THE RESEARCH UNIVERSITY IN THE HELMHOLTZ ASSOCIATION

Annual Report 2017 of Karlsruhe Institute of Technology

KIT – The Research University in the Helmholtz Association

Mission

We create and impart knowledge for the society and the environment.

From fundamental research to applications, we excel in a broad range of disciplines, i.e. in natural sciences, engineering sciences, economics, and the humanities and social sciences.

We make significant contributions to the global challenges of mankind in the fields of energy, mobility, and information.

Being a big science institution, we take part in international competition and hold a leading position in Europe.

We offer research-based study programs to prepare our students for responsible positions in society, industry, and science.

Our innovation efforts build a bridge between important scientific findings and their application for the benefit of society, economic prosperity, and the preservation of our natural basis of life.

Our working together and our management culture are characterized by respect, cooperation, confidence, and subsidiarity. An inspiring work environment as well as cultural diversity characterize and enrich the life and work at KIT.

Employees 2017

Total	9,297
Teaching and research	4,987
Professors	367
Foreign scientists and researchers	1,026
Infrastructure and services	4,310
Trainees	432

Students

Winter semester 2017/18:	25,495

Budget 2017 in Million Euros

Total	901.7
Federal funds	287.6
State funds	255.4
Third-party funds	358.7

Karlsruhe Institute of Technology – The Research University in the Helmholtz Association – stands for excellent research and outstanding academic education. It also is a driver of innovation by making best possible use of the synergies resulting from the merger of a state university with a national large-scale research center eight years ago.

In our annual report, we look back on a very active year 2017 and present to you some highlights of our work. You will read about exciting results and course-setting developments in the areas of research, teaching, and innovation. For example, KIT has been successful with four cluster-of-excellence initiatives and was able to establish nine new tenure-track professorships within the framework of the Early-career Researchers Pact (Nachwuchspakt). In a field test accomplished by KIT in Landau, Germany, selected private households tested decentralized power trading at a regional level as a possible model for the energy market of the future. Moreover, KIT researchers are helping to shape the mobility of the future – last year, for example, by developing a geo-information tool for the analysis of potential locations for rapid-charging stations.

Of course, we also inform you about life at KIT, such as the Open Day on June 24, when around 35,000 people took the opportunity to visit Campus North to gain fascinating insights into experiments, science, and work at KIT. We also look back on other events, such as the Children's University or the Science Night, or the successful re-audit as a family-friendly university.

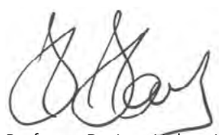
Numerous awards and the entrusting of honorable functions show that, with the help of its outstanding students, professors, and staff in research and administration, KIT is optimally prepared for a successful future.

On behalf of the Presidential Committee of KIT, I express my sincere thanks to our political partners, our partners in research and industry, the KIT Supervisory Board, and the members of KIT for their trusting, intense, and successful cooperation last year.

I cordially invite you to take your time to read and leaf through this annual report and I hope you will enjoy looking back on KIT – The Research University in the Helmholtz Association – in 2017.
May 2018 become as thrilling as last year!

Enjoy reading.

Yours,



Professor Dr.-Ing. Holger Hanselka
President of KIT

A RETROSPECTIVE VIEW OF KIT

The year 2017 at KIT was determined by the evaluations within the framework of the program-oriented funding scheme of the Helmholtz Association and was primarily marked by the preparation for the Excellence Strategy, the successful participation in the Tenure-track Program, and the implementation of the KIT 2025 Umbrella Strategy.

The German Research Foundation (Deutsche Forschungsgemeinschaft - DFG) and the German Council of Science and Humanities are jointly implementing the Excellence Strategy Program in two funding lines: Clusters of Excellence and Universities of Excellence. In the first round of the Excellence Clusters funding line, KIT submitted eight proposals. On September 29, the DFG finally announced the results: The KIT is in the final round with four initiatives for the Clusters of Excellence and can submit full proposals for projects in informatics, materials science, elementary particle and astroparticle physics, and energy research. If KIT is awarded funding for at least two clusters in September 2018, it can also apply for the Excellence Universities funding in December 2018.

Thanks to its convincing funding proposal for young researchers, the KIT received nine tenure-track professorships from the Nachwuchspakt, the federal / state government program for promoting early-career researchers. To ensure that each of the eleven departments of KIT gets an endowed professorship, two further positions are being financed within KIT. The Tenure-track Program aims to make career paths in academia more projectable and transparent. The program will run until 2032.

The application for the Tenure-track Program was the central task of the lead project "Karrierephasen und -wege für den Wissenschaftlichen Nachwuchs" (career phases and career paths for young researchers) as part of the implementation of the KIT 2025 Umbrella Strategy. Another lead project "Ausgestaltung der Innovationsstrategie" (designing the innovation strategy) was completed with its adoption by the KIT Senate and Supervisory Board in 2017. With the area of action "International Affairs," an additional chapter of the Umbrella Strategy was formulated and adopted by the KIT committees.

ERC Grants for the KIT

In 2017, KIT researchers were particularly successful in attracting funding from the European Research Council (ERC).

The ERC awards so-called "Proof of Concept Grants" in order to further develop application-relevant work from basic research for the market. The SCOOTER project aims to enable serial data transmission of more than 100 gigabits per second while meeting the high requirements of micro-integration and the energy efficiency of chips. The LockChip project intends to significantly reduce the temperature dependence of the measurement results of compact nuclear magnetic resonance devices.

Dr. Cornelia Lee-Thedieck received an "ERC Starting Grant" for the bloodANDbone project, in which she develops models of the human bone marrow to investigate the regeneration of blood and bone by stem cells and the disturbance of this regeneration in diseases such as leukemia or bone metastases.

Two KIT researchers were awarded the "ERC Consolidator Grant." In his project TeraSHAPE, Professor Dr. Christian Koos combines photonic and electronic methods to generate terahertz signals and make them usable for data transmission and measurement technology. In the Tribo-Key project, Dr. Christian Greiner investigates how metals behave in frictional contacts in order to reduce friction and wear and thereby reduce energy and raw material consumption.

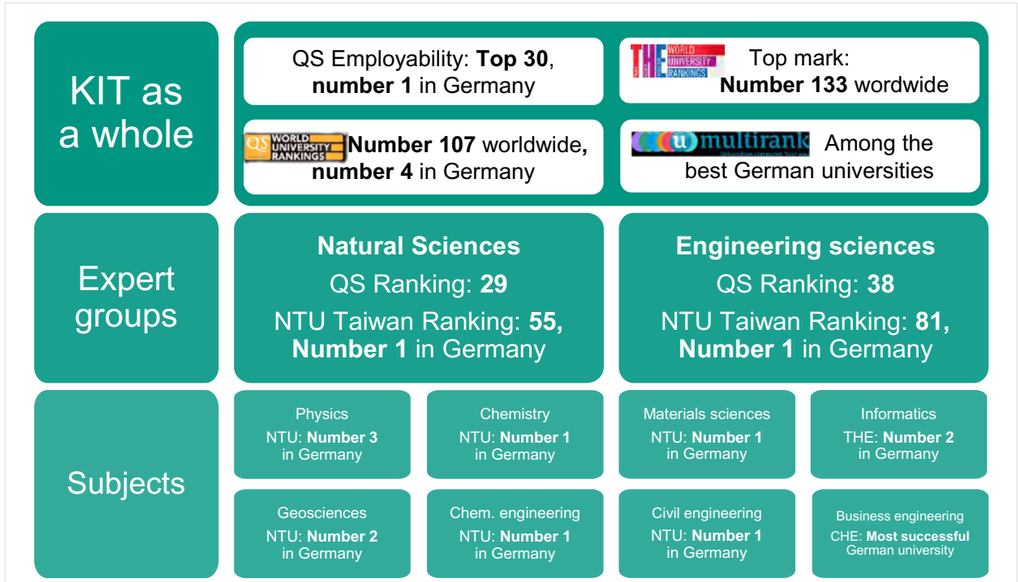
The event "erc = science² | European Top Research at KIT" on the occasion of the 10th anniversary of the European Research Council was opened by Professor Dr. Oliver Kraft, Vice President for Research, in the presence of a large audience.

In addition, two scientists of KIT were awarded the "ERC Advanced Grant." In the MoQuOS project, Professor Dr. Wolfgang Wernsdorfer deals with the optical manipulation and characterization of molecular quantum bits. In the CRISBREED project, Professor Dr. Holger Puchta investigates how several molecular scissors, so-called CRISPR/Cas systems, can be used simultaneously to precisely modify genetic information and recombine certain properties in cultivated plants.

So far, 19 researchers of KIT have been supported by an ERC grant during the ten-year existence of the ERC. KIT contributed to the 10-year anniversary with the event "erc = science² | Top European Research at KIT," which took place on March 16, 2017. Three KIT researchers, each of whom received an ERC Starting Grant, Consolidator Grant, or Advanced Grant, presented their research at the event. Afterwards, they discussed with the audience their experiences gained with ERC, and the social issues in public discourse that are critical and interesting for their research.

Ranking Performance

As in the previous years, the results in various rankings in 2017 show that KIT is very well positioned in national and international comparisons. In the "U-Multirank" evaluation funded by the EU Commission, KIT is in the top group in the category "research" in terms of the number of post-docs and scientific publications as well as the total amount of third-party funds raised. In the category "knowledge transfer," KIT received top marks for patents and spinoffs, among other things. Individual departments also performed very well in a number of indicators: Top group ranking was achieved seven times by Electrical Engineering and Information Technology, six times by Informatics, and five times by Mechanical Engineering. Informatics has been rated particularly highly in the research category, such as for publications and the number of doctorates. In knowledge transfer, Electrical Engineering and Information Technology as well as Chemical Engineering score high, among other things, concerning co-publications with partners from industry. KIT occupies top positions in the field of International Affairs in terms of the number of employees from abroad and in publications produced jointly with partners from abroad. The international orientation of teaching has been rated as very good, especially in Electrical Engineering and Information Technology. The learning experience was ranked as good throughout in all departments in a survey among KIT students.



Summary of KIT's current ranking results. The Times Higher Education World University Ranking (THE) and the CHE University Ranking, which appears in the ZEIT Study Guide, are not described in this annual report.

In the "Performance Ranking of Scientific Papers for World Universities," which has been published by the National Taiwan University since 2011 and is based on an analysis of scientific publications, the KIT is listed as the best German university in natural sciences (number 55 worldwide) and engineering sciences (number 81 worldwide). KIT also achieved excellent results in individual subjects, with first places in chemical engineering (number 46 worldwide), chemistry (number 61 worldwide), materials science (number 67 worldwide), and civil engineering (number 135 worldwide). KIT is ranked second in Germany in geosciences (number 47 worldwide), and is among the best German universities in physics, mechanical engineering, and environment/ecology (3rd place in each case), informatics (4th place), and electrical engineering (5th place).

In the "QS World University Rankings," the overall ranking of the best universities in the world published by Quacquarelli Symonds Ltd. in London, the KIT ranked 107th in 2017. KIT scores particularly well in the "Reputation among Employers," achieving 36th place internationally and even third place in Germany. In a national comparison, KIT ranks fourth overall, thus confirming the good results of the previous years.

In the "QS Graduate Employability Rankings," the KIT is the best German university, ranking seventh in Europe, and 30th worldwide. 600 universities worldwide were considered, thirty of them in Germany. This ranking focuses on the preparation of university graduates for the labor market. The "QS Graduate Employability Rankings" measure, among other things, the reputation of the university among employers, the number of very successful alumni, the networking of the university with employers, and the attractiveness of graduates for employers from industry and business. The creators of the ranking emphasize KIT's strong cooperation with industry through strategic partnerships and joint research projects, as well as the KIT events for students, such as the Career Fair or the Company Speed Dating event.

The "QS World University Rankings by Subject 2017" are based on such criteria as reputation among scientists and employers, citation frequency of scientific works, and the Hirsch index, which is an indicator of the research performance of scientists. The "QS World University Rankings by Subject" consider both subject areas and individual subjects. Internationally, the KIT scores particularly well in the natural and engineering sciences: In natural sciences, KIT improved by five places to rank 29 compared to the previous year, and in engineering and technology by 24 places to rank 38 worldwide. In individual subjects, KIT is among the top 50 universities in the world in physics (international rank 31) and materials science (international rank 49). The

KIT also reaches the international top 100 in architecture, informatics, chemical engineering, civil engineering, electrical engineering, mechanical engineering, and chemistry.

Providing Advice to Politics and Society

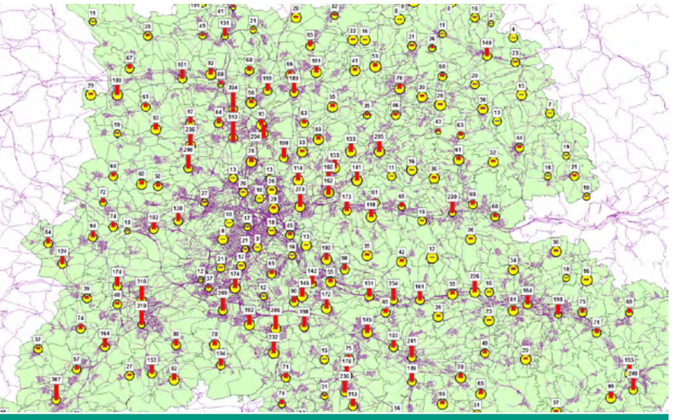
KIT also set an example in providing advice to politicians and society. For instance, the Institute of Information Systems and Marketing has started an unusual field test: In Landau, Germany, selected private households are testing decentralized power trading at a regional level as a possible model for the energy market of the future.

Researchers of KIT's Institute for Transport Studies and of Fraunhofer Institute for Systems and Innovation Research have developed a geo-information tool for the analysis of locations for rapid charging stations in the region of Stuttgart, Germany.

Among other things, this planning tool takes into account the accessibility of the stations, forecasts the demand for charging, and can be adapted to various general conditions.

A study by the Institute for Information Processing Technology at KIT, the FZI Research Center for Information Technology at KIT, and Stuttgarter Straßenbahnen AG shows how autonomous driving can work and contribute to reducing costs at bus depots.

On February 14, 2017, on the occasion of the first National Conference on IT Security Research in Berlin, the heads of the three German competence centers for IT security research, KASTEL at KIT, CISPA in Saarbrücken, and CRISP in Darmstadt, presented the Federal Minister of Education and Research, Professor Dr. Johanna Wanka, with a position paper on the current status of cybersecurity. The researchers describe the most important challenges and make concrete suggestions on how to overcome them. Among other things, the experts recommend the strategic improvement of digital sovereignty in Germany and Europe, the targeted promotion of cybersecurity infrastructures, and an improvement of the research framework.



With spatial resolution, the planning instrument for the expansion of the charging infrastructure in the Stuttgart region forecasts the daily charging processes of electric vehicles.

An international team under the patronage of UNESCO and under the technical direction of the Division of Hydrogeology at KIT's Institute of Applied Geosciences has presented a "World Karst Aquifer Map" to internationally improve the protection and management of the so-called karst aquifers i.e., branched groundwater systems in karst areas.

An analysis carried out by the KIT-operated Office of Technology Assessment with the German Bundestag shows options for medical innovations in developing countries.

Laboratory-bred animal muscle tissue promises real meat consumption without a guilty conscience. Researchers at the KIT Institute for Technology Assessment and Systems Analysis have investigated whether this so-called *in vitro* meat is really a suitable alternative.

Under the leadership of KIT, the "Transformation Center for Sustainable Futures and Cultural Change" will be established in Karlsruhe over the next two years. This will expand and stabilize KIT's Urban Transition Lab. In the long term, the cultural change towards greater sustainability, and the associated technical, social, and institutional restructuring of our society will be supported. The aim is to close the gap between knowledge and action and to investigate in a special way the transformation into sustainable lifestyles and subsistence strategies.

At the newly founded Institute of Technology Futures, the connections between technology, society, and culture in technology developments are being investigated. The results are new perspectives for current technological debates on e.g., the energy and mobility turnarounds.

The future space of the Urban Transition Lab serves science and the public as a sustainability center in urban space.

Strategic Partnerships with Industry

In 2017, the KIT intensified its relations with various industrial companies, in particular by establishing strategic partnerships.
At the end of December 2016, KIT and SAP SE entered into a strategic partnership. The aim of this partnership is to gain new insights for digital solutions in business, science, and society through innovative teaching and learning concepts, cooperation in the field of entrepreneurship, and joint research and innovation projects. A main focus in teaching are student development and consulting projects based on real business tasks. Joint activities in research and innovation are energy networks, autonomous driving, Industry 4.0, big data, cybersecurity, robotics, and automatic translation.

At the beginning of June 2017, KIT and Robert Bosch GmbH extended their long-standing cooperation with a framework agreement on a strategic partnership in research, teaching, and innovation. It is the starting point for future projects, such as initiation of further research and development projects, joint teaching and information programs for students, exploitation of innovative research results, use of synergies in internationalization, and joint dialog with society on technology developments and impacts. This close cooperation will promote and strengthen the position of the partners nationally and internationally in the long term.

KIT and BASF SE have been cooperating in the field of battery research for several years. In the Battery and Electrochemistry Laboratory (BELLA), basic research goes hand in hand with application-oriented projects on materials

Professor Dr. Thomas Hirth, Professor Dr.-Ing. Holger Hanselka, Gerhard Oswald, Member of the Executive Board of SAP, and Dr. Bernd Welz, Chief Knowledge Officer at SAP (from left to right) after conclusion of the agreement on a strategic partnership.

Professor Dr.-Ing. Holger Hanselka, Dr. Volkmar Denner, Chairman of the Bosch Management Board (from the left, in front), Professor Dr. Thomas Hirth, and Dr. Jürgen Kirschner, Head of Research and Advance Engineering at Bosch (from left, rear) concluding a strategic partnership in research, teaching, and innovation.

and components for next-generation batteries. A strategic collaboration agreed in November 2017 provides the framework for further projects in research, teaching, and innovation.

Already in September 2017, an agreement was reached on the "ZEISS Innovation Hub @ KIT," for which Carl Zeiss AG will construct a new innovation building on Campus North to be used jointly with KIT. In January 2018, the two partners expanded their existing long-term cooperation in research and teaching into a strategic partnership. As a result, joint product development and the establishment of startups increasingly will come to the fore. The partners agreed on first concrete research projects in the fields of digitization and robotics. The focus is on machine learning, digital optics, and computer vision applications.

Special Events

Making the supply networks fit for the energy turnaround, testing autonomous vehicles in real road traffic, developing security technologies for the digitized world: Major social challenges such as these cannot be solved exclusively within individual scientific disciplines, but must be tackled at the common interfaces. Successful networking between the disciplines was the focus of KIT's Annual Celebration on May 4, 2017.

On June 24, 2017, KIT opened its doors at Campus North: About 35,000 visitors took the opportunity to be fascinated by science and technology with over 180 program items. The KIT presented itself as an attractive place to study and work and provided information about studies, training, and lifelong learning. Children and young people discovered science and technology up-close during a research rally and at numerous experimental stations. The Open Day at KIT also marked the start of the Karlsruhe science festival EFFEKTE, where all scientific institutions in Karlsruhe were invited to participate and enjoy themselves for a week.

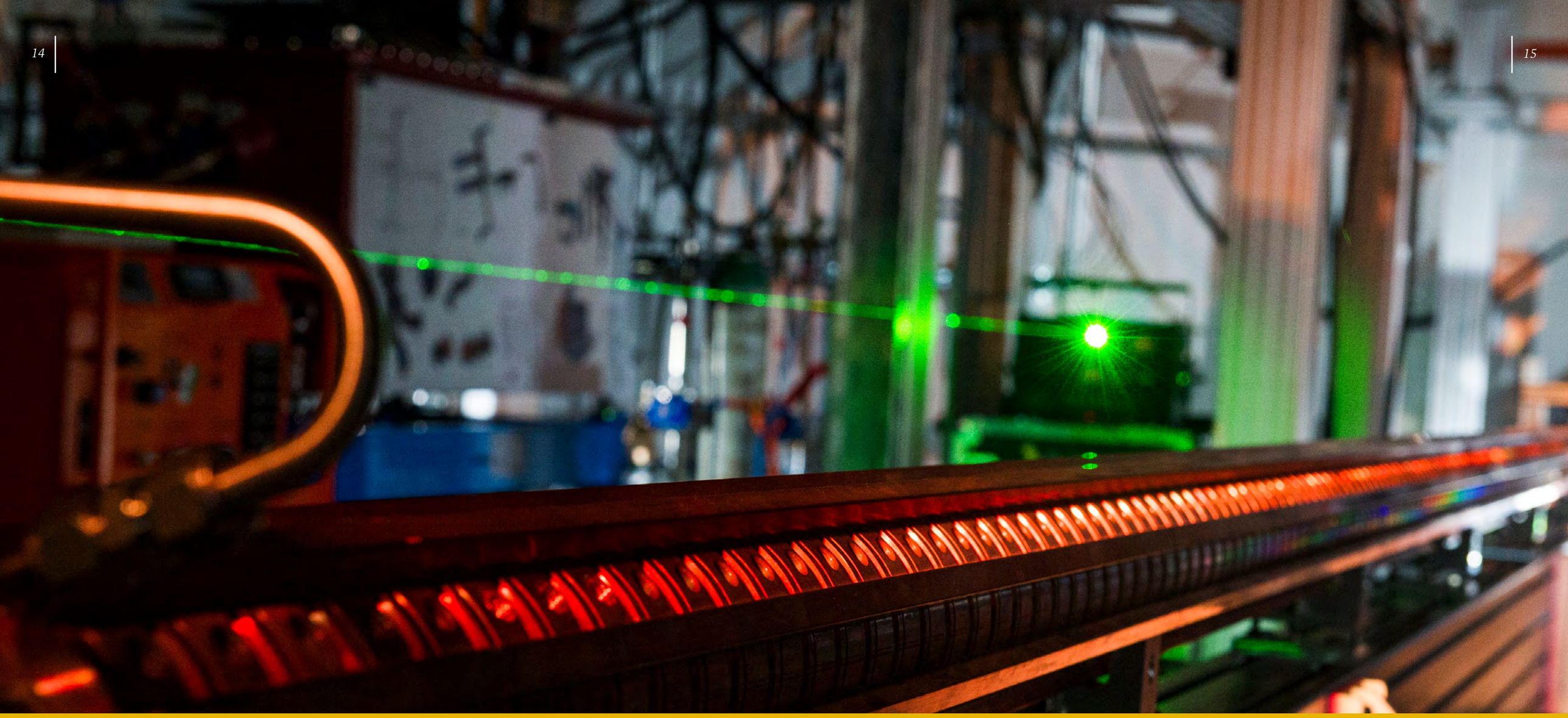
In 2017, the KIT organized a festive event to mark the centenary of Karl Steinbuch, co-founder of informatics and visionary of the digital age. Almost 60 years ago, he became a professor in Karlsruhe. Karl Steinbuch was concerned early on with artificial intelligence and caused a sensation as a futurologist by making astonishing predictions. For example, he forecast that after the year 2000, we would watch films and text messages on portable minicomputers. At the event, the KIT explicitly commemorated Steinbuch's life`s work as an outstanding scientist, but emphasized that the political views that Steinbuch represented at an advanced age are not being shared.

A "Venetian Masked Ball" awaited 600 guests at the festively decorated canteen on Campus South.

The second TEDxKIT conference on "(Re)Imagining the Future" took place on November 18, 2017. After a brilliant start in 2016, a significantly extended version of the internationally successful TEDx format entered its second round at KIT. The topics were as varied as they were fascinating. On the premises of the KIT Mathematics Building on Campus South, eight lectures, held by lecturers from the KIT and others, took the approximately 330 listeners with them into their visions of shaping a better future.

On Saturday, November 11, 2017, guests were invited by the Presidential Committee of KIT to dance, revel, and celebrate at a "Venetian Masked Ball." With dance music, an enchanting show program, and around 600 cheerful guests disguised with fanciful masks, the KIT ball was again a great success in its second year.

The Presidential Committee in 2017: Professor Dr.-Ing. Holger Hanselka, President, Christine von Vangerow, Vice President for Human Resources and Law, Professor Dr. Thomas Hirth, Vice President for Innovation and International Affairs, Dr. Ulrich Breuer, Vice President for Finance and Business Affairs, Professor Dr. Oliver Kraft, Vice President for Research, and Professor Dr. Alexander Wanner, Vice President for Higher Education and Academic Affairs (from top left, clockwise).



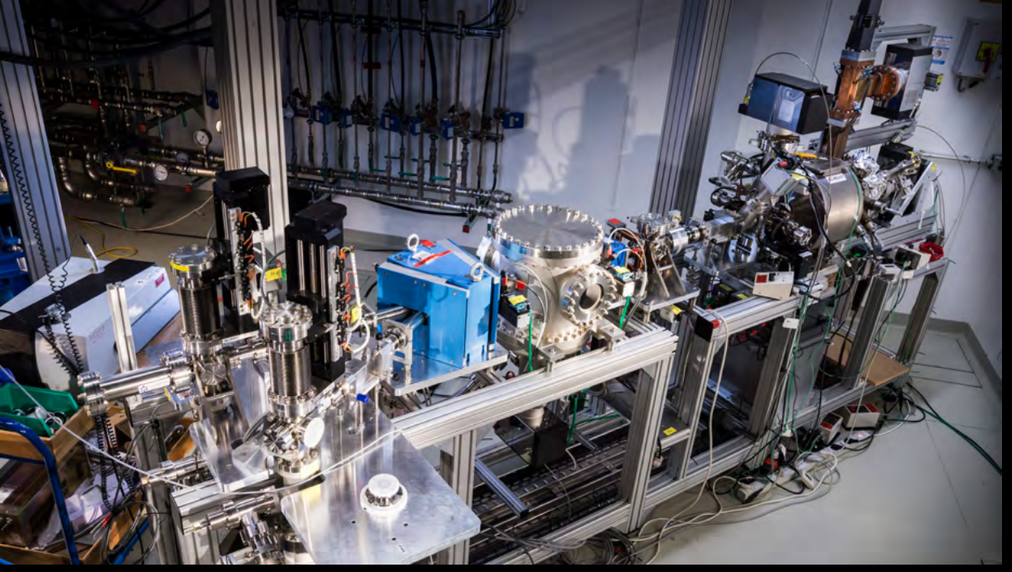
RESEARCH

Research is the central mission of KIT. KIT's research strategy relies on the competencies and capabilities of every scientist. Modern research increasingly takes place within collaborative projects with regional, national, and international partners in science, industry, or public institutions.

In 2017, for example, KIT acquired funding for a number of path-breaking projects in the profile-building area of mobility. The RegioMOVE project is to pool mobility services in the region of Karlsruhe in a system-overlapping, interconnected, environmentally compatible, and user-friendly portfolio. Separate information platforms, tariff systems, and access options are combined in a scheme that integrates all means of transport. Apart from the KIT, a number of regional partners are involved in the project funded by the Karlsruhe Transport Authority.

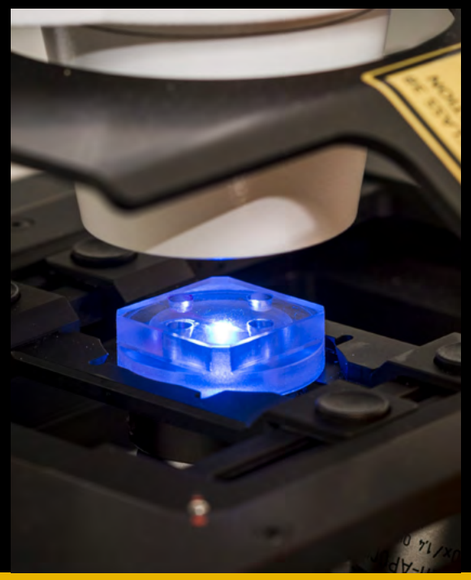
The joint project SmartAQnet (Smart Air Quality Network) is coordinated by KIT and funded by the Federal Ministry of Transport and Digital Infrastructure (BMVI). It is to develop a closely meshed network for high-resolution prognosis of air quality in the model region of Augsburg. Existing sets of meteorological data, traffic data, and classical stationary air quality data are to be complemented by measurement flights of drones and fine dust measurements by citizens using their specially equipped smartphones.

