Karlsruhe Institute of Technology

Annual Report 2024 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 application, we excel in a broad range of disciplines, i.e. natural sciences, engineering sciences, economics as well as 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 mutual respect, cooperation, confidence, and subsidiarity. An inspiring work environment as well as cultural diversity characterize and enrich the life and work at KIT.

Employees 2024

Total:	10,107
Scientists:	5,872
of which professors:	415
of which international employees:	1,730
Administration and infrastructure:	4,235
of which trainees:	337

Students

Winter semester 2024/2025:	22,761
of which international students:	5,247

Budget 2024

Total:	EUR 1,225.2 million
Federal funds:	EUR 365.0 million
State funds:	EUR 364.6 million
Third-party funds:	EUR 495.6 million


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What Makes Us Human Beings?

This is certainly one of the oldest – and always most topical – questions of human history. It also guides us at Karlsruhe Institute of Technology (KIT) because in learning and teaching, research and transfer, as well as in administration, the human being and the society are always at the center of all deliberations. From the perspective of a scientific and educational institution with a focus on technology and natural sciences, being human is based on three factors: The (biological) organism, the intellect, and the society. This means that humans are living, thinking, and thus intelligent, but also social beings. However, this question arises again and again in learning, research, and work – and requires different approaches each time.

Especially with regard to these three facets of humanity, we are facing great challenges to the solution of which we at KIT are contributing actively: The blend of life and technology, the further development of artificial intelligence, or the change towards a sustainable future. As "The Research University in the Helmholtz Association," KIT bears particular responsibility, not only to drive research and ensure the transfer of knowledge, but also to develop new teaching and learning concepts, integrating the latest technologies.

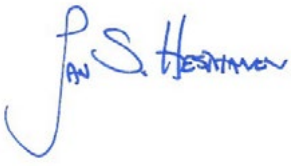
The greatest challenge here is the pace at which we have to design technologies in order to face these changes. At the same time, I perceive this as an opportunity to bring us closer together again as a society. In fact, another answer to the question I asked at the beginning is: Humans are multi-faceted beings. It is the diversity of a society that makes it innovative and resilient at the same time. Only a society that embodies openness and tolerance, respect and solidarity can achieve great things.

I am delighted to have the opportunity to shape this change together with KIT. In October 2024, I took office as President of KIT. In September 2024 already, Dr. Stefan Schwartze had succeeded Michael Ganß as Vice President Finance, Human Resources, and Infrastructure. This means that after a transitional phase of about one year, the Executive Board is complete again.

In the last year, the KIT family has grown again and now includes nearly 33,000 members. KIT would be nothing without the people – on behalf of the Executive Board, I would like to express my sincere thanks to the students, teachers, researchers, and employees in administration and infrastructure for their unwavering commitment. I would also like to extend my thanks to our partners and sponsors from science and business as well as from politics, culture, and the civil society for the trusting and successful cooperation. Together with them, we are able to realize ambitious projects and continue the 200-year-old tradition of KIT as a place that shapes the future.

Dear readers, I look forward to taking a look back at the year 2024 and its special moments at KIT, big and small, together with you.
I hope you will enjoy your reading.

Yours,



Professor Dr. Jan S. Hesthaven
President of KIT

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A RETROSPECTIVE VIEW OF KIT

Professor Jan S. Hesthaven took office as President of KIT on October 1, 2024. On the occasion of the official inauguration ceremony on December 4, with over 400 invited guests in attendance, Petra Olschowski, Baden-Württemberg's Minister of Science, Research, and the Arts, and Professor Michael Kaschke, Chairman of the Supervisory Board of KIT, presented the chain of office to the new President.

Professor Hesthaven noted in his inaugural speech that KIT had a duty to be of service to society and that it faced major changes and challenges. Increased internationalization will play a key role. KIT needs to ensure that it will attract talent not only from Germany but also from all over the world.

The President named three challenges confronting society: New health technologies for an aging population, the evolution of artificial intelligence, and a turn in society towards a sustainable future. These are the three areas in which KIT needs to provide solutions in cooperation with its partners. Facing these challenges calls for what had characterized KIT over the past 200 years: Boldness.

Baden-Württemberg's Minister of Science, Research, and the Arts, Petra Olschowski, praised Hesthaven's great international experience, which will significantly help with making KIT fit for the future. As a University of Excellence with national large-scale research responsibilities, KIT is a beacon in Baden-Württemberg's university landscape. The minister said she was very happy that KIT has succeeded in recruiting Professor Jan S. Hesthaven, an internationally recognized scientist and manager, to head this unique research university and keep KIT on track for future success.

In his welcome speech, Professor Michael Kaschke drew attention to the university's long-term prospects. He stressed that KIT's potential was unique in all of Germany. It is a potential that obliges us not to stop after achieving something, but to keep on improving, to anticipate new circumstances instead of merely adapting to them.

200 Years of KIT

In 2025, KIT is celebrating its 200th anniversary, while preparations were already in full swing in 2024. On October 7, 1825, the Polytechnic School, one of KIT's predecessor institutions, was founded. The small school became Karlsruhe Technical University in the second half of the 19th century. After the Karlsruhe Nuclear Research Center had been founded in 1956, both institutions soon started collaborating on all levels. In 2009, Karlsruhe University and Karlsruhe Research Center finally merged to become Karlsruhe Institute of Technology.

During the anniversary year, KIT is not only celebrating the achievements and successes of the past 200 years and the present, but also takes a look into the future. In festivals, lectures, interactive formats, workshops, and an exhibition featuring 100 objects, to which the KIT employees contributed and which illuminates KIT's history, KIT wants to share and celebrate its knowledge and expertise with academia, industry, and society.

Ludwig I, Grand Duke of Baden, signed the founding charter for the Karlsruhe Polytechnic School in 1825. [4]

High-ranking Visitors

On January 12, 2024, Winfried Kretschmann, Minister-President of Baden-Württemberg, State Science Minister Petra Olschowski, and State Transport Minister Winfried Hermann came to Karlsruhe to catch up on ongoing mobility research projects and results. The visit focused on the Future Mobility Innovation Campus (ICM), within which KIT and the University of Stuttgart are working on viable mobility and production solutions with funds granted by the State. In the course of the visit, the Baden-Württemberg Institute for Sustainable Mobility (BWIM) introduced itself. As an independent think-and-do tank, it is involved in the active shaping of the mobility transition in Baden-Württemberg.

Members of the Baden-Württemberg state government came to Karlsruhe to catch up on research into sustainable and efficient mobility and production of tomorrow. [5]

Dr. Danyal Bayaz, Baden-Württemberg's Minister of Finance, came to visit KIT on February 1, 2024. After the Minister of Finance had talked to members of the Executive Board and signed in KIT's guest book, he held a public lecture on finance policy in challenging times, to which KIT students and employees were invited. Danyal Bayaz stressed the importance of KIT as a global exporter of knowledge and innovations and called KIT an "elite training center in Baden-Württemberg."

During his visit at KIT, Danyal Bayaz, Baden-Württemberg's Minister of Finance held a lecture for KIT students and employees. [6]

Petra Olschowski, Minister of Science, Research and the Arts in Baden-Württemberg, visited KIT on February 13, 2024 to get an overview of fusion research at KIT. KIT's

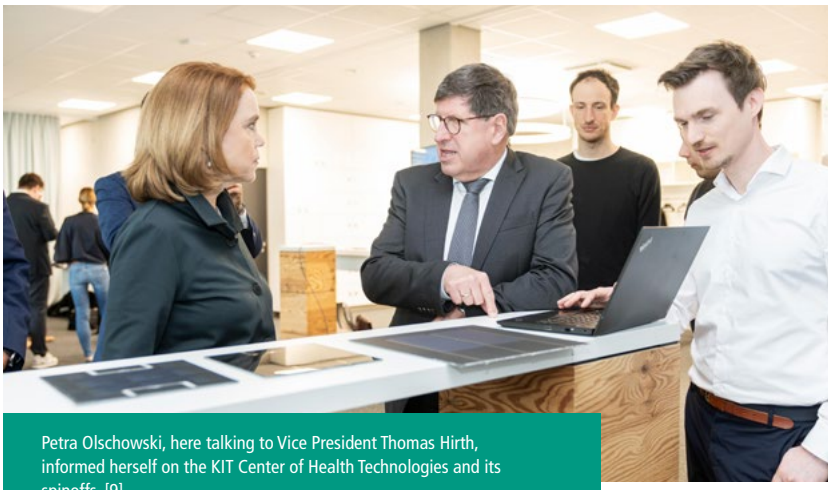
fusion research comprehensively covers the areas of technology and materials development required for realizing a future fusion power plant. She was shown around the fusion materials lab and the Karlsruhe tritium lab.

Minister Petra Olschowski talking to Oliver Kraft, Acting President of KIT, and Klaus Hesch, Spokesperson of the Fusion Program (from left to right). [7]

On March 1, 2024, KIT received an official visit from Dr. Volker Wissing, Federal Minister for Digital Affairs and Transport, and then Undersecretary of State Michael Theurer who wanted to obtain information about current results and ongoing projects in mobility and energy research, focusing on the KIT Mobility Systems Center. In the Energy Lab, they also gained insight into Europe's largest research infrastructure for renewables and then took a test ride in a highly automated, emission-free shuttle of the FZI Research Center for Information Technology, one of KIT's innovation partners.

Volker Wissing, Federal Minister for Digital Affairs and Transport, discusses current mobility and energy research with Vice President Kora Kristof. [8]

On her startup tour through Karlsruhe and Stuttgart, Minister of Science, Research, and the Arts in Baden-Württemberg, Petra Olschowski, paid a visit to KIT on March 27, 2024. She was informed about funding and support opportunities for research-based spinoffs. In the "ZEISS Innovation Hub @ KIT," two KIT spinoffs, Nanoscribe and Phytonics, as well as the KIT Center of Health Technologies presented themselves. During her subsequent visit of the TRIANGEL Transfer | Culture | Space site, Minister Olschowski learned about the transfer and founding activities at KIT.



Petra Olschowski, here talking to Vice President Thomas Hirth, informed herself on the KIT Center of Health Technologies and its spinoffs. [9]

Kai Gehring, member of the German Bundestag and Chairman of the Committee for Education, Research, and Technology Assessment at the Bundestag, and Alexander Salomon, member of the Baden-Württemberg state parliament for the Karlsruhe West electoral district, came to KIT on July 22, 2024. Their visit focused on energy transition and climate neutrality. They visited the Energy Lab and the facilities of the NECOC joint project, two focal points of the energy and sustainability research performed at KIT.

