of the tunnel carcass and the entrance building will be completed within the coming weeks; the technical infrastructure is now being installed on site. Connecting the two FLASH tunnels makes it

necessary to interrupt FLASH operation. In parallel construction has started for the new FLASH II experimental hall. From the beginning of 2014, the first of five beamlines will generate light for first experiments.

Not quite as visible as all the building work is the successful setup of the expertise in the field of laser research and development in the past years, which is extremely important for the further development of FLASH and the European XFEL. Ingmar Hartl came on board at the beginning of 2013 as head of the new group for laser development and operation, which will develop and operate novel lasers for accelerators and experiments.

All these developments would be unthinkable without the successful research done at DORIS for more than 30 years, laying the cornerstone not only for future research with synchrotron radiation. We will look back on the pioneering experiments which paved the way for groundbreaking research worldwide during the DORIS DAYS on 14 and 15 May.

Yours,
Edgar Weckert

out. When, in 2015, construction starts for the real observatory, the prototype will also move to this site. However, a decision has not yet been made upon the location. There are plans for one in the southern and one in the northern hemisphere.

In its commitment for CTA, DESY benefits to a great extent from the experience gained at other gamma observatories. With groups at VERITAS and MAGIC on the northern hemisphere and H.E.S.S. on the southern hemisphere, DESY participates in all large gamma observatories on earth, and also in the gamma space telescope "Fermi" – in connection with Markus Ackermann and Rolf Bühler, who recently was awarded the Shakti-P-Duggal Award for astroparticle physics. "This is a great advantage, because we are perfectly linked up and can build on a broad range of experiences and are familiar with different cultures. With this, we are perfectly prepared for CTA," Stegmann emphasises.

Not only CTA promises new insights into cosmic particle accelerators. The neutrino telescope IceCube at the South Pole, with DESY as the second largest group after the University of Wisconsin-Madison, delivered first hints of high-energy cosmic neutrinos. "An exciting time is beginning at IceCube: after the construction phase of many years, we will now bring in the scientific harvest," said Stegmann.

Bessel laureate in Zeuthen

The Spanish astroparticle physicist Diego F. Torres from the University of Barcelona received a Friedrich Wilhelm Bessel Research Award granted by the Alexander von Humboldt Foundation and will come to Zeuthen for a research stay. In the group of Elisa Bernardini, Torres will work among others on time-dependent phenomena in the high-energy cosmos. The Friedrich Wilhelm Bessel Award includes a prize money of 45 000 euros and is presented to renowned scientists from abroad to facilitate joint research projects with colleagues in Germany.

Already now, scientists are thinking about the extension of the giant detector which currently has more than 5000 photomultipliers within one cubic kilometre of eternal ice, scouting for the rare collisions of cosmic neutrinos. A proposal named PINGU plans to deploy extra photomultipliers into the ice in the inner zone of IceCube. As an alternative – or in addition – the detector could be extended with another 80 strings of photomultipliers in the outer zone; the proposal has the working title IceCube++. Zeuthen scientists are participating in the assessment of both options.

IceCube and CTA complement each other on the way to a common important goal, as Stegmann emphasises: "We investigate two cosmic messenger particles, neutrinos and photons. This will help us to understand how the high-energy universe works." (tim)

An eye on the pulse

New powering scheme tested at DESY saves space and money



The complete detector setup of the prototype in the test beam. The small silver box (lower right) provides the innovative power supply

Sometimes scientists tackle problems from unexpected angles. Future particle detectors like the ones for the International Linear Collider ILC or the Compact Linear Collider CLIC will face many challenges, some of which are similar to those of the running detectors at the Large Hadron Collider LHC, and some are very different. One such challenge is space: there is notoriously little of it, because the sophisticated particle tracking and identification methods leave no room for 'dead space' and it all needs to fit into the confines of the detector's powerful magnet.

So scientists working on detector prototypes for the ILC came up with the idea to save space by reducing the space-eating cooling mechanism for the electronics and sensitive materials. In order to make sure that the components don't overheat without cooling, they had another invention: a new powering scheme called power pulsing. In power-pulsed mode the detector electronics are only powered up when collisions are about to happen; inbetween cycles they go in a sort of stand-by mode. Running electronics generate a lot of heat, so powering them down makes sure heat isn't generated in the first place. It has the added advantage of saving power, and thus money.