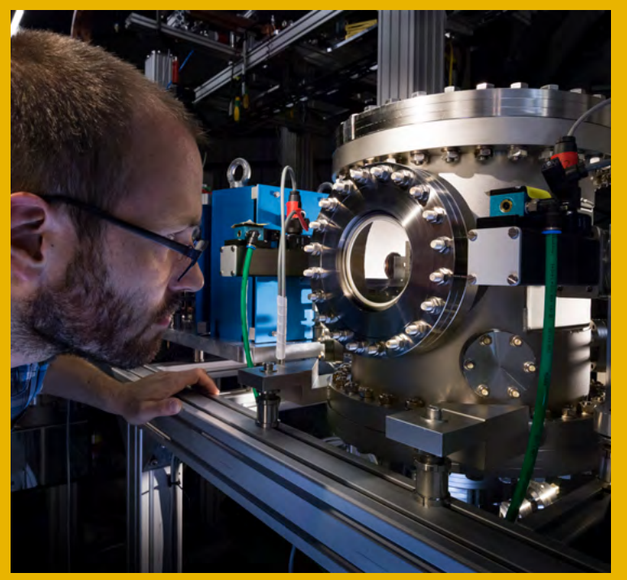
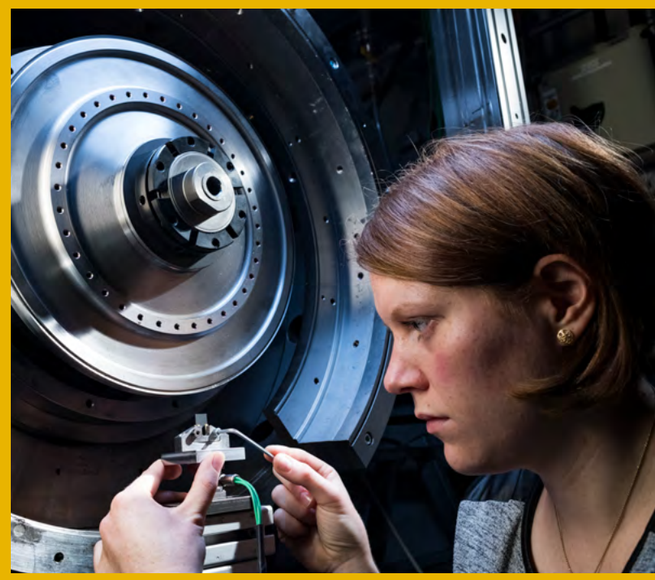
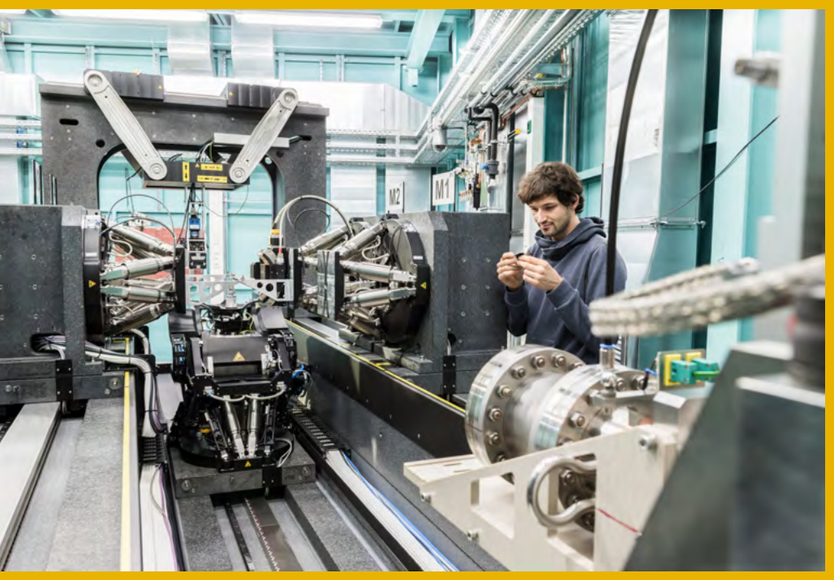
The Baden-Württemberg state government also has decided to fund the project "Plant Engineering for the Production of Stators by Hair Pin Technology – AnStaHa." Under this project, KIT and partners develop plants for the series- and type-flexible production of electric motors for vehicles. In this way, medium-sized enterprises are to be enabled to quickly use innovative technologies and remain competitive.











ENVIRONMENTALLY COMPATIBLE, EFFICIENT, AND FLEXIBLE

KIT COORDINATES PROJECTS FOR THE ENERGY TRANSITION

Smart interconnection of various energy system components is indispensable to implementing the energy transition. Storage technologies and their integration are of decisive importance to stable supply. KIT manages the Energy Systems Integration project as a "key future research topic" of the Helmholtz Association and coordinates the European research project SmILES.

Customized Models for Future Energy Systems

Interconnection of energy system components, i.e. of producers, storage systems, and consumers, so far has not adequately considered their interaction. Within the Energy Systems Integration project headed by Professor Dr. Veit Hagenmeyer, KIT, these interactions are to be studied and environmentally compatible, efficient, flexible, and stable energy systems are to be customized for the future. The project additionally considers processes of the metal processing, cement processing, and petrochemical industries. "To ensure reliable, economically efficient, and environmentally compatible energy supply, it is essential to combine and integrate all components in an intelligent way," Project Coordinator Veit Hagenmeyer explains. Within the project, scientists develop models of technological, economic, and ecological interactions on various levels, from components to processes to the integrated system.

The project comprises three work packages. The first package covers the coupling of power, gas, and heat networks as well as of material flows with IT infrastructures in sustainable, multi-modal energy systems. Secondly, researchers study the possibilities of increasing the flexibility of processes in energy-intensive industries. The third work package deals with market and regulatory issues in future energy supply that will be based primarily on regenerative sources and be characterized by both centralized and decentralized infrastructures and a highly flexible demand.

Within the framework of its Initiative and Networking Fund, the Helmholtz Association will finance the project as a "key future research topic" with EUR 5 million for the next three years. Apart from the KIT, another six Helmholtz centers will be involved. All partners together will contribute another 5 million euros.

Environmentally compatible, efficient, flexible, and stable energy systems have to be customized for future energy supply.

The project partners are the KIT, Helmholtz-Zentrum Berlin für Materialien und Energie, Forschungszentrum Jülich, the German Aerospace Center, the Max Planck Institute for Plasma Physics, Helmholtz-Zentrum Dresden-Rossendorf, and the Helmholtz Centre Potsdam – German Research Centre for Geosciences.

SmILES Integrates Heterogeneous Energy Sources and the Corresponding Storage Technologies

Storage of renewable energies and smart integration of storage devices in decentralized grid systems are of decisive importance to future stable energy supplies. The SmILES (Smart Integration of Energy Storage in Local Multi Energy Systems) project coordinated by KIT pools Europe-wide know-how on the simulation, optimization, and use of such infrastructures. The project is aimed at establishing a platform for the exchange of data and best practices relating to the integration of heterogeneous energy sources and their storage technologies and at strengthening joint European research.

European research partners pool their know-how on a variety of energy infrastructures, including storage systems, and on solar power and biomass for the energy transition to become reality.

The *energiewende* will result in more and more decentralized power supply systems based on a variety of energy sources. Their fluctuating contributions will be pooled and balanced by a smart supply grid in the future. "We will no longer have a single energy source that meets all the demand," explains Dr. Isabelle Südmeyer, Coordinator of SmILES. Hence, flexible and sustainable multi-energy systems will be needed to guarantee stable supply conditions with rising shares of renewable resources.

One of the challenges is balancing the fluctuating supply from renewable sources and consumption by smart storage technologies, such that hybrid electricity and heat supply grids can be operated efficiently and economically. Many research projects in Europe investigate how different energy carriers and their storage technologies can be integrated in an overall grid system, but they are based on different research approaches, tools, and heterogeneous boundary conditions.

This is the point of departure for SmILES. In the course of the project, six research partners will combine their methods and results and analyze the extent to which simulations, models, and optimizations are not only comparable, but can be generalized and extrapolated to other situations. Partial projects in urban quarters, in a small town in a rural environment, in an industrial facility, and on the research campus of KIT are to reflect various application scenarios and system configurations. On this basis, a generally accessible data platform is to be established. It is to provide the research community with analytical data and information on energy consumption and energy supply in various contexts.

SmILES is part of the European Common Research and Innovation Agenda (ECRIA) and intended to support implementation of the objectives of the Strategic Energy Technology Plan (SET Plan). Apart from KIT as the project coordinator, the Austrian Institute of Technology GmbH, Danmarks Tekniske Universitet, Electricité de France SA, the European Energy Research Alliance, Vlaamse Instelling voor Technologisch Onderzoek NV, and the European Institute for Energy Research are involved in the project.

HIGH-TOOL SUPPORTS TRANSPORT PLANNING IN EUROPE

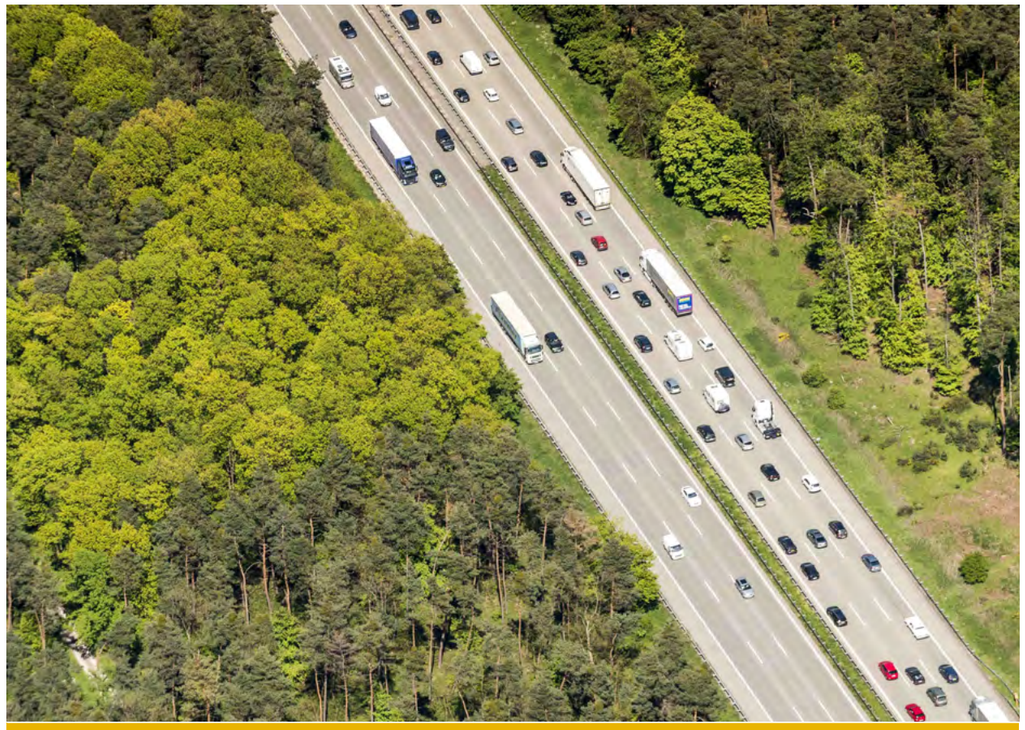
KIT-COORDINATED EU PROJECT WAS COMPLETED AND GRANTED THE GERMAN MOBILITY PRIZE

The HIGH-TOOL project is one of the winners of the German Mobility Prize 2017. During the ceremony held at the Federal Ministry of Transport and Digital Infrastructure, the prize was presented to the Karlsruhe Institute of Technology and its partners by Parliamentary State Secretary Dorothee Bär and Ute Weiland, Director of the "Germany – Land of Ideas" initiative.

With the help of the HIGH-TOOL model, long-term impacts of transport policy on the economy, society, and the environment can be assessed. HIGH-TOOL is an open-source model consisting of modules for demography, economy and resources, vehicle stock, passenger demand, and freight demand, as well as environment and safety. Eight partners from five countries were involved in the EU project that was coordinated by KIT and completed successfully in 2017.

Mobility of people in Europe is increasing, as are the challenges faced when planning transportation. Planning is to reduce dependence on fossil fuels, counteract congestion in cities, decrease greenhouse gas emissions, mitigate air pollution and noise, improve traffic safety, and extend trans-European transport networks. As decisions in transportation planning have effects lasting for decades, it is particularly important to plan actions in the long term and to assess their consequences at an early stage.

The HIGH-TOOL model (Strategic high-level transport model) is used to model transport policy measures and their impacts on the computer. With this tool, the Directorate-General for Mobility and Transport (DG MOVE) of the European Commission will have an instrument to quantitatively assess the impact of transportation policy measures on economy, society, and the environment for several decades to come. HIGH-TOOL can be applied to strategically assess options and to preselect them for a more detailed examination.



Motorways and transport alternatives on railways, waterways, and in the air are modeled with HIGH-TOOL to support political decision-making.

"The perspective of HIGH-TOOL is global. The focus, however, lies on Europe and in particular on the EU member states," explains Project Coordinator Dr. Eckhard Szimba, who heads the respective working group at the Institute of Economics (ECON) of KIT. "The forecast period is divided into intervals of five years each and extends until 2050." Apart from modules for demography, economy and resources, vehicle stock, passenger and freight demand as well as environment and safety, HIGH-TOOL comprises a comprehensive data inventory and a user interface. HIGH-TOOL is an open-source software for user-friendly application. For any strategy simulation, an assessment report is issued which lists major results in the form of Excel tables and diagrams.

Input and output indicators of HIGH-TOOL are largely based on major European strategy papers, such as the "White paper on transport," the "Roadmap for moving to a competitive low-carbon economy in 2050," and the "EU reference scenario 2013," a collection of long-term prognoses until 2050. The project consortium presented HIGH-TOOL at several large conferences on transport research and organized workshops for future users. Currently, the model is being used to assess strategies for shifting transport from road to rail.

Under the 7th Research Framework Programme, the European Union funded the HIGH-TOOL project with about EUR 2.5 million. The project had a duration of three and a half years. Eight partners from Germany, the Netherlands, Belgium, Spain, and Hungary were involved. KIT coordinated the project, additionally participated in all development areas, and was responsible for the passenger demand module.

SECURE AND ANONYMOUS SYSTEM FOR BETTER PROTECTION OF PRIVACY

DIGITAL PAYMENT AND COLLECTION OF BONUS POINTS WITHOUT LEAVING A DATA TRACE

The bonus card for the supermarket, the prepaid card for the public swimming pool, or the smartphone app for paying public passenger transit tickets – many of us open these "electronic purses" every day. However, most of us are not aware of the fact that by doing so, we largely lose privacy and run the risk of disclosing sensitive information about ourselves, if such systems are misused.

Computer scientist Dr. Andy Rupp, member of the "Cryptography and Security" Group of KIT, always is surprised about this lack of awareness of the problem: "Only few users are aware of the fact that by using such bonus or payment systems, they disclose in detail how and what they consume or to which places they went."

To prevent manipulation of the accounts by dishonest users, customer data and account balances of payment and bonus schemes are usually administered with the help of a central database. In every payment transaction, the customer is identified and details of the transaction are transmitted to the central database. This repeated identification process produces a data trace that could be tracked by the provider or third parties.

And even without the explicit supply of customer data, the risk is great that purchases can be linked with customer identities. The resulting movement patterns and personal profiles allow conclusions to be drawn regarding the purchasing behavior of people, their state of health, or their personal preferences.

Purchasing public passenger transit tickets with a smartphone is becoming increasingly popular. But is it secure?

Secure Payment without a Data Trace

Andy Rupp did not want to resign himself to the apparent conflict between privacy and security concerning electronic payment systems. Together with Gunnar Hartung and Matthias Nagel, KIT, and Max Hoffmann of Ruhr-Universität Bochum, he developed the basics of an "electronic purse" that works anonymously and, at the same time, prevents data misuse.

The "black-box accumulation plus" (BBA+) protocol transfers all necessary account data to the card used or the smartphone and guarantees confidentiality with the help of cryptographic methods. BBA+ also offers security guarantees for the operator of the bonus or payment system. The protocol guarantees a correct account balance. The identity of the user is disclosed as soon as the attempt is made to pay with a manipulated account.

The new protocol is a further development of an anonymous bonus card system designed by KIT. This system, however, required an internet connection. The new protocol now guarantees privacy and security for customers during offline operation as well. This is very important to the payment system's suitability for daily use. The high efficiency of the new protocol also is impressive: During the first test runs, researchers executed payments within about one second.

Secrecy Obligation for the Digital Piggy Bank

More than 80% of German households participate in bonus programs. The question "Do you collect bonus points?" is part of the daily shopping routine. To prevent sensitive information from being disclosed when such systems are misused, the "Cryptography and Security" Group of KIT has developed a digital bonus and payment system. It is designed to protect anonymity of clients and to offer the added values desired to operators.

With their bonus cards, consumers collect bonus points when paying for purchases. Cryptographic methods help to better protect privacy.

The end device, a smartcard or smartphone, no longer executes any calculations for bonus points collection. It only sends an identification number, by means of which the new bonus points can be allocated to a client account. Dr. Andy Rupp, cryptography expert at KIT, and his colleague Professor Dr. Tibor Jager from the University of Paderborn now want to make these end devices smarter.

The devices would store the points collected and execute cryptographic algorithms together with the operator. By means of these algorithms, the points can be added or subtracted securely and anonymously. Only the customer is informed about where the bonus points come from. A prototype with core functions is already being used on smartphones and will be optimized and extended for use with smartcards.

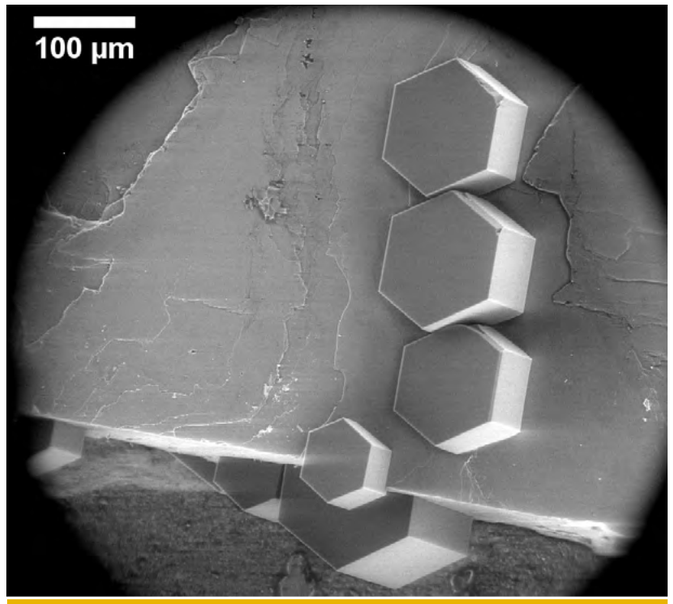
CLOUD FORMATION: FELDSPAR ACTING AS ICE NUCLEUS

ICE CRYSTALS FIRST GROW AT DEFECTS ON THE PARTICLE SURFACE

About 90% of precipitation over land depends on the formation of ice crystals in clouds, which fall down due to their increasing weight. But water in clouds only freezes in the presence of certain particles, on which ice crystals can grow, so-called ice nuclei. Of all aerosol particles, i.e. suspended solid particles in the atmosphere, however, only few act as ice nuclei. These rare aerosol particles decisively determine precipitation on Earth. It therefore is important to understand how they differ from other particles. Such knowledge will improve forecasts of ice and precipitation formation in clouds under the impact of climate change and fine dust pollution in the future.

Scientists of the Institute of Meteorology and Climate Research, in cooperation with the KIT Laboratory of Electron Microscopy and University College London, have now succeeded in identifying special properties of the most important class of inorganic atmospheric ice nuclei, namely, feldspar dust particles. The team was the first to combine electron microscopy observations with molecular dynamics modeling to determine the atomic nature of this important inorganic ice nucleus. They found that on feldspar crystallites, ice growth starts not on the accessible crystalline faces, but on microscopic defects such as edges, cracks, and small depressions. Even though these defects are distributed randomly on the crystallite surface, all ice crystals grow with the same orientation relative to the feldspar crystal lattice.

From this observation and from extensive molecular modeling, the scientists concluded that the ice nucleus is a specific crystal face that is accessible at defects on the surface of the feldspar crystallite only. Similar studies are now expected to reveal the properties of other minerals acting as ice nuclei.



Ice crystals on a feldspar crystallite under the electron microscope. Although they grow on various levels of the feldspar, they have the same orientation relative to the crystal lattice.

COMPLEX, HIGHLY PRECISE, AND SMALL

GLASS FROM THE 3D PRINTER

Glass is one of the oldest materials used by humankind, as far back as ancient Egypt and ancient Rome. An interdisciplinary team headed by mechanical engineer Dr. Bastian E. Rapp of the Institute of Microstructure Technology has now developed a process that allows glass to be processed using 3D printing, the manufacturing technology of the 21st century. Until now, this technology has been used only for metals and plastics. It was considered impossible to form glass with a 3D printer, because glass processing actually requires high temperatures or aggressive chemicals.

A new process enables 3D printing of glass structures. Resolutions may range from a few micrometers to some centimeters.

The newly developed process consists of mixing high-purity quartz glass nanoparticles with a small quantity of liquid polymer and curing this mixture at specific points using light in a stereolithography process. The no-longer-needed liquid material is washed out in a solvent bath, thus leaving behind the desired cured structure. The polymer still embedded in this glass structure is then removed by heating. In a final step, heating is continued until the glass particles fuse and the structure stabilizes.

3D printing can be used to produce very tiny and complex structures of highly pure quartz glass with respective chemical and physical properties, also in small series. The glass structures made by KIT scientists have resolutions in the range of a few micrometers. They are transparent and resistant to heat and acids. Dimensions may be in the range of a few centimeters, which make these structures suited for a number of applications.

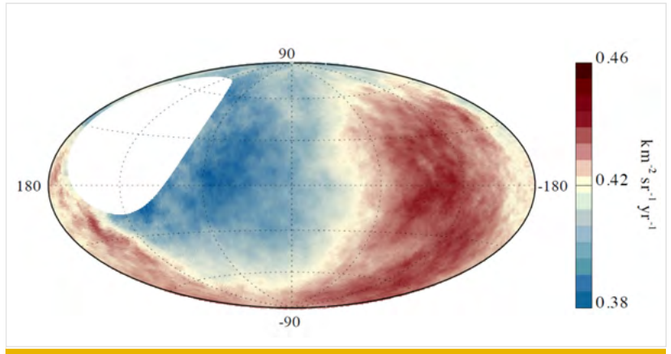
3D-formed glass can be applied in future data technology, for instance. The next-plus-one generation of computers will presumably use light. For this, complicated processor structures will be needed. 3D printing technology might also be used to manufacture miniaturized complex structures from a large number of very small optical components of different orientations. For biological and medical technologies, very small analytical systems based on miniaturized glass tubelets might be produced. In addition, 3D glass microstructures might be employed in a variety of optical areas, from eyeglasses meeting special requirements to lenses in laptop cameras.

The project is financed by the Federal Ministry of Education and Research (BMBF) under the “NanoMatFutur” junior scientist funding program to support the development of innovative materials for industry and society. Funding started in 2014, is scheduled for a period of four years, and amounts to EUR 2.8 million.

AMBASSADORS FROM DISTANT GALAXIES

PROOF OF EXTRAGALACTIC ORIGIN OF HIGH-ENERGY COSMIC RAYS

Since the early 1960s, it has been known that high-energy cosmic particles exist and enter the Earth's atmosphere. Since then, scientists have been trying to find the origin of these particles and the process responsible for their high energy. The recent discovery by the Pierre Auger Observatory in Argentina for the first time proved the extragalactic origin of these particles.



High-energy cosmic rays reach the Earth from a preferred direction (red) that does not correspond to the center of our Milky Way.

Researchers studied the arrival direction of more than 30,000 particles and found that particles of cosmic rays preferably enter the Earth's atmosphere from a direction deviating from the center of the Milky Way by 120 degrees. Hence, these particles do not originate from our galaxy. It is not yet possible to identify their source, as the particles, on their way towards the Earth, are strongly deflected by galactic and extragalactic magnetic fields. From their preferred arrival direction, however, it can be concluded that their origin lies in the cosmological neighborhood of the Milky Way, where the density of galaxies is high.

High-energy cosmic rays very seldom arrive on Earth. Every year, only one particle hits an area of 1 km^2, which corresponds to not even one impact per century on an average football field. On Earth, cosmic rays can be detected indirectly only: The particle itself does not reach the ground surface, but collides with atomic nuclei in the Earth's upper atmosphere. This produces cascades of new particles – air showers of more than ten billion particles – which hit the Earth's surface. These secondary particles are measured by the detectors of the Pierre Auger Observatory in Argentina.

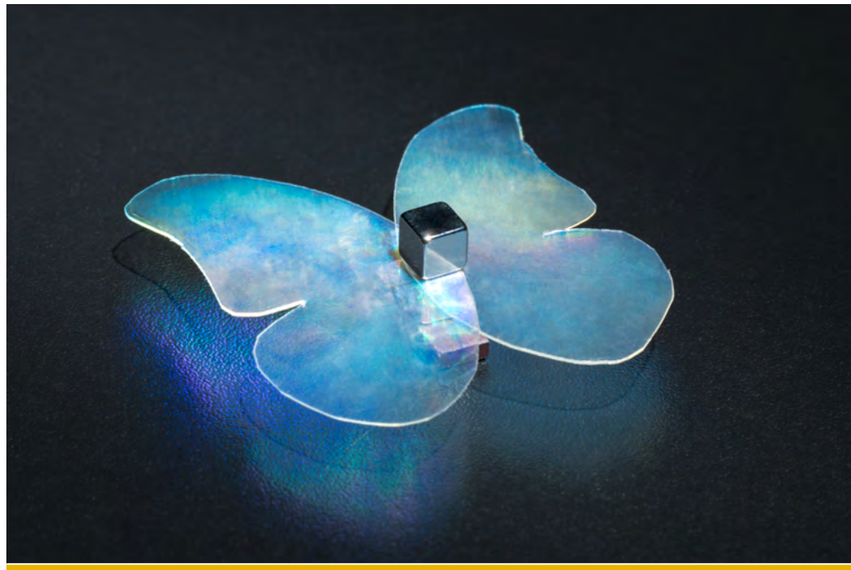
The Pierre Auger Observatory in the province of Mendoza in Argentina covers an area of 3,000 km^2 and is the largest project worldwide to study high-energy cosmic rays. More than 400 scientists from 18 countries are involved. KIT manages the Pierre Auger Observatory project and also was responsible for the assembly of major components. For the funding period from 2011 to 2017, the Federal Ministry of Education and Research provided approximately EUR 8.3 million.

The Pierre Auger Observatory in the Argentinian pampa covers an area of 3,000 km^2 and measures the high-energy component of cosmic rays.

EFFICIENCY INCREASE THANKS TO THE NANOSTRUCTURE

BUTTERFLY WING INSPIRES PHOTOVOLTAICS

Sunlight reflected by solar cells is lost as unused energy. To enhance light absorption, the team of scientist Dr. Hendrik Hölscher of KIT's Institute of Microstructure Technology and Radwanul H. Siddique (formerly KIT, now CalTech) was inspired by nature. The butterfly *Pachliopta aristolochiae*, also called common rose, has extremely dark black wings. It perfectly absorbs sunlight for optimum heat extraction. Even more fascinating than its appearance are the mechanisms that help reach this high absorption rate: The wings are provided with nanostructures, i.e. small holes, that absorb a wide spectrum of light far better than flat surfaces. These structures now have been reproduced on solar cells, thus enhancing the cells' light absorption rate by up to 200%. The scientists reproduced the butterfly's nanostructures on the silicon layer of a thin-film solar cell.



Nanostructures on the wing of *Pachliopta aristolochiae* can be transferred to solar cells and enhance their absorption rates by up to 200%.

Subsequent analysis of light absorption yielded promising results: Compared to a flat surface, the absorption rate of perpendicular incident light increases by 97% and rises continuously until it reaches 207% at an angle of incidence of 50 degrees. This is particularly interesting when thinking of European light conditions with frequently diffuse light that hits solar cells at a shallow angle. However, this increase has to be considered a theoretical limit for efficiency enhancement of the complete photovoltaic system, as other components also play a role.

Prior to reproducing the nanostructures on solar cells, the researchers determined the diameter and arrangement of the nanoholes on the wing of the butterfly by means of microspectroscopy. Then, they analyzed the rates of light absorption for various hole patterns in a computer simulation.

They found that disordered holes of varying diameters, such as those found in *Pachliopta aristolochiae*, produced the most stable absorption rates over the complete light spectrum at variable angles of incidence. For this reason, the researchers arranged the holes on the solar cell randomly with diameters varying from 133 to 343 nanometers and showed that light yield can be enhanced considerably by material removal.

HEIDELBERG CASTLE REVISITED

HEIDELBERG CASTLE RECONSTRUCTED IN A COMPUTER SIMULATION

Strikes of lightning, fires, wars – the ravages of time left their traces on Heidelberg Castle. Today, it is considered one of the most important Renaissance buildings north of the Alps. And it is one of the most popular tourist destinations in Germany with about 1.1 million visitors from all over the world every year. Now, a researcher of Karlsruhe Institute of Technology has reconstructed the castle as it looked before its destruction by means of three-dimensional virtual modeling.

The enchanted building on a hill above the historic old town of Heidelberg is one of the best-known castle ruins in the world. Martin Luther, the reformer who came to Heidelberg to defend his theses, praised the beauty of the impressive fortress. Later, after its destruction by troops of French Sun King Louis XIV, the ruin became the epitome of German romanticism.

Today, empty window holes look down on the picturesque Neckar valley and the remains of ivy-covered walls point to the sky like rugged rocks. In the simulation by KIT's Institute for History of Arts and Architecture, however, visitors can climb the formerly massive, but now half-destroyed Bulky Tower, walk underneath the groined vaults of the Emperor Hall in the Ottheinrich Building, look at the figures decorating the Friedrich

A detail of computer reconstruction: The corner chapel in the library building.

Building reminiscent of a Venetian palazzo, or let their eyes wander through the courtyard of 1683.

The expenditure associated with the digital reconstruction of the castle is high: Using historical plans, views, and drawings, every detail has to be modeled on the computer. Reconstruction is no fantasy, but scientifically accurate. Every small detail is based on historical sources. The amounts of data involved thus are gigantic. The complex of buildings measuring 270 to 280 meters in reality requires a storage capacity of around 3 gigabytes on the hard disk.

Fortunately, numerous picture sources exist, because the first efforts to reconstruct Heidelberg Castle began 100 years ago. For this purpose, all buildings were documented and surveyed and hundreds of plans were drawn.

A magnificent residence: Reconstruction of Heidelberg Castle around 1683.

FROM MAIL ARMORS TO TWISTS

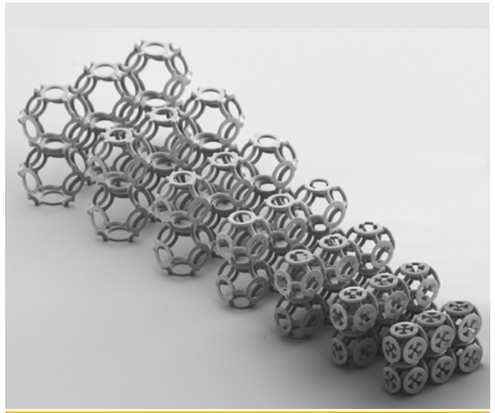
METAMATERIALS WITH NOVEL PROPERTIES

Metamaterials are artificially produced materials with optical, electric, or magnetic properties not encountered in nature. These properties result from microscopic inner structures, such as cells or individual elements made of electric or magnetic materials. Two teams led by Dr. Martin Wegener of the Institute of Applied Physics have succeeded in creating metamaterials with novel properties.

Inspired by Medieval Mail Armor

The structure of medieval mail armor inspired the development of a metamaterial with a three-dimensional ring structure. Magnetic properties of the micrometer-sized ring structure, however, only existed in theory, as fabrication of the three different components appeared to be too difficult.

