Online Annual Report 2015

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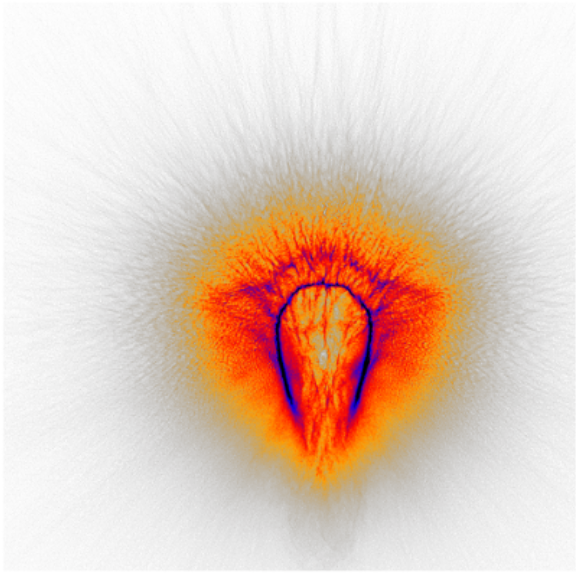

Content

Imprint

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Online Annual Report 2015

Address from the Board of Directors

Dear Readers,

"Science knows no borders" – the poster at the entrance of our center reflects the reality of research undertaken in Dresden – not only at the HZDR, but at all scientific establishments in Saxony's capital city. Approximately 15 percent of the 1,100 HZDR employees come from abroad, about one third of our researchers. Scientists from all over the world arrive in Dresden every year to embark on research in an excellent working environment. We need the knowledge, skill and talent of these gifted individuals regardless of their country of origin. Only together can we solve the urgent questions of our time.

Modern science relies heavily on cooperation – in most cases on the international level. A prime example is EIT Raw Materials, which our Helmholtz Institute Freiberg for Resource Technology (HIF) successfully established in the past year on behalf of the European Institute for Innovation and Technology (EIT). This Knowledge and Innovation Community (KIC) links approximately one hundred European universities, research institutions and businesses from the resource sector. The largest raw materials network in the world has been an independent limited liability company (GmbH) since early 2016.

Two further projects promise a similarly strong collaboration. Together with our Helmholtz colleagues from the German Cancer Research Center (DKFZ) in Heidelberg as well as from the Carl Gustav Carus University Hospital and the Medical Department at the TU Dresden we are creating an on-site partner location for the National Center for Tumor Diseases (NCT). Due to the many years of strong ties to the DKFZ and the outstanding level of cancer research in our city, Dresden was the city of choice.

The Helmholtz International Beamline for Extreme Fields (HIBEF), which we set up in cooperation with the *Deutsches Elektronen-Synchrotron* DESY at the European XFEL near Hamburg, can also only exist through a coalition of approximately 130 international research institutions.

Isolationist tendencies are harmful. It is such flagship projects that are decisive in the competition for the best minds. The prospect of undertaking research in this outstanding environment leads these minds to us. A climate of exclusion, however, destroys the sturdiest foundations. Therefore, please support us in maintaining the strong research environment of our city and our region by impartially welcoming individuals from abroad.

We very much hope you enjoy reading our 2015 online Annual Report on the following pages. The center's more detailed Progress Report (*Fortschrittsbericht*) for the past year can also be viewed on request.

Prof. Roland Sauerbrey (Scientific Director) & Prof. Peter Joehnk (Administrative Director)

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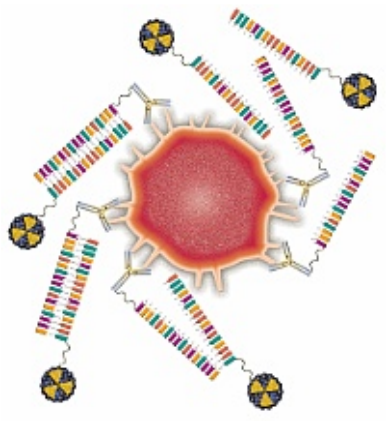
Scientific Highlights

New method for improved tumor diagnosis successfully tested on preclinical scale



Scientists at the Helmholtz-Zentrum Dresden-Rossendorf (HZDR), in cooperation with colleagues at the Universities of Zurich and Bochum, have successfully tested a new tumor diagnosis method on mice under near-real conditions for the first time. For several years, cancer research has relied on radioactively labeled antibodies to diagnose and fight malignant tumors. Because they specifically interact with certain target structures, the diseased cells can be detected and treated with high precision.

One problem has thus far been their large molecular mass resulting in long circulation in the patient's body for a relatively long period of time before they bind to the tumor cells. They thus also accumulate in healthy tissue. This substantially delays detection of the tumor and leads to detrimental radiation exposure of healthy organs. The researchers from Dresden, Zurich and Bochum have therefore chosen an alternative strategy, the so-called pretargeting approach. In this multistep process, unlabeled antibodies specific for the epidermal growth factor receptor – a cancer biomarker – are administrated in the first step. Upon injection, sufficient time is allowed for circulation, tumor accumulation and clearance of excess antibodies from the body.