Kai Gehring, member of the German Bundestag (right), and Alexander Salomon, member of the Baden-Württemberg state parliament (center), talking to Professor Roland Dittmeyer. [10]

Dr. Andre Baumann, Undersecretary of State at the Baden-Württemberg Ministry of the Environment, Climate Protection and the Energy Sector, visited KIT's Institute of Concrete Structures and Building Materials (IMB) and the Karlsruhe Materials Testing and Research Institute

on August 6, 2024 to catch up on the building materials research at KIT. During his visit, the focus was on discussing the state of projects and current topics targeted at resource efficiency and closed-loop economy in concrete construction. Here, IMB is pursuing a holistic approach in order to develop concrete materials with an optimized CO_2 and resource footprint.

Undersecretary of State Andre Baumann visited the Institute of Concrete Structures and Building Materials at KIT and the Karlsruhe Materials Testing and Research Institute. [11]

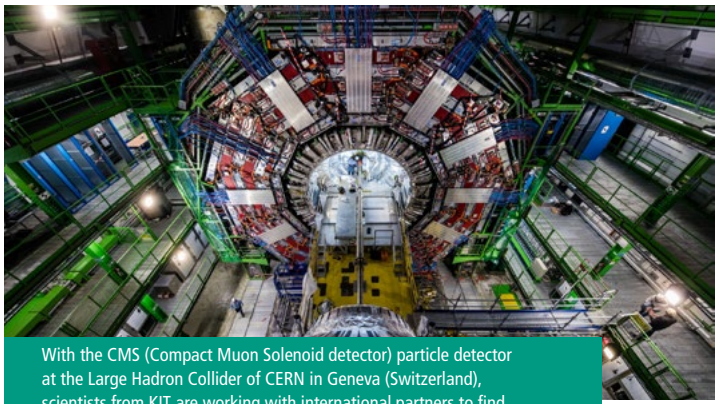
To find out about the current research in the field of health technologies, Baden-Württemberg's Minister of Social Affairs, Health and Integration Manne Lucha and Karlsruhe's Lord Mayor Dr. Frank Mentrup visited the KIT Center of Health Technologies (HealthTech) on August 14, 2024. The center is advancing the digital transformation of medical technologies, personalized medicine, and patient healthcare. The researchers presented both the "Karlsruhe Region of Health Technologies" and the "OpenEarable" open source hardware development platform to the politicians and demonstrated how tissue, such as customized heart valves for children, can be made using a 3D printer.

The Karlsruhe School of Education (KSE) was officially opened in a ceremony on December 5, 2024, in presence of Baden Württemberg's Minister of Science, Research, and the Arts, Petra Olschowski. By founding the KSE, KIT and the Karlsruhe University of Education are augmenting their long-standing, successful collaboration. The aim of their jointly operated academic institution is to develop new ideas and impulses for teacher education and expand their cooperation in learning, teaching, research, transfer, and promotion of young talent (see also page 54).

Baden-Württemberg's Minister of Health Manne Lucha (left) and Karlsruhe's Lord Mayor Dr. Frank Mentrup (2nd from right) during their visit of the KIT Center of Health Technologies, talking to Ute Schepers (2nd from left) and Andrea Robitzki, Head of Division I at KIT. [12]

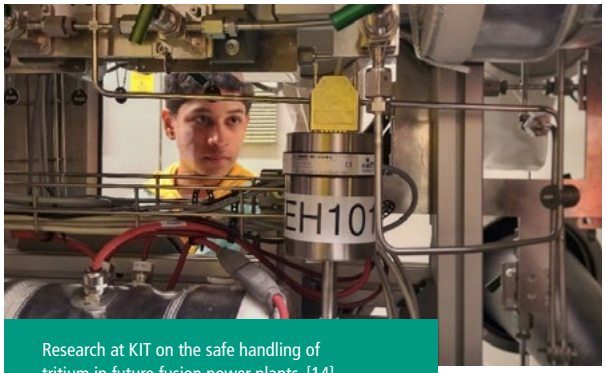
National Funding

In order to answer the elementary questions about the smallest building blocks of matter, the Federal Ministry of Education and Research (BMBF) is funding several KIT projects for the next three years, starting on July 1, 2024, with EUR 8.2 million, strengthening the further development of experimental particle physics, especially for the search of Dark Matter, and new physics.



With the CMS (Compact Muon Solenoid detector) particle detector at the Large Hadron Collider of CERN in Geneva (Switzerland), scientists from KIT are working with international partners to find answers to questions about the structure of matter. [13]

Power plants with fusion reactors are the great hope for clean energy generation in the future. The BMBF is initially funding the SyrVBreTT (fuel cycle and tritium technologies synergy network) project coordinated by KIT with EUR 17 million for three years. Of that amount, EUR 4.8 million will go to KIT. The objective is to develop a concept and build a test facility for handling the fuel in a future fusion power plant.



Research at KIT on the safe handling of tritium in future fusion power plants. [14]

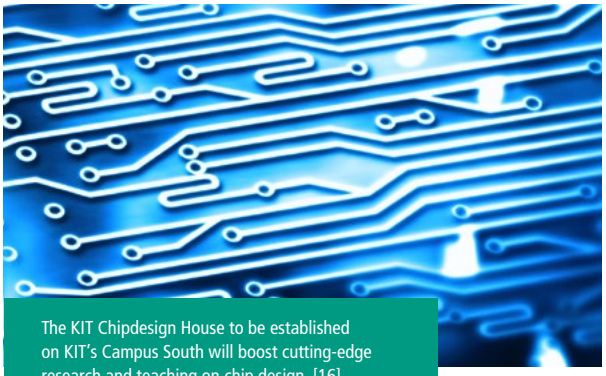
The Country to City Bridge (C2C Bridge) project explores alternatives to the private car to connect urban and rural areas as a complement to existing public transport services. The Federal Ministry for Digital and Transport has been funding C2C Bridge since January 2024 for three years.

As of March 2024, the Baden-Württemberg Ministry of Science, Research, and the Arts (MWK) has been funding nine research projects that use microorganisms to develop and optimize climate-friendly processes and to realize production technically. KIT is receiving funds for four of the nine projects: Two KIT projects and two joint projects.

The MWK is funding six so-called INSPIRE BW hubs to further strengthen the startup culture at Baden Württemberg's universities. Among them is the DeepTechHub under the aegis of KIT. With this initiative, local universities aim to raise southwest Germany's profile by bringing relevant actors together and jointly supporting startup activities. The ministry is funding DeepTechHub with up to EUR 1.95 million.

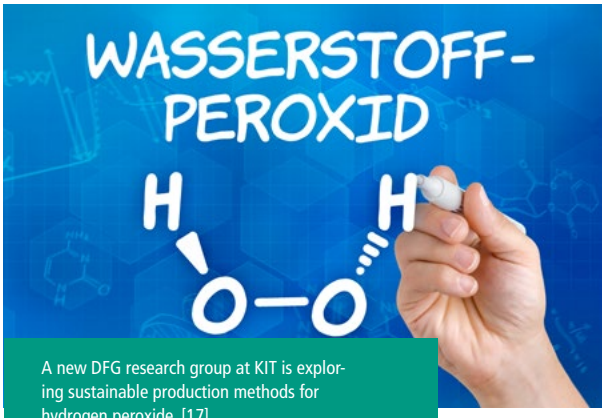
With eight initiatives, the state of Baden-Württemberg intends to advance the digitalization of teaching, research, and administration at its higher education institutions. Participating in five of these initiatives, KIT assumes leadership of the following: bwJupyter initiative for teaching, bwGPT, and the GitLab state service (see also page 103).

Be it smartphones, computers, or cars: Nearly all modern technologies are based on powerful microchips. Currently, leading semiconductor manufacturers are mostly based in Asia and North America, supplying producers worldwide with their microchips. In order to boost chip production in Europe and further strengthen Germany as a location for innovative chip design, the Baden-Württemberg Ministry of Science, Research, and the Arts has now approved the foundation of the virtual Karlsruhe Chipdesign House (KCH) at KIT to be set up by 2026. A new chip design Master's degree program is also planned.



The KIT Chipdesign House to be established on KIT's Campus South will boost cutting-edge research and teaching on chip design. [16]

The German Research Foundation (DFG) provides KIT with EUR 3.9 million for the research group "Bridging Concepts in Thermo- and Electro-Hydrogen Peroxide Catalysis" (HyPerCat), which works on the development of common concepts for thermal and electrocatalytic processes to be used in the direct synthesis of hydrogen peroxide. The HyPerCat project consists of eight subprojects, seven located at KIT and one at the Technische Universität Berlin.



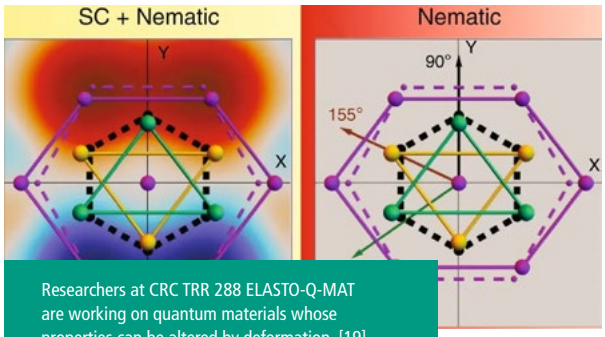
A new DFG research group at KIT is exploring sustainable production methods for hydrogen peroxide. [17]

In order to support young scientists, the DFG decided in December 2024 to fund a new Research Training Group (RTG) at KIT for five years. The RTG "Sustainable hydrogels: From chemical structures to applicability" considers the entire life-cycle of hydrogels from their formation to aging.

The Research Training Group newly funded by the DFG has the objective to research into sustainable hydrogels, for example in food or for medical applications. [18]

For the Research Training Group 2561 "MatCom-ComMat: Materials Compounds from Composite Materials" to work on high-temperature composites, the DFG decided in February 2024 to extend the funding period after a successful review. The second funding period started on October 1, 2024, and will last until March 31, 2029. For this period, a budget of more than four million euros was granted. In this Research Training Group, KIT's partners are the TU Darmstadt and DECHEMA.

Quantum materials are seen as the key to future quantum technologies. The Collaborative Research Center CRC TRR 288 "ELASTO-Q-MAT: Elastic Tuning and Elastic Response of Electronic Quantum Phases of Matter," in which KIT has a stake, investigates such quantum materials whose properties change significantly by elastic deformation. The DFG is funding this Collaborative Research Center for a further four years with around EUR 10 million.



Researchers at CRC TRR 288 ELASTO-Q-MAT are working on quantum materials whose properties can be altered by deformation. [19]

In addition, the DFG continues funding the CRC 1441 "TrackAct: Tracking the Active Site in Heterogeneous Catalysis for Emission Control." This CRC seeks to obtain a holistic understanding in order to improve catalysts by predicting structural changes based on existing knowledge.

Applying and developing new technologies for DNA synthesis to pave the way for producing entire artificial genomes – that is the goal of a new interdisciplinary center that is being established at KIT, Heidelberg University, and Johannes Gutenberg University Mainz. The aim of the Center for Synthetic Genomics is to spark new developments in synthetic genomics through basic research and technology development using methods of artificial intelligence. The Carl Zeiss Foundation (CZS) is financing the center's establishment over a period of six years with a total amount of EUR 12 million.