Research focused on the Hall effect that describes the occurrence of a transverse electric voltage across an electric conductor that is passed by current flow and located in a magnetic field. The voltage is measured with the help of the material-dependent Hall coefficient. Its sign allows conclusions to be drawn as to whether charge carriers in the semiconductor carry positive or negative charge.



The ring structure of this metamaterial was inspired by mail armors of medieval knights.

The three-dimensional ring structure was expected to reverse the sign of the Hall coefficient. And indeed, researchers found that a single basic material is sufficient, provided that the ring structure chosen follows a certain geometric arrangement. Using a high-resolution 3D printer, Christian Kern and Dr. Muamer Kadic produced polymer scaffolds that were then coated with semiconducting zinc oxide.

In this way, the scientists succeeded in producing metamaterials with a positive Hall coefficient, even though their components had negative coefficients. The charge carriers in the material remain negatively charged, but are forced to take detours by the structure and, hence, behave as if they were positively charged.

Metamaterial with a Twist

If a force is exerted from above onto a material block, the latter deforms in various ways, but it will not rotate according to the rules of mechanics. Tobias Frenzel and colleagues, however, have now succeeded in designing a filigree three-dimensional cubic structure that reacts to pressure forces by a rotation around its axis.

By means of a computer simulation, the group developed a design that has such a mechanical property. The computed cubes consist of bars and rings that are connected to each other in a certain pattern. Pressure forces from above are transmitted via the downward moving bars to the vertically arranged rings. This leads to a rotation of the rings and pulls on the ends of the horizontal planes of the cube. The complete structure starts to twist around its axis.

The towers of cubic structures of variable sizes, strengths, and pieces were produced using a 3D microprinting method. The edge length of the cubes ranged from 100 to 500 micrometers. The towers were composed of four to 500 cubes and were two millimeters high.

A STEP TOWARDS THE QUANTUM COMPUTER

SUPERCONDUCTING QUANTUM SIMULATOR OUTPERFORMS CONVENTIONAL COMPUTER

Contrary to classical bits, quantum bits can assume two states at the same time: Right and left, yellow and blue, zero and one.

Hurricanes, traffic jams, demographic development – the effects of such events are predicted by means of computer simulations. Many processes in nature, however, are so complicated that conventional computers fail. Researchers are pinning big hope on quantum simulators. One of the basic phenomena in nature is the interaction between light and matter in photosynthesis. The Institute of Physics and the Institute for Theoretical Solid-State Physics of KIT have now taken a big step towards a quantum mechanics understanding of plant metabolism.

As the high efficiency of mass and energy conversion by plants with the help of light cannot be understood completely with classical physical theories, researchers use a quantum model. For the first time, they have demonstrated in an experiment that quantum simulations of the interaction between light and matter - the basis of photosynthesis and, hence, of life – work in principle.

The interaction between light and matter in photosynthesis, such as when sunlight shines on a leaf, can be described as an interaction of photons of light with the atoms of matter on the microscopic level. The nearly 100% efficiency of this mechanism suggests that it is subject to the rules of quantum physics, which is difficult to simulate with classical computers and simple bits, which represent information with a switch that can store information as zero or one. Quantum bits, by contrast, are able to assume the states of zero and one at the same time according to quantum physics rules. Hence, quantum computers or simpler quantum simulators can solve the problem more quickly and efficiently. A quantum simulator is the preliminary stage of a quantum computer. It is not able to make any calculations, but is designed for the solution of a certain problem.

In the developed quantum simulator of light-matter interaction, superconducting circuits serve as quantum bits to represent atoms, i.e. matter, while electromagnetic resonators represent photons, i.e. light. The researchers succeeded in producing an effect in which the quantum bit and the resonator assumed two opposite states at the same time. Quantum bit and resonator are coupled. As compared to classical computers, the computational capacity of this system is improved exponentially. Fulfilling this fundamental principle of quantum mechanics has demonstrated the feasibility of analog quantum simulation with superconducting circuits.

SOLAR GLASSES GENERATE SOLAR POWER

SEMITRANSPARENT ORGANIC SOLAR CELLS IN EYEGLASSES POWER MICROPROCESSOR

Organic solar cells are flexible, transparent, and lightweight. In addition, they can be manufactured in arbitrary shapes and colors. As a result, they are suitable for a variety of applications that cannot be realized with conventional silicon solar cells. Researchers at KIT's Light Technology Institute have developed sunglasses with colored, semitransparent solar cells in the lenses that supply a microprocessor and two displays with electric power. In the future, organic solar cells might also be integrated into windows, for instance.

These solar glasses with lens-fitted semitransparent organic solar cells supply two sensors and electronics in the temples with electric power.

The "smart" sunglasses are self-powered to measure and display the intensity of solar radiation and ambient temperature. The solar sun lenses are perfectly fitted to a commercial plastic frame, have a thickness of approximately 1.6 mm, and weigh about 6 g – just like the lenses of conventional sunglasses. The microprocessor and the two small displays are integrated in the temples of the solar glasses. They show the illumination or light intensity and the ambient temperature as bar graphs. The solar glasses also work in indoor environments at an illumination as low as 500 Lux, which is the usual illumination of an office or living area. Under these conditions, each of the "smart" lenses still generates 200 microwatts of electric power, enough to operate a hearing aid or a step counter.

Another field of application is the integration of solar cells in buildings: Since the glass facades of high-rise buildings must often be shaded, it is an obvious option to use organic solar modules for converting the absorbed light into electric power. A vision is to coat large surfaces with organic solar cells using reel-to-reel technology.

Research was funded by the Federal Ministry of Education and Research (BMBF) within the scope of the POPUP project for the development of novel materials and device structures suitable for competitive mass production processes and applications in the field of organic photovoltaics.

TEACHING

In the 2017/18 winter semester, the number of KIT students totaled 25,495 and was slightly below the record total of the past year. One reason for this can be seen in the introduction of tuition fees for international students from non-EU member states. Hence, the increase in the proportion of foreign students slowed down, the share being 23% at the start of the 2017/18 winter semester. The proportion of female students has grown steadily over to the current historic high of 28.8%. As outlined in the KIT 2025 Umbrella Strategy, this proportion is planned to be increased to 40% by 2025.

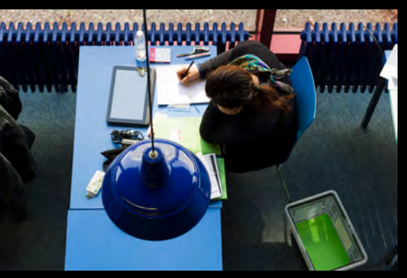
In the 2017/18 winter semester, the KIT Department of Mechanical Engineering, in cooperation with the Carl Benz School of Engineering, established a new bachelor's program "Mechanical Engineering International B.Sc." that is taught in the English language.

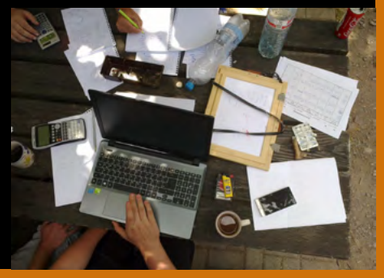
Following the implementation of the bachelor's/master's scheme within the Bologna Process, all study programs have to be accredited. Based on its successful system accreditation, KIT has been given the right to accredit programs on its own. In 2017, KIT's teaching degree programs passed the internal KIT-PLUS accreditation process that had been slightly modified for this purpose.

System accreditation covers the internal quality assurance system of the academic education programs offered by an institution. In May 2014, the Swiss Agency for Accreditation and Quality Assurance (AAQ) approved KIT's scheme of system accreditation. In February 2015, compliance with additional requirements was verified and the system accreditation right was granted to KIT until September 30, 2020. According to the rules for the accreditation of study programs and for system accreditation specified by the German Accreditation Council, a short interim evaluation is to take place after half of the first accreditation period. This interim evaluation was completed successfully by KIT in late 2017.


KIT Bibliothek


KIT
NaWik





UNDERSTANDABLE COMMUNICATION OF RESEARCH

PERMANENT FUNDING OF THE NATIONAL INSTITUTE FOR SCIENCE COMMUNICATION

At the symposium "Mehr als Fakten – Wissenschaft heute kommunizieren" (More than Facts – Communicating Science Today) in May 2017 on the occasion of the 5th anniversary of the National Institute for Science Communication (NaWik), both partners of NaWik, the Klaus Tschira Foundation and Karlsruhe Institute of Technology, announced that they will continue funding of NaWik on a permanent basis.

The symposium impressively demonstrated how communication can succeed in the post-truth era. Workshops covered modern and new approaches to communication. Theresia Bauer, Baden-Württemberg Minister for Science, Research and the Arts, took part in the panel discussion on science communication as reflected by political debates and decisions. Here, communication about artificial intelligence served as an example.

NaWik is the only institute of its kind with a nationwide reach. Good science communication is essential. A glimpse at the situation worldwide reveals how important it is to make society aware of the significance of free science. NaWik makes a valuable contribution to reaching this goal by enabling scientists to communicate their research in an understandable way.

NaWik is a non-profit limited-liability company established in 2012 by the Klaus Tschira Foundation and the KIT to sustainably support the dialog between science and society. The institute conveys to researchers and students the fundamentals of understandable and good science communication to non-specialists. NaWik offers eleven types of seminars based on a standardized didactic concept, from writing and presentation courses to video trainings. Within the first five years of work, NaWik organized 3000 person-seminar days. In addition, NaWik offers a range of workshops, organizes presentations, and participates in research projects on science communication.

KIT attaches great importance to science communication. The Science Communication Group of KIT's Institute for German Studies is a partner of NaWik and studies the reception and understandability of communicated science. Research of the Science Communication Group is closely linked to academic education within the program Science – Media – Communication. The corresponding bachelor's and master's programs focus on science journalism and public relations of scientific institutions as well as on the acquisition of knowledge in natural and engineering sciences.

NaWik conveys to researchers and students the fundamentals of understandable and good science communication.

STUDENTS ON A SURVEYING TRIP

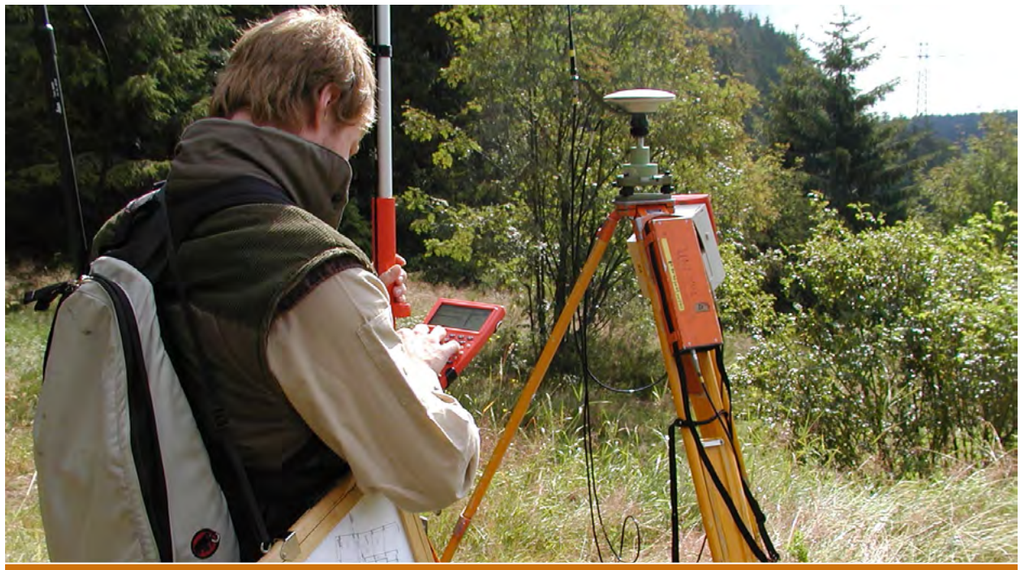
125 YEARS OF SURVEYING EXERCISES IN THE BLACK FOREST

Today, specialists in geodesy and geographical information systems are needed not only for classical surveying tasks and the delineation of borders, but also for urban planning and development, navigation, and mapping. The "Geodäsie und Geoinformatik" (geodesy and geoinformatics) program of KIT is characterized by its embrace of practice at an early stage of the studies and has a long tradition: For 125 years now, surveying exercises have been organized in the Black Forest. In July 2017, the latest exercise with several student teams of KIT took place in order to collect data for topographic maps, to plan redistribution of a property, and to train precision surveying near a reservoir.

Geodesy today covers remote sensing, geodetic sensor technology, and satellite-based geodesy. Geoinformatics deals with data structures and algorithms to process geodata. To guarantee water supply of megacities, for instance, large data volumes and complex models are needed.

Since 1892, the surveying exercise has been a mandatory integral constituent of the study programs in Karlsruhe – be it today's bachelor's and master's program "Geodäsie und Geoinformatik" (geodesy and geoinformatics) or the predecessor diploma program "Vermessungswesen" (surveying). The surveying exercise concept of KIT is the only one of its kind in Germany. Depending on their knowledge level, students work on close-to-practice projects in three consecutive modules. In the master's program, the exercise is completed by the challenging task of geodetic monitoring of the Linach reservoir in the Southern Black Forest.

The exercises enhance the scientific competencies of students. In addition, their soft skills and personal development are strengthened through teamwork and the necessity of self-organization. For this surveying exercise concept, the team of supervisors was granted the Teaching Award by the KIT Department of Civil Engineering, Geo- and Environmental Sciences in 2017.



Learning with a long tradition. For 125 years now, surveying exercises in the Black Forest have been enriching the study program "Geodäsie und Geoinformatik" (geodesy and geoinformatics) and its predecessors.

ACQUIRING KEY COMPETENCIES AT THE UNIVERSITY

HOUSE OF COMPETENCE PROVIDES TRAINING OF TRANSFERABLE SKILLS

In our global knowledge society, employees need to have not only expert knowledge, but also communication skills, creativity, high motivation, independence, and adaptability. These skills are also referred to as key competencies. Apart from conveying technical or scientific know-how, personal development and acquisition of such key competencies are major elements of studies at KIT.

To help develop these competencies and to conduct associated research, Karlsruhe Institute of Technology established the House of Competence (HoC). On the occasion of its 10th anniversary, HoC organized a conference on key competencies in early October 2017.

At this conference, participants discussed the following topics in four panels: How can learning processes be supported during stressful situations? How can training of interdisciplinary methods be professionalized? Which standards have to be defined for scientific writing in order to prevent plagiarism? And how can students develop awareness of their own health under examination pressure?

HoC is a central scientific institution of KIT and has become an established provider to support the development of key competencies of students. HoC is also visible in national research and fulfills major tasks in quality assurance and further development. HoC conducts research in the areas of psychology, sociology, German studies, education, and sports sciences and relates the findings to engineering sciences. In about 100 courses per semester, HoC imparts to students basic rules of presentation and a variety of transferable skills. Future engineers and natural and social scientists learn how to manage and organize projects and how to prepare for a job.

For more than ten years now, the House of Competence has been conveying key competencies to students of KIT.

EDUCATION OF TEACHERS-TO-BE IN KARLSRUHE

JOINT INFORMATION EVENT OF FOUR UNIVERSITIES IN KARLSRUHE

Before the start of the school term in autumn 2017, a study by the Bertelsmann Foundation attracted attention: In 2025, the number of pupils in Germany will total 8.3 million. These are a million more than the figure officially prognosticated by the Conference of Ministers of Education in 2013. As outlined by the study, this will considerably aggravate the shortage of teachers. More than 24,000 teachers will be needed at German elementary schools alone. After 2030, another 27,000 teachers will be required on the secondary school level. Young people interested in becoming teachers have several study options in Karlsruhe. At a joint event on November 9, 2017, Karlsruhe Institute of Technology, Karlsruhe University of Education, Karlsruhe University of Music, and the Karlsruhe State Academy of Fine Arts informed prospective students and their parents about their teacher degree programs.

Joint education of teachers is also in the focus of MINT²KA, a project that covers teaching-learning labs in STEM subjects and is run by KIT and Karlsruhe University of Education.

Teachers educate the next generations. They not only impart knowledge and competencies, but generate and strengthen interests – be it in the humanities, social or natural sciences, the arts, or engineering. The joint information event was intended to underscore the high importance of teachers to our society. It also emphasized that a teacher degree program does not exist in a world of its own, but is directly linked with hot topics and widely discussed issues in the respective subject. An example is KIT's teacher degree program of natural sciences and engineering for German secondary schools. More than twenty institutes in the areas of mechanical engineering, natural sciences, civil engineering, materials sciences, food processing technology, electrical engineering, and information technology contribute to this program.

KIT offers the teacher degree programs of "Ingenieurpädagogik" (engineering education) and "Lehramt an Gymnasien" (secondary school teaching). Seven of the eleven KIT departments are involved in the education of secondary school teachers. The following subjects are covered: Biology, chemistry, German, geography, computer science, mathematics, natural sciences and engineering, philosophy/ethics, physics, and sports.

INNOVATION

The KIT 2025 Umbrella Strategy set the course for the development of KIT in the decade to come. Large areas of action contain descriptions of targets and measures. These measures are translated into everyday activities of KIT in a project structure composed of lead projects and implementation projects.

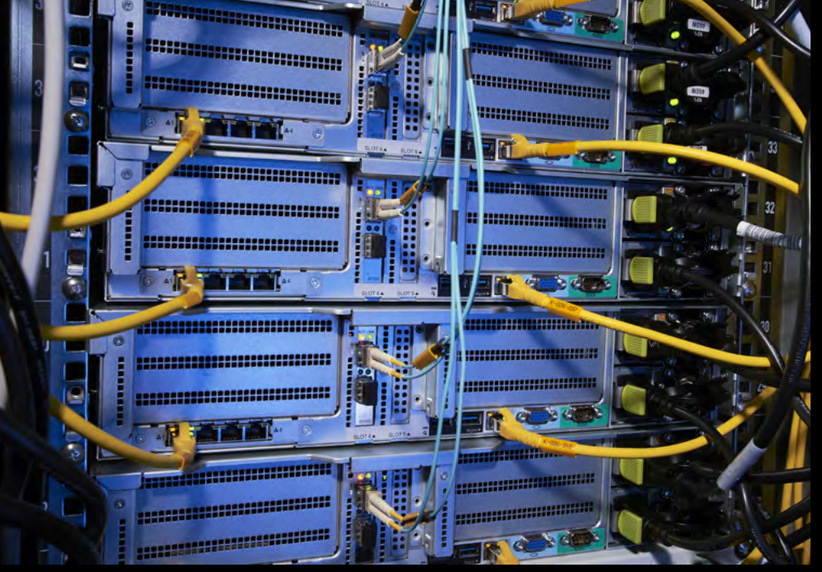
As one of the first lead projects, the “Design of the Innovation Strategy” was completed in 2017. The Innovation Strategy was agreed upon by the KIT Senate and Supervisory Board. It includes five higher-level topic areas whose implementation is to enhance the innovative performance of KIT.

The five subject areas are these: Cooperation with existing and new partners from industry within the framework of the cooperation fan; increasing economic yield; raising income from intellectual property rights; adding to the number of startups; and strengthening innovation culture and improving general framework conditions for innovation.

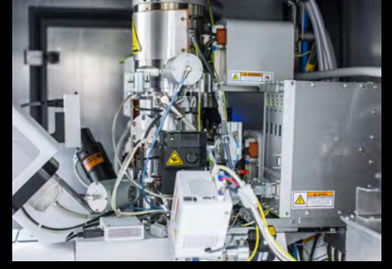
The lead project allowed the framework of the Umbrella Strategy (targets, sub-targets, measures) to be defined more closely across the five subject areas, operationalized, and spread out.

Its explanations of the innovation concept now provide KIT with a practical framework which will support the efforts towards cultivating even more intensely the key task of KIT, namely innovation.

The definition of values contributed to innovation allowed points of departure across divisions and departments to be elaborated so as to combine research and teaching even more closely with innovation by showing all staff members an individual approach to adding to innovation at KIT.



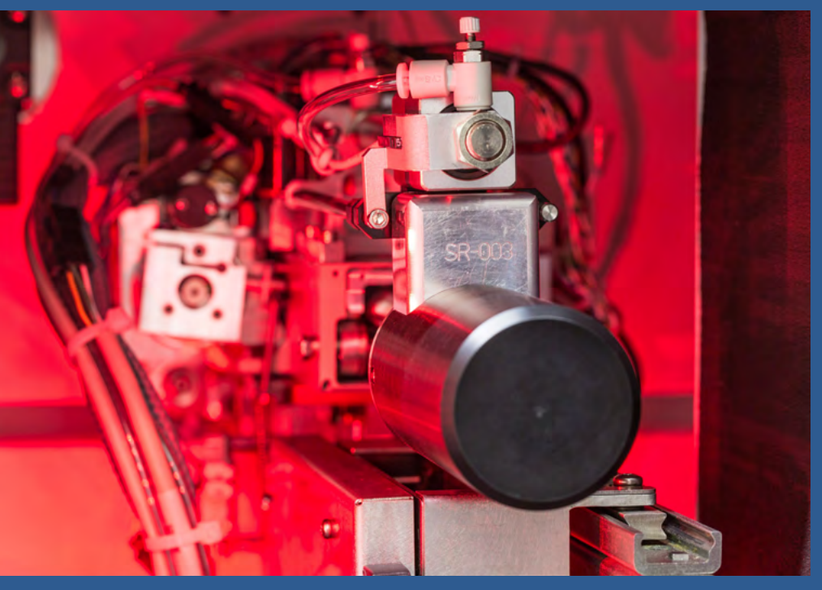

CENTER FOR ENTREPRENEURSHIP




NEULAND


RESEARCH TO BUSINESS
Technologieangebote des KIT
RESEARCH TO BUSINESS
Technologieangebote des KIT


KIT
KIT BUSINESS CLUB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SUPPLEMENTING AND JOINTLY USING COMPETENCES

STRATEGIC PARTNERSHIPS IN RESEARCH, TEACHING, AND INNOVATION

Dr. Martin Brudermüller, Deputy Chairman of the Board of Executive Directors and Chief Technology Officer of BASF SE, and Professor Dr.-Ing. Holger Hanselka, President of KIT, signing an agreement about strategic partnership.

To create and disseminate knowledge jointly, KIT establishes strategic partnerships with innovative industrial partners so as to cope with societal challenges by means of science and technology. In this way, KIT intensifies long-standing cooperation with its industrial partners in research, teaching, and innovation.

The fruitful cooperation existing with BASF, innovative industrial partner in the field of battery research, is now raised to a new level. The central objective is to facilitate cooperation among the scientists of BASF and KIT in future joint projects. Moreover, the partnership opens up other subject areas in teaching or in recruiting qualified staff.

KIT is establishing a strategic partnership with Robert Bosch GmbH in order to jointly investigate ideas and benefit from supplementary competences. Cooperation constitutes the framework for projects to come, such as the initiation of other research and development projects, joint formats of teaching and information for students up to, and including, the utilization of innovative research findings.

Among the objectives of KIT and SAP SE are new findings for digital solutions in business, science, and society via innovative teaching and learning concepts, cooperation in entrepreneurship, and joint research and innovation projects. The focal areas considered include power grids, autonomous driving, Industry 4.0, and robotics. Under the heading of teaching, plans provide for student development and consulting projects based on real problems in industry.

Besides strategic partnerships, there are many other formats and projects of cooperation serving to implement research findings. One case in point are bilateral technology transfer projects for specific product development. For instance, breast cancer is the most frequent cancer affecting women, with 1,600,000 cases annually occurring worldwide. 3D ultrasonic computerized tomography (USCT) is an innovative technology for medical diagnostics developed at KIT. It is able to image the breast to the precision of a millimeter, taking into account tissue properties not considered previously. A prototype is currently being tested in Germany in a second trial. Other USCT systems with optimized image quality and improved ultrasonic transducers are being developed with Chinese industrial partners for use in a large trial in China. Medical approval in China is in process.

EXEMPLARY PROMOTION

SECOND PLACE FOR KIT IN THE STARTUP RADAR AND ON THE GERMAN STARTUP MONITOR

Innovation on the same level as research and teaching is one of the core tasks of KIT contributing to social benefit and adding value at the interface between science and business. The excellent rankings achieved by KIT in the "Startup Radar" and the "German Startup Monitor" document its exemplary promotion of startups.

In the "Startup Radar," the Germany-wide ranking of startups by the Stifterverband für die Deutsche Wissenschaft, KIT in 2017 won second place in the "Large Universities" category with over 15,000 students together with the University of Potsdam. First place was won by the Technical University of Munich and the Munich Hochschule. The "Startup Radar" was arranged for the third time by the Stifterverband für die Deutsche Wissenschaft in collaboration with the German Federal Ministry for Economic Affairs and Energy.

The focus of interest is how universities promote the establishment of industrial companies by sensitizing and supporting startups and by laying the institutionalized foundations for a sustainable startup culture. This evaluation also includes the startup activities finally coming to fruition, i.e., the output produced by the efforts made to promote startups.

In July 2017, the "German Startup Monitor" was published for the fifth time. It is the result of an online inquiry performed annually of startups from all over Germany. The German Startup Monitor was initiated by the Bundesverband Deutscher Startups e. V. Since 2016, the Chair for E-Business and E-Entrepreneurship of the University of Duisburg-Essen has been responsible for supplementing the study in scientific terms.

Among the top ten startup universities, KIT with a share of 2.9% of startups ranks second in the German Startup Monitor after the Technical University of Munich. In addition, four out of five startup members hold university degrees. Special favorites are economics and STEM disciplines. This underscores the general importance of universities as well as of specific study courses in the German startup scene.

One of the building blocks in supporting startups at KIT: The Hightech Incubator on Campus North.

Bringing together value-added research findings about spinoffs, participations, licenses, and services for industry is very important to KIT. Partners in industry, students, and staff members find tailor-made offerings under the roof of KIT. First contacts in matters of startups and financing are the team in charge of startups and interests of the Innovation and Relations Management Service Unit. Offerings can be found, among other sources, on the Internet at www.kit-gruenderschmiede.de. Moreover, the Hightech Incubator of KIT offers an incubator for spinoffs.

CLOSE CONNECTION PROMOTES SYNERGY EFFECTS

ZEISS INVESTING EURO 30 MILLION FOR INNOVATION HUB

The Karlsruhe Institute of Technology and ZEISS are planning an innovation building for joint use, the "ZEISS Innovation Hub @ KIT," which is to be erected on Campus North. This is a sustainable investment in Germany as a country of innovation by ZEISS, a company active worldwide in the optical and opto-electronic industries. The new building will contain modern offices, laboratories, and manufacturing stations in a total area of 12,000 m². Construction is expected to begin in the spring of 2018 and the building is to be commissioned in late 2019.

This hub allows KIT to offer spinoffs a longer-term commitment on this location, as the space currently existing for these purposes is fully booked. The hub offers the possibility to rent a defined share of areas for spinoffs and innovative activities of its own.

In this way, ZEISS positions itself as an active promoter of science seeking to make more intensive use of synergy effects through closer interconnection of industry and science. The company plans to allow high-tech and digital startups to settle in the hub and to run innovative and new business activities of its own. KIT is thus given the opportunity to design technologies of the future jointly with experts of ZEISS.

Cooperation between KIT and ZEISS will have a solid footing this way, because Nanoscribe GmbH also will occupy new space in this building. This is a successful KIT spinoff, existing since 2007, in which ZEISS holds an interest. Nanoscribe thus will have more space to grow its innovative technology for micro 3D printing.

The many years of successful cooperation between ZEISS and KIT expanded into a strategic partnership in January 2018. Joint product development and the establishment of startups are now moving into the foreground. In addition, KIT and ZEISS will cooperate in teaching, innovation, advanced education, internationalization, recruiting and university marketing, and in the social dialog about technology development.

Professor Dr. Michael Kaschke, Chairman of the Group Executive Board of Carl Zeiss AG (center), Professor Dr.-Ing. Holger Hanselka, President of KIT (right), and Professor Dr. Thomas Hirth, KIT Vice President, Innovation and International Affairs (left), present the "ZEISS Innovation Hub @ KIT".

CONTACTS ESTABLISHED AT KIT CAREER FAIR AND INNOVATION DAY

MEETING POINTS FOR EMPLOYEES, STUDENTS, BUSINESSES, INVESTORS, AND STARTUPS

Regional, national, and international employers presented themselves on Campus South at the 5th Career Fair of KIT in mid-May. Students and postgraduates as well as graduates of KIT and other universities were invited to use the opportunity to meet potential employers and establish some initial contacts.

Some 250 companies, among them both large groups and small and medium-sized businesses from the region, power suppliers, automobile manufacturers, IT companies, and business consultants – employers from nearly all industries – presented themselves at the KIT Career Fair. Three topical days devoted to different areas in engineering, humanities and natural sciences up to and including informatics and economics offered some guidance to interested visitors.

Persons interested in finding a job and employers were able to meet for even closer exchanges in 15-minute interviews, and companies also offered glimpses of their everyday activities and current projects in brief presentations. Individuals were able to obtain information about possibilities of recruitment and to establish some first contacts with companies they were interested in. The Career Fair also offered checks of application folders and shooting of application photos as part of its framework program.

Under the headline of "Creating Innovation," innovators, companies, investors, students, employees, and members of the regional startup scene met at KIT in late June for the annual Innovation Day under the heading of NEULAND. As a central event, it offered a platform to the third core activity of KIT, namely innovation, inviting everybody interested in innovation, wanting to advance their ideas, and looking for partners for implementation.

Vice President Professor Dr. Thomas Hirth and presenter Markus Brock opening the NEULAND Innovation Day on June 29, 2017.

The variety of innovation at KIT thus became tangible, promoting exchanges on projects and new ideas. On that day, a large number of seminars and workshops were on the agenda, such as financing possibilities, patents and communication. Interesting projects from KIT research about the profile-sharpening topics such as energy, information, and mobility, were presented. An innovation gallery showed selected research and startup teams.

The program also included ceremonies awarding the startup prizes and the NEULAND innovation prize of KIT, the impulse lecture on "All groups of companies once were startups – how much of this is preserved?" by Professor Dr. Michael Kaschke, CEO of Carl Zeiss AG, and a late-night talk about innovation.

Meeting point for students and businesses: The KIT Career Fair on Campus South.