In order to later deliver a radionuclide of choice to the tumor-bound antibodies, the researchers combined them with derivatives of the peptide nucleic acid (PNA) – a stable, synthetic DNA analog. The complementary PNA counterparts were radiolabeled with the diagnostic radionuclide technetium-99m and injected in a second step. These small molecules reach the malignant tissue quickly and bind the local antibody-PNA conjugates with minimal accumulation elsewhere. And indeed, the researchers were able to clearly visualize the tumor in a short period of time while minimizing the risk of radiation exposure of healthy tissues. Using this pretargeting approach, the researchers can overcome limitations of conventional radiolabeled antibodies, which is particularly important for therapeutic applications.

- **Press release:** Molecular Spies to Fight Cancer
- **Publication:** A. Leonidova, C. Foerster, K. Zarschler, M. Schubert, H. Pietzsch, J. Steinbach, R. Bergmann, N. Metzler-Nolte, H. Stephan, G. Gasser, „In vivo demonstration of an active tumor pretargeting approach with peptide nucleic acid bioconjugates as complementary system", in: Chemical Science (2015), DOI: 10.1039/c5sc00951k
- **Contact:** Dr. Holger Stephan, Institute of Radiopharmaceutical Cancer Research

Particle accelerator at the underground laboratory in Gran Sasso shows rare event

An international research group, in which scientists from the HZDR played a leading role, has demonstrated a nuclear reaction for the first time that only occurs in what are known as red giants. Many chemical elements that make up the matter in our surroundings are created within these enormous stars. At the end of the red giants' lifecycle, these elements are hurled into the cosmos by means of gigantic explosions. The researchers at the Laboratory for

Underground Nuclear Astrophysics (LUNA) in the Gran Sasso laboratory explore the processes that occur within stars. LUNA is part of the Italian National Institute for Nuclear Physics.

LUNA lies one-and-a-half kilometers beneath the Gran Sasso mountains. This thick rock cover protects the experiments from the disruptive influences of cosmic radiation. This enables the researchers to recreate conditions similar to those within stars. At the LUNA accelerator, the scientists could measure three hitherto unobserved “resonances” for the first time in the neon-sodium cycle, which is vital for sodium production. Particle physicists use the term "resonance" to denote interaction rate increases that only occur at very specific energies. If atomic nuclei collide, an excited nuclear state - a “resonance” - can form when the energy levels are right.

To carry out their studies, the researchers accelerated hydrogen nuclei and used them to bombard the neon-22 noble gas isotope. Using special detectors, they could subsequently observe the extremely rare process. The observed increase in sodium production may help explain the so-called neon-sodium anticorrelation observed in some stars.

- **Press release:** The Puzzle of the Origin of Elements in the Universe
- **Publication:** F. Cavanna, R. Depalo, M. Aliotta, M. Anders, D. Bemmerer, A. Best, A. Boeltzig, C. Broggini, C.G. Bruno, A. Caciolli, P. Corvisiero, T. Davinson, A. di Leva, Z. Elekes, F. Ferraro, A. Formicola, Z. Fülöp, G. Gervino, A. Guglielmetti, C. Gustavino, G. Gyürky, G. Imbriani, M. Junker, R. Menegazzo, V. Mossa, F. R. Pantaleo, P. Prati, D. A. Scott, E. Somorjai, O. Straniero, F. Strieder, T. Szücs, M.P. Takács, D. Trezzi, „Three new low-energy resonances in the ^{22}Ne(p,gamma)^{23}Na reaction“, in: Physical Review Letters, 115, 252501 (2015), DOI: 10.1103/PhysRevLett.115.252501
- **Contact:** PD Dr. Daniel Bemmerer, Institute of Radiation Physics

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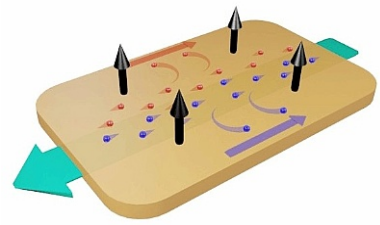
Researchers discover giant magnetoresistance in new material



Information technology is expected to process and save larger amounts of data faster and in a smaller amount of space. Engineers have therefore been exploiting physical effects such as giant magnetoresistance for quite a long time. This phenomenon describes the great alteration of the electrical resistance of a material when exposed to a magnetic field. This is how an increase in storage density could be achieved in modern hard drives. In order to attain this effect, the computer industry has relied on various delicately layered materials. The production of such systems is highly complex.

An alternative could arise from combining niobium and phosphorus: niobium phosphate. Researchers from the Max Planck Institute for Chemical Physics of Solids together with scientists from the Dresden High Magnetic Field Laboratory at the HZDR observed an approximately 10,000-fold resistance increase in this material. The reason for the drastic change is attributed to what is known as relativistic electrons within the niobium phosphate. These are superfast charge carriers, which move at approximately three hundred kilometers per second. The influence of the applied magnetic field in turn depends on the velocity of the electrons.