The linear collider's pulsed beam cycle would easily allow for running the detectors in power-pulsing mode, so detector developers have started building prototypes to test whether their idea would work in real life. One such prototype delivered proof of power-pulsing principle earlier this year in a test beam at DESY: a Franco-Japanese collaboration working on a calorimeter for the ILD detector at the ILC tested their technological prototype in pulsed mode both with beam and in a magnet. Results were promising: "There seems

to be no extra signal from the power supply, which means that the signal is just as clean as in continuous mode," explains engineer Remi Cornat from the French lab Leprince-Ringuet (LLR).

Detectors are supposed to see a clear signal of the processes relevant to the physics phenomena that are being studied, but because of electronics, currents and various materials there is no such thing as 100% signal – there is always a little background noise. Keeping the noise down is crucial for good results. Scientists were worried that the new powering scheme might have a negative influence on the ratio of signal to noise, but there seems to be no effect. The next step is a refined version of the detector, with more channels, more chips, more front-end boards that will grow to more than three times as many layers as it is now and a total length of two metres. Then there's more testing to check the reliability and predictability of the new system. (baw)



Engineer Stephane Callier setting up the technological prototype for the silicon-tungsten calorimeter of the future ILC detector

Model for the future

The first wiggler in Europe was developed at DORIS in the 1980s. New models as shown here are used worldwide to generate brilliant X-ray radiation. The pioneering achievements will be commemorated at the DORIS DAYS on 14 and 15 May.
Photo: Heiner Müller-Elsner

WHAT'S ON AT DESY

May

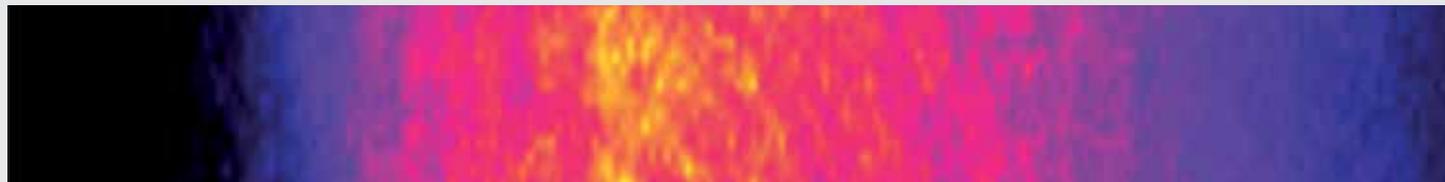
- 14-15** DORIS DAYS (<http://dorisdays.desy.de>)
DESY, Hamburg
- 21** Staff assembly
DESY, Hamburg, auditorium, 9:30 h
- 21** Colloquium
Colloquium for Christian Spiering
DESY, Zeuthen, seminar room 3, 17:00 h
- 22** Science Café DESY (<http://sciencecafe.desy.de>)
Graphen, das dünnste Lasermaterial der Welt
Isabella Gierz, DESY, Hamburg, DESY Bistro, 17.00 h
- 22** Teleskop Inauguration
MST prototype for the Cherenkov Telescope Array CTA
Berlin-Adlershof, 11:00-13:00 h
- 22** Public lecture (<http://fortbildung.desy.de>)
China – Wie überall und nirgendwo sonst
Martina Böck, DESY, Hamburg, auditorium, 19:00 h
- 27-31** Workshop (<http://lc2013.desy.de>)
ECFA LC2013

June

- 2** DESY Open Day in Zeuthen (<http://tdot2013-zeuthen.desy.de>)
10:00-17:00 h
DESY, Zeuthen
- 8** Lange Nacht der Wissenschaften
16:00-24:00 h
Campus Berlin-Adlershof, am Teleskop
- 12** Science Café DESY (<http://sciencecafe.desy.de>)
Hautnah – Zell- und Bakterienhaut im Forschungsfokus
Oliver Seeck, DESY, Hamburg, DESY Bistro, 17:00 h
- 12** Public lecture (<http://fortbildung.desy.de>)
Vom Urknall bis zum Kältetod – Die Geschichte des Universums
Karsten Büber, DESY, Hamburg, auditorium, 19:00 h
- 15** Event series Music & Science
„Einsteins Universe“, B. Foster & J. Liebeck, 17:30 h
Konzert, J. Liebeck (violin) und J. Drake (piano), 20:00 h
Laiezhalle, small hall
- 18** Lecture Series “Gesund Bleiben”
Reisebegegnungen mit Gifttieren
bldg. 1c, seminar room 4a, 16:00 h
Professor Dietrich Mebs, Uni Frankfurt
- 18** Tuesday seminar
HERA Forum: Results for the Summer Conferences
DESY, Hamburg, DESY-Hörsaal, 16:45 h
- 18-21** Meeting
VERITAS Collaboration Meeting
DESY, Zeuthen