PROMOTING YOUNG TALENT

Qualified and motivated personnel are the most important pillar on which the success of KIT rests. For this reason, transparent and responsible personnel planning, promotion, and recruitment are important objectives of KIT.

As indispensable pillars of the German science system, young scientists make major contributions to research, teaching, and innovation. Recruiting excellent junior scientists and supporting them from graduation onward therefore are factors of high strategic importance to KIT.

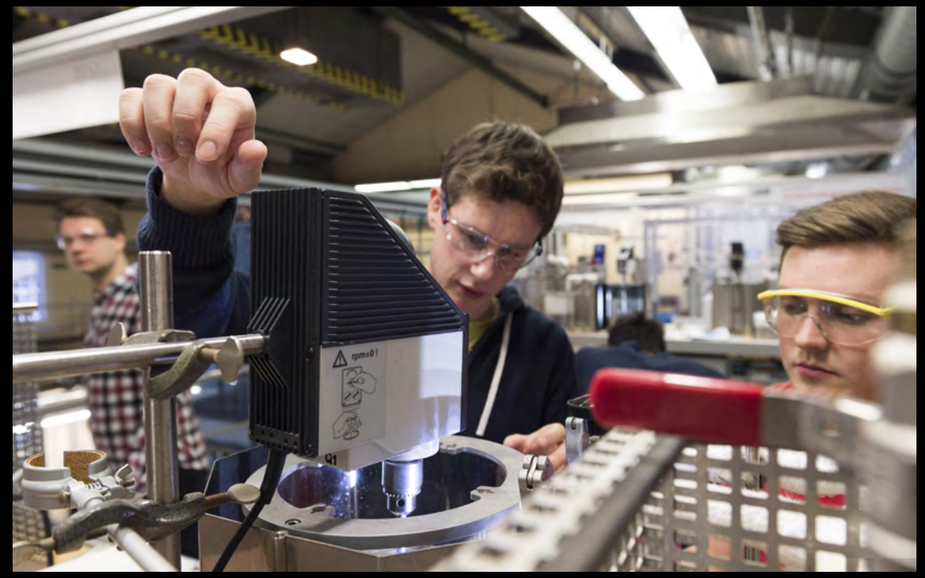
It is one of the objectives of KIT to offer to junior scientists a portfolio of career paths that is clear and understandable, both internally and externally. An important role in this respect is played by the executives of KIT, whose support in the career development of junior scientists is accompanied by central measures. The compatibility of family and scientific careers is promoted systematically by KIT.

A doctorate is indispensable to a scientific career as proof of the ability to produce independent scientific achievements. Quality assurance in the process of conferring doctors‘ degrees follows the “QualityDoc@KIT” concept distinguished by the State of Baden-Württemberg.

The postdoctoral phase is important in achieving further scientific qualification, seeking guidance in national and international science systems, and deciding in favor of a career in science, society or business. KIT supports postdocs in their development and their decisions. In this way, a clear perspective of a future within or outside KIT will be found at the end of the postdoc phase of not more than three years.



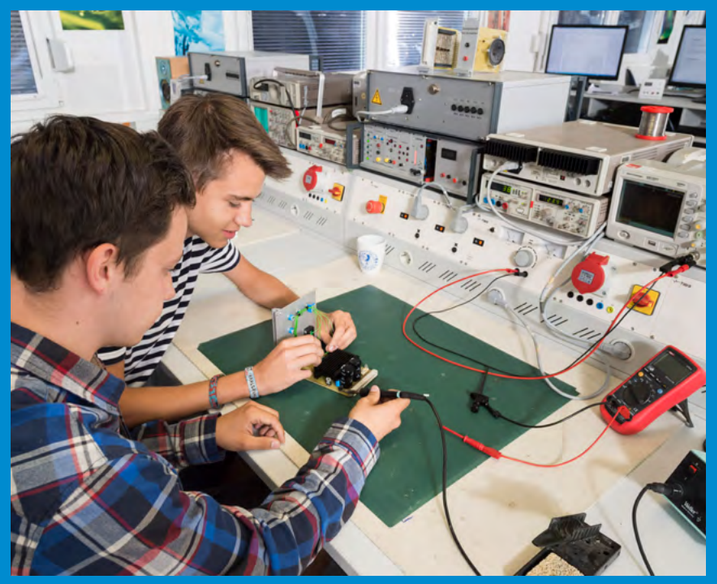










STEM CELL GROWTH IN SYNTHETIC BONE MARROW MODELS

ERC STARTING GRANT TO DR. CORNELIA LEE-THEDIECK

Dr. Cornelia Lee-Thedieck of the Institute of Functional Interfaces at KIT received an ERC Starting Grant for her research into the origins of blood and musculo-skeletal diseases. The European Research Council is financing her "bloodANDbone" project to the tune of EUR 1.5 million for a period of five years. The scientist is developing models of human bone marrow to study the regeneration of blood and bones by stem cells, and disorders of this regeneration as a result of diseases like leukemia or bone metastases.

Both blood and bones can regenerate by means of multipotent stem cells located in the bone marrow which are able to develop into different cell types. In many blood and musculo-skeletal diseases, this regeneration is impaired. The application of stem cells is considered a key to the treatment of such diseases.

Dr. Cornelia Lee-Thedieck receives a starting grant by the European Research Council for her research into the origins of blood diseases and musculo-skeletal disorders.

Dr. Cornelia Lee-Thedieck investigates the connection and interaction of blood and bones in order to learn how their regenerative capabilities are disturbed by diseases and can be restored by new treatment approaches. Observations indicate that blood stem cells are influenced very much by the conditions of their natural environment, their niche in the bone marrow. Little has been known so far about the reverse influence of blood-forming stem cells on bone marrow and the bone-forming system. This gap is now being closed by Dr. Cornelia Lee-Thedieck and her research.

In this work, *in vitro* models of human bone marrow are developed for studies of the origins and development of frequent hematological and musculo-skeletal diseases, such as leukemia, multiple myeloma, and bone metastases. These models of bone marrow are made up of large-pore biomaterials loaded with cells. Their physical, biochemical and biological properties can be set precisely.

In this way, novel biomimetic models simulating biological structures can be produced. Lee-Thedieck uses these models to investigate how the regenerative equilibrium in human bone marrow is maintained in a healthy state and disturbed as a result of various diseases. Recognizing this difference is an important precondition to the development of new regenerative therapies. Thanks to their scalability, bone marrow models also can serve as *in vitro* test systems for screening new drugs and therapies.

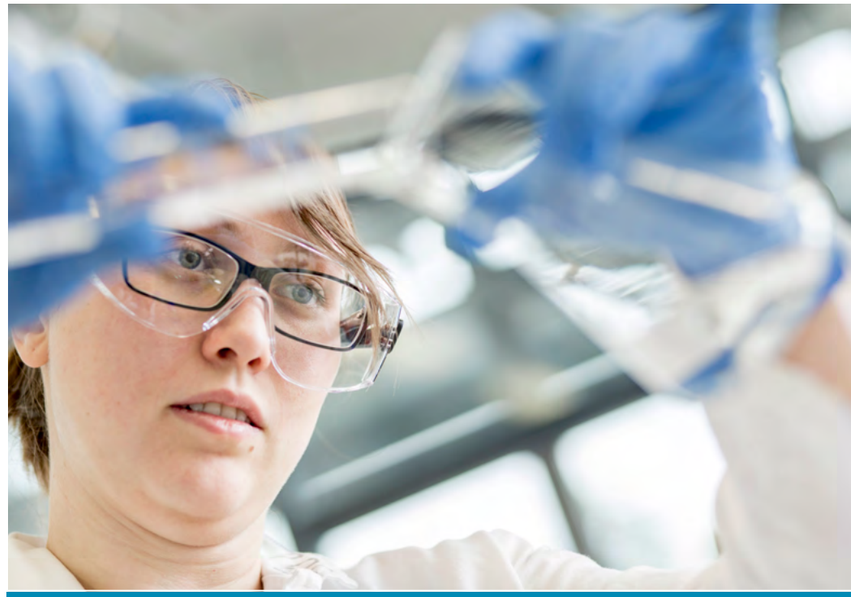
The ERC Starting Grant of the European Research Council (ERC) promotes outstanding junior scientists in pioneering research projects, whose doctorate is not older than two to seven years.

A GOOD WAY TO A PROFESSORSHIP

KIT ESTABLISHES ELEVEN TENURE-TRACK PROFESSORSHIPS

A topic of debate in Germany for a couple of years has been the so-called tenure-track professorship. Highly talented young scientists at the beginning of their careers initially are awarded a junior professorship for a limited period of time which includes tenure track, i.e. the promise that, after positive evaluation, the faculty position will be converted into a permanent W3 professorship within six years.

KIT intends to establish eleven such posts, for the time being, one in each KIT department. For nine of these tenure-track professorships, KIT receives funds from a program run by the federal and state governments to promote early-career researchers, the "Nachwuchspakt." The other two posts are financed by KIT.



In the years to come, KIT will establish eleven tenure-track professorships, one at each KIT department. The federal and state governments will finance nine of these posts through the Nachwuchspakt.

Recruiting excellent junior scientists and promoting them as soon as they have obtained their doctorates is of great strategic importance to KIT. Consequently, a lead project in the KIT 2025 Umbrella Strategy was devoted to this activity, received priority treatment, and has meanwhile been completed. It served to make career paths for junior scientists transparent and plannable and, in this way, offer reliable career perspectives to those with high potential in science.

On the basis of the successful postgraduate promotion established at KIT, a multi-perspective career system and a concept for designing and assuring the quality of junior professorships with tenure track have been developed and adopted by the Presidential Committee, the Staff Council, and the KIT Senate.

As a rule, posts are advertised internationally. A basic precondition to an application is a change of universities after obtaining a doctorate, or at least two years of scientific work outside of KIT. The junior professorship with tenure track is limited to a total of six years after a positive interim evaluation. In the case of successful evaluation in accordance with previously defined and weighted criteria regarding research, teaching, and innovation, a junior professorship results in a call to a W3 professorship. Equal opportunities and the combination of work and family are fixed components of the concept.

To initiate the transition to a tenure-track culture, KIT intends to establish up to 35 tenure-track professorships on a medium term. In this way, tenure-track professorships become a new way, besides "habilitation" and direct appointment to a W3 position, for up to 30% of the positions for university teachers and appointed senior scientists.

PROMOTING YOUNG TOP TALENT

HELMHOLTZ INTERNATIONAL RESEARCH SCHOOL FOR ASTROPARTICLE PHYSICS AND ENABLING TECHNOLOGIES

The Helmholtz Association has developed a new funding tool, the "Helmholtz International Research Schools," to allow junior talents to obtain international doctorates. In this way, postgraduates are to be introduced directly to top ranking international research programs in basic research areas. In the first round of invitations to international graduate schools, three cooperative ventures with research and university institutions were chosen.

In the "Matter" research area, KIT succeeded together with the Universidad Nacional de San Martín from Buenos Aires. Some 20 junior scientists in astroparticle physics are now able, within the framework of their doctoral theses at the "Helmholtz International School for Astroparticle Physics and Enabling Technologies," to study, among other things, cosmic radiation at the renowned Pierre Auger Observatory in Argentina.

The Pierre Auger Observatory with its detector field of 3000 km² is the leading instrument in the world for research on high-energy cosmic rays. A field of detectors the size of Luxemburg was built in the West of the Argentinian province of Mendoza at an altitude of 1500 m. It consists of optical telescopes and more than 1600 water tanks weighing tons that are equipped with photosensors. More than 90 research groups from 17 countries are trying to trace high-energy particles from outer space at that location.

The foundation of the "Helmholtz International Research School for Astroparticle Physics and Enabling Technologies" continues and intensifies the dual-doctoral program of the Universidad Nacional de San Martín and KIT in the field of astroparticle physics that has existed since 2015. Each postgraduate student has one Argentinian and one German mentor and can spend one year each working in Argentina and in Germany.

Promotion by the Helmholtz Association includes travel grants and teacher exchanges. At the end, graduates will hold a diploma documenting, in Spanish on one side and in German on the other side, their ability to conduct successfully top level research in a second language and culture.

Simulation of the spread of an air shower over the Pierre Auger Observatory in Argentina. This air shower is initiated by cosmic ray particles in the Earth's atmosphere.

VOCATIONAL TRAINING AND COOPERATIVE STUDIES

KIT RECEIVES THE "GERMANY'S BEST TRAINING COMPANIES 2017" SEAL FROM FOCUS MONEY

In the Karlsruhe Technology Region, KIT is the largest source of training positions, enjoying an excellent reputation across state borders. Thus, the vocational training offered by KIT was awarded the "Germany's Best Training Companies 2017" seal by Focus Money in a nationwide test.

The success rate in final exams in 2017 was nearly 100%, which is considerably above the state and federal averages. When the best graduates of 2017 of the Karlsruhe District of the Chamber of Industry and Commerce (IHK) were honored, KIT contributed a total of six award winners. Special honors also went to three students of the Baden-Württemberg Cooperative State University (DHBW). KIT again received a document by the IHK for its excellent training in 2017.

Hassan Abdullah-Ali came to Germany from Somalia as a refugee in 2014. After spending one year on practical work as an entrance qualification at KIT, he started training as an industrial mechanic in September.

The special function of KIT as an important regional training location is also reflected in the fact that two staff members of the Personnel Development and Vocational Training Service Unit were elected to the University Councils of the DHBW at the Karlsruhe and Mannheim locations, and in the appointment of one staff member to the Vocational Training Committee of the IHK Karlsruhe by the Baden-Württemberg State Ministry of Economics.

In 2017, KIT cooperated with a total of 17 secondary schools and "Realschulen" and grammar schools within the "Business as School Models" IHK initiative. Various campaigns with the cooperating schools enabled many pupils to acquire practical experience in the world of work at an early stage and, in this way, obtain valuable information helping them to decide on their career.

More than 250 pupils from all types of schools were invited by KIT in 2017 to spend up to two weeks in a vocational guidance program (OiB, BORS, and BOGY). Moreover, also in 2017, 194 places for practical work were made available to 429 students from Germany and abroad, and 232 final papers were organized, mentored, and completed. In addition, refugees were able to attend a variety of practical courses for brief periods learning about working life and training possibilities in Germany. As of September 2017, two refugees started dual training at KIT respectively as a cook and an industrial mechanic. Four other refugees are working for their entrance qualification at KIT in cooperation with the Labor Agency. Vocational training at KIT is also helped by information events organized for delegations and groups of visitors from Germany and abroad.

INTERNATIONAL AFFAIRS

Science as it manifests itself in research, teaching, and innovation is not confined to geographic and linguistic boundaries. Throughout the world, researchers are by far the most mobile professionals, and excellent science is unthinkable today without cross-national collaborations. The KIT therefore adheres to a policy of international commitment, and it is international commitment that shapes and influences its strategic orientation. People from more than 120 countries conduct research, teach, work, and study at KIT.

In regards to life and work on campus, KIT's mission stresses the significance of cultural diversity, which is the result of internationalization. The KIT, moreover, assumes its social responsibility across national borders.

The area of action International Affairs, which was omitted in the first edition of the KIT 2025 Umbrella Strategy in November 2015 in anticipation of a new Vice President for Innovation and International Affairs, has now been formulated as an additional chapter. The area of action International Affairs specifies targets, sub-targets, and associated measures related to the topics of cultural diversity as an enrichment, qualification, cooperation, visibility and attractiveness as well as monitoring of internationalization. The measures make a significant contribution to the internationalization of the key tasks of research, teaching, and innovation.

The area of action International Affairs was developed in 2016 and 2017 under the leadership of Vice President for Innovation and International Affairs Professor Dr. Thomas Hirth. It was discussed and resolved in the KIT committees and was finally adopted by the Supervisory Board on March 12, 2018. The second edition of the KIT 2025 Umbrella Strategy with “International Affairs” having been added as the eighth chapter, or eighth field of action, is now available.


材料科学与工
SCHOOL OF MATERIALS SCIENCE AND
诚信严谨挑战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KIT
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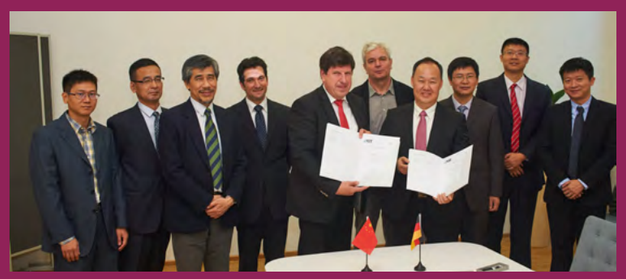


European Campus


eucor
Der European Campus
2.300.000.000
Euro Jahresbudget
115.000
Studierende
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Doktorandinnen
und Doktoranden
15.000
Lehrende und
Forschende
35.700
Mitarbeiterinnen
und Mitarbeiter

ENHANCED COLLABORATION

KIT EXPANDS COOPERATION WITH CHINA

Since 2014, KIT has been operating a branch office at Suzhou Industrial Park near Shanghai in the Chinese province of Jiangsu. As an interdisciplinary platform, the KIT China Branch is KIT's incubator and central contact point for industry and science in China.

To exchange ideas with strategic partners in Jiangsu province and in Shanghai, Professor Dr. Thomas Hirth, Vice President for Innovation and International Affairs, traveled to China with a delegation at the beginning of March 2017. His visit mainly served to evaluate the previous collaboration in the project "Strategic Partnerships for Joint Innovation – KIT in Jiangsu Province and Greater Shanghai" with the partner universities in Nanjing, Suzhou, and Shanghai.

A development strategy for further projects has been defined: Especially in the fields of Smart Manufacturing, Energy, Environmental Technology, and Smart City, the universities want to cooperate more closely. The delegation, moreover, visited local industrial partners to strengthen the close cooperation with KIT. A highlight was the conference entitled "Internationalization and Innovation at KIT" that was organized by the KIT China Branch to present KIT's research activities and expertise.

Together with the Chinese partner University of Suzhou, the KIT China Branch wants to explore digital change and promote the exchange of knowledge and scientists. In September, a cooperation agreement with the Xiangcheng Institute of Robotics and Intelligent Equipment was signed to establish a close cooperation in the fields of robotics and intelligent manufacturing.

According to the European Commission, China is one of the chief emitters of carbon dioxide. The second KIT Innovation Day in mid-October in Suzhou was therefore dedicated to energy and the environment. Five experts from KIT presented their works in order to draw attention to current global challenges in these fields. The aim was to create a dialog on common research interests and collaboration opportunities.

In mid-November, the Vice Minister of Development of Jiangsu province visited KIT with a delegation to explore possibilities for cooperation in the field of environmental technology. Against this background, Vice President Professor Dr. Thomas Hirth signed a joint Memorandum of Understanding with representatives from Jiangsu.

The MoU provides for intensive collaboration in the development of a concept for a German-Chinese Center for Environmental Technology. The province of Jiangsu wants to take a pioneering role in this field within China. KIT, as the Jiangsu government's only German premium partner, is to play a leading role in this regard.

A delegation from the Chinese province of Jiangsu discussed a joint center for environmental technology with KIT. Both partners signed a Memorandum of Understanding.

ACROSS BORDERS

EUCOR – THE EUROPEAN CAMPUS

Eucor – The European Campus is a trinational consortium of the universities of Basel, Freiburg, Haute-Alsace in Mulhouse, and Strasbourg as well as the KIT with currently 120,000 students and 15,000 researchers. The aim of the collaboration is to pool the strengths of the member universities in joint research projects and to mutually give students free access to all courses offered.

In Mulhouse, the member universities in December 2015 signed the documents establishing a European Consortium for Territorial Cooperation. In May 2016, Eucor was inaugurated in Strasbourg. The network is to be expanded into a research and science area with international appeal, which enables joint appointments, joint personnel, and joint applications for research funding as well as the establishment of integrated study programs.

In addition to scientific projects, Eucor also supports cultural exchange and strengthens the cooperation of its members. Under the motto "Three countries, five universities, one festival," 120 cyclists in front of Karlsruhe Palace in early June began the 20th Tour Eucor to the Eucor university cities of Karlsruhe, Freiburg, Strasbourg, Mulhouse, and Basel. The tour of students, employees, and alumni of the five universities ended on June 10 on KIT Campus South with a vibrant and atmospheric music festival with groups from all Eucor universities.

In order to strengthen the research infrastructure in the Upper Rhine Metropolitan Region, the Monitoring Committee of the Interreg V Upper Rhine Program has approved the application for funding of the large-scale research infrastructure project "RMTMO.RI – Stärkung der Forschungsinfrastruktur in der Metropolregion Oberrhein" (strengthening the research infrastructure in the Upper Rhine Metropolitan Region) with over 900,000 euros. This is another milestone for the Trinational Metropolitan Region of the Upper Rhine (TMO). The aim of the three-year project is to develop a concept for the establishment of an innovative cross-border research infrastructure, which will decisively strengthen the science region on the Upper Rhine.

The project is a central undertaking of the TMO and the European Campus to advance the scientific integration on the Upper Rhine. In addition to the University of Freiburg, which manages the project, 13 other universities and research institutions from Germany, France, and Switzerland, including KIT, are involved. The 14 partners want to draw up an inventory of research infrastructure and present a roadmap at the end of the project in 2020 on how the large-scale research infrastructure can become a unique feature of the cross-border research landscape on the Upper Rhine.

In front of Karlsruhe Palace: On June 6, 2017, around 120 students, staff, and alumni from Eucor universities started a tour to all locations of the European Campus.

SUSTAINABLE TECHNOLOGIES FOR THE CHILEAN INDUSTRY

KIT ESTABLISHES A VIRTUAL INSTITUTE WITH THREE CHILEAN PARTNER UNIVERSITIES

The main building of Universidad de Chile in Santiago, one of KIT's three partner universities in Chile.

In view of an intensifying and diversifying consumption of industrial products, the sustainability of industry is of decisive importance. In the context of industrial ecology, industry is developing innovative concepts to increase its eco-efficiency and reduce its impact on society and the environment. This creates great opportunities for international cooperation. While the industries of developed countries often have to make their structures more sustainable retrospectively, countries that are newly industrializing have the chance to implement sustainable technologies right from the start.

Against this background, KIT, together with three universities in Chile, plans to found the Institute for Eco-Industrial Development (IEDE). Since November 1, 2017, the Federal Ministry of Education and Research (BMBF) has been funding a project for establishing this virtual institute, which aims to make important contributions to improving industrial sustainability.

In setting up the virtual institute, KIT, Universidad de Chile in Santiago, Universidad de Concepción, and Universidad Austral de Chile in Valdivia are focusing on research, teaching, and innovation. The partners are working on scientific projects with great potential for applications. From the very beginning, the institute has also been integrating the industry and business of both countries. German and Chilean companies can set research priorities and specify research requirements that are incorporated into doctoral theses and student research projects. The virtual institute implements the projects on the basis of a joint training of postgraduates.

The project was developed by KIT's Chile Cluster. Since 2015, more than 45 researchers from 17 KIT institutes have joined forces in the network to promote cooperation in research, teaching, and innovation in the fields of renewable energies and sustainable use of raw materials and to pool the numerous individual collaborations of actors at KIT with partners in Chile.

The virtual institute is dedicated to three key aspects "raw materials and water," "energy," and "climate" in four work packages. These deal with sustainable water and energy use in the urban context, the sustainable material and energy transformation of biomass use, the eco-industrial use of underground resources, and climate-friendly decentralized energy supply for sustainable regional development.

A BRIDGE INTO SILICON VALLEY

ALUMNI SEMINAR IN CALIFORNIA

"Connecting with success" was the motto of the KIT seminar that took place at the end of September in Silicon Valley near San Francisco. 25 alumni exchanged ideas with experts in the fields of entrepreneurship and innovation - among them Orestis Terzidis, Professor of Entrepreneurship and Technology Management at KIT, and Professor Volker Saile, Head of KIT's Division V - Physics and Mathematics until 2015.

During the three-day seminar, the KIT alumni caught up on all aspects of entrepreneurship and innovation. The program included a visit to Stanford University that was guided by a KIT alumnus currently doing his doctorate there. A visit to LinkedIn was also led by an alumnus of KIT. Other highlights were the visit to Stanford d.school, the meeting with Professor Larry Leifer, Founding Director of the Center for Design Research at Stanford and the Hasso Plattner Design Thinking Research Program at Stanford, and an interview with Cyriac Röding at the German Consulate General in San Francisco. Röding, who also is an alumnus of KIT, developed an app for trading that leads customers to participating stores via a bonus system. This app has become a tremendous success in the USA.

One of the goals of the seminar was to refresh KIT's relations with its alumni in the USA and to network the alumni with each other. Furthermore, the aim was to establish contacts for possible long-term collaborations with local universities and companies. In addition, the seminar was the starting point for exploring ideas for KIT's future presence in Silicon Valley and further cooperation with the alumni.

The participants in the seminar also took home many personal impressions from Silicon Valley. They observed that KIT alumni living there were pleased about the visit from Karlsruhe, that they are grateful to their former university for their well-founded education, and that they definitely wish for a deeper relationship with the university at which they studied. Moreover, the visitors identified certain career paths: The alumni in Silicon Valley have either made their careers in an existing company or right from the start founded their own companies.

Participants in the alumni seminar organized by KIT in California's Silicon Valley.

KIT AS AN EMPLOYER

With 9,297 employees, KIT is one of the largest employers in the region. The staff is made up of 4,620 scientific and 4,310 non-scientific members and includes 432 trainees as well as the students of the Baden-Württemberg Cooperative State University. The share of women is 37.1 percent. KIT hosts 1,231 foreign employees, the majority of whom are academic personnel. In addition, there are 367 professors and senior researchers, 15 of whom were appointed in 2017.

Important topics in 2017 were the 10th anniversary of the Health Network “Netzwerk Gesundheit,” the third certification for the “audit as a family-friendly university,” the start of the project "Conflict Management System at KIT," and the start of a pilot phase for the "Cross-Cultural Competences" certificate program.

Every year, KIT systematically prepares around 150 trainees and students in more than 30 professions and 12 degree programs at the Baden-Württemberg Cooperative State University for their future tasks. KIT is one of the top addresses for vocational training among young people in the Karlsruhe technology region and throughout Germany. This is also reflected by awards from external sources.

The Focus Money business magazine awarded KIT with the “Deutschland Test” seal of quality for being among "Germany's Best Training Companies 2017." At the annual event of the Karlsruhe Chamber of Industry and Commerce (IHK) honoring the best trainees of the year, six prize winners came from KIT. In addition, three students from the Baden-Württemberg Cooperative State University received individual awards. In 2017 again, the IHK awarded KIT a certificate for its excellent vocational training.


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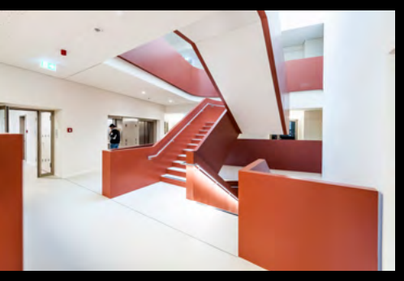


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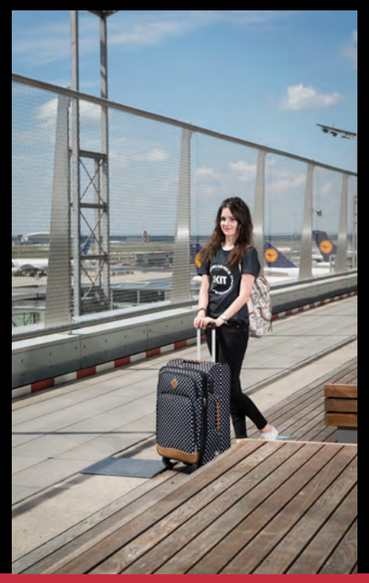



KIT
MOBILISATION
KRÄFTIGUNG
ENTSPANNUNG
ÖNN' DIR EINE PAUSE!


802617
KIT


DIVISION
HERO

WORKPLACE HEALTH PROMOTION AT KIT

THE HEALTH NETWORK "NETZWERK GESUNDHEIT" CELEBRATES ITS 10TH ANNIVERSARY

Cycling to work – many KIT employees took part in the campaign of "Netzwerk Gesundheit" in front of the canteen at Campus North.

Workplace health promotion has always been an integral part of KIT's corporate philosophy. The health network "Netzwerk Gesundheit" is responsible for health promotion planning and implementation. It is a cooperative association of various actors from KIT and external supporters from the domain of accident and health insurance.

In 2017, "Netzwerk Gesundheit" celebrated its 10th anniversary and organized activities on various topics throughout the year. The first events in March were the participation in the "KIT-ON Office Day," and a bowel cancer screening campaign. On the occasion of the "Let's Move" fitness day that followed in April, the employees were invited to test their fitness and try out the new "Personal Training" offer, among other things. The May campaigns, a "Life in Balance?!" workshop and a "Cycling to Work" event held in front of the canteen, were very well attended. After the summer break, a workshop on mindfulness and a cardiovascular health campaign focusing on reanimation training were held on the occasion of World Heart Day.

Another major focus of the work of "Netzwerk Gesundheit" over the last two years has been the pilot project "Gefährdungsbeurteilung psychischer Belastungen" (assessment of the risk of psychological stress). Since 2013, the German Occupational Safety and Health Act has explicitly been calling for the collection of data on psychological stress, the derivation of suitable measures, and appropriate documentation.

Workplace health promotion at KIT primarily addresses employees and trainees. Another large group at KIT are the students, who are now also taken into consideration. In cooperation with the Techniker Krankenkasse, the Institute of Sports and Sports Science and the House of Competence at KIT initiated the participatory project "MyHealth - Gesund studieren am KIT" (MyHealth – healthy studying at KIT), which will run until 2021. In addition to "Netzwerk Gesundheit," numerous actors e.g., the Students' Union Executive Committee (AStA), the Student Services (Studierendenwerk), Vice President for Higher Education and Academic Affairs Professor Dr. Alexander Wanner, and a representative of the KIT Studies Deans, are involved in MyHealth.

10 Jahre NETZWERKGESUNDHEIT

EQUAL OPPORTUNITIES

KIT CERTIFIED FOR THE THIRD TIME AS "FAMILY-FRIENDLY UNIVERSITY"

On June 20, 2017, KIT received the certificate "Family-friendly University" for the third time and has thus committed itself to strengthening and further expanding the compatibility of studies, career, and family in the next three years.