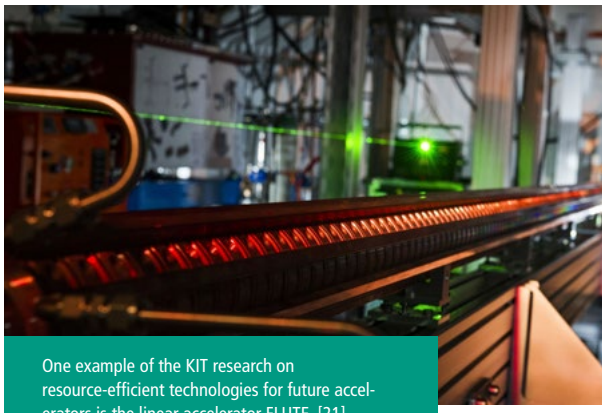
The three members of the Board of Directors Edward Lemke (Mainz University), Sylvia Erhardt (KIT), and center spokesperson Michael Knop (Heidelberg University), as well as Alan Gärtig of the Carl Zeiss Foundation (from left to right). [20]

KIT researchers have successfully acquired funds via the "CZS Wildcard" program of the Carl Zeiss Foundation. In her project entitled "UCART – Ultracompact electron accelerators for internal radiotherapy," Professor Anke-Susanne Müller is working on a new radiation therapy method for directly irradiating tumors in the patient's body with an electron accelerator. Professor Dirk Holtmann is developing a process for converting CO_2 into useful chemicals in his project "CoMet2 – Co-cultivation of anaerobic methanogens with aerobic methanotrophs in a bio-electrochemical 200% cell." With its Wildcard program, the Carl Zeiss Foundation (CZS) funds unconventional research projects with EUR 900,000 each for a period of two years.

International Funding

Research Facility 2.0 (RF 2.0) is a EU research project aimed at making the operation of particle accelerators and other large-scale facilities more resource-efficient. Since the beginning of the year, ten European institutions coordinated by KIT have been working on optimized components and digital solutions to reduce the energy consumption of accelerator systems. The European Commission and the Swiss State Secretariat for Education,

Research, and Innovation are funding the project with a total of EUR 5.6 million over three years. The KIT test center for energy efficiency and grid stability in large-scale research infrastructures (KITTEN) plays a central role in the RF 2.0 project: It hosts researchers who are working on the analysis of important parameters and the development of realistic demonstrators.

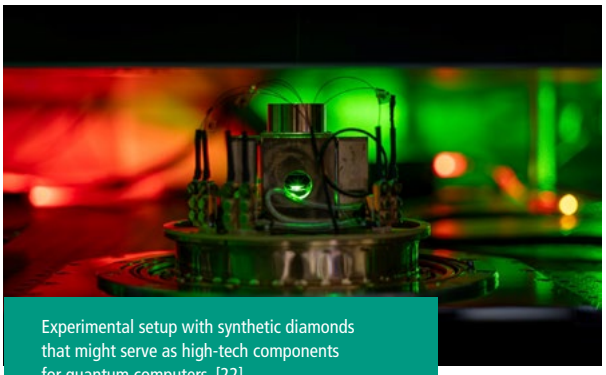


One example of the KIT research on resource-efficient technologies for future accelerators is the linear accelerator FLUTE. [21]

On the road to climate neutrality, the "RISEnergy – Research Infrastructure Services for Renewable Energy" project is expected to accelerate the development of innovations for renewable energies until they are launched on the market. Above all, access of researchers and companies to research infrastructures will be facilitated. This project coordinated by KIT started on March 1, 2024. RISEnergy will be funded by the European Commission with about EUR 14.5 million for a duration of four and a half years (see also page 26).

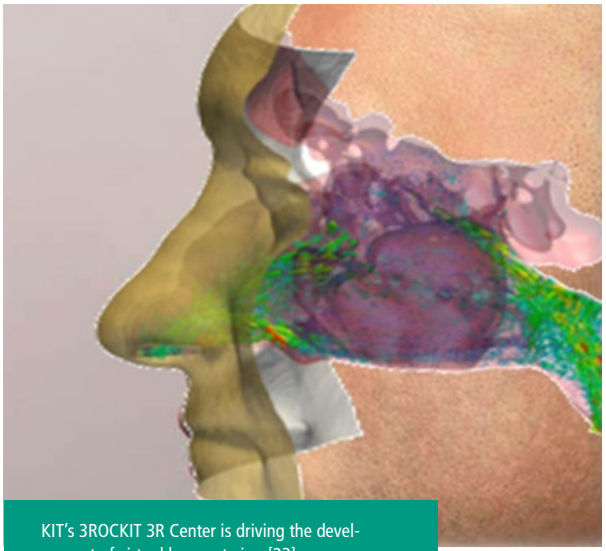
Research Networks

For the past ten years, the Center for Integrated Quantum Science and Technology (IQST) at the Universities of Stuttgart and Ulm and the Max Planck Institute for Solid State Research has been at the forefront of interdisciplinary research in quantum science and technology. Its mission extends beyond basic research to focus on potential applications and their benefits for society. KIT has joined the world-renowned center in November 2024, marking a significant step towards a state-wide network for the scientific "quantum community" in Baden-Württemberg. KIT and the universities of Stuttgart and Ulm are also pooling their quantum research expertise in the planned joint "Chem4Quant" cluster application as part of the Excellence Strategy competition, focusing on molecular quantum systems, a new subfield of quantum technology. This rapidly evolving subfield ideally supplements the expertise developed at IQST over the last decade, further strengthening Baden-Württemberg's globally leading position in quantum sciences.



Experimental setup with synthetic diamonds that might serve as high-tech components for quantum computers. [22]

In future medicine, personalized computer models, so-called virtual twins, could help in the planning of individual therapies. Today already, human organs can be simulated on chips or in petri dishes: Scientists are developing computer-aided methods and in-vitro technologies that are intended to reduce or even replace animal testing. The new 3ROCKIT 3R Center (Replace Reduce Refine Organismal Research by Computational and Cellular technologies@KIT) is a driving force behind this endeavor. As of January 1, 2025, Baden-Württemberg will add it to the statewide 3R network, funding it with EUR 100,000 annually over three years.



KIT's 3ROCKIT 3R Center is driving the development of virtual human twins. [23]

It will become the focal point for AI-based robotics in Germany: The Robotics Institute Germany (RIG) started operation on July 1, 2024. It is being established under the leadership of the Technical University of Munich with

the participation of KIT and eight other universities as well as four non-HEI research institutions. Spokesperson of RIG is Professor Tamim Asfour from the Institute for Anthropomatics and Robotics at KIT. RIG will be funded initially with EUR 20 million from Germany's Federal Ministry of Education and Research over four years. The starting conditions are ideal: Researchers in AI-based robotics from Germany are among the international leaders and have made significant contributions to the global robotics landscape.

KIT has joined the Cyber Valley Innovation Campus, Europe's largest and leading center for artificial intelligence (AI) and modern robotics, on July 21, 2024. Cyber Valley is based on scientific excellence and entrepreneurial innovation. Already today, the Innovation Campus is a leading institution for machine learning and fields such as computer vision technology. The second phase, which has started now, focuses on the pioneering fields of robotics and healthcare, where KIT is represented strongly with its own research. Since its foundation, the Cyber Valley community has been extended strategically all the time.

Intelligent robots such as ARMAR-7 represent one of the many facets of AI-based research at KIT. [24]

ERC Grants

Refrigeration and cryogenics expert Professor Steffen Grohmann received an Advanced Grant of the European Research Council (ERC) in 2024. The ERC is thereby funding Grohmann's project GRAVITHELIUM (Gravitational Wave Detectors Cooled with Superfluid Helium) on the development of a key technology for the Einstein telescope (ET) – the next-generation European gravitational-wave detector. GRAVITHELIUM aims to push the sensitivity of cryogenic laser interferometers to fundamental limits using superfluid helium. This technology is expected to solve a central challenge in observing gravitational waves from the entire universe with the ET.

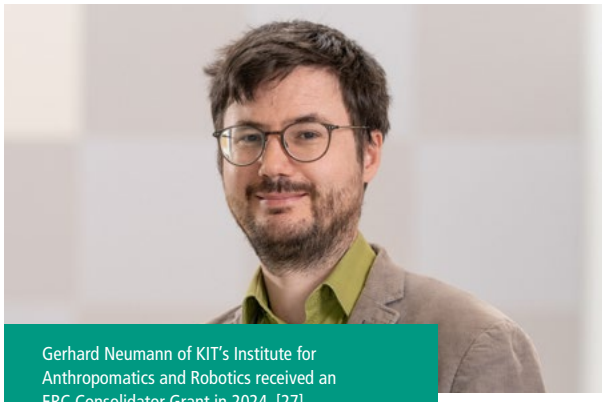
Steffen Grohmann receives an ERC Advanced Grant for his GRAVITHELIUM project where he is developing key technologies for the Einstein telescope. [25]

The ERC is funding the research project "Active Hybrid Photonic Integrated Circuits for Ultra-Efficient Electro-Optic Conversion and Signal Processing" (ATHENS) led by Professors Christian Koos and Stefan Bräse with a Synergy Grant. The project's objective is to improve the performance and energy efficiency of optical communications systems. Given the growing demand for the transmission of large volumes of data by artificial intelligence applications, such improvements are especially relevant. The ERC is funding ATHENS for six years with a total of EUR 14 million.

ERC Synergy Grant for the ATHENS project team with Adrian Schwarzenberger, Stefan Bräse, Christian Koos, and Hend Kholeif (from left to right). [26]

Robots are playing an increasingly important role in many sectors such as medicine, industry, and development. They can help people with their work, or take over tasks entirely. With his SMARTI³ (Scalable Manipulation Learning through AR-Enhanced Teleoperation enabling Intuitive Interactive Instructions), Professor Gerhard Neumann aims to investigate how to implement them in real environments. His project has been awarded a 2024 Consolidator

Grant by the ERC. He will receive EUR 2.4 million over the next five years for his research.



Gerhard Neumann of KIT's Institute for Anthropomatics and Robotics received an ERC Consolidator Grant in 2024. [27]

Rankings

In 2024, KIT achieved excellent results again in the various rankings and was thus very well positioned in national and international comparison. From the many results, only three will be mentioned here:

In the Funding Atlas 2024 of the German Research Foundation (DFG), KIT is mentioned multiple times with excellent results. In the ranking of Germany's most research-intensive universities, KIT is the best institution in Germany without a medical faculty as regards the total amount of third-party funds approved by the DFG. In the discipline of chemistry, KIT ranked first again considering the amount of DFG third-party funds approved. In the discipline of materials sciences, KIT reached a very good 3rd rank in the category of DFG total funding level in 2024. In natural sciences as a whole, KIT finished second in 2024, and in engineering sciences overall, it ranked fifth in terms of DFG approvals.

