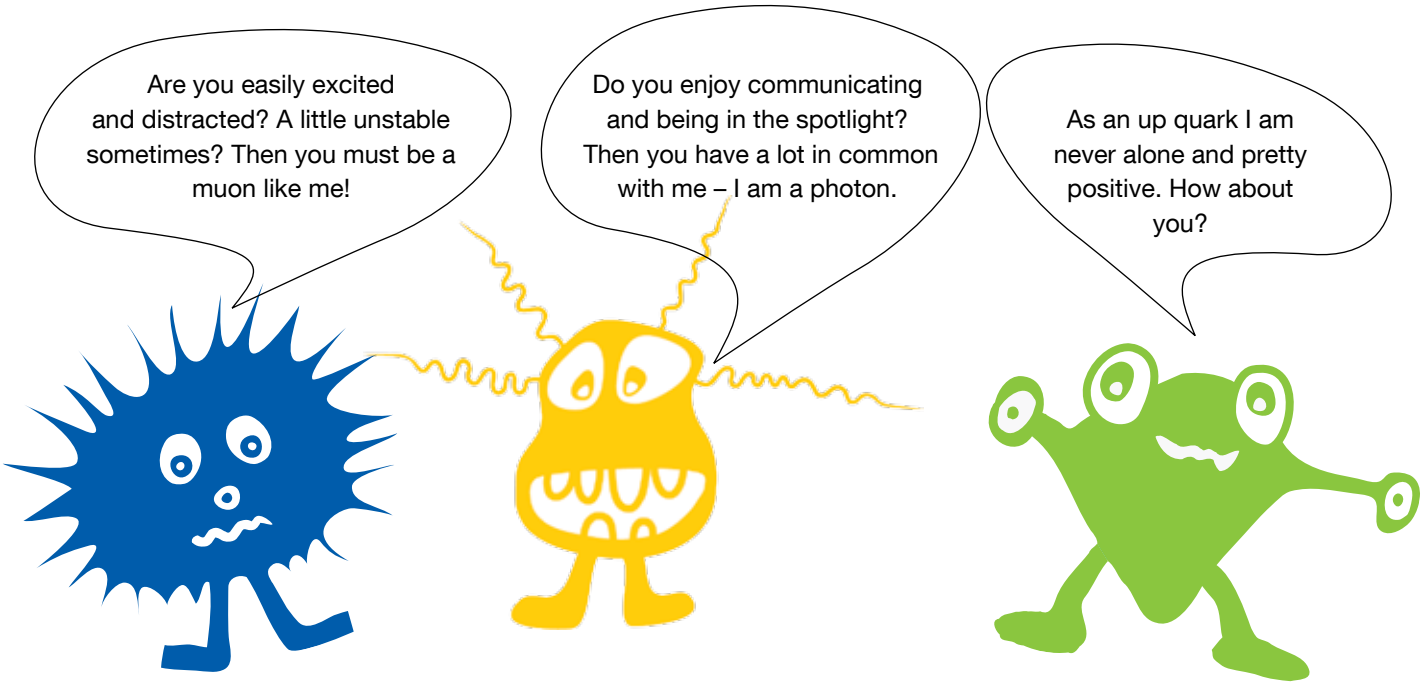
DESY inFORM.

09|13
Newsletter of the
Research Centre DESY

# Which particle suits you best?

## "Teilchenzoo" – interactive exhibition presented by DESY and the science center Universum Bremen




Do you enjoy being part of a large group and is your view on the world positive? If so, the up quark is a good match for you! If you are a communicative person and like to be in the limelight, you might identify with the photon. And if you just feel heavy and lethargic, the Higgs particle could be the one for you.

In a catchy design and not to be taken too seriously, a personality test with the elementary particles kicks off the exhibition "Teilchenzoo" (particle zoo) which DESY and the science center Universum Bremen will inaugurate on 27 September in Bremen. With the aim to motivate the visitors to go on the hunt for the Higgs, quarks and other particles, each participant will first find out what their particle counterpart is before going on an individual tour through the exhibition. Anthropomorphising particles will probably not go down well with all physicists; however, it invites the non-professionals to get involved with the otherwise abstract world of particle physics. The presentation of the particles as pleasant little monsters supports this approach.