Already in 2010, KIT decided to focus on a family-friendly personnel and study policy and was audited for the first time. After the successful establishment and implementation of numerous measures set out in a target agreement, the topic of the second re-audit in 2014 was "Studying with a Child." In the third and current round, too, there is a catalog of measures that will be examined and implemented over the next three years.

In addition to focusing on child care and nursing support, future parents and students in special circumstances are considered, as are international scientists. One measure of the current target agreement is the initiation of a network for relevant actors who look after students with children at KIT. This measure was already successfully implemented in the summer of 2017.

The target agreement also includes numerous measures for KIT employees. For example, the development of a company agreement on "teleworking" and "mobile working" is a milestone. Another group of people the target agreement provides for are international scholars. The agreement, among other things, sets out in writing how international researchers and their families can be comprehensively informed, advised, and supported before even starting their work at KIT.

The certificate for the "Family-friendly University Audit" was accepted in Berlin by Deputy Commissioner for Equal Opportunities Biserka Mathes (fourth from the right).

Overall, the certification as a "family-friendly university," which has been valid for eight years now, clearly shows that at KIT, the compatibility of studies, career, and family is a strategic goal whose continuous implementation is promoted by numerous actors and benefits all members of the KIT.

Zertifikat seit 2010
audit familiengerechte hochschule

AVOIDING AND SETTLING CONFLICTS

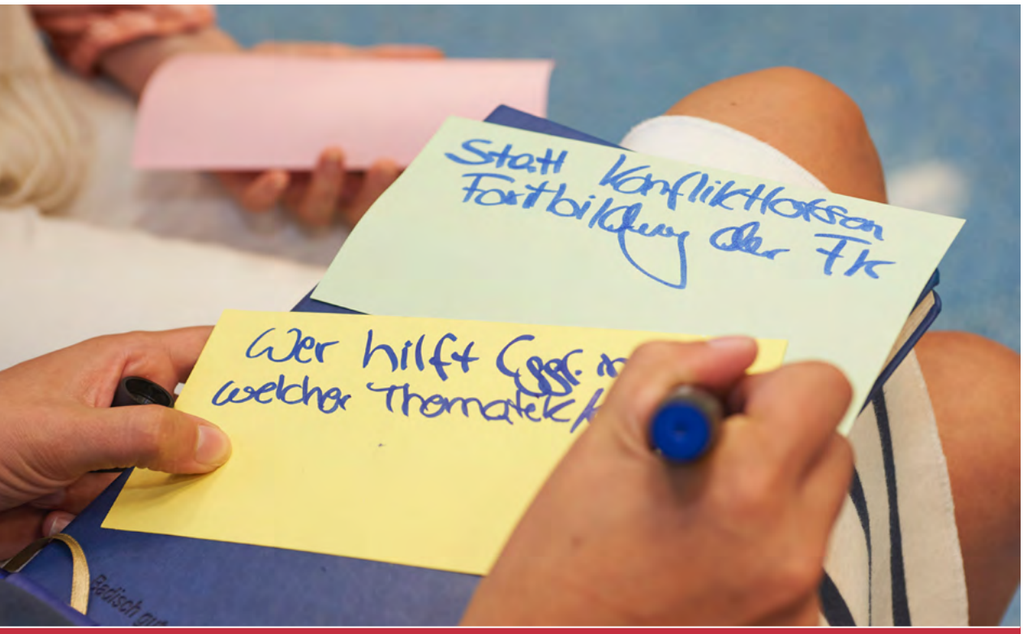
SYSTEMATIC CONFLICT MANAGEMENT AT KIT

"Avoiding and settling conflicts" are the objectives of two measures that have gained momentum in 2017 in the field of Human Resources and Law of KIT's Presidential Committee: Initiation of the project "Conflict Management System at KIT" and establishment of the Staff Unit for Mediation on January 1, 2017.

Since the summer of 2017, Vice President for Human Resources and Law Christine von Vangerow has been working on a project aiming to put conflict management at KIT on a new footing. Various service units and persons e.g., the Medical Services, the Staff Council, the Mediation Staff Unit, the ombudspersons, and the Operational Counseling staff, are entrusted with the resolution of conflicts. It is not always clear to the KIT employees in what cases they can turn to which office, and how they can be helped there.

In order to create more transparency, the project "Conflict Management System at KIT" was launched in July 2017. Its aim is to develop a concept for preventing conflicts in the future or for resolving them competently and constructively at an early stage. Emphasis will be placed on clear responsibilities, contact structures, and consulting formats for employees, especially for managers. All existing contact points for solving conflicts are involved in the project and want to optimize their interaction. The project is managed by the Operational Counseling Office of the Personnel Development and Vocational Training Service Unit and is accompanied by a company for business mediation and communication management.

Since the kick-off of the project, the project team, consisting of representatives of the existing contact points for solving conflicts, has been working together with managers, researchers, and administrative staff in several working groups. The results obtained in these working groups form the basis for a KIT-wide overall concept of conflict management.



The project "Conflict Management System at KIT" wants to create transparency in conflict counseling.

CROSS-CULTURAL COMPETENCES

PROMOTING ADMINISTRATIVE AND TECHNICAL EMPLOYEES

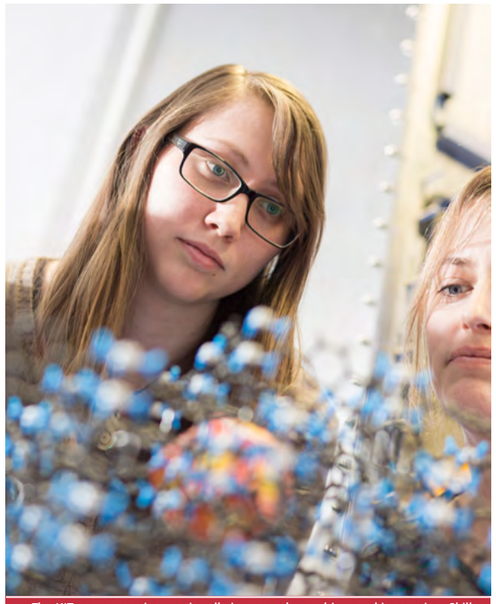
As a collaboration between the service units Personnel Development and Vocational Training and International Affairs, the KIT, in September 2017, started a pilot phase for the "Cross-Cultural Competences" certificate program in the area of personnel development for administrative and technical employees.

The program combines advanced training in intercultural skills with language acquisition and a stay abroad through the EU Erasmus Staff Mobility program and can be completed within a period of one to three years. The duration and costs of the program can be controlled by individual choice, especially with regard to the type of language acquisition and the time schedule for the modules. The certificate concludes with a B2 or higher English level according to the Common European Framework of Reference for Languages, and, depending on the individual orientation, with another European language at level B2 (or above). The target group includes technical and administrative employees who work in an international context to support research and teaching, provide services for international employees or students, work with international colleagues, or want to develop their language skills and intercultural understanding. The participants are accompanied individually and will write a short report in English after completion.

The "Cross-Cultural Competences" certificate program addresses administrative and technical employees who support research and teaching in the international context.

The first seminar entitled "Intercultural Competences" was held in September 2017. Since its launch, the program has been in good demand.

Intercultural skills are in demand today more than ever. KIT cooperates internationally in science, teaching, and innovation. International cooperation has become a matter of course in all areas. As a result, networking, language, and skills for collaborative and target-oriented cooperation in an international context have increasingly become part of the everyday work of technical and administrative employees who support research and science.

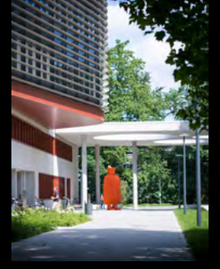


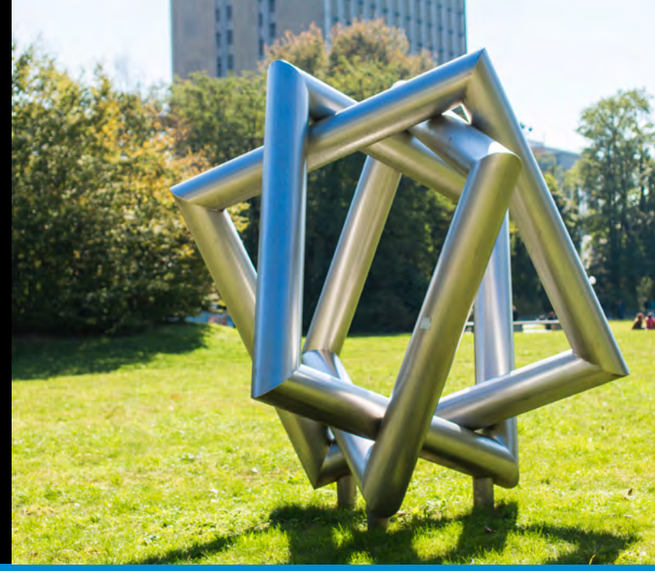
The KIT cooperates internationally in research, teaching, and innovation. Skills for international cooperation, therefore, have increasingly become part of everyday work.

LIFE AT KIT

A research university lives on organized change, on new ideas, topics of importance for the future, and strong personalities. Only where this can be fused into a symbiosis will creativity arise to address topics of the future. From the beginnings of KIT as a polytechnic some 200 years ago, the environmental needs of people in their daily lives have changed fundamentally. Digitization has been, and will be, decisive in determining the way people live, work and communicate, both now and in the future. True, a room with a place to work will continue to play an important role when work has to be done by individuals or in silence. However, it needs to be supplemented by a communication platform. This is where the needs of scientists, students, or clerks in administration differ only slightly. Planned and unplanned communication is increasingly moving into the foreground when solutions are developed for interdisciplinary problems.

Consequently, sustainable refurbishment and new construction of buildings at KIT means "building the future, i.e. building communication." This has been achieved in the new canteen completed on Campus North in 2014 and in the energetic refurbishment of the Mathematics Building on Campus South that was finished in 2016, both of which projects became models of their kind. On these two locations, innovative communication spaces were created with many features highly praised by all users. Other communication spaces will soon be built on Campus South, e.g. a new learning and application center and the new buildings on Adenauerring. The objective is to imitate the style of Vienna Coffee House culture in the late 19th century in creating sustainable internal and external communication spaces where people like to stay. These are special institutions that will interlink the physical and virtual campus, providing places where everyone at KIT can spend hours sitting, learning, discussing, reading, writing, and, above all, communicating.






Karlsruher Institut für Technologie


Spatenstich
Energy Lab 2.1

SUSTAINABILITY AT KIT

CAMPUS DEVELOPMENT, MOBILITY, ENERGY, CLIMATE PROTECTION

The new gas engine test laboratory and the cogeneration plant act as research platforms and sustainable infrastructure facilities on KIT Campus North.

The official start of sustainability processes at KIT in December 2013 also launched the vote on an integrated master plan for sustainable campus development. After discussions in internal groups were finished, and approval of the 2030 master plan was expressed by the KIT Presidential Committee and Supervisory Board in 2016, recommendations for action at all locations of KIT now constitute a binding framework for action.

The fundamental principles were defined even more precisely for campus development. KIT now has an ecological concept of development and management of open spaces. This not only serves environmental protection purposes, but is also meant to successively balance and enhance the quality of living at all locations. After all, creativity is possible only where people like to be. An important factor for the students of KIT will be the availability of spaces for teaching and learning. For this purpose, an implementation project was initiated within the Umbrella Strategy. This serves to connect the virtual world with the real world at KIT so as to achieve the desired marketplace of knowledge.

The energy and climate protection focus also is of major importance in this topic area because of KIT's profound scientific expertise. For this reason, close integration of science in the formulation of specific measures is necessary.

Mobility, the third focus, affects all people using our facilities. Mobility on and between locations, and the general development of our sites are more than just sophisticated logistics problems. Mobility consumes resources and pollutes the environment. Consequently, KIT is trying to avoid mobility where possible. Where it is unavoidable, public offerings are given priority. The city of Karlsruhe and its environment can boast of exemplary structures serving this purpose. In addition, Karlsruhe is a favorite city for biking, which may be the best possibility for alternative mobility. KIT will take advantage of these very positive features and, on the basis of a decision of last year, will change all locations into bicycle campuses. This reconstitution of traffic flows is to produce a safer and a higher quality of life.

"EFFECTS AT KIT" OPEN DAY

35,000 GUESTS LOOKED BEHIND THE SCENES OF RESEARCH ON CAMPUS NORTH

The world's most precise balance, Germany's largest solar storage park, and Karlsruhe's coldest refrigerator. A superfast computer, a cloud-producing chamber, and a simulator for riding in an e-car. These research facilities and projects and many others were presented by KIT on its open day on June 24, 2017. The entire bandwidth of activities was experienced by 35,000 visitors attending 180 tours, experiments, popular lectures, and exhibitions at more than 50 places on Campus North. This open day also was the initial event and highlight of the EFFEKTE science festival organized by the city of Karlsruhe, where more than 100 events allowed guests to obtain impressions of the Karlsruhe research scene.

President Professor Dr.-Ing. Holger Hanselka and Karlsruhe Mayor Dr. Frank Mentrup jointly opened the EFFEKTE science festival on the open day of KIT.

The rich variety of research in energy, mobility, information, materials and technologies, climate and environment as well as particle physics was discovered by guests in spectacular research facilities as well as in instructive experiments, demonstrations, and tours: From the bioliq pilot plant producing modern fuels out of residues from agriculture and forestry to the 70 m long KATRIN balance tracing the lightest particles in the universe; from a tornado raging in a glass of water to high-speed cameras which make the closing of a mousetrap seem slow, from a "Holodeck" for the analysis of scientific experiments to a toy-size dinosaur – and more – produced in a 3D printer. Children and young people joining the researcher rally and gathering at numerous experimental stations experienced hands-on science and technology.

35,000 guests experienced the fascination of research while walking the festival mile, visiting the institutes, attending lectures and exhibitions.

In addition, student groups and many other institutions of KIT displayed their manifold activities alongside partner institutions and sponsors. Last, but not least, KIT presented itself simultaneously as an attractive location to study and as an attractive employer informing guests about such things as study courses, training, and lifelong learning.

BREAKING GROUND FOR THE "ENERGIEWENDE"

START OF CONSTRUCTION OF ENERGY LAB 2.0

The energy mix of the future is both flexible and interconnected. Electricity, heat and cold, gases, and fuels will constitute an intelligent overall energy system interconnected by information technology. The technologies that will make this happen are being developed by KIT and its partners within the project Energy Lab 2.0, which is funded to the tune of EUR 22 million by the federal and Baden-Württemberg state governments. The ground-breaking ceremony for the first group of buildings and laboratories of what is expected to be a 20-year project was conducted in mid-June.

The greatest challenge in the "energiewende" arises from the need to combine fluctuating energy sources in a way that keeps energy affordable and reliable. Energy Lab 2.0, a real laboratory and a simulation platform at the same time, makes it possible to try new approaches to integrating different technologies within one energy system. For this purpose, large experimental plants generating electricity from renewable sources, storage and conversion into gas, fuels, and heat, and turning chemical energy resources back into electricity are being interconnected for the first time.

In this way, it is possible to derive and comprehensively study design drafts of a cellular, flexible, and intelligent overall system of energy supply. Besides interconnecting electric, thermal, and chemical energy flows and energy stores, the focus is on new information and communication technologies for managing and controlling interconnected energy networks. This interconnection of an intelligent overall system is achieved in the "Smart Energy System Simulation and Control Center (SEnSSiCC)," for which a new building is being erected with approx. 800 m^2 of experimental and laboratory space.

The SEnSSiCC is composed of four subprojects. The "Power-Hardware-in-the-Loop-System (PHIL)" is able to use individual real electric components of up to 1 megawatt power, such as transformers or current limiters, in a simulated complex electrical grid, including their feedback.

The "Smart Energy System Control Laboratory" will be used to study power grids ranging between 100 and 200 kilowatts at the borderline of stability. It includes real machines, equipment, and plants for connecting power grids with heat systems, such as heat pumps or intelligent household appliances.

The "Lead Points and Control Center (LCC)" is responsible for setting up the control system for fundamental monitoring and supporting the operation of the facilities within Energy Lab 2.0. At the same time, novel planning and optimization tools are to be studied for the operation and planning of overall smart-grid solutions.

The "Modeling, Simulation, and Optimization" subproject develops executable software models for power plants and complex smart grids.

The ground-breaking ceremony performed by (left to right) Professor Dr. Joachim Knebel, Professor Dr. Veit Hagenmeyer, Professor Dr. Roland Dittmeyer, Professor Dr. Mathias Noe, and Reinhard Subbert (all KIT) and Jörg Usinger (Behnisch Architekten Stuttgart) marks the beginning of the construction phase of the new hall of Energy Lab 2.0 on KIT Campus North.

PLAYING GAMES AT COMPETITION LEVEL

KIT SC SETS UP E-SPORTS DIVISION

E-sports is gaming at competition level. All over the world, e-sports events fill even large arenas. Instead of pale computer nerds spending entire nights on chips and soft drinks just playing computer games, these are well-paid professionals combating each other in the multi-game mode of popular video games. E-sports fans also are gaining more and more recognition in this country. In the KIT Sports Club, KIT SC, there has been an e-sports division since July 2017, a corresponding university group having existed long before that. Approximately 100 students train regularly, the best 20 of them in the club. KIT is the only German university supporting top video gaming in an official sports club.

Members of the e-sports division of the KIT club, KIT SC, newly founded in 2017.

E-sports has a character very different from the widespread image of the sleepless computer kid spending solitary time in front of a video screen. In actual fact, millions in prize money is being paid at international tournaments. The finals of the electronic sports league were played in the sold-out Cologne Lanxess arena in July 2017. Fans follow games on huge video screens at the venue or on specialized streaming portals at home. Skilled gamers are stars of the scene and are well-paid professionals.

Players perform in different classes and disciplines. These include genres, like Multiplayer Online Battle Arena (MOBA), a kind of virtual besieging of a fortress, First Person Shooter, in which players experience the battle from a personal perspective, or mass multi-player online role-playing games in which thousands of players simultaneously occupy a virtual world. Popular titles, such as League of Legends, Dota2, or Counter-Strike, are favorites among e-gamers.

The "Explorers" team from the eSUKA (eSports United Karlsruhe) university group is active in the UEG, the German e-sports league for students. They play League of Legends. In this MOBA, two teams of five players each fight each other. The teams start on opposite sides of a map close to a main building called Nexus. The objective is to destroy the opponent's Nexus. Training is for two hours twice a week. A training schedule features both individual management of as many of the game`s roughly 120 characters as is possible, and team playing.

Players combat each other in competitions on computers in different game categories and disciplines.

PRIZES, HONORS, AWARDS, AND APPOINTMENTS

In 2017, KIT conferred several high honors. Awarding of honorary titles is agreed upon by the Presidential Committee and KIT Senate in accordance with the pertinent regulations of KIT.

Rainer Blickle, partner of SEW-EURODRIVE GmbH & Co. KG and Executive Director of the SEW-EURODRIVE Foundation, was appointed Honorary Senator of KIT. The SEW-EURODRIVE Foundation funds research projects and guest professorships, grants several scholarships under the national Deutschlandstipendium program every year, and supports a newly established endowed professorship. Dr. Wolfgang Eichelberger also was appointed Honorary Senator. Together with his wife, he established the “Erika und Dr. Wolfgang Eichelberger-Stiftung” trust at KIT in early 2012. The purpose is to grant scholarships and prizes to graduates of the KIT Departments of Physics and Informatics.

Dr. Anja Schümann was conferred the honor of an Honorary Citizenship of KIT. She chairs the Reinhard Frank Foundation that supports the Pupils Research Laboratory, an international exchange program, and the KIT Studies Center for the Visually Impaired. Another Honorary Citizenship was awarded to Martin Litschel. As Member of the Council of the Vector Foundation, he funds a young investigators group of KIT and a number of scholarships under the national Deutschlandstipendium program as well as some highly talented students. Dr. Sybill Storz, Managing Director of KARL STORZ SE & Co. KG and founding member of the KIT Foundation, Volker Krebs, professor emeritus and Vice President for Studies and Teaching of the then University of Karlsruhe, and Wolfgang Müller, honorary professor of KIT and Chairman of the Executive Board of BBBank eG, Karlsruhe, received medals of merit for their extraordinarily high commitment. The Merit Pin of KIT was handed over to Hans Helmut Bernhart, professor emeritus of KIT’s Institute for Water and River Basin Management.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DEUTSCHER RECHENZENTRUMSPREIS
2017
URKUNDE
1. PLATZ
DEUTSCHER RECHENZENTRUMSPREIS
2017


KIT


Urkunde


KIT
Karlsruher Institut für Technologie
Herzlich Willkommen
zum Ehrenabend des Präsidenten
PRÄSIDIUM

MODELING STRUCTURES OF MATERIALS

LEIBNIZ PRIZE FOR BRITTA NESTLER

For her research relating to computer-aided modeling of materials, Professor Dr. Britta Nestler was granted the 2017 Gottfried Wilhelm Leibniz Prize.

Professor Dr. Britta Nestler was granted the 2017 Gottfried Wilhelm Leibniz Prize by the German Research Foundation (DFG). The award ceremony was held at the Annual DFG Meeting in Halle on July 4, 2017. With this highest endowed German science prize in the amount of EUR 2.5 million, DFG honored the mathematician and physicist for her research into computer-aided materials modeling.

Britta Nestler studies microstructures of materials with the help of computer-aided simulations. By combining materials science and software technology expertise, she develops realistic three-dimensional models of materials using multi-scale and multi-physical approaches.

Nestler incorporates her theoretical findings into close-to-practice research collaborations with industry to improve brake disks, corrosion prognosis, and medical diagnostics, among other things. Her studies focus on structures of crystals, fabrication processes, porous media, crack propagation, and phase transition between the liquid and solid as alloys solidify. As a materials researcher, Nestler collaborates with e.g. geologists to analyze the formation of grain structures in rock and helps to better understand processes of geologic history and the use of geothermal energy. In cooperation with energy researchers, she develops foam structures with integrated phase transition materials for use in latent heat storage systems.

Nestler works not only as a scientist and professor at Karlsruhe Institute of Technology, but also as a Member of the Board of Directors of the Institute for Applied Materials. Since 2001, she has also been professor at Karlsruhe University of Applied Sciences. In 2008, she was appointed Director of the Computational Materials Science and Engineering Department of the Institute of Materials and Processes there.

Britta Nestler studied physics and mathematics at RWTH Aachen University, where she also was conferred her doctorate. As a third subject, she studied pedagogics. Among the prizes she has received so far is the State Award for Applied Research of the Baden-Württemberg Ministry of Science, Research, and the Arts. Together with the Department of Informatics of Karlsruhe University of Applied Sciences, she received the State Teaching Award. In addition, Nestler was granted the Research Prize of Karlsruhe University of Applied Sciences, the Materials Science and Technology Prize of the Federation of European Materials Societies, and the Richard von Mises Prize of the Society for Applied Mathematics and Mechanics. Since 2010, Britta Nestler has conducted research and lectured at Karlsruhe Institute of Technology. She succeeded in acquiring funding for research and education in the amount of more than EUR 5.5 million.

TWO ERC ADVANCED GRANTS FOR SCIENTISTS OF KIT

WOLFGANG WERNSDORFER AND HOLGER PUCHTA ARE GRANTED FUNDING BY THE EUROPEAN RESEARCH COUNCIL

For the second time, molecular biologist Professor Dr. Holger Puchta and experimental physicist Professor Dr. Wolfgang Wernsdorfer have each been awarded an ERC Advanced Grant by the European Research Council, most recently in 2017. Wernsdorfer received the grant for his project "Molecular Quantum Opto-Spintronics" (MoQuOS), which deals with optical manipulation and characterization of molecular quantum bits. Puchta's project CRISBREED covers the simultaneous use of several molecular scissors, so-called CRISPR/Cas systems, to specifically modify genetic information and combine certain traits in crops.

Quantum physics effects open up many new applications of significantly enhanced capacity, sensitivity, and speed in a variety of areas. An example is information processing: While classical computers work with bits that assume the value of either zero or one, quantum computers use as the smallest computing units so-called quantum bits, or qubits, which may also assume values in between. Entanglement of qubits results in mixed quantum states that allow for the parallel execution of many computation steps. Professor Wernsdorfer mainly works in the area of molecular quantum spintronics, which is part of experimental solid-state physics at the interface to chemistry and materials sciences. He is one of the leading international experts for molecular magnets and their future use in quantum computers.

Professor Dr. Wolfgang Wernsdorfer is Humboldt Professor at KIT and works at the Physikalisches Institut and Institute of Nanotechnology.

CRISPR/Cas is an easy-to-handle molecular scissors for precise modifications of the DNA (deoxyribonucleic acid) that carries genetic information. In this way, genes can be switched off rapidly and precisely or they can be modified. The plants produced by this so-called genome editing do not contain any foreign DNA and cannot be distinguished scientifically from the plants obtaining their properties by natural inheritance. Hence, genome-edited plants are not genetically modified organisms. Professor Puchta is considered a pioneer of genome editing: More than twenty years ago, he was the first scientist in the world to demonstrate specific modification of plant genomes by the use of molecular scissors.

Professor Dr. Holger Puchta holds the Chair for Molecular Biology and Biochemistry at KIT's Botanical Institute.

TWO SCIENTISTS OF KIT RECEIVE ERC CONSOLIDATOR GRANTS

EUROPEAN RESEARCH COUNCIL FUNDS PROJECTS OF CHRISTIAN KOOS AND CHRISTIAN GREINER WITH ABOUT EUR 2 MILLION EACH

Professor Dr. Christian Koos heads the Institute of Photonics and Quantum Electronics and is Member of the Board of the Institute of Microstructure Technology.

At KIT, Professor Dr. Christian Koos combines photonic and electronic methods to generate terahertz signals and make them usable for data transmission and measurement. Dr. Christian Greiner studies the behavior of metals under friction in order to reduce friction and wear and, thus, decrease the consumption of energy and raw materials. The European Research Council (ERC) has awarded Consolidator Grants to both scientists. In the next five years, their projects will be funded with about EUR 2 million each.

Ultra-rapid wireless communication at data transmission rates of up to 1 terabit per second and highly precise signal processing in medical imaging, non-destructive materials testing, or security technology – these are examples of potential applications of concepts developed within the TeraSHAPE project. Christian Koos and his team combine photonic and electronic methods to generate and detect electromagnetic signals with bandwidths in the terahertz range. The TeraSHAPE (Terahertz Waveform Synthesis and Analysis Using Hybrid Photonic-Electronic Circuits) project focuses on frequencies between 100 gigahertz and 1 terahertz (1000 gigahertz). Researchers use optical frequency combs together with highly parallelized signal processing in digital electronic circuits for the precise synthesis and analysis of waveforms in the optical range.

Friction and wear are responsible for one third of energy consumption in the transport sector and substantially influence the service lives of many products. To reduce consumption of energy and raw materials, it is therefore essential to develop friction-optimized metal alloys. Dr. Christian Greiner and his team study how the microstructure of materials changes under so-called tribological loading. Tribological loading occurs when components are in contact with and move relative to each other. Within the framework of the TriboKey (Deformation Mechanisms Are the Key to Understanding and Tailoring Tribological Behavior) project, the team studies deformation processes of various alloys under friction loading and the resulting structural changes inside the metals. Using a unique approach, they couple friction experiments with non-destructive testing methods, data science algorithms, and high-resolution electron microscopy.

Dr. Christian Greiner heads the Emmy Noether Research Group "Materials Tribology – Materials under Tribological Loading" at the Institute for Applied Materials – Computational Materials Science.

OTHER PRIZES, HONORS, AWARDS, AND APPOINTMENTS

■ **Dr. Mahdi Abbasi**, Institute for Chemical Technology and Polymer Chemistry, was granted a Max Buchner Research Scholarship for his work on polymer foams based on definably branched polymers.

■ **Dr. Manuel Amann**, Institute for Algebra and Geometry until September 2017, received the 2017 von Kaven Award of the German Research Foundation for his work at the interface between Riemannian geometry and algebraic topology.

■ The Australian Research Council conferred on **Professor Dr. Christopher Barner-Kowollik**, Institute for Chemical Technology and Polymer Chemistry of KIT and Queensland University of Technology, an Australian Laureate Fellowship for his research into customizing coatings and materials for various applications using monochromatic laser light.

■ **Dr. Boris Bitsch**, Institute for Mechanical Process Engineering and Mechanics, received the Peter and Luise Hager Prize for his outstanding work relating to an innovative concept for the formulation of pastes with excellent coating properties for the fabrication of Li-ion battery electrodes with improved electrochemical properties.

■ **Henning Bockhorn**, professor emeritus of the Engler-Bunte Institute, was granted the Rudolf Günther Prize for his longstanding scientific achievements. The Prize is awarded every two years by the Combustion Institute (German Section), the German Association for Combustion Research, and the VDI Society for Energy and the Environment.

■ **Dr. Ralph Engel**, Institute for Nuclear Physics, was elected Scientific Spokesperson of the Pierre Auger Collaboration at the meeting of the members of the collaboration in November 2017 in Malargüe, Argentina.

■ **Bettina Fleck** won the Erna Scheffler Sponsorship Award 2017 of the Soroptimist Club Karlsruhe for her master's thesis "Neuartige Peptoide als potenzielle antibiotische Wirkstoffe gegen MRSA" (novel peptoids as potential antibiotic substances against MRSA) written at the KIT Institute of Toxicology and Genetics.

■ **Professor Dr. Herbert Gleiter** was presented the Medal of Friendship – Order of Merit of the government of the Chinese province of Jiangsu for the foundation and establishment of the "Herbert Gleiter Institute of Nanoscience." Since 2012, he has been director of the institute named after him. Within the Network of Excellent Retired Scientists, he continues to conduct research at the Institute of Nanotechnology of KIT.

■ Nanoscientist **Professor Dr. Herbert Gleiter** was appointed fellow by the US-American National Academy of Inventors for his outstanding innovation achievements. The non-profit organization honors as fellows those scientists, whose innovative developments or technical novelties are of sustainable benefit for the economy and society.