In the CHE 2024 University Ranking, published in the Student's Guide of ZEIT ONLINE, students assess their studying conditions. KIT reached several top positions there. Besides facts on topic fields such as studies, teaching, and research, the ranking presents the results of surveys, which comprised 120,000 students in 10,000 study programs at German universities. The assessments are presented with a 5-star scale. The broad support offers for first-year students at KIT were well received across all disciplines. In addition, all assessed disciplines at KIT got four or more stars for the "introduction to scientific work" aspect. Students also rated the IT and library facilities as excellent.

For the CHE ranking, 120,000 students from all over Germany were asked for their opinion on their study programs. [28]

In the 2024 edition of the QS World University Rankings by Subject, KIT was ranked 46th in natural sciences and 48th in engineering sciences worldwide. In Germany, KIT came 3rd in both subjects. Die QS World University Rankings by Subject list disciplines and then individual subjects. In 15 subjects altogether, KIT counts among the 100 best universities in the world. KIT obtained top ranks in Germany for environmental sciences, chemical engineering, and petroleum engineering.

Bereavements

KIT is mourning the loss of its Founding President Professor Horst Hippler, who passed away on March 6, 2024, at the age of 77. Together with his colleagues from the rectorate body of the then University of Karlsruhe and the board of the former Karlsruhe Research Center, Horst Hippler initiated the merger of a state university and a national research center – a unique step in the German educational and research landscape. With the idea to found the Karlsruhe Institute of Technology, which was going to break the column-like structure of the academic system in Germany, the then University of Karlsruhe won the 2006 Excellence Initiative competition of the German federal and state governments and became one of initially only three Universities of Excellence. Since October 1, 2009, Horst Hippler and Professor Eberhard Umbach had been Founding Presidents of KIT. Hippler shaped KIT significantly during its first years and drove the merger process with determination. Horst Hippler extended the KIT cooperations in research, teaching, and innovation, and thus contributed substantially to the international visibility of KIT.

Horst Hippler, Founding President of KIT, died on March 6, 2024, aged 77. [29]

KIT is also mourning its honorary citizen Professor Hans Lenk, who died on July 30, 2024, aged 89. From 1969 to 2003, Lenk was Professor of Philosophy at the former University of Karlsruhe. He was one of the most important representatives of German contemporary philosophy. Lenk was not least known for his sporting achievements: In the 1960 Olympics in Rome, he won the gold medal in the rowing eights event.

KIT said goodbye to Professor Robert Stieglitz, who passed away on December 6, 2023, at the age of 58. In 2009, Robert Stieglitz became Head of the Institute for Neutron Physics and Reactor Technology, he was involved in several Helmholtz programs, and was a long-standing member of the steering committee of the KIT Energy Center.

On June 28, 2024, the KIT Department of Economics and Management held a scientific colloquium in memory of Professor Nora Szech who had died on August 16, 2023, aged only 43. In 2013, she accepted a call to KIT where she held the professorship for Political Economy at the Institute of Economics.

Prizes Awarded by KIT

Dr. Chris Funk, Director of the Climate Hazards Center at the University of California, Santa Barbara, is the winner of the 2024 International Excellence Award of KIT and the Fellowship of SCHROFF Foundation. With these awards, KIT honors the prominent scientist and his interdisciplinary work on climate change, extreme weather, and food security. The awards include a research stay of up to six months at KIT. The Excellence Award is part of the International Excellence Grants initiative within the framework of KIT's successful University of Excellence concept. It is aimed at promoting international collaboration in top-level research and attracting international researchers to KIT.

American climatologist Dr. Chris Funk received the International Excellence Award of KIT. [30]

On October 22, KIT and the KIT Freundeskreis und Fördergesellschaft e.V. Association awarded the 2024 Heinrich Hertz Guest Professorship to computer scientist Dr. Cordelia Schmid, Research Director at the French INRIA research institute (Institut national de recherche en informatique et en automatique) in Grenoble. Cordelia Schmid was honored for her outstanding research achievements in the field of artificial intelligence. After a public lecture themed "Multimodales Verstehen von Video-Datenströmen und Bild-Sprache gesteuerte Robotik" (using multimodal reasoning to understand video data streams and generate 3D scenes), she held a seminar to discuss the subject with KIT students.

Computer scientist and KIT alumna Cordelia Schmid was awarded the 2024 Heinrich Hertz guest professorship. [31]

The KIT Elementary Particle and Astroparticle Physics Center awarded two Julius Wess Awards in 2024: On February 9, 2024, the 2023 Julius Wess Award was granted to Dr. Belén Gavela, professor for theoretical physics at the Universidad Autónoma de Madrid in Spain. She received the award in recognition of her significant contributions

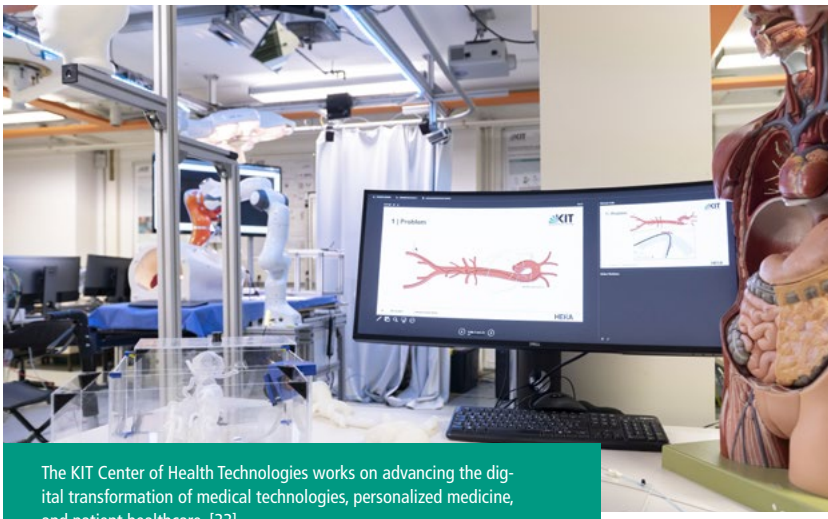
in the field of theoretical and phenomenological particle physics and her outstanding role in science management. On December 18, 2024, Professor Glennys Farrar, an American particle physicist, received the 2024 Julius Wess Award for her important contributions to particle and astroparticle physics and her pioneering work on the structure of our galaxy's magnetic field.

In 2024, Belén Gavela (left) and Glennys Farrar received a Julius Wess Award. [32]

Events

On two occasions, KIT Centers were the main focus of the successful series of science communication events entitled "KIT im Rathaus" (KIT at City Hall) in Karlsruhe, seeking the dialog with the citizens. The work of the KIT Health Technologies Center focuses on the digitalization of healthcare, the goal being to develop digital and technological solutions for medical products from the perspective and for the benefit of society and to meet the society's medical needs. On January 29, 2024, the researchers presented their work on these topics to the general public.

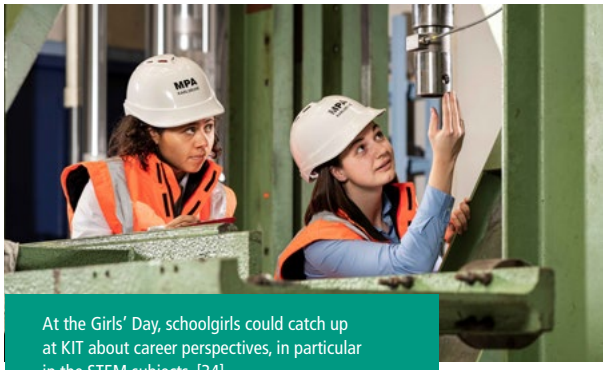
How can energy storage systems be made more efficient in order to minimize losses and to use the stored energy in an optimum way? What are sustainable building refurbishment strategies like? How can geothermal energy contribute to the heat transition in the long run? Researchers from the KIT Energy Center presented recent developments in energy research at KIT and options for their practical implementation on June 5, 2024, in the Karlsruhe City Hall.



The KIT Center of Health Technologies works on advancing the digital transformation of medical technologies, personalized medicine, and patient healthcare. [33]

The Spring Meeting of the German Physical Society (DPG), held from March 4 to 8, 2024, focused on elementary particles. More than thousand physicists from all over Germany met at KIT. The DPG working groups Equal Opportunities and Young DPG were also involved in the program. The public was invited to attend an evening talk about the mysteries of the invisible universe. A special highlight of the event was a ceremonial session to honor particle physicist Professor Herwig Schopper on the occasion of his 100th birthday. He was Professor at the Karlsruhe University and former Director of the Institute for Nuclear Physics at the Karlsruhe Nuclear Research Center. As part of this event, KIT's Physics Department awarded Herwig Schopper its honorary doctorate.

How can TikTok & co know what you want to see? How can you send messages securely on the Internet? How can you build a solar cell using fruit juice? And what is the job of a woman working as an electronics engineer, a hydraulics engineer, or a physicist? Schoolgirls received answers to these questions and the matching study programs and qualified jobs at KIT's Girls' Day on April 25, 2024. Pupils from all types of secondary schools could attend lectures and workshops where they learned more about the fields of work and the tasks involved in the STEM disciplines at KIT.



At the Girls' Day, schoolgirls could catch up at KIT about career perspectives, in particular in the STEM subjects. [34]

Mobility plays an important role for the active participation in social life. At the same time, it is associated with challenges in terms of energy consumption, emissions, and landscape and climate protection. How can mobility and the increasing need for mobility services be implemented equitably and safely for all? How can at the same time the negative impacts of this development be reduced significantly? These and other questions were in the focus of the Spring Academy Sustainability at KIT from March 18 to 21, 2024. The event started with a public keynote and a forum presenting the region's research activities and projects.

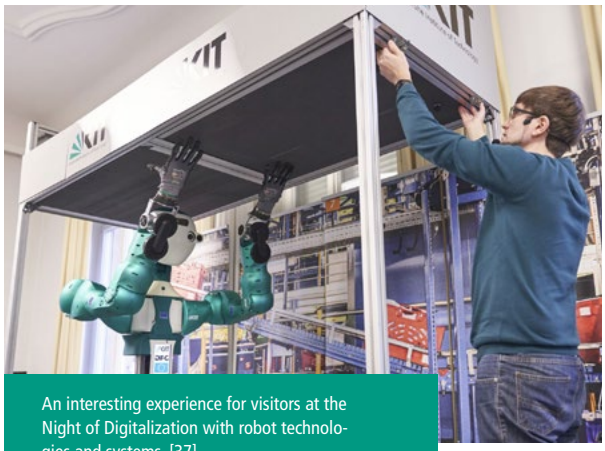
The Spring Academy Sustainability covered various topics on sustainable, fair, and secure mobility. [35]

The Annual Celebration of KIT, held on April 9, 2024, focused on the title of the Science Year 2024 – Freedom. In the recently opened InformatiKOM building, guests from science, industry, and politics enjoyed a diverse mix of retrospect, stocktaking, discussion, and reflection. Professor Oliver Kraft, Acting President of KIT, said that freedom is no matter of course. We are constantly made aware of that. This also holds for the freedom of science. In his speech, Kraft emphasized the importance of democratic, open-minded, and tolerant societies. He said that this is the only type of society where findings and ideas that bring us forward can develop.