Visitors can pick their favourite particle and learn more about the fascinating world of particle physics from exhibition panels, interactive exhibits and multimedia stations. Matter particles and force particles, ghost particles, antiparticles, the famous Higgs particle, and also the graviton, which so far only exists in theory – all are presented in separate areas of the exhibition. Who discovered which particle, when and how; why do theorists go on inventing new particles? How do scientists study the smallest particles of the universe? How do they all fit together in the grand theo-

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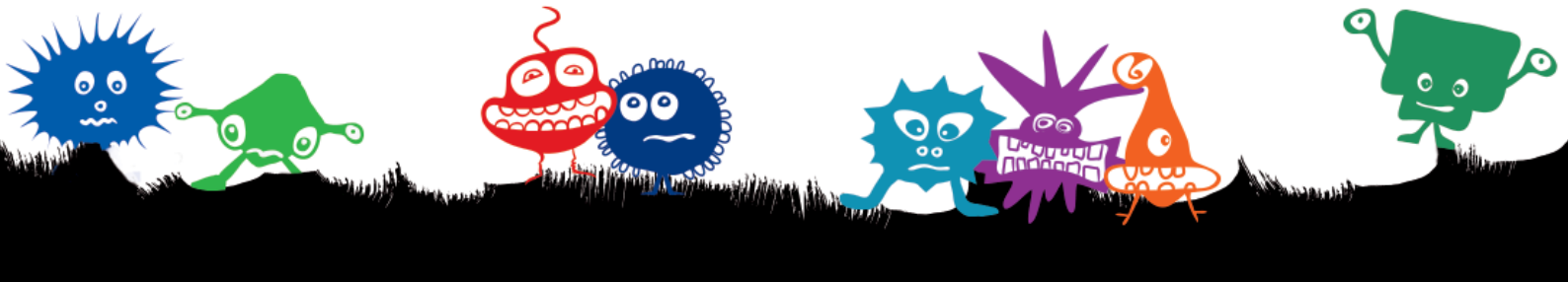

## DIRECTOR'S CORNER

Dear colleagues,

After thorough preparatory work, the DESY mission and guiding principles have been formulated in a joint effort. The result was presented at the recent staff meeting.

The creation of guiding principles was an important task; now it is time for implementation. To conduct an opinion poll is useful not only before elections. At the staff meeting, a televoting system supported us in finding priorities. The result: you think that the guiding principles "research at the highest level" and "work and private life" are the most important. This view is shared by the directorate.

With regard to the implementation of our guiding principles, you think most action is needed for the topics "joint operations", "work and private life" and "sustainability". These topics can apparently be improved at both DESY institutes, and this will also be essential to accomplish the major tasks of the coming years. The operation of the European XFEL, the cooperation of numerous users at facilities of both institutes and the networking of infrastructure and administration are important preconditions for DESY's success.

The joint DESY staff outing was a good opportunity to experience our sense of togetherness. It offered the possibility to have fun across departmental borders. The Open Day in Hamburg is another major event in which many colleagues will cooperate in order to present DESY to the public.

The second half of the year 2013 will be stressful. I wish you a lot of success for the coming months and I hope we will enjoy an autumn that is as beautiful as this summer was.

Yours,
Christian Scherf

ry of the world which scientists have been trying to work out for centuries? Many fascinating questions hang over the particle zoo, and in an entertaining and easy way, the visitors will find answers - which can again raise new questions.

DESY did not only contribute its theoretical expertise to this joint "Teilchenzoo" project but also made some hands-on contributions. For example, the DESY in-house workshops built exhibition panels and exhibits. There is a cloud and a spark chamber in which you can observe aesthetic traces of particles; the so-called analogy exhibits show in a simplified way the scientific principles of particle physics. Moreover, DESY scientists talk about their work and the fascination of particle physics in short films. For at least nine months, the "Teilchenzoo" – conceived as a travelling exhibition – will be shown at the Universum in Bremen before moving to other appropriate exhibition sites as for example Deutsches Museum in Munich. Visitors can also see the "Teilchenzoo" on the web or find their favourite particle in the corresponding app on their smart phone.

