Karlsruhe Institute of Technology

1825
1956
2009

THE RESEARCH UNIVERSITY IN THE HELMHOLTZ ASSOCIATION

Annual Report 2019 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 humankind 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 2019

Total:	9,398
Teaching and research:	5,183
Professors:	368
Foreign scientists and researchers:	1,178
Infrastructure and services:	4,215
Trainees:	371

Students

Winter semester 2019/2020:	24,381

Budget 2019 in Million Euros

Total:	951.3
Federal funds:	310.2
State funds:	271.4
Third-party funds:	369.7

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 ten years ago of a state university with a national large-scale research center. In October 2019, we celebrated our 10-year anniversary with the theme "Unique Together."

In our annual report, we look back on an eventful anniversary year 2019 and present to you some highlights of that year. You will read about exciting results and course-setting developments in the areas of research, teaching, and innovation. For example, KIT was able to regain the title of "University of Excellence." In the keen competition of the Excellence Strategy of the Federation and the Federal States, our application with the leitmotif "Living the Change" was convincing, and the KIT was selected for funding in July.

We report on approaches to the production of regenerative fuels, new results of battery research, and solutions for storage systems for the energy system of the future, on autonomous mobility on roads and rails as well as on the use of artificial intelligence (AI) in industry, medicine, and meteorology and we highlight many more exciting projects conducted by the researchers at KIT.

Moreover, we take a look at the life at KIT – for example a review of our Open Day on the premises of Campus East, where discoverers of all ages were offered a varied entertainment program and science to touch. In 2019, we were again able to welcome some prominent guests at KIT. The visit of ESA astronaut Alexander Gerst on the occasion of the award of his honorary doctorate attracted numerous students and employees to the fully booked Audimax lecture hall – and also to screens to watch the live stream.

Numerous awards and honorable titles and functions granted to our outstanding students, professors, and staff in research and administration for their merits and commitment show that KIT is optimally prepared for a successful future.

On behalf of the Executive Board 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 last year's trusting, intense, and successful collaborations.

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 2019. May 2020 become as thrilling as last year!

Enjoy reading.

Yours,

Professor Dr.-Ing. Holger Hanselka
President of KIT

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A RETROSPECTIVE VIEW OF KIT

Two events shaped Karlsruhe Institute of Technology – The Research University in the Helmholtz Association – in 2019: The positive performance as a University of Excellence within the framework of the Excellence Strategy, and the tenth anniversary of the foundation of KIT.

The decision was made on the afternoon of July 19, 2019: In the Universities of Excellence funding line of the Excellence Strategy competition launched by the Federation and the Federal States, KIT asserted itself successfully in a strong field of applicants and emerged from the competition as one of eleven universities of excellence. The concept of "The Research University in the Helmholtz Association | Living the Change" now receives funding.

A total of EUR 105 million to be used over the next seven years has been applied for.

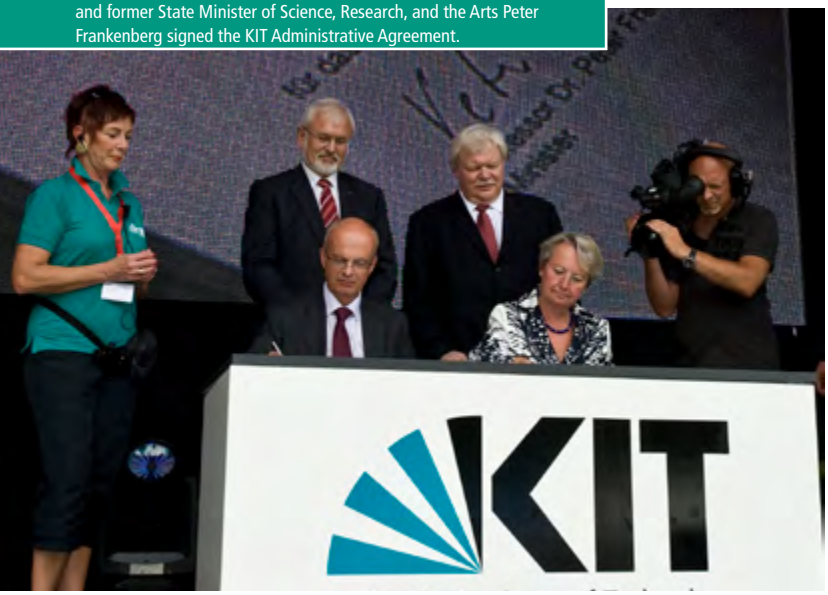
The concept is based on three central, interlinked packages of measures derived from the KIT 2025 Umbrella Strategy: Strengthening excellent research and its agility over the entire range from basic research to applications, intense dialogue and exchange with society, and offering reliable career paths for scientists.

All three packages of measures are embedded in a cultural change in which KIT focuses on the concrete requirements for a KIT-wide culture of willingness to change, equal opportunities, and diversity. In order to accelerate this cultural change, KIT intends to establish one hundred new professorships within the next ten years.

Beginning in September 2018, KIT successfully acquired two Clusters of Excellence in the first funding line of the Excellence Strategy: The "3D Matter Made to Order" cluster with the University of Heidelberg on 3D designer materials, and the "Post Lithium Storage" cluster with Ulm University on new storage materials. This success was the prerequisite for an application in the second funding line, "Universities of Excellence," which KIT submitted in December 2018, and for an on-campus assessment in March 2019.

Ten Years of KIT

Annette Schavan, the then Federal Minister of Education and Research, and former State Minister of Science, Research, and the Arts Peter Frankenberg signed the KIT Administrative Agreement.



On October 1, 2009, Forschungszentrum Karlsruhe GmbH and Universität Karlsruhe (TH) merged to form the Karlsruhe Institute of Technology. The merger was based on the KIT Act, which was unanimously adopted by the State Parliament of Baden-Württemberg on July 8, 2009, and the KIT Administrative Agreement built thereon and signed on July 30, 2009 by former Federal Minister of Education and Research Annette Schavan and the then Baden-Württemberg Minister of Science, Research, and the Arts Professor Peter Frankenberg.

The KIT celebrated its tenth anniversary in many different ways. On the morning of October 1, the staff raised their glasses in a toast, as President Holger Hanselka sent a video message and email to all members of the KIT. Many individuals and small groups – including the Executive Board – had themselves photographed on Campus North and Campus South in a walk-in anniversary logo.

Many members of the KIT had themselves photographed in the walk-in anniversary logo.

Some of these pictures decorate the final pages of an anniversary issue of KIT's in-house magazine KITdialog.

Video congratulations from personalities associated with KIT, ministers, heads of universities and research institutions, and students highlighted the manifold relations of KIT. A specially created anniversary logo, which is also found on the cover of this annual report, reminds us of KIT's milestones: The founding years of its predecessor institutions and the year of foundation of the KIT.

Clusters of Excellence

The two Clusters of Excellence, which the KIT acquired in 2018 in the Excellence Strategy, officially started their work in 2019.

With additive methods such as 3D printing, almost any structure – down to the nanoscale – can now be manufactured. Depending on the "ink" used, these structures can perform a wide variety of functions: From hybrid optical chips to bioscaffolds for cellular tissues. In the joint Cluster of Excellence "3D Matter Made to Order" (3DMM2O), researchers of the KIT and Heidelberg University want to take three-dimensional additive manufacturing to the next level. The goal is to develop new technologies that enable flexible digital printing of structures from the molecular to the macroscopic level using tabletop printers.

3D printing enables many large and very small applications: For example, bioscaffolds for cellular tissues can be created using special inks.

To achieve this goal, the researchers are working in three interlinked fields of research. The "technologies" field is dedicated to the development of novel tools that can manufacture structures down to the size of ten nanometers. Using different inks and photoresists, these

tools enable faster, more precise printing than previous methods. The inks and photoresists are being developed by the researchers working in the "molecular materials" field. The tailor-made artificial materials have a broad spectrum of properties and can be combined. The "applications" field brings research into application. Here, the focus is on optics and photonics, material sciences, and life sciences. The printed 3D structures can, for example, improve the performance of optical chips for information processing or be used in artificial retinae.

A central structural element of that cluster is the HEiKA Graduate School on "Functional Materials." HEiKA stands for the Heidelberg Karlsruhe Strategic Partnership that covers all joint bilateral activities of KIT and Heidelberg University. With master's and doctoral students, the graduate school also integrates early-stage researchers into the highly interdisciplinary research area.

The ceremonial launch of the "Post Lithium Storage" (POLiS) Cluster of Excellence and the CELEST (Center for Electrochemical Energy Storage Ulm & Karlsruhe) research platform took place at Helmholtz Institute Ulm (HIU). The foundation of HIU in 2011 marked the beginning of a successful collaboration in battery research between KIT, Ulm University, and the Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW).

With the research fields "Lithium-ion technology," "Energy storage beyond lithium," and "Alternative technologies for electrochemical energy storage," CELEST, which also includes a Graduate School on Electrochemical Energy Storage (GS-EES), covers all research topics relevant to electrochemical energy storage. In addition to industrial collaboration and technology transfer, the promotion of early-stage researchers is one of the platform's declared objectives.

The first outstanding success of CELEST was the approval of the POLiS Cluster of Excellence in the Excellence Strategy of the Federation and the Federal States. POLiS aims to create the fundamentals for a storage technology beyond the lithium-ion battery using elements that are more readily available and more recyclable than lithium. One possible material is magnesium, which has a higher storage capacity than lithium and theoretically enables lighter and smaller batteries. POLiS will initially be funded with around EUR 50 million for seven years (see also page 28).

The project partners inaugurate CELEST and POLiS (from left to right): Maximilian Fichtner, HIU; Holger Hanselka, KIT; Ulrich Steinbach, MWK; Christian Luft, BMBF; Margret Wohlfahrt-Mehrens, ZSW; Helmut Ehrenberg, KIT; Michael Weber and Axel Groß, both University of Ulm.

Ranking Performance

KIT as a whole	QS WORLD UNIVERSITY RANKINGS: Place 124 (5) QS GRADUATE EMPLOYABILITY RANKINGS: Place 36 (1)	THE WORLD UNIVERSITY RANKINGS: Place 175 (20)*
	NTU RANKING: Place 228 (19)*	U.S.News & WORLD REPORT: Place 181 (12)*
Subject groups	**NATURAL SCIENCES** QS Ranking: 48 (4) NTU "Taiwan" Ranking: 67 (1) THE Ranking: 69 (7)	**ENGINEERING SCIENCES** QS Ranking: 59 (4) THE Ranking: 74 (4) NTU "Taiwan" Ranking: 106 (1)
Subjects	**Physics** QS Ranking: 31 (4) US News: 48 (3) NTU: 54 (2)	**Chemistry** US News: 65 (3) NTU: 73 (2)
	Material Sciences QS: 47 (3) ARWU: 51-75 (1-2) US News: 66 (1) NTU: 80 (1)	**Informatics** THE: 50 (3) ARWU: 51-75 (1-3) QS: 51-100 (2-5)
	Geosciences NTU: 39 (1) US News: 53 (1)	**Atmospheric Sciences** ARWU: 8 (1) **Energy Sciences** ARWU: 32 (1)
	Chemical Engineering NTU: 72 (1) QS: 51-100 (2-4)	**Mechanical Engineering** QS: 37 (4) **Civil Engineering** QS: 51-100 (1-3) NTU: 138 (1)

Summary of the current ranking results of the KIT. The numbers in brackets indicate the national rank, the numbers without brackets indicate the international rank.
Rankings marked with an asterisk (*) strongly favor universities with medical departments.

In 2019, KIT again performed excellently in the various rankings and is thus very well positioned in national and international comparison. Four of the many rankings are highlighted below.

The Employability Ranking by Quacquarelli Symonds (QS) assesses the preparation of university graduates for the job market. Among other things, the ranking measures the university's reputation with employers, the number of very successful alumni, the university's networking with employers, and the attractiveness of graduates to companies in the business world. The KIT scores very well in the indicators "Cooperation with Employers" (95.8 out of 100 possible points), "Reputation with Employers" (92.4), and "Proportion of Employed Alumni" (89.7). KIT is thus ranked first in Germany, seventh in Europe, and, with rank 36, is among the top seven percent internationally.

In its annual rankings, the Center for Higher Education Development (Centrum für Hochschulentwicklung – CHE) ranks the two master's programs in mechanical and chemical engineering at KIT among the best in German-speaking countries. In mechanical engineering, the KIT achieved above-average results especially in the categories of course offerings, course organization, scientific relevance, support of stays abroad, doctorates per professor, and the transition to master's courses. The master's program in chemical engineering scores highly in scientific relevance, course offerings, and course organization. With its rankings, CHE primarily addresses prospective students seeking orientation and information on the universities' study programs.

U.S. News is a monthly news magazine published in the USA. The overall ranking of Best Global Universities is based on a total of ten indicators that reflect the research performance and the international and national research reputation of an institution. KIT takes first place among the German universities in two subjects, geosciences, which also ranked first the previous year, and material sciences. In addition, engineering sciences, physics, and chemistry take third place.

The current Academic Ranking of World Universities (ARWU), also known as Shanghai Ranking because of its publisher Shanghai Ranking Consultancy, lists KIT's atmospheric research in an outstanding 8th place in worldwide comparison. Compared to the previous year, KIT improved by eight places and is thus the best Ger-

man university in this research field. KIT also performs very well overall in the ARWU ranking: It is among the top 100 worldwide with nine subjects in the engineering sciences, and with three subjects in natural sciences.

New Research Infrastructures and Networks

As member of the Helmholtz Association, KIT develops and operates large scientific infrastructures, such as large-scale facilities and service facilities, and is significantly involved in national and international research networks.

Supported by digitization, artificial intelligence, and machine learning, science and industry jointly transfer new manufacturing processes from the drawing board to practice in the shortest possible time: This is the vision of the **Karlsruhe Research Factory**. In July 2019, KIT and the Fraunhofer-Gesellschaft (FhG) laid the foundation stone for the joint project. From the end of 2020, researchers and company representatives want to start working in the Research Factory.

The Karlsruhe Research Factory sees itself as a development and demonstration center for the factory of the future. The aim is to achieve agile production, i.e. high-quality products leave the assembly line while the associated production process is still being optimized. The goal of agile production is to significantly shorten the time to market – in some cases by several years. This enables innovative companies to place new products into target markets much earlier than before.

The researchers working at the Research Factory want to find out how this can be achieved and, together with industrial partners, aim to transfer the respective processes into applications. They therefore look at the maturation of a production process on a laboratory scale, the start of production with machines on an industrial scale and, finally, continuous monitoring and improvement of ongoing production processes. All three phases are supported in the Research Factory by machine learning and artificial intelligence methods. The researchers of KIT and Fraunhofer-Gesellschaft are driven by the vision of not only making individual production steps agile, but also expanding entire process chains into an internally communicating self-learning system.

In the **National Research Data Infrastructure (NFDI**), the valuable data stocks of science and research are to be systematically developed, networked, and made usable for the entire German science system. Up to now, the data have mostly been available in a decentralized, project-related, or temporary form. The Federation and the Federal States will jointly fund the NFDI and use this digital knowledge repository as an indispensable prerequisite for new research issues, findings, and innovations. In 2019, the Joint Science Conference decided NFDI's directorate would be located in Karlsruhe. The KIT and FIZ Karlsruhe will assume the tasks that are pending in the complex foundation phase.

Rendering of the Karlsruhe Research Factory on KIT's Campus East.

The central element of the NFDI will be consortia in which users and providers of research data will work together with institutions of the information infrastructure. Formally, NFDI will become a separate legal entity, managed and coordinated by the directorate and its administrative office.

The goal of the new Science Data Center for Molecular Materials Research is to jointly and sustainably use data from many laboratories.

Research data are expensive. Huge amounts of working and computing hours and expensive equipment and materials are the price of scientific knowledge, which is usually paid for with public funds. The value of the data received is often imperishable, and even older data can be used for current research. New analytical methods in particular can maximize the knowledge gained from these data and, thus, their long-term usefulness.

Researchers who deal with data every day strive for a free flow of information. However, the raw data generated in laboratories pose a number of hurdles in data exchange. The Science Data Center for Molecular Materials Research at KIT, in cooperation with the Karlsruhe University of Applied Sciences and FIZ Karlsruhe, seeks to change this with the help of funding to the tune of EUR 2.5 million from the Baden-Württemberg Ministry of Science, Research, and the Arts.

The **ACTRIS-D** project, to which KIT is making a major contribution within the framework of the national roadmap of the Federal Ministry of Education and Research (BMBF), opens up new perspectives on the atmosphere and on climate change. The BMBF has put the project on a list of high-priority research infrastructures. The project partners can now begin detailed planning to establish a unique worldwide research infrastructure for climate research within the next five years.

ACTRIS-D aims to bundle the long-term observation of aerosols, clouds, and trace gases in the atmosphere and to determine more precisely the influence of these short-lived atmospheric constituents on the regional climate. To this end, existing ground-based measuring equipment, such as FTIR spectrometers and LIDAR radars, will be more closely networked, including on the European level, and new sites will be added. This will create a research platform that is unique in the world and has three core elements: Field measuring stations equipped with state-of-the-art measuring technology, atmospheric simulation chambers, and laboratories for equipment calibration and quality assurance.

The KIT contributes to subprojects and other measures that account for about one quarter of the requested funding amount of EUR 86 million. After a multi-stage build-up phase through 2026, the operating phase will continue until 2036. A total of 13 institutes from Germany are involved. The overall project coordinator is the Leibniz Institute for Tropospheric Research (TROPOS) in Leipzig.

The instruments of the KITcube can measure many relevant atmospheric parameters simultaneously and with high resolution.

The transport routes for people and goods are the lifelines of our networked society: Locally, for example, as a daily commuter route, or globally as merchant shipping routes on the oceans. However, in times of urbanization, resource scarcity, and climate change, traditional means of transport no longer appear to be sustainable. Therefore, the State of Baden-Württemberg is now funding the **Innovation Campus "Future Mobility"** (ICM) of KIT and the University of Stuttgart, which breaks new ground on business models for sustainable mobility in the future. ICM is a focus of the Ministry of Science in Baden-Württemberg's Strategy Dialogue for the Automotive Sector.

The aim of ICM is to create groundbreaking technologies through excellent basic research in the fields of mobility and production. The first two pilot projects, for example, deal with emission-free drive systems and additive manufacturing, such as the use of 3D printers to produce high-quality and serviceable (lightweight) components.

On the one hand, the focus is on the vision of digital production supported by a fully flexible production technology. Products could then be manufactured on site, if required, at short notice, in high quality, at low cost, and in any small quantities. On the other hand, additive processes can provide drive systems with lower emissions, as they help to save weight, installation space, material and energy, or combine the functions of different components.

The CELEST research platform with its partners KIT, Ulm University, and ZSW participates in the European research initiative BATTERY 2030+.

Batteries are among the key technologies for sustainably storing energy from renewable sources and reducing carbon dioxide emissions. They thus are an indispensable component of the energy transition. The aim of **BATTERY 2030+** is to develop more powerful batteries and a cutting-edge technology for the European industry.

Better batteries are needed to successfully implement the energy transition and store regenerative energy. The ten-year European research initiative brings together leading researchers and companies from all over Europe to achieve decisive advances in battery science and technology. The preparatory project for BATTERY 2030+ started in March 2019 and lays the foundation for this initiative on battery technologies of the future.

The CELEST research platform (see page 28) plays a key role in this research initiative, which is coordinated by Sweden's Uppsala University.

The Innovation Campus "Future Mobility" aims to provide a clearer picture of the innovations that will be needed in the future.

Special Events

Presented by Markus Brock, SWR, Minister Theresia Bauer, MWK, Oliver Kraft, and Ralf Reussner, both KIT (from right to left), discussed "Informatics in the Age of Digitization."

The foundation of the Institute of Informatics and the introduction of the subject of study of Informatics in 1969 at the then Universität Karlsruhe (TH) were milestones in the success story of informatics in Germany. On June 19, 2019, KIT celebrated the beginnings of informatics studies in a ceremony with a historical lecture by emeritus professor Gerhard Goos, founder of the KIT Department of Informatics, and with a panel discussion on "Informatics in the Age of Digitization." Baden-Württemberg Science Minister Theresia Bauer, KIT Vice-President for Research Professor Oliver Kraft, and Vice-Dean for Research of KIT's Department of Informatics Professor Ralf Reussner took part in the discussion (see also page 44).

On July 12, 2019, ESA astronaut Alexander Gerst reported on his two missions that took him to the International Space Station (ISS) in 2014 and 2018. On his second mission, he was ISS commander. His scientific roots lie in Karlsruhe: In 2003, Alexander Gerst received his diploma in geophysics from Universität Karlsruhe (TH), today's Karlsruhe Institute of Technology. The KIT Departments of Physics and of Civil Engineering, Geo- and Environmental Sciences awarded him an honorary doctorate and presented him with a certificate during his visit to KIT (see also page 85).

On October 2, 2019, entrepreneur Titus Dittmann was invited to the Karlsruhe founders' scene by KIT's Founders Forge. Titus Dittmann is a skateboard pioneer, series founder, and philanthropist. The guests at the event experienced an inspiring keynote speech: As an active

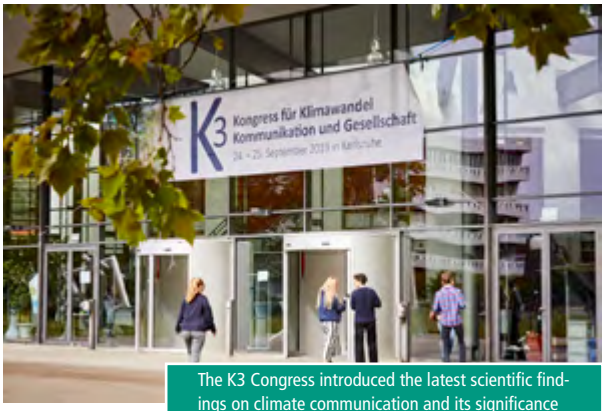
The honorary doctorate certificate was handed over to Alexander Gerst (center) by Georg Weiß, Friedemann Wenzel, Holger Hanselka, and Frank Schilling (from left to right).

enthusiast, Titus Dittmann, who is now over 70 years of age, contributed a lot to establishing skateboarding in Germany in the 1980s and has remained true to the sport to this day. After he had been a teacher in German secondary schools, he became an entrepreneur who built up an extensive value-added network around skateboarding. Dittmann was a successful series founder, but he also had to overcome serious crises in his business. In addition to his entrepreneurship, he is above all committed to an educational mission. In 2009, he set up his own foundation. With the skate-aid initiative, he supports worldwide youth and children's projects that provide development aid through skateboarding. Where

Entrepreneur, teacher, and lateral thinker Titus Dittmann speaking at KIT's Audimax lecture hall on the initiative of the KIT Founders Forge.

life is determined by terror, violence, and destruction, Titus Dittmann wants to make children strong with the educational power of skateboarding.

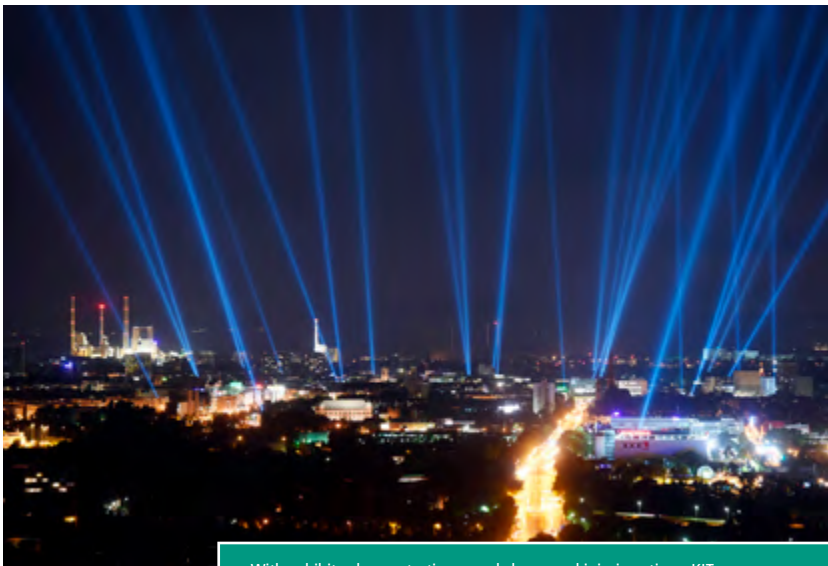
Students around the world are on strike for greater climate protection. Since the drought summer of 2018, climate change has become an important topic in society and politics. For science, the basic facts about the human-made climate crisis are clear – but a drastic reduction in greenhouse gas emissions has not yet been achieved. The K3 Congress highlighted how communication can help close the gap between knowledge and action in politics, economy, and society. On September 24 and 25, 2019, experts at KIT presented their ideas for new communication about climate. The congress introduced the latest scientific findings on climate communication and created opportunities for debating topics, such as post-growth, environmental psychology,



The K3 Congress introduced the latest scientific findings on climate communication and its significance for society.

new visions of the future, and visual thinking. It brought together around 400 domestic and foreign actors from the natural and social sciences, politics, climate protection, art, and journalism. The German Climate Consortium conceived and coordinated the event, which was sponsored by the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety.

Digitization changes everything. A holistic perspective is important to ensure its successful introduction for the benefit of people and its acceptance by society. Making digitization visible and tangible in all its facets was the objective of the Colorful Night of Digitization (Bunte Nacht der Digitalisierung) on October 11, 2019 in Karlsruhe. KIT researchers participated in an extensive program at several locations. The central meeting point was the large foyer of the Mathematics Building on KIT's Campus South, where exhibits, demonstrations, and participatory actions were presented to a broad audi-



With exhibits, demonstrations, workshops, and join-in actions, KIT participated in the Colorful Night of Digitization in Karlsruhe.

Martin Brudermüller was awarded the 2019 Heinrich Hertz Guest Professorship certificate by Holger Hanselka, KIT, and Michael Huber, KIT Freundeskreis und Fördergesellschaft e.V. (from right to left).

ence. Experts gave tips on digital security and provided information on computer simulations, encryption algorithms, and study opportunities and job profiles in a digital society. The Robot Learning Lab, which provides virtual access to real robots for research and teaching, was presented, as was the MaterialDigital innovation platform. At other locations, visitors were introduced to how machines learn or how the future of work and industry can be shaped. In a workshop, pupils learned how to program a robot arm. Hochleistungsrechner Karlsruhe, the Karlsruhe high-performance computer, was also open to the public.

The KIT and KIT Freundeskreis und Fördergesellschaft e.V. awarded the 2019 Heinrich Hertz Guest Professorship to Dr. Martin Brudermüller. On October 31, 2019, the Chairman of the Executive Board and Chief Technology Officer (CTO) of BASF SE spoke about the "Chemical Industry in Transition" at the Johann Gottfried Tulla lecture hall on KIT's Campus South and highlighted how society and industry are changing at an unprecedented scale and speed. In Asia in particular, new sales markets are emerging, and numerous new competitors are appearing. Technical development is progressing faster and faster along with changes in customer behavior and expectations. Meanwhile, society is looking for convincing answers to pressing problems, such as climate change, the increasing scarcity of resources, and the littering of the world's oceans. In a presentation, Dr. Martin Brudermüller talked to the KIT students about "Carbon Management - Strategies for CO_2 Reduction in the Chemical Industry."

On November 16, 2019, the Executive Board extended invitations to the fourth Ball of the KIT. The event, which has already become a tradition, was themed "La Pasión." The canteen on Campus South was transformed again into an elegant ballroom. About 600 guests came to dance, enjoy, and celebrate. A live band presented a varied repertoire of dance music. In a second ballroom, a DJ created the right atmosphere and lured the guests to the dance floor with rousing rhythms. In addition, the guests were inspired by a varied show program.

Appointments and Reappointments to the Supervisory Board

The KIT Supervisory Board monitors the development and shaping of the profile of the Research University in the Helmholtz Association and ensures a framework that will increase its performance and competitiveness. Its

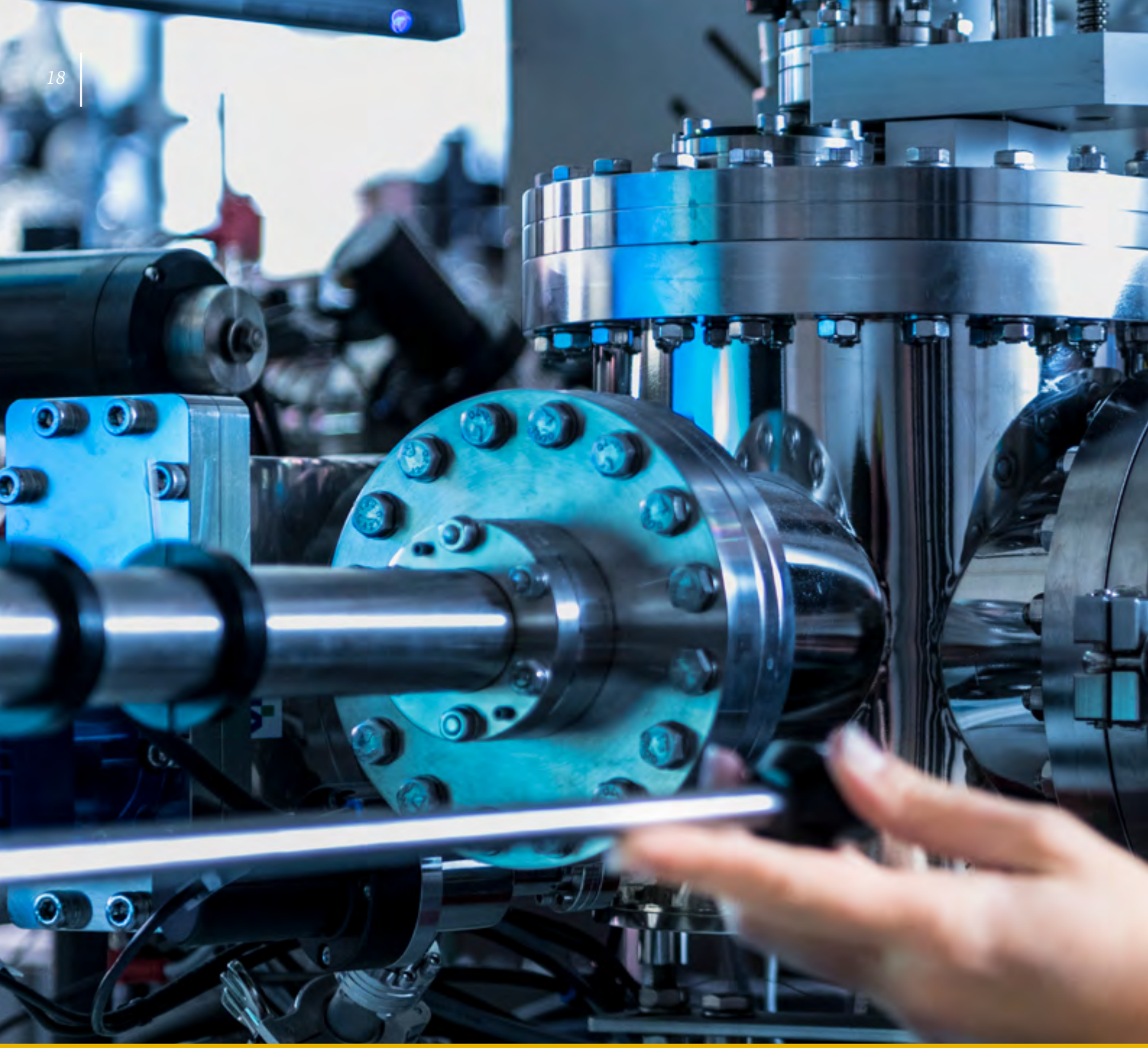
One of the highlights of the Ball of the KIT themed "La Pasión" was the varied show program.

duties include electing members of the Executive Board and deciding on the Structure and Development Plan, as well as on the Construction Plan. The Supervisory Board meets three times a year. Its eleven members each serves for a period of four years and can be re-elected. Several new members were appointed to the Supervisory Board on October 1, 2019. In its meeting on November 11, 2019, Professor Dr. Michael Kaschke, Chairman of the Executive Board of the ZEISS Group, was elected the new Chairman of the KIT Supervisory Board. He succeeds Professor Dr. Renate Schubert of ETH Zurich, who held the chair from March 2012 to September 2019.

Michael Kaschke, Chairman of the Executive Board of the ZEISS Group, was elected the new Chairrman of the KIT Supervisory Board in the meeting on November 11, 2019.

The other members of the Supervisory Board are Professor Dr. Gerald Haug, Max Planck Institute for Chemistry, Mainz, and President of the Leopoldina; Dr. Andreas Keller, Deputy Chairman of Gewerkschaft Erziehung und Wissenschaft, Frankfurt; Susanne Kunschert, Managing Partner of Pilz GmbH & Co. KG, Ostfildern; Professor Dr. Catrin Misselhorn, University of Göttingen; Professor Dr. Anke-Susanne Müller, KIT; Professor Dr. Jörg Neugebauer, Max-Planck-Institut für Eisenforschung, Düsseldorf; Stefan Quandt, Chairman of the Administrative Board of AQTON SE; Ministerialdirektorin Professor Dr. Ina Schieferdecker, Federal Ministry of Education and Research, Berlin; Professor Dr. Kerstin Schill, Hanse-Wissenschaftskolleg, Delmenhorst; and Ministerialdirigentin Dr. Simone Schwanitz, Ministry of Science, Research, and the Arts of Baden-Württemberg, Stuttgart.

The members of the Executive Board and two of the Heads of Divisions of the KIT toast KIT's tenth anniversary: Joachim Knebel, Alexander Wanner, Holger Hanselka, Christine von Vangerow, Karl-Friedrich Ziegahn, Oliver Kraft, Michael Ganß, and Thomas Hirth (from left to right).