The 2024 Annual Celebration of KIT was dedicated to Freedom, matching the topic of the Science Year. [36]

The Colloquium Fundamentale held by "General Studies. Forum Science and Society (FORUM)," which is the central institution for science communication at KIT, also focused on different perspectives and facets of freedom. Five lectures from April 24 to July 11, 2024, dealt with the conception of freedom and its facets from various perspectives.

At the City Festival "Bunte Nacht der Digitalisierung" (Night of Digitalization) on June 7, 2024 at KIT, citizens could experience digital learning tools, try accessible interaction with a computer, get an impression of how robots might support our everyday life in the future, or talk to company founders.



An interesting experience for visitors at the Night of Digitalization with robot technologies and systems. [37]

During the "Startup Date" talk series, organized by KIT together with other higher education institutions and networks in Germany, YouTuber Daniel Jung paid a visit to KIT on June 27, 2024. He spoke on the Kronenplatz square where he focused on the future of our educational system, artificial intelligence, and his experience as a company founder. Daniel Jung published more than 3,000

maths tuition videos on his YouTube channel since 2011, viewed by millions of users.

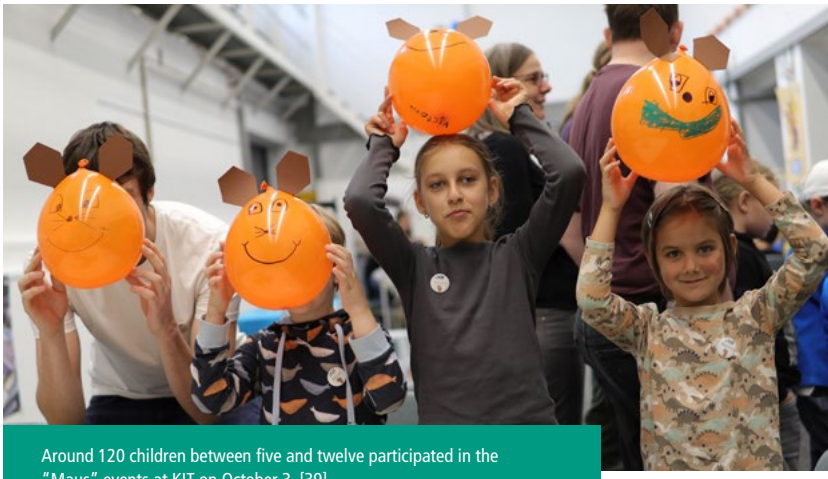
In collaboration with KIT's Center for Technology-Enhanced Learning and Schülerakademie Karlsruhe, the Department of Electrical Engineering and Information Technology organized a Science Camp for schoolchildren from July 28 to September, 2. Among other things, the participants programmed microcontrollers and learned how to connect and control various sensors and actuators.

In an increasingly digitalized world, information technologies and people are becoming ever more closely intertwined. The way we deal with computers and digital technologies is shaping not only the world of work, but also everyday life. The challenges and opportunities of this development were the focus of "Mensch und Computer," Europe's largest conference series in the field of human-computer interaction, which took place for the first time at KIT from September 1 to 4, 2024. Under the motto "Hybrid Worlds," it offered a platform for interdisciplinary exchange between experts from science and practice.

The "Mensch und Computer" conference focused on the design of human-centric hybrid worlds. [38]

To mark the International Day of Democracy on September 15, KIT hosted the "Days of Democracy" for the third time, together with partners. For an entire week, Karlsruhe's Kronenplatz square became a meeting place. Through lectures and discussions, as well as art, film, and musical presentations, the present and future of parliamentary democracy were explored. A special focus was placed on "Freedom," the theme of the current science year.

As part of the event day "Türen auf mit der Maus", and based on the very popular TV scientific show for kids "Sendung mit der Maus" featuring a cartoon mouse, KIT organized three events on October 3, 2024. In the Research Center for School Sports and Sports of Children and Adolescents, non-swimmer children learned how they can play safely at and in the water. At the same time, the Center for Advanced Technological and Environmental Training opened the doors of a chemistry lab for around 40 children. The Institute for Photon Science and Synchrotron Radiation created a journey into the world of particle accelerators.



Around 120 children between five and twelve participated in the "Maus" events at KIT on October 3. [39]

The Knowledge Weeks have become one of the regular formats of science communication in the calender of TRIANGEL Transfer I Culture I Space on Karlsruhe's Kronenplatz square. In 2024, two Knowledge Weeks were held. From October, 8 to 12, the KIT Center Mathematics invited young and old to explore the maths discipline anew. From November 5 to 9, the ANYMOS competence cluster (Anonymization for Networked Mobility Systems), of which KIT is a member, provided insight into the world of mobility data collection with various events.

Executive Board and Heads of Divisions

On October 1, 2024, Professor Jan S. Hesthaven took office as President of KIT. Prior to assuming his position at KIT, Jan S. Hesthaven was Provost and Vice President for Academic Affairs at the École Polytechnique Fédérale de Lausanne (EPFL). His responsibilities included tight integration of research and teaching, all appointment procedures, and close cooperation with the president of EPFL including the university's strategic alignment (see also page 6).

New President of KIT: Jan S. Hesthaven took office on October 1, 2024. [40]

In his first term of office, the 58-year-old Danish citizen will focus on a clearer position of KIT in the national and international scientific landscapes. Central topics are the close integration of research, teaching, knowledge transfer, and the dialog with society, as well as attracting international talents and a close cooperation with strong partners around the world.

Professor Jan S. Hesthaven follows Professor Holger Hanselka, who took the reins at the Fraunhofer-Gesellschaft in August 2023. Professor Oliver Kraft, Vice President Research at KIT, was Acting President of KIT for internal and external matters during the interim period.

On September 1, 2024, Dr. Stefan Schwartze took office as Vice President Finance, Human Resources, and Infrastructure at KIT. Stefan Schwartze, born in 1966, previously worked at the German Research Centre for Geosciences in Potsdam, where he was in charge of administrative matters for more than a decade.

New Vice President Finance, Human Resources, and Infrastructure at KIT: Stefan Schwartze. [41]

Stefan Schwartze followed Michael Ganß who left KIT and retired on July 31, 2024. Reorganizing the administration of KIT was Michael Ganß' main task during his term of office as Vice President of KIT. Initially responsible for Business Affairs and Finance, he later was in charge of the expanded Finance, Human Resources, and Infrastructure department. Michael Ganß led the KIT to greater administrative autonomy. For example, he managed KIT's process of assuming the responsibility of owner-builder and took the efficiency of the administrative structures to a new level.

Michael Ganß, Vice President Finance, Human Resources, and Infrastructure of KIT, retired on July 31, 2024. [42]

The Division Council of Division I – Biology, Chemistry, and Process Engineering elected Professor Dr. Andrea Robitzki unanimously as Head of Division for a second five-year term of office that started on February 17, 2025. The core of the Division I is formed by twenty KIT institutes, the Natural, Artificial and Cognitive Information Processing, and the Materials Systems Engineering programs in the Helmholtz Association's Information research field. In addition, it comprises the KIT Department of Chemistry and Biosciences and the Department of Chemical and Process Engineering. ■

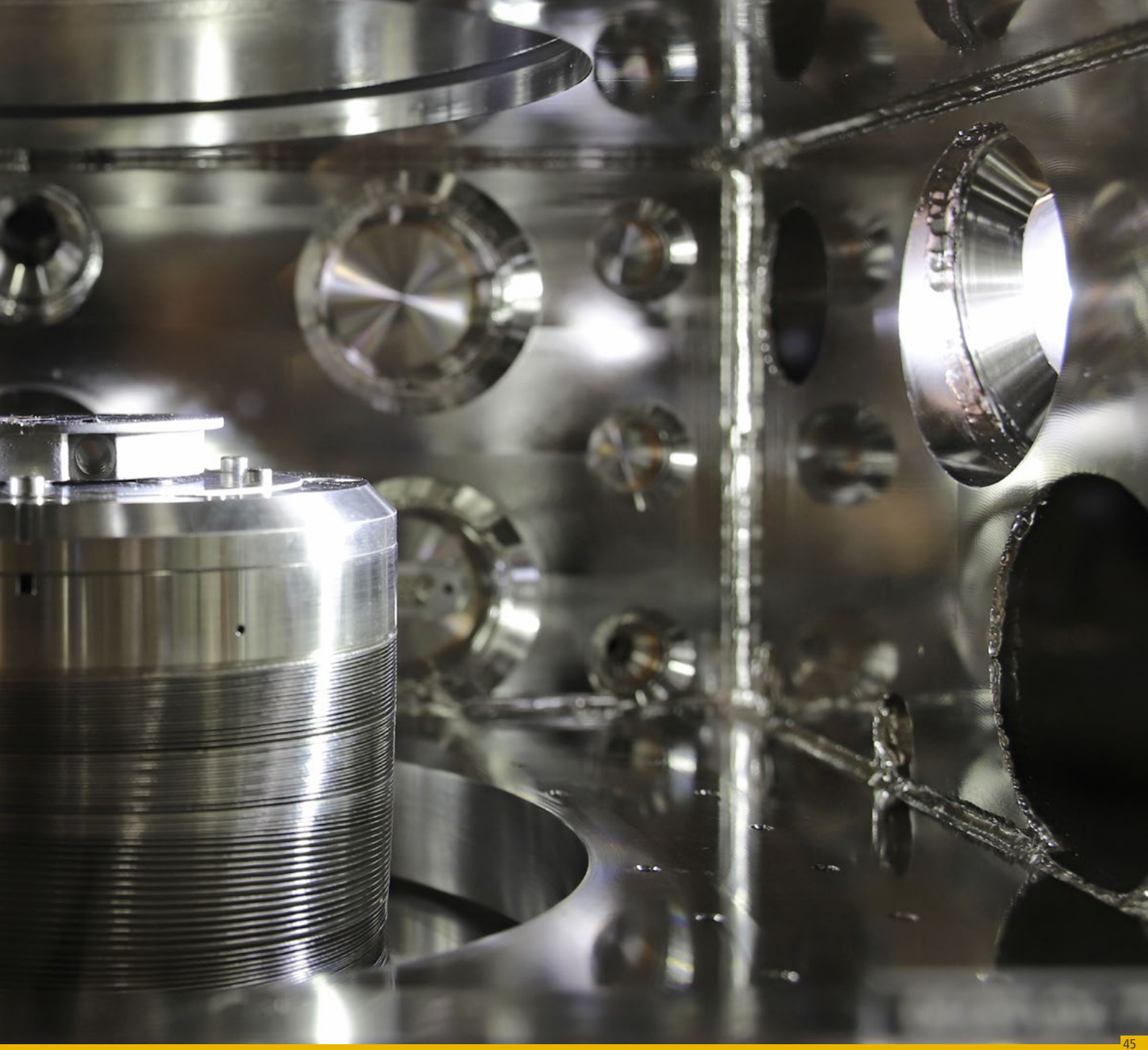
Andrea Robitzki will continue to head KIT's Division I for five more years. [43]

KIT's Executive Board in December 2024: Kora Kristof, Thomas Hirth, Jan S. Hesthaven, Oliver Kraft, Alexander Wanner, and Stefan Schwartze. [44]

RESEARCH

The aim of the Excellence Strategy pursued by the Federal and State governments is to strengthen the science location Germany in a sustainable manner and to further improve its international competitiveness. The Clusters of Excellence funding line is intended to promote project-based research areas that are competitive at the international level. The aim of the Universities of Excellence funding line is to strengthen the universities permanently as a whole and to develop their international top position in research.