This phenomenon is due to the deflection of the charge carriers through the Lorentz force. This leads to the fact that with rising magnetic field an ever larger portion of the electrons flows in the wrong direction. The electrical resistance thus increases. The faster the electrons, the greater the effect of the magnetic field. As the researchers managed to demonstrate, the exotic characteristics of niobium phosphate are based on some electrons that behave as if they had no mass. They can thus move exceptionally fast. The material therefore may be highly suitable for future applications in information technology.

- **Press release:** With 300 Kilometers per Second to New Electronics
- **Publication:** C. Shekhar, A.K. Nayak, Y. Sun, M. Schmidt, M. Nicklas, I. Leermakers, U. Zeitler, Y. Skourski, J. Wosnitza, Z. Liu, Y. Chen, W. Schnelle, H. Borrmann, Y. Grin, C. Felser, B. Yan, „Extremely large magnetoresistance and ultrahigh mobility in the topological Weyl semimetal candidate NbP”, in: Nature Physics, 11, 645 (2015), DOI: 10.1038/nphys3372
- **Contact:** Prof. Joachim Wosnitza, Dresden High Magnetic Field Laboratory

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New model calculations predict the most economically efficient metal processing

One of the most important processes in extracting precious metals from deposits lies in the processing. This involves crushing the rock and separating the ore from the unusable waste rock, through an array of various methods. Which specific methods come into use depends on the ore properties, such as the mineralogical composition or the concentration of precious elements contained within.

HZDR researchers from the Helmholtz Institute Freiberg for Resource Technology have developed an adaptive method with which they can predict how processing methods must be combined and how equipment must be adjusted to achieve the most economically efficient yield. The development of such model calculations is particularly important for extracting economically strategic high-tech metals such as germanium, gallium, indium or rare earths. Due to their low concentration in mostly complex composite ores, they are often mined as by-products.

During the exploratory phase, an ore deposit is divided into several blocks of rock measuring approximately 1,000 cubic meters each. Based on drill core data and statistical methods, the mathematicians from Freiberg create series of alternative three-dimensional models with possible properties of these blocks. The researchers can thus derive what methods and settings are most likely to be suitable for the processing of each individual block. What is new within these computations is that the scientists can account for the fact that the ore properties of each block are not truly observed, but rather guessed from boreholes on its surroundings. The separation processes thus can be adjusted in the processing plant according to the locally changing ore properties and the data we have about them.

- **Publication:** R. Tolosana-Delgado, U. Mueller, K.G. van den Boogaart, C Ward, J. Gutzmer, „Improving processing by adaptation to conditional geostatistical simulation of block compositions", in: The Journal of the Southern African Institute of Mining and Metallurgy 115 (2015)
- **Contact:** Dr. Raimon Tolosana Delgado, Helmholtz Institute Freiberg for Resource Technology

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Better understanding emergency scenarios in nuclear reactors

In nuclear reactors fission heat is used to heat water at high pressure, for example to about 300 degree Celsius in a pressurized water reactor. This way steam for operation of a turbine is generated in a secondary loop. In case of an emergency shut-down continuous cooling of fuel rods, which still produce decay heat, is essential for the safety of the nuclear reactor. If the emergency was caused by a leak in the primary loop, the loss of coolant has to be compensated by feeding additional water from extra reservoirs.

This water is, however, much colder than the reactor components. The difference in temperature due to insufficient mixing of hot and cold water could in turn cause thermomechanical strains in the reactor wall with the danger of crack initiation. Hence good mixing of hot water in the loop and cold feed water is essential. For this, scientists need to simulate the fluid flow and mixing by advanced and complex computer simulations.

Experimental data at plant conditions for validation of such computational fluid dynamics simulations are, however, scarce. Researchers from the HZDR Institute of Fluid Dynamics have now managed to separate different partial effects of the feed water injection process for the first time and observed them with high resolution measurement techniques. With a high-speed camera as well as mobile pressure and temperature sensors, they could precisely observe the behavior of the cold water jets when penetrating the hot water. The HZDR test facility TOPFLOW was used to carry out the measurements under realistic temperature and pressure conditions.

This globally unique data set is not only relevant for safety measures in reactor plants, but can also be transferred to chemical engineering processes. The results could then contribute to an increase in efficiency.

- **Publication:** T. Seidel, „Direct condensation and entrainment steam experiments at the TOPFLOW-DENISE facility", atw – International Journal for Nuclear Power, 2015

- **Contact:** Matthias Beyer, Institute of Fluid Dynamics

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Calendar of Events

- **January: Europe's high magnetic field laboratories forge stronger connection**

The leading European high magnetic field laboratories from Germany, France and the Netherlands jointly establish the European Magnetic Field Laboratory (EMFL) in Brussels. They thus also form a legal entity. The four EMFL founding organizations – the HZDR, the French *Centre National de la Recherche Scientifique*, the Radboud Universität Nijmegen and the Foundation for Fundamental Research on Matter in the Netherlands – offer users the highest magnetic fields as well as unique experimental possibilities with their laboratories in Dresden, Grenoble, Toulouse and Nijmegen. The HZDR's scientific director, Prof. Roland Sauerbrey, was appointed the first President of the Council.