RESEARCH

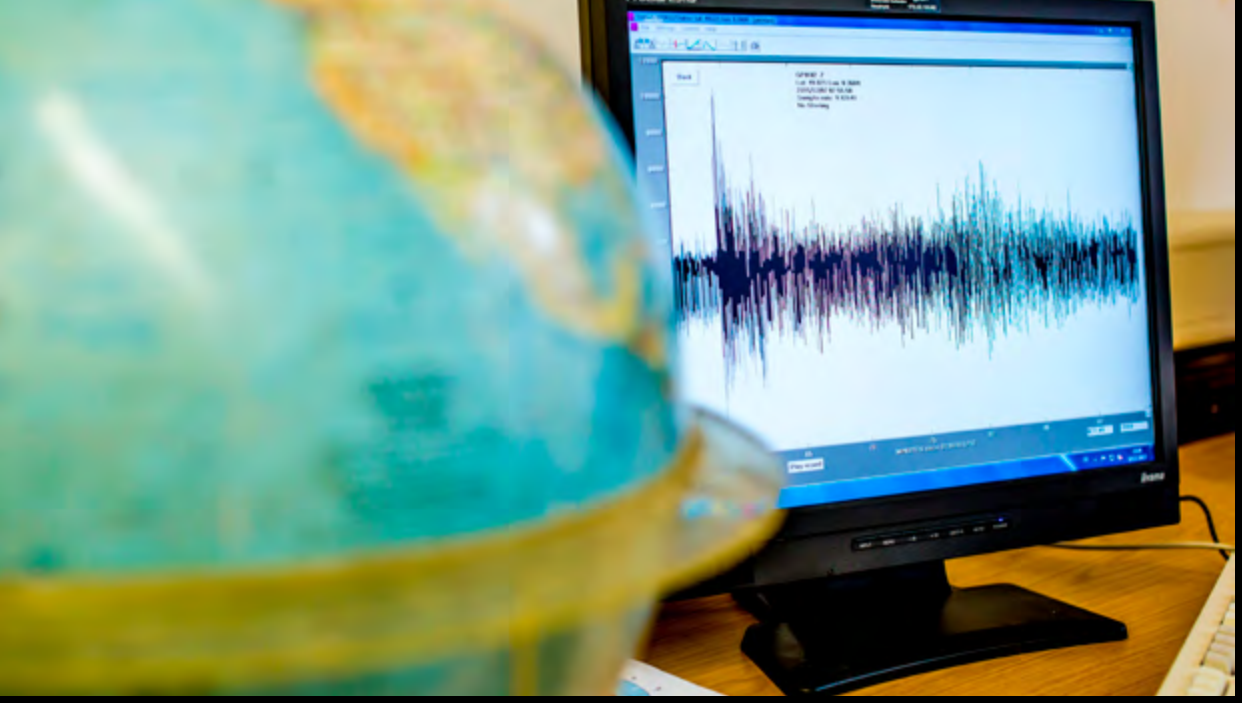
The 2019 Science Year focused on artificial intelligence (AI), which has become indispensable in many applications. Every day, AI is used in the form of language assistants, models for weather forecasting, and recommendations we receive on internet shopping portals. Future autonomous cars, tomorrow's factories, and modern operating theaters are inconceivable without AI.

One thing is clear: AI and machine learning will change our work, our everyday life, and the society as a whole. Shaping this change and analyzing both opportunities and risks are challenges addressed by KIT's researchers from various perspectives.

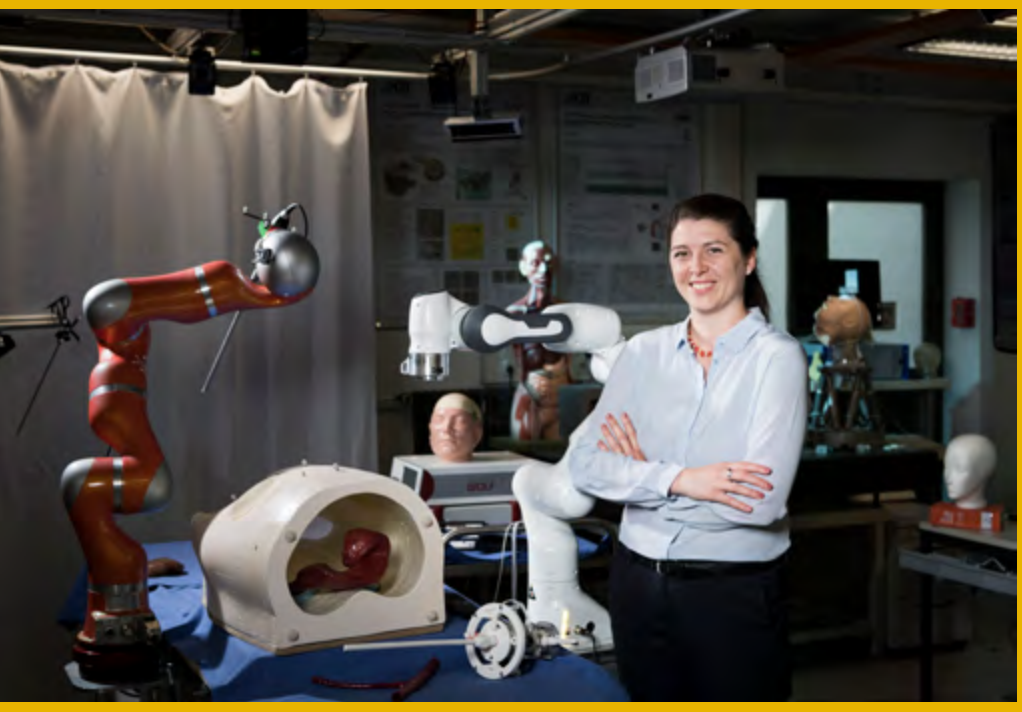
Many AI-related projects of KIT will be presented on the following pages of the "Research" section, but also in the other sections of this report. Other AI-related activities of KIT produced the following findings in 2019: The AI-based assistance system "Kern" will help extend concentrated work phases, the so-called flow, as long as possible and give an impetus to personal and professional competence development.

PrognoNetz is a self-learning sensor network to predict load capacity of power lines as a function of weather conditions. With this AI-based network, capacity of existing power grids can be optimally utilized.

KIT researchers have used a neural network to determine the arrival time of seismic waves and, thus, precisely locate earthquake centers. They found that AI can considerably improve earthquake analysis, not only when handling big data, but also in the case of limited data volumes.




INERATEC




Lifting

ARTIFICIAL INTELLIGENCE

NEW OPTIONS FOR PRODUCTION, MEDICINE, AND WEATHER FORECASTS

KIT employs artificial intelligence (AI) in many areas of research. The combination of computer science and engineering is one of KIT's strengths, but other areas also profit from AI.

Artificial Intelligence for Future Agile Manufacture

Clients request customized solutions, product lifecycles become shorter, and new business models emerge: Industrial production has to keep pace with these dynamic changes. An interdisciplinary group of mechanical engineers, electrical engineers, IT experts, and computer scientists at KIT developed an agile production system that autonomously and dynamically adapts to changing product specifications. The AgiProbot (the German acronym for agile production system based on mobile learning robots with multi-sensor technology for uncertain product specifications) project is funded by the Carl Zeiss Foundation with EUR 3 million. The project is aimed at developing a pilot factory to demonstrate remanufacturing of electric motors made by the automotive industry. In an agile and automated process, the motors will be disassembled and processed for reuse.

Agile production and rapid transfer of production processes from scratch to practice also are the goals of the Karlsruhe Research Factory, a joint project of KIT and Fraunhofer-Gesellschaft that will start operation by late 2020 (see also section "A Retrospective View of KIT").

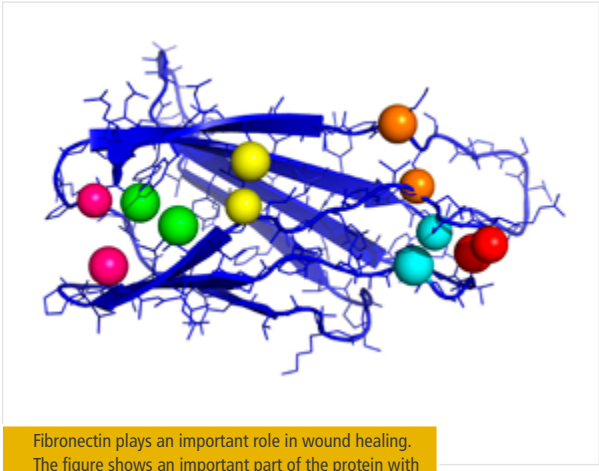
Artificial Intelligence in Medicine

Proteins are high-performance biological machines. They can be found in every cell and play an important role in human blood coagulation or as main constituents of hairs or muscles. The functions of these molecular tools are obvious from their structures. Depending on their shapes, proteins can interact with other molecules by penetrating or enclosing them. Protein structure is very difficult to identify, so experiments for this purpose are expensive and complex. Protein structure resembles a string of pearls, with the string consisting of protein components, called amino acids. The three-dimensional protein structure and associated properties result from some distant "pearls" forming pairs, thus folding the protein. A KIT team taught an AI system which pairs have proved to be successful in known protein sequences during evolution. They computed so-called "self-attention neural networks" that are also

Agile manufacturing systems with learning robots make industrial production viable.

applied in popular translation programs. These networks can identify which parts of a sentence are linked, or – in the context of proteins – which amino acids form a pair.

Another project at KIT analyzes the opportunities and challenges associated with the interaction of artificial intelligence, modern human genomics, and genome editing. Modern genome research is aimed at understanding and predicting how genetic differences between humans determine complex features, such as the disposition for common diseases. Use of advanced forms of machine learning promises to achieve decisive progress. In particular, so-called deep learning may be used not only to "read" human genomes, but to understand complex biophysical relationships and mechanisms that turn genetic dispositions into physical traits. Such approaches are associated with the hope for new, far more effective therapies for cancer, cardiovascular diseases, and dementia.



Fibronectin plays an important role in wound healing. The figure shows an important part of the protein with contact pairs (spheres of the same color).

Artificial intelligence can significantly improve local weather forecasts and often proves to be more precise than established techniques.

Artificial Intelligence for Weather Forecasts

Thunderstorms, sun, cold, heat – the weather changes rapidly. This is due to the chaotic system of the atmosphere: Physical properties, such as temperature, humidity, and cloud cover are constantly changing. Weather forecasters try to predict this chaos and make reliable statements. Meteorologists and mathematicians at KIT jointly developed a new AI-based method that corrects mistakes of weather forecasts, taking into account non-linear correlations. Neural networks are applied. These computer programs use the brain as a model in how they process information. Artificial neurons are arranged in layers. By adding a new intermediate layer to the network, the chaotic, non-linear interactions between the data from the meteorological stations and the simulated physical states of the atmosphere can be analyzed and evaluated. This is how the mathematicians "train" the network to process certain data in an optimal way. With every piece of information that flows through the network during the training phase, the network gains "experience," continues to improve, and more precisely determines the probability of occurrence of local weather events.

The forecasts made by the network were compared with forecasts made by established techniques. The new approach was found to produce far more accurate forecasts for almost all weather stations with far less computational effort.

FUTURE MOBILITY

EVALUATION AND DEVELOPMENT OF NEW MOBILITY SYSTEMS

Future mobility is to be flexible, environmentally compatible, and emission-free, if possible. In addition, the chain of value added must be retained in Germany. To achieve this, KIT has established the Mobility Systems Center, in which more than 35 institutes work on latest research projects, while making use of the synergies they create.

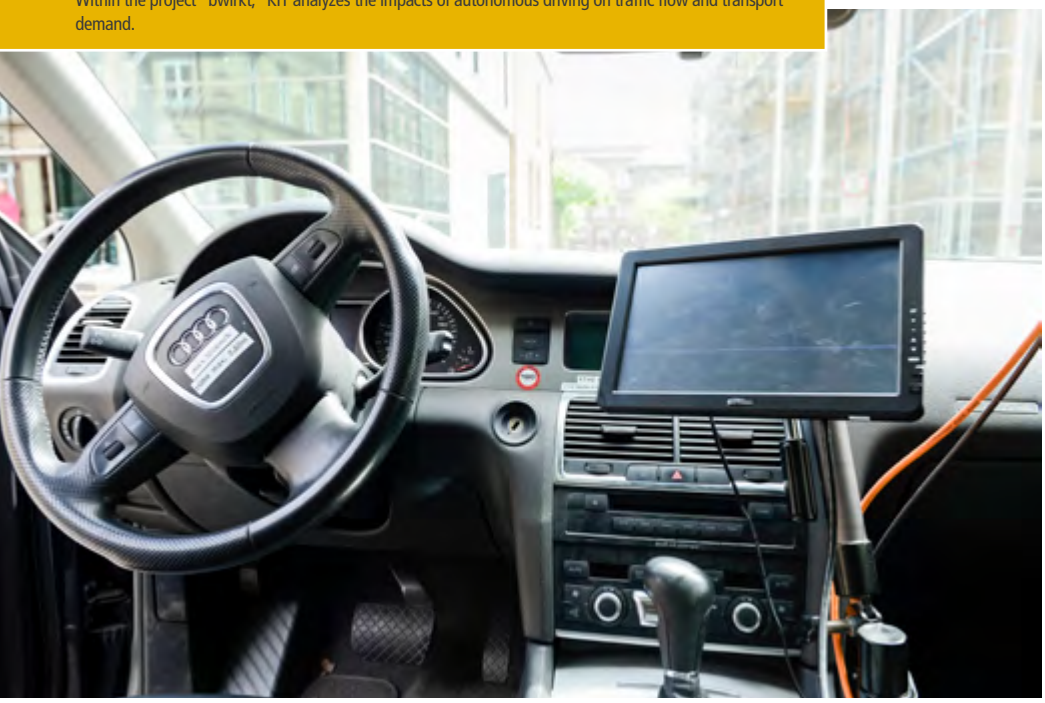
Accompanying Research on the Test Area for Autonomous Driving

On the Baden-Württemberg Test Area for Autonomous Driving (TAF BW), realistic conditions are producing valuable findings for the development of automated driving. Part of the real road traffic network, TAF BW is ideal for studying impacts on society and associated legal aspects of automated driving. This is one of the goals of the "bwirkt" project. Another goal is to derive recommendations for science, industry, and politics. Researchers of KIT mainly concentrate on the impacts of automated and networked driving on transport demand and traffic flow. For example, scientists want to learn whether automated driving affects the number of trips and driving times and whether destinations or the choice of transport means will change. The FZI Research Center for Information Technology, an innovation partner of KIT, coordinates the project. Apart from KIT, the State Agency for New Mobility Solutions and Automotive Baden-Württemberg, e-mobil GmbH, is involved in the project. It is funded by the Baden-Württemberg Ministry of Transport with EUR 300,000.

High-performance Center for Mobility Research

To maintain its leading position in changing mobility, Baden-Württemberg pools its expertise in the High-performance Center for Mobility Research. It is to be the first contact point for companies, planners, and political decision-makers dealing with new mobility concepts. Collaboration with regional and supraregional industry partners is aimed at pushing the transformation of the mobility sector by developing sustainable mobility solutions, intensifying dialogue with society, and advising politicians. Six projects are executed to make the region fit for the future, such as "Implementation Scenarios for Cooperative, Networked Driving," "Changing Urban Mobility," or "Development of a Drive Train Based on Regenerative Fuels Free of Aromatic Substances." The four Fraunhofer Institutes for Chemical Technology (ICT), Systems and Innovation Research (ISI), Optronics, System Technologies and Image Exploitation (IOSB), and Mechanics of Materials (IWM), the FZI Research Center for Information Technology, Karlsruhe University of Applied Sciences, and KIT have established the High-performance Center for Mobility Research. The project involves 20 institutes and has a budget of EUR 9 million for the next two years. The State Ministries of Science, Research, and the Arts and of Economic Affairs, Labor, and Housing provide funding of EUR 4.75 million. The partners and industry contribute about the same amount.

Within the project "bwirkt," KIT analyzes the impacts of autonomous driving on traffic flow and transport demand.



The "High-performance Center for Mobility Research" is to be the first contact point for companies, planners, and political decision-makers dealing with new mobility concepts.

Human-machine Interface

Automated vehicles of the future will not only relieve drivers, but will temporarily take over entire vehicle control. Still, there will be situations in which humans will react better than the machine. Identifying such situations, passing control from the vehicle to the driver in an anticipatory and reliable way, and developing an automated vehicle that adapts to the needs of the driver were the goals of the KIT-coordinated interdisciplinary collaboration project "Personalized, Adaptive Cooperative Systems for Automated Vehicles" (PAKoS).

After three years of development work, the prototype was presented on a test route in Bad Sobernheim. It demonstrated how human drivers and digital pilots will interact in future. Via cameras inside the car and sensors on the steering wheel, the current performance of the driver is determined. Data are exchanged multi-modally. The total project budget amounts to about EUR 4.2 million. BMBF granted funding in the amount of EUR 3.1 million.

Autonomous Tram

The project "Autonomous Tram in Depot" (AStriD) is aimed at reaching the next milestone on the way towards autonomous transport systems: Full automation of a tram depot with an autonomous tram and digital depot operations. The project of KIT, Siemens Mobility, and other partners is funded by the Federal Ministry of Transport and Digital Infrastructure (BMVI) under the mFUND research initiative and scheduled for a duration of three years. Technical feasibility is demonstrated by autonomous service operations at the depot of Verkehrsbetriebe Potsdam (Potsdam Transport Company). For example, trams are run through a washing bay onto a siding. In the medium term, depot automation will be commercialized in the first stage of autonomous tram operation. KIT contributes vast expertise in the specification and digitization of depots, process automation, and identification of needed data.

The AStriD project focuses on technical and legal challenges associated with the automation of tram depots.

REPLACING FOSSIL FUELS

SYNTHETIC FUELS FROM REGENERATIVE SOURCES

Transformation of the energy and transport sectors to enhance sustainability is a task of society as a whole. KIT executes a number of research projects along this line.

Fossil fuel-based private and heavy-duty traffic accounts for 20% of total CO_2 emissions in Germany. Synthetic fuels from non-fossil carbon sources might replace petroleum-based gasoline and diesel and thus help protect the climate. For many years, KIT has pursued various approaches in this respect.

For instance, the project "reFuels – Re-thinking Fuels" started in January 2019. In this project, the state government, KIT, and industry seek to establish alternatives to fossil fuels. In August 2019, KIT and partners unveiled an integrated containerized test facility to produce fuels from air-captured carbon dioxide and hydrogen from regenerative power within the Kopernikus project "P2X" funded by the federal government. Both projects are aimed at finding new approaches to the energy transition in Germany.

reFuels – Re-thinking Fuels

In the project "reFuels – Re-thinking Fuels," KIT and partners from automotive, automotive supply, and mineral oil industries study the potentials of refuels, i.e. synthetic fuels from regenerative sources, for society, industry, and the environment. The integrated project is funded by the Baden-Württemberg state government.

Work focuses on larger-scale processes to produce gasoline and diesel on the basis of hydrogen from regenerative power and sustainable resources. Studies also cover the impact of regenerative fuels on pollutant emission and operation of vehicles and their components. In parallel, the project is familiarizing society and consumers with these novel fuels to enhance their acceptance.

"Refuels represent an important step towards closing the CO_2 cycle," said Professor Thomas Hirth, KIT Vice-President for Innovation and International Affairs, who heads the project consortium. "Regenerative fuels may open up

Official kickoff of "reFuels – Re-thinking Fuels:" State Transport Minister Winfried Hermann (middle) with Thomas Hirth, KIT Vice-President for Innovation and International Affairs (left), and Ralf Schairer, Managing Director of the MiRO upper Rhine mineral oil refinery (right).

entirely new fields of business along the chain of values added."

With "bioliq" and "Energy Lab 2.0," KIT operates two platforms for the production of refuels already. The bioliq pilot plant produces high-quality gasoline from biogenic raw materials and residues, such as straw. Energy Lab 2.0 is the world's first cluster of plants that combines latest technologies for the production and use of electric, thermal, and chemical energy. Gas turbines, power-to-methane and water electrolysis technologies will produce various fuel components, such as diesel or jet fuels, in future.

Kopernikus Project P2X

Several challenges associated with the energy transition might be managed by coupling the sectors of electric power and mobility: Green power may be stored for the long term and fuels of high energy density could be used in a carbon dioxide-neutral way. This type of sector coupling was demonstrated by the power-to-X (P2X) Kopernikus project on the premises of KIT. The first liters of fuel were produced from carbon dioxide, water, and green power. The world's first containerized test facility integrates all four chemical steps needed in a continuous process with maximum carbon dioxide utilization and very high efficiency.

"Worldwide, wind and sun supply sufficient amounts of energy, but not always at the right time," says Professor Roland Dittmeyer, KIT, to describe the dilemma of the energy transition. He coordinates the "Hydrocarbons and Long-chain Alcohols" research cluster of P2X. "Moreover, a few important transport segments, such as air or heavy-duty traffic, will continue to need liquid fuels of high energy density in future." Hence, it is only reasonable to store the so far unused green power in chemical energy carriers.

The project partners, Climeworks, Ineratec, Sunfire, and KIT, have combined the necessary chemical process steps in a compact plant, achieved coupled operation, and demonstrated operation in principle. This combination of technologies promises optimal use of carbon dioxide and maximum energy efficiency, as mass and energy flows

The world's first integrated power-to-liquid (PtL) test facility to synthesize fuels from air-captured carbon dioxide.

are recycled internally. This test facility can produce about 10 liters of fuel per day. In the second phase of the P2X Kopernikus project, a plant with a capacity of 200 l per day will be designed. After that, a pre-industrial demonstration plant in the megawatt range, i.e. with a production capacity of 1500 to 2000 l per day, will be built. That plant may theoretically reach efficiencies of about 60%, which means that 60% of the green power used can be stored in the fuel as chemical energy.

EXCELLENT BATTERY RESEARCH AT KIT

DEVELOPMENT OF SUSTAINABLE ENERGY STORAGE SYSTEMS FOR THE FUTURE

Some 1500 scientists and technical staff are working at the KIT Energy Center, one of the largest energy research centers in Europe. Work focuses on topics like energy efficiency and renewable energies, energy storage systems, and energy grids as well as on electric mobility. Numerous research projects of KIT cover these topics.

CELEST Research Platform and POLiS Battery Cluster of Excellence

In 2019, the Center for Electrochemical Energy Storage Ulm & Karlsruhe (CELEST), the biggest German research and development platform in the area of electrochemical energy storage, started operation. CELEST will develop high-performance and environmentally friendly energy storage systems that are urgently needed for a successful energy transition and climate-friendly electric mobility. CELEST was established by KIT, Ulm University, and the Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW). It pools the expertise of 29 institutes and 45 working groups of the partners, with tasks ranging from fundamental research to battery development and production.

Within the cross-institutional Post Lithium Storage (POLiS) Cluster of Excellence, researchers in Karlsruhe and Ulm conduct research into novel, powerful, and sustainable battery technologies that are designed to work without the use of the elements of lithium and cobalt.

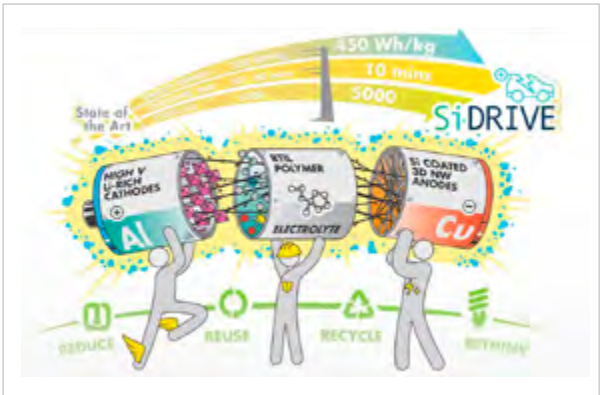
BATTERY 2030+ Research Initiative

The European research initiative BATTERY 2030+ is scheduled for a duration of ten years and brings together leading scientists and companies from all over Europe to achieve major progress in battery science and technology. The goal of BATTERY 2030+ is to develop more powerful batteries and a cutting-edge technology for European industry. Extremely powerful, reliable, safe, sustainable, and inexpensive batteries are needed. By means of machine learning and artificial intelligence, new battery materials will be identified more rapidly. Apart from KIT, five universities and eight research centers in Europe are involved in the project.

Si-DRIVE Research Project

Within the Si-DRIVE research project, KIT, Helmholtz Institute Ulm (HIU), and European collaboration partners develop innovative solutions for sustainable battery production in Europe. The goal is to establish a sustainable cell concept for lithium-ion battery manufacture that is ex-

Battery research for the success of the energy transition and environmentally friendly electric mobility is one of the central priorities of KIT.



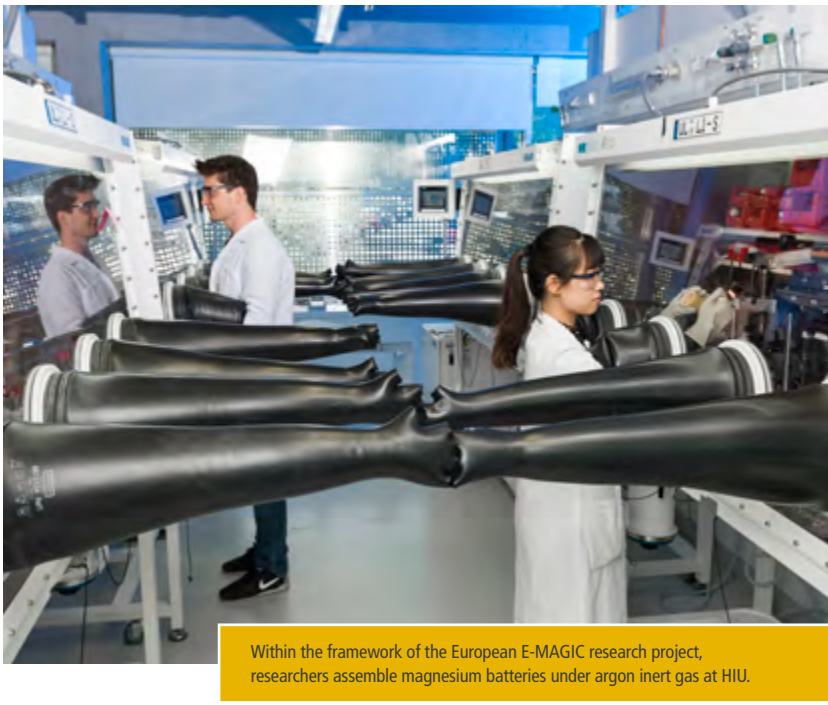
clusively based on ecologically and economically uncritical materials. The new battery cell is to consist of a nano-structured silicon anode, a novel solid electrolyte based on ionic liquids, and a complete cobalt-free, but lithium-rich cathode. A cell of this type and a comprehensive recycling program might enable sustainable battery production. The project is funded by the European Union (EU) with EUR 8 million. The project duration is four years.

Research Project E-MAGIC

Within the European research project Magnesium Interactive Battery Community (E-MAGIC), KIT, HIU, and partners are developing a magnesium-based energy storage technology. The novel magnesium batteries are to have a better performance and enhanced safety at lower costs than lithium-ion batteries. Compared to the latter, a magnesium battery would have many advantages, as a magnesium anode increases energy density and safety. Moreover, magnesium technology in battery production might help to reduce the dependence on lithium as a raw material. The project is funded by the European Union with more than EUR 6.5 million.

Optimized Mass Storage Facilities for Future Energy Systems

In times of increasingly decentralized and fluctuating energy production from renewable sources, the building of storage capacity for grid stabilization is a central challenge. Two close-to-series mass storage systems now complement the large-scale Energy Lab 2.0 research infrastructure of KIT. Development was aimed at providing cost-optimized and efficient mass storage solutions for the future energy system. Researchers test an optimized control system consisting of a new lithium-ion storage system for short-term grid stabilization and a new redox-flow system for longer storage periods. Interaction of the new energy storage systems with other grid components will be demonstrated in close-to-practice operation.



Within the framework of the European E-MAGIC research project, researchers assemble magnesium batteries under argon inert gas at HIU.

CLIMATE CHANGE

KIT STUDIES CAUSES AND EFFECTS OF GLOBAL WARMING

Significantly less than two degrees Celsius above pre-industrial times – this is the temperature to which global warming should be limited according to the Paris Climate Agreement. However, a special report of the Intergovernmental Panel on Climate Change revealed that global temperature has already increased by one degree Celsius. Research projects of KIT study the different consequences of climate change with the help of measurements and modeling.

A major prerequisite for industry and society to better adapt to future climate are reliable statements on medium-term climate developments, in particular for certain regions. A model to make more precise regional climate forecasts for a period of up to ten years was developed by KIT and partners under the MiKlip project.

A network of weather stations in Burkina Faso and Kenya supplies data for the models of the research group "Climate Change and Health in Sub-saharan Africa."

Forests protect the climate. Reforestation helps limit global warming, according to the Paris Agreement. Researchers of KIT used simulations to study the requirements that have to be fulfilled in Europe. They found that sufficient enlargement of forest areas requires a transformation of the food sector and, in particular, reduction of meat consumption.

The Asian tropopause aerosol layer (ATAL) is located 12 to 18 km above the Middle East and Asia. Its composition and effect, however, have not yet been studied. A European consortium of scientists found that this layer consists of crystalline ammonium nitrate. Experiments in KIT's AIDA cloud chamber revealed how this substance is formed in the upper troposphere.

Heatwaves are not only characterized by hot Mediterranean or Saharan air flowing to central Europe. Within the project "Climate Change and Extreme Events" (ClimXtreme), in which KIT is a leading partner, researchers studied weather and climate processes in the troposphere. They identified another reason for heatwaves: Air parcels coming from the Atlantic are heated up when they descend. ClimXtreme is aimed at developing corresponding early warning systems.

Climate change also aggravates global health problems, above all for people in Africa. The group, "Climate Change and Health in Sub-saharan Africa," funded by the German Research Foundation (DFG), studies climate-induced damage to health in Burkina Faso and Kenya. In this project, a team at KIT develops a high-resolution model to forecast the spread of malaria. It heavily depends on temperature, precipitation volume, and humidity in the respective region.

GLOBALLY EXCELLENT

KIT IS PARTNER OF OUTSTANDING RESEARCH COLLABORATIONS WORLDWIDE

KIT combines the tradition of a renowned technical university with that of a large-scale research institution pursuing long-term projects in a unique way. Worldwide exchange and global collaborations determine work at KIT. Interdisciplinary research projects, big international research collaborations and teams, as well as the use of unique research facilities, open up new development perspectives.

The IceCube neutrino observatory at the South Pole measures high-energy neutrinos in an ice volume of one cubic kilometer. IceCube is part of the US-American Amundsen-Scott South Pole Station and, in 2017, found convincing proof of a first source of high-energy cosmic neutrinos. Now, the observatory is being upgraded with German participation. The IceCube detector will also measure lower energies and, hence, the properties of neutrinos, with so far unmached accuracy. In this way, understanding of basic processes in the universe, such as physics in galactic nuclei, will be enhanced. Within the framework of the IceCube Upgrade project, seven additional cables are being installed deep in the ice in the middle of existing lines. They are equipped with 700 upgraded detectors. After the USA, Germany is the second most important partner in IceCube. The German Electron Synchrotron DESY and KIT, both members of the Helmholtz Association, finance the development and construction of the new detectors with a total of EUR 5.7 million.

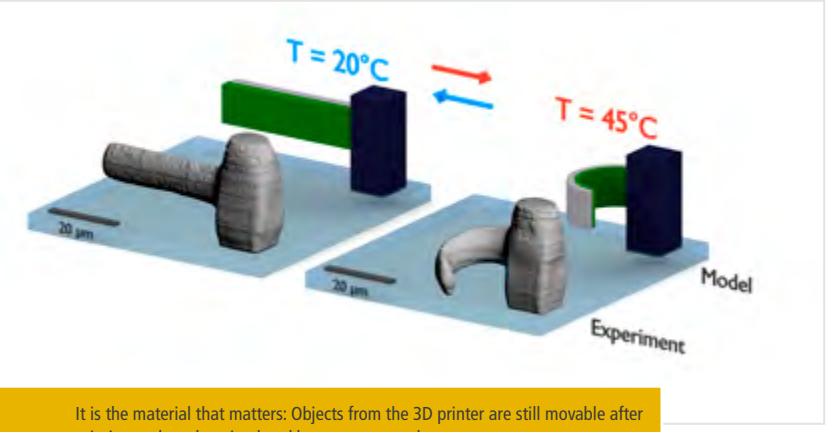
Polar light above the South Pole. The red point is the IceCube laboratory. The neutrino experiment proper is installed several kilometers deep in the ice.

More than 20% of the world's population are dependent on karst groundwater. In these regions, large amounts of water seep into the porous rock and are available at great depths only. Moreover, karst water is susceptible to pollution. Using karst water for sustainable water supplies is a challenge in threshold and developing countries. With the Seo Ho water pumping plant in North Vietnam, scientists of KIT have implemented a viable water supply system within the framework of the KaWaTech Solutions project funded by BMBF. The plant's capacity is sufficient to supply about 10,000 people on the Dong Van karst plateau with water, irrespective of rain and drought periods. The plant was designed and built after long years of research and development work. This sustainable water supply concept may be transferred to other threshold and developing countries as well.

Karst areas often suffer from water shortages. Water is available at great depths only and susceptible to pollution.

FURTHER DEVELOPMENTS OF 3D LASER LITHOGRAPHY

MICROSTRUCTURES AND NANOSTRUCTURES FROM THE PRINTER



It is the material that matters: Objects from the 3D printer are still movable after printing and can be stimulated by temperature changes.