With one new full proposal and two renewal proposals, KIT will go into the final of the Clusters of Excellence funding line.



A new initiative is called Chemically Designed Quantum Architectures (Chem4Quant). Researchers of KIT, Ulm University, and the University of Stuttgart have conceived their joint initiative "Chem4Quant" to specifically design materials for future quantum technologies. Using a chemical platform, Chem4Quant proposes to establish a fundamentally new approach. The initiative aims to develop novel quantum bit materials and implement first components for the future quantum Internet.

In addition, KIT will submit renewal proposals for the two Clusters of Excellence already funded since the end of 2019: In the "3D Matter Made to Order" Cluster of Excellence, scientists from KIT and Heidelberg University are developing innovative technologies for three-dimensional additive manufacturing, from a molecular to a macroscopic scale.

The focus of the "Post Lithium Storage" Cluster of Excellence of KIT, Ulm University, and the University of Gießen are the batteries of the future. The researchers are working on novel materials and technologies helping to make energy storage systems more powerful, reliable, sustainable, and eco-friendly than today's lithium-ion batteries. The Center for Solar Energy and Hydrogen Research Baden-Württemberg is partnering the cluster.

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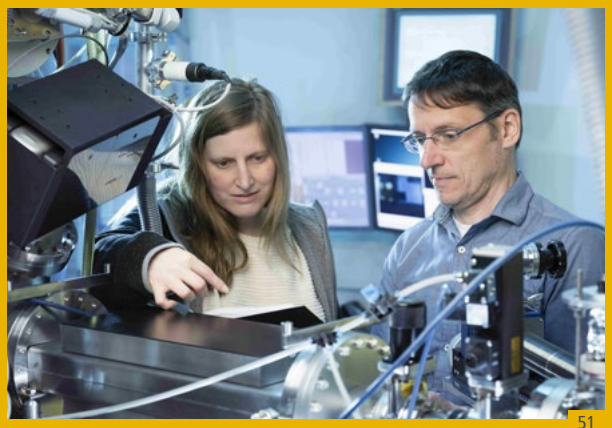

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ENERGY TRANSITION

Research on the Way to Climate Neutrality

Germany aims to implement the energy transition by 2045; the European Union wants to reach climate neutrality by 2050. Scientists from KIT are working in national and international projects on many topics that are to advance the energy transition.

Orientation in Energy Transition Research

More than one hundred energy researchers developed the Helmholtz Energy Transition Roadmap (HETR), a common guide for energy research. The HETR was published by Helmholtz Energy, the Energy research field in the Helmholtz Association. KIT, which operates the Energy Lab, the largest research infrastructure for renewable energies in Europe, made major contributions to this milestone in the German energy research efforts.

The HETR imparts comprehensive knowledge on the challenges linked to the energy transition, and provides valuable guidance on how energy research can support the successful transformation of the energy system in the short, medium, and long run. The objective: A secure, environmentally friendly, economically viable, and socially accepted energy system with sustainable resource cycles, not only in Germany and Europe, but worldwide.

Helmholtz Study Drafts Integrated Scenarios for a Sustainable Transformation

Researchers from KIT, the German Aerospace Center, and Forschungszentrum Jülich have outlined how to manage a sustainable transformation of the energy system. In a policy briefing, the Helmholtz Association scientists analyze possible future scenarios, taking ecological, economic, institutional, organizational, and social aspects into consideration.

"Socio-technical energy scenarios and an assessment of their effects in terms of sustainability are at the heart of our analyses," said Jürgen Kopfmüller of KIT's Institute for Technology Assessment and Systems Analysis. "With these analyses, our goal is to provide policymakers with a good basis for making the decisions needed to transform our energy system to one that is sustainable and carbon-neutral by 2045." According to Kopfmüller, the integrative approach does better justice to the issue's complexity than other scenarios.

The authors, who prepared the briefing for the Helmholtz Energy System Design program, advise against basing future energy scenarios only on demographic and economic developments, which in their view are difficult to predict. Global events such as conflicts or the development of the EU affect immigration and population trends just as world markets affect Germany's economy. Energy needs will differ significantly from one scenario to another.

Expanded power generation should be coupled with the construction of infrastructure for effectively managing carbon dioxide storage or processing. As things stand today, the authors forecast that greenhouse gas emissions will remain unavoidable in the future, particularly in agriculture and industry. Suitable strategies will be needed to meet the rising demand for critical raw materials such as lithium, cobalt, and nickel

Future scenarios for the energy transition take both technical and social aspects into consideration. [58]

in an environmentally friendly manner while minimizing geopolitical risks.

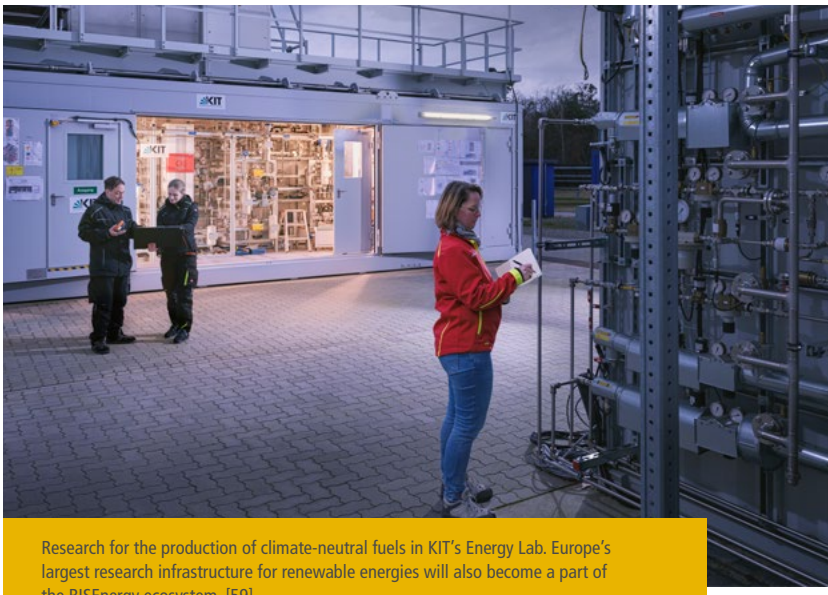
RISEnergy

KIT is coordinating an EU project that aims to promote and link all fields of renewable energies across technologies. On the road to climate neutrality, the RISEnergy (Research Infrastructure Services for Renewable Energy) project is expected to accelerate the development of innovations for the use of renewable energy sources and the commercialization of the respective technologies. Above all, access of researchers and companies to research infrastructures in European and non-European countries is to be facilitated.

"RISEnergy will create a European ecosystem covering all areas of renewable energy technologies," said Dr. Olga Sumińska-Ebersoldt, research fellow at Helmholtz Institute Ulm, which was founded by KIT in cooperation with Ulm University, and operative co-project head of RISEnergy. "We want to push the development of promising technologies from the laboratory level to industrial maturity." While joint research infrastructure projects have already been launched for certain technologies, RISEnergy is the first project of this dimension in Europe that covers all areas of renewable energy technologies: Photovoltaics, concentrated solar power, hydrogen, biofuels, wind energy, ocean energy, as well as integrated power grids, energy storage, materials research, information and communication technologies.

In the RISEnergy project, 84 research infrastructures from 19 European countries as well as the USA, Canada, and Japan open their facilities for external researchers and developers from companies. They can apply for using them, and a consortium of experts decides on the assignment. RISEnergy will cover the running costs of the research infrastructure as well as travel and accommodation expenses. The majority of the project budget is reserved for this purpose.

The offer is specifically aimed at small and medium-sized enterprises. Uncomplicated access to large-scale research infrastructures is expected to support the development



Research for the production of climate-neutral fuels in KIT's Energy Lab. Europe's largest research infrastructure for renewable energies will also become a part of the RISEnergy ecosystem. [59]

of innovations there. "We offer free laboratory use. Scientists and experts from companies can travel there, exchange ideas, and perform experiments," said Sumińska-Ebersoldt. ■

More information:
Helmholtz Energy Transition Roadmap:
https://energy.helmholtz.de/helmholtz-energy-transition-roadmap/
RISEnergy:
https://www.itas.kit.edu/english/projects_haas24_risenergy.php
"Integrative considerations on energy transition" policy brief:
https://energy.helmholtz.de/en/translate-to-englisch-forschungshighlights/translate-to-englisch-die-energiewende-integrativ-denken/

ARTIFICIAL INTELLIGENCE

AI-based Technologies Applied to Medicine, Sports, Technology Assessment, and Solar Power Plants

Information plays a central role in all areas of industry and society: We are surrounded by an increasing number of smart technical information systems that provide capabilities such as interaction, environmental awareness, and self-adaptation. At KIT, more than 800 researchers in about 30 institutes across all disciplines are working on technical systems for these purposes and deal with topics such as cybersecurity, big data handling, or future-oriented developments for society.

Precise Detection of Tumors: Algorithms Improve Medical Image Analysis

Positron emission tomography and computer tomography are among the most important imaging techniques for the diagnosis of cancer. Precisely determining the location, size, and type of tumors is essential for choosing the right therapy. Tumor growth causes hundreds of lesions, i.e., pathological changes that all need to be recorded. Doctors determine the size of the tumor lesions by manually marking 2-D slice images – an extremely time-consuming task.

"Automated evaluation using an algorithm would save an enormous amount of time and improve the results," explains Professor Rainer Stiefelhagen, Head of the Computer Vision for Human-Computer Interaction Lab. For example, algorithms based on deep learning can determine the location and size of tumors.

Secure and Reliable: Parallel Development of Algorithms and Chips for Artificial Intelligence

AI can only be used successfully if powerful microchips are available. This will require high computing power, low costs, energy efficiency and, in particular, security and reliability. "Hardware development calls for special expertise because the design processes are considerably more complex than for software," says Professor Mehdi B. Tahoori from KIT's Institute of Computer Engineering. To facilitate the efficient development of AI chips and AI systems, the EDAI project (German Open-Source Tools for AI Algorithm-Hardware Co-Design) is taking a new approach.