■ **Professor Dr. Tilmann Gneiting**, Institute of Stochastics of KIT and Heidelberg Institute for Theoretical Studies, has been editor-in-chief of the peer-review journal "The Annals of Applied Statistics" of the Institute of Mathematical Statistics since January 2017.

■ **Dr. Christian Greiner**, Institute for Applied Materials, received an "ERC Consolidator Grant" of the European Research Council. He studies the behavior of metals under friction in order to reduce friction and wear and, thus, consumption of energy and raw materials (see also page 86).

■ **Dr. Manuel Gruber** was granted the Doctoral Thesis Prize of the German-French University for his outstanding binational doctorate in physics. He completed his doctorate at the Engler-Bunte Institute of KIT and the Université de Strasbourg. The Prize was funded by the Robert Bosch Foundation.

■ **Professor Dr. Peter Gumbsch,** Institute for Applied Materials, was appointed Chairperson of the Scientific Commission of the Council of Science and Humanities in January 2017.

■ At the annual meeting of the "Conference of European Schools for Advanced Engineering Education and Research" (CESAER) in Budapest, the President of KIT, **Professor Dr.-Ing. Holger Hanselka**, was unanimously elected Member of the Board of Directors.

■ In early July, the assembly of members of the German Research Foundation (DFG) elected **Professor Dr. Marlis Hochbruck**, Institute for Applied and Numerical Mathematics, Member of the Board for another four years.

■ **Professor Dr. Michael J. Hoffmann**, Institute for Applied Materials, was granted the Robert B. Sosman Award of the Basic Science Division of the American Ceramic Society. The Award is the Society's highest honor granted in recognition of outstanding achievements in basic science relating to high-performance ceramics.

■ **Professor Dr. Corinna Hoose**, Institute of Meteorology and Climate Research, received the Early Career Scientist Medal Award of the International Association of Meteorology and Atmospheric Sciences for her research relating to cloud physics.

■ **Dr. Alik Ismail-Zadeh**, Institute of Applied Geosciences, was selected Member of the International Geoscience Programme Council by the Director-General of UNESCO.

■ For a second term of four years, **Professor Dr. Ellen Ivers-Tiffée**, Institute for Applied Materials, was elected Member of the Senate of the German Research Foundation (DFG).

■ **Dr. Emma Järvinen**, Institute of Meteorology and Climate Research, received the Doctoral Prize of the Helmholtz Association for her outstanding scientific achievements.

■ **Lisa Kahl**, KIT Department of Architecture, received the Schelling Studies Award for her design of a bathhouse combining traditional bathing culture with modern, fast-paced city life within her graduation thesis.

■ The Berlin-Brandenburg Academy of Science and Humanities elected **Professor Dr. Manfred Kappes**, Institute of Physical Chemistry, Ordinary Member in the Class of Mathematics and Natural Sciences.

■ Doctoral Candidate **Vanessa Kappings**, who is involved in the further development of the so-called vasQchip in the team headed by Professor Dr. Ute Schepers at the Institute of Toxicology and Genetics, won the 2017 LUSH PRIZE supporting animal-free testing in research in the category of "Young Researcher."

■ acatech – National Academy of Science and Engineering elected **Professor Dr. Heike P. Karbstein**, Institute of Process Engineering in Life Sciences, as member at the meeting of members on October 17, 2017. This election acknowledges her scientific achievements and is an honorary mandate.

■ In 2017, **Dr. Teppei Kitahara**, Postdoc of the Institute for Theoretical Particle Physics, was selected for the "Young Scientist Award 2018" of the Japanese Physical Society in the category of "Theoretical Particle Physics" for his work on direct CP violation in the decay of kaons into two pions.

■ **Professor Dr. Willem Klopper**, Institute of Physical Chemistry, was elected Member of the Norwegian Academy of Sciences for his significant contributions to quantum chemistry.

■ **Professor Dr. Christian Koos**, Institute of Photonics and Quantum Electronics and Institute of Microstructure Technology, received an "ERC Consolidator Grant" of the European Research Council for his work on combining photonic and electronic methods to generate terahertz signals and to make them usable for data transmission and measurement technology (see also page 86).

■ **Professor Dr. Christian Koos**, Institute of Photonics and Quantum Electronics and Institute of Microstructure Technology, was awarded a "Proof of Concept Grant" by the European Research Council for the SCOOTER project to improve serial data transmission with energy-efficient microchips.

■ **Professor Dr. Jan G. Korvink**, Institute of Microstructure Technology, received a "Proof of Concept Grant" of the European Research Council for the LockChip project that is aimed at reducing temperature dependence of measurement results of compact nuclear magnetic resonance devices.

■ For her research on the development of hematological and musculo-skeletal disorders, **Dr. Cornelia Lee-Thedieck**, Institute of Functional Interfaces, received an "ERC Starting Grant." The European Research Council will fund her project bloodANDbone (see also page 52).

■ The German Bundestag and the French National Parliament awarded to **Dr. Nikolaus Marsch**, Center for Applied Legal Studies of KIT, and to Yoan Vilain and Dr. Mattias Wendel (both Berlin) the German-French Parliament Prize 2016. This Prize honors their joint work on a comparison of French and German constitutional law.

■ 27-year-old Iranian **Allen Ali Mohammadi**, who studies mechanical engineering at KIT, was included in the Forbes List "30 under 30" and ranked among the most influential young Europeans by the US business magazine. This ranking honors his search for a new method for the early diagnosis of cardiac diseases.

■ The Gips-Schüle Foundation granted the Gips-Schüle Research Award to scientists **Sascha Mühlbrandt**, **Professor Dr. Christian Koos**, and **Professor Dr. Manfred Kohl** for the demonstration of a novel plasmonic photodector that is a hundred times smaller and much quicker than conventional detectors.
.

■ **Julien Pinay** received the Excellence Prize of the German-French University for his excellent study achievements in the binational study program of mechanical engineering. He completed his studies at KIT and the Institut National des Sciences Appliquées de Lyon.

■ For his graduation thesis, **Damian Platten**, KIT Department of Architecture, received the Schelling Studies Award. With this, the Schelling Architecture Foundation honors trendsetting developments in architecture.

■ For the second time in a row, molecular biologist **Professor Dr. Holger Puchta**, Botanical Institute, received the renowned "ERC Advanced Grant" of the European Research Council for his research into the use of molecular scissors for plants (see also page 85).

■ **Dr. Alexandra Schade**, Institute of Organic Chemistry, reached third place in the competition for the Gips-Schüle Young Scientist Award with her doctoral thesis on porous materials characterized by an extraordinary large surface area and high stability, so-called microporous organic polymers.

■ Earthquake expert **Andreas Schäfer**, doctoral candidate at the Geophysical Institute, reached the second place in the regional round of the FameLab science communication competition.

■ **Frank Scholze**, KIT Library, and Michael Witt, associate professor for library science at Purdue University, West Lafayette, Indiana, were granted the renowned Oberly Award for Bibliography by the Association of College and Research Libraries, Science and Technology Section, for their commitment to fusing re3data.org, the Registry of Research Data Repositories, with DataCite.

■ **Dr. Nicole Stricker** received the Erna Scheffler Sponsorship Award 2017 of the Soroptimist Club Karlsruhe for her doctoral thesis on the robustness of chained production systems written at the wbk Institute of Production Science.

■ **Dr. Christian Schulz**, Institute of Theoretical Informatics, was granted the Heinz Billing Prize 2017 of the Max Planck Society. The Prize is to honor outstanding work in the area of scientific computing and was granted to Schulz for his development of the KaHiP (Karlsruhe High Quality Partitioning) tool, a widely usable tool for graph partitioning.

■ For her studies of emulsifying and emulsion-stabilizing properties of citrus pectin, **Dr. Ulrike van der Schaaf**, Institute of Process Engineering in Life Sciences, was granted the "KaTe" prize for pioneering food research by the food technology company KaTech Katharina Hahn + Partner GmbH.

■ **Dr. Ulrike van der Schaaf**, Institute of Process Engineering in Life Sciences, received a Max Buchner Research Grant for her work to increase the physical and chemical stability of emulsions by using ferulic acid-rich sugar beet pectins as hydrocolloid emulsifiers.

■ At the meeting of members in October 2017, the acatech – National Academy of Science and Engineering – elected **Professor Dr. Peter Vortisch**, Institute for Transport Studies, one of its members. This election acknowledges his scientific achievements and is an honorary mandate.

■ **Professor Dr. Alexander Waibel**, Institute for Anthropomatics and Robotics, was elected member of the Engineering Sciences Section by Leopoldina, one of the oldest science academies in the world.

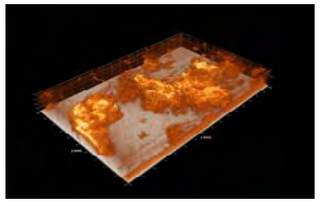
■ For his support of the social and political work of the German Rectors Conference (HRK), **Professor Dr. Alexander Waibel**, Institute for Anthropomatics and Robotics, was appointed Honorary Senator by the Board of the Foundation Supporting the HRK.

■ Experimental physicist **Professor Dr. Wolfgang Wernsdorfer**, Physikalisches Institut and Institute of Nanotechnology, received an "ERC Advanced Grant" of the European Research Council for his project "Molecular Quantum Opto-Spintronics" (MoQuOS). This is the second "Advanced Grant" for the scientist (see also page 85).

■ **Professor Dr. Sigmar Wittig**, former Head of the Institute of Thermal Turbomachines and Rector of the then Universität Karlsruhe, was granted the ISABE Prize by the International Society for Airbreathing Engines (ISABE). This is to honor his outstanding contributions to the development of aircraft engines and gas turbines.

■ The online portal "Für-Gründer.de" analyzed all startup competitions in 2016 and determined the top 50 startups based on the number of prizes and the prize money received as a function of types and sizes of the competitions. The KIT spinoff **Arti-Minds Robotics GmbH** reached first place and was given the unofficial title as the most promising "Future Hidden Champion 2016."

■ The bio-electrochemical fuel cell (**BioBZ**) can generate electric power without the digestion process used to date. For this innovative concept, in the development of which researchers of KIT were involved and which was coordinated by TU Clausthal, the group won the German Sustainability Award of the Federal Ministry of Education and Research in the category of research.



■ Allen Ali Mohammadi's company **Hippogriff** was first in the "Capgemini's global innovation competition Innovators Race 50" in the category of "Consumers and Well-being" and received the associated "Serge Kampf Award for Entrepreneurship and Innovation." With a method for the early diagnosis of cardiac diseases, he bested 1000 startup companies from 37 countries.

■ **INERATEC GmbH**, a spinoff of KIT, reached third place in the category of "Emission Reduction, Processing, and Separation" of the 2017 Baden-Württemberg Environmental Technology Award competition. The spinoff develops and commercializes microstructured chemical compact facilities for the decentralized conversion of greenhouse gases into chemicals and synthetic fuels.

■ **KIT** was granted the "IEEE Milestone Otto Lehmann" by the renowned Institute of Electrical and Electronics Engineers (IEEE). With this, the international association of engineers honors physicist Otto Lehmann (1855 – 1922) and his research into liquid crystals in Karlsruhe.

■ Prize for the newly built computing center of the ForHLR II high-performance computer of **KIT**: In the competition for the German Computing Center Prize 2017, the supercomputer was ranked in first place in the category of "Newly Built Energy- and Resource-efficient Computing Centers."

■ The "HIGH-TOOL" project is one of the winners of the German Mobility Prize 2017. In a project coordinated by **KIT**, a planning tool to forecast quantitative impacts of transport policy measures was developed for the EU (see also pages 20/21).

■ The KIT startup team of **memetis** reached second place in the category of industrial technologies of the CyberOne Hightech Award Baden-Württemberg. memetis also won the state final of the Elevator Pitch BW in Stuttgart and the competition Weconomy – The Startup Initiative 2017. Moreover, it received the init Innovation Prize of the CyberChampions Award competition. The young startup develops, produces, and sells foil-based miniaturized actuators based on shape-memory alloys.

■ The "**Urban Transition Lab 131: KIT findet Stadt (KIT Meets City)**" of the Institute for Technology Assessment and Systems Analysis was honored twice by the Council for Sustainable Development of the Federal Government: With the quality label "Sustainability Project 2017" and as a transformation project to which the jury assigns a great potential to enhance the world's sustainability.

■ The company **renumics**, a spinoff of KIT, reached third place in the CyberOne Hightech Award Baden-Württemberg competition. In addition, it was one of six winners of the "Startup Competition – Digital Innovations" of the Federal Ministry for Economic Affairs and Energy. renumics focuses on computer-aided engineering and is financed by the Young Innovators Program of the State of Baden-Württemberg.

■ The virtual reality platform Cross Connected® of the Karlsruhe software company **Rüdenauer 3D Technology GmbH (R3DT)** is a "Selected Place 2017" of the initiative "Germany – Land of Ideas." The corresponding certificate was handed over by Federal President Frank-Walter Steinmeier in Berlin.

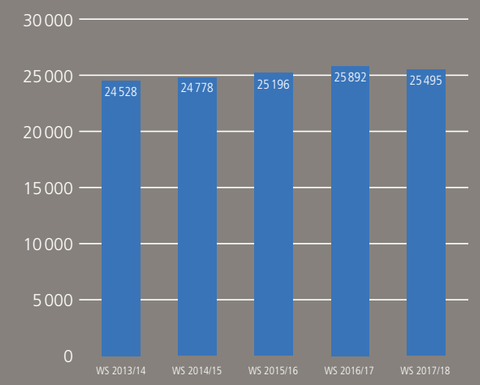
■ The **Smart Data Innovation Lab (SDIL)** of KIT was one of five European research platforms honored with the title "BDVA i-Space." The Big Data Value Association (BDVA) supports the EU Commission under the Horizon 2020 research framework programme.

■ First place in the competition for the Environmental Technology Award Baden-Württemberg 2017 in the category of "Energy Efficiency" went to the photovoltaic-thermal energy supply unit **SOLINK**. The tandem collector combines photovoltaics and solar thermal technologies with an air-heat exchanger in a supply unit for heat pumps. The preliminary studies were performed by scientists of KIT.

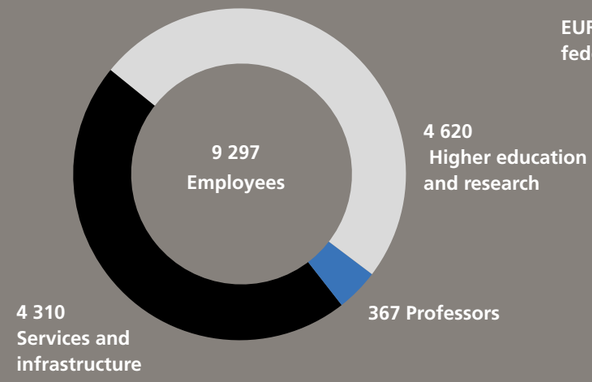
■ The company **Vincent Systems GmbH** established by a scientist of KIT was one of three finalists in the competition for the German President's Award for Innovation in Science and Technology. It developed a kit for artificial hand prostheses with a sense of touch that can be adapted specifically to the wearer.

FACTS AND FIGURES

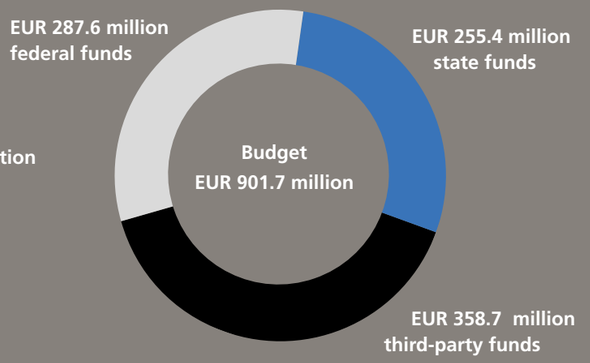
Number of students



Employees 2017



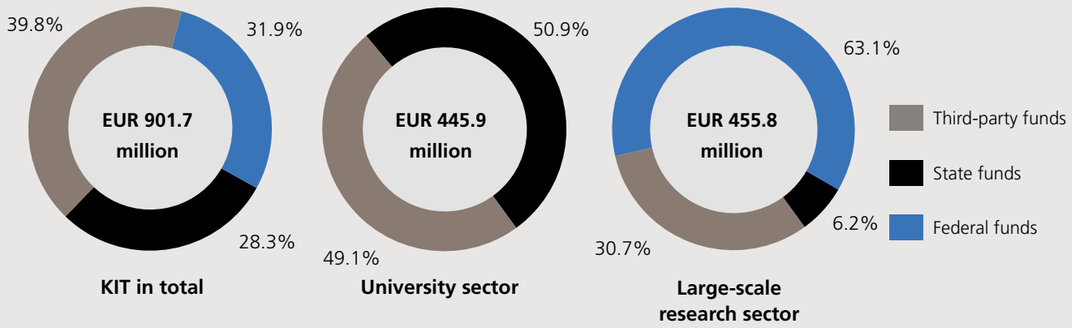
Total budget 2017



CONTENT

FUNDING

Federal, State, and Third-party Funds Acquired in 2017



Sources of Funding

KIT in Total

In million euros	2013	2014	2015	2016	2017
Income in total	844.6	847.4	860.8	851.1	901.7
Third-party funds	357.5	369.2	358.0	336.4	358.7
State funds	216.0	221.3	248.1	251.5	255.4
Federal funds	271.1	256.9	254.7	263.2	287.6

University Sector

In million euros	2013	2014	2015	2016	2017
Income in total	427.3	420.0	428.4	429.6	445.9
Third-party funds**	239.3	230.5	208.7	208.1	218.7
State funds**	188.0	189.5	219.7	221.5	227.2
Federal funds*	0.0	0.0	0.0	0.0	0.0

* In the University Sector. federal funds are included in the third-party funds. as they are granted for special projects rather than for basic funding.
** Quality assurance funds (about EUR 12.5 million) are included in third-party funds until 2014 and in state funds from 2015.

Large-scale Research Sector

In million euros	2013	2014	2015	2016	2017
Income in total	417.3	427.4	432.4	421.5	455.8
Third-party funds	118.2	138.7	149.3	128.3	140.0
State funds	28.0	31.8	28.4	30.0	28.2
Federal funds	271.1	256.9	254.7	263.2	287.6

Sources of Third-party Funding

KIT in Total

In million euros	2013	2014	2015	2016	2017
Third-party funding in total	357.5	369.2	358.0	336.4	358.7
Third-party funding by DFG, incl. CRC	45.3	47.0	44.1	50.3	52.9
Third-party funding by EU	30.3	31.6	32.3	29.4	30.0
Third-party funding by ExIn I	20.9	3.5	0.0	0.0	0.0
Third-party funding by Fed. and State	123.9	133.8	133.8	124.0	140.9
Other income	137.1	153.3	147.8	132.7	134.9

University Sector*

In million euros	2013	2014	2015	2016	2017
Third-party funding in total	239.3	230.5	208.7	208.1	218.7
Third-party funding by DFG, incl. CRC	39.2	39.4	38.8	41.1	41.4
Third-party funding by EU	14.0	11.9	13.3	11.0	11.9
Third-party funding by ExIn I	20.9	3.5	0.0	0.0	0.0
Third-party funding by Fed. and State	92.0	101.7	92.1	90.6	93.6
Other income	73.2	74.0	64.5	65.4	71.8

* Third-party funds shall be all income of and grants awarded to the University Sector under the Solidarity Pact in addition to basic funding.

Large-scale Research Sector

In million euros	2013	2014	2015	2016	2017
Third-party funding in total	118.2	138.7	149.3	128.3	140.0
Third-party funding by DFG, incl. CRC	6.1	7.6	5.3	9.2	11.5
Third-party funding by EU	16.3	19.7	19.0	18.4	18.1
Third-party funding by ExIn I	0.0	0.0	0.0	0.0	0.0
Third-party funding by Fed. and State	31.9	32.1	41.7	33.4	47.3
Other income	63.9	79.3	83.3	67.3	63.1

Use of Funds in 2017

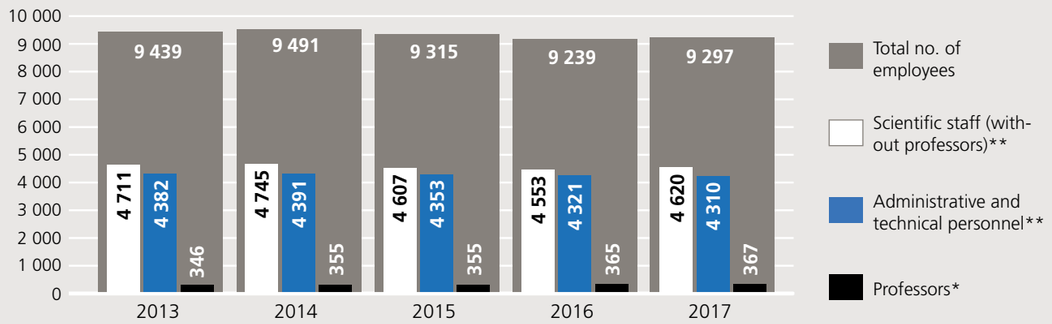
In million euros	KIT in Total	University Sector*	Large-scale Research Sector
Expenses in total	901.7	445.9	455.8
Investments in total	82.6	30.0	52.6
of these, major investments	23.1	0.0	23.1
of these, ongoing investments	59.5	30.0	29.5
Personnel expenses	554.0	309.5	244.5
Material expenses	265.1	106.4	158.7

* Figures taken from the financial statement corrected by cost items not relevant to expenses (e.g. provisions).

PERSONNEL INFORMATION

KIT Staff in Total

Staff (headcount)	2013	2014	2015	2016	2017
Total number of employees	9 439	9 491	9 315	9 239	9 297
of these, female employees	3 334	3 380	3 363	3 373	3 447
Professors*	346	355	355	365	367
of these, female professors	43	47	47	49	49
of these, junior professors	15	13	8	8	7
of these, female junior professors	6	7	3	3	2
of these, international professors	27	29	32	34	36
of these, endowed professors	8	7	8	9	9
Scientific staff (without professors)**	4 711	4 745	4 607	4 553	4 620
of these, female scientists	1 218	1 245	1 193	1 190	1 244
of these, staff financed from third-party funds	2 572	2 536	2 365	2 341	2 408
of these, international employees	907	942	933	950	990
of these, employment contracts of limited duration	3 848	3 909	3 677	3 561	3 585
of these, part-time employees	1 342	1 439	1 436	1 529	1 530
Administrative and technical personnel**	4 382	4 391	4 353	4 321	4 310
of these, female staff	2 073	2 088	2 123	2 134	2 154
of these, staff financed from third-party funds	838	812	746	736	753
of these, international employees	193	189	191	194	205
of these, employment contracts of limited duration	1 302	1 251	1 158	1 056	965
of these, part-time employees	1 024	1 052	1 058	1 112	1 110
of these, trainees and students of Baden-Württemberg Cooperative State University	454	474	471	464	432
of these, female trainees and students	146	146	139	162	152
Trainees' share in the total number of employees [%]	5	5	5	5	5



* Professors, junior professors, and executive scientists receiving W-type salary according to Article 14 KIT Act.
** Deviations from the 2016 Annual Report due to revision of the category.

Habilitations

	2013	2014	2015	2016	2017
Total	11	8	22	19	20
Men	8	7	17	16	19
Women	3	1	5	3	1

Appointments to W-3 University Professor at KIT in 2017

Name, division	Professorship	Previous employer institution
Professor Dr. Florian Bernlochner, Division V	Experimentelle Teilchenphysik	University of Bonn
Professor Dr. Achim Dittler, Division I	Mechanische Verfahrenstechnik	Daimler AG
Professor Dr. Martin Frank, Division V	Computational Science and Mathematical Methods	RWTH Aachen University
Professor Dirk Hebel, Division IV	Nachhaltiges Bauen	ETH Zürich
Professor Dr. Anne-Kristin Kaster, Division I	Biotechnologie und Mikrobielle Genetik	Leibniz Institute DSMZ-German Collection of Microorganisms and Cell Cultures, Braunschweig
Professor Dr. Torsten Kröger, Division II	Komplexe Systeme in Automation und Robotik	Google Inc.
Professor Dr. Markus Lehmkuhl, Division II	Wissenschaftskommunikation in digitalen Medien	FU Berlin
Professor Meinrad Morger, Division IV	Gebäudelehre	Technische Universität Darmstadt
Professor Dr. Reinhard Rauch, Division I	Chemische Konversion erneuerbarer Energien	Technische Universität Wien
Professor Dr. Steffen Rebennack, Division II	Stochastische Optimierung	Colorado School of Mines, USA
Professor Dr. Andreas Rietbrock, Division V	Geophysik	University of Liverpool
Professor Dr. Patrick Théato, Division I	Präparative Makromolekulare Chemie	Universität Hamburg
Professor Dr. Heike Weber, Division II	Technikkulturwissenschaft	University of Wuppertal
Professor Dr. Marwan Younis, Division III	Radarsysteme für die Raumfahrt	DLR Oberpfaffenhofen

PERSONNEL INFORMATION

Appointment to W-1 University Professor at KIT

Name, division	Professorship	Previous employer institution
Professor Dr. Matti Schneider, Division III	Juniorprofessur für Computational Micromechanics	Fraunhofer ITWM Kaiserslautern

Appointments to Apl. Professor and Honorarprofessor in 2017

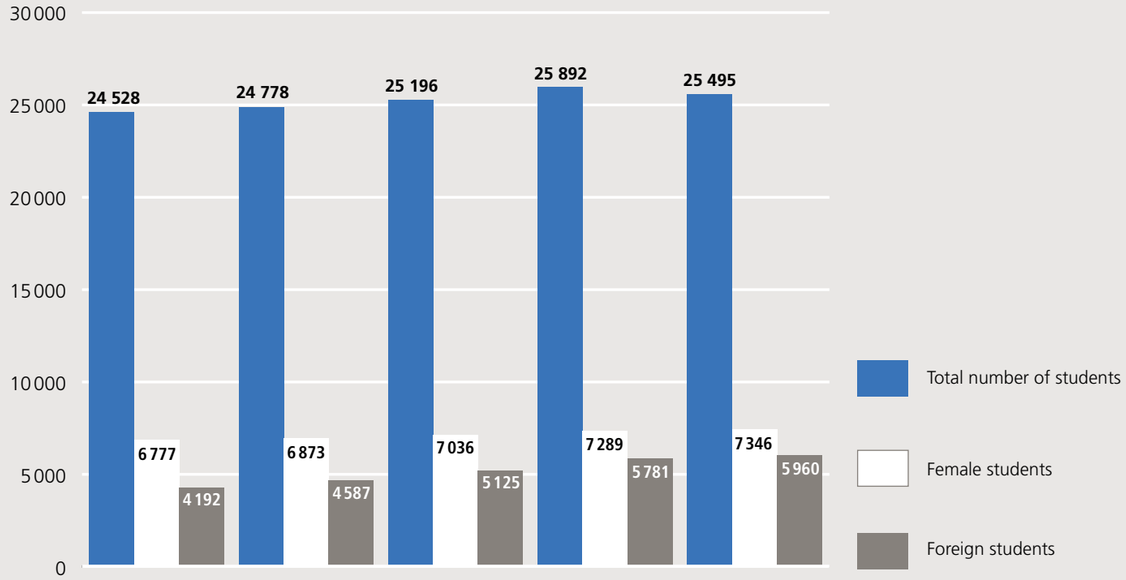
Name	Type	KIT department
PD Dr. Detlef Beckmann	Apl. Professor	Physics
Professor Dr.-Ing. Rainer Hess	Honorarprofessor	Civil Engineering, Geo- and Environmental Sciences
Professor Dr. Walter Jungmann	Apl. Professor	Humanities and Social Sciences
Professor Dr. Agnes Kontny	Apl. Professor	Civil Engineering, Geo- and Environmental Sciences
PD Dr. Michael Kunz	Apl. Professor	Physics
Professor Dipl.-Ing. Hermann Schröder	Honorarprofessor	Civil Engineering, Geo- and Environmental Sciences

Emeriti/Retirements in 2017

Name	Institute	Division
Professor Dr. Gerhard Kasper	Institute for Mechanical Process Engineering and Mechanics	Division I
Professor Dr. Harald Müller	Institute of Concrete Structures and Building Materials	Division IV
Professor Dr. Walter Nägeli	Institute of Architectural Design, Art, and Theory	Division IV
Professor Dr. Bruno Neibecker	Institute of Information Systems and Marketing	Division II
Professor Dr. Hans-Peter Schütt-Groth	Institute of Technology Futures	Division II
Professor Dr. Rudi Studer	Institute of Applied Informatics and Formal Description Methods	Division II

STUDENTS

Students in Total



Students and Desired Degrees

Desired degree	WS 2013/14	WS 2014/15	WS 2015/16	WS 2016/17	WS 2017/18
Bachelor	14 077	14 086	14 136	14 245	14 129
Master	5 256	6 819	8 181	9 193	9 424
Teacher (secondary and vocational schools)	782	750	780	823	872
Doctorate	880	809	664	555	475
State examination	95	70	50	23	14
Diploma	2 801	1 579	796	462	57
Studienkolleg	217	227	224	230	207
No degree*	420	438	365	361	317
Total	**24 528**	**24 778**	**25 196**	**25 892**	**25 495**

*No degree: In particular exchange students, who do not aim at a degree at KIT.