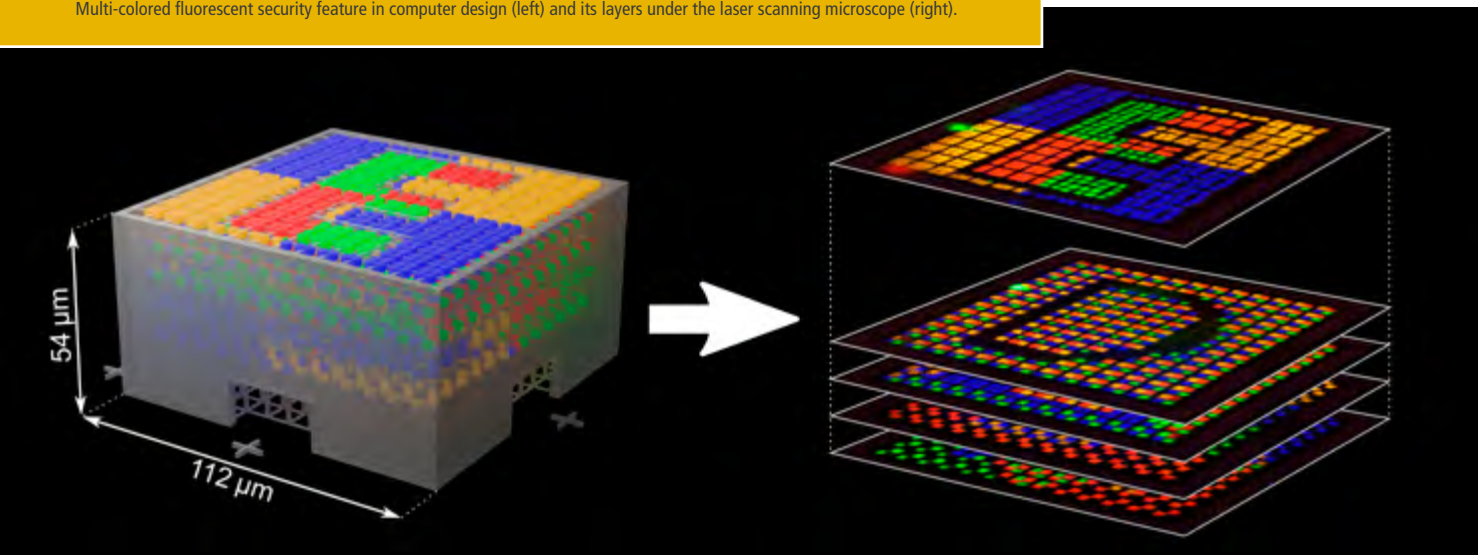
Laser-based 3D printing can already be used to produce nearly any structure of the smallest dimensions. These three-dimensional structures on the micro- and nanoscales have great potential for a number of applications, such as components for data processing with light, optical microlenses, mechanical meta materials, security features of banknotes or branded products, artificial scaffolds for cell cultures, and other applications in biomedicine. Scientists of KIT have pursued various approaches to advancing 3D printing of smallest structures.

A team of KIT's Zoological Institute and the Institutes of Applied Physics and Nanotechnology, together with chemists from Karlsruhe and Heidelberg, have succeeded in producing movable microstructures. The "inks" they used were so-called stimuli-responsive polymers, whose properties may be modified by external signals. Material properties, such as the extent of movement in the case of a certain temperature change, were predicted by computer simulations and adjusted very precisely. Instead of temperature changes, scientists also used focused light as a control signal. The 3D structures produced are functional in aqueous environments and thus ideal for applications in biomedicine and biology.

Nearly all micro- and nanostructures produced by 3D laser lithography so far have been made of only a single material. Scientists of KIT's Institutes of Nanotechnology, Applied Physics, Chemical Technology and Polymer Chemistry, and of the School of Chemistry of Queensland University of Technology in Brisbane/Australia, together with researchers of Carl Zeiss AG, developed a new system for the efficient and precise production of printed three-dimensional micro- and nanostructures from several materials. For this purpose, a microfluidic chamber for the fluids was integrated directly into a 3D laser lithography device.

Both activities were pursued within the Cluster of Excellence "3D Matter Made to Order" (3DMM2O) acquired by KIT and Heidelberg University in the Excellence Strategy competition of the Federation and the Federal States.

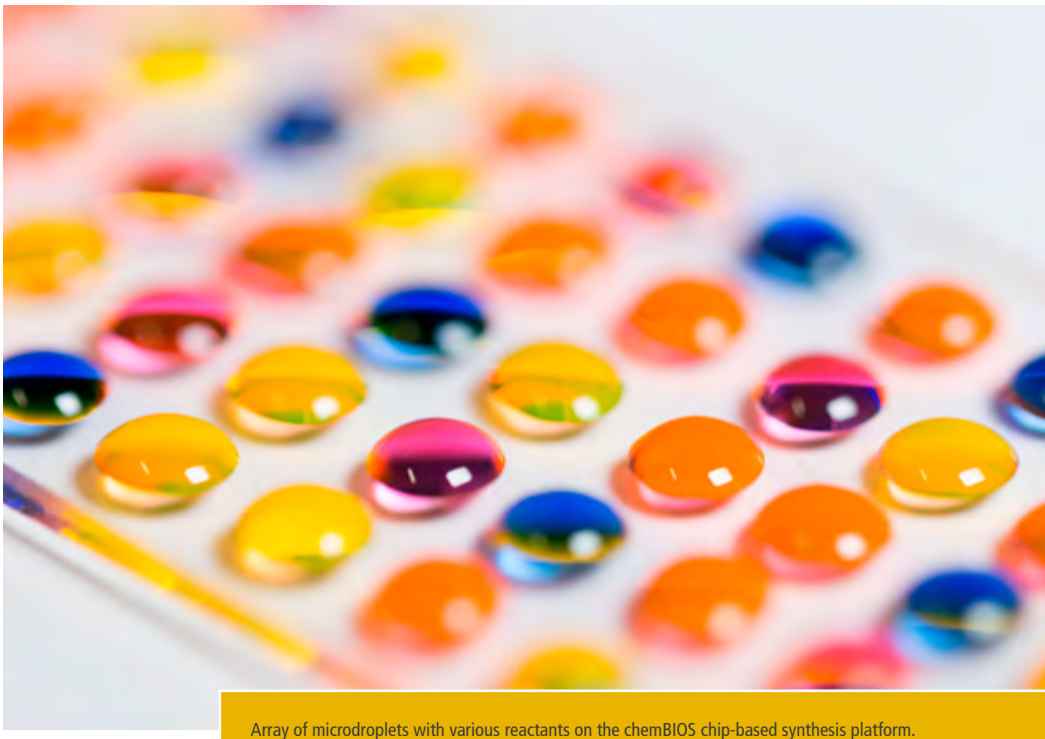
Multi-colored fluorescent security feature in computer design (left) and its layers under the laser scanning microscope (right).



THREE IN ONE BLOW

NEW TURBO CHIP FOR ACCELERATED AND EASIER DRUG DEVELOPMENT

In spite of increasing demand, the number of newly developed drugs decreased continuously in past years. The main reason is that the search for new active substances, i.e. their production, characterization, and screening for biological effectiveness, is very complex and costly, because these three steps have been carried out separately to date. Scientists of KIT succeeded in combining these processes on a chip and, hence, in facilitating and accelerating the process to produce promising medical substances at reduced cost.



Array of microdroplets with various reactants on the chemBIOS chip-based synthesis platform.

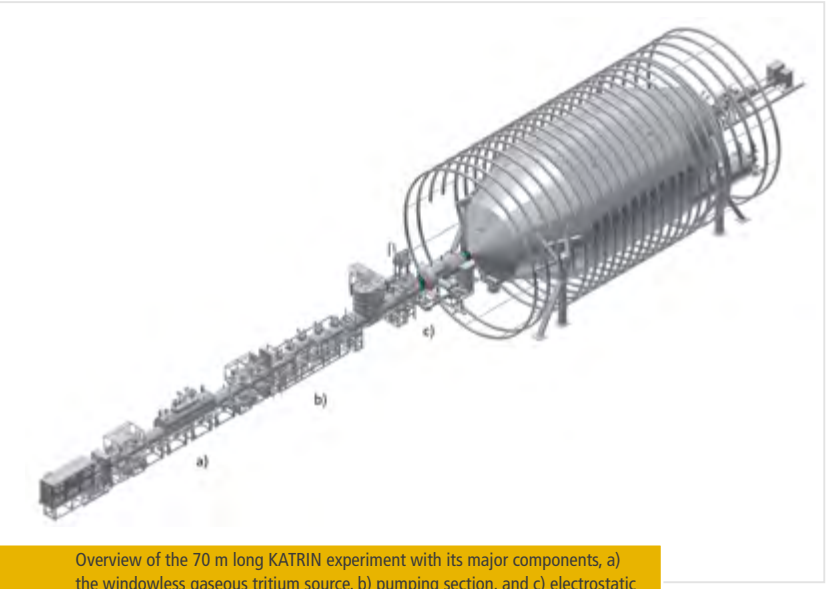
Drug development is based on high-throughput screening of large compound libraries. However, miniaturized and parallelized methods for chemical high-throughput synthesis in the liquid phase have been lacking. Moreover, synthesis of bioactive compounds and screening for their biological effectiveness often are incompatible and have led to a strict separation of these steps. This makes the process expensive and inefficient. Because of the time expenditure and spatial and methodological separation of the synthesis of compounds, their screening, and clinical studies, development of a new medicine often takes more than 20 years and costs between 2 and 4 billion dollars.

For this reason, researchers at the Institute of Toxicology and Genetics have developed a platform that combines the synthesis of compound libraries with biological high-throughput screening on a single chip. This so-called chemBIOS platform is compatible with both organic solvents for synthesis and aqueous solutions for biological screenings. The platform can be used to carry out 75 parallel three-component reactions for synthesis of a library of lipids, i.e. fats, followed by their characterization using mass spectroscopy, on-chip formation of lipoplexes, and biological cell screening. Lipoplexes are nucleic acid-lipid complexes that can be taken up by eukaryotic, i.e. human and animal, cells.

The complete process from library synthesis to cell screening takes only three days and about one milliliter of solution, thus demonstrating the potential of the chemBIOS technology to increase efficiency and accelerate screenings and drug development. Usually, such processes need several liters of reactants, solvents, and cell suspensions.

LIMITS OF LIGHTNESS

KATRIN SETS NEW LIMIT FOR THE NEUTRINO MASS



Overview of the 70 m long KATRIN experiment with its major components, a) the windowless gaseous tritium source, b) pumping section, and c) electrostatic spectrometers and focal plane detector.

Aside from photons, the mass-free elementary quanta of light, neutrinos are the most abundant elementary particles in the universe. Observation of neutrino oscillations around two decades ago proved that they possess a small non-zero mass, contrary to earlier expectations. Accordingly, these lightweights play a key role in the evolution of large-scale structures in the universe as well as in the world of elementary particles, where their small mass scale points to new physics beyond known theories. Over the coming years, the most precise scale of the world, the international Karlsruhe Tritium Neutrino Experiment KATRIN at KIT, is set to measure the mass of these fascinating neutrinos with unprecedented precision.

In past years, the KATRIN experiment, a collaboration of 20 institutions from seven countries, successfully mastered many technological challenges in the commissioning of the 70 m long experiment. In mid-2018, KATRIN reached an important milestone: Official inauguration of the beamline and the start of measurement operations with tritium, a radioactive hydrogen isotope that is subjected to beta-decay and produces a helium atom, an electron, and a neutrino.

During a measurement campaign of several weeks in spring 2019, KATRIN succeeded in limiting the neutrino mass to less than 1.1 electron volts, which already is more than twice as precise than previous laboratory experiments partly based on campaigns of several years. Both hardware and analysis groups were ready for taking neutrino mass data. Three international analysis teams deliberately worked separately from each other to guarantee truly independent results. In doing so, special emphasis was put on ensuring that no team member was able to prematurely deduce the neutrino mass results before completion of the final analysis step. To coordinate their final steps, the analysts met for a one-week workshop at KIT in mid-July 2019.

KATRIN's current result builds upon years of efforts, which established a data processing framework, identified and constrained key backgrounds and sources of uncertainty, and constructed a comprehensive model for the instrumental response. Through simulations and test measurements, the analysts gained a deep understanding of the experiment and its detailed behavior.

Members of the international KATRIN collaboration convene in the KATRIN control room of the Karlsruhe Tritium Laboratory during the 2019 spring neutrino mass measurement campaign.

MEN ARE HARDER COMPETITORS

LABORATORY EXPERIMENT ON GENDER DIFFERENCE IN SABOTAGE

In competitive situations, men invest more resources than women in reducing their competitors' performance. They overestimate sabotage against them and accordingly respond in a more hostile way, while women realistically assess the sabotage efforts of their competitors. This is the result of a laboratory experiment at KIT. A work environment that creates transparency and reduces uncertainties about sabotage by competitors thus causes men to sabotage less.

A team of researchers of KIT's Chair for Human Resource Management and the Institute for Applied Microeconomics of Bonn University studied differences in conduct of men and women in competition. The goal was to clearly show gender differences in unethical conduct, i.e. sabotage, and understand the underlying mechanisms in order to develop countermeasures in the long term.

In the experiment, the participants were told to encode words by a sequence of numbers. For each correct coding, they were given points and the person scoring the most points received a bonus. On the average, women and men showed similar performances. Both genders therefore would have had about the same chance to win the competition against each other.

In competition, however, relative performance counted. It was only important to be better than the competitors, meaning either to work harder and increase one's own performance or to reduce the performance of the competitor by activities, such as sabotage. Accordingly, the participants were given the option to reduce the competitor's score by the use of money.

Men turned out to sabotage more than women. They invested more money in reducing the performance of their competitor. For this reason, they won more often. Moreover, the information given to the participants in the experiment about the sabotage activities of their competitors was varied specifically. The own sabotage behavior was found to be determined by the uncertainty about the sabotage activity of their competitors. Men systematically overestimated the amount of sabotage directed against them. For this reason, their own sabotage activity was higher. Women, by contrast, realistically assessed the sabotage level. Women and men may not have different moral values, but men perceive their environment as more competitive.

Based on the findings of the study, countermeasures shall be developed in the long term: When men are given the feedback that the world is not as competitive as they assume, they adapt their expectations and conduct accordingly and reduce their sabotage activity to that of women. Then, it is the better person that wins and women are not systematically disadvantaged. A company can counteract sabotage just by creating an awareness of these mechanisms.

Women and men have similar moral values, but men perceive their environment as more competitive.

DISADVANTAGED BY THE ALGORITHM

THE RISK OF BEING DISCRIMINATED BY AUTOMATED DECISIONS

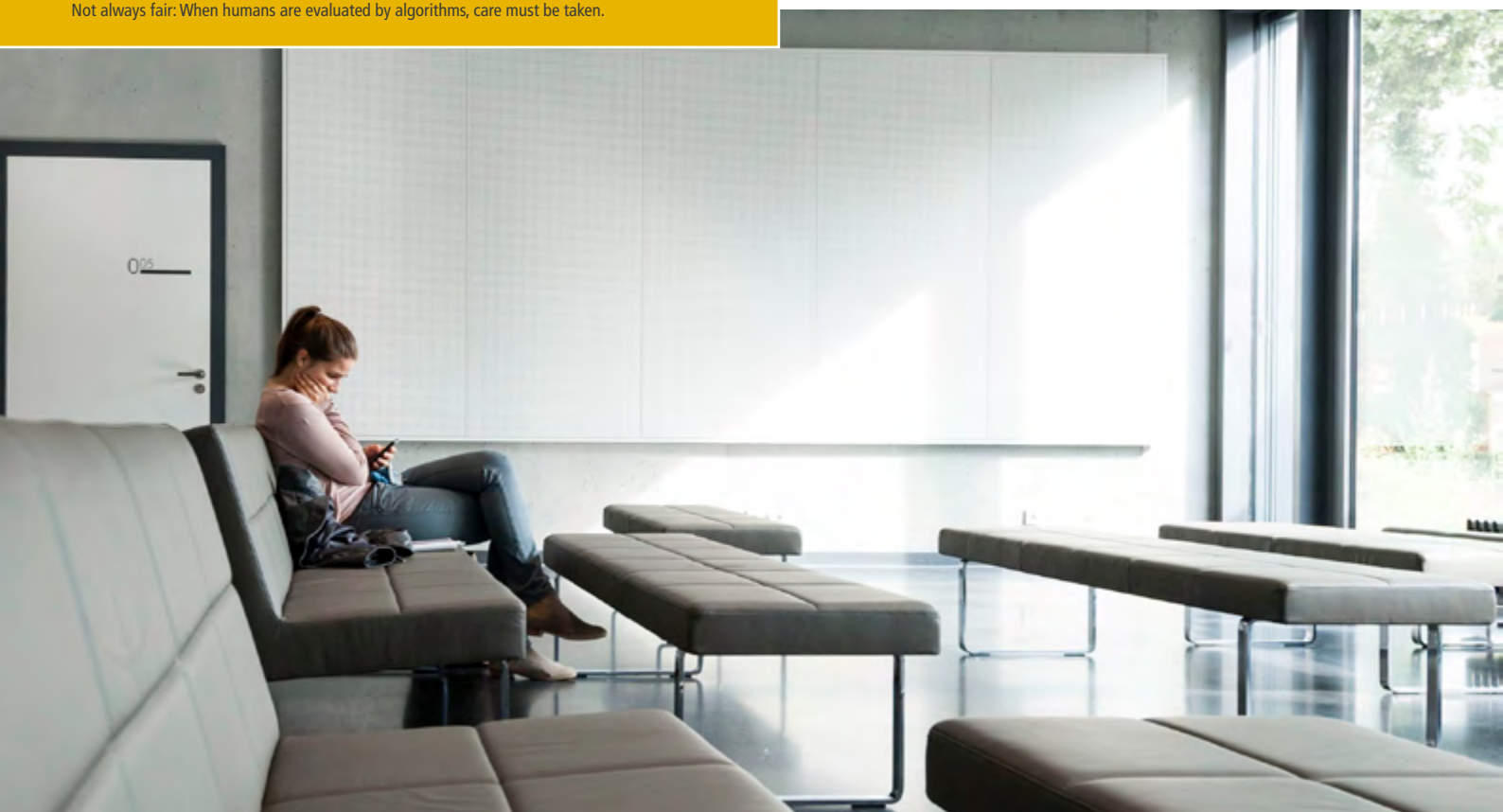
Granting a loan, selecting new staff, or making legal decisions – in an increasing number of fields, algorithms, i.e. calculation instructions implemented in computers, are applied to prepare human decisions or to make these decisions for humans. Their efficiency saves time and money, but also entails many risks for individuals or population groups being discriminated. This is the result of a study made by the Institute for Technology Assessment and Systems Analysis of KIT on behalf of the Federal Anti-Discrimination Agency. Unfortunately, it is often a mistake to think that algorithms lead to more objective and fairer decisions. Situations become particularly critical when algorithms work with biased data and rely on criteria that ought to be protected, such as age, gender, ethnic origin, religion, sexual orientation, or disability.

The study entitled "Diskriminierungsrisiken durch Verwendung von Algorithmen" (discrimination risks by using algorithms) lists 47 examples to illustrate how algorithms can discriminate people in various ways and how this can be detected and proved. For instance, the study describes situations on the real estate market, where migrants and people with a disability or non-white skin color were discriminated, the loan market, where an algorithm preferred men to women, or the penal system, where decisions on early releases from prison systematically overestimated black peoples' risk of re-offending.

Machine learning systems often have problems when they are trained with data reflecting unequal treatment or stereotypes. In these cases, the algorithms generated also do so. When processing data containing evaluations of people by other people, unequal treatments and discriminations may even spread or increase.

However, society must no longer accept these unequal treatments. The study lists several options to counteract discrimination by algorithms. Companies may ask antidiscrimination agencies to instruct their staff and IT experts and increase their awareness. Then, these persons will use datasets that do not reflect any discriminating practices or unequal treatments. The goal is to make future algorithms "discrimination-free by design."

Not always fair: When humans are evaluated by algorithms, care must be taken.



PHOTOVOLTAICS – VERSATILE IN SHAPE AND COLOR

PRINTED PEROVSKITE SOLAR MODULE FOR FLEXIBLE USE IN BUILDINGS

In the PRINTPERO project, German and Greek researchers and industry partners develop printed perovskite solar modules for flexible use in buildings.

Perovskite semiconductors currently are among the most promising materials for highly efficient and cost-effective next-generation solar modules. Thin-film solar cells based on these perovskites already achieve efficiencies of more than 23% in the laboratory. However, the processes currently used in research to manufacture perovskite solar cells cannot be transferred to industrial standards.

Within PRINTPERO, a project coordinated by KIT, work is aimed at replacing laboratory processes with digital printing processes that run at low temperatures and are suitable for industrial production. German and Greek scientists, together with industry partners, will demonstrate the technical feasibility of digitally printed solar modules based on perovskite semiconductors. They work on prototypes that can be designed in different shapes and colors. The goal of PRINTPERO is to develop digitally printed, highly efficient, and stable solar modules that can be integrated into roofs, facades, and windows.

To achieve these goals, the participating researchers use the potential of digital ink jet printing. In addition, they develop printable luminescent layers to realize different color impressions and protect solar cells from harmful UV radiation. Together with their project partners, KIT researchers are also working on improving the stability of perovskite solar cells, connecting several of these cells in series to form large-area solar modules, and encapsulating the modules to protect them from moisture and resulting decay.

PRINTPERO is carried out by KIT and the Technological Educational Institute of Western Greece as well as the solar industry companies SUNOVATION Produktion GmbH (Aschaffenburg/Germany) and Brite Hellas S.A. (Thessaloniki/Greece). Within the Framework Program Research for Sustainable Developments (FONA), the Federal Ministry of Education and Research (BMBF) is funding the three-year German-Greek collaboration project, which was launched in 2018.

TEACHING

In the 2019/20 winter semester, the number of KIT students totaled 24,381, about 2.9% less than in the previous year. The proportion of international students remained at the same 23% level as in the past year, while the share of female students has meanwhile reached a new maximum of 29.4%.

In the 2019/20 winter semester, KIT started to offer a bachelor's and master's program in information systems to convey competencies for the digital worlds of work and life. These programs are organized by the KIT Departments of Informatics and Economics.

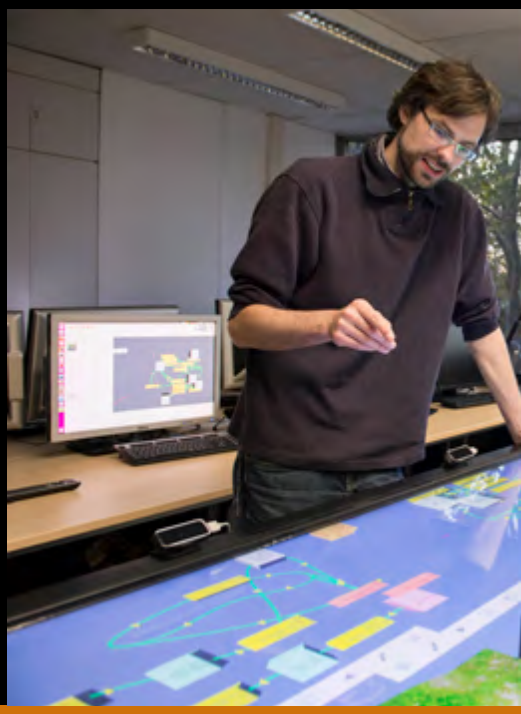
In the 2019/20 winter semester, students could enroll in 43 bachelor's, 56 master's, and eight continuing master's programs at KIT, including teaching degree programs for future teachers of German secondary schools (including specializations) and one program for vocational school teachers.

In May 2014, KIT was granted system accreditation for the first time, which means that study programs can be given an internationally recognized quality label after thorough examination by KIT. A central element of the internal quality assurance scheme of KIT is the KIT PLUS procedure (here, PLUS stands for "evaluation of teaching and studies programs").

Quality assurance is organized in line with an external program accreditation process that covers several steps. In 2019, preparations started for the reaccreditation of KIT in 2020.

Usually, programs have to be accredited separately by external agencies in order to prove quality of education, which is associated with a high time and cost expenditure. Education institutions having an appropriate internal quality management system for studies and teaching only are permitted to assess and accredit their own programs.


Work. Experience. Discover.




KIT
Lehre
Lecturing


KIT
Karlsruher Institut für Technologie

FOR AN OPTIMAL START OF STUDIES

BADEN-WÜRTTEMBERG FUNDS PROGRAMS TO FACILITATE THE BEGINNING OF STUDIES AT KIT

All beginnings are difficult. This also holds for starting university studies. Questions like "Did I choose the right subject?" or "Will I cope with the requirements?" determine whether students drop out or continue their studies, particularly in the initial phase. Measures taken by universities to support studies in this phase are now funded by the state under the "Fonds Erfolgreich Studieren in Baden-Württemberg" (FESt, Fund for Successful Studies in Baden-Württemberg). KIT is presently carrying out four projects to facilitate the start of studies and set the course for successful graduation.

The project "Studienlotsen, Mentoring und entschleunigte Studienpläne" (study pilots, mentoring, and slowed-down study plans) that started successfully at KIT was granted follow-up funding. It covers services and advice to support students in the initial phase of their studies and prevent unnecessary dropouts, such as subject-specific mentoring programs, customized advice, and information events on job profiles.

The project "Betreuung, Pflege und Weiterentwicklung der Online-Angebote des MINT-Kollegs für Studieninteressierte und Studienanfänger*innen" (support, maintenance, and further development of online courses of the MINT-Kolleg for prospective students and student beginners) is run jointly by KIT and Stuttgart University and facilitates transition from school to university in STEM subjects. For this purpose, online courses in mathematics and physics are offered to deepen basic knowledge, bring the participants to a common level of knowledge, and familiarize them with university methods.

The orientation test for the selection of study programs will be developed by KIT and the universities of Stuttgart and Ulm. Through selection interviews and knowledge and aptitude tests, prospective students are to be given individual feedback before they apply. In this way, they are informed in more detail about the requirements of the study programs.

For students from abroad, KIT plans to extend its socio-integrative buddy program and to offer preparatory language and scientific courses. "Learning from and with each other" is the motto according to which students from abroad are assisted by a fellow student from the same department, if possible. The buddies will help foreign students after their admission to find their way around, to establish contacts, and to organize studies properly.

KIT students are offered programs to facilitate the start of studies and prevent dropouts.

SHAPING DIGITIZATION

START OF THE INFORMATION SYSTEMS PROGRAM

Digitization leads to profound changes in industry and society. Successful design of sustainable digital solutions requires knowledge of informatics, economics, and law. The corresponding qualifications for the digital worlds of work and life are imparted by KIT's bachelor's and master's information systems programs that started in the 2019/20 winter semester and build on a long-standing, interdisciplinary teaching tradition.

In addition to basic knowledge of informatics, economics, and law, the information systems program imparts practice-oriented problem solution competencies.

Information systems experts are needed by all branches. They work at the interface between business perspective and the potential of information technologies. Studies of information systems combine the science and practice of digitization and provide an excellent basis for managing challenging tasks in areas such as the development of software and digital services, consulting, data analysis, or starting one's own business. The program organized by the KIT Departments of Informatics and Economics makes students fit for careers at startups, medium-sized enterprises, and big companies.

In addition to basic knowledge of informatics, economics, and law, the program assigns crucial importance to practice-oriented problem solving, which fits perfectly with KIT's concept of research-oriented teaching. Within a comprehensive team project, bachelor's students are to develop an executable software application using the latest methods and tools. Based on this knowledge, master's students can choose from a number of elective modules for individual specialization in artificial intelligence, IT security, or marketing and logistics.

Studies of information systems are characterized by real interdisciplinarity, individuality, internationality, and integration of digitization science and practice. Exchange programs, language courses, lectures in English, and funded internships abroad enable students to acquire international experience beginning in the bachelor's phase. A network of national and international partners ensures close interconnection of science and practice.

50 YEARS OF INFORMATICS IN GERMANY

ANNIVERSARY OF INFORMATICS AS A SUBJECT IN KARLSRUHE

The founding of the "Institute of Informatics" and the introduction of informatics as a subject at the former University of Karlsruhe (TH) in 1969 was a milestone in the success story of informatics in Germany. The predecessor of KIT was among the first institutions in Germany to realize the importance of this branch of science and to firmly entrench it in an institute of its own.

KIT celebrated the birth of the informatics degree program on June 19, 2019 with a ceremony in the presence of Baden-Württemberg Science Minister Theresia Bauer. The agenda included a presentation on the history of informatics in Karlsruhe by the founder of the KIT Department of Informatics, Professor emeritus Gerhard Goos, and a panel discussion on "Informatics in the Age of Digitization."

The age of digitization is determined by information technology innovations. Electronic devices are omnipresent in daily life. 50 years ago, however, computers were pretty much non-existent outside the professional world and the profession of computer scientist was unknown. The University of Karlsruhe (TH) changed all that, founding the "Institute of Informatics," and introducing the subject of informatics as did four other universities in Germany. In 1972, the first German informatics department was finally established in Karlsruhe.

At today's Department of Informatics of KIT, research covers the big issues of our times, such as autonomous robot assistance systems and artificial intelligence processes. Teaching in this area also benefits from current research and KIT´s long tradition. With a strong link to research, graduates are prepared for today's tasks in economics, science, and society and also enrich the startup scene in Karlsruhe.

The continuing high importance of informatics at KIT is also reflected by the just started construction of the "InformatiKOM" buildings with funds of the Klaus Tschira Foundation. On KIT's Campus South, a new forum will be built for exchange between university and society. The buildings will accommodate institutes of both informatics as well as science communication and applied cultural studies. The six-story main building will additionally house seminar and working rooms for scientists and students of KIT.

KIT's students of informatics profit from the latest research and a long tradition.

ON THE WAY TOWARDS THEIR OWN STARTUP

THE STUDENT INNOVATION LAB – A PROJECT-ORIENTED TEACHING CONCEPT

Research, teaching, and innovation – this triad defines KIT's self-conception. As "The Research University in the Helmholtz Association," KIT highly values research-based teaching. The Student Innovation Lab (SIL), a new innovative course based on a project-oriented teaching concept, has complemented KIT's master's programs since the 2019/20 winter semester. It is intended to support the students' innovative capacity.

The Student Innovation Lab established in the 2019/20 winter semester supports the innovative capacity of students.

The course addresses master's students of electrical engineering and information technology, mechatronics, informatics, and economics. Within a period of two semesters, students are to turn an idea into a demonstrator. First, a theoretical part conveys the basics of innovation management and agile systems development methods. This part of the course is organized by the Institute for Entrepreneurship, Technology Management, and Innovation and the Institute for Information Processing Technology.

The second part covers practical development of innovation proper in three labs, the Automation Innovation Lab of KIT's Institute for Control Systems, the Industry 4.0 Innovation Lab of the Institute of Radio Frequency Engineering and Electronics, and the IOT Innovation Lab of the Institute for Information Processing Technology.
The Student Innovation Lab is embedded in the "KIT Research-based Teaching PLUS" project that is financed from funds of the Program for more Quality in Teaching. It was launched by the Federal Ministry of Education and Research to improve the support of students as well as studies conditions and teaching quality of universities.

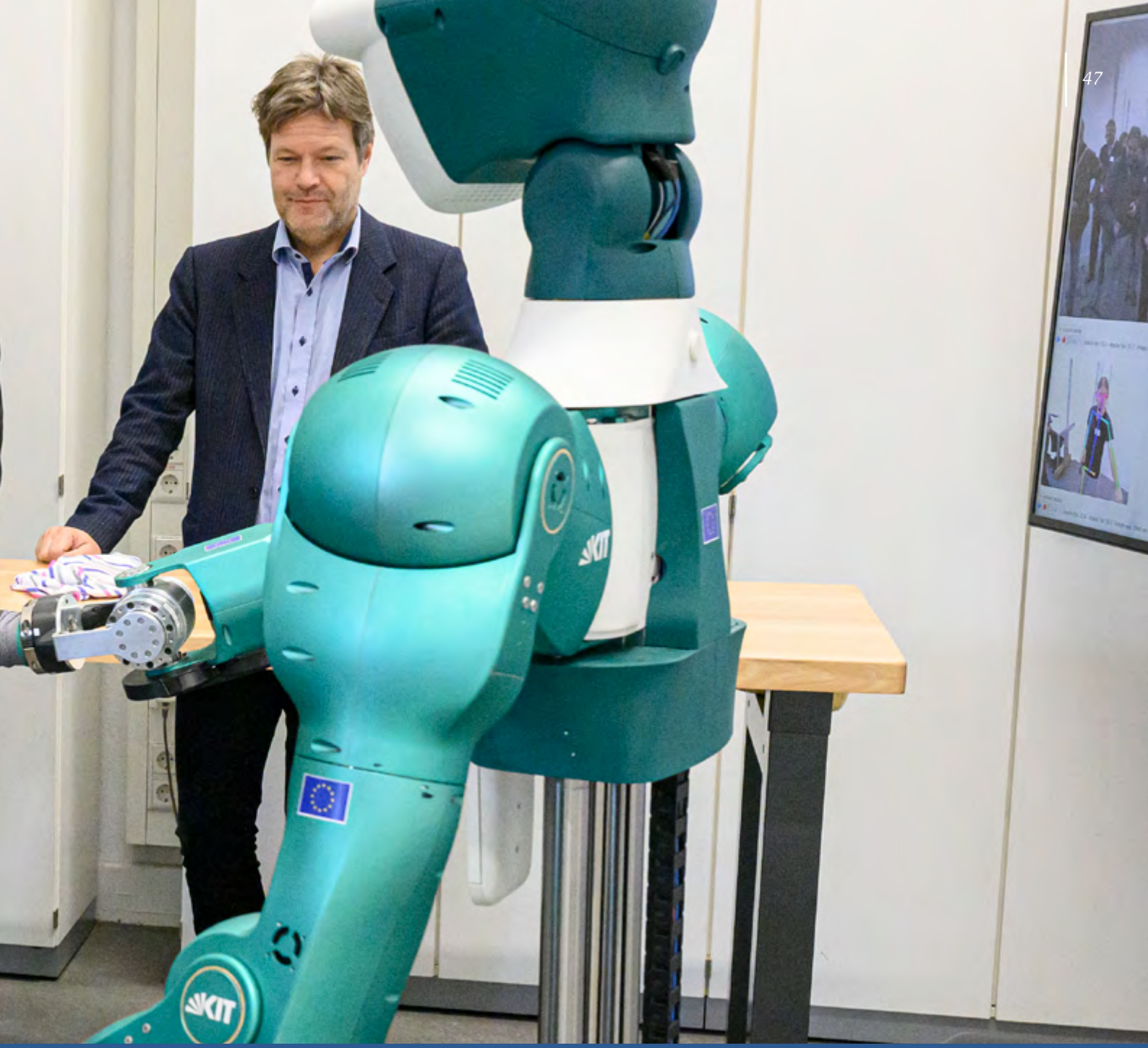
KIT Research-based Teaching PLUS is aimed at implementing the research-based teaching concept in all studies programs of KIT. As of the start of their studies, all bachelor's and master's students of KIT are to profit from research-based teaching and to test and discover their research interests. Successful research-based teaching and learning formats of KIT are reflected and advanced to generate synergy effects for the further development of studies programs.