The "Teilchenzoo" interactive exhibition will be presented from end of September 2013 until the end of June 2014 in the SchauBox of Universum Bremen. *(uw)*

The Science Center Universum in Bremen

**INFO**

**Interactive exhibition „Teilchenzoo" (particle zoo)**
28 September 2013 - 30 June 2014
http://teilchenzoo.desy.de

Opening hours:
Monday to Friday
9.00 am to 6.00 pm
Saturday, Sunday, public holidays
10.00 am to 6.00 pm

Admission fee
Universum and exhibition:
Adults 16 Euros
Concessions 11 Euros
Families 40 Euros

Additional offers:
Lectures and demonstrations,
Special tour for school classes

Universum Bremen
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28359 Bremen
www.universum-bremen.de

# (Not) a matter of course

## Mission and guiding principles present the goals and values of DESY

*By Beate Ritz*

Even when several aspects are already well rooted in the established DESY work culture, it is still an important and not quite easy step to formulate our goals and values appropriately. Therefore, it was a long process of elaborating the mission and guiding principles for DESY. Under the aegis of the directorate and with support of the works council, the staff too had the opportunity to take an active part in the process. At the staff meeting on 13 August, the chairman of DESY's board of directors, Helmut Dosch, presented the result to the DESY staff members in Hamburg and Zeuthen.

The mission summarises the mandate of our research centre: DESY as a major and internationally oriented research centre conducts research into the fundamental relationships of matter – its structure and function – and contributes to the knowledge base that is needed to solve the huge and urgent challenges that are facing society, science and the economy. The guiding principles form the flanking corporate philosophy and describe the kind of values and work culture that will turn the goals and commitments formulated in the mission into reality. Helmut Dosch summarised the topics of a total of ten guiding principles: "The mission statements pertain to our social mandate, our position in the German and international scientific and research environment and our particular responsibility in dealing with public funds. They provide us with reliable guidelines for dealing with the men and women who are our colleagues and for behaving in accordance with social, ecological and ethical principles." This way they shall "serve as everyday guidance for each and every one of us."

The importance that was given to the individual guiding principles by the DESY staff after the presentation at the staff meeting was revealed by televoting, with the participation of 332 DESY staff members in Hamburg and Zeuthen. In each case, twenty per cent of the participants thought that "research at the highest level" and "work and private life" are the most important guiding principles and that the greatest need for action is required for the topics "joint operations", "work and private life" and "sustainability". The detailed results of the televote are available at https://leitbild.desy.de/belegschaftsversammlung (internal access only).

These results will be taken into consideration in further steps which will make sure that mission and guiding principles are filled with life. Among other things, detailed guidelines which will be implemented into everyday work will be set up. Everybody is invited to join the discussions with opinions and suggestions: Why do we see the greatest need for action in the fields "joint operations", "work and private life" and "sustainability"? How can we improve this? A special online forum has been established for this purpose at https://leitbild.desy.de.

**INFO**

Join the discussion at the forum:
https://leitbild.desy.de/
(internal access only)
or via email to leitbild@desy.de

A brochure concerning the DESY mission and guiding principles can be downloaded at the above URL or collected in the PR office Hamburg (foyer, building 1)

**Summer students wave goodbye**
They come from five continents: More than 100 students from over 30 countries have gathered research experience at DESY in Hamburg and Zeuthen in this year's summer student programme. On 5 September it is time to wave goodbye already.
Photo: Marta Mayer



## September

**2.-6.** Workshop (http://qcd-lhc.desy.de)
**QCD@LHC**
DESY, Hamburg

**4.** Event
**Groundbreaking ceremony CSSB**
DESY, Hamburg, 14:00 h

**10.-19.** Workshop (https://indico.desy.de/event/CASPAR2013)
**CASPAR – Cosmic Rays Acceleration, Sources and Propagation: A Rendez-vous**
DESY, Hamburg

**12.** Event (http://mint.desy.de)
**2. Mädchen-MINT-Tag bei DESY**
DESY, Hamburg, auditorium, 9:00-16:00 h

**13.** Choir concert & string quartet
**„Vom Tafeln und Bechern"**
DESY, Hamburg, canteen annex, 20:00 h

**16.-20.** Graduiertenkolleg (www.masse-spektrum-symmetrie.de)
**Masse, Spektrum, Symmetrie**
DESY, Zeuthen

**24.-27.** Theorie-Workshop (https://th-workshop2013.desy.de)
**Nonperturbative QFT: Methods and Applications**
DESY, Hamburg