- **February: PET equipment moves to the city center**

An era of patient care at the Dresden-Rossendorf Center for Positron Emission Tomography (PET) comes to an end with the transfer of the PET/MRI device for full body testing. The facility that combines PET with magnetic resonance imaging (MRI) is moved to the University Hospital Dresden. Within the OncoRay project, HZDR scientists continue to operate the facility together with the researchers at the site. Cancer patient care in Dresden is thus focused in one location and optimized. At the prior Rossendorf location, three generations of PET devices were used to examine 14,000 patients in the last twenty years.

- **March: Links with China strengthened**

The HZDR signs a Memorandum of Understanding with the Shanghai Institute of Microsystem and Information Technology (SIMIT). Based on the agreement, both institutions wish to forge cooperation in the fields of research, education and service. The aim is long-term strategic cooperation between the Ion Beam Center at HZDR and the Chinese institution in the area of materials modification and analytics for information technology. For example, projects are planned for producing ultra-thin semiconductor layers with high charge-carrier mobility using ion-based technologies.

- **April: From biology laboratory to the largest international trade fair**

At the Hannover Messe in mid-April, Dr. Tobias Günther and Dr. Jürgen Hofinger present an environmentally friendly coating method for processing plastic surfaces. The industrial sector has so far been using chromosulfuric acid. The two researchers from the Helmholtz Institute Freiberg for Resource Technology, together with three further HZDR colleagues, developed the method, which avoids the use of this chemical that is environmentally damaging and hazardous to health. The scientists now strive to establish the innovative coating technology in the commercial sector via the HZDR spin-off company Biconex. During the start-up phase, the company was supported by the programs Exist and Helmholtz Enterprise.

- **May: Posters illustrate temporal dimensions of final nuclear waste repositories**

HZDR researchers from the Institute of Resource Ecology illustrate, through an art project, the topic of final radioactive material disposal. In Germany, the repository must shield the material from the biosphere for one million years. In order to put this period into context so that it is understandable, the scientists, along with artist Florian Dombois, developed a "time rope". During a "Flock of Happenings"on the Dresden Postplatz, they project one million years onto a 200-meter-long rope, first based on historical moments into the past, then through fictional periods and disintegration rates of radioactive materials in the future. The rope thus reaches back to the beginnings of human existence.

- **June: Dresden hosts first German Terahertz Conference**

The first German Terahertz Conference lures approximately one hundred participants from both the research and commercial sectors to Dresden. The three-day event, organized by the HZDR together with the *Deutsche Terahertz-Zentrum*, is concerned with terahertz radiation, which has become increasingly popular due to the construction of many first-rate radiation sources in recent years. This type of thermal radiation with wavelengths between one millimeter and ten micrometers is, for example, ideal for studying new types of materials and for scanning objects. Elementary processes within materials can thus be studied.

- **July: Helmholtz Association invests 46 million Euros in laboratory platform**

The Helmholtz Senate decides to establish a large-scale infrastructure for synthesis and development of new material systems for energy conversion and storage. The total estimated amount is 46 million Euros for 2016 through 2020. The Helmholtz Energy Materials Foundry (HEMF) is coordinated by the Helmholtz-Zentrum Berlin. Five additional centers within the research association are participating in the planning and organization: *Deutsche Zentrum für Luft- und Raumfahrt* (German Aeronautics and Space Administration), the *Forschungszentrum Jülich*, the *Helmholtz-Zentrum Geesthacht*, the HZDR and the Karlsruhe Institute of Technology.

- **August: Apprenticeship year begins with ten new trainees**

During the traditional start of the apprenticeship year on August 18th, thirteen graduates from the past class bid farewell while ten new trainees are welcomed to the HZDR: three laboratory technicians (two physics, one chemistry), one electrical engineer in automation technology, an electrical engineer for devices and systems, two technical product designers, two industrial technicians and one radiation technician (Bachelor of Science). Lisa Bauer, biology lab technician, receives the prize for best trainee. Steffen Winkelmann, long-serving instructor in electronics for devices and systems goes into “instructor retirement”.

- **September: From practice into practice – the *HZDR Technikerakademie***

The *Technikerakademie* marks the beginning of a new HZDR educational program aimed specifically at the center’s roughly two hundred technical employees. The new elements are to be tailored and combined to complement the existing training courses. The program encompasses a total of seven topic groups, which are divided into individual training courses: technical qualification, radiation protection, occupational safety, information technology, communication and social skills, internal HZDR topics as well as the expertise forum for instructors. The academy is organized for two weeks each spring and autumn.

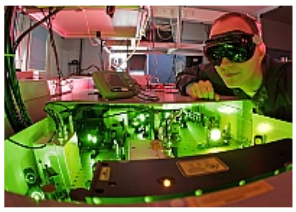
- **October: New Helmholtz President visits Dresden-Rossendorf**

During his inaugural visit, the new president of the Helmholtz Association, Prof. Otmar Wiestler, acquaints himself with research undertaken at the HZDR. During the first hundred days in his new position, the prior Scientific Director of the German Cancer Research Center (DKFZ), visited the individual centers. As Wiestler stresses during a speech to HZDR staff, he sees great potential within the Association to cover the entire range of innovation cycles in its fields of expertise. As not even the largest institutions can fulfill this goal alone, he urges closer cooperation between the 18 Helmholtz centers as well as with universities, other non-university research institutions and businesses.