KIT Research-based Teaching PLUS consists of 15 decentralized, independent subprojects with a superordinate project administration. The 15 subprojects are carried out by and at the institutes, departments, and business units of KIT, thus networking them more closely.

INNOVATION

On a par with research and teaching, innovation is part of the statutory mission of KIT. KIT carries out projects from the idea to the solution, often in close collaboration with industry. A one-time research contract, research collaborations, recruitment of qualified staff among graduates, or technology transfer projects: KIT offers a variety of collaboration options for industrial companies.

The Entry Point Industry is the central contact for industrial companies. It arranges contacts when information is needed on research expertise, advertising on campus, sponsoring, or when companies look for graduates.



The KIT Business Club is the central communication platform for companies that cooperate with KIT in a broad range of areas. Club members are offered individualized, personally coordinated access to experts, the Executive Board of KIT, and the innovators of other member companies.

KIT's scientific institutes produce countless ideas, inventions, technologies, and processes that may serve as the basis for cooperation with industry. Companies looking for technical solutions are offered many collaboration options or concrete technologies. KIT looks for partners from business and industry to develop these technologies into innovative products that are of benefit to both sides and society.

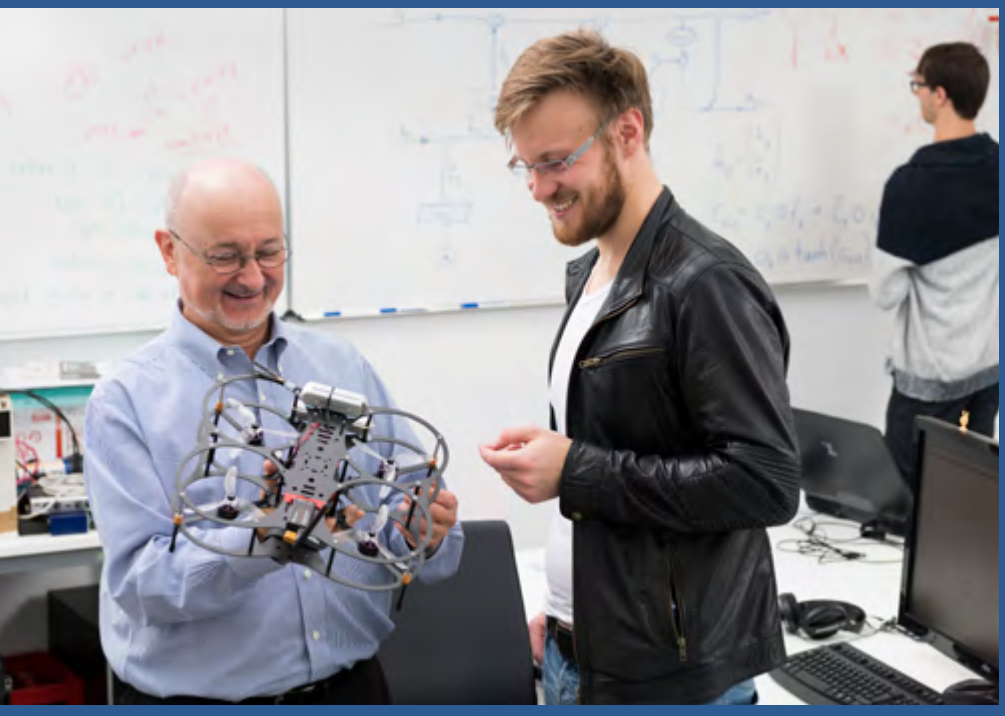
With 24,381 students and 9,398 employees, KIT offers an attractive environment for companies to present themselves and their services. Companies may come to KIT's annual Career Fair, display flyers and posters on the campus, or sponsor events or lecture halls.


KIT
Digital Twin and "Click & Build"
Artificial Intelligence
Breaking the Language Barrier


KIT
Creating the


prenode


GROW

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NG – INNOVATION


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KIT
NEULAND


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SIMUTENCE
Virtual Composite Solutions
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Hörsaal


VR-Teleoperation
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KIT
Deines Glückes
Schmied.
KIT-Gründerschmiede


heat it


ZEISS-PAVILLON
deas into innovation

INTERNATIONAL STARTUPS

KIT AND PARTNERS LAUNCH GLOBAL HORIZON PROGRAM

A successful startup does not develop in a vacuum. Entrepreneurial spirit and specific funding belong together. Young entrepreneurs from KIT have demonstrated again and again how a good idea can be turned into an innovation for the common good. The EXIST funding program of the Federal Ministry for Economic Affairs and Energy (BMWi) has proved to be a very successful instrument in supporting startups and spinoffs at KIT.

Together with regional partners, KIT established an alliance for internationalization of startup support and launched the Global Horizon Program. The BMWi has agreed to fund this program for strategic internationalization of startup support with EUR 2.2 million in the next four years. It will make KIT the most important interface between technology startups in Southwest Germany and the global markets.

Together with the universities of Mannheim and Heidelberg, KIT plans to connect the startup scenes and founders in Karlsruhe and the Rhine-Neckar region with the world. Associated partners are the other universities in the three cities and several national and international network partners. DAX companies, such as Merck, SAP, or BASF, have promised their support.

An example of a successful startup of KIT is thingsTHINKING, which was funded under the EXIST program. The founders developed software that can understand text irrespective of its formulation and find similar contents.

While computers normally fail to understand texts, the software made by thingsTHINKING comprehends, processes, and uses the semantics of language. For this reason, it can be used wherever large amounts of text have to be analyzed within short terms, e.g. by auditors, tax consultants, and law offices. The company was present in the media when it compared the coalition agreement of the grand coalition with the party programs and found that the coalition agreement contained more concepts of the SPD than of the CDU/CSU.

Thomas Neumann, Head of the Startup and Participations Group of the Innovation and Relations Management Business Unit is handed the grant certificate of the EXIST-Potentials Competition by Sabine Hepperle, Federal Ministry for Economic Affairs and Energy.

AS MANY AS NEVER BEFORE

RECORD NUMBER OF GERMANY SCHOLARSHIPS

On November 7, 2019, the Germany Scholarship certificates were presented at KIT's Audimax.

In 2019, KIT was in a position to grant 259 Germany Scholarships, as many as never before since the start of the scholarship program in 2011. The scholarships in the amount of EUR 300 per month are funded half by private sponsors, such as companies, individuals, foundations or associations, and half by the German Federation. In 2019, the share donated by KIT's alumni more than doubled: The total amount of donations by alumni of KIT exceeded EUR 100,000.

Registered students of all nationalities can apply for the scholarship. It is to sponsor students, who, due to their previous results, are expected to show above-average achievements in the future. Among the selection criteria are success at school or university as well as extra-curricular activities in associations, university politics, church or political organizations, in the social environment, family, or a social institution. Special consideration is given to students who have to overcome difficult situations because of their family or cultural origin.

The Netzwerk Deutschlandstipendium Karlsruhe e.V. network connects current scholarship holders, alumni, and sponsors in Karlsruhe. Established by current and former scholarship holders, the network complements financial support by various ideational services. On the average, it offers two events per month, including presentations by experts, workshops on various key qualifications, and excursions. The broad spectrum of topics covered and events helps scholarship holders broaden their horizon and obtain insight into various areas. The program is rounded off by regular meetings and leisure activities to foster interdisciplinary exchange.

The sponsors of the Germany Scholarship also play an important role in the network. Thanks to its unique concept, scholarship holders have the opportunity to establish new contacts to industry and business. The network plans to further strengthen networking activities by a variety of collaboration projects.

VIRTUAL PROCESS CHAINS

KIT PARTICIPATES IN SIMUTENCE

SIMUTENCE GmbH, a spinoff of KIT, uses a virtual process chain to support designers and manufacturers of fiber-composite components in the development and optimization of lightweight construction solutions and manufacturing processes. Lightweight construction specialist SIMUTENCE is currently funded by the Helmholtz Association under the Initiative and Networking Fund and receives an additional budget for integrating an external manager. In 2019, KIT decided to participate. With this, the number of KIT's participations in spinoffs increased to ten.

SIMUTENCE provides services and develops software for the use of fiber-reinforced plastics in industry. These materials have excellent mechanical properties, such as a high material stiffness, and, at the same time, extremely low weight. While they have enormous potential for use in lightweight vehicle structures, the resistance of some components and their producibility have not yet been simulated accurately enough.

This results in high development costs due to insufficient material utilization. To solve this problem, SIMUTENCE GmbH, whose founders come from the Institute of Vehicle System Technology, developed additional modules for the already established virtual process and structure simulation software that can be used to reliably design components and optimize production processes. In the future, the virtual process chain by SIMUTENCE could help companies minimize costs and risks when using fiber-composite materials.

Using SIMUTENCE's virtual process chain, companies can simulate the resistance and producibility of components made of fiber composites.

TRANSFER ACROSS BORDERS

EU PROJECT KTUR FOSTERS COLLABORATION IN THE UPPER RHINE REGION

Universities, trade associations, and industrial companies in the trinational Upper Rhine Metropolitan Region want to enhance future knowledge and technology transfer. The necessary basis is created by the "Knowledge Transfer Upper Rhine" (KTUR) project funded by the European Union (EU). KTUR was initiated within Eucor – The European Campus, in which the universities of Basel and Freiburg, the Université de Haute-Alsace, KIT, and the Université de Strasbourg form a trinational higher education area. Eucor also is an associated partner of KTUR.

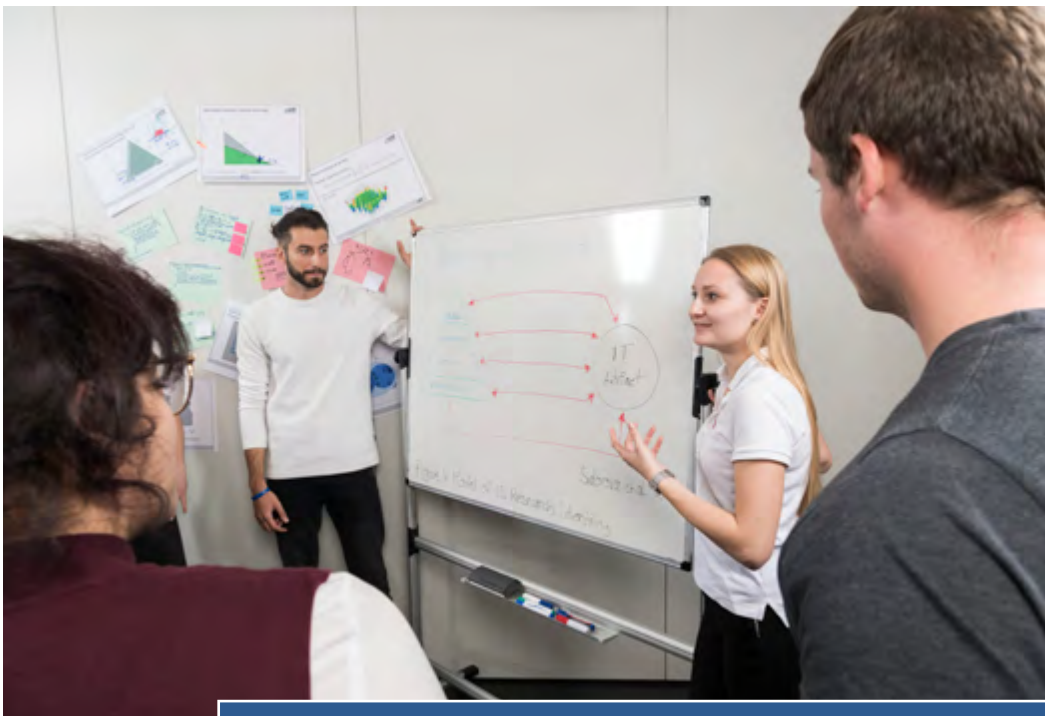
The Upper Rhine Metropolitan Region connects markets in Germany, France, and Switzerland. The region is home to a number of science institutions, clusters, and companies which already make it a pioneer region for European collaboration. Future intensified cooperation in research and development, licensing, or in establishing cross-border startups might considerably enhance growth and employment in the region.

The EU-funded KTUR project has been initiated to foster cross-border knowledge and technology transfer. The EU approved funding of KTUR with EUR 1.6 million in the next three years. 12 partners from universities are involved in the project coordinated by KIT. The project budget totals EUR 3.9 million.

Within the KTUR project, universities and trade associations want to learn from each other across the borders, create a corporate identity in knowledge and technology transfer on the upper Rhine, and lower existing barriers to intensify contacts and initiate projects between universities and industry.

To reach these goals, solutions are developed for selected areas of action. They will then be implemented and tested with the active participation of more than 100 companies.

Several aspects are studied, such as structurization of collaboration of universities on the upper Rhine. Joint knowledge and technology transfer services will be developed and tested for e.g. advanced training, startups, cross-border innovation events, a single entry point for industry, and a modular and adaptable research-to-business information and exchange platform. The most effective measures will be made permanent upon the completion of the project.



The EU-funded KTUR project aims to strengthen collaboration of innovators in Germany, France, and Switzerland.

PROMOTING YOUNG TALENT

With its concept "The Research University in the Helmholtz Association I Living the Change," KIT was successful in the Excellence Strategy competition in 2019.

The concept focuses on three central, interconnected packages of measures derived from the KIT 2025 Umbrella Strategy. One of these packages is aimed at providing reliable career paths in academia. Two of the measures included, the Young Investigator Group Preparation Program (YIG Prep Pro) and KIT Excellent Tenure, address excellent young researchers.

YIG Prep Pro covers international recruiting of excellent young researchers, who earned their doctorate not more than four years ago. The program supports them in preparing and drafting a proposal for a junior research group funded by third parties, such as an ERC Starting Grant, a DFG-funded Emmy Noether Group, or comparable groups. In parallel, YIG Prep Pro offers training in the area of professional skills and a program of measures to help these researchers find their way around at KIT, plan their career, or draft their proposals with the support of mentors.

Support by KIT covers the researcher's own position, initial funding, and material resources. In the case of successful acquisition of a junior research group, members of YIG Prep Pro will have access to the Young Investigator Network (YIN) of KIT and to KIT's Excellent Tenure Program.

The KIT Excellent Tenure measure is intended to considerably increase the number of tenure-track professorships. KIT plans to recruit ten junior research group leaders of the highest international level every year with half of them coming from YIG Prep Pro.


EXIT

YIG PREP PRO

CAREER OPTIONS FOR EARLY-STAGE RESEARCHERS

The Young Investigator Group Preparation Program (YIG Prep Pro) emerged from the KIT 2025 Umbrella Strategy as a means to offer reliable career options to young researchers on their way towards a professorship. The program started in 2019 and has been funded within the Excellence Strategy since November 2019.

Of 55 international applicants in 2019, 21 candidates were invited to KIT. During a so-called exploration week, they were given the opportunity to further elaborate their research idea in cooperation with their potential host institute, to inform themselves about important funding programs, and to get to know the KIT and the city of Karlsruhe. At the end of the exploration week, the candidates presented their proposal to KIT's Council for Research and Promotion of Young Scientists (CRYS). Following final selection, 17 candidates for the three funding lines were offered a fellowship under the YIG Prep Pro program. As soon as the program starts, they have two years to intensively work on their research idea and to acquire funding for a junior research group.

The exploration week at KIT had two goals: First, final selection of proposals and candidates by CRYS, and second, personal ties between the candidates and KIT by establishing contacts to the host institute, persons relevant to the program, other fellows, or members of the Young Investigator Network (YIN) of KIT.

KIT distinguishes three groups of fellows: Funded fellows are granted a contract of two years' duration by KIT. Their positions and initial funding for a period of two years are financed from program funds. In addition, funded fellows can participate in all program offerings. KIT postdoc fellows already are postdocs at KIT. As of 2020, they will also be granted financial support and are given the opportunity to participate in all program offerings. Remote fellows remain on their postdoc position at their home institution and are supported from there. They are also invited to participate in all program offerings. In addition, up to two stays per year at the potential host institute for personal exchange or participation in qualification courses may be funded.

In principle, all fellows are assigned a mentor from their host institute, who will provide scientific support and advice relating to potential career options in science. In addition, fellows are given tailored advice and coaching for the acquisition of a junior research group, an individual development plan as regards scientific and transferable skills, and the opportunity to exchange experience within the YIG Prep Pro network and beyond.

Oliver Kraft, KIT Vice-President for Research, welcomed the participants in the exploration week in April 2019.

ANOTHER SIX TENURE-TRACK PROFESSORSHIPS

FUNDING ACQUIRED FOR EARLY-STAGE RESEARCHERS

Early-stage researchers decisively contribute to research, teaching, and innovation at KIT. Thanks to the introduction of tenure-track professorships in 2013, KIT can now offer transparent and plannable career paths for early-stage researchers and, hence, provide them with reliable framework conditions for their research.

Due to its convincing concept for supporting early-stage researchers, KIT was granted funds for another six tenure-track professorships in the second round of the Federal-states Program for Promoting Young Scientists in 2019. In the first round in 2017, KIT had already succeeded in acquiring nine tenure-track professorships.

Tenure-track professors decisively contribute to academic education, research, and innovation at KIT.

Tenure track refers to a transparent procedure of granting permanent employment after a successful probationary phase. Upon quality assurance, professors that are initially appointed for a limited period of time are granted a permanent professorship contrary to classical habilitation with unclear career perspectives. The criteria for granting a tenure track are agreed upon by the university and the appointed professor in a clearly defined and transparent process at the beginning of employment, which means shortly after the doctorate of the candidate. At defined points of the candidate's career, evaluations take place.

To improve the framework conditions for early-stage researchers and tenure-track professors, KIT's support concept envisions a variety of measures. Courses for advanced education and further training, staff appraisal interviews, and staff and appointment planning interviews play an important role. In addition, quality assurance is implemented on various levels. Interim evaluations provide regular feedback on the state of the scientific career and ensure transparency and reliability.

As the phase of starting a family and the qualification phase may coincide in time, special measures are offered, such as extended leaves in the case of the birth or adoption of a child, family-friendly working time schemes, extensive childcare, career counseling of partners and spouses, or general and individual assistance.

AI TRAINING TO MAKE STUDENTS FIT FOR THE JOB

STUDENTS TRAIN AI METHODS FOR LATER PROFESSIONAL PRACTICE

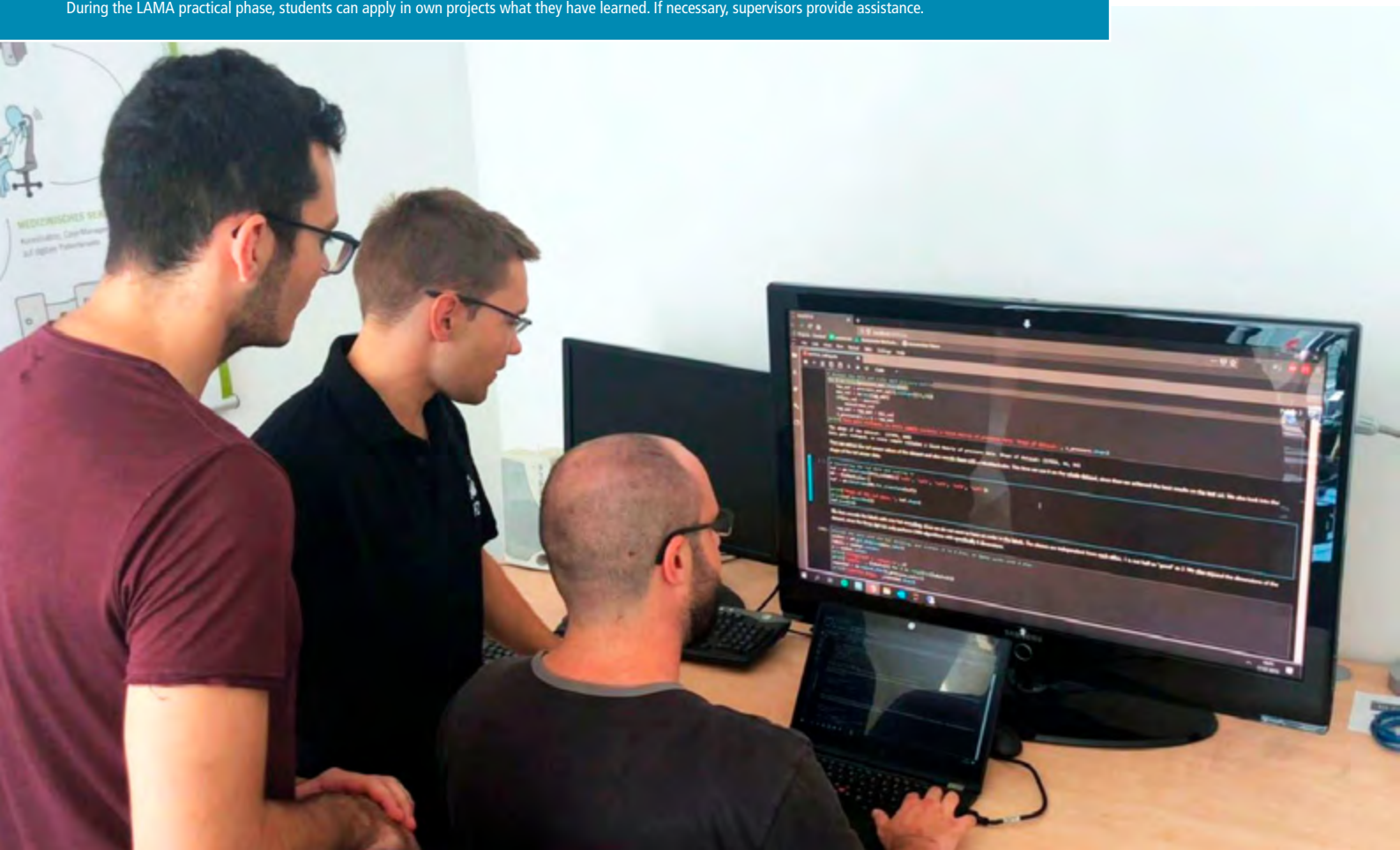
Machine learning currently is one of the hot topics in science and industry. It is used for customized IT products and weather forecasts, in personalized medicine and production technologies. Profitable use of artificial intelligence (AI) methods requires experience. At KIT, future engineers are already being taught AI during their studies. At the Laboratory for Applied Machine Learning Algorithms, LAMA for short, they are prepared for future work by project-based AI training.

At LAMA, AI lessons that were accessible only to specialists until a few years ago are now attended by students of electrical engineering and information technology. Students are trained to cope with practical challenges, they are imparted the wide range of opportunities associated with machine learning as well as its limits, and they develop innovative solutions for science, established companies, and young startups to generate new fields of business, from language assistants to Industry 4.0 to autonomous driving.

At the laboratory, supercomputers of the latest generation are available to students; Machine learning requires much computing capacity and gigantic volumes of data. In the initial LAMA lessons, students are imparted the most important tools for data processing and program design. During the practical phase, called "Into the wild," students are given four weeks to use their newly acquired knowledge in their own projects, such as prognosis of solar power generation, image recognition, an office chair that does not strain the back, or a neural network composing music. In the 2019 summer semester, 30 students learned to identify challenges, formalize them scientifically, and solve them creatively with AI methods.

The results convinced the supervisors: Motivation of the students was very high. They brought along their own projects and pursued their own ideas. Also, students were rather positive. They would like to join an advanced course in the next semester. Work is now aimed at transferring LAMA experience to academic education at other KIT departments.

During the LAMA practical phase, students can apply in own projects what they have learned. If necessary, supervisors provide assistance.



DIVERSE SUPPORT PROGRAMS

GRADUATE SCHOOLS AT KIT

Early-stage researchers are offered a variety of doctoral programs at KIT. Candidates can earn a doctorate as part of a research program or within a structured qualification concept. Graduate schools, research training groups, and doctoral research groups in various disciplines are part of such doctoral programs. They focus on the education of doctoral researchers in future-oriented research areas and support their personal development and scientific autonomy. Moreover, such programs foster early networking, internationalization, and interdisciplinary cooperation of doctoral researchers. Eight graduate schools exist at KIT. Two of them were established under the Clusters of Excellence "POLiS" and "3D Matter Made to Order" and are funded by the German Research Foundation (DFG).

The graduate school "Electrochemical Energy Storage" (GS-EES) of the "POLiS" Cluster of Excellence was established in the 2019 summer semester and offers a comprehensive program of lectures and courses in the area of electrochemical energy storage and conversion. Training covers a wide range of topics in materials and synthesis chemistry, electrochemistry, instrumental analysis, powder technology, and process engineering.

The HEiKA graduate school "Functional Materials" is a central element of the Cluster of Excellence "3D Matter Made to Order." Apart from scientific research, a modular program is offered to prepare doctoral researchers for future research in this area. Annual research conferences and other events are part of the program. Welcome and networking events serve to deepen partnerships and develop new interdisciplinary connections between KIT and Heidelberg University.

Another six graduate schools offer doctoral researchers comprehensive qualification and training: The Karlsruhe School of Optics and Photonics (KSOP), the Karlsruhe School of Elementary Particle and Astroparticle Physics: Science and Technology (KSETA), the Helmholtz Information and Data Science School for Health (HIDSS4Health), the Helmholtz International Research School for Astroparticle Physics and Enabling Technologies, the Graduate School for Climate and Environment GRACE, and the BioInterfaces International Graduate School (BIF-IGS).

The graduate schools are financed by the DFG, the Baden-Württemberg Ministry of Science, Research, and the Arts, the Helmholtz Association, and from KIT's own funds. In addition to the eight graduate schools, nine research training groups affiliated to KIT departments and six other doctoral programs exist at KIT.

KIT's graduate schools focus on training doctoral researchers in future-oriented research areas.

INTERNATIONAL AFFAIRS

Eucor – The European Campus is a unique trinational university network. In the heart of Europe, five universities together have created a clearly profiled scientific area with international appeal without walls and borders. It is based on common structures, common governance, and a common strategy in research and teaching.

The future of the universities on the Upper Rhine is European. Cross-border mobility is intended to become an everyday experience for students and researchers. To achieve this, the potentials at the member universities are being pooled: Research infrastructures will be opened up, service points will

be working in networks. The research and education region will thus become a center of attraction for the best early-stage researchers and for international students.

Eucor member universities are University of Basel, Switzerland, Université de Haute-Alsace and Université de Strasbourg, France, and University of Freiburg and Karlsruhe Institute of Technology, Germany. In a joint strategy plan for the years 2019 to 2023 adopted in February 2019, the universities concretize their vision and the advancement of the alliance with projects, objectives, and measures in the fields of research and innovation, teaching, and doctoral qualification.

Eucor distinguishes itself from the "European University" EPICUR in particular through its regional orientation. In EPICUR, eight universities, including four Eucor universities, have joined to form a university association. EPICUR (European Partnership for Innovative Campus Unifying Regions) prevailed in 2019 in a European Commission competition and will receive funding to the tune of EUR five million over the next three years.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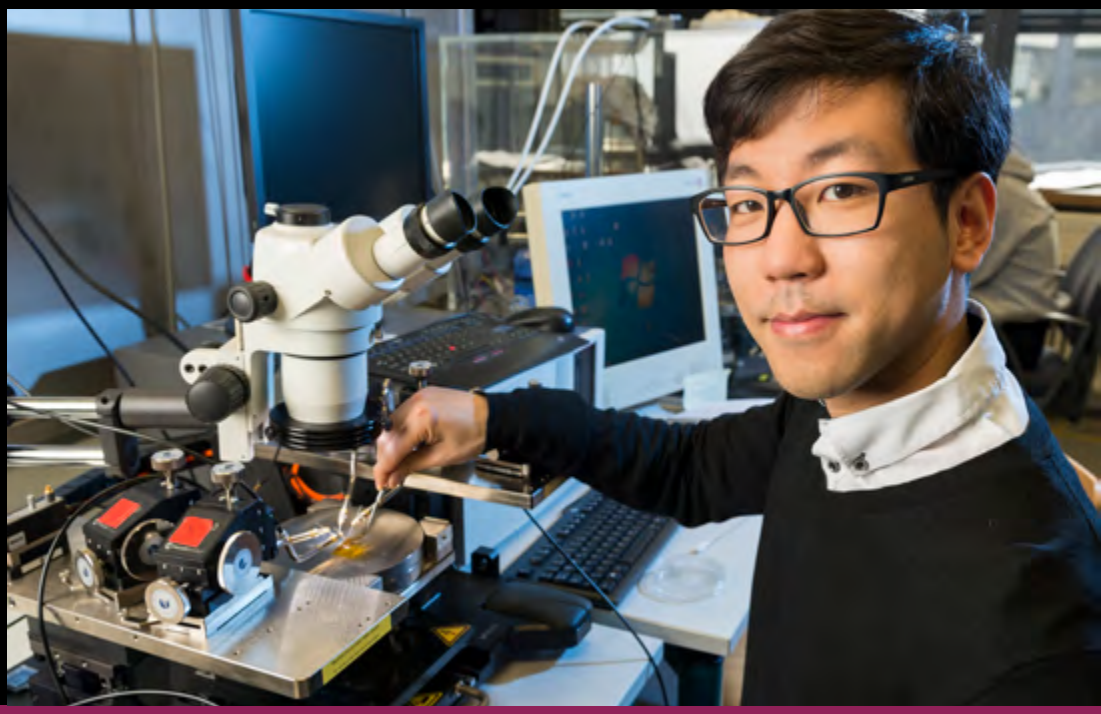

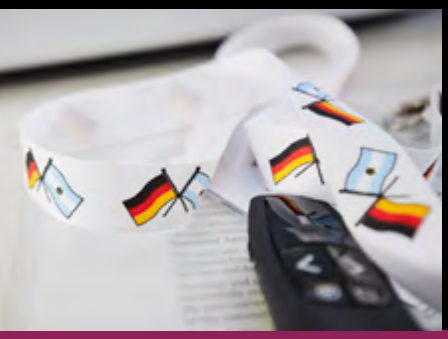


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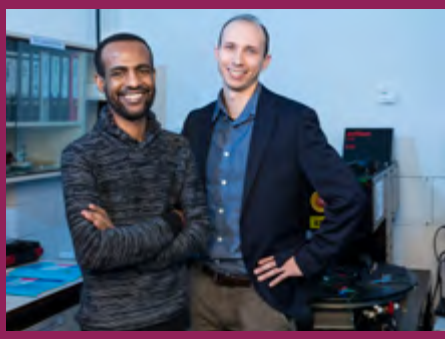


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SUCCESS FOR EPICUR AS A "EUROPEAN UNIVERSITY"

ASSOCIATION COMPRISING EIGHT EUROPEAN UNIVERSITIES COMES OUT ON TOP IN EUROPEAN COMMISSION COMPETITION

Cross-border cooperation, innovative teaching formats, and international scientific exchange are the aims of a new European university association. The KIT and seven other partners have joined in EPICUR (European Partnership for Innovative Campus Unifying Regions) to build the European university of the future. The European Commission will support the association with EUR five million over the next three years. EPICUR is one of 17 university associations in Europe selected as "European Universities" from among 54 applicants. They provide impulses for the development of a European education area and are on their way to becoming models for other universities in the European Union.

The European Commission's "European Universities" initiative envisages to establish up to 25 transnational European university alliances by 2025. The first three years are considered the pilot phase of this long-term process, which in the future will enable students to experience Europe by studying in different countries. The alliances supported are intended to strengthen the quality, degree of inclusion, and competitiveness of European higher education, increase the mobility of students and university staff, and promote cooperation between the institutions.

EPICUR aims to develop mutual understanding between the partners and to find solutions to questions of mobility and multilingualism which are of great interest also to other regions. The goal is to firmly root common values in European science and, despite differences in approach and educational models, to work together as European neighbors to overcome major societal challenges.

The eight partners of the EPICUR alliance are Adam Mickiewicz University in Poznan (Poland), University of Amsterdam (the Netherlands), Aristotle University of Thessaloniki (Greece), University of Upper Alsace (France), University of Natural Resources and Life Sciences in Vienna (Austria), University of Freiburg (Germany), University of Strasbourg (France), and Karlsruhe Institute of Technology. The project of the EPICUR partners in six countries is divided into different focuses, each of which is coordinated by one partner. The KIT has taken over the work package "Strengthening and connecting regions."

Another long-term goal of EPICUR is the establishment of a four-year bachelor's program "European Bachelor of Liberal Arts and Sciences," which will be offered in English by several EPICUR universities.

In February 2019, the EPICUR project team of the eight partner universities met at University of Strasbourg.

INTERCULTURAL AND INTERNATIONAL

FIRST INTERNATIONAL DAYS AT KIT

KIT's first International Days themed "Karlsruhe and the World" took place in the middle of October. The International Affairs Business Unit arranged a varied program from presentations on international scientific projects, seminars, and workshops on intercultural competence and communication, cultural contributions, and a photo exhibition.

This event was intended to strengthen intercultural understanding among students, researchers, and staff members, promote the exchange of international activities at KIT, and present KIT as an international institution to the outside world. In presentations and consultations, numerous business units explained their range of services for international students and scientists.

The Humboldt-Tag was one of the highlights of the International Days.

A lecture by China expert Dr. Manuel Vermeer provided material for discussion. Vermeer called on Germany and other countries in Europe to develop a clear position on cooperation and competition with China. A panel discussion with KIT scientists about their international experiences also stimulated a lively exchange.

International research projects, such as the KATRIN experiment, were presented, and central institutions, such as the ZAK | Centre for Cultural and General Studies, presented their intercultural offerings. Internationally active student groups exchanged information about their projects with the audience.

One of the highlights of the International Days was the Humboldt-Tag, where scientists from many countries exchanged their experiences and discussed their projects with their hosts.

The program also included honors for international commitment. The honors ceremony was accompanied by the KIT Concert Choir. The awards included the DAAD Prize for Extraordinary Commitment of Foreign Students at KIT and the DAAD Grant for Outstanding Academic Achievements and Exceptional Commitment of Doctoral Researchers at KIT. In addition, the KIT awarded the first certificates for CrossCultural Competence, an advanced training program for KIT administrative and technical staff, which, via ERASMUS, combines advanced training in intercultural skills and languages with a stay abroad in a country of the European Union.