**25.** Hertz Lecture
**The String Magic**
Cumrun Vafa, Harvard University
DESY, Hamburg, auditorium, 17:30 h

**25.** Science Café DESY (http://sciencecafe.desy.de)
**Wie funktionieren eigentlich Computer?**
Martin Köhler, DESY, Hamburg, DESY Bistro, 17:00 h

**25.** Event (http://cern.ch/icd2013)
**2. International Cosmic Day**
Participation worldwide possible!

## 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

**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

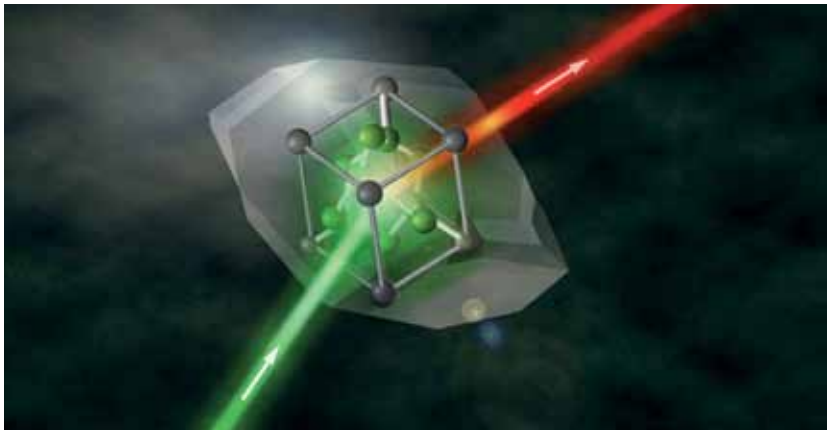
**30.** Jentschke Lecture
**How to simulate without a Computer – A physics approach to the brain**
Karlheinz Meier, Universität Heidelberg
DESY, Hamburg, auditorium, 17:00 h

**+++ 2 November: DESYs Open Day and Night of Knowledge +++**
All current events: www.desy.de/veranstaltungen

# First laser-like X-ray light from a solid

## FLASH opens up new avenues of investigation for materials science

Researchers have for the first time created an X-ray laser based on a solid. The method developed at DESY's free-electron laser FLASH opens up new avenues of investigation in materials research, as reported by the team of Martin Beye and Alexander Föhlisch of the Helmholtz Zentrum Berlin (HZB) in the British scientific journal "Nature." "This technology makes it possible to analyse sensitive samples that otherwise are quickly destroyed by intense X-ray light," notes co-author Wilfried Wurth of the University of Hamburg and the Hamburg Center for Free-Electron Laser Science (CFEL).



The incoming laser light (depicted in green) excites the atoms in the silicon crystal to produce its own laser puls with a slightly longer wavelength (depicted in red). Credit: ©HZB/E. Strickert

Unlike laser diodes in home DVD players, it has thus far not been possible to build X-ray lasers as compact devices based on a solid. The researchers used DESY's free-electron laser FLASH instead to excite a silicon crystal to emit X-ray radiation. The high energy of the FLASH pulses is enough to knock a relatively tightly bound electron out of the electron shell of each of the silicon atoms, with the atoms thereby becoming ionized. Shortly thereafter, this hole is filled by a less strongly bound electron, which changes to a lower-energy state.

The energy released by this step is usually passed on non-radiatively to another electron through the so-called Auger process. Only rarely a photon is emitted instead. But FLASH can ionize so many atoms simultaneously that there will always be spontaneously emitted photons. These photons stimulate the emission of further photons from the ionized atoms, similar to the stimulated emission in a laser. This way, a photon snowball rolls through the silicon crystal and gains the upper hand on the Auger process. In a similar fashion, a research group of Nina Rohringer from CFEL had earlier created the first X-ray laser on an atomic basis with neon gas at the Linac Coherent Light Source (LCLS) at SLAC.