- **November: Helmholtz Energy Alliance closing symposium in Dresden**

Sixty participants from the scientific and commercial sectors present the results of the Helmholtz Energy Alliance “Energy Efficient Multiphase Processes”. The group, which consists of seven partners and is coordinated by the HZDR, has been concerned for the last three-and-a-half years with how process efficiency in chemical engineering can be increased. One special focus lies on the reaction apparatuses with the aim of optimizing the chemical syntheses taking place within those apparatuses. A great deal of potential for saving energy exists in this area.

- **December: Leading European laser laboratories combine forces**



To ensure that scientists across international borders have easy access to lasers, thirty of the most important facilities in this research field from sixteen countries have united in the EU project "Laserlab-Europe". Lund University in Sweden is the coordinator of this project. Prof. Ulrich Schramm, director at the Institute of Radiation Physics, represents the HZDR. The joint research is to further develop existing infrastructures. Europe can thus play a leading role globally in the fields of bio- and nanophotonics as well as in materials analysis.

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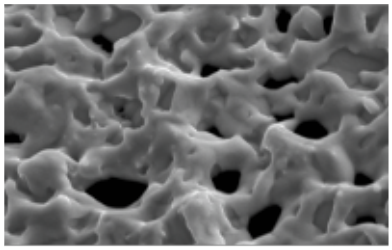
Knowledge and Technology Transfer

HZDR spin-off companies develop successfully



The aim of knowledge and technology transfer is to exploit the research results arising from scientific HZDR work. One good way to do so is to establish new companies. There are currently thirteen firms that have arisen from HZDR research. Two companies in particular were able to positively promote their developments during the last year. In this manner, i3membrane GmbH convinced several investment companies of their products in November: multi-functional separation technologies that combine ion and membrane technology. For further development and for introducing the products to the market, the company received approximately 1.5 million Euros in additional capital.

Biconex GmbH was also in discussions with investors late last year. The company, which developed an environmentally friendly coating process for refining plastic surfaces, was successful in sealing these negotiations in March 2016. With investment capital in the sum of 1.5 million Euros, the founders wish to establish the method as quickly as possible in the industrial sector. The spin-off project GRIDLAB was also able to secure funds from the Helmholtz Enterprise program. Using the software developed within the project, laboratory instruments from different providers can be coordinated and operated in a synchronized manner.

HZDR Innovation GmbH, a subsidiary firm and commercial arm of HZDR, has shown a clear increase in sales. With a total revenue of 2.6 million Euros, the company saw a profit of 182,000 Euros (gross). The HZDR also successfully completed setting up the Knowledge and Innovation Community "EIT Raw Materials".

The view of the remaining transfer indicators of HZDR shows following results. The number of new license agreements and patent applications are below the average of previous years. While revenue from licensing agreements has clearly increased, commercial revenue from research and development contracts decreased. By increasing third-party-sponsored projects, in which industry companies participate, cooperation with the economic sector however, remains at approximately the same level as in past years.

In order to improve the transition of research insights, the HZDR further developed its strategy for technology and knowledge transfer. This plan is to improve the transfer culture at the center by, for example, holding additional events to raise awareness. In addition, the HZDR will provide an innovation fund in 2016, with annual funding of 400,000 Euros.

Furthermore, the scientists are to receive better support in transferring their results. In addition to the three existing innovation managers, another specialist, who concentrates on physical research areas and materials research, has been hired. In the past year, the HZDR also joined the *Technologieallianz*, the German association for knowledge and technology transfer.

Contact: Dr. Björn Wolf, Department of Technology Transfer and Legal Affairs

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Personnel Matters

Calls / Appointments

- **Prof. Esther Troost** accepted a professorship in “Image Guided High Precision Radiotherapy” on March 1st, 2015, at the OncoRay center and the HZDR Institute of Radiooncology. A native of the Netherlands, Troost strives to improve imaging in tumor therapy.
- In early April 2015, the Chinese Academy of Science’s Shanghai Institute of Optics and Fine Mechanics (SIOM) appointed **Prof. Roland Sauerbrey** to its Advisory Committee. As a member of this committee, the Scientific Director of the HZDR assesses the establishment’s research strategy. SIOM develops high-power lasers and optoelectronic facilities.
- **Dr. Ute Bergner** joined the HZDR’s Kuratorium in early April. The physicist is the managing partner of VACOM, a company in Jena, one of the leading European specialists in vacuum technology. The Kuratorium is the HZDR’s supervisory body. It makes decisions on fundamental matters concerning the center and oversees the Board of Directors.
- Since September 2015, **Prof. Markus Reuter** has served as the new director, together with Prof. Jens Gutzmer, at the Helmholtz Institute Freiberg for Resource Technology. The expert in metal recycling and sustainable technology previously worked at the Finnish firm Outotec before moving to Saxony. His research concentrates mainly on material- and energy-efficient circular economy 4.0 of metallic raw materials.
- After nearly nine years at the HZDR’s Institutes of Safety Research and Resource Ecology, **Prof. Bruno Merk** accepted a position as Chair of Computational Modeling for Nuclear Engineering at the University of Liverpool. The position is supported jointly by the National Nuclear Laboratory, the Royal Academy of Engineering and the university.
- To recognize his outstanding scientific achievements, **Dr. Holger Stephan** from the Institute of Radiopharmaceutical Cancer Research was named HZDR Research Fellow. Stephan heads the “Nanoscalic Systems” working group as well as the Helmholtz Virtual Institute NanoTracking. He develops new custom materials for tumor diagnostics and therapy control in cancer-related illnesses.