HUNTING FOR THE HIGHEST ENERGIES

PIERRE AUGER OBSERVATORY IN ARGENTINA CELEBRATES ITS 20TH ANNIVERSARY

With a ceremony and a scientific symposium in Malargüe, Argentina, around 300 researchers and guests from all over the world gathered November 14 to 16, 2019, to celebrate the 20th anniversary of the Pierre Auger Observatory, which measures the high-energy component of cosmic rays. During the ceremony, the Argentinean Senate awarded the observatory the honorary title of "Honorable Senator."

Cosmic rays are charged particles that constantly bombard the Earth. At the highest energies, they are only slightly deflected by the galactic and extragalactic magnetic fields, which opens up a new window for astronomy. The energy of the most energetic of these particles is more than 100,000 times the energy that can be reached in the largest human-made accelerators.

The particles on the Earth can be detected only indirectly: The cosmic rays themselves do not reach the ground, but collide with atomic nuclei in the upper atmosphere, creating cascades of new particles – air showers of more than ten billion particles – that reach the Earth's surface. These secondary particles are measured with the detector systems of the Pierre Auger Observatory.

The Pierre Auger Observatory in the province of Mendoza in Argentina is the world's largest project to study high-energy cosmic radiation. 1660 water tanks, each containing twelve cubic meters of ultrapure water, and 27 telescopes collect the indirect light signals of the secondary particles over an area of 3000 square kilometers. The light pulses registered by the telescopes allow conclusions to be drawn with respect to the energy and direction of incidence of the original particles. More than 400 researchers from 18 countries work together in the research collaboration. From Germany, in addition to the KIT, RWTH Aachen University and the Universities of Hamburg, Siegen, and Wuppertal are involved. KIT is the spokes-institution and project manager of the Pierre Auger Observatory and was in charge of the construction of the fluorescence telescopes. The Pierre Auger Observatory is funded by the Federal Ministry of Education and Research.

Spurred on by the scientific results achieved so far, the observatory is currently being upgraded to "AugerPrime," mainly with the aim of improving its sensitivity to ultra-high-energy cosmic rays. This is done by installing new electronics and an additional detector that is being built at KIT with international cooperation.

To celebrate the 20th anniversary of the Pierre Auger Observatory, some 300 participants met in Malargüe, Argentina, for a ceremony and a scientific symposium.

INTERNATIONAL AND INTERDISCIPLINARY

THE GERMAN-JAPANESE UNIVERSITY CONSORTIUM HEKKSAGON

Since 2010, KIT has played a major role in the German-Japanese university consortium HeKKSaGOn. HeKKSaGOn is an association of Heidelberg University, Georg-August-Universität Göttingen, and Karlsruhe Institute of Technology with three of Japan's leading universities, Kyoto University, Osaka University, and Tohoku University in Sendai. HeKKSaGOn stands for Heidelberg – Kyoto – Karlsruhe – Sendai – Göttingen – Osaka – network. In addition to intensifying scientific cooperation, the focus is particularly on the sustainability of transnational measures and projects.

At the 7th HeKKSaGOn conference in Heidelberg in September, the presidents and rectors of the six partners agreed on the central topics "Transcultural studies and the transformation of cultural heritage," "Data science, digitization, and artificial intelligence," "Health, well-being, safe and resilient societies," and "Engineering molecular systems."

References to these topics are an important criterion in the internal selection of existing working groups and new initiatives that can apply for funding. In addition, joint research activities within the university network are to be geared even more closely to the sustainability goals of the United Nations in the future, thus creating added value for the societies in Japan and Germany.

The HeKKSaGOn universities share the conviction that major global problems can only be solved through interdisciplinary and international cooperation in research and through the open and free exchange of knowledge. Renowned researchers from the partner universities join forces to share their expertise and research knowledge and to promote further cooperation and technological progress.

The HeKKSaGOn conferences and summer schools inspire talented doctoral students by giving them the opportunity to meet scientists who have succeeded in initiating new interdisciplinary innovations in science.

The 7th conference of the German-Japanese university consortium HeKKSaGOn was held in Heidelberg in September 2019.

KIT AS AN EMPLOYER

With 9,398 employees, KIT is one of the largest employers in the Karlsruhe technology region. The staff is made up of 5,183 scientific and 4,215 non-scientific members. The share of women is 37.8%. KIT hosts 1,401 foreign employees, the majority of whom are scientific personnel. In addition, there are 368 professors and senior researchers, 18 of whom were appointed in 2019.

April 31, 2019 marked the end of the term of office of KIT's four Equal Opportunities Officers and their four deputies. The newly elected scientific Equal Opportunities Officers Dr. Britta Bergfeldt and Dr. Birgit Langer, their deputies Sarah Herfurth and

Biserka Mathes, and the Equal Opportunities Officers for non-scientific staff Elke Krüger and Kristina Wiesner and their deputies Claudia Bechtold and Sabine Grindler took up their activities on March 1, 2019.

In 2014, KIT had drawn up and adopted its first equal opportunities scheme. It was valid for the period from January 1, 2014, to December 31, 2018 and is now being continued until December 31, 2021. This continuation also serves to synchronize the scheme with KIT's Structure and Development Plan, which, so far, has had a different runtime.

Another important topic at KIT in 2019 was the development of a basis for the introduction of a management system for preventive occupational medical care, which included the description of processes, the development of data protection, IT security, and operational concepts, and the implementation of a new database.

NEW SERVICE AGREEMENT CONCLUDED
TELEWORK AND MOBILE WORK

More flexibility and a better work-life balance as well as an effective measure against blurring the boundary between work and private life: This is the claim and the goal of the new "Dienstvereinbarung zur Telearbeit und mobilen Arbeit am Karlsruher Institut für Technologie (KIT)" (service agreement on telework and mobile work at Karlsruhe Institute of Technology), which came into force on February 25, 2019.

In times of digitization of work and a potentially associated growing flexibility, opportunities and risks are closely related. On the one hand, working from home offers many advantages – for example, more flexible care for one's children, even in the case of short-term bottlenecks at the day-care center or in the case of traffic or weather-related obstacles on the way to work, or simply the time saved by eliminating the need for commuting. On the other hand, there is a risk that work blurs into private life. Telework and mobile work demand a high level of trust and responsibility among managers and employees.

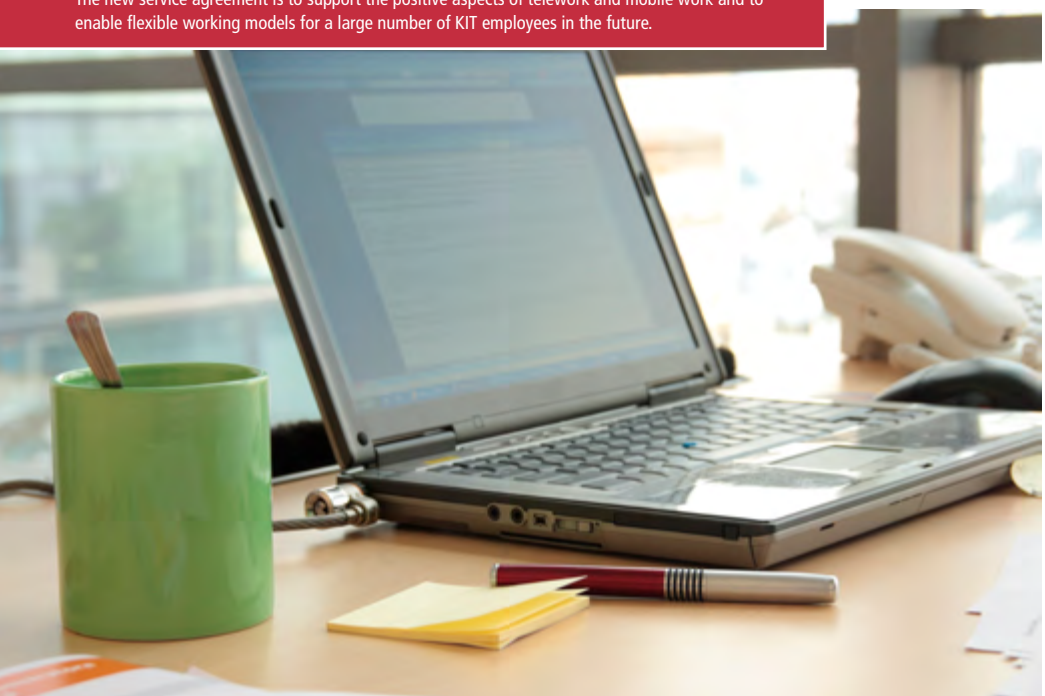
The new service agreement is intended to support the positive aspects of telework and mobile work, to enable more flexible working models for a large number of KIT employees in the future, and thus to further promote the compatibility of work and private life.

A basic distinction must be made between telework and mobile work. So-called alternating telework refers to work at KIT and at a permanently installed telework station on a regular alternating basis. It may comprise a maximum of 40% of the contractually agreed working time and is restricted to certain days of the week. The former limitation of the eligibility for telework to family-related reasons has been eliminated. Mobile work can be done outside KIT in exceptional or unpredictable situations, for example in trains or airplanes. It can also be arranged if, for example, child care or care for a close family member who has fallen ill cannot be secured on short notice. On business trips, mobile work makes it possible to use travel time effectively. Mobile work must be discussed and agreed upon with the immediate superior in each individual case.

The service agreement applies in principle to all KIT employees. The work performed, however, must be suitable for telework or mobile work. This excludes, for example, laboratory or workshop work or work where sensitive personal data are necessary for the completion of a task. Furthermore, there is an obligation to be present at team meetings, events, and the like. For telework and mobile work, conventional workplace accident insurance is provided.

Overall, the conclusion of the new service agreement and the regulation of telework and mobile work at KIT associated with it were very much welcomed.

The new service agreement is to support the positive aspects of telework and mobile work and to enable flexible working models for a large number of KIT employees in the future.



PART-TIME EMPLOYMENT IN THE FORM OF A SABBATICAL

TIME OFF FROM WORK

On March 18, 2019, the statutes for part-time employment in the form of a sabbatical year were announced at KIT. With these statutes, KIT has created a good and simple possibility to comply with the wish of many employees to take time off from work. In most cases, this wish arises shortly before retirement. Many employees use such time off to dedicate themselves to their families or to educate themselves.

The sabbatical year can be taken by all full- and part-time employees having a permanent civil service relationship with KIT and officials who as a rule have been working at the KIT for at least five years, as well as by permanent TV-L and TVöD KIT employees.

Sabbaticals are a special temporary form of part-time employment that allow employees to be released from work at the end of the approval period while proportionate payments continue. To be able to ensure the latter, the actual working time is being distributed unevenly over the approval period.

In the first phase, the so-called accumulation phase, employees accumulate time credits, which are then used up in the second phase, the sabbatical phase. Throughout the entire approval period, payments correspond to the monthly amounts received during part-time employment.

The employees and KIT conclude a separate agreement for the approved part-time employment. In the case of civil servants, approval is through an administrative act.

Sabbaticals are a special temporary form of part-time employment that allows employees to take time off from work.

DATA PROTECTION

CONTINUED IMPLEMENTATION OF THE GENERAL DATA PROTECTION REGULATION (GDPR)

The European General Data Protection Regulation (GDPR) has standardized data protection law throughout the EU. In addition, the national legislator was authorized to firm up and supplement some of the GDPR provisions with national regulations.

On November 19, 2019, the essential results of the KIT pilot project on implementation of the GDPR were presented in a final event.

In November 2019, the Executive Board adopted the "Richtlinie zu Ansprechpartnerinnen und Ansprechpartnern für Datenschutz und Informationssicherheit in den Organisationseinheiten des KIT" (guideline on contact persons for data protection and information security in the organizational units of KIT) as an essential component of data protection at KIT.

The roles and capacities of the contact persons in the KIT organizational units will depend on the risk to the rights of the data subjects associated with data processing. The contact persons will be appointed in 2020.

In the pilot project, the Data Protection Staff Unit developed, among other things, a query system for determining the risk to the rights of data subjects pursuant to Article 32 of the General Data Protection Regulation.

The EU-compliant design and implementation of all data protection procedures at KIT are being developed successively and have already been partially established.

With the European General Data Protection Regulation (GDPR), data protection law has been standardized throughout the EU.

This query system was mapped by an IT solution by the Steinbuch Centre for Computing (SCC). In order to fulfill the accountability of the KIT, the risk analysis will be made available as a PDF file in the electronic register of processing operations.

The KIT e-learning data protection module, which was completely redesigned and created by the Data Protection Staff Unit and the House of Competence, Center for Technology-Enhanced Learning (ZML), was also established in 2019. Since July 2019, the Data Protection Staff Unit and SCC have been developing new data protection training courses.

Implementation of the GDPR is a continuous process that is being permanently accompanied by the Data Protection Staff Unit.

VOCATIONAL TRAINING AT KIT

AWARD-WINNING AND ACKNOWLEDGED

In the Karlsruhe technology region, KIT is one of the largest providers of apprenticeships and enjoys an excellent reputation even beyond the borders of the state of Baden-Württemberg. This is reflected, among other things, by the Deutschlandtest seal awarded by Focus Money to "Germany's Best Training Companies 2019." The vocational training section of KIT's Human Resources Development and Vocational Training (PEBA) Business Unit has received this award for three years in a row.

Mayor Bernd Stober (3rd from left) and Ingo Zenkner from the Employment Agency (5th from left) were given an impression of integration put into practice at KIT's vocational training section by Ann-Kathrin Schaber, Andreas Schmitt, Uwe Schwarzwälder, Bernd Ritter, and Hassan Abdullah Ali, all KIT.

In 2019, the success rate of final examinations of apprentices was again well above the state and national averages at over 90%. At the 2019 award ceremony of the Karlsruhe Chamber of Industry and Commerce (IHK), six award winners came from the KIT. Two chemical laboratory assistants were honored for the scientific professions, two industrial mechanics for the industrial-technical professions, one industrial management assistant/foreign trade for the commercial professions, and one IT specialist for the IT professions. In 2019, the KIT was again honored by the Chamber of Industry and Commerce with a certificate for excellent training.

Another special prize received in 2019 was the Kreisintegrationspreis (District Integration Award) awarded by the Karlsruhe District Office for KIT's program for the successful integration of refugees in vocational training. Through practice-oriented taster days at the central trainee workshop, as well as initial qualification and apprenticeship, KIT's vocational training section integrates young refugees into the German working world. In addition, KIT's weekly language classes at the KIT Language Center and assistance in finding accommodations contribute to the success of training and apprenticeship. In addition, the vocational training section of KIT's Human Resources Development and Vocational Training (PEBA-BEA) Business Unit offers special tutoring programs to prevent refugees from falling behind at vocational school.

Beginning in 2015, PEBA-BEA developed a multi-stage concept for selecting and integrating refugees and, thus, has enabled numerous young people to do internships and start professional life. For the coming year of training, PEBA-BEA will once again offer young refugees the opportunity to start successful apprenticeships.

During a guided tour through the workshops of the vocational training section and a discussion with refugees and their supervisors, Ingo Zenkner, Chairman of the Management Board of the Karlsruhe-Rastatt Employment Agency, and Bernd Stober, Mayor of the Municipality of Eggenstein-Leopoldshafen, got an idea of how integration is put into practice at KIT's vocational training section.

LIFE AT KIT

As a large research and teaching institution, the KIT imparts knowledge for society in a comprehensive way. KIT makes significant contributions to global challenges in the fields of energy, mobility, and information and thus contributes to the conservation of our natural resources. As a campus, KIT seeks to achieve sustainability in practice.

Life at KIT becomes more sustainable through active and collective action. With its criteria for buildings/infrastructure, energy, climate protection, and mobility, the integrated Master Plan 2030 forms the basis of future development for KIT's real estate, and breaks new ground on fundamental

issues. Detailed measures are implemented within the framework of "structural and infrastructural development planning" involving science and all stakeholders and play an important role in campus development today.

The design and sustainable transformation of our built environment is a necessary central function. This goes hand in hand with a rethinking of how to use resources and of our own actions. Important first projects have already been implemented together with students and employees at KIT: These include the use of environmentally friendly paper, a campus garden, bicycle repair stations with a mobile workshop, carpool benches, car sharing, and the real-world laboratory "District Future – Urban Lab."

Participation of students and employees is an integral part of sustainability approaches at KIT. Under the heading of "Energiewende@KIT," for example, the scientific community participates in further activities to sustainably lead KIT into the future. The focus is on the consumption and supply of renewable energy at KIT. A broad spectrum of sustainability activities, created by the KIT itself, is evidence of active steps to rethink the campus.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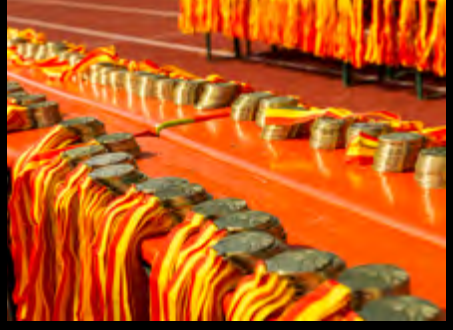


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ARTIFICIAL INTELLIGENCE ON THE CINEMA SCREEN

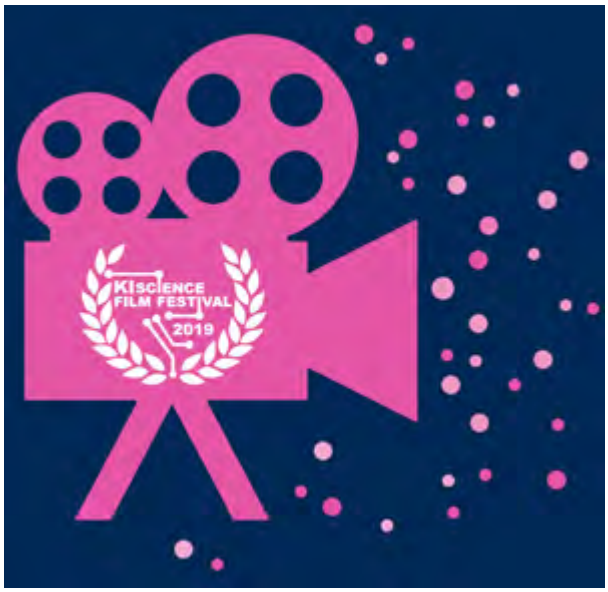
FIRST INTERNATIONAL AI SCIENCE FILM FESTIVAL AT KIT

Artificial intelligence (AI) is considered a key technology: Many see it promising to make our lives better and easier, in the health or mobility sectors, for instance. Others warn of dangers and paint negative scenarios of a society in which people increasingly lose control. To address these different emotions and conceptions, to reflect them, and to critically analyze them, films are better suited than any other medium.

In the framework of the Science Year 2019 – Artificial Intelligence – the international AI Science Film Festival was presented by KIT from July 3 to 5, 2019. Filmmakers from all over the world were invited to submit their documentaries, commentaries, or fictional works. The AI Science Film Festival was organized by ZAK | Centre for Cultural and General Studies at KIT together with KIT's Corporate Communications Department and was funded by the Federal Ministry of Education and Research.

By the end of March 2019, about 50 filmmakers from 13 countries had submitted their works to the AI Science Film Festival. A jury of experts consisting of film artists, researchers, and critics, selected twelve finalist films – six short and six long ones. The jury of six also included two KIT members, Professor Barbara Deml, Head of the Institute for Human and Industrial Engineering, and Philipp Schrögel, Institute of Technology Futures.

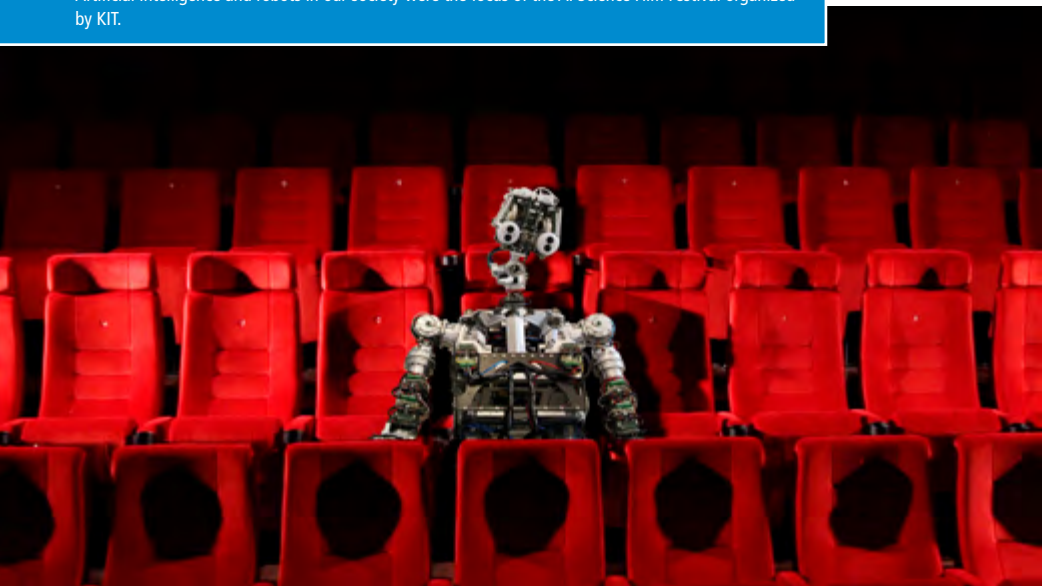
The selected films were screened on July 3 and 4, 2019, at the AI Science Film Festival at ZKM | Center for Art and Media Karlsruhe and at the Schauburg Karlsruhe movie theater. The crowning event of the festival was a gala evening with an awards ceremony for the winning films on July 5, 2019 on the main stage of the EFFEKTE Science Festival in Karlsruhe.



The work "Who Made You?" by the Finnish director Iiris Härmä was awarded as best feature-length film and the Canadian film "CC" directed by Kailey and Sam Spear was honored as best short film. The audience award went to the German film "Autonomous Artifacts" by the directing duo Johannes Kohout and Janek Totaro.

Following the AI Science Film Festival, the 12 finalist films were sent on tour to several German cities through the end of 2019. In each of these cities, including Stuttgart and Berlin, a selection of the films was presented by a local partner institution.

Artificial intelligence and robots in our society were the focus of the AI Science Film Festival organized by KIT.



ARTIFICIAL BUT REAL

COLLOQUIUM FUNDAMENTALE WITH A SERIES OF PUBLIC LECTURES ON ARTIFICIAL INTELLIGENCE

Often unnoticed, artificial intelligence (AI) has found its way into our lives, be it Alexa and Siri in living rooms, satellite navigation devices in cars, or voice and face detection systems in mobile phones. Clever algorithms and smart machines offer a promising future and bear the potential to transform the job market and revolutionize research. At the same time, the growing influence of AI also produces fears and insecurities.

In the summer semester of 2019, the Colloquium Fundamentale at KIT was dedicated to the technological and cultural facets of artificial intelligence, including its use in autonomously driving cars.

Under the title "Künstlich aber real – die stille Revolution der KI-Technologien" (Artificial but real – the silent revolution of AI technologies), the Colloquium Fundamentale at KIT dealt with the different technological and cultural facets of artificial intelligence. Experts from different disciplines spoke about exactly what artificial intelligence is, its capabilities, and how we can understand its complexity. They also shed light on the question of whether an AI-driven social order is already a reality or still a dream of the future, what role AI will play in our lives, and whether there are already ethical approaches to shape an AI-influenced future.

The focus was both on the advantages of the latest technological developments and the arguments of AI opponents as well as on those AI technologies that have long been shaping our everyday life in many ways. The aim of the series was to provide insight and a multifaceted exchange through lectures and audience discussions. The series of lectures was opened by technical historian Professor Dr. Martina Heßler from the Technical University of Darmstadt with the topic "Schach dem Menschen. Deep Blues Sieg und die Geschichte Künstlicher Intelligenz" (Giving check to humans. Deep Blue's victory and the history of artificial intelligence).

Further topics of the lecture series were "Mobile maschinelle Wahrnehmung für Automatische Automobile" (Mobile machine perception for automatic automobiles) by Professor Dr. Christoph Stiller, KIT, "A.I. & Speech: A Silent Anthropomorphism?" by Professor Dr. Björn W. Schuller, University of Augsburg & Imperial College London & audEERING, "PrognoNetz: Erhöhung der Übertragungskapazität mittels intelligenter Stromnetze" (Increasing transmission capacity through smart grids) by Professor Dr. Wilhelm Stork, KIT, and "KI, Ethik und Gesellschaft – Entwicklungen, Erwartungen und Herausforderungen" (AI, ethics, and society – developments, expectations, and challenges) by Professor Dr. Oliver Bendel, School of Business, University of Applied Sciences and Arts Northwestern Switzerland.

The Colloquium Fundamentale is one of the central lecture series of the KIT. Each semester, it focuses on a socially important topic with interdisciplinary lectures, debates, and panel discussions and addresses students and KIT members as well as the interested public. Usually, the focus in the winter semester is on topics of sociopolitical relevance, whereas in the summer semester the focus is on a specific research area and its social implications.

FOCUS ON MOBILITY

SUCCESSFUL OPEN DAY AT KIT

Mobility with numerous vehicle-related technical facilities was the focus of the Open Day at KIT's Campus East.

Self-learning tractors, synthetic CO_2-neutral fuels, new technologies for e-mobility, and innovative vehicle and traffic systems. Add to that a knowledge rally for children and a first-rate stage program. All this was part of the Open Day at KIT on June 29, 2019, which also marked the beginning of the 2019 EFFEKTE Science Festival in Karlsruhe. At midsummer temperatures, 9000 visitors experienced exciting research at KIT's Campus East.

The focus of the event was the broad subject of mobility with numerous vehicle-related technical facilities such as test stations and research halls on KIT's Campus East which is located in the vicinity of the Baden-Württemberg Test Area for Autonomous Driving. Among the presentations were demonstrations of state-of-the-art test stations for rail sensors and machinery as well as of a chassis dynamometer. The students of the KA-RaceIng team presented their racing cars. The Kamaro university group´s booth featured self-driving model robots for use in agriculture, which pulled in the crowds, as did a presentation of renewable fuels by the reFuels research project.

But the researchers of KIT also showcased exciting current projects far beyond the issue of mobility, from wearable robot technologies and new materials to the Energy Lab 2.0. There was also lots of interest to children, including the traditional knowledge rally and numerous interactive experiments.

The different activities of the student groups and many other KIT institutions, as well as their partners and sponsors, offered plenty of variety and information. In the buildings and the info tents on Campus East, KIT presented itself as an attractive place of study and employment.

In the afternoon, Karlsruhe mayor Dr. Frank Mentrup and KIT President Professor Holger Hanselka officially kicked off the EFFEKTE Science Festival, where numerous Karlsruhe research institutions presented hands-on science.

Variety was also the theme on the stage, with shows by the Austrian science cabaret artists Science Busters and TV stand-up comedian Bernhard Hoëcker continuing into the evening after the opening of the festival.

Alongside the Open Day, Unifest organized by KIT students, took place on Campus South. On several stages around the Altes Stadion, live bands and DJs served up a fantastic party atmosphere.

FROM SPACE BACK TO THE SCIENTIFIC ROOTS

ALEXANDER GERST WAS CONFERRED THE HONORARY DOCTORATE OF THE KIT

In the full Audimax lecture hall, Alexander Gerst spoke about his time in Karlsruhe and his missions in space.

For ESA astronaut Alexander Gerst, the scientific path to becoming the second European and first German commander on the International Space Station ISS began in Karlsruhe. He dealt with processes inside the Earth, and, in his diploma thesis, studied changes in stresses in the Earth's crust under the Ruapehu volcano in New Zealand before and after an eruption. In 2003, he received his diploma in geophysics at the former Universität Karlsruhe, today's KIT.

The Earth with all its processes and organisms had always fascinated him, Alexander Gerst said. He had always wanted to know how earthquakes or volcanoes developed. He believes that it is important to share experiences, especially with future generations. He says that he is now in a position to perhaps inspire young people, and girls in particular, and show them what possibilities there are and how important it is to take on tasks in science and technology.

In 2019, the KIT Departments of Physics and of Civil Engineering, Geo- and Environmental Sciences granted an honorary doctorate to Gerst. For the ceremony and a presentation in the full Audimax lecture hall, the German ESA astronaut had returned to his former university. Gerst spoke about his time in Karlsruhe and his missions in space. He said he liked to think about Karlsruhe, because Karlsruhe was where his scientific career started and because he had learned a lot from which he has since benefited as a researcher and astronaut of the European Space Agency ESA.

On his missions, Alexander Gerst was able to look at the Earth from the outside and to see how fragile it was. In order to protect it, it is particularly important to share this view with society, Gerst thinks. Students and researchers like those at KIT play a decisive role in this respect with their commitment and projects, but also because they communicate about their research and seek a dialogue with the public.

The KIT is particularly proud to see how successfully Alexander Gerst has continued his journey since his studies in Karlsruhe. According to President of the KIT Professor Holger Hanselka, ISS astronaut Alexander Gerst is a role model and motivation for students and early-stage researchers, and for all of us when it comes to thinking beyond borders.

PROGRAM WITH PRESENTATIONS, DISCUSSIONS, AND CULTURAL EVENTS

KARLSRUHE DIALOGUES ON THE RESPONSIBLE SOCIETY

The 23rd Karlsruhe Dialogues focused on responsibility of the civil society, politics, and business.

From February 22 to 24, 2019, international experts, creative artists, and activists met for the Karlsruhe Dialogues under the heading "The Responsible Society: Between Challenge and Overload?."

Serious environmental problems, national egoisms, social inequality, the threat of terrorism, turbo-capitalism: In turbulent times, the call for the assumption of responsibility and commitment – in contrast to the tendency towards resignation or the attraction of "simple" populist solutions – becomes increasingly louder.

What is responsibility and how can it limit ruthlessness, egoism, and an unbridled will to power? Which socio-political and legal framework conditions could favor a greater willingness to accept responsibility? What role do technological innovations, the education system, and the media play in this context? Shouldn't we all want to take responsibility instead of just demanding it from others? The Karlsruhe Dialogues focused on the consequences of our actions and inaction. They discussed the social, political, and economic aspects of responsibility, questioned conventional ways of thinking, and encouraged the search for new insights.

On the opening evening, the U.S. historian and bestselling author Timothy Snyder spoke in KIT's Audimax lecture hall on the topic "Responsibility Policy: An Answer to the Democratic Crisis." A symposium at the Karlsruhe Chamber of Industry and Commerce was about "Responsibility in Times of Globalization Pressure." International guests such as the British ethicist Professor Craig Smith, the Spanish media maker Cristina Manzano, or the Berlin migration researcher Professor Wolfgang Kaschuba discussed political, economic, and media responsibility, innovative movements, and civil society participation. In keeping with the European election year 2019, a panel discussion focused on "Europe's responsibility – democracies between the rule of law and populism." The Karlsruhe Dialogues were complemented by various cultural events.

At the 23rd Karlsruhe Dialogues, Professor Caroline Y. Robertson-von Trotha said goodbye to her full-time work as director of ZAK.

ENERGIEWENDE@KIT

ENERGIEWENDE DAY 2019 IN KARLSRUHE AND STUTTGART

Sustainability is increasingly moving politics in Europe and at state and federal levels. A large part of society is demanding stronger contributions to climate protection. Research and teaching institutions cannot escape these demands and in science, too, there is a growing willingness to question one's own actions: How sustainable is science?

KIT already declared its own "energiewende" (or "energy transition") in 2015. Since then, scientists and administrators have been working on solutions to make KIT more sustainable. The initiative "Energiewende@KIT" covers the integrated Master Plan 2030 as well as science-based projects to make current research results useful for routine KIT tasks. The Baden-Württemberg Energiewende Day is a crucial link to the broad communication of relevant topics, both internally and externally. KIT's own Energiewende Day provides a forum for alternately presenting perspectives and results from research and on-the-premises energy-efficient building operation on Campus South and Campus North.

The focus is on the exchange of information among the actors and on the participatory effect. With great participation of the institutes and administration and, for the first time, of the students, KIT presented a broad range of topics on energy generation and efficient energy use. Sustainable thermal energy transition and mobility change were the focus of the Energiewende Day 2019. For the first time, interested visitors were invited to take part in an energy management game to identify opportunities to help shape the energy transition through a playful and constructive exchange.

Comprehensive perspectives on the KIT campuses were presented and discussed on the basis of the integrated Master Plan 2030. The integration of requirements for utilization and campus criteria as well as the comparison of energy consumption and energy supply result in a common orientation for the future and ensure a sustainable and climate-friendly campus.

The KIT booth at Schlossplatz Stuttgart during the Baden-Württemberg Energiewende Day 2019.

By participating in the central Energiewende Day of Baden-Württemberg in Stuttgart, the event found an interested public forum: At the invitation of the Ministry of the Environment, KIT was again active at the central event of the Energiewende Day at Schlossplatz Stuttgart in 2019. Together with other exhibitors, KIT staff members informed the interested public about important topics of the energy transition. Many interested and inquisitive visitors came to the KIT booth to obtain information, or hold lively discussions on specific topics. Both internally and externally, a critical and constructive discourse is of great importance to the acceptance and implementation of sustainability.

ENERGIEWENDE@KIT

PRIZES, HONORS, AWARDS, AND APPOINTMENTS

For years, KIT has awarded honorary titles to friends and sponsors committed to supporting KIT in accordance with pertinent regulations.