Like the neon gas, the silicon crystal must be excited first by an intense X-ray laser like FLASH and the resulting X-ray light also has somewhat less energy than the incoming pulse. Still, the new method offers a decisive advantage: The X-ray light generated can itself be used to study the generating material, and the sample does not get heated up as much and is therefore not destroyed. This doesn't only work with silicon, but also with other materials and therefore opens up new avenues of investigation for materials science. *(tim)*

Reference: „Stimulated X-ray emission for materials science"; M. Beye, S. Schreck, F. Sorgenfrei, C. Trabant, N. Pontius, C. Schüßler-Langeheine, W.Wurth & A. Föhlisch; Nature, 2013; DOI: 10.1038/nature12449

# New emittance world record at DESY

## PETRA III on course to become the ultimate storage ring X-ray source

The PETRA III machine physicists set a new world record. At a beam energy of 3 Giga electron volts (GeV), they achieved a horizontal beam emittance of 160 picometre radiant (pm rad) – smaller than ever. The emittance is the product of cross-section and bundling of a particle bunch in an accelerator and consequently a measure for the size and order of the bunch. It significantly determines the properties of an accelerator as a light source. The smaller, the better. For example, a smaller emittance produces a higher resolution at synchrotron experiments.

"In our machine studies, we wanted to find out if our theoretical calculations are still valid for such small emittances," says Alexander Kling, head of the study, "and with 160 pm rad, the experiment perfectly coincided with the expected 158 pm rad."

For their experiment, the researchers' group used a three weeks interruption of user operation at PETRA III. They ran the accelerator at energies of 3 and 5 GeV and with several hundred weakly charged electron bunches. With this, the scientists want to extend the application possibilities for PETRA III and to take further steps on the road to the "ultimate storage ring X-ray source".

"With a reduced emittance, the transversal coherence increases and the light becomes more laser-like," Kling explains. The group of scientists presented the first results of this study at the beginning of August at the Three-way Workshop in the United States, a regular meeting of the operators of the world's leading storage ring X-ray sources. *(tz)*

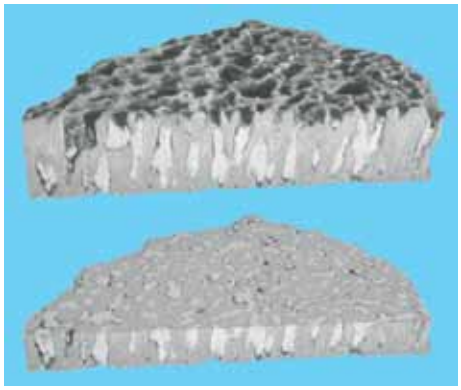
# Dinosaur eggs X-rayed

## Scientists peer into 150 million years old fossils at DESY

A spectacular discovery elucidates the evolution history of the egg. North of the Portuguese capital Lisbon, palaeontologists have dug out a nest with 150-million-year-old dinosaur eggs which even contain petrified embryo bones. X-ray investigations at the measuring stations of Helmholtz Zentrum Geesthacht (HZG) at DESY for the first time revealed the properties of these primeval eggs.

Thanks to the embryo bones, it is possible to attribute this nest to a Torvosaurus, a carnivore belonging to the Theropod species. Almost all carnivorous dinosaurs belonged to the Theropods, including the legendary T-Rex. They are also the ancestors of our present-day birds. The Portuguese nest has the oldest Theropod eggs ever discovered. There are older dinosaur eggs, but they originate from the Sauropods – a parallel branch in the dinosaur genealogy.

Measurements at the High Energy Materials Science (HEMS) beamline at PETRA III and at the DORIS beamline HARWI II – also operated by HZG – show that these ancient eggs only had a single egg shell layer. In contrast, Theropod eggs from the cretaceous age 80 million years ago already had two or three layers, like today's bird's eggs. Moreover, the Torvosaurus eggs – when compared with younger Theropod eggs – have a strikingly large number of irregular ribs and a honeycomb structure with large pores. This makes them similar to today's crocodile eggs.



Synchrotron radiation from DESY's light sources reveal the porous honeycomb shell structure of the 150 million years old dino eggs from the Lourinhã excavation site. Credit: R.M. Martins

The discovery does not only enable a first sight on the properties of million-year-old Theropod eggs; the investigation also allows deducing the breeding behaviour of Theropods, as described in the scientific journal "Scientific Reports" by the researchers' team of Ricardo Araújo from the Southern Methodist University in Dallas (Texas): The large pores are necessary for gas exchange between egg and environment. Thus, the scientists assume that the Torvosaurs buried their eggs in sand or mud, similar to what for example sea turtles still do today. *(tim)*