Scientists Measure X-ray Laser's Heartbeat

Ultrafast stopwatch determines duration of femtosecond FLASH pulses



Profile of a complete FLASH pulse

Many fundamental processes in nature, including certain chemical and biological reactions, occur on very small time-scales. X-ray free-electron lasers (FEL), with their intense light bundled into femtosecond (trillionth of a second) pulses, hold promise for watching these processes in real-time. Using DESY's pioneering FEL FLASH, a German-Polish research team has developed a novel pulse duration monitor, which allows the measurement of FEL pulses while simultaneously performing ultrafast experiments. The scientists report their method in the journal "Nature Communications".

A major complication is the irregular "heartbeat" of FELs. The length of individual pulses emerging from the FEL and the time between them vary from shot

to shot. Therefore, researchers require a fast timing tool that has the ability to tell them precisely when each single pulse arrives at the sample and how long it lasts, while the very same pulses are still used for probing the sample. To this end, the team, including DESY scientists, use a transparent membrane made from silicon nitride, a mere 20 nanometres (millionth of a millimetre) thick, that changes its reflectivity when hit by an FEL pulse.

Because the FEL pulse slants through the membrane, it reaches different positions on the membrane at different times, producing a temporal profile of the pulse. To read out this profile, the researchers shine an infrared laser through the membrane, while a camera behind the membrane records the transmitted light. This way, length and timing of the indi-

vidual FEL pulses can be determined, measuring the "heartbeat" of the FEL.

"With our method, users can directly measure the FEL pulse length in their experiment, and they can do so for every individual pulse," says DESY scientist Sven Toleikis, part of the team. "The thin material absorbs only fifty to eighty percent of the FEL radiation, letting enough intensity through for other experiments," says first author Robert Riedel from Franz Tavella's group at Helmholtz-Institut Jena. Thus, experimentalists will now be able to simultaneously perform ultrafast experiments and crucial pulse duration measurements.

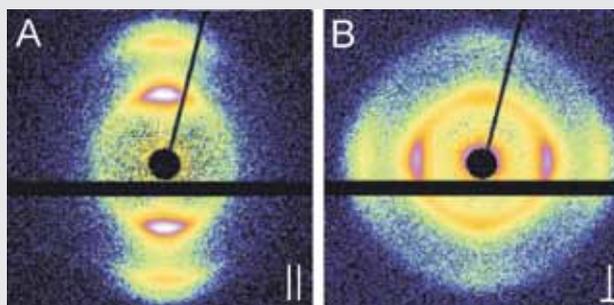
Reference: "Single-shot pulse duration monitor for extreme ultraviolet and X-ray free-electron lasers"; *Nature Communications*, 2013; DOI: 10.1038/ncomms2754

Surprising turn of microparticles in capillaries

X-rays reveal unexpected re-orientation

When small particles flow through thin capillaries, they display an unusual orientation behaviour. This has been discovered by a research team led by Stephan Förster and Walter Zimmermann from the University of Bayreuth at DESY's X-ray sources DORIS III and PETRA III. The discovery is of major importance for spinning processes designed for the production of synthetic fibres, and for the understanding of vascular stenosis, as the team, including scientists from DESY, report in the scientific journal PNAS.

Rod- or plate-like particles flowing through thin capillaries, usually orientate themselves parallel in relation to the flow direction. But if a capillary widens, for instance after a bottleneck, the particles align themselves perpendicular to the flow direction. Not only have the scientists



X-ray diffraction shows the parallel (A) and perpendicular (B) orientation of the particles in flow direction

discovered this surprising phenomenon, they have also found an explanation. In theoretical calculations they were able to show that within the widening capillary segment, strong dilating forces appear perpendicular to the flow direction that cause a realignment of the particles.