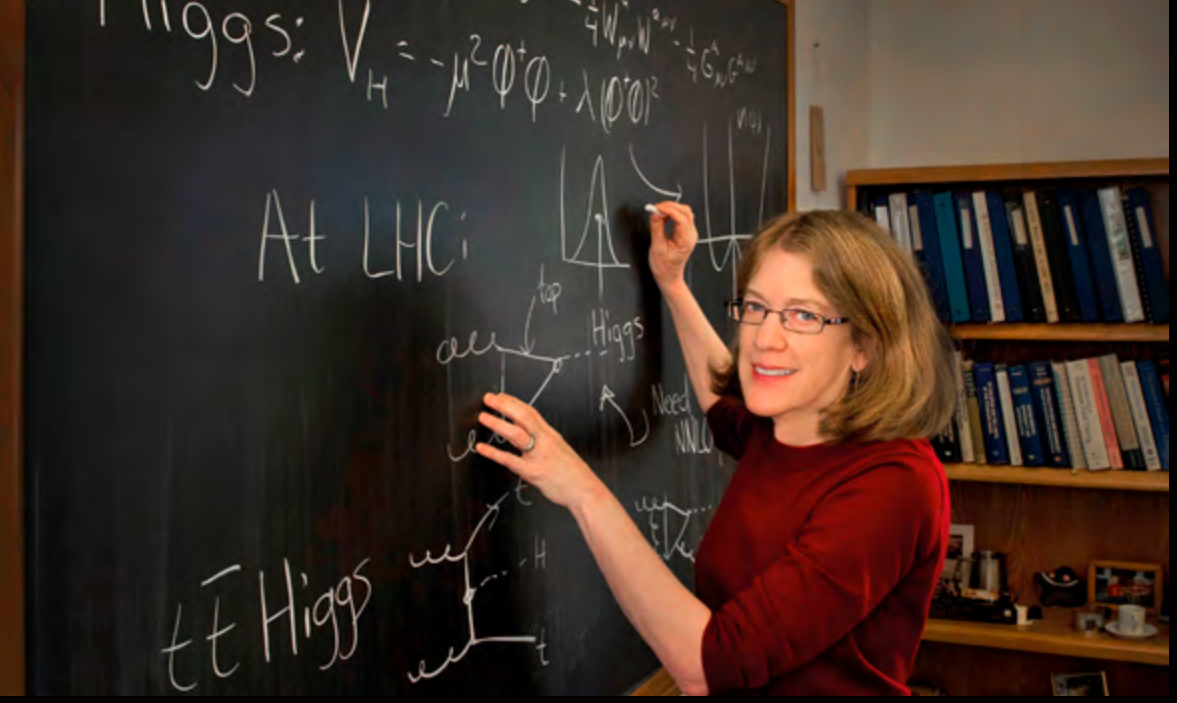
In 2019, the Executive Board decided to grant the Needle of Merit of KIT to three persons. Professor Dr. Wilfried Juling, former Division Head and Chief Information Officer of KIT, was granted the Needle of Merit for his special contributions to the merger of the computing centers of Karlsruhe Research Center and Karlsruhe University. Anton Kathrein, former personally liable partner and Managing Director of Kathrein-Werke in Rosenheim, received the Needle of Merit for long years of funding and scientific support

of antenna research at KIT. Professor Dr. Volker Saile, former Division Head of KIT, was awarded the Needle of Merit for his special support of the successful proposal of KIT for the Excellence Strategy competition launched by the Federation and the Federal States.

The Executive Board and KIT Senate granted the KIT Medal of Merit to Beate Spiegel, Managing Director of the Klaus Tschira Foundation. At the moment, the Foundation is funding the construction of two buildings with innovative seminar and learning rooms for KIT. The Foundation also sponsors a number of other activities at KIT, including the National Institute for Science Communication NaWik.

The 2018 Julius Wess Award of the KIT Elementary Particle and Astroparticle Physics Center (KCETA) was presented to Professor Sally Dawson on July 29, 2019. Dawson works as a leading scientist at Brookhaven National Laboratory, USA. Her research focuses on the physics of the Higgs boson and top quark.

At the Annual Celebration on May 17, 2019, Vice-President Professor Dr. Alexander Wanner presented the KIT Department Teaching Awards for achievements in teaching and student advisory services (see page 135).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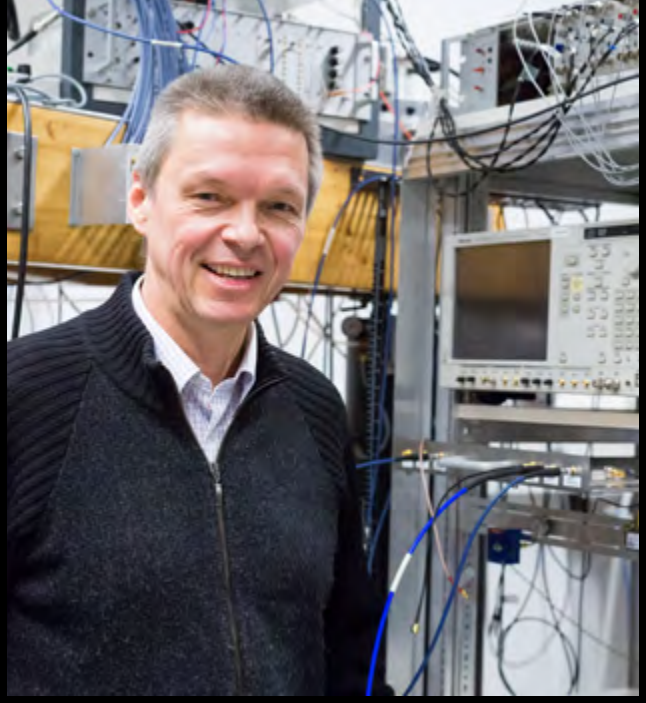


KIT
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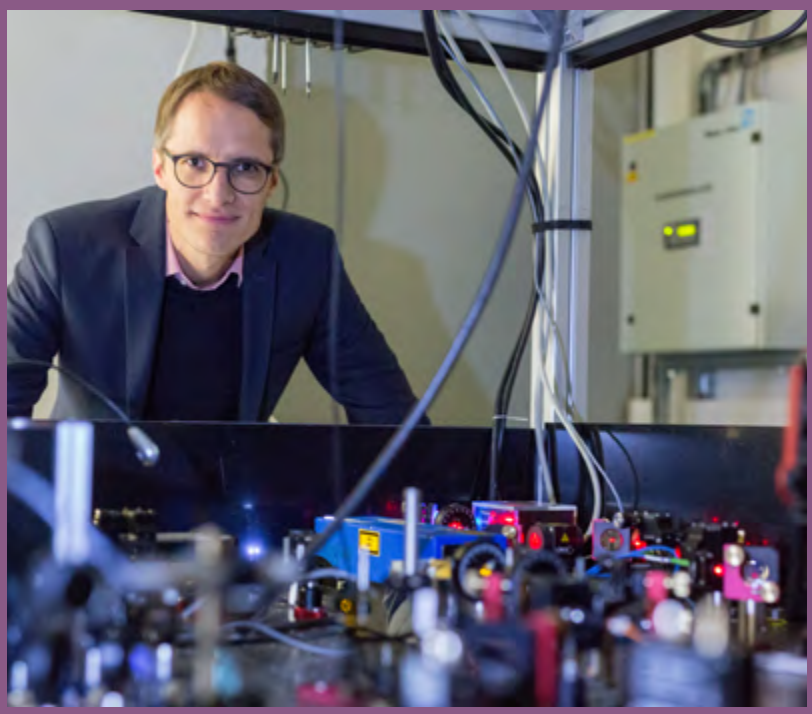



DFG

GERMANY'S HIGHEST COMPUTER SCIENCE PRIZE GOES TO KIT COMPUTER SCIENTIST

DOROTHEA WAGNER IS THE FIRST WOMAN TO RECEIVE THE KONRAD ZUSE MEDAL

The President of the German Informatics Society, Hannes Federrath, presents the Konrad Zuse Medal to Dorothea Wagner.

Professor Dr. Dorothea Wagner's research on automated route planning is applied daily all over the world. So far, the computer scientist of KIT has published more than 250 articles about algorithmics issues. The professor combines theoretical and practical approaches to optimizing energy systems, among others. The German Informatics Society that presented the Konrad Zuse Medal to Dorothea Wagner at the Annual Meeting in 2019 honored her as "an outstanding scientist, whose contributions to informatics research are at the leading edge worldwide."

Wagner is the first woman to receive the Konrad Zuse Medal, which has been awarded every two years since 1987. She considers this fact an important signal. "In spite of all efforts, we have unfortunately not yet succeeded in increasing the share of female students of informatics. As a rule, it is below 20%," Wagner says. She chose informatics as a minor when she started to study mathematics in 1976. At the time, informatics had just emerged as a subject at German universities. "It was always clear to everybody working in this discipline that the potential of informatics is growing," says the scientist, who was conferred her doctorate by RWTH Aachen University. Habilitation at TU Berlin covered a topic in the area of informatics. Since 2003, Wagner has been teaching and conducting research in Karlsruhe. Parallel to her work at KIT, she represents the interests of informatics in a number of bodies and science institutions.

Her scientific excellence "goes hand in hand with an exemplary voluntary commitment to informatics and science," the Informatics Society emphasized in its laudation. Wagner has advocated internationalization of her discipline and in 2018 received the Werner Heisenberg Medal of the Alexander von Humboldt Foundation for her efforts in international scientific collaboration. At the Sino-German Center for Research Promotion of the German Research Foundation (DFG) in Beijing, Wagner supports scientific collaboration between both countries. "Science is international. From the very beginning, I was interested in contributing to science also beyond my own discipline," says Wagner, who was Vice President of the DFG from 2007 to 2019. Since 2015, she has been Member and, since 2019, Deputy Chairperson of the Scientific Commission of the Council of Science and Humanities that advises the Federation on science and research topics. In January 2020, Dorothea Wagner was elected Chairperson of that Council.

CEREMONY ON THE OCCASION OF THE DAY OF GERMAN UNITY

CROSS OF THE ORDER OF MERIT FOR BRITTA NESTLER

"Mut zur Zukunft: Grenzen überwinden" (looking boldly into the future: crossing borders) – under this heading, Federal President Frank-Walter Steinmeier presented the Cross of the Order of Merit of the Federal Republic of Germany to 25 citizens on the occasion of the Day of German Unity. One of the honored citizens was Professor Dr. Britta Nestler, who conducts research and teaches at both KIT and Karlsruhe University of Applied Sciences (HsKA). She received this high honor for her scientific merits and in particular for her pioneering role in combining fundamental with applied research.

Federal President Frank-Walter Steinmeier presented the Cross of the Order of Merit of the Federal Republic of Germany to Britta Nestler on October 02, 2019.

The KIT scientist was honored for her groundbreaking work in materials research: "Britta Nestler is two times a pioneer: The professor for informatics works at both Karlsruhe University of Applied Sciences and Karlsruhe Institute of Technology," states the Federal President's Office's laudation. "She is building bridges between fundamental and applied research. Her computer models and simulations calculate service lives of materials and enable a more efficient and sustainable use of resources for everyday objects, industry production, and space research."

Since 2010, Britta Nestler has been conducting research and teaching at KIT, where she is member of the Collegial Management of the Institute for Applied Materials. Since 2008, she additionally has been Director of the Computational Materials Science and Engineering Department of the HsKA's Institute of Materials and Processes, today's Institute for Digital Materials Science. In 2008, she also established the Steinbeis Transfer Center "Materials Simulation and Process Optimization," which she heads. Since 2001, Britta Nestler has been professor at HsKA. Before, she spent several research stays abroad.

How does the microstructure of a material evolve during manufacturing by e.g. casting or rolling of metal sheets? What is the influence of heat or mechanical stress on the service life of materials, e.g. in power plant boilers or solar facilities? To answer these questions, Britta Nestler and her team study the microstructures of materials by means of computer-aided simulations. Theoretical findings obtained from microstructure modeling on supercomputers are incorporated in close-to-practice research projects with industry.

The Cross of the Order of Merit is awarded by the Federal President to German and foreign citizens for political, economic, social, and intellectual achievements as well as for special services to the Federal Republic of Germany. It is the only general award recognizing merits in Germany and the highest acknowledgement of services for the public benefit by the Federal Republic of Germany.

2019 SCHRÖDINGER PRIZE FOR A MULTIDISCIPLINARY TEAM OF KIT

FERROELECTRICITY IMPROVES PEROVSKITE SOLAR CELLS

Silicon is considered the "old bull" of solar cell materials. However, metal-organic perovskite solar cells have caught up rapidly and now reach efficiencies of 25% in the laboratory, thanks to research at KIT. A multidisciplinary team of six scientists at KIT found evidence of ferroelectric microstructures and, in this way, contributed to explaining the functioning of modern perovskite solar cells. For this excellent achievement, the team was awarded the Erwin Schrödinger Prize of the Helmholtz Association and the Stifterverband in the amount of EUR 50,000.

What would a perfect solar cell look like? Besides a black surface for optimal light harvesting, the perfect solar cell efficiently guides the photo-generated charge carriers out of the device to the electrodes, hence minimizing so-called recombination losses, which means that less charge carriers are lost. The KIT team has succeeded in combining expertise from optoelectronics and ceramic materials for in-depth understanding of perovskite solar cells. At the new Material Research Center for Energy Systems (MZE) of KIT, the team of scientists from the areas of electrical engineering, materials science, and physics produced evidence that a typical building block of metal-organic perovskite solar cells, methyl ammonium lead iodide, is ferroelectric. The microscopic electrical fields within separate areas, so-called domains, may help to separate photo-generated charge carriers and, hence, to reduce their recombination. Ferroelectricity as a key property of perovskite solar cells may provide a new design criterion for novel light-harvesting materials in solar cells.

The MZE was opened three years ago to fertilize KIT's interdisciplinary research on energy conversion and storage. As such, the MZE will be the ideal environment to advance research into novel photovoltaic concepts in the future. On this scientific basis, for which the Erwin Schrödinger Prize was awarded, the research team will continue to explore and understand novel ferroelectric compounds for enhanced power harvesting, with a focus on eco-compatible and sustainable solutions.

Research was supported by the Baden-Württemberg Foundation, the Federal Ministry of Education and Research, and the Helmholtz Association through its Science and Technology of Nanosystems program.

Presentation of the Erwin Schrödinger Prize at the Annual Meeting of the Helmholtz Association: (From left to right) Otmar Wiestler (President of the Helmholtz Association), Michael J. Hoffmann, Tobias Leonhard, Holger Böhm, Holger Hanselka, Alexander Colsmann, Susanne Wagner, Alexander D. Schulz (all KIT), Kurt Bock (Vice-President of the Stifterverband).

OTHER PRIZES, HONORS, AWARDS, AND APPOINTMENTS

Persons

- **Professor Dr. Gerhard Adrian**, President of the German Weather Service and Professor of the Institute of Meteorology and Climate Research, was elected President of the World Meteorological Organization for four years.

- **Professor Dr. Almut Arneth**, Institute of Meteorology and Climate Research, and three other KIT scientists are among "Highly Cited Researchers" 2019, an international ranking published by the Web of Science Group.

- **Dr. Ivy Becker**, Institute of Applied Geosciences, received the Georg Hunaeus Prize, which recognizes support of early-stage researchers in the German Society for Petroleum and Coal Science and Technology.

- For his master's thesis, **Niklas Bernhart**, Institute for Technology and Management in Construction, was granted the 2019 Innovation Prize by the German Demolition Association.

- "Technology Review" magazine listed **Dr. Andreas Bihlmaier**, former staff member of the Institute for Anthropomatics and Robotics, and two other KIT alumni in the top 10 "Innovators under 35" for their outstanding projects.

- **Dr. Anna Böhmer**, Institute for Quantum Materials and Technologies, and three other young scientists of KIT were selected for participation in the 69th Lindau Nobel Laureate Meeting.

- "Technology Review" magazine listed **Dr. Tim Böltken**, former staff member of the Institute for Micro Process Engineering, and two other KIT alumni in the top 10 "Innovators under 35" for their outstanding projects.

- **Miriam Brosi**, Institute for Beam Physics and Technology, and three other young scientists of KIT were selected for participation in the 69th Lindau Nobel Laureate Meeting.

- For his doctoral thesis, **Dr. Matthias Budde**, Institute of Telematics, was granted the 2018 Sparkasse Environmental Award that was presented in October 2019. Three other young researchers of KIT were also honored by the Environmental Foundation of Sparkasse Karlsruhe.

- **Professor Dr. Klaus Butterbach-Bah**l, Institute of Meteorology and Climate Research, and three other KIT scientists are among "Highly Cited Researchers" 2019, an international ranking published by the Web of Science Group.

- **Laura Cordes**, Institute of Thermal Turbomachinery, was granted an Amelia Earhart Fellowship by the Zonta International Foundation.

- **Professor Dr. Luisa De Cola**, Institute of Nanotechnology, received the Izatt-Christensen Award 2019 of the International Symposium on Macrocyclic and Supramolecular Chemistry at Brigham Young University.

■ The Heinrich Büssing Prize was granted by the "Foundation for Support of Sciences at the Carolo-Wilhelmina" of the Braunschweig University Association to **Dr. Niels Dehio**, now Institute for Anthropomatics and Robotics, for his excellent doctoral thesis.

■ Every two years, the Soroptimist Club Karlsruhe grants the Erna Scheffler Sponsorship Award to female researchers for excellent scientific achievements at KIT. The 2019 Dissertation Award was granted to **Dr. Anja Exler**, Institute of Telematics.

■ The Association for Geography at German-speaking Universities and Research Institutions granted the Dissertation Prize in Physical Geography to **Dr. Julia Fuchs**, Institute of Meteorology and Climate Research and Institute of Photogrammetry and Remote Sensing.

■ **Dr. Axel Funke**, Institute of Catalysis Research and Technology, assumed leadership of an international bioenergy working group of the International Energy Agency (IEA).

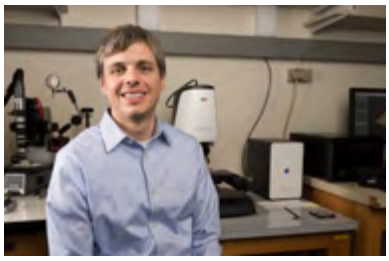
■ **Professor Dr. Frank Gauterin**, Institute of Vehicle System Technology, was elected member of the National Academy of Science and Engineering (acatech).

■ For his master's thesis, **Lukas Gerlin**g, Institute for Building Design and Technology, was granted the 2018 Sparkasse Environmental Award, which was presented in October 2019. Three other young researchers of KIT were also honored by the Environmental Foundation of Sparkasse Karlsruhe.

■ **Professor Dr. Dagmar Gerthsen**, Laboratory of Electron Microscopy, was elected Chairperson of the German Society for Electron Microscopy (DGE). The term of office of two years began January 01, 2020.

■ **Professor em. Dr. Gerhard Goos**, pioneer of German informatics and founding father of the Informatics Department of the then Karlsruhe University, was appointed Fellow of the International Federation for Information Processing (IFIP).

■ **Dr. Christian Greiner**, Institute for Applied Materials, received the Adolf Martens Prize for Young Scientists of the Federal Institute for Materials Research.



■ The German Research Foundation (DFG) granted this year's Bernd Rendel Prize for promising and original geoscientific research at the beginning of a career to **Dr. Michael Grund**, Geophysical Institute.

■ **Professor Dr. Armin Grunwald**, Institute for Technology Assessment and Systems Analysis, was appointed Member of the "Zukunftskreis" Commission of the Federal Ministry of Education and Research that is also chaired by him.

■ The International Science Council (ISC) appointed **Professor Dr. Armin Grunwald,** Institute for Technology Assessment and Systems Analysis, Member of the Committee for Science Planning.

■ **Professor Dr. Peter Gumbsch**, Institute for Applied Materials, was elected a member of the National Academy of Science and Engineering (acatech).

■ For her doctoral thesis, **Dr. Julia Hackenbruch**, Institute of Meteorology and Climate Research, was granted the 2018 Sparkasse Environmental Award, which was presented in October 2019. Three other young researchers of KIT were also honored by the Environmental Foundation of Sparkasse Karlsruhe.

■ **Professor Dr. Horst Hahn**, Institute of Nanotechnology, was elected Fellow of the US National Academy of Inventors.

■ **Professor Dr.-Ing. Holger Hanselka**, President of KIT, was appointed Member of the High-tech Forum, the central body advising the federal government in matters of research and innovation. Together with politics, the body pushes the implementation and further development of the 2025 High-tech Strategy. In addition, Hanselka was appointed Member of the Steering Group of the Science Platform for Climate Protection of the Federal Ministries of Education and Research and for the Environment, Nature Conservation, and Nuclear Safety.

■ The Society of Petroleum Engineers (SPE) granted **Professor Dr. Christoph Hilgers**, Institute of Applied Geosciences, the "SPE Regional Distinguished Achievement Award for Petroleum Engineering Faculty" for his achievements in research and academic education.

■ **Dr. Alik Ismail-Zadeh**, Institute of Applied Geosciences, received the Ambassador Award of the American Geophysical Union. The Ambassador Award is granted to persons, whose achievements extend far beyond those honored by traditional scientific awards.

■ At the Berlin Tech Hackathon, **Lisa Käde**, Institute for Information and Economic Law and Center for Applied Legal Studies, and her team qualified with their tool viz.law for the final of the Global Legal Hackathon in New York.

■ For his doctoral thesis, **Dr. Sven Killinger**, Institute for Industrial Production, was granted the 2018 Sparkasse Environmental Award, which was presented in October 2019. Three other young researchers of KIT were also honored by the Environmental Foundation of Sparkasse Karlsruhe.

■ **Professor Dr. Matthias Kind**, Institute of Thermal Process Engineering, was appointed Secretary of Heidelberg Academy of Sciences.

■ For his doctoral thesis, **Dr. Frederik Kotz**, former staff member of the Institute of Microstructure Technology of KIT, received the Südwestmetall Sponsorship Award and the German Studies Award of the Körber Foundation in the section of Natural and Engineering Sciences.

■ In September 2019, **Sebastian Kuntz**, Institute of Solid-state Physics, was granted one of three "Otto Haxel Prizes for Physics 2018" by the universities of Heidelberg and Göttingen.

■ **Vladimir Lenok**, Institute of Experimental Particle Physics, and three other young scientists of KIT were selected for participation in the 69th Lindau Nobel Laureate Meeting.

■ **Professor Dr. Annette Leßmöllmann**, Institute for German Studies, was elected Deputy Chairperson of the Program Committee of the Radio Council of the Deutschlandradio radio station.

■ **Professor Dr. Nikolaus Marsch**, Institute for Information and Economic Law, received the Science Award of the German Foundation for Law and Informatics (DSRI) for his habilitation thesis.

■ **Professor Dr. Michael Mönnich**, KIT Library, was admitted to the Académie Internationale d'Histoire de la Pharmacie.

■ **Professor em. Dr. Harald S. Müller**, Institute of Concrete Structures and Building Materials, was granted the honorary membership of the American Concrete Institute.

■ **Professor Dr. Johannes Orphal**, Institute of Meteorology and Climate Research, was elected Corresponding Member by the Académie de l'air et de l'espace.

■ **Professor Dr. Stefano Passerini**, Helmholtz Institute Ulm, was admitted to Leopoldina, the National Academy of Sciences.

■ **Dr. Theo Peschke**, former staff member of the Institute for Biological Interfaces of KIT, was granted the 2019 DECHEMA Industrial Bioprocess Award for his doctoral thesis.

■ **Dr. Magnus Schlösser**, Institute for Technical Physics, and three other young scientists of KIT were selected for participation in the 69th Lindau Nobel Laureate Meeting.

■ **Andreas Schlüter**, Institute of Meteorology and Climate Research, was admitted to the current class of the Schmidt Science Fellows Program in New York. The doctoral researcher is the only representative of a German institution in the program.

■ **Frank Scholze**, KIT Library, was appointed new Director General of the German National Library as of 2020.

■ **Professor Dr. Alexandros Stamatakis**, Institute of Theoretical Informatics, and three other KIT scientists are among "Highly Cited Researchers" 2019, an international ranking published by the Web of Science Group.

■ **Professor Dr. Christoph Stiller**, Institute of Measurement and Control, was appointed IEEE Fellow by the Institute of Electrical and Electronics Engineers.

■ **Professor Dr. York Sure-Vetter**, Institute of Applied Informatics and Formal Description Methods, was appointed Member of the "Zukunftskreis" Commission of the Federal Ministry of Education and Research.

■ **Professor Dr. Theodoros Triantafyllidis**, Institute of Soil Mechanics and Rock Mechanics, was conferred the honorary doctorate by the University of Patras.

■ **Professor Dr. Kathrin Valerius**, Institute for Nuclear Physics, was ranked in the "Young Elite 2019" of the "Top 40 under 40," category "Science and Society," published by the Capital magazine.

■ **Professor Dr. Melanie Volkamer**, Institute of Applied Informatics and Formal Description Methods, was appointed Member of the Steering Group of the Initiative "IT Security in Industry" of the Federal Ministry for Economic Affairs and Energy.

■ **Professor Dr. Alexander Waibel**, Institute for Anthropomatics and Robotics, was granted the ICMI Sustained Accomplishment Award at the International Conference of Multimodal Interaction (ICMI).

■ Every two years, the Soroptimist Club Karlsruhe grants the Erna Scheffler Sponsorship Award to female researchers for excellent scientific achievements at KIT. The prize for a master's thesis in 2019 went to **Marie Weiel-Potyagaylo**, Steinbuch Centre for Computing.

■ **Professor Dr. Marion A. Weissenberger-Eibl**, Institute for Entrepreneurship, Technology Management and Innovation, is ranked among the 100 most influential women of German industry by the manager magazine.

■ **Professor Dr. Wolfgang Wernsdorfer**, Physikalisches Institut, and three other KIT scientists are among "Highly Cited Researchers" 2019, an international ranking published by the Web of Science Group.

■ **Professor Dr. Christof Wöll**, Institute of Functional Interfaces, was conferred an honorary doctorate by Syddansk Universitet (University of Southern Denmark).

■ "Technology Review" magazine listed **Dr. Sebastian Zanker**, former staff member of the Institute of Solid-state Physics, and two other KIT alumni among the top 10 "Innovators under 35" for their outstanding projects.

■ The Bavarian State Ministry for the Environment and Consumer Protection presented the Bavarian State Medal for contributions to environmental policy to **Dr. Karl-Friedrich Ziegahn**, Division IV. In addition, Ziegahn was appointed Member of the Council of the University of Augsburg and of the "FIA Environment and Sustainability Commission" of the Fédération Internationale de l'Automobile (FIA).

■ **Professor Dr. Thomas Zwick**, Institute of Radio Frequency Engineering and Electronics, was elected Member of the National Academy of Science and Engineering (acatech).

Institutions

■ The project **ARES**, which studies bionic ship coatings to reduce friction between ship walls and water was granted the 1st prize of the Validation Award Competition of the Federal Ministry of Education and Research.

■ The **Evayu** project of a team of the enactus university group was granted both the endowed Knowledge and Competencies Prize and the Audience Prize. The project is aimed at installing particulate filters in evaporation systems of schools in India.

■ The **HoloMed** system co-developed by KIT to support surgeons in the operating theater with augmented reality was granted the Innovation Award NEO 2019 of the Karlsruhe Technology Region. With the simultaneous interpreting technology by kites GmbH, another development of KIT was in the final of the NEO award competition.

■ The city of **Karlsruhe** was chosen Creative City of Media Arts by UNESCO. On the Advisory Board, KIT was involved in the development of a corresponding action plan.

■ In the competition "EXIST-Potentials" of the Federal Ministry for Economic Affairs and Energy, category "internationally convincing", **KIT** was selected for funding from among 220 universities. The proposal was submitted by the Innovation and Relations Management Business Unit.

■ At the Annual Conference of the Federal University Communication Association, **KIT** was granted the "Prize for Exemplary Training of Interns 2019". For many years, the Corporate Communications Group of SEK has trained interns for future tasks in science communication.

■ The German Expert Association for Air and Water Hygiene honored **KIT** (Campus North) for "exemplary work in the area of room air hygiene."

■ The district of Karlsruhe honored the **KIT Energy Lab 2.0** in the competition "Exemplary Building Project in the District of Karlsruhe 2013 – 2019."

■ The **Mehr.WERT.Pavillon**, a pavilion at the Federal Garden Show designed and built by students, researchers, and lecturers of the KIT Department of Architecture from reused and recycled materials was granted the materialPREIS 2019 in the "Public Voting" category.

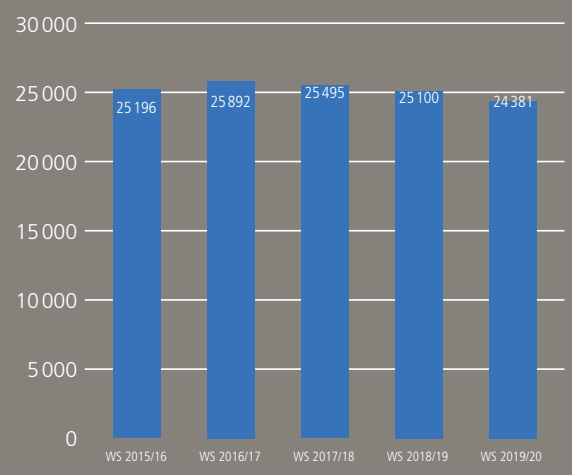
■ The district of Karlsruhe honored the **Human Resources Development and Vocational Training** Business Unit of KIT for its exemplary work for the integration of refugees and migrants in work and education by granting the District Integration Award.

■ In the two-stage innovation competition "Artificial Intelligence as Driver of Economically Relevant Ecosystems" of the Federal Ministry for Economic Affairs and Energy, the research project "**SDaC – Smart Design and Construction**" was successful. 16 of 130 consortia in all branches won the competition. Among them were SDaC and two other projects, in which KIT was a partner.

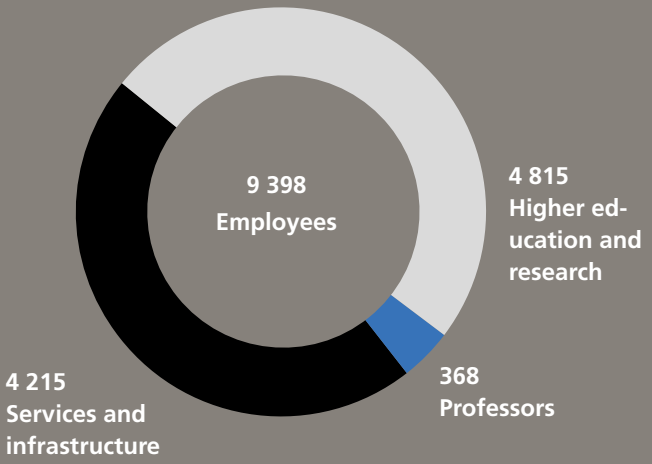
■ At the State Orchestra Competition of the German Music Council, both the KIT **Symphony Orchestra** conducted by Tobias Drewelius and the **Chamber Orchestra** conducted by Dieter Köhnlein qualified for the 10th German Competition of Orchestras.