Honors

- 2015 HZDR Prizes (awarded March 17th, 2016)
- In her dissertation, undertaken at the OncoRay center and at the HZDR, **Dr. Kristin Stützer** was able to further develop a measurement method with which treatment of moving tumors can be better controlled. The Behnken Berger Foundation awarded this achievement with its second emerging talent prize, which is endowed with 10,000 Euros. This marks the fourth time in a row this award was given to an OncoRay and HZDR researcher.
- On January 30th, 2015, **Dr. Sebastian Reinecke** from the HZDR's Institute of Fluid Dynamics was awarded the 2014 SICK Dissertation Prize for developing a sensor with which the processes in bioreactors can better be monitored. The honor, endowed with 6,000 Euros, is granted by Dorothea Sick-Thies, the daughter of Dr. Erwin Sick, founder of the sensor manufacturer SICK AG.
- The German Society for Radiation Oncology awarded the Hermann Holthusen Prize, which is endowed with 5,000 Euros, to **Dr. Iris Eke** for her postdoctoral thesis (*Habilitationsschrift*), which she completed at the OncoRay center. Her work examined tumor resistance to new targeted medications in combination with radiotherapy.
- The 2015 Hanns-Langendorff Prize, endowed with 1,500 Euros, was awarded to **Dr. Stephan Helmbrecht** for his doctoral work, undertaken at the OncoRay center and at the HZDR's Institute of Radiation Physics. The physicist could optimize data processing for clinical application in regards to a measurement method with which the range of proton and ion beams can be determined.
- At the Annual Meeting for Nuclear Technology, **Tobias Seidel** from the HZDR’s Institute of Fluid Dynamics received the 2015 Siempelkamp Competence Prize, endowed with 1,000 Euros. The doctoral candidate presented his dissertation project at the “Maintaining Competence” workshop. His project examines condensation effects at the thermohydraulic test facility TOPFLOW.
- The 1,000 Euro John Dawson Dissertation Prize for 2015 was granted to **Dr. Karl Zeil** from the HZDR’s Institute of Radiation Physics. In his dissertation, the physicist studied the mechanisms of laser-particle

- acceleration to enable better scaling of the particles' energy. The aim was to develop a compact laser-particle accelerator for modern cancer treatment using protons.
- The Dresden University of Applied Sciences has awarded **Dr. Michael Kuntzsch** the Emerging Researcher Prize, endowed with 1,000 Euros. The scientist from the Institute of Radiation Physics won over the jury with his thesis. Kuntzsch conceived and created a laser-based synchronization system for distributing a time reference signal for the HZDR's ELBE electron accelerator.
- Last year, the Green Photonics Award went to a research team from Dresden: **Prof. Andrés Lasagni** and **Sebastian Eckhardt** from the Institute of Manufacturing Technology at the TU Dresden, **Dr. Lars Müller-Meskamp** from the Institute of Applied Photophysics as well as **Dr. Mathias Siebold** and **Markus Löser** from the Institute of Radiation Physics at the HZDR received the prize in the field of “Laser-based Manufacturing and Micro/Nano Manufacturing”.
- **Dr. Frank Hofheinz** from the HZDR's Institute of Radiopharmaceutical Cancer Research received a prize from the academic journal *Nuklearmedizin* for an article published in 2012. His contribution (F. Hofheinz et al., "Automatic volume delineation in oncological PET. Evaluation of a dedicated software tool and comparison with manual delineation in clinical data sets“, Nuklearmedizin, 2012, Vol. 51, pp. 9-16) was the most frequently cited study last year.
- **Dr. Manja Kubeil** has been granted a Marie Curie Stipend from the European Commission, worth approximately 280,000 Euros, for a two year research visit to Monash University in Melbourne, Australia. The chemist from the Institute of Radiopharmaceutical Cancer Research wants to develop nanoparticles that destroy tumors with the help of carbon monoxide.
- As in past years, HZDR graduates were also recognized in 2015 by the Dresden Chamber of Commerce for their excellent exam results. **Richard Kaubisch**, an electrical device and systems engineer, and technical product designer **David Sobiella** are designated the best in their fields within the Dresden Chamber’s district. Both earned a score of 92 out of 100 possible points in their respective applied technicians’ field exams. This achievement also ranks Kaubisch as the best in the Free State of Saxony. These honors at the same time confirm the HZDR’s educational concept. For the sixteenth time in a row, the research center was classified as an “Outstanding Educational Enterprise”. In addition, the notion of work-life balance isn't forgotten as has been confirmed by the *berufundfamilie gGmbH* (career and family) evaluation, which certified the HZDR’s personnel policy as family friendly.