Reference: „Filling the gaps of dinosaur eggshell phylogeny: Late Jurassic Theropod clutch with embryos from Portugal"; Ricardo Araújo, Rui Castanhinha, Rui M. S. Martins, Octávio Mateus, Christophe Hendrickx, F. Beckmann, N. Schell & L. C. Alves; Scientific Reports, 2013; DOI: 10.1038/srep01924

## NEWS

**Open Day programme online**

On 2 November DESY invites the interested public to an Open Day on the occasion of the 5. Hamburg „Night of Knowledge". DESY expects thousands of visitors on this day. A preliminary version of the events schedule for the „DESY TOUR 2013" is now online at www.desy.de/desytour. With already nearly 70 events, the programme is still growing. For the whole day, helpers are still wanted and are kindly requested to register as soon as possible at http://registrierung-tdot.desy.de.


**Committee recommends potential ILC site**

The Japanese ILC site selection committee recommends a site in the Northern Japanese Kitakami region as best domestic candidate site for the International Linear Collider ILC. The committee announced their decision on 23 August. It had to evaluate two sites, one in the South of Japan in the Kyushu district and one in the North, in the Tohoku district. The committee's decision will be passed on as a recommendation to the Japanese government.
http://newsline.linearcollider.org

**Kerstin Borras elected as deputy spokesperson of CMS**

DESY particle physicist Kerstin Borras was elected deputy spokesperson of the CMS experiment at the world's largest particle accelerator LHC. At the turn of the year, the head of the CMS group at DESY will assume this office for two years, together with Paris Sphicas from the University of Athens. New spokesperson will be Tiziano Camporesi from the European particle physics laboratory CERN near Geneva, the location of the CMS detector.

The PIER running team of Patrick Vaudrevange and Clemens Wieck (back row, 6th and 5th from right).

Photo: Lea Keidel

# The fastest physicists in town...

## ...are the DESY and University of Hamburg PhD students and postdocs

*By Mirko Siemssen*

On 6 August – a bright sunny day – a group of 25 athletic young scientists participated in the "B2RUN" company run in the Altona Volkspark. Nearly 6000 people from 250 companies from Hamburg and the outskirts were at the starting line of the six-kilometre race course. The mixed team of men and women wearing T-shirts sponsored by the PIER Helmholtz Graduate School reached an admirable 13th place, the men team even made it to 8th place. Patrick Vaudrevange, postdoc in the DESY theory group and one of the initiators of the running team, said: "This was a great event. We had regularly trained since May – and from week to week, more people joined our team. Such a run really brings us together." PIER executive director Christian Salzmann is pleased about the initiative of the running physicists: "We highly welcome this enthusiasm. The running group offers the possibility for discussions which otherwise would perhaps not take place. Some of these discussions might even become relevant for our scientific work."

Co-initiator Clemens Wieck, PhD student in the DESY theory group and scholarship holder of the Joachim Herz Foundation, already thinks ahead: "For next year, we want to motivate more running enthusiasts to participate. We really want to establish a regular training on the Bahrenfeld campus. We meet every Tuesday evening at 7 p.m. and run across the Volkspark. Newcomers are always welcome, no matter if beginner or advanced."


Photo: B2RUN

HELMHOLTZ ASSOCIATION

### „Helmholtz Perspektiven"

The Helmholtz Society has launched a new science magazine. "Helmholtz Perspektiven" (Helmholtz perspectives, available only in German) will be published every two months. With news, interviews and reports, the magazine will provide insight into research of the largest German scientific organisation and introduce the people that are doing it. With commentaries and analyses, it is supposed to kick off discussions about controversial topics from science, politics and education.

The first edition of "Helmholtz Perspektiven" includes topics like climate change, the consequences of the flood and the question whether the so-called impact factor should continue to decide on scientific careers The magazine – available in print and e-paper version – complements the newly designed homepage www.helmholtz.de, which provides daily news about science and research of the Helmholtz Association and beyond.

The Helmholtz Association continues its theme-oriented and up-to-date communication with two new series of events. With "Helmholtz & Uni", the association enters a dialogue with universities on the future of the scientific system. So far the university of Frankfurt and the university of Cologne have acted as cooperation partners. The next events will take place at the universities of Leipzig and Hamburg. In "Fokus@Helmholtz", Helmholtz regularly brings together science, politics and society to discuss in public the controversial questions on future challenges. So far, the themes were fracking and personalised medical approaches.

http://www.helmholtz.de/perspektiven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