FACTS AND FIGURES

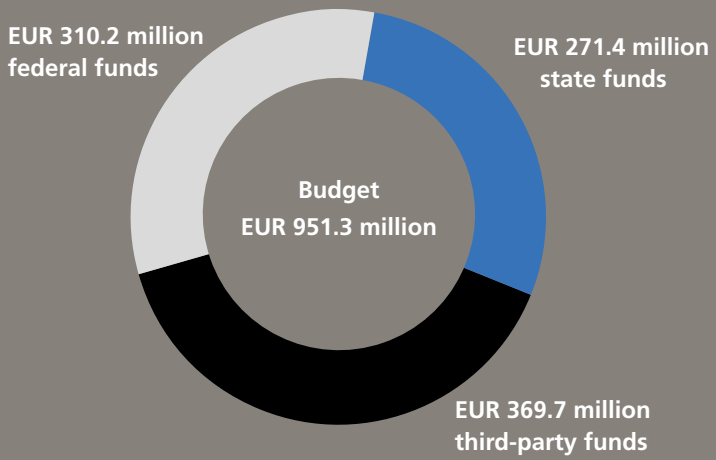
Number of students



Employees 2019



Total budget 2019



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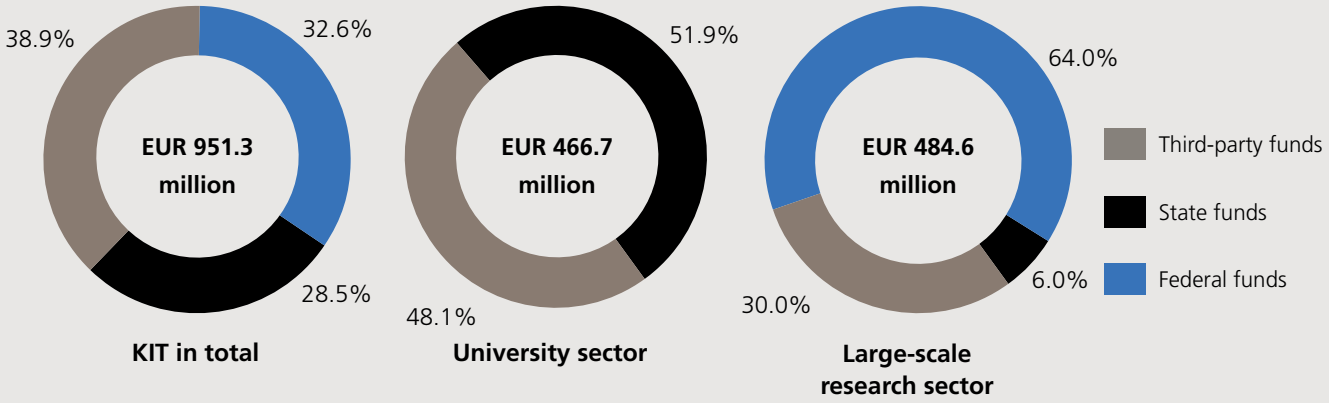
FUNDING

Federal, State, and Third-party Funds Acquired



Sources of Funding

KIT in Total

In million euros	2015	2016	2017	2018	2019
Income in total	860.8	851.1	901.7	880.9	951.3
Third-party funds	358.0	336.4	358.7	338.0	369.7
State funds	248.1	251.5	255.4	263.0	271.4
Federal funds	254.7	263.2	287.6	279.9	310.2

University Sector

In million euros	2015	2016	2017	2018	2019
Income in total	428.4	429.6	445.9	440.3	466.7
Third-party funds**	208.7	208.1	218.7	206.5	224.4
State funds**	219.7	221.5	227.2	233.8	242.3
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	2015	2016	2017	2018	2019
Income in total	432.4	421.5	455.8	440.6	484.6
Third-party funds	149.3	128.3	140.0	131.5	145.3
State funds	28.4	30.0	28.2	29.2	29.1
Federal funds	254.7	263.2	287.6	279.9	310.2

Sources of Third-party Funding

KIT in Total

In million euros	2015	2016	2017	2018	2019
Third-party funding in total	358.0	336.4	358.7	338.0	369.7
Third-party funding by DFG, incl. CRC	44.1	50.3	52.9	51.4	59.9
Third-party funding by EU	32.3	29.4	30.0	25.2	28.5
Third-party funding by Fed. and State	133.8	124.0	140.9	129.2	142.6
Other income	147.8	132.7	134.9	132.2	138.7

University Sector*

In million euros	2015	2016	2017	2018	2019
Third-party funding in total	208.7	208.1	218.7	206.5	224.4
Third-party funding by DFG, incl. CRC	38.8	41.1	41.4	42.9	45.1
Third-party funding by EU	13.3	11.0	11.9	9.6	11.0
Third-party funding by Fed. and State	92.1	90.6	93.6	83.0	91.2
Other income	64.5	65.4	71.8	71.0	77.1

* 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	2015	2016	2017	2018	2019
Third-party funding in total	149.3	128.3	140.0	131.5	145.3
Third-party funding by DFG, incl. CRC	5.3	9.2	11.5	8.5	14.8
Third-party funding by EU	19.0	18.4	18.1	15.6	17.5
Third-party funding by Fed. and State	41.7	33.4	47.3	46.2	51.4
Other income	83.3	67.3	63.1	61.2	61.6

Use of Funds in 2019

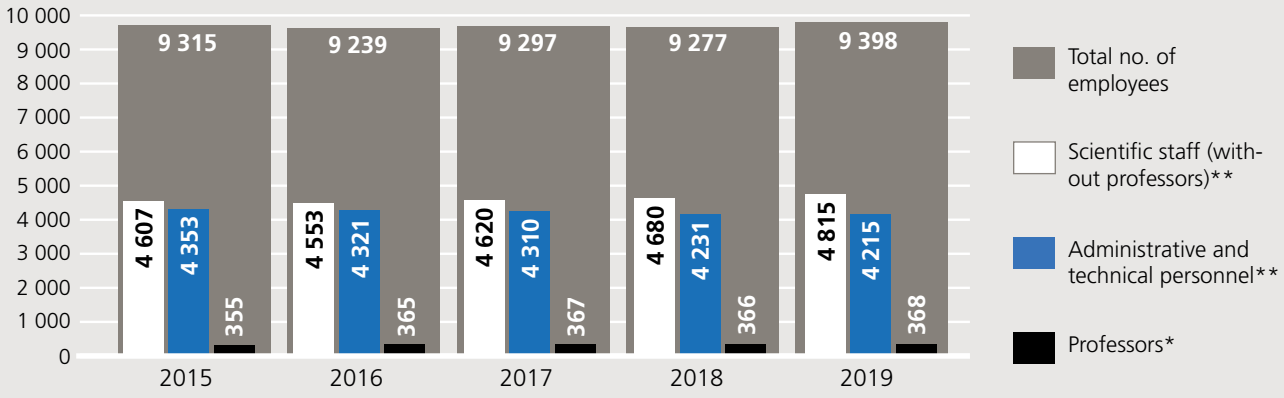
In million euros	KIT in Total	University Sector*	Large-scale Research Sector
Expenses in total	951.3	466.7	484.6
Investments in total	109.4	34.3	75.1
of these, major investments	28.8	0	28.8
of these, ongoing investments	80.6	34.3	46.3
Personnel expenses	597.4	336.0	260.4
Material expenses	244.9	95.8	149.1

* 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)	2015	2016	2017	2018	2019
Total number of employees	9 315	9 239	9 297	9 277	9 398
of these, female employees	3 363	3 373	3 447	3 454	3 553
Professors*	355	365	367	366	368
of these, female professors	47	49	49	51	54
of these, junior professors	8	8	7	9	11
of these, female junior professors	3	3	2	3	3
of these, international professors	32	34	36	39	43
of these, endowed professors	8	9	9	7	6
Scientific staff (without professors)**	4 607	4 553	4 620	4 680	4 815
of these, female scientists	1 193	1 190	1 244	1 255	1 317
of these, staff financed from third-party funds	2 365	2 341	2 408	2 421	2 446
of these, international employees	933	950	990	1 035	1 135
of these, employment contracts of limited duration	3 677	3 561	3 585	3 612	3 737
of these, part-time employees	1 436	1 529	1 530	1 587	1 605
Administrative and technical personnel**	4 353	4 321	4 310	4 231	4 215
of these, female staff	2 123	2 134	2 154	2 148	2 182
of these, staff financed from third-party funds	746	736	753	785	751
of these, international employees	191	194	205	212	223
of these, employment contracts of limited duration	1 158	1 056	965	894	845
of these, part-time employees	1 058	1 112	1 110	1 101	1 149
of these, trainees and students of Baden-Württemberg Cooperative State University	471	464	432	396	371
of these, female trainees and students	139	162	152	154	140
Trainees' share in the total number of employees [%]	5	5	5	4	4



* 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

	2015	2016	2017	2018	2019
Total	22	19	20	7	12
Men	17	16	19	7	10
Women	5	3	1	0	2

Appointments to W-3 University Professor at KIT

Name, division	Professorship	Previous employer institution
Prof. Dr. Tabea Arndt, Division III	Supraleitende Magnettechnologie	Siemens AG
Prof. Dr. Dorothee Frey, Division V	Analysis	TU Delft
Prof. Dr. Markus Garst, Division V	Theoretische Festkörperphysik	TU Dresden
Prof. Simon Hartmann, Division IV	Bauplanung und Entwerfen	HHF Architekten Büro Basel
Prof. Dr. Tobias Hartnick, Division V	Algebra und Geometrie	Justus-Liebig Giessen University
Prof. Dr. Anne Koziolek, Division II	Software-Technik	KIT
Prof. Dr. Nikolaus Marsch, Division II	Öffentliches Recht, insbesondere öffentliches Informationsrecht, Datenschutzrecht und Regulierungsrecht	KIT
Prof. Dr. Laurent Schmalen, Division II	Nachrichtensysteme	Nokia Bell Labs
Prof. Dr. Thorsten Stein, Division II	Sportwissenschaft mit Schwerpunkt Bewegungswissenschaft und Biomechanik	KIT
Prof. Dr. Ahmet Cagri Ulusoy, Division III	Integrierte Hochgeschwindigkeitsschaltungen	Michigan State University
Prof. Dr. Joaquin Medina Warmburg, Division IV	Bau- und Architekturgeschichte	Universidad Torcuato di Tella

Appointments to W-1 University Professor at KIT

Name, division	Professorship	Previous employer institution
Tenure-track Prof. Dr. Pascal Friederich, Division II	KI-Methoden in den Materialwissenschaften	University of Toronto
Tenure-track Prof. Fabian Krüger, Division II	Emprische Wirtschaftsforschung	Heidelberg University
Jun. Prof. Dr. Franziska Mathis-Ullrich, Division II	Medizinrobotik	ETH Zurich

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PERSONNEL INFORMATION

➔ Appointment to W-1 University Professor at KIT

Name, division	Professorship	Previous employer institution
Jun. Prof. Dr. Katharina Scherf, Division I	Bioaktive und funktionelle Lebensmittelinhaltsstoffe	Leibniz LSB
Jun. Prof. Dr. Julian Thimme, Division II	Finanzwirtschaft, Banken und Versicherungen	Goethe University Frankfurt
Tenure-track Prof. Dr. Christian Wressnegger, Division II	KI-Methoden in der IT-Sicherheit/ IT-Sicherheit KI-basierter Systeme	TU Braunschweig

Appointments to Apl. Professor and Honorarprofessor

Name	Type	KIT department
Prof. Dr. Ron Dagan	Apl. Professor	Mechanical Engineering
Prof. Dr. Kirsten Drüppel	Apl. Professor	Civil Engineering, Geo- and Environmental Sciences
Prof. Dr. Chris Gerbing	Honorarprofessor	Humanities and Social Sciences
PD Dr. Julian Hanschke	Apl. Professor	Architecture
PD Dr. Hendrik Hölscher	Apl. Professor	Mechanical Engineering
Prof. Dr. Dietmar Hönig	Honorarprofessor	Civil Engineering, Geo- and Environmental Sciences
Prof. Dr. Alexander Konyukhov	Apl. Professor	Civil Engineering, Geo- and Environmental Sciences
Prof. Dr. Martin Kremmer	Honorarprofessor	Mechanical Engineering
Prof. Dr. Peer Kunstmann	Apl. Professor	Informatik

Emeriti/Retirements

Name	Institute	Division
Prof. Dr. Rüdiger Dillmann	Institute for Anthropomatics and Robotics	Division II
Prof. Dr. Martin Fischer	Institute for Vocational Education and General Education	Division II
Prof. Dr. Harald Fuchs	Institute of Nanotechnology	Division V
Prof. Kerstin Gothe	Institute for Urban and Landscape Design	Division IV
Prof. Dr. Eberhard Hohnecker	Institute of Highway and Railroad Engineering	Division IV
Prof. Dr. Ellen Ivers-Tiffée	Institute for Applied Materials	Division III
Prof. Dr. Andreas Kirsch	Institute for Applied and Numerical Mathematics	Division V
Prof. Dr. Dietmar Koch	Institute for Applied Materials	Division III

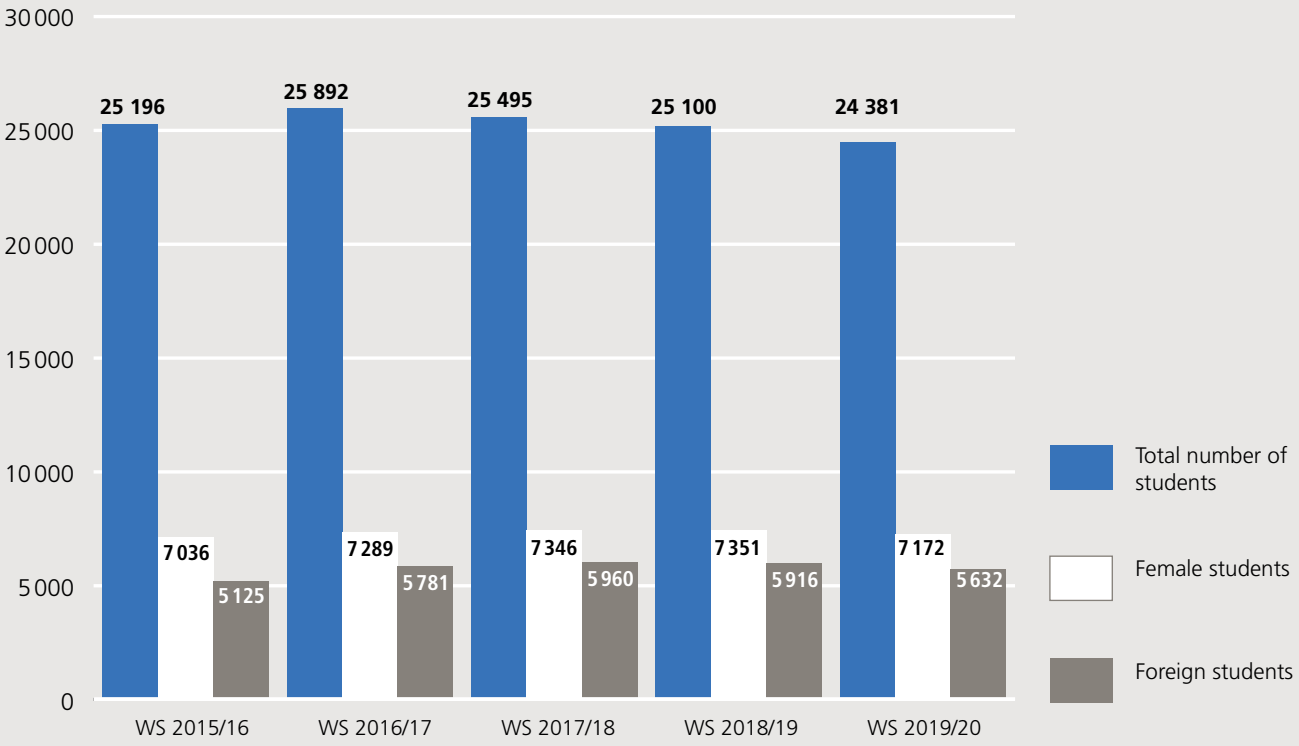
➔

➔ **Emeriti/Retirements**

Name	Institute	Division
Prof. Dr. Thomas Schulenberg	Institute for Nuclear and Energy Technologies	Division III
Prof. Dr. Theodoros Triantafyllidis	Institute of Soil Mechanics and Rock Mechanics	Division IV
Prof. Dr. Lutz Weis	Institute for Analysis	Division V

STUDENTS

Students in Total



Students and Desired Degrees

Desired degree	WS 2015/16	WS 2016/17	WS 2017/18	WS 2018/19	WS 2019/20
Bachelor	14 136	14 245	14 129	13 810	13 495
Master	8 181	9 193	9 424	9 313	8 955
Teacher (secondary and vocational schools)	780	823	872	918	952
Doctorate	664	555	475	457	441
State examination	50	23	14	6	0
Diploma	796	462	57	50	32
Studienkolleg	218	230	207	214	185
No degree*	371	361	317	332	321
Total	**25 196**	**25 892**	**25 495**	**25 100**	**24 381**

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

Allocation of Students to Subject Groups

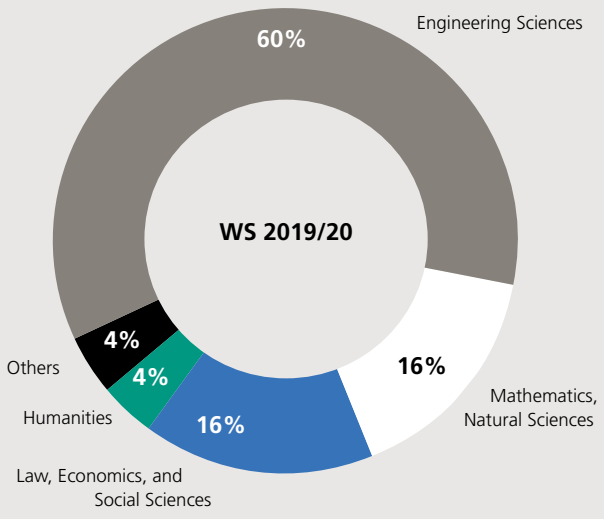
Subject group	WS 2015/16	WS 2016/17	WS 2017/18	WS 2018/19	WS 2019/20
Engineering Sciences	15 204	15 785	15 671	15 303	14 729
Mathematics, Natural Sciences	4 536	4 504	4 225	4 156	4 042
Law, Economics, and Social Sciences	3 831	3 889	3 854	3 835	3 833
Humanities	832	840	872	889	877
Others	793	874	873	917	900
Total	**25 196**	**25 892**	**25 495**	**25 100**	**24 381**

Allocation of Foreign Students to Subject Groups

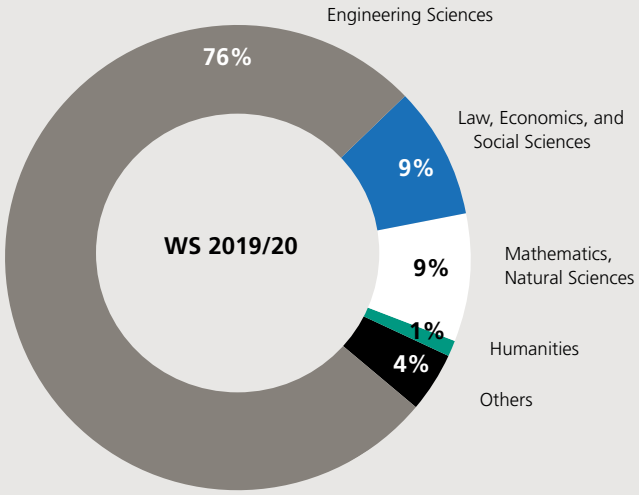
Subject group	WS 2015/16	WS 2016/17	WS 2017/18	WS 2018/19	WS 2019/20
Engineering Sciences	3 951	4 483	4 674	4 565	4 267
Mathematics, Natural Sciences	391	457	447	473	507
Law, Economics, and Social Sciences	473	508	527	515	529
Humanities	71	83	81	79	78
Others	234	250	231	284	251
Total	**5 120**	**5 781**	**5 960**	**5 916**	**5 632**

Foreign students: Not of German nationality

Allocation of Students to Subject Groups

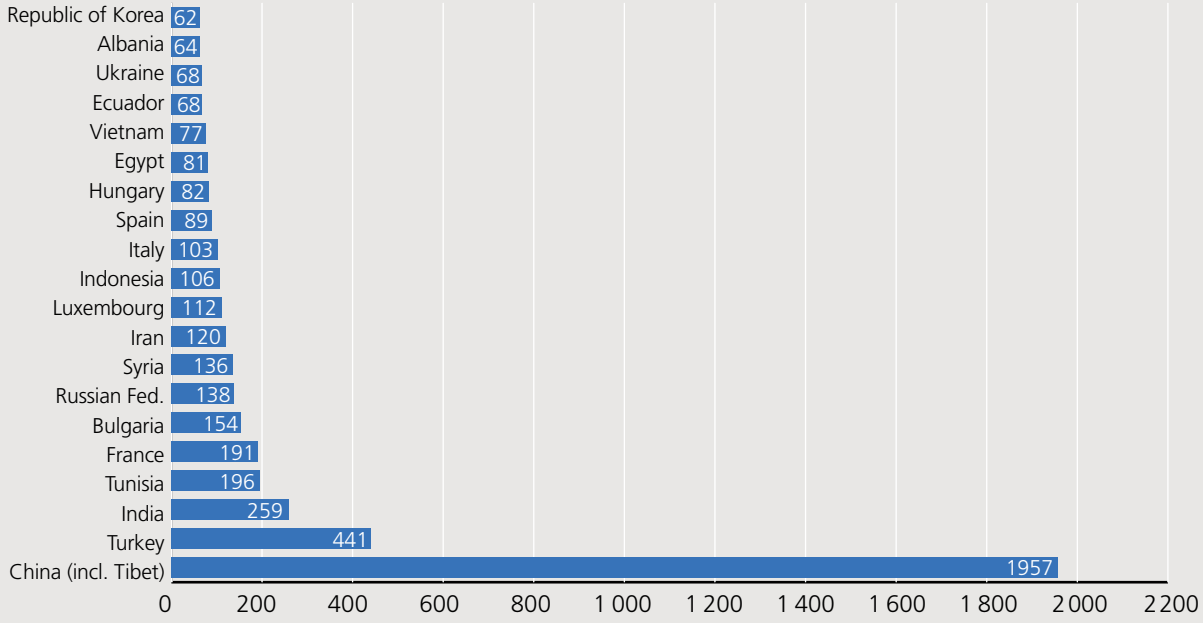


Allocation of Foreign Students to Subject Groups



STUDENTS

Home Countries of Foreign Students (Top 20 of 130)

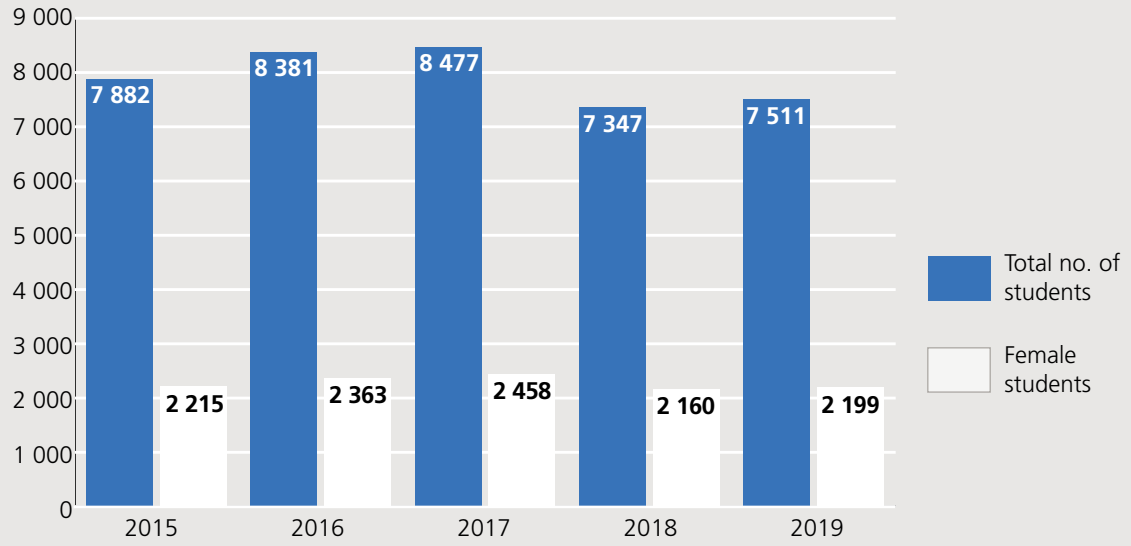


Student Beginners and Degrees Targeted in the 1st Semester*

Desired degree	2015	2016	2017	2018	2019
Bachelor	4 214	4 439	4 551	4 076	4 038
Master	3 196	3 433	3 390	2 765	2 924
Bachelor's degree in teaching at secondary schools	136	168	180	223	211
Bachelor's degree in teaching at vocational schools	32	39	37	28	16
Master's degree in teaching at secondary schools	0	0	0	0	33
Master's degree in teaching at vocational schools	19	17	8	15	27
Studienkolleg	285	285	325	240	260
Total	**7 882**	**8 381**	**8 491**	**7 347**	**7 509**

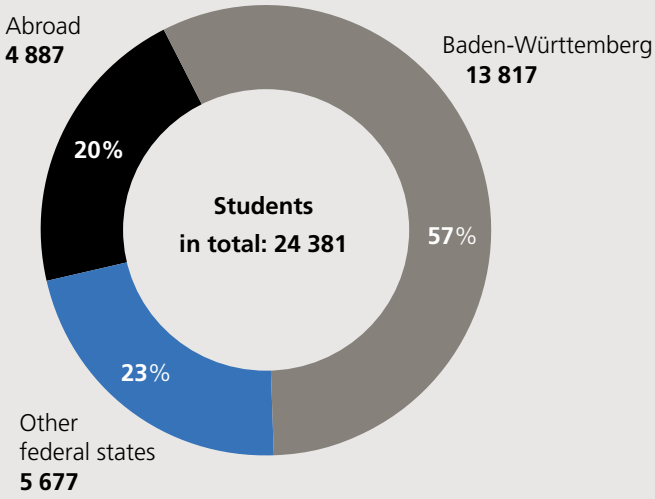
*Without doctoral students and exchange students, who do not aim at a degree at KIT.

Number of Student Beginners in the 1st Semester*



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

Origin of Students in the 2019/20 Winter Semester*

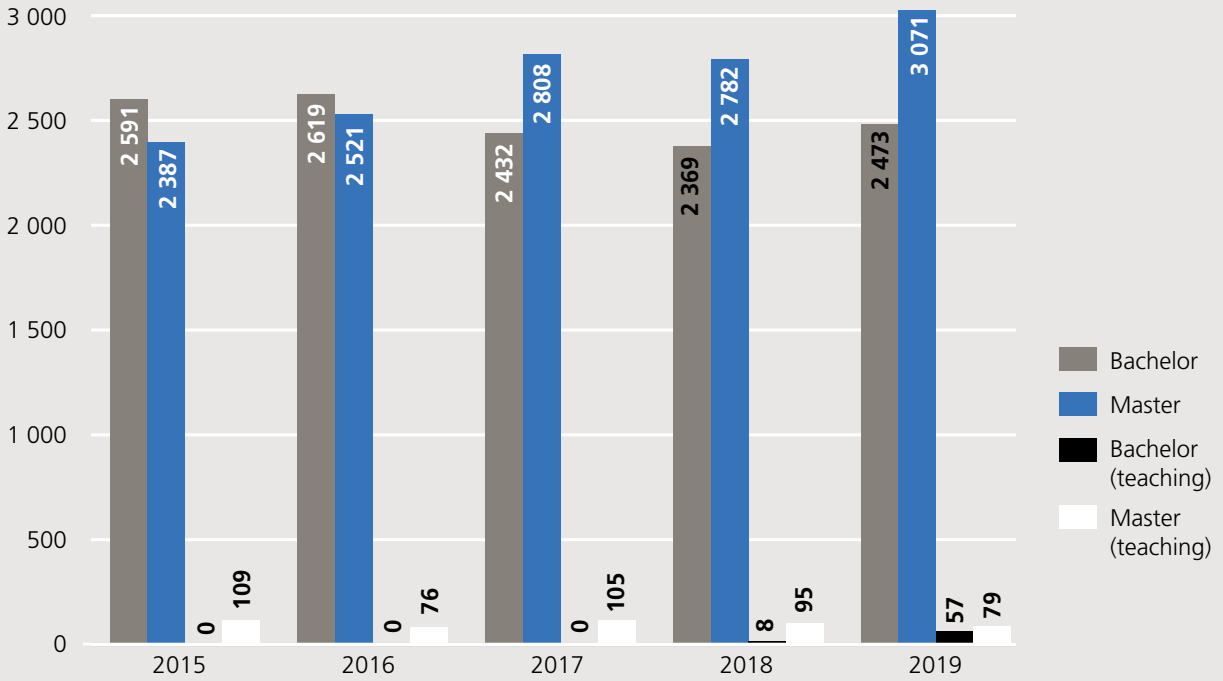


*Place of acquisition of university entrance qualification.

Region	Students
Karlsruhe city and district	4 066
Karlsruhe Regional Council District	3 690
Rest of Baden-Württemberg	6 061
Baden-Württemberg in total	13 817
Rhineland-Palatinate	1 725
Bavaria	997
Hesse	863
North Rhine-Westphalia	851
Lower Saxony	383
Other federal states	858
Germany without Baden-Württemberg	5 677
Asia	2 839
Europe	1 269
Africa	369
America	399
Australia and Oceania	11
Abroad	4 887
KIT in total	**24 381**

STUDENTS

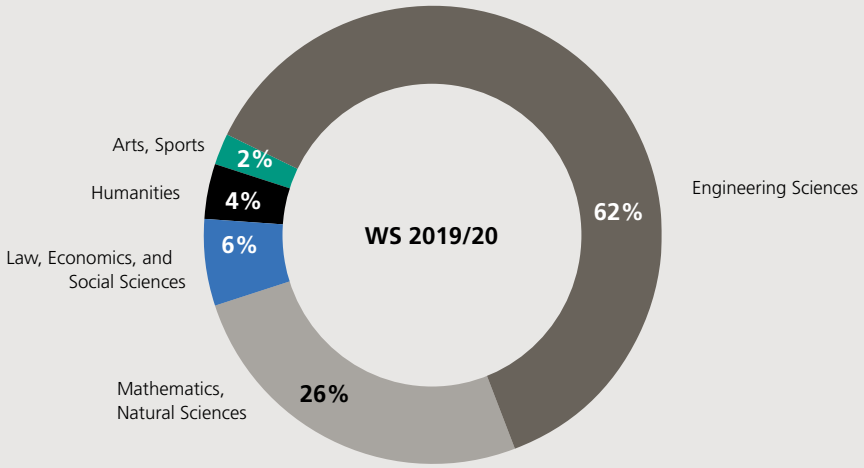
Number of Graduates*



* The number of graduates in 2019 is not yet final.

Doctoral Candidates in the Different Subject Groups

Subject group	Male	Female	Total
Engineering Sciences	1 554	391	1 945
Mathematics, Natural Sciences	493	328	821
Law, Economics, and Social Sciences	132	64	196
Humanities	63	78	141
Arts, Sports	25	28	53
Total	**2 267**	**889**	**3 156**



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 *(École Nationale Supérieure d'Architecture de Strasbourg, France)*
Bauingenieurwesen	●	●			
Bioingenieurwesen	●	●			
Chemieingenieurwesen/Verfahrens-technik	●	●			
Elektrotechnik und Informationstechnik	●	●			German-French Double Degrees B.Sc. and M.Sc. *(Institut National Polytechnique Grenoble, France)*
Energy Engineering und Management				●	
Financial Engineering				●	
Funktionaler und Konstruktiver Ingenieurbau – Engineering Structures		●			
Geodäsie und Geoinformatik	●	●			German-French Double Degrees B.Sc. and M.Sc. *(Institut National des Sciences Appliquées Strasbourg, France)* Double Master *(Università degli Studi di Trento, Italien)*
Remote Sensing and Geoinformatics		●			
Information Systems Engineering and Management				●	
Informatik	●	●	●		*Double Master Informatics (Institut National Polytechnique Grenoble, France)* *Double Master Cryptography (Université de Rennes, France)*
Informationswirtschaft	●	●			
Management of Product Development				●	
Mechanical Engineering	●	●			*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)*

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STUDENTS

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

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
					German-French Bachelor's and Master's Program *(École 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, South 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 und Werkstofftechnik	●	●			
Mechatronik und Informationstechnik	●	●			
Mobilität und Infrastruktur		●			
Naturwissenschaft und Technik			●		
Optics and Photonics		●			Double Master's Program (*Aix Marseille Université, France; École Centrale de Marseille, France; Barcelona Universities, Spain)*
Production and Operations Management				●	
Regionalwissenschaft		●			Dual *Master's* Degree Program *(Universidad de Concepción, Chile)*
Water Science and Engineering		●			
Wirtschaftsinformatik	●	●			

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 *(École Polytechnique Paris, France)*
Meteorologie	●	●			
Physik	●	●	●		German-French Double Master *(UFR de Physique of Université Joseph Fourier Grenoble, France)* German-French Double Master *(École 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			●		
Ingenieurpädagogik für Ingenieurinnen and Ingenieure			●		
Pädagogik	●	●			
Technische Volkswirtschaftslehre	●	●			
Wirtschaftsingenieurwesen	●	●			German-French Double Master *(Institut National Polytechnique Grenoble, France) Double Master (Linköpings universitet, Sweden)*

* Will be terminated from the 2019 summer semester

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 Ideengeschichte (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	Wellenphänomene: Analysis und Numerik	Prof. Dr. Marlis Hochbruck, Institute for Applied and Numerical Mathematics	2015 – 2023
SFB 1176/1	Molekulare Strukturierung weicher Materie	Prof. Dr. Michael Meyer, Institute of Organic Chemistry	2016 – 2020
SFB/TRR 257	Phänomenologische Elementarteilchen-physik nach der Higgs-Entdeckung	Prof. Dr. Kirill Melnikov, Institute for Theoretical Particle Physics	2019 – 2022

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 1598	From Catchments as Organised Systems to Models Based on Dynamic Functional Units – CAOS	Prof. Dr. Erwin Zehe, Institute for Water and River Basin Management	2011 – 2019
FOR 1650	Dislocation-based Plasticity	Prof. Dr. Peter Gumbsch, Institute for Applied Materials	2011 – 2019
FOR 2383	Erfassung und Steuerung dynamischer lokaler Prozesszustände in Mikroreak-toren mittels neuer in-situ-Sensorik	Prof. Dr. Roland Dittmeyer, Institute for Micro Process Engineering	2016 – 2023

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 88/3	Kooperative Effekte in homo- und heterometallischen Komplexen (3MET)	Prof. Dr. Gereon Niedner-Schatteburg, TU Kaiserslautern (Spokesperson) Prof. Dr. Manfred Kappes, Institute of Physical Chemistry and Institute of Nanotechnology, KIT	2011 – 2022
SFB TRR 89/3	Invasives Rechnen (InvasIC)	Prof. Dr. Jürgen Teich, Friedrich-Alexander-Universität Erlangen-Nürnberg (Spokesperson) Prof. Dr. Jörg Henkel, Institute of Computer Engineering, KIT	2010 – 2022

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RESEARCH

➔ Collaborative Research Centers with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
SFB TRR 150/2	Turbulent chemisch reagierende Mehrphasenströmungen in Wandnähe	Prof. Dr. Andreas Dreizler, TU Darmstadt (Spokesperson) Prof. Dr. Olaf Deutschmann, Institute for Chemical Technology and Polymer Chemistry, KIT	2015 – 2022
SFB TRR 165/2	Waves to Weather: Wellen, Wolken, Wetter	Prof. Dr. George C. Craig, LMU München Prof. Dr. Volkmar Wirth, JGU Mainz Prof. Dr. Peter Knippertz, Institute of Meteorology and Climate Research, KIT	2015 – 2023

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 1246	Kilimanjaro ecosystems under global change	Prof. Dr. Ingolf Steffan-Dewenter, Universität Würzburg (Spokesperson) Dr. Ralf Kiese, Institute of Meteorology and Climate Research, KIT	2010 – 2019
FOR 1451	Exploring mechanisms underlying the relationship between biodiversity and ecosystem functioning	Prof. Dr. Nico Eisenhauer, Universität Leipzig, (Spokesperson) Prof. Dr. Wolfgang Wilcke, Institute of Geography and Geoecology, KIT	2010 – 2020
FOR 1498	Alkali-Kieselsäure-Reaktionen in Betonbauteilen bei gleichzeitiger zyklischer Beanspruchung und externer Alkalizufuhr	Prof. Dr. Rolf Breitenbücher, Ruhr-Universität Bochum (Spokesperson) Prof. Dr. Harald S. Müller, Institute of Concrete Structures and Building Materials, KIT	2011 – 2019
FOR 1525	INUIT – Ice Nuclei research UnIT	Prof. Dr. Joachim Curtius, Universität Frankfurt am Main (Spokesperson) Prof. Dr. Corinna Hoose, Dr. Alexei Kiselev, Prof. Dr. Thomas Leisner, Dr. Ottmar Möhler, Institute of Meteorology and Climate Research, KIT	2011 – 2019

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➔ DFG-funded Research Units with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
FOR 1701	Introducing Non-flooded Crops in Rice-Dominated Landscapes: Impact on Carbon, Nitrogen and Water Cycles (ICON)	Prof. Dr. Volkmar Wolters, Universität Gießen (Spokesperson) Dr. Ralf Kiese, Prof. Dr. Klaus Butterbach-Bahl, Institute of Meteorology and Climate Research, KIT	2011 – 2019
FOR 1993	Multifunktionale Stoff- und Energie-wandlung	Prof. Dr. Burak Atakan, Universität Duisburg-Essen (Spokesperson) Prof. Dr. Olaf Deutschmann, Institute for Chemical Technology and Polymer Chemistry, KIT Prof. Dr. Ulrich Maas, Dr. Robert Schießl, Institute of Technical Thermodynamics, KIT	2013 – 2019
FOR 2063	The Epistemology of the Large Hadron Collider	Prof. Dr. Gregor Schiemann, Bergische Universität Wuppertal (Spokesperson) Prof. Dr. Rafaela Hillerbrand, Institute for Technology Assessment and Systems Analysis, KIT	2016 – 2019
FOR 2083	Integrierte Planung im öffentlichen Verkehr	Prof. Dr. Anita Schöbel, Georg-August-Universität Göttingen (Spokesperson) Prof. Dr. Dorothea Wagner, Institute of Theoretical Informatics, KIT	2015 – 2019
FOR 2093	Memristive Bauelemente für neuronale Systeme	Prof. Dr. Hermann Kohlstedt, Christian-Albrechts-Universität zu Kiel (Spokesperson) Dr. Kiran Chakravadhanula, Institute of Nanotechnology, KIT	2014 – 2019
FOR 2290	Understanding Intramembrane Proteolysis	Prof. Dr. Dieter Langosch, Technische Universität München (Spokesperson) Prof. Dr. Burkhard Luy, Institute of Organic Chemistry, KIT	2015 – 2019
FOR 2325	Interactions at the Neurovascular Interface	Prof. Dr. Ralf H. Adams, Max-Planck-Institut für molekulare Biomedizin, Münster (Spokesperson) Prof. Dr. Ferdinand le Noble, Zoological Institute, KIT	2016 – 2019

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➔ DFG-funded Research Units with KIT Participation

Number	Title	Spokesperson / KIT participation	Duration
FOR 2337	Denitrification in Agricultural Soils: Integrated Control and Modelling at Various Scales (DASIM)	Prof. Dr. Christoph Müller, Justus-Liebig-Universität Gießen (Spokesperson) Prof. Dr. Klaus Butterbach-Bahl, Institute of Meteorology and Climate Research, KIT	2015 – 2019
FOR 2589	Zeitnahe Niederschlagsschätzung und -vorhersage	Prof. Dr. Christian von Savigny Universität Greifswald, (Spokesperson) Prof. Dr. Wolfgang Wilcke, Institute of Geography and Geoecology, KIT	2018 – 2021
FOR 2730	Umweltveränderungen in Biodiversitäts-Hotspot-Ökosystemen Süd-Ecuadors: Systemantwort und Rückkopplungseffekte (RESPECT)	Prof. Dr. Christian von Savigny Universität Greifswald, (Spokesperson) Prof. Dr. Wolfgang Wilcke, Institute of Geography and Geoecology, KIT	2018 – 2021
FOR 2820	Revisiting The Volcanic Impact on Atmosphere and Climate – Preparations for the Next Big Volcanic Eruption	Prof. Dr. Christian von Savigny Universität Greifswald, (Spokesperson) Prof. Dr. Corinna Hoose, Dr. Gholamali Hoshyaripour, Dr. Bernhard Vogel, Institute of Meteorology and Climate Research, KIT	2019 – 2022
FOR 2936	Klimawandel und Gesundheit in Afrika südlich der Sahara	Prof. Dr. Rainer Sauerborn Universitätsklinikum Heidelberg, (Spokesperson) Prof. Dr. Harald Kunstmann, Institute of Meteorology and Climate Research, KIT	2019 – 2022

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.