This is crucial to the understanding of many biological and technical flow processes. One example is the process of spinning, whereby solutions of macromolecules and particles are pressed through fine spinning nozzles. For strong fibres the macromolecules and particles have to be parallel to the flow direction. However, after leaving the nozzle they turn

perpendicular. This explains why spun fibres have to be stretched to put the building blocks in the parallel position again.

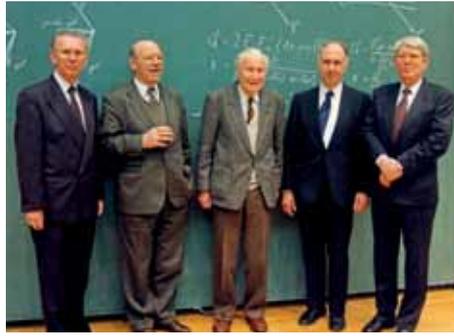
Reference: "Anisotropic particles align perpendicular to the flow-direction in narrow microchannels"; *PNAS*, 2013; DOI: 10.1073/pnas.1219340110

Tireless commitment

Former DESY director Herwig Schopper becomes honorary member of the German Physical Society

At its spring meeting, the German Physical Society (DPG) made former DESY director Herwig Schopper a honorary member. Another honorary membership was presented to the German laser pioneer Dieter Röb. The exclusive circle of living DPG honorary members has now grown to ten, the Society reports.

Herwig Schopper, born in 1924, studied physics in Hamburg and, as a postdoc, worked with Lise Meitner in Stockholm. The particle physicist was awarded the honorary membership in acknowledgement of his long-time tireless commitment to fundamental research in physics in Germany and Europe, especially during his time as director of DESY and CERN. With the storage rings PETRA and LEP, he laid the foundations for ground-breaking measurements, the Society emphasised. Moreover, as president of the DPG in the period of the German reunification and as president of the European Physical Society, he has made important contributions to strengthen and make visible physics in Europe. Herwig Schopper was DESY director from 1973 until 1980.



Former DESY director Herwig Schopper (leftmost) with his fellow colleagues Wolfgang Paul, Willibald Jentschke, Volker Soergel and Björn H. Wiik (f.l.t.r.)

Dieter Röb, born in 1932, ran the first laser in Germany at the end of the 1960s and, as chairman of the executive board of the Wilhelm und Else Heraeus Foundation he has dedicated himself to promote both science communication and young scientists in the field of physics for more than 25 years. (tim)

INFO

DPG honorary members: <http://www.dpg-physik.de/preise/ehrenmitglieder.html>

One day at DESY

40 teachers from all over Germany on a discovery tour

By Karen Ong

On occasion of the 104th congress of the MNU (German association to promote mathematical and natural sciences at school), 40 teachers from all parts of Germany met at DESY at the end of March. For many years, DESY has been engaged in encouraging interest in physics: in the school labs at the Hamburg and Zeuthen institutes, school classes get the opportunity to do experiments; in the DESY Science Café, pupils experience first-hand science; in the masterclasses, they even do research with real data.

At the national MNU congress, the participating teachers themselves had

the opportunity to witness a day at DESY. The all-day excursion started at the DESY “physik.begreifen” school lab in Hamburg, opening its laboratories during the morning. The teachers were able to learn much about work at the school labs and to try out experiments themselves. In the afternoon, they were taken on an extended tour around the research centre and at the end they gathered in the Science Café to focus on history, misinterpretations and myths of the Coriolis force. In addition, DESY offered a teaching workshop giving the participants a lot of suggestions and recommendations on how to convey the fascination of physics to pupils.

NEWS

Communicator-Prize for Metin Tolan

This year’s communicator prize for outstanding science communication goes to the experimental physicist Metin Tolan from the University of Dortmund, who for many years was chairman of the DESY Scientific Council. According to the German Research Foundation and the Donors’ Association for the Promotion of Sciences and Humanities in Germany presenting this prize every year, the 48-year-old physicist convinced the jury in the first place with his witty and variegated communication formats. Themes as “James Bond and physics” and “Laugh with Stan and Olli – physics is fun” are also regularly presented by Tolan in the public evening lectures at DESY.