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PhD Degrees

Following is a list of PhD degrees awarded by the HZDR in 2015.

Institute of Fluid Dynamics

Dr. Gustavo Adolfo Montoya Zabala: Development and Validation of Advanced Theoretical Modeling for churn-Turbulent Flows and subsequent transitions (Dr. Dirk Lucas)

Dr. Martin Seilmayer: Untersuchungen zu magnetohydrodynamischen Instabilitäten in Flüssigen Metallen (Dr. Frank Stefani)

Dr. Tobias Vogt: Experimentelle Untersuchungen zu transienten und dynamischen Vorgängen in elektro-magnetisch getriebenen Flüssigmetall-Drehströmungen (Dr. Sven Eckert)

Helmholtz Institute Freiberg for Resource Technology

Dr. Tobias Günther: S-Layer als Technologieplattform-Selbstorganisierende Proteine zur Herstellung funktionaler Beschichtungen (Dr. Katrin Pollmann)

Dr. Ardalan Othman: Remote sensing based exploration and landslide risk in Kurdistan (Dr. Richard Gloaguen)

Dr. Stefan Pavetich: Determination of non-routine radionuclides by medium-energy accelerator mass spectrometry (Dr. Silke Merchel)

Dr. Dirk Sandmann: Methodenentwicklung für die automatisierte Mineralogie (Prof. Gutzmer)

Dr. Matthias Suhr: Isolierung und Charakterisierung von Zellwandkomponenten der gram-positiven Bakterienstämme Lysinibacillus sphaericus JG-A12 und JG-B53 und deren Wechselwirkungen mit ausgewählten relevanten Metallen und Metalloiden (Dr. Katrin Pollmann)

Institute of Ion Beam Physics and Materials Research

Dr. Anja Banholzer: Magnetische Charakterisierung von Vortex-Dreifachlagen mittels Röntgentransmissionsmikroskopie, Magnetowiderstand und ferromagnetischer Resonanz (Prof. Jürgen Faßbender)

Dr. Robert Endler: Ionenstrahlgestützte Fasertexturierung und Kornwachstum in polykristallinem Dünnschichtsilizium (Prof. Sibylle Gemming)

Dr. Susette Germer: Design and analysis of integrated optical waveguide structures and their coupling to silicon based light emitters (Prof. Manfred Helm)

Dr. Julia Osten: Auswirkung lokaler Ionenimplantation auf Magnetowiderstand, Anisotropie und Magnetisierung (Prof. Jürgen Fassbender)

Dr. Bernadeta Pelic: Nanoscale surface engineering for improved corrosion resistance of CuZn, PbSn and TiAl alloys (Dr. Wolfgang Skorupa)

Dr. Denise Reichel: Ripple pyrometry during millisecond annealing on shallow Boron-doped Silicon wafers (Dr. Wolfgang Skorupa)

Dr. Torsten Sendler: Leitwertkontrolle einzelner elektrisch kontaktierter Moleküle (Prof. Manfred Helm)

Dr. Yutian Wang: Defect-induced ferromagnetism in SiC (Prof. Manfred Helm)

Dr. Clemens Wündisch: Das Diffusions- und Aktivierungsverhalten von Arsen und Phosphor in Germanium (Prof. Manfred Helm)

Dr. Matthias Zschornak: Defect-induced Local Electronic Structure Modifications within the system SrO – SrTiO3 – TiO2 (Prof. Sibylle Gemming)

Dr. Sabine Zybell: Relaxation dynamics in photoexcited semiconductor quantum wells studied by time-resolved photoluminescence (Prof. Manfred Helm)

Dresden High Magnetic Field Laboratory

Dr. Kathrin Götze: Untersuchung der Hochfeldphasen und der elektrischen Bandstruktur intermetallischer Verbindungen (Prof. Joachim Wosnitza)

Dr. Rico Schönemann: Untersuchungen von stark korrelierten Materialien unter extremen Bedingungen (hohen Magnetfeldern und tiefsten Temperaturen) mit Hilfe magnetometrischer Messmethoden (Dr. Thomas Herrmannsdörfer)

Institute of Radiopharmaceutical Cancer Research

Dr. Stefanie Koristka: Entwicklung neuartiger Strategien zur antigenabhängigen Aktivierung humaner regulatorischer T-Zellen mit polyklonaler Rezeptorspezifität (Prof. Michael Bachmann)

Dr. Sven Rötering: Synthese und Evaluierung von [18F]NS14490 zur molekularen Bildgebung von α7 nikotinischen Acetylcholinrezeptoren mit Positronen-Emissions-Tomographie (Prof. Peter Brust)