STUDENTS

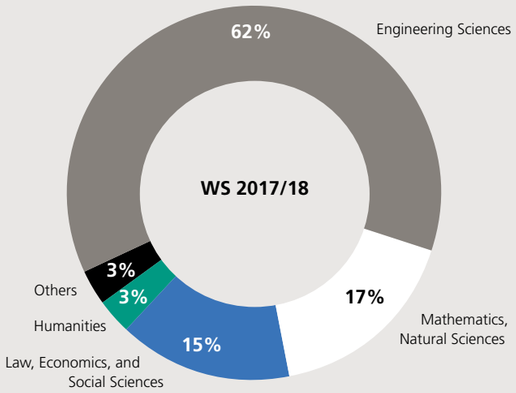
Allocation of Students to Subject Groups

Subject group	WS 2013/14	WS 2014/15	WS 2015/16	WS 2016/17	WS 2017/18
Engineering Sciences	14 086	14 481	15 204	15 785	15 671
Mathematics, Natural Sciences	4 911	4 716	4 536	4 504	4 225
Law, Economics, and Social Sciences	3 908	4 014	3 831	3 889	3 854
Humanities	809	767	832	840	872
Others	814	800	793	874	873
Total	**24 528**	**24 778**	**25 196**	**25 892**	**25 495**

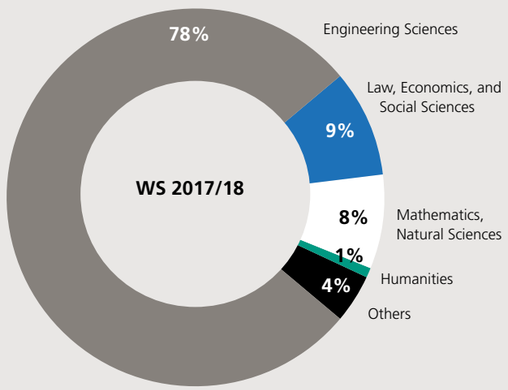
Allocation of Foreign Students to Subject Groups

Subject group	WS 2013/14	WS 2014/15	WS 2015/16	WS 2016/17	WS 2017/18
Engineering Sciences	3 055	3 429	3 951	4 483	4 674
Mathematics, Natural Sciences	393	397	391	457	447
Law, Economics, and Social Sciences	440	459	473	508	527
Humanities	75	67	70	83	81
Others	229	235	234	250	231
Total	**4 192**	**4 587**	**5 119**	**5 781**	**5 960**

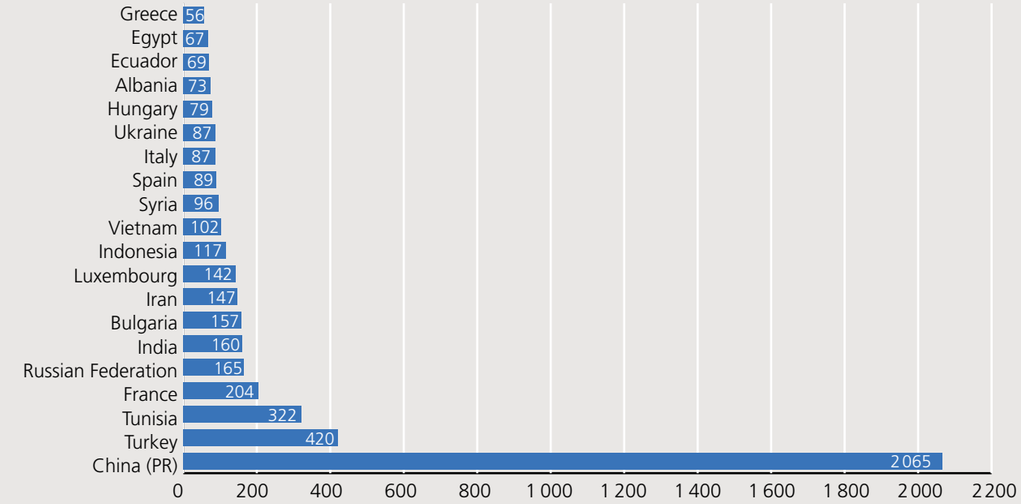
Allocation of Students to Subject Groups



Allocation of Foreign Students to Subject Groups



Home Countries of Foreign Students (Top 20 of 117)



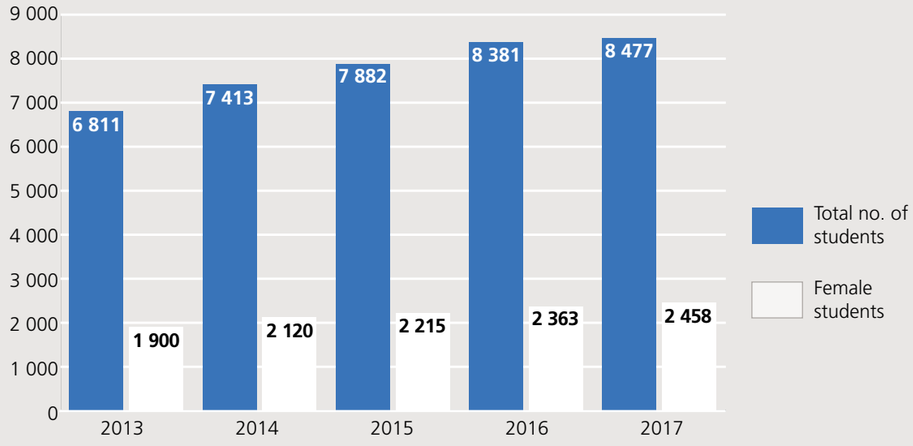
Student Beginners and Degrees Targeted in the 1st Semester*

Desired degree	2013	2014	2015	2016	2017
Bachelor	4 472	4 350	4 214	4 439	4 551
Master	1 925	2 607	3 196	3 433	3 390
Bachelor's degree in teaching at secondary schools	155	171	136	168	175
Bachelor's degree in teaching at vocational schools	16	28	32	39	37
Master's degree in teaching at vocational schools	10	6	19	17	8
Studienkolleg	233	251	285	285	316
Total	**6 811**	**7 413**	**7 882**	**8 381**	**8 477**

*Without doctoral students and exchange students, who do not aim at a degree at KIT.

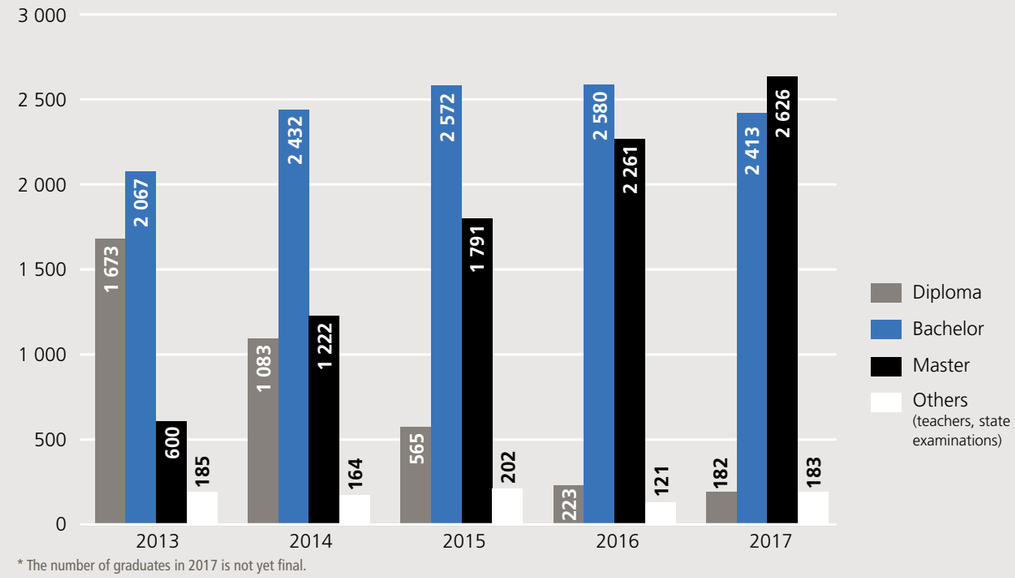
STUDENTS

Number of Student Beginners in the 1st Semester*



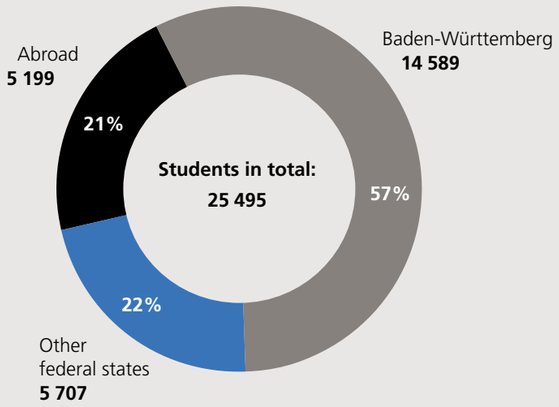
* Without doctoral students and exchange students, who do not aim at a degree at KIT.

Number of Graduates*



* The number of graduates in 2017 is not yet final.

Origin of Students in the 2017/18 Winter Semester*

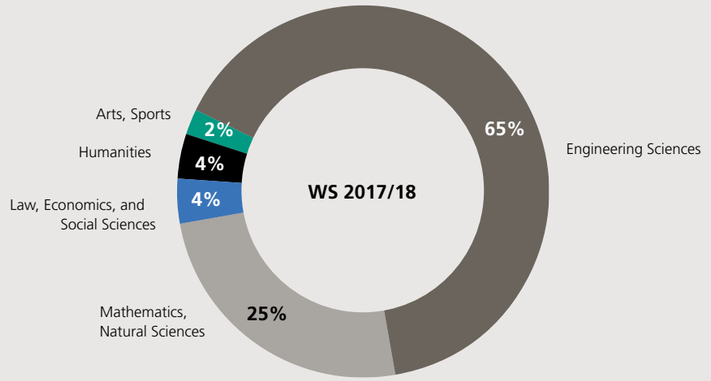


*Place of acquisition of university entrance qualification.

Region	Students
Karlsruhe city and district	4 256
Karlsruhe Regional Council District	3 928
Rest of Baden-Württemberg	6 405
Baden-Württemberg in total	14 589
Rhineland-Palatinate	1 682
Bavaria	996
North Rhine-Westphalia	932
Hesse	865
Lower Saxony	394
Other federal states	838
Germany without Baden-Württemberg	5 707
Asia	2 949
Europe	1 356
Africa	522
America	358
Australia	14
Abroad	5 199
KIT in total	**25 495**

Doctoral Candidates in the Different Subject Groups in 2017 (preliminary figures)

Subject group	Male	Female	Total
Engineering Sciences	1 682	412	2 094
Mathematics, Natural Sciences	491	309	800
Law, Economics, and Social Sciences	94	43	137
Humanities	57	56	113
Arts, Sports	23	39	62
Total	**2 347**	**859**	**3 206**



STUDENTS

Study Programs in the Area of Engineering Sciences

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Altbauinstandsetzung				●	
Architektur	●	●			German-French Double Master *(Ecole Nationale Supérieure d'Architecture de Strasbourg, France)*
Bauingenieurwesen	●	●			
Bioingenieurwesen	●	●			
Chemieingenieurwesen/Verfahrens-technik	●	●			
Electronic Systems Engineering and Management				●	
Elektrotechnik and Informations-technik	●	●			German-French Double Degrees B.Sc. and M.Sc. *(Institut National Polytechnique Grenoble, France)*
Energy Engineering and Management				●	
Financial Engineering				●	
Funktionaler and Konstruktiver Ingenieurbau – Engineering Structures		●			
Geodäsie and Geoinformatik	●	●			German-French Double Degrees B.Sc. and M.Sc. *(Institut National des Sciences Appliquées Strasbourg, France)* Double Master *(Università degli Studi di Trento, Italy)*
Green Mobility Engineering				●	
Informatik	●	●	●		Double Master Informatics *(Institut National Polytechnique Grenoble, France)* Double Master Cryptography *(Université de Rennes, France)*
Informationswirtschaft	●	●			
Management of Product Development				●	

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➔ **Study Programs in the Area of Engineering Sciences**

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Maschinenbau	●	●			German-French Bachelor´s and Master´s Program *(Arts et Métiers ParisTech, France)* German-French Bachelor´s and Master´s Program *(Institut National des Sciences Appliquées Lyon, France)* German-French Bachelor´s and Master´s Program *(Ecole Polytechnique Paris, France)* German-French Double Master *(Institut National Polytechnique Grenoble, France)* German-Bulgarian Double Degree FDIBA Cooperation *(TU Sofia, Bulgaria)* Dual Master´s Program *(Korea Advanced Institute of Science and Technology, Korea)* Double Master Vehicle or Production Technology *(CDHK, Tongji University, China)* Dual Master´s Program *(Instituto Tecnológico de Buenos Aires, Argentina)* Master´s Program ENTECH (*IST Lisboa, Portugal; Uppsala Universitet, Sweden; INP Grenoble, France)*
Mechanical Engineering (International)	●				
Materialwissenschaft and Werk-stofftechnik	●	●			
Mechatronik and Informationstechnik	●	●			
Mobilität and Infrastruktur		●			
Naturwissenschaft and Technik			●		
Optics and Photonics		●			Double Master´s Program (*Aix Marseille Université, France; Ecole Centrale de Marseille, France; Barcelona Universities, Spain)*
Production and Operations Management				●	
Regionalwissenschaft		●			Dual Master´s Degree Program *(Universidad de Concepción, Chile)*
Service Management and Engineering				●	
Water Science and Engineering		●			

STUDENTS

Study Programs in the Area of Arts, Art Science

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Kunstgeschichte	●	●			

Study Programs in the Area of Mathematics, Natural Sciences

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Angewandte Geowissenschaften	●	●			
Biologie	●	●	●		
Chemie	●	●	●		
Chemische Biologie	●	●			
Geographie			●		
Geoökologie	●	●			
Geophysik	●	●			
Lebensmittelchemie	●	●			
Mathematik	●	●	●		German-French Bachelor´s and Master´s Program *(Ecole Polytechnique Paris, France)*
Meteorologie	●	●			
Physik	●	●	●		German-French Double Master *(UFR de Physique der Université Joseph Fourier Grenoble, France)* German-French Double Master *(Ecole Polytechnique Paris, France)*
Technomathematik	●	●			
Wirtschaftsmathematik	●	●			

Study Programs in the Areas of Law, Economics, and Social Sciences

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Ingenieurpädagogik			●		
Pädagogik	●	●			
Personalentwicklung – Berufs- und Betriebspädagogik				●	
Technische Volkswirtschaftslehre	●	●			
Wirtschaftsingenieurwesen	●	●			German-French Double Degree M.Sc. *(Institut National Polytechnique Grenoble, France)* Double Master *(Linköpings Universitet, Sweden)*

Study Program in the Area of Sports

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Sport			●		
Sportwissenschaften	●	●			

Study Programs in the Area of the Humanities

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Europäische Kultur und Ideen-geschichte (European Studies)	●	●			
Germanistik / Deutsch	●	●	●		
Philosophie / Ethik			●		
Wissenschaft - Medien - Kommunikation	●	●			

RESEARCH

Coordinated Research Programs

Collaborative Research Centers with KIT Being the Coordinating University

Number	Title	Spokesperson	Duration
SFB 1173/1	Wave Phenomena: Analysis and Numerics	Professor Dr. Marlis Hochbruck, Institute for Applied and Numerical Mathematics	2015 – 2019
SFB 1176/1	Molekulare Strukturierung weicher Materie	Professor Dr. Michael Meyer, Institute of Organic Chemistry	2016 – 2019

The typical budget approved for a Collaborative Research Center / Transregio Project is about EUR 1 to 3 million per year of duration. The duration refers to the complete project. Partial projects at KIT may deviate.

DFG-funded Research Units of KIT with KIT Being the Coordinating University

Number	Title	Spokesperson	Duration
FOR 1546	Rechnergestützte kooperative Trassenplanung in mehrskaligen 3-D-Stadt- und Bauwerksmodellen	Professor Dr. Martin Breunig, Geodetic Institute	2011 – 2017
FOR 1548	Geometry and Physics of Spatial Random Systems	Professor Dr. Günter Last, Institute of Stochastics	2011 – 2017
FOR 1598	From Catchments as Organised Systems to Models based on Dynamic Functional Units – CAOS	Professor Dr. Erwin Zehe, Institute for Water and River Basin Management	2011 – 2017
FOR 1650	Dislocation based Plasticity	Professor Dr. Peter Gumbsch, Institute for Applied Materials	2011 – 2017
FOR 2383	Erfassung und Steuerung dynamischer lokaler Prozesszustände in Mikroreaktoren mittels neuer in-situ-Sensorik	Professor Dr. Roland Dittmeyer, Institute for Micro Process Engineering	2016 – 2019

The typical budget approved for a DFG-funded research unit is about EUR 0.4 to 1.5 million per year of duration. The duration refers to the complete project. Partial projects at KIT may deviate.

Collaborative Research Centers with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
SFB TRR 88/2	Kooperative Effekte in homo- und heterometallischen Komplexen (3MET)	Professor Dr. Gereon Niedner-Schatteburg, TU Kaiserslautern (Spokesperson) Professor Dr. Manfred Kappes, Institute of Physical Chemistry and Institute of Nanotechnology, KIT	2011 – 2018
SFB TRR 89/2	Invasives Rechnen (InvasIC)	Professor Dr. Jürgen Teich, Friedrich-Alexander-Universität Erlangen-Nürnberg (Spokesperson) Professor Dr. Jörg Henkel, Institute of Computer Engineering, KIT	2010 – 2018
SFB TRR 150/1	Turbulent chemisch reagierende Mehrphasenströmungen in Wandnähe	Professor Dr. Johannes Janicka, Fachgebiet Energie- und Kraftwerkstechnik, TU Darmstadt (Spokesperson) Professor Dr. Olaf Deutschmann, Institute for Chemical Technology and Polymer Chemistry, KIT	2015 – 2018
SFB TRR 165/1	Waves to Weather: Wellen, Wolken, Wetter	Professor George C. Craig, Meteorologisches Institut, LMU München Professor Volkmar Wirth, Institut für Physik der Atmosphäre, JGU Mainz Professor Peter Knippertz, Institute of Meteorology and Climate Research, KIT	2015 – 2019

The typical budget approved for a Collaborative Research Center / Transregio Project amounts to about EUR 1 to 3 million per year of duration. The duration refers to the complete project. Partial projects of KIT may deviate.

DFG-funded Research Units with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
FOR 1095	Stratospheric Change and its Role for Climate Prediction (SHARP)	Professor Dr. Ulrike Langematz, Freie Universität Berlin (Spokesperson) Dr. Björn-Martin Sinnhuber, Dr. Gabriele Stiller, Institute of Meteorology and Climate Research, KIT	2009 – 2017
FOR 1246	Kilimanjaro ecosystems under global change	Professor Dr. Ingolf Steffan-Dewenter, Universität Würzburg (Spokesperson) Dr. Ralf Kiese, Institute of Meteorology and Climate Research, KIT	2010 – 2018

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➔ DFG-funded Research Units with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
FOR 1451	Exploring mechanisms underlying the relationship between biodiversity and ecosystem functioning	Professor Dr. Nico Eisenhauer, Universität Leipzig, Deutsches Zentrum für Integrative Biodiversitätsforschung (Spokesperson) Professor Dr. Wolfgang Wilcke, Institute of Geography and Geoecology, KIT	2010 – 2018
FOR 1498	Alkali-Kieselsäure-Reaktionen in Betonbauteilen bei gleichzeitiger zyklischer Beanspruchung und externer Alkalizufuhr	Professor Dr. Rolf Breitenbücher, Ruhr-Universität Bochum (Spokesperson) Professor Dr. Harald S. Müller, Institute of Concrete Structures and Building Materials, KIT	2011 – 2018
FOR 1525	INUIT – Ice Nuclei research UnIT	Professor Dr. Joachim Curtius, Universität Frankfurt am Main (Spokesperson) Professor Dr. Corinna Hoose, Dr. Alexei Kiselev, Professor Dr. Thomas Leisner, Dr. Ottmar Möhler, Institute of Meteorology and Climate Research, KIT	2011 – 2017
FOR 1701	Introducing Non-Flooded Crops in Rice-Dominated Landscapes: Impact on Carbon, Nitrogen and Water Cycles (ICON)	Professor Dr. Volkmar Wolters, Universität Gießen (Spokesperson) Dr. Ralf Kiese, Professor Dr. Klaus Butterbach-Bahl, Institute of Meteorology and Climate Research, KIT	2011 – 2017
FOR 1756	Functional dynamics of cell contacts in cellular assemblies and migratory cells	Professor Dr. Jörg Großhans, Zentrum Biochemie und Molekulare Zellbiologie, Universitätsmedizin Göttingen (Spokesperson) Dr. Jubin Kashef, Dr. Clemens Franz, Zoological Institute, KIT	2011 – 2017
FOR 1993	Multifunktionale Stoff- und Energiewandlung	Professor Dr. Burak Atakan, Universität Duisburg-Essen (Spokesperson) Professor Dr. Olaf Deutschmann, Institute for Chemical Technology and Polymer Chemistry, KIT Professor Dr. Ulrich Maas, Dr. Robert Schießl, Institute of Technical Thermodynamics, KIT	2013 – 2019

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➔ DFG-funded Research Units with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
FOR 2063	The Epistemology of the Large Hadron Collider	Professor Dr. Gregor Schiemann, Interdisziplinäres Zentrum für Wissenschafts- und Technikforschung, Bergische Universität Wuppertal (Spokesperson) Professor Dr. Rafaela Hillerbrand, Institute of Philosophy, KIT	2016 – 2019
FOR 2083	Integrierte Planung im öffentlichen Verkehr	Professor Dr. Anita Schöbel, Institut für Numerische und Angewandte Mathematik, Georg-August-Universität Göttingen (Spokesperson) Professor Dr. Dorothea Wagner, Institute of Theoretical Informatics, KIT	2015 – 2018
FOR 2093	Memristive Bauelemente für neuronale Systeme	Professor Dr. Hermann Kohlstedt, Institut für Elektrotechnik und Informationstechnik Arbeitsgruppe Nanoelektronik, Christian-Albrechts-Universität zu Kiel (Spokesperson) Dr. Kiran Chakravadhanula, Institute of Nanotechnology, KIT	2014 – 2017
FOR 2290	Understanding Intramembrane Proteolysis	Professor Dr. Dieter Langosch, Wissenschaftszentrum Weihenstephan, Lehrstuhl für Chemie der Biopolymere, Technische Universität München (Spokesperson) Professor Dr. Burkhard Luy, Institute of Organic Chemistry, KIT	2015 – 2018
FOR 2325	Interactions at the Neurovascular Interface	Professor Dr. Ralf H. Adams, Max-Planck-Institut für molekulare Biomedizin, Münster (Spokesperson) Professor Dr. Ferdinand le Noble, Zoological Institute, KIT	2016 – 2019
FOR 2337	Denitrification in Agricultural Soils: Integrated Control and Modelling at Various Scales (DASIM)	Professor Dr. Christoph Müller, Institut für Pflanzenökologie, Justus-Liebig-Universität Gießen (Spokesperson) Professor Dr. Klaus Butterbach-Bahl, Institute of Meteorology and Climate Research, KIT	2015 – 2018

The typical budget approved for a DFG-funded research unit amounts to about EUR 0.4 to 1.5 million per year of duration. The duration refers to the complete project. Partial projects of KIT may deviate.

RESEARCH

ERC Grants

Name, institute, division	Title of project	Duration
Professor Dr. Dennis Hofheinz, Institute of Computer Engineering, Division II	ERC Consolidator Grant PREP-CRYPTO – Preparing Cryptography for Modern Applications	07/2017 – 06/2022
Professor Dr. Corinna Hoose, Institute of Meteorology and Climate Research, Division IV	ERC Starting Grant C2Phase – Closure of the Cloud Phase	04/2017 – 03/2022
Professor Dr. Jan Korvink, Institute of Microstructure Technology, Division III	ERC Advanced Grant NMCEL – A modular micro nuclear magnetic resonance in vivo platform for the nematode Caenorhabditis elegans	07/2012 – 06/2017
Dr. Pavel Levkin, Institute of Toxicology and Genetics, Division I	ERC Starting Grant DropCellArray – DropletMicroarrays: Ultra High-Throughput Screening of Cells in 3-D Micro-environments	02/2014 – 01/2019
Professor Dr. Holger Puchta, Botanical Institute, Division I	ERC Advanced Grant CRISBREED – Multidimensional CRISPR/Cas mediated engineering of plant breeding	10/2017 – 09/2022
Dr. Martin Weides, Physikalisches Institut, Division V	ERC Consolidator Grant QuantumMagnonics – Interfacing spin waves with superconducting quantum circuits for single magnon creation and detection	06/2015 – 05/2020
Professor Dr. Wolfgang Wernsdorfer, Physikalisches Institut, Division V	ERC Advanced Grant MoQuOS – Molecular Quantum Opto-Spintronics	07/2017 – 06/2022

The total budget of an ERC Grant ranges from EUR 1.5 million (Starting Grant) to EUR 2.5 million (Advanced Grant).

Young Investigators Groups

Emmy Noether Junior Research Groups

Name, institute, division	Title of group	Duration
Dr. Frank Biedermann, Institute of Nanotechnology, Division V	In vitro und in vivo Sensing von (Bio)organischen Analyten mit neuartigen Hoch-Affinitätsrezeptoren	10/2016 – 09/2021
Dr. Benjamin Flavel, Institute of Nanotechnology, Division V	Kohlenstoffnanoröhren, Solarzellen und Sensoren	06/2013 – 12/2018
Dr. Christian Greiner, Institute for Applied Materials, Division III	Size effects and microstructure evolution in textured metal surfaces during reciprocating sliding	10/2012 – 03/2019

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➔ Emmy Noether Junior Research Groups

Name, institute, division	Title of group	Duration
Dr. Manuel Hinterstein, Institute for Applied Materials, Division III	BNT-BT als zukünftige bleifreie Funktionswerkstoffe für PTCR-. Aktor- und Sensoranwendungen	04/2016 – 03/2021
Dr. Lars Pastewka, Institute for Applied Materials, Division III	Korrelation von Reibung und Verschleiß amorpher Materialien	01/2015 – 12/2017
Dr. Nadine Rühr, Institute of Meteorology and Climate Research, Division IV	Die Auswirkungen von Extremereignissen auf den Kohlenstoff- und Wasserkreislauf	10/2016 – 09/2019
Dr. Karsten Woll, Institute for Applied Materials, Division III	Pulsed Metallurgy on Metallic Thin Films	01/2017 – 12/2022

Average total budget of an Emmy Noether Group: EUR 1.2 million to 1.8 million plus valid program lump sum.

Helmholtz Young Investigators Groups

Name, institute, division	Title of group	Duration
Dr. Hartwig Anzt, Steinbuch Centre for Computing, Division II	Fixed-Point Methods for Numerics at Exascale (FiNE)	05/2017 – 04/2022
Dr. Anna Böhmer, Institute of Solid State Physics, Division V	Strain Tuning of Correlated Electronic Phases	10/2017 – 09/2022
Dr. Damian Cupid, Institute for Applied Materials, Division III	Integrated Computational Materials Engineering (ICME) of Electrochemical Storage Systems	04/2014 – 06/2017
Dr. Christian Grams, Institute of Meteorology and Climate Research, Division IV	Sub-seasonal atmospheric predictability: understanding the role of diabatic outflow	10/2017 – 09/2022
Dr. Matthias Mauder, Institute of Meteorology and Climate Research, Division IV	Capturing All Relevant Scales of Biosphere-Atmosphere Exchange – The Enigmatic Energy Balance Closure Problem	02/2012 – 01/2018
Dr. Ulrich Paetzold, Institute of Microstructure Technology, Division III	Nanophotonics for Perovskite/Silicon Multijunction Solar Cells	05/2016 – 04/2021

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➔ Helmholtz Young Investigators Groups

Name, institute, division	Title of group	Duration
Dr. Alexander Schug, Steinbuch Centre for Computing, Division II	Multi-scale Simulations of Regulatory RNAs and Two-Component signal Transduction	04/2011 – 08/2018
Dr. Miriam Sinnhuber, Institute of Meteorology and Climate Research, Division IV	Solar variability, climate, and the role of the mesosphere/ lower thermosphere	09/2010 – 08/2017
Dr. Svetoslav Stankov, Institute for Synchrotron Radiation, Division V	Interplay between structure and lattice dynamics in epi-taxial rare earth nanostructures	05/2010 – 12/2018
Dr. Manuel Tsotsalas, Institute of Functional Interfaces, Division I	Hierarchically Structured Biomaterials	01/2016 – 12/2020
Dr. Ralf Matthias Ulrich, Institute for Nuclear Physics, Division V	Interpretation of Ultra-High Energy Cosmic Ray Data Using LHC Measurements	04/2011 – 12/2017
Dr. Kathrin Valerius, Institute for Nuclear Physics, Division V	Analysis of KATRIN data to measure the neutrino mass and search for new physics	07/2014 – 06/2019
Dr. Tonya Vitova, Institute for Nuclear Waste Disposal, Division III	Advanced synchrotron-based systematic investigations of actinide (An) and lanthanide (Ln) systems to understand and predict their reactivity	07/2011 – 10/2019
Dr. Frank Weber, Institute of Solid State Physics, Division V	Competing Phases in Superconducting Materials	01/2012 – 12/2018
Dr. Roswitha Zeis, Helmholtz Institute Ulm, Division I	Investigation of Overpotentials in High Temperature Proton Exchange Membrane Fuel Cells	05/2010 – 02/2020

The annual budget of a group typically is EUR 1.25 to 1.8 million.

Young Investigators Group

Name, institute, division	Title of group	Duration
Dr. Luise Kärger, Institute of Vehicle System Technology, Division III	Gewichtsoptimierte Fahrzeugstrukturen durch maß-geschneiderte Hochleistungsfaserverbunde (supported by the Vector Foundation)	07/2014 – 06/2018

The annual budget typically amounts to EUR 80,000 plus a non-recurrent investment allowance of EUR 50,000.

BMBF Junior Research Groups

Name, institute, division	Title of group	Duration
Dr. Gerardo Hernandez-Sosa, Light Technology Institute, InnovationLab Group, Division III	BIOLicht – Gedruckte biologisch abbaubare organische lichtemittierende Bauteile	11/2014 – 10/2018
Dr. Samiro Khodayar, Institute of Meteorology and Climate Research, Division IV	Vorhersagemodelle für Extremwetterereignisse unter einem geänderten Klima – Abschätzung des mehrskaligen Einflusses aufgrund der Rückkopplung zwischen Boden und Atmosphäre	08/2014 – 07/2018
Dr. Julia Maibach, Institute for Applied Materials, Division III	InSEIde: Grenzflächen in Lithium-Ionen-Batterien verstehen und manipulieren	09/2017 – 09/2022
Dr. Bastian E. Rapp, Institute of Microstructure Technology, Division III	Fluoropor – chemisch inertes, mikro- bis nanoporöses "Teflon" mit einstellbarem Benetzungsverhalten	10/2014 – 09/2018
Dr. Cornelia Lee-Thedieck, Institute of Functional Interfaces, Division I	BioInterfaces Stammzellen-Material-Wechselwirkung	10/2013 – 09/2019
Dr. Aiko Voigt, Institute of Meteorology and Climate Research, Division IV	Wolken-Strahlungs-Wechselwirkungen mit der nord-atlantischen Sturmzugbahn (CONSTRAin)	09/2016 – 08/2021

The total budget of a group typically ranges from EUR 1.5 to 3.2 million.