Anniversary table football tournament

The DESY table football tournament goes into its fifth round: the traditional competition takes place from 13 May to 13 June. Registration deadline is 8 May. The players compete as doubles; the preliminaries begin on 13 May, the playoffs on 3 June. The finals take place on 13 June, including the customary barbecue. Not only players, also spectators are always welcome.

www.desy.de/~kicker/

Demography model of the month

In April, the Potsdam state chancellery distinguished the Zeuthen institute of DESY as a “demography model of the month” to highlight their pioneering work for the Brandenburg “Future Day for boys and girls”. At the award presentation, Tina Fischer, state secretary and representative of Brandenburg to the Federal Government, pointed out that eleven years ago DESY was one of the first institutions in Brandenburg to join this internship day and which has continuously expanded its offers. Moreover, DESY stands out with safeguarding of skilled personnel and many other initiatives and ideas.

“Speed Dating” with DESY role models

Science and technology offer exciting careers – also for women. On 18 April, a group of four DESY women had the opportunity to convey this to about 90 secondary level pupils from Bismarckschule in Elmshorn near Hamburg. In three speed-dating rounds of 20 minutes, the DESY role models informed the future high school graduates about job opportunities in the field of mathematics, informatics, natural sciences and technology (MINT); about what made them choose their profession and what fascinates them about their work.

For the 2nd girls’ MINT-Day in September, the organisers are again seeking women as role models who are willing to present their profession and answer questions.

Interested women please contactgb@desy.de
www.desy.de/ueber_desy/karriere/mint/role_models

Bundestag relies on Helmholtz

From August 2013 and for the coming five years after that, the Helmholtz Association will be represented with two of its centres at the Office of Technology Assessment at the German Bundestag (TAB). This was the result of an election among German parliament members end of February. Accordingly, the Institute for Technology Assessment and Systems Analysis (ITAS) at the Karlsruhe Institute of Technology was confirmed as the main operator; the Helmholtz Centre for Environmental Research was added as a new partner. Further partners are the IZT - Institute for Futures Studies and Technology Assessment and the VDI/VDE Innovation + Technology GmbH.

TAB analyses the consequences of new science and technology developments, the opportunities they offer and which legal, economic and social parameters are already available or must still be created for a successful implementation. On this basis, the office develops recommendations for policymakers, thus playing an extremely important advisory role for German parliament members.

www.helmholtz.eng/hermann



Warming up for the Open Day

Next marathon for bright eyes and hands-on experiences on 2 November

If you enjoy being bombarded with questions asked by curious visitors from Hamburg and like to present to a large audience what we are doing at DESY, please mark 2 November in your calendar, the date of the next DESY Open Day. From noon to midnight, thousands of Hamburg residents will flock to our campus to learn more about our lab.

Every two years, the open day takes place at DESY in parallel to Hamburg's Night of Science, and DESY is always the most visited place of this science marathon. In the end this is due to all the DESY people presenting their personal facets of the research centre to the visitors, including the library, the workshops and – of course – the laboratories. Everybody finds their own way to approach the visitors and many of them get so much into it that they forget to take a break or work on long after their “shift” has officially ended. “I was completely excited when I experienced my first open day in 2009,” DESY head Helmut Dosch said. “Every

visitor who was here must have sensed the heartbeat of science.”

Again this year we encourage everybody at DESY to contribute to the open day. All kinds of activities are welcome: individual actions together with colleagues from the working group or single helpers for general and special tasks – everyone who wants to join the “DESY information source” team of around 800 people is asked to register and put their name down for the standard helper's equipment. Very urgent questions can already be asked via email tdot@desy.de; a corresponding website will be available from June, with information and the possibility to register and enter planned actions.

Everybody who would like to experience the open day atmosphere in advance are invited to go to Zeuthen on 2 June where this year's open day takes place from 10 a.m. to 5 p.m. (tz)

Imprint

Publisher
DESY-PR
Notkestraße 85
D-22607 Hamburg

Contact
email: inform@desy.de
telephone +49/40/8998-3613
www.desy.de/inform
(online version + newsletter subscription)

Editors
Gerrit Hörentrup
Till Mundzek (editor-in-chief)
Barbara Warmbein
Ute Wilhelmsen
Thomas Zoufal

Production
Britta Liebaug (layout)
Veronika Werschner (translation)
Kopierzentrale DESY (print)