Dr. Georg Schramm: Evaluation and Improvement of MR-based Attenuation Correction for PET/MR (Prof. Jörg van den Hoff)

Dr. Maik Schubert: Entwicklung der targetspezifischen Komponente eines Tumor-Pretargeting Systems auf der Basis L-konfigurierter Oligonukleotide (Prof. Jörg Steinbach / Dr. Hans-Jürgen Pietzsch)

Dr. Frank Starke: Entwicklung und radiopharmazeutische Charakterisierung von radiomarkierten, EGFR-spezifischen Oligopeptiden (Prof. Jörg Steinbach / Dr. Hans-Jürgen Pietzsch)

Dr. Sandra Ullm: Funktionelle Charakterisierung der Wechselwirkungen zwischen neuartigen polymeren Biomaterialien und dem Organismus (Prof. Jens Pietzsch)

Institute of Radiation Physics

Dr. Roland Hannaske: Deuteronenaufbruch in der Big-Bang Nukleosynthese (Dr. Arnd Junghans)

Dr. Stephan Helmbrecht: Partikeltherapie-PET – Optimierung der Datenverarbeitung für die klinische Anwendung (Dr. Fine Fiedler)

Dr. Michael Kuntzsch: Optische Synchronisation am CW-Beschleuniger ELBE (Prof. Tom Cowan)

Dr. Josefine Metzkes: Studying the interaction of ultrashort, intense laser pulses with solid targets (Prof. Tom Cowan)

Dr. Heide Rohling: Simulation studies for the in-vivo dose verification of particle therapy (Prof. Wolfgang Enghardt)

Dr. Konrad Schmidt: Experimentelle Studien der 40Ca(α,γ)44Ti Reaktion (PD Dr. Daniel Bemmerer)

Institute of Radiooncology

Dr. Ellen Dickreuter: Zelladhäsionsbedingte Strahlenresistenz von Tumorzellen: Bedeutung von beta1 Integrinen für die DNA-Reparatur (Prof. Nils Cordes)

Institute of Resource Ecology

Dr. Sawsan Eid Abu Sharkh: Spectroscopic and calorimetric studies of anhydrobiosys (Prof. Karim Fahmy)

Dr. Siriwan Dulnee: Sorption and redox reactions of Sn(II) and Sn(IV) at the magnetite/water interface in presence and absence of organic ligands (Dr. Andreas Scheinost)

Dr. Elisabeth Fischermeier: Binding and Transport of Copper in Biomembranes (Prof. Karim Fahmy)

Dr. Corinna Gagell: Charakterisierung mikrobieller Gemeinschaften in ehemaligen, neutralen Uranerzbergwerken in Sachsen und Untersuchungen zur mikrobiellen Immobilisierung von Uran und Arsen (Dr. Thuro Arnold / Prof. Isolde Röske)

Dr. Sascha Hofmann: Der Einfluss endlagerrelvanter Elektrolyte auf die Wechselwirkung dreiwertiger Lanthanide und Actinide mit Calcit (Prof. Thorsten Stumpf)

Dr. Richard Husar: Kolloidbildung, -stabilität und -reaktivität von tetravalenten Actiniden in silikatischen Systemen (Prof. Thorsten Stumpf)

Dr. Reuven Rachamin: Conceptual Design of Pressure Tube Light Water Reactor with Variable Moderator Control (Dr. Emil Fridman)

Dr. Ahmed Moustafa Taha Sayed: Spectroscopic investigation of conformational transitions in the copper-transporting P1B-ATPase CopB from Enterococcus hirae (Prof. Karim Fahmy)

Dr. Isabel Zirnstein: Influence of Biofilms on Migration of Uranium, Americium and Europium in the Environment (Dr. Thuro Arnold / Prof. Isolde Röske)

Administrative Branch

Dr. Diana Stiller: Die Auswirkungen der Finanz- und Wirtschaftskrise der Jahre 2007 bis 2011 auf das Management von Unternehmen (Prof. Peter Joehnk)

Communication and Media Relations

Dr. Matthias Streller: The educational effects of pre and post-work in out-of-school laboratories (Prof. Gesche Pospiech / Prof. Avi Hofstein / Prof. Jürgen Faßbender)

Online Annual Report 2015

HZDR Facts and Figures (as of Dec. 31, 2015)

Total annual budget including investments	approx. 121 million Euros
of that, external revenues	approx. 23 million Euros

Number of employees	1.074
Number of PhD students	139
Number of trainees	36

Professors	
Number of joint appointments at Saxon Universities	16
Adjunct and honorary professorships	8

Junior Research Groups	10

ERC Starting Grants	2

Publications	
Articles (ISI / Scopus cited)	539
Other cited publications	28
Books	8
Doctoral theses	44

Large-scale scientific facilities (performance category II)	
Ion Beam Center IBC	13.293 hours
ELBE – Center for High-Power Radiation Sources	3.745 hours
Dresden High Magnetic Field Laboratory	80 measurement campaigns / 126 measurement weeks / 4.100 applied magnetic pulses

Science and technology transfer	
Applications by priority	7

Students at DeltaX School Lab	2.700