The researchers couple the design of AI algorithms and AI chips, and algorithm hardware co-design tools are developed, combining the optimization of AI algorithms with the exploration of the hardware design space. Besides, licenses for hardware design tools are extremely expensive. This is a big challenge, especially for small and medium-sized companies. The project, which is being funded by the Federal Ministry of Education and Research, is based on open source software to enable easier access to AI-based solutions.

AI is creating new opportunities for many sectors. Putting it to successful use will require the development of suitable microchips. [60]

Humans and Machines: AI Recognizes Athletes' Emotions

Using computer-assisted neural networks, researchers at KIT and the University of Duisburg-Essen have been able to accurately identify affective states from the body language of tennis players. For the first time, an AI-based model for pattern recognition was trained with video data from real competitions.

"Our model can identify affective states with an accuracy of up to 68.9 percent, which is comparable and sometimes even superior to

assessments made by both human observers and earlier automated methods," said Professor Darko Jekauc of KIT's Institute of Sports and Sports Science. The system focused on the body language displayed when a point was won or lost. The videos showed players with lowered head, arms raised in exultation, hanging racket, or differences in walking speed; these cues could be used to identify the players' affective states.

Technological Consequences: Reducing Risks in the Development of AI-based Technologies

How do AI applications intervene in the dissemination of disinformation, and how can they even evade human control entirely? The objective of the "Systemic risks of artificial intelligence" project is to develop viable evaluation and action approaches for this. "Systemic risks are characterized by complex interactions that can lead to dysfunctionality or even the failure of systems," says Dr. Carsten Orwat from KIT's Institute for Technology Assessment and Systems Analysis.

The first subproject investigates indications of such risks arising from the use of AI applications, analyzing causes, specific mechanisms, and forms of damages in order to derive suitable forms of regulation. The second subproject aims at elaborating recommendations for action, which will contribute to take potential risks into account at an early stage. The Federal Ministry of Education and Research is funding both subprojects for two years.

AI-based Optimization: Cost-effective Mirrors for Solar Thermal Power Plants

Researchers from the German Aerospace Center (DLR), together with consultants from the Helmholtz.AI of Forschungszentrum Jülich and the Scientific Computing Center at KIT, developed an AI-based heliostat optimization that significantly increases the efficiency of solar thermal power plants. Heliostats are sun-tracking mirrors that are expensive to make. Thus, it is crucial to optimize their production and performance.

KIT researchers have developed an AI model that can recognize the emotions of tennis players through their body language. [61]

In a test facility in Jülich operated by the DLR, nearly 2,000 mirrors reflect the concentrated sunlight to an absorber located on a tower. Such solar tower power plants can supplement wind and photovoltaic energy as a renewable energy source. Currently, the mirrors are not perfectly flat, which leads to an uneven heat distribution in the tower, requiring high safety margins and thus reducing efficiency. With the new AI-based method, it is easier to detect irregularities in the mirrors. ■

More information:
KIT Center Information | Systems | Technologies:
https://www.kcist.kit.edu/
Recognizing emotions in sports:
https://www.sciencedirect.com/science/article/pii/S0950705124004908?via%3Dihub
Systemic risks of AI:
https://www.itas.kit.edu/english/projects_orwa24_seri1.php

THE WAY TO FUTURE MOBILITY

Joint and Local Projects for the Mobility of Tomorrow

In our modern society, it is essential to transport people and goods in a quick, reliable, and resource-saving manner. Researchers at KIT are working on future-oriented safe, sustainable, and convenient solutions for tomorrow's mobility. Infrastructure, traffic, and energy are investigated from an interdisciplinary and holistic perspective.

Autonomous Buses for Flexible Local Public Transport

In a joint project called RABus (Real-world Lab for Automated Bus Operation), scientists from KIT and partners are exploring small self-driving buses as a mobility offer under real conditions. Here, on-demand offers have an enormous potential – provided that they are well implemented and communicated. The aim of the project is to make local public transport more cost-effective and environmentally friendly in order to ensure better mobility for the citizens in the long run.

Rural areas in particular are supposed to benefit from the fully automated on-demand operation of smaller vehicles, complementing the classic local public transport services. Since the autumn of 2024, autonomous buses have been tested in Friedrichshafen and Mannheim. The project shuttles equipped for autonomous driving by the ZF Friedrichshafen AG technology corporation accommodate up to ten passengers including one seat for people restricted in mobility. With one battery charge, the shuttle buses could cover a distance of about 100 kilometers – at a speed of 40 km/h in built-up areas and up to 60 km/h out of town.

"Our analysis has shown that many people are favorable towards the new technology, while sporadic doubts and reservations, for example, with respect to safety, can often be dispelled by explaining the matter," says Dr. Martin Kagerbauer of KIT's Institute for Transport Studies. "Especially in rural or suburban areas, autonomous buses were primarily used to avoid rides in private cars. The first major application of shuttles, however, should take place in regions where the citizens already use public transportation, at least from time to time, because these are the ones who are more inclined to accept the new offer. The Baden-Württemberg Ministry of Transport has been funding this project with nearly EUR 14 million since 2020.

Tram Takes over Parcel Service

In a joint project called LogIKTram that deals with a logistics concept and an ICT platform for tram-based freight transport, KIT, Albtal-Verkehrs-Gesellschaft (AVG), the FZI Research Center for Information Technology, an innovation partner of KIT, and further partners have developed a logistics concept to shift more freight transport from road to rail. The scientists studied how future freight transport can be shifted to tram and light rail vehicles in order to relieve urban and regional road traffic.

They developed a technical concept for a freight tram for local public transport on the basis of a two-system light rail service called "Karlsruhe model," which combines tram lines in the city and railway lines in the surrounding area. AVG provided the researchers with an older vehicle, which they adapted to the project requirements to use it as a demonstration vehicle for test drives.

Winfried Hermann, Baden-Württemberg's Minister of Transport, (center) announced the extension of the joint RABus project. [62]

Parcels on board: A freight tram could relieve the burden on road freight transport in Karlsruhe in the future. [63]

"Special attention was given to the automated loading and unloading of the transport containers and to the possible ways of securing them on the tram. We also studied how to position the trams at the stops, as this is important in order to move the transport containers with centimeter precision and to comply with the normal passenger changeover times in public transport," says Dr. Michael Frey from the Institute of Vehicle System Technology (FAST) at KIT. In addition, the effects of the freight tram concept on road and rail traffic were investigated by scientists of KIT's Institute for Transport Studies.

The freight tram integrated smoothly and without technical problems into the AVG's rail-based public transport network. An electrically assisted bicycle trailer moved autonomously to the designated area of the tram to be transported from there to the delivery area. In the future, parcels could be picked up at a stop by a bicycle courier, for example. LogIKTram was funded by the Federal Ministry for Economic Affairs and Climate Action with a total amount of around EUR 2.75 million.

Efficient Services for Commuting between Urban and Rural Areas

Living in rural areas and working in the city is a challenge for many people because seamless and efficient transport systems are still rare in rural areas. Often, they are no alternative to the private car. Sustainable and attractive transport services between the city and its rural neighborhoods are in the focus of the Country to City Bridge (C2C Bridge) project of the German Center for Future Mobility in Karlsruhe.

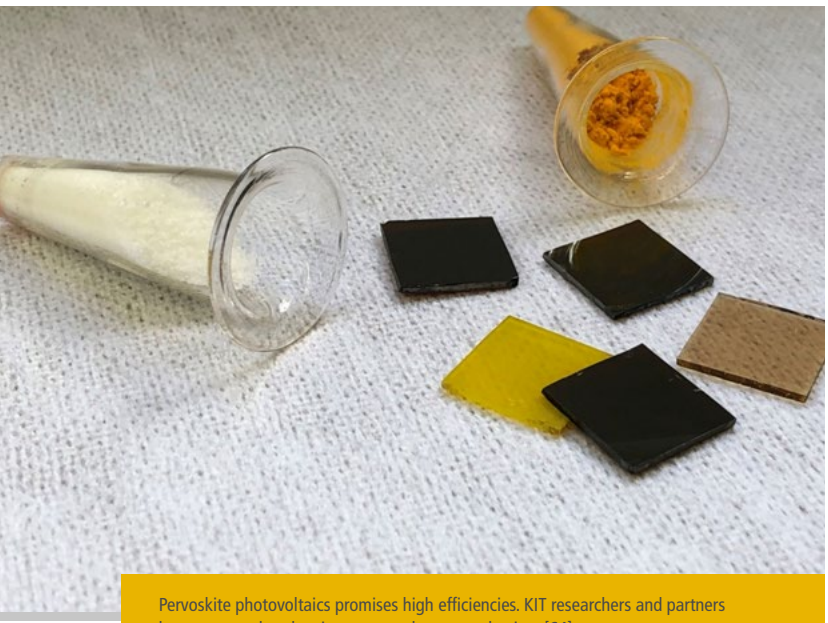
The project coordinated by KIT covers public passenger transport services such as shared autonomous taxis on call and smart transport interchange hubs. Under C2C Bridge, researchers study how the current gaps in public transport services can be closed. "We want to find out which aspects make people change their mobility behavior," says Professor Frank Gauterin, Head of FAST and spokesperson of the C2C Bridge consortium.

The project is aimed at developing mobility services with a high public acceptance and based on new, automated vehicle concepts and their interconnected operation. Automated shared taxis on call will offer efficient rides in rural areas. On the outskirts of the city, mobility stations will allow people to change to conventional public passenger transport systems or alternative transport means, such as rental bikes. Germany's Federal Ministry for Digital and Transport is funding the first leg of the project with EUR 12.3 million. ■

More information:
General information:
Details on the KIT Mobility Systems Center
Autonomous Buses for Flexible Local Public Transport:
More information, Project video (in German),
Tram Takes over Parcel Service:
https://www.kit.edu/kit/english/pi_2024_053_mobility-tram-takes-over-parcel-service.php
Efficient Services for Commuting between Urban and Rural Areas (in German):
https://www.fast.kit.edu/lff/Projekte_16941.php

PHOTOVOLTAICS

Vacuum Process May Offer a Short Track to Commercialization



Pervoskite photovoltaics promises high efficiencies. KIT researchers and partners have now analyzed various approaches to production. [64]

Over the past decade, perovskite-silicon tandem solar cells In the last years Perovskite-silicon tandem solar cells have demonstrated a stunning development: In research, efficiencies of more than 33 percent have been shown, exceeding by far those of conventional silicon-based solar cells. However, the technology has not yet reached the market. One of the major challenges is the unresolved question of which process is best suited for mass production of perovskite solar cells. While solvent-based manufacturing processes are used in laboratories around the world, vacuum vapor-phase deposition processes are still the standard for the production of thin films for photovoltaics or organic light-emitting diodes.