ERC Grants

Name, institute, division	Title of project	Duration
Dr. Christian Greiner, Institute for Applied Materials, Division III	ERC Consolidator Grant TriboKey – Deformation Mechanisms are the Key to Understanding and Tayloring Tribological Behaviour	09/2018 – 08/2023
Prof. Dr. Dennis Hofheinz, Institute of Computer Engineering, Division II	ERC Consolidator Grant PREP-CRYPTO – Preparing Cryptography for Modern Applications	07/2017 – 01/2020
Prof. Dr. Corinna Hoose, Institute of Meteorology and Climate Research, Division IV	ERC Starting Grant C2Phase – Closure of the Cloud Phase	04/2017 – 03/2022

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➔ ERC Grants

Name, institute, division	Title of project	Duration
Prof. Dr. Christian Koos, Institute of Photonics and Quantum Electronics, Division III	ERC Consolidator Grant TeraSHAPE – Terahertz Waveform Synthesis and Analysis Using Hybrid Photonic-electronic Circuits	05/2018 – 04/2023
Dr. Pavel Levkin, Institute of Toxicology and Genetics, Division I	ERC Starting Grant DropCellArray – DropletMicroarrays: Ultra High-throughput Screening of Cells in 3D Microenvironments	02/2014 – 01/2019
Prof. Dr. Holger Puchta, Botanical Institute, Division I	ERC Advanced Grant CRISBREED – Multidimensional CRISPR/Cas mediated engineering of plant breeding	10/2017 – 09/2022
Dr. Frank Schröder, Institute for Nuclear Physics, Division V	PeV-Radio – Digital Radio Detectors for Galactic PeV Particles	02/2019 – 01/2024
Prof. 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
Prof. Dr. Florian Bernlochner, Institute of Experimental Particle Physics, Division V	Suche nach neuer Physik und Präzisionsmessung des CKM Matrixelements |Vub| mit dem Belle II Experiment	02/2018 – 09/2019
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. Christian Greiner, Institute for Applied Materials, Division III	Size effects and microstructure evolution in textured metal surfaces during reciprocating sliding	10/2012 – 03/2019
Dr. Manuel Hinterstein, Institute for Applied Materials, Division III	BNT-BT als zukünftige bleifreie Funktionswerkstoffe für PTCR-, Aktor- und Sensoranwendungen	04/2016 – 03/2021

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➔ Emmy Noether Junior Research Groups

Name, institute, division	Title of group	Duration
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. Tom Brown, Institute for Automation and Applied Informatics, Division III	New Methodologies to Master Complexity in Energy System Optimisations	04/2018 – 03/2024
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. Benno Meier, Institute for Biological Interfaces 4, Division I	Hyperpolarized Magnetic Resonance	03/2019 – 02/2025
Dr. Ulrich Paetzold, Institute of Microstructure Technology, Division III	Nanophotonics for Perovskite/Silicon Multijunction Solar Cells	05/2016 – 04/2021
Dr. Alexander Schug, Steinbuch Centre for Computing, Division II	Multi-scale Simulations of Regulatory RNAs and Two-component signal Transduction	04/2011 – 06/2019
Dr. Manuel Tsotsalas, Institute of Functional Interfaces, Division I	Hierarchically Structured Biomaterials	01/2016 – 12/2020

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➔ Helmholtz Young Investigators Groups

Name, institute, division	Title of group	Duration
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. 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.

Industry Fellowship (IF)

Name, institute, division	Title of group	Duration
Dr. Nicole Stricker, wbk Institute of Production Science, Division III	Robuste Produktionstechnik	07/2019 – 06/2022
Dr. Frederik Zanger, wbk Institute of Production Science, Division III	Optimierte Prozesse und Prozessketten für additiv gefertigte Bauteile (OptiPro²Addi)	10/2019 – 09/2022

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

Young Investigators Group

Name, institute, division	Title of group	Duration
Dr. Luise Kärger, Institute of Vehicle System Technology, Division III	Gewichtsoptimierte Fahrzeugstrukturen durch maßgeschneiderte Hochleistungsfaserverbunde (funded by the Vector Foundation)	07/2014 – 12/2021

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

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BMBF Junior Research Groups

Name, institute, division	Title of group	Duration
Dr. Gerardo Hernandez-Sosa, Light Technology Institute, AG InnovationLab, Division III	BIOLicht – Gedruckte biologisch abbaubare organische lichtemittierende Bauteile	11/2014 – 10/2022
Dr. Julia Maibach, Institute for Applied Materials, Division III	InSEIde: Grenzflächen in Lithium-Ionen-Batterien verstehen und manipulieren	09/2017 – 09/2022
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. Christian Brandl, Institute for Applied Materials, Division III	Computergestützte Nanomechanik von Materialien	05/2015 – 12/2020	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
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. Benjamin Flavel, Institute of Nanotechnology, Division V	Carbon Nanotube-based Solar Cells	11/2018 – 10/2021	Heisenberg position
Dr. Benjamin Häfner, wbk Institute of Production Science, Division III	Agile Produktionsregelkreise	02/2019 –02/2024	EU, Carl Zeiss Foundation
Dr. Andreas Haupt, Institute for Sociology, Media, and Cultural Sciences, Division II	Economic Inequality and Labor Markets	01/2015 – 01/2019	Elite program for postdocs of the Baden-Württemberg Foundation, DFG

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➔ Other Junior Research Groups and Funding Measures

Name, institute, division	Title of group	Duration	Funding
Dr. Robert Heinrich, Institute for Program Structures and Data Organization, Division II	Quality-driven System Evolution	03/2018 – 12/2019	MWK and BMBF
Dr. Michael Hirtz, Institute of Nanotechnology, Division V	Dip-pen Nanolithography and Related Techniques	03/2011 – 12/2020	DFG and others
Dr. Daniel Hoang, Institute for Finance, Banking, and Insurance, Division II	Unternehmensfinanzierung	10/2016 – 09/2019	DFG and others
Dr. Sebastian Höfener, Institute of Physical Chemistry, Division I	Molecular electronic structure methods in complex environments	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. Mathias Krause, Institute for Applied and Numerical Mathematics 2/ Institute for Mechanical Process Engineering and Mechanics, Divisions V and III	Lattice Boltzmann Research Group	05/2018 – 04/2024	DFG and others
Dr. Axel Loewe, Institute of Biomedical Engineering, Division III	Computational Cardiac Modelling	11/2018 – 06/2021	DFG and MWK
Dr. Rainer Mandel, Institute for Analysis, Division V	Nichtlineare Helmholtz-gleichungen	05/2017 – 06/2019	Junior Research Group within a CRC
Dr. Zbigniew Pianowski, Institute of Organic Chemistry, Division I	Chemical Biology, Supramolecular Systems and Prebiotic Chemistry	10/2016 – 09/2019	DFG
Dr. Ioan M. Pop, Physikalisches Institut, Division V	Supraleitende Quantenelektronik	10/2015 – 09/2020	Sofja Kovalevskaja Prize of the Humboldt Foundation
Dr. Achim Rettinger, Institute of Applied Informatics and Formal Description Methods, Division II	Adaptive Data Analytics	06/2014 – 06/2020	BMBF and EU

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➔ Other Junior Research Groups and Funding Measures

Name, institute, division	Title of group	Duration	Funding
Dr. Andy Rupp, Institute of Theoretical Informatics, Division II	CyPhyCrypt	07/2017 – 09/2019	DFG, KASTEL
Dr. Somidh Saha, Institute of Theoretical Informatics, Division II	Sylvanus	08/2019 – 10/2021	BMBF and others
Dr. Birgit Schörkhuber, Institute for Analysis, Division V	Singularity Formation in Nonlinear PDEs	02/2019 -12/2021	CRC, Klaus Tschira Foundation
Dr. Katrin Schulz, Institute for Applied Materials, Division III	Dislocation-based Continuum Theory of Plasticity	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 Finanzmärkten	05/2017 – 09/2019	DFG and others

Junior Professorships

Name, institute, division	Area	Duration
Jun. Prof. Dr. Andreas Ch. Braun, Institute of Regional Science, Division IV	Risikoorientierte Regionalentwicklung	05/2015 – 05/2020
Jun. Prof. Dr. Pascal Friederich, Institute of Theoretical Informatics, Division II	KI-Methoden in den Materialwissenschaften	12/2019 – 12/2025
Jun. Prof. Dr. Lennart Hilbert, Zoological Institute, Division I	Systembiologie/Bioinformatik	10/2018 – 09/2022
Jun. Prof. Dr. Anne Koziolek, Institute for Program Structures and Data Organization, Division II	Softwaretechnik	02/2013 – 01/2019
Jun. Prof. Dr. Fabian Krüger, Institute for Economic Policy Research, Division II	Empirische Wirtschaftsforschung	10/2019 – 10/2022
Jun. Prof. Dr. Xian Liao, Institute for Analysis, Division V	Analysis Partieller Differentialgleichungen	11/2018 – 11/2022

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➔ Junior Professorships

Name, institute, division	Area	Duration
Jun. Prof. Dr. Franziska Mathis-Ullrich, Institute for Anthropomatics and Robotics, Division II	Medizinrobotik	04/2019 – 04/2025
Jun. Prof. Dr. Boris Neubert, Institute for Visualization and Data Analysis, Chair for Computer Graphics, Division II	Visual Computing	04/2015 – 05/2019
Jun. Prof. Dr. Katharina Scherf, Institute for Applied Biosciences, Division I	Bioaktive und funktionelle Lebensmittel-inhaltsstoffe	08/2019 – 07/2025
Jun. Prof. Dr. Matti Schneider, Institute of Engineering Mechanics, Division III	Computational Micromechanics	09/2017 – 08/2021
Jun. Prof. Dr. Katharina Schratz, Institute for Applied and Numerical Mathematics, Division V	Zeitabhängige Partielle Differenzialgleichungen	09/2013 – 08/2019
Jun. Prof. Dr. Thorsten Stein, Institute of Sports and Sports Science, Division II	Bewegungswissenschaft und Biomechanik	04/2013 – 03/2019
Jun. Prof. Dr. Julian Thimme, Institute for Finance, Banking, and Insurance, Division II	Finanzierung	08/2019 – 07/2025
Jun. Prof. Dr. Ingo Wagner, Institute of Sports and Sports Science, Division II	MINT-Fachdidaktik im Bereich der Fächer Sport und Mathematik oder Physik	10/2018 – 09/2022
Jun. Prof. Dr. Christian Wressnegger, Institute of Theoretical Informatics, Division II	Intelligente Systemsicherheit	12/2019 – 11/2025

RESEARCH

Graduate Schools Funded by the DFG or Helmholtz Association

Graduate School	Funded by	Spokesperson / participant	Duration
Karlsruhe School of Optics & Photonics (KSOP)	DFG	Prof. Dr. Ulrich Lemmer, Light Technology Institute	2006 – 2019
Karlsruher Schule für Elementarteilchen- und Astroteilchenphysik: Wissenschaft und Technologie (KSETA)	DFG	Prof. Dr. Ulrich Nierste, Institute for Theoretical Particle Physics	2012 – 2019
Graduiertenschule für Klima und Umwelt (GRACE)	HGF	Prof. 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
Elementarteilchenphysik bei höchster Energie und höchster Präzision	DFG	Prof. Dr. Dieter Zeppenfeld, Institute for Theoretical Physics	2011 – 2020
Molekulare Architekturen für die fluoreszente Bildgebung von Zellen	DFG	Prof. Dr. Hans-Achim Wagenknecht, Institute of Organic Chemistry	2015 – 2019
Integrierte Entwicklung kontinuierlich-diskontinuierlich langfaserverstärkter Polymerstrukturen	DFG	Prof. Dr. Thomas Böhlke, Institute of Engineering Mechanics Together with: University of Waterloo, University of Western Ontario, University of Windsor (all Canada)	2015 – 2019
Energiezustandsdaten – Informatik-Methoden zur Erfassung, Analyse und Nutzung	DFG	Prof. Dr. Klemens Böhm, Institute for Program Structures and Data Organization	2016 – 2020
Asymptotische Invarianten und Limiten von Gruppen und Räumen	DFG	Prof. Dr. Roman Sauer, Institute for Algebra and Geometry Together with: Prof. Dr. Anna Wienhard, Mathematisches Institut, Ruprecht-Karls-Universität Heidelberg	2016 – 2021
Simulation mechanisch-elektrisch-thermischer Vorgänge in Lithium-Ionen-Batterien	DFG	Prof. Dr. Thomas Wetzel, Institute of Thermal Process Engineering	2017 – 2021
Tailored Scale-bridging Approaches to Computational Nanoscience	DFG	Prof. Dr. Marcus Elstner, Institute of Physical Chemistry	2019 – 2023

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➔ **Research Training Groups Funded by the DFG or Helmholtz Association**

Research Training Group	Funded by	Spokesperson / participant	Duration
Mechanisms and Interactions of Climate Change in Mountain Regions MICMoR	HGF	Prof. Dr. Hans Peter Schmid, Institute of Meteorology and Climate Research	2012 – 2019
Energy Scenarios – Construction, Assessment and Impact	HGF	Prof. Dr. Armin Grunwald, Institute for Technology Assessment and Systems Analysis	2011 – 2019
Helmholtz International Research School for Astroparticle Physics and Enabling Technologies (HIRSAP)	HGF	Prof. Dr. Ralph Engel, Institute for Nuclear Physics	2018 – 2024
Helmholtz Information and Data Science School for Health (HIDSS4Health)	HGF	Prof. Dr. Ralf Mikut, Institute for Automation and Applied Informatics	2019 – 2025

INNOVATION

Innovation Characteristics

Year	Invention disclosures	Priority-establishing patent applications	Property rights (existing)	Royalties [million euros]	New companies (spinoffs)	Participation in spinoffs
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
2018	115	63	1 949	1.57	21 (7)	9
2019	97	40	1 889	1.27	50 (9)	9

Establishments of New Companies

Spinoffs
Appointrix GmbH
AURA
CEPRI
Promonode
Schnaitec GmbH
secure radiation lab
Smelldect GmbH
Thissen Analytics GmbH
VENTECON – Beckedorf und Wiest GbR

Startups	
AIRflow	MADOC
AskYourUI	ModuGen
Barbra	motyfes
Baustell	NeosAI
Bladesign	nutrilize
BOCK auf Karlsruhe	NVRRT Technologies (TRASH AI)
carformore	Obviate-AI
Constreo	Ökobag
CreateData	PeachUp
Entropify	Raison d'Être
Fiami	she.codes
Forest Flight	Semantic Search Engine
Frozengusto	Sensum Tech.
Hebammenplattform	Smada
INDO	smartING
Itravelpoetry	Steck-Fix
Just here for the food	The Fitness App
KANISTER	Vivi
Kit merch	Voxelhost
likvi	VRWorkbench
Lumitrast	

AWARDS

External Awards

(see separate chapter of this Annual Report from page 88)

KIT Department Teaching Awards

KIT Department	Award winners
Architecture	Prof. Dirk E. Hebel
Civil Engineering, Geo- and Environmental Sciences	Dominik Waleczko
Chemistry and Biosciences	Prof. Dr. Mirko Bunzel
Chemical and Process Engineering	Researchers of the group of Prof. Dr. Hermann Nirschl: Ermek Asylbekov, Jörg Baumgartner, Susanne Cernak, Maximilian Gaedtke, Dr. Marco Gleiß, Simon Hammerich, Michael Kespe, Benjamin Radel, Sebastian Schuhmann, Julian Ungerer
Electrical Engineering and Information Technology	Dr. Stefan Wünsch
Humanities and Social Sciences	Prof. Dr. Stefan Scherer
Informatics	Dr. Iona Gheta
Mechanical Engineering	Prof. Dr. Andreas E. Guber
Mathematics	Prof. Dr. Roman Sauer and Dr. Holger Kammeyer
Physics	Dr. Antje Bergmann
Economics and Management	Prof. Dr. Alexander Mädche

Awards for Doctoral Researchers

KIT Doctoral Awards

Name	Institute
Dr. Hannah Rothfuß	Institute for Chemical Technology and Polymer Chemistry
Dr. Andreas Schlüter	Institute of Meteorology and Climate Research
Dr. Merita Tafili	Institute of Soil Mechanics and Rock Mechanics

Other Doctoral Awards

Name	Institute	Institution
Dr. Almut Albiez	Institute for Applied Materials	Bertha Benz Prize for Female Engineers
Dr. Frederik Kotz	Institute of Microstructure Technology	Südwestmetall Sponsorship Award
Dr. Sven Lindner	Institut für Kolbenmaschinen	Sponsorship Award of the Friedrich and Elisabeth Boysen Foundation

MEDIA/PUBLICATIONS

Development of Visibility in the Media

	2015	2016	2017	2018	2019
Printed articles	14 609	16 913	20 372	20 191	24 756
Online articles*	13 309	18 098	19 599	23 574	23 635

*Deviation from previous annual reports due to updated data.

Publications

Publications in the year	2015	2016	2017	2018	2019
Publications of researchers of KIT	6 597	7 655	7 809	8 469	8 637
of these, books and proceedings	893	821	871	826	877
of these, articles in proceedings	829	953	1 079	1 305	1 023
of these, articles in journals	2 386	3 713	3 739	3 969	3 877
of these, in WoS- or Scopus-referenced journals	2 073	3 510	4 113	3 658	3 645
of these, open access articles	903	1 044	1 516	1 902	2 122

RANKINGS

National Rankings

		2015	2016	2017*	2018	2019
Wirtschaftswoche	Electrical Engineering	4	2	–	2	3
	Informatics	5	2	–	1	2
	Mechanical Engineering	4	3	–	2	3
	Natural Sciences	–	7	–	7	8
	Business Engineering	3	2	–	2	2

* In 2017, no ranking was published by Wirtschaftswoche.

International Rankings

		2015	2016	2017	2018	2019
National Taiwan University Ranking	International – Overall	192	198	211	216	228
	International – Natural Sciences	49	53	55	62	67
	International – Engineering Sciences	58	80	81	95	106
	National – Overall	18	18	19	19	19
	National – Natural Sciences	1	1	1	1	1
	National – Engineering Sciences	1	1	1	1	1
QS World University Rankings	International – Overall	93	98	107	116	124
	International – Natural Sciences	34	–	29	37	48
	International – Engineering Sciences & IT	62	–	38	51	59
	National – Overall	4	4	4	4	5
	National – Natural Sciences	3	–	3	4	3
	National – Engineering Sciences	4	–	4	4	4
Times Higher Education	International – Overall	138	144	133	135	175
	International – Natural Sciences	46	68	61	69	69
	International – Engineering Sciences	48	60	55	54	74
	National – Overall	14	14	14	14	20
	National – Natural Sciences	4	9	7	5	7
	National – Engineering Sciences	3	4	4	3	4
Academic Ranking of World Universities	International – Overall	201–300	201–300	201–300	201–300	201–300
	International – Natural Sciences	76–100	51–75	–	–	–
	International – Engineering Sciences	101–150	151–200	–	–	–
	National – Overall	14–21	15–21	16–22	15–20	11–21

SUSTAINABILITY

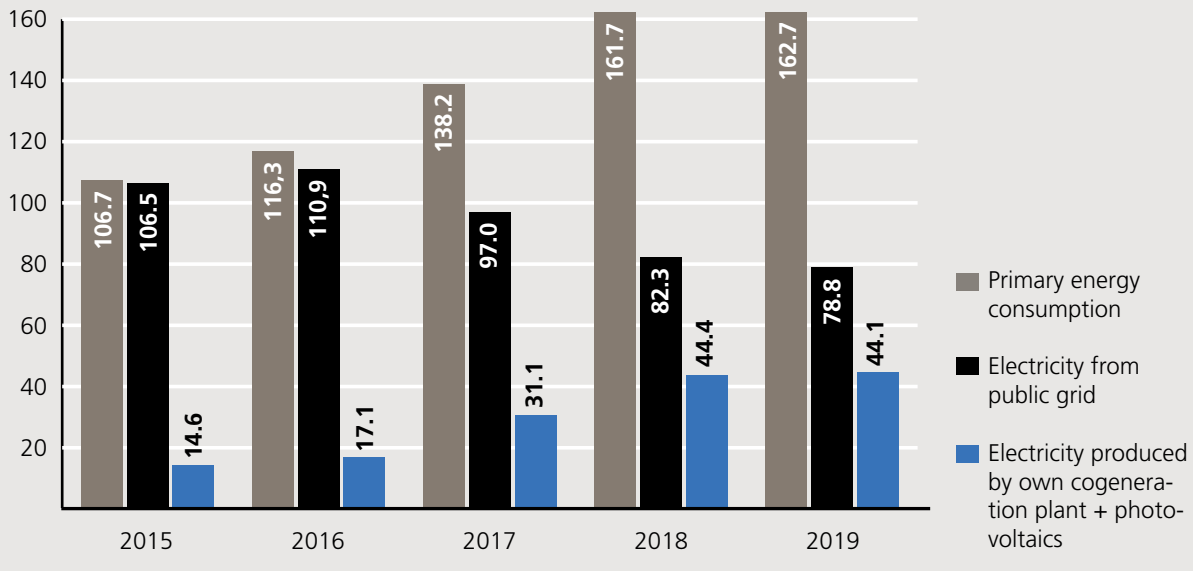
CO_2 Emissions of Heating Power Plants on Campus North

	2015	2016	2017	2018	2019
Heating plant CO_2 [t/a]	12 580	16 361	10 671	8 511	8 025
Cogeneration plant CO_2 [t/a]	6 281	4 205	6 496	4 754	4 210
Total CO_2 [t/a]	18 861	20 566	17 167	13 265	12 235
Allocated CO_2 certificates [t/a]	11 073*	9 688*	8 346*	7 047*	5 791

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

Energy Consumption and Energy Production on Campus North

Type of energy	2015	2016	2017	2018	2019
Primary energy consumption [GWh]	106.7	116.3	138.2	161.7	162.7
Electricity from the public grid [GWh]	106.5	110.9	97.0	82.3	78.8
Electricity produced by own cogeneration plant [GWh]	13.6	16.1	30.1	43.2	44.1
Electricity produced by own photovoltaics facilities [GWh]	1.0	1.0	1.0	1.2	0.9
Heat produced (district heating power plant + cogeneration plant) [GWh]	71.4	77.3	78.9	73.1	76.6
Heat, weather-adjusted [GWh]	74.4	77.3	78.1	81.3	79.0



Supply and Waste Management Services

Type of service	2017		2018		2019	
	CN	CS*	CN	CS*	CN	CS*
Electricity supply [GWh]	80	54	79	55	77	54
Heat supply [GWh]	41	44	38	45	40	49
Weather-adjusted [GWh]	40	44	42	50	42	51
Water supply [m³]	107 543	222 970	99 759	229 100	86 058	220 941
Waste disposal [t]	16 455**	955	19 978**	899	12 370**	1 629

* 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

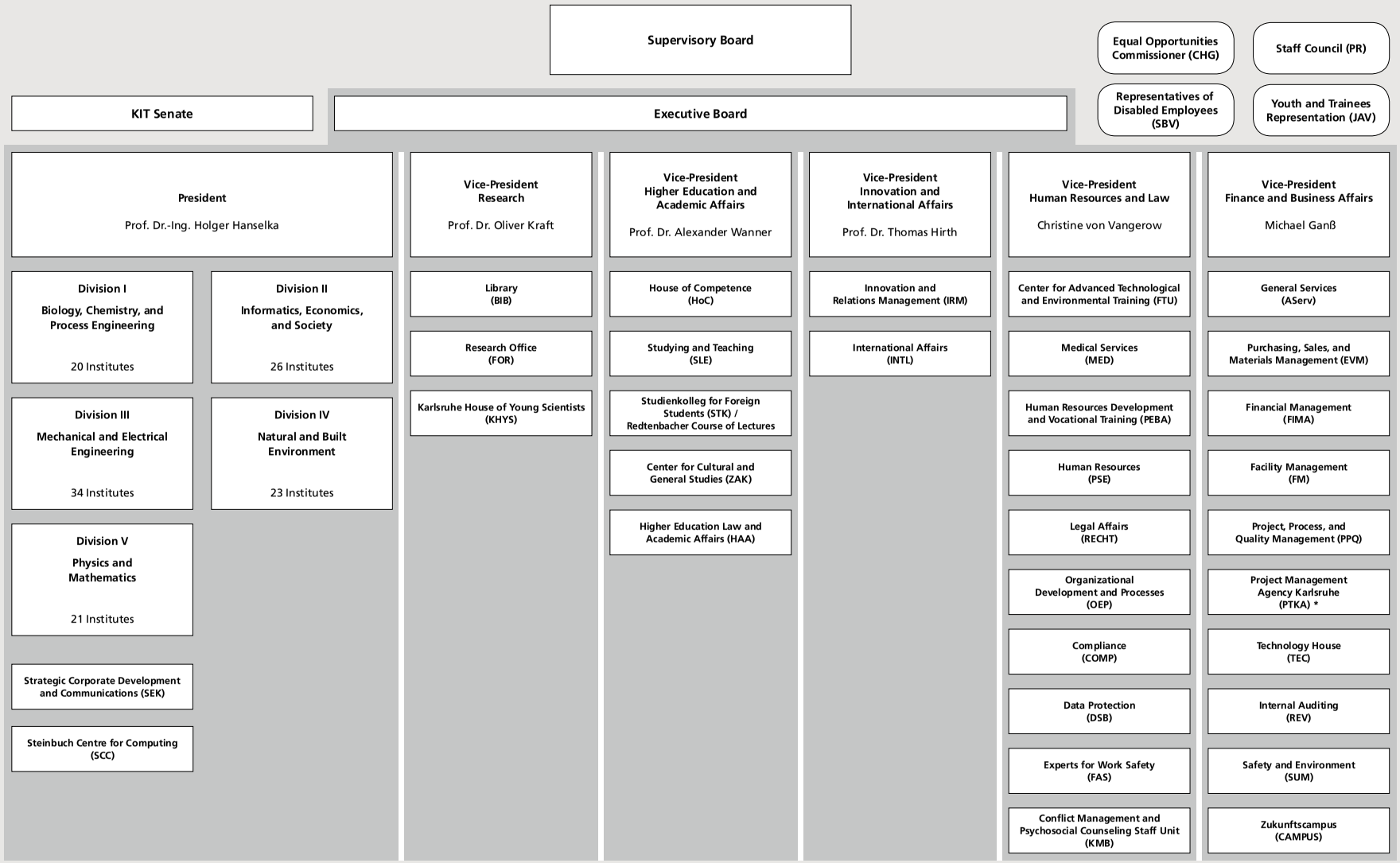
Type of area [m²]	KIT in total		Campus South*		Campus North**	
	[m²]	%	[m²]	%	[m²]	%
Office areas (including conference rooms, rooms for copiers and servers)	171 305	35.9	100 101	34.7	71 204	37.7
Laboratories, workshops, experiment halls	166 378	34.8	82 591	28.6	83 787	44.4
Storage and similar facilities	62 362	13.1	36 532	12.7	25 830	13.7
Teaching and studies (lecture halls, seminar rooms, practice rooms)	59 193	12.4	53 120	18.4	6 073	3.2
Library areas (central + decentralized libraries)	13 632	2.9	11 991	4.2	1 641	0.9
Sports areas	4 648	1.0	4 432	1.5	216	0.1
Total usable area	477 518	100	288 767	100	188 751	100
of this, rented areas			17 436 m²		2 793 m²	

* incl. Campus East and Campus West

** incl. Campus Alpine

ORGANIZATIONAL CHART

Organizational Structure



** no professional instructions by KIT Executive Board*

Issued by
Karlsruhe Institute of Technology (KIT)
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Photos: Aharoni, Sahar, ZAK/KIT: 86; Albrecht, Lydia: 45, 76; ARTIS - Uli Deck: 100; Ballach, J./Wetzel, C.: 60; Balzer, Manuel: 20; Bastmeyer, Martin: 8; Benz, Maximilian: 33; Bildkraftwerk: 50; BMWi/Bildkraftwerk Kurc: 100; BNL: 90; Bramsiepe, Amadeus: 17, 20, 21, 28, 38-39, 40, 41, 49, 57, 62, 65, 72, 73, 80, 97, 98; Breig, Markus: Title 6-7, 8, 12, 13, 14, 15, 16, 18-19, 20, 26, 35, 40, 41, 42, 44, 46-47, 48, 49, 53, 56, 57, 59, 60, 61, 64, 65, 70, 72, 80, 81, 84, 85, 90, 99; Cordts, Anne: 42, 91; Costard, Carsten, Mainz: 73; DFG/David Ausserhofer: 91; Drollinger, Andreas: 14, 51, 90, 91, 101; endostock - Fotolia: 74; Fabry, Andrea: 3; Fuge, Robert: 48, 49, 88, 90; Gigler, Dominik: 17; Göttisheim, Sandra: 22, 25, 41, 97; Grandel, Heiko: 9; Grünschloss, Felix, ZAK/KIT: 86; Hauser, Magali: 15, 21, 40, 48, 49, 56, 57, 64, 65, 72, 80, 90, 96, 98; Heinle, Wischer and Partner, Freie Architekten: 11; Hippler, Marc: 32; IMT/KIT: 37; KIT-HERA: 100; Kunstmann, Harald: 30; Langer, Patrick: 20, 21, 27, 36, 41, 54, 56, 64, 67, 80, 83, 96, 98; Mallot, Kathrin, IceCube, NSF: 31; Martin, Miguel: 68; Mayer, Frederik: 32; Meißner, Tanja: 16, 24, 25, 40, 41, 65, 73, 80, 81; Meloni, Michaela: 34; Oberle, Peter: 31; olly – stock.adobe.com: 75; Pixabay: 21; Presse- and Informationsamt der Bundesregierung: 93; private: 91; Reinartz, Ines: 23; Rothe, Philipp: 69; Ruf, Cynthia: 78; Schmidt, Gerhard, KIT: 87; Schröder, Catherine, Université de Strasbourg: 66; Show-Shot-Foto – Fotolia: 76; Si-DRIVE: 28; SIMUTENCE: 52; Stadtmarketing Karlsruhe: 15; Sultanova, Anastasiya: 77, 80, 81, 96; Tkotz, Laila: 12, 21, 23, 29, 57, 64, 65, 72; Urban, Marco: 94; vs148/Shutterstock.com: 44; Wamhof, Franz: 99; Wefers, Uni Kassel: 92; Wolf, Joachim: 34; YIG Prep Pro Management Team: 58; Zachmann, Gabi: 48, 80, 81, 95; ZAK, KIT: 82

Pictures edited by: Annika Müller, General Services (AServ)
Gabi Zachmann, SEK

Translated by: KIT Translation Services, International Affairs (INTL)
Proofread by: KIT Translation Services, INTL; Byron Spice

Layout: Nicole Gross, AServ

Printed by: Systemedia GmbH, Wurmberg
Printed on 100% recycled paper with the "Der Blaue Engel"
(The Blue Angel) environmental label

Status: December 31, 2019
(Status financial data: June 17, 2020)

Karlsruhe Institute of Technology 1825 1956 2009

The anniversary logo of 2019 recalls the milestones reached by KIT and its long tradition in research, teaching, and innovation.

On October 1, 2009, KIT was established by the merger of its two predecessor institutions: The Polytechnic School and later University of Karlsruhe (TH) was founded in 1825, the Nuclear Reactor Construction and Operation Company and later Karlsruhe Research Center in 1956.