Other Junior Research Groups and Funding Measures

Name, institute, division	Title of group	Duration	Funding
Dr. Stefanie Betz, Institute of Applied Informatics and Formal Description Methods, Division II	Nachhaltigkeit in der Software-entwicklung	02/2015 – 01/2020	Margarete von Wrangell Habilitation Grant of MWK and others
Dr. Christian Brandl, Institute for Applied Materials, Division III	Computergestützte Nanomechanik von Materialien	05/2015 – 04/2018	DFG and others
Dr. Dominic Bresser, Helmholtz Institute Ulm, Division I	Neuartige Elektrodenmaterialien für Wiederaufladbare Elektro-chemische Energiespeicher (NEW E^2)	05/2017 – 06/2020	Vector Foundation

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RESEARCH

➔ Other Junior Research Groups and Funding Measures

Name, institute, division	Title of group	Duration	Funding
Dr. Guillaume Delaittre Institute of Toxicology and Genetics, Division I	Polymeric (Nano)Materials for Biotechnology and Biology	03/2013 – 12/2018	BMBF
Dr. Azad M. Emin, Institute of Process Engineering in Life Sciences, Division I	Extrusion of Biopolymeric Systems	08/2016 – 07/2019	DFG and others
Dr. Dietmar Gallistl, Institute for Applied and Numerical Mathematics, Division V	Numerische Mehrskalen-methoden	05/2017 – 08/2019	Junior Research Group within a CRC
Dr. Andreas Haupt, Institute for Sociology, Media, and Cultural Sciences, Division II	Economic Inequality and Labor Markets	01/2015 – 01/2018	Elite program for postdocs of the Baden-Württemberg Foundation, DFG
Dr. Michael Hirtz, Institute of Nanotechnology, Division V	Dip-Pen Nanolithography and Related Techniques	03/2011 – 12/2020	DFG and others
Dr. rer. pol. Daniel Hoang, Institute for Finance, Banking, and Insurance, Division II	Unternehmensfinanzierung	10/2016 – 09/2019	DFG, Funk Foundation
Dr. Sebastian Höfener, Institute of Physical Chemistry, Theoretical Chemistry Group, Division I	Molecular electronic structure methods in complex environ-ments	02/2017 – 12/2019	DFG and others
Dr. Patrick Jochem, Institute for Industrial Production, Division II	Transport und Energie	10/2009 – 07/2020	BMWi and others
Dr. Pavel Levkin, Institute of Toxicology and Genetics, Division I	DropCellArray – DropletMicroar-rays: Ultra High-Throughput Screening of Cells in 3D Micro-environments	02/2014 – 01/2019	ERC Starting Grant
Dr. Rainer Mandel Institute for Analysis, Division V	Nichtlineare Helmholtz-gleichungen	05/2017 – 06/2019	Junior Research Group within a CRC
Dr. Ingo Münch, Institute for Structural Analysis, Division IV	Ferroelectric nanostructures for energy harvesting	02/2017 – 02/2018	DFG and others

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➔ Other Junior Research Groups and Funding Measures

Name, institute, division	Title of group	Duration	Funding
Dr. Philipp Niemann, Institute for German Studies: Literature, Language, Media, Division II	Science in Presentations	12/2015 – 11/2018	Klaus Tschira Foundation
Dr. Zbigniew Pianowski, Institute of Organic Chemistry, Division I	Chemical Biology, Supramo-lecular Systems and Prebiotic Chemistry	10/2016 – 09/2019	DFG
Dr. Ioan M. Pop, Physikalisches Institut, Division V	Supraleitende Quantenelektronik	10/2015 – 09/2020	Alexander von Humboldt Foundation
Dr. Achim Rettinger, Institute of Applied Informa-tics and Formal Description Methods, Division II	Adaptive Data Analytics	06/2014 – 06/2020	BMBF and EU
Dr.-Ing. Andy Rupp, Institute of Theoretical Informatics, Division II	CyPhyCrypt	07/2017 – 09/2019	DFG, KASTEL
Dr. Frank Schröder, Institute for Nuclear Physics, Division V	Tunka-Rex-Experiment	02/2017 – 12/2017	DFG
Dr.-Ing. Katrin Schulz, Institute for Applied Materials, Division III	Modellierung plastischer Verformungen in Metallen auf der Mikroskala	01/2016 – 12/2020	Margarete von Wrangell Habilitation Grant of MWK and others
Dr. Philipp Schuster, Institute for Finance, Banking, and Insurance, Division II	Liquiditätseffekte auf Fi-nanzmärkten	05/2017 – 09/2019	DFG and others
Dr. Martin Weides, Physikalisches Institut, Division V	QuantumMagnonics – Inter-facing spin waves with super-conducting quantum circuits for single magnon creation and detection	06/2015 – 05/2020	ERC Consolidator Grant

RESEARCH

Junior Professorships

Name, institute, division	Area	Duration
Junior Professor Dr. Andreas Chr. Braun, Institute of Regional Science, Division IV	Juniorprofessur für Risikoorientierte Regionalentwicklung	05/2015 – 05/2019
Junior Professor Dr. Anne Koziolek, Institute for Program Structures and Data Organization, Division II	Juniorprofessur für Softwaretechnik	02/2013 – 10/2018
Junior Professor Dr. Henning Meyerhenke, Institute of Theoretical Informatics, Division II	Juniorprofessur Forschungsgruppe Paralleles Rechnen	10/2011 – 09/2017
Junior Professor Dr. Boris Neubert, Institute for Visualization and Data Analysis, Division II	Juniorprofessur für Visual Computing	04/2015 – 03/2019
Junior Professor Dr. Jens Rottmann-Matthes, Institute for Analysis, Division V	Juniorprofessur für Zeitabhängige partielle Differentialgleichungen	09/2013 – 12/2017
Junior Professor Dr. Matti Schneider, Institute of Engineering Mechanics, Division III	Juniorprofessur für Computational Micromechanics	09/2017 – 08/2021
Junior Professor Dr. Katharina Schratz, Institute for Applied and Numerical Mathematics, Division V	Juniorprofessur für Zeitabhängige partielle Differentialgleichungen	09/2013 – 08/2019
Junior Professor Dr. Petra Schwer, Institute for Algebra and Geometry, Division V	Juniorprofessur für Metrische Geometrie	10/2014 – 09/2018
Junior Professor Dr. Thorsten Stein, Institute of Sports and Sports Science, Division II	Juniorprofessur für Sportwissenschaft mit dem Schwerpunkt Bewegungswissenschaft und Biomechanik	04/2013 – 04/2019

Graduate Schools Funded by the DFG or Helmholtz Association

Graduate School	Funded by	Spokesperson / participant	Duration
Karlsruhe School of Optics & Photonics (KSOP)	DFG	Professor Dr. Ulrich Lemmer, Light Technology Institute	2006 – 2018
Karlsruher Schule für Elementarteilchen- und Astroteilchenphysik: Wissenschaft und Technologie (KSETA)	DFG	Professor Dr. Ulrich Nierste, Institute for Theoretical Particle Physics	2012 – 2018
Graduiertenschule für Klima und Umwelt (GRACE)	HGF	Professor Dr. Stefan Hinz, Institute of Photogrammetry and Remote Sensing	2011 – 2022

Research Training Groups Funded by the DFG or Helmholtz Association

Research Training Group	Funded by	Spokesperson / participant	Duration
Prozessketten in der Fertigung: Wechselwirkung, Modellbildung und Bewertung von Prozesszonen	DFG	Professor Dr. Volker Schulze, Institute of Production Science	2008 – 2017
Elementarteilchenphysik bei höchster Energie und höchster Präzision	DFG	Professor Dr. Dieter Zeppenfeld, Institute for Theoretical Physics	2011 – 2020
Molekulare Architekturen für die fluoreszente Bildgebung von Zellen	DFG	Professor Dr. Hans-Achim, Wagenknecht, Institute of Organic Chemistry	2015 – 2019
Integrierte Entwicklung kontinuierlich-diskontinuierlich langfaserverstärkter Polymerstrukturen	DFG	Professor Dr. Thomas Böhlke, Institute of Engineering Mechancis Together with: University of Waterloo, University of Western Ontario, University of Windsor (all Canada)	2015 – 2019
Energiezustandsdaten – Informatikmethoden zur Erfassung, Analyse und Nutzung	DFG	Professor Dr. Klemens Böhm, Institute for Program Structures and Data Organization	2016 – 2020
Asymptotische Invarianten und Limiten von Gruppen und Räumen	DFG	Professor Dr. Roman Sauer, Institute for Algebra and Geometry Together with: Professor Dr. Anna Wienhard, Mathematisches Institut, Ruprecht-Karls-Universität Heidelberg	2016 – 2021
Simulation mechanisch-elektrisch-thermischer Vorgänge in Lithium-Ionen-Batterien	DFG	Professor Dr.-Ing. Thomas Wetzel, Institute of Thermal Process Engineering	2017 – 2021
Energy Related Catalysis	HGF	Professor Dr. Olaf Deutschmann, Institute for Chemical Technology and Polymer Chemistry	2010 – 2017
Helmholtz International Research School for Teratronics – HIRST	HGF	Professor Dr. Christian Koos, Institute of Microstructure Technology	2012 – 2018
Mechanisms and Interactions of Climate Change in Mountain Regions MICMoR	HGF	Professor Dr. Hans Peter Schmid, Institute of Meteorology and Climate Research – Atmospheric Environmental Research	2012 – 2019
Energy Scenarios – Construction, Assessment and Impact	HGF	Professor Dr. Armin Grunwald, Institute for Technology Assessment and Systems Analysis	2011 – 2019
IMD – Helmholtz Research School on "Integrated Materials Development for Novel High-temperature Alloys"	HGF	Professor Dr. Martin Heilmaier, Institute for Applied Materials	2013 – 2018

INNOVATION

Innovation Characteristics

Year	Invention disclosures	Priority-establishing patent applications	Property rights (existing)	Royalties [million euros]	New companies (spinoffs)	Participation in spinoffs
2013	129	52	1 874	2.18	25 (7)	6
2014	133	77	1 884	2.16	33 (7)	6
2015	119	59	1 902	2.04	18 (8)	6
2016	127	55	2 000	1.70	21 (10)	7
2017	124	55	1 965	1.44	29 (10)	7

Establishment of New Companies in 2017

Spinoffs	Startups
ACT Air Coating Technologies GmbH	49nord GmbH
Lumobiotics uG	BestFit GbR
Memetis GmbH	Blueflower UG
Quorrection GmbH	Colusto UG
Renumics GmbH	Eatapple GbR
Risklayer UG	Friedhofsglück GbR
SciMo – Elektrische Hochleistungsantriebe GmbH	Guardian Horse GbR
Stochastic Combinatorics GbR	Hippogriff AB
Vanguard Automation GmbH	Lackey GbR
Vitrum 3D GbR	Melody Scanner GbR
	Nesto Software GmbH
	Polunio GbR
	Ridy GbR
	SmartCase GbR
	Smartivate GbR
	Trino Life GbR
	Usertimes GbR
	Vanory GmbH
	winerisk GbR

AWARDS

External Awards

(see separate chapter of this Annual Report from page 80)

KIT Department Teaching Awards

KIT Department	Award winners
Architecture	Dr. Alexandra Axtmann
Civil Engineering, Geo- and Environmental Sciences	Dr. Christoph Herrmann, Dr. Michael Illner, Dr. Manfred Juretzko, Dr. Paul Vincent Kuper, Torsten Lauer, Dr. Thomas Ulrich, Dipl. Martin Vetter, Dr. Karl Zippelt
Chemistry and Biosciences	Professor Dr. Reinhard Fischer
Chemical and Process Engineering	Professor Dr. Steffen Grohmann
Electrical Engineering and Information Technology	Professor Dr. Thomas Zwick
Humanities and Social Sciences	Dr. Thomas Mikhail
Informatics	Professor Dr. Gregor Snelting
Mechanical Engineering	Professor Dr. Kay André Weidenmann, Dr. Joachim Binder
Mathematics	Professor Dr. Frank Herrlich
Physics	Dr. Ulrich Corsmeier, Professor Dr. Andreas Fink, Bernhard Mühr
Economics and Management	Professor Dr. Oliver Grothe, Professor Dr. Melanie Schienle

Awards for Doctoral Researchers

KIT Doctoral Awards

Name	Institute
Dr. Daniel Bahro	Light Technology Institute
Dr. Pascal Friederich	Institute of Nanotechnology
Dr. Gustavo Lenis	Institute of Biomedical Engineering

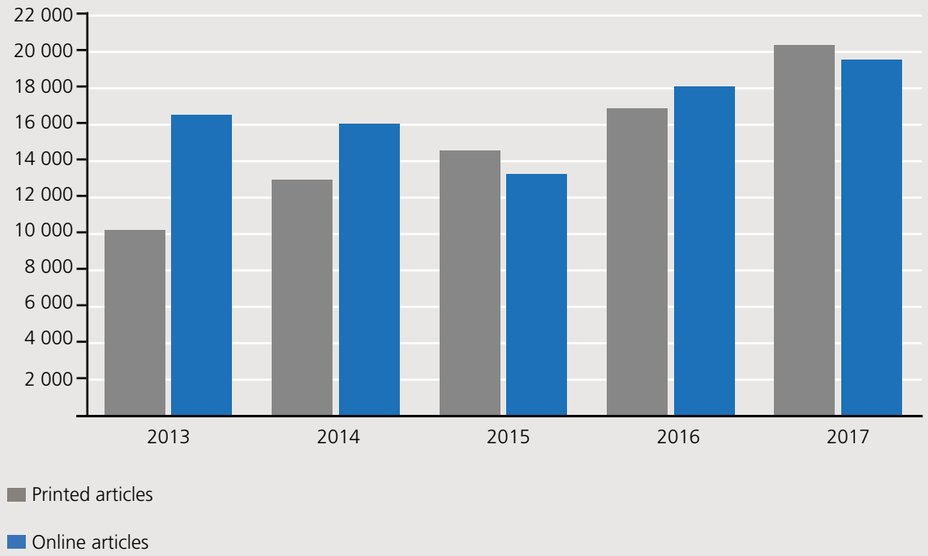
Other Doctoral Awards

Name	Institute
Dr. Emma Järvinen	Institute of Meteorology and Climate Research
Dr. Konstantin Frölich	Institute for Applied Materials
Christoph Hank	Fraunhofer Institute for Solar Energy Systems

MEDIA/PUBLICATIONS

Development of Visibility in the Media

	2013	2014	2015	2016	2017
Printed articles	10 207	12 968	14 609	16 913	20 372
Online articles	16 562	16 046	13 309	18 098	19 599



Publications

Publications in the year	2013	2014	2015	2016	2017
Publications of researchers of KIT	8 093	7 986	6 597	7 655	7 809
of these, books and proceedings	1 290	843	893	821	871
of these, articles in proceedings	2 094	1 831	829	953	1 079
of these, articles in journals	2 440	2 996	2 386	3 713	3 739
of these, in WoS- or Scopus-referenced journals	n.a.	n.a.	2 073	3 510	4 113
of these, open access articles	n.a.	n.a.	903	1 044	1 516

RANKINGS

National Rankings

		2013	2014	2015	2016	2017
Wirtschaftswoche	Electrical Engineering	2	2	4	2	2
	Informatics	1	1	5	2	1
	Mechanical Engineering	3	1	4	3	2
	Natural Sciences	5	8	–	7	7
	Business Engineering	2	1	3	2	2

International Rankings

		2013	2014	2015	2016	2017
National Taiwan University Ranking	International – Overall	185	190	192	198	211
	International – Natural Sciences	51	52	49	53	55
	International – Engineering Sciences	61	79	58	80	81
	National – Overall	14	18	18	18	19
	National – Natural Sciences	1	1	1	1	1
	National – Engineering Sciences	1	1	1	1	1
QS World University Rankings	International – Overall	116	127	93	98	107
	International – Natural Sciences	34	34	34	–	29
	International – Engineering Sciences & IT	33	47	62	–	38
	National – Overall	6	5	4	4	4
	National – Natural Sciences	3	3	3	–	3
	National – Engineering Sciences	3	4	4	–	4
Times Higher Education	International – Overall	154	165	138	144	133
	International – Natural Sciences	–	–	46	68	61
	International – Engineering Sciences	52	56	48	60	55
	National – Overall	9	11	14	14	14
	National – Natural Sciences	–	–	4	9	7
	National – Engineering Sciences	3	3	3	4	4
Academic Ranking of World Universities	International – Overall	201-300	201-300	201-300	201-300	201-300
	International – Natural Sciences	101-150	76-100	76-100	51-75	–
	International – Engineering Sciences	76-100	101-150	101-150	151-200	–
	National – Overall	15-23	14-22	14-21	15-21	16-22

MISCELLANEOUS

Sustainability

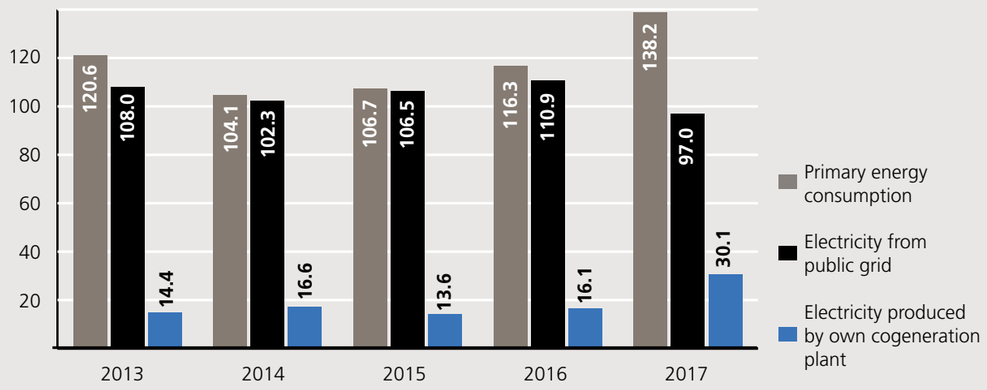
CO_2 Emissions of Heating Power Plants

	2013	2014	2015	2016	2017
Heating plant CO_2 [t/a]	14 936	11 091	12 580	16 361	10 671
Cogeneration plant CO_2 [t/a]	6 714	7 604	6 281	4 205	6 496
Total CO_2 [t/a]	21 650	18 695	18 861	20 566	17 167
Allocated CO_2 certificates [t/a]	13 968	12 501*	11 073*	9 688*	8 346*

* Due to excessive, not needed CO_2 certificates, no further CO_2 certificates had to be purchased.

Primary Energy Consumption, Energy Production

Type of energy	2013	2014	2015	2016	2017
Primary energy consumption [GWh]	120.6	104.1	106.7	116.3	138.2
Electricity from the public grid [GWh]	108	102.3	106.5	110.9	97.0
Electricity produced by own cogeneration plant [GWh]	14.4	16.6	13.6	16.1	30.1
Electricity produced by own photovoltaics facilities [GWh]	–	–	1.0	1.0	1.0
Heat produced (district heating power plant + cogeneration plant) [GWh]	84.1	65.9	71.4	77.3	78.9
Heat, weather-adjusted [GWh]	79.3	80.3	74.4	77.3	78.1



Supply and Waste Management Services

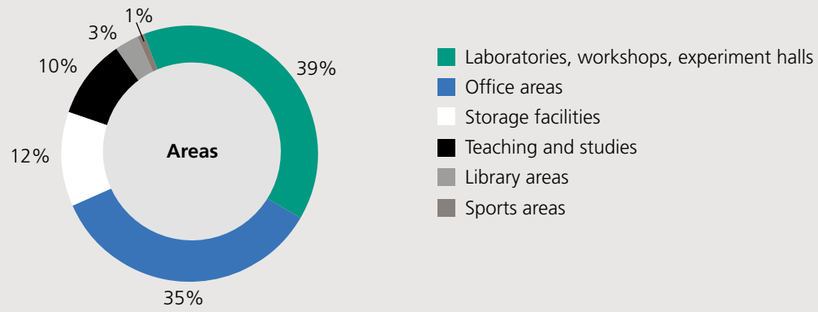
	2015		2016		2017	
Type of service	CN	CS*	CN	CS*	CN	CS*
Electricity supply [GWh]	78	53	84	55	80	54
Heat supply [GWh]	45	43	51	44	41	44
Weather-adjusted [GWh]	47	48	51	44	40	44
Water supply [m³]	130 319	236 948	116 512	224 257	107 543	222 970
Compressed air generation [million m³]	8	–	7.9	–	6.3	–
Sewage disposal [m³]	110 849**	–	96 085**	–	93 994**	–
Waste disposal [t]	15 022**	889	9 549**	1 021	16 455**	955

* The data for Campus East and Campus West are included in Campus South.
** The data refer to Campus North in total, including external institutions.

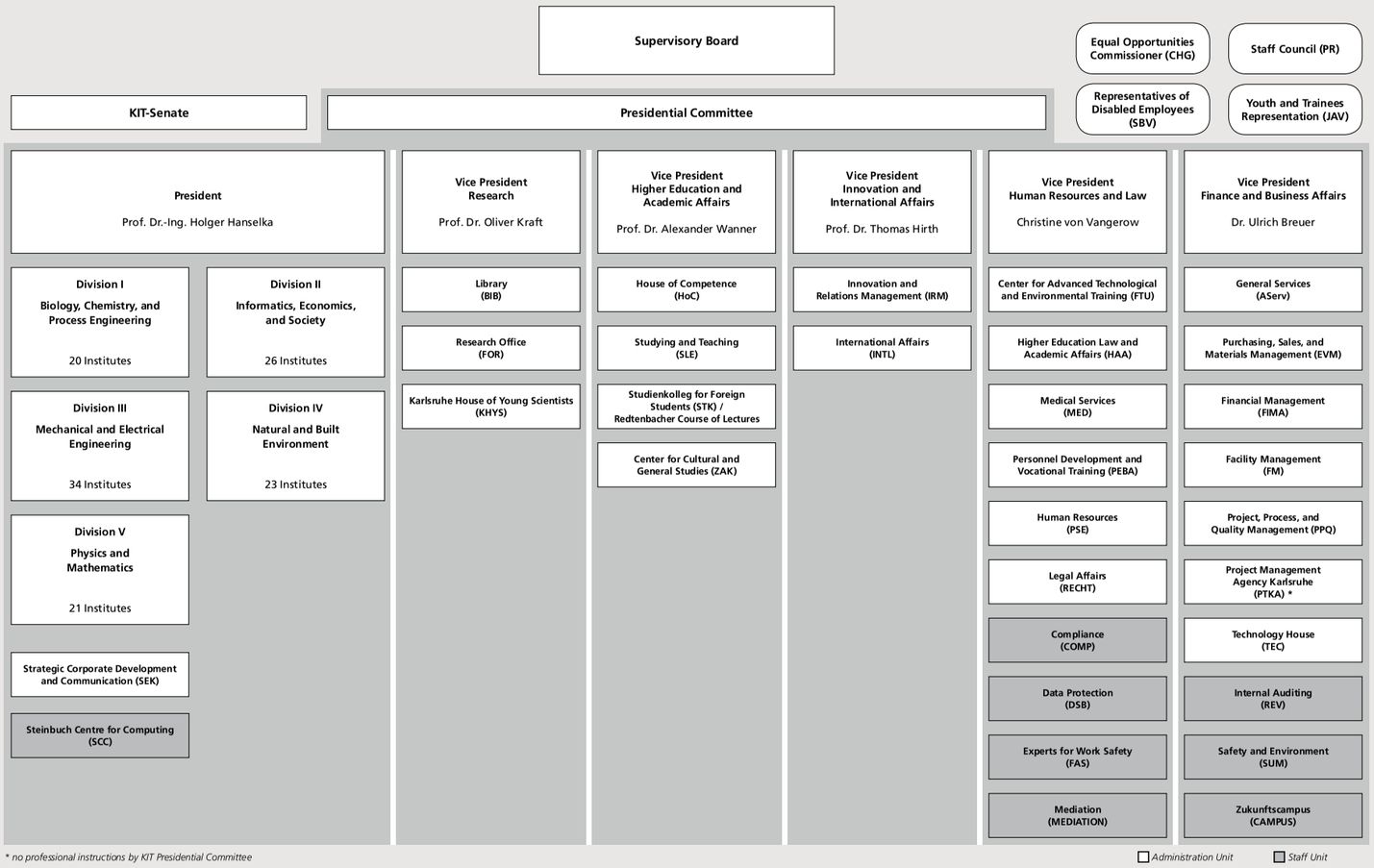
Areas 2017

Type of area [m2]	KIT in total		Campus South*		Campus North**	
	[m²]	%	[m²]	%	[m²]	%
Office areas (including conference rooms, rooms for copiers and servers)	167 062	34.8%	95 612	33.6%	71 450	36.6%
Laboratories, workshops, experiment halls	185 199	38.6%	100 464	35.3%	84 735	43.4%
Storage and similar facilities	59 454	12.4%	28 155	9.9%	31 299	16.0%
Teaching and studies (lecture halls, seminar rooms, practice rooms)	50 548	10.5%	44 849	15.8%	5 699	2.9%
Library areas (central + decentralized libraries)	13 174	2.7%	11 350	4.0%	1 824	0.9%
Sports areas	4 480	0.9%	4 211	1.5%	269	0.1%
Total usable area	479 917	100.0%	284 641	100.0%	195 276	100.0%
of this, rented areas			14 490 m²		2 550 m²	

* incl. Campus East and Campus West ** incl. Campus Alpine



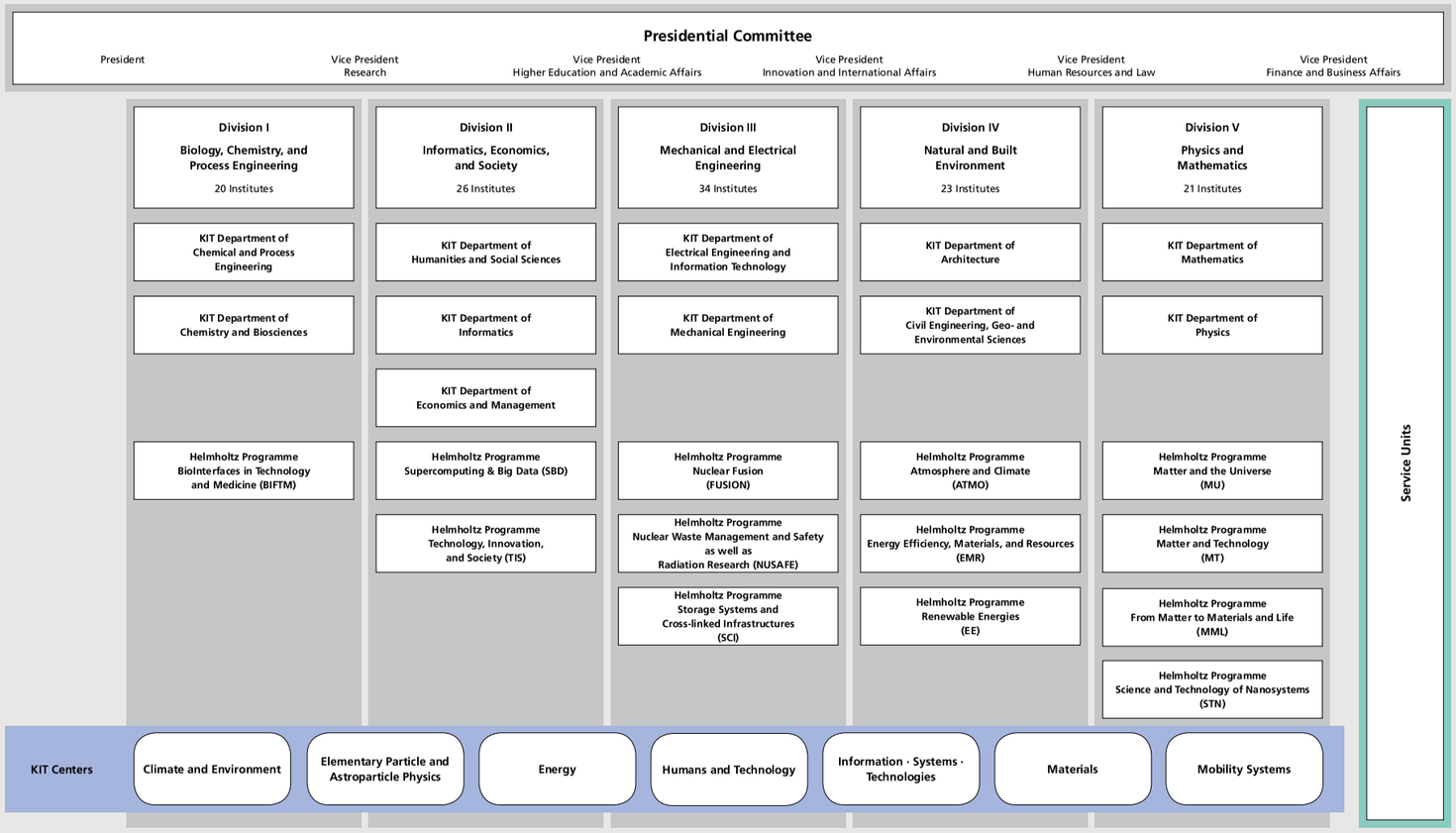
Organizational Structure



* *no professional instructions by KIT Presidential Committee*

Administration Unit *Staff Unit*

Science Organization



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Kaiserstraße 12 · 76131 Karlsruhe, Germany

www.kit.edu

KIT – The Research University in the Helmholtz Association

Contact

Strategic Corporate Development and Communications
Phone: +49 (0) 721 608-21152
Email: info@kit.edu

Edited by

Dr. Sabine Fodi, Dr. Joachim Hoffmann (responsible editors)
Strategic Corporate Development and Communications (SEK)

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