An international consortium of academic and industrial partners led by KIT and the National Renewable Energy Laboratory of the U.S. Department of Energy has now published a comparative study that reveals major differences in the scientific discussion of these production processes: 98 percent of all scientific studies published in 2022 dealt with solvent-based processes. Vacuum-based processes, on the other hand, have proven themselves in industry for many decades. Although they can decisively advance the commercialization of solar cells, they are heavily underrepresented.

The study analyzes the pros and cons of both methods. The prevailing dominance of solvent-based production in research is mainly due to its ease of use in the laboratory, its excellent efficiency under laboratory conditions, and its low cost.

Vacuum-based production in contrast is associated with slightly higher investment costs. Deposition rates are still lower than those of solvent-based research production. However, the authors present a variety of solutions and conclude that vacuum-based technology is competitive in terms of real parameters such as energy costs, production yield, material costs, decommissioning costs, and recycling costs.

The good reproducibility of deposition, the ease of process control, the availability of industrial process equipment, and the easy scalability of deposition from small lab-scale solar cells to application-relevant product surfaces make vacuum-based production highly attractive for commercialization. However, to take full advantage of the scaling effects of vacuum-based processes, further improvements will be needed. ■

More information:
Original publication:
https://pubs.rsc.org/en/content/articlepdf/2024/ee/d3ee03273f

DECENTRALIZED LOCAL ENERGY SYSTEMS

How Microgrids Make Urban Infrastructures More Resilient

Climate change increases the probability of extreme events, such as massive flooding. It is up to cities and municipalities to make the population's power supply more resilient and more secure in view of such crises. Local decentralized energy systems, known as microgrids, e.g., consisting of networked photovoltaic systems and combined heat and power plants, can increase the resilience of urban infrastructures, reducing the risks for the population, for example in large-scale power outages due to natural hazards or cyberattacks.

Scientists from KIT have developed a model for the spatial structure of microgrids, which takes a fair design of local decentralized energy systems into account and provides urban planners with a template for a planning process that integrates various aspects – including socio-economic factors and societal participation. The approach does not consider technical parameters or cost issues as isolated factors, but rather looks at the question of what role the design of microgrids plays in terms of a fair energy distribution.

The study focuses on the relationship between the different vulnerabilities of socio-economic groups and equitable access to energy and other services. To this end, the researchers have developed metrics using existing vulnerability indices that describe the well-being of the population as a measurable variable and show how power disruptions affect socially and economically vulnerable groups in particular, such as sick or elderly persons, families, and low-income earners.

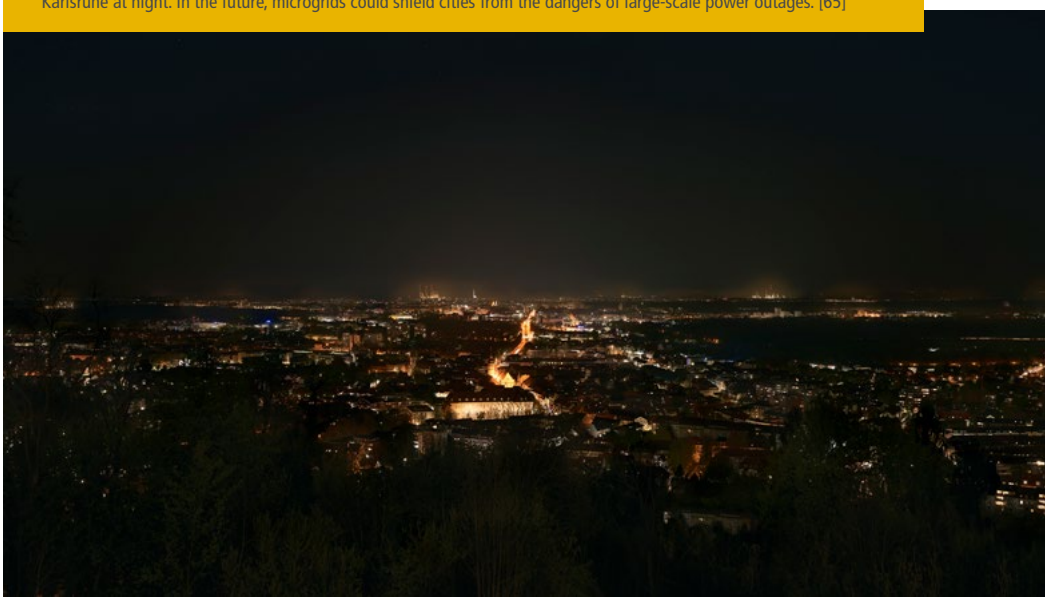
The study was based on data contributed by the US project partners who had conducted a comprehensive case study after the power outages caused by hurricane Florence in North Carolina in September 2018. It allowed the researchers to analyze the critical infrastructure, its vulnerability in connection with the geographical distribution of deprived households, and their access to basic services.

The project team used this data to develop a universal design that allows to comprehensively assess urban resilience for every city and to generate proposals for the design of microgrids, taking technical and social aspects into account. One of the recommendations is that a city should have not just one, but several microgrids to ensure a fair distribution and accessibility of critical services such as healthcare and safety structures.

The search for optimized microgrid designs is highly complex and requires new algorithms for the development of viable models from the available data. Resilient solutions are not necessarily a question of more investment, but above all of sophisticated planning. ■

More information:
https://publikationen.bibliothek.kit.edu/1000172573

Karlsruhe at night. In the future, microgrids could shield cities from the dangers of large-scale power outages. [65]



KARLSRUHER FORSCHUNGSFABRIK

World's First Agile Battery Cell Production Facility Opened

Battery cells are gaining in importance as a versatile and efficient means of storing energy. They are a driving force in advancing electromobility, for example, and a key technology of great strategic and economic significance for manufacturing companies. Current demand is mainly met through cost-driven mass production in Asia and North America, which also affects the mechanical and plant engineering sectors.

While Germany does not have the conditions to be competitive in the purely cost-driven mass production of cells and the associated mechanical engineering facilities, researchers at KIT demonstrated with the opening of the world's first agile battery-cell production system in the Karlsruhe Research Factory that it is possible to address the high-margin premium segment and niche markets in a targeted way with a highly flexible and resource-efficient production.

In cooperation with Exyte, a German engineering company, KIT researchers developed special robot cells for battery cell production. They serve as local drying rooms, also known as micro environments, which protect the moisture-sensitive battery material. Compared to conventional drying rooms, the room volume to be dehumidified is significantly smaller and therefore has a particularly high energy-saving potential.

The project team also created a "digital twin" (software-based simulation) of the production system, which allows the scientists to perform software-based analyses of the scale effects of replicating individual microenvironments and to determine values for production-related variables such as optimum batch sizes. The simulation can also be used to plan the agile battery cell production system's output. The physical system is connected with a database so that all processes can benefit from AI-based adaptations and improvements in the future.

The researchers are working in the AgiloBat research project dealing with the design of an agile pouch-cell production system that is flexible with respect to size, material, and number of pieces. They developed the battery cell production system in cooperation with medium-sized mechanical and plant engineering companies. The project will enable the companies to jointly supply competitive systems for the entire process chain. KIT's contribution of process expertise for more flexible and modular systems will also help the companies to establish automated and resource-efficient production of a wide variety of battery cells and to test new material systems using industrial processes with small amounts of material. ■

More information:
wbk Institute of Production Science:
https://www.wbk.kit.edu/
AgiloBat research project (in German):
https://inzepro-cluster.de/projekt/agilobat2/
Karlsruher Forschungsfabrik:
https://www.karlsruher-forschungsfabrik.de/en.html

Pilot line for agile and modular battery cell production in the Karlsruher Forschungsfabrik. [66]

INFORMATION TECHNOLOGIES

HoreKa Supercomputer One of the World's Most Energy-efficient

With supercomputers, it is possible to perform complex simulations, data analyses, and calculations that are essential to scientific research and help us find answers to today's most pressing questions. But we also need to keep energy consumption and other sustainability aspects in mind.

The "Hochleistungsrechner Karlsruhe" (HoreKa), a supercomputer in operation at KIT since June 2021, is one of the fastest computers in Europe. After a recent upgrade, it now ranks 6th on the semiannual Green500 list of the world's most energy-efficient supercomputers, up from 13th place in 2021. This excellent position in the top 10 shows that KIT managed to make performance and energy efficiency compatible.

HoreKa brings together a wide range of components and delivers an extremely high calculation performance, for example in solving systems of equations or training neural networks for artificial intelligence. Efficient cooling, smart power management, and optimized hardware architectures all help to minimize energy consumption and promote sustainability in research.

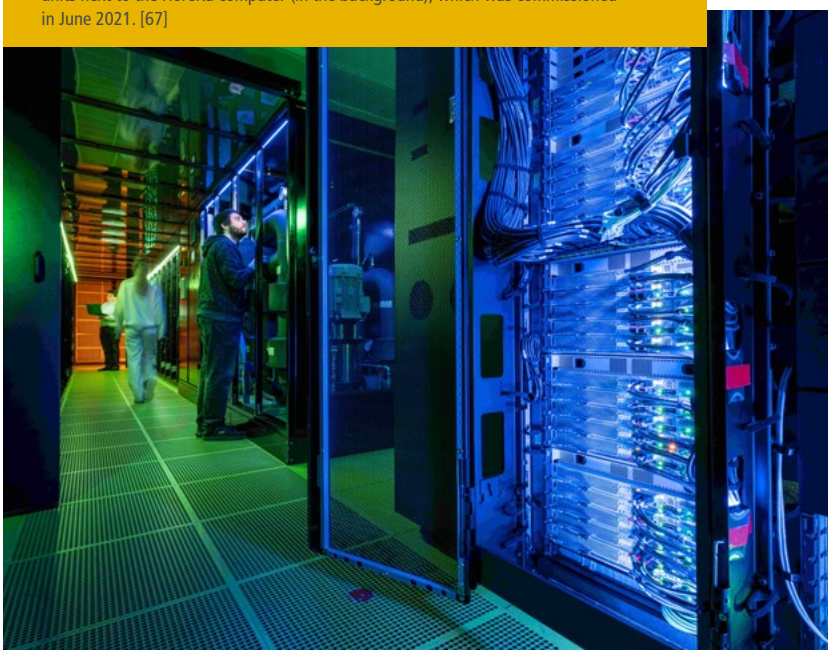
HoreKa is a hybrid system consisting of 668 accelerator processors (GPUs) and 60,000 standard commercially available processors (CPUs). The CPU partition is called HoreKa Blue, the GPU partition HoreKa Green. To these two groups, the KIT researchers have added HoreKa-Teal with 88 new NVIDIA H100 processors to increase HoreKa's performance from 17 to over 20 petaFLOPS. One petaFLOP corresponds to a quadrillion operations per second. The accelerators perform calculations with much greater energy efficiency than before because they have been produced in an advanced manufacturing process with considerably smaller processor structures.

The computing performance of the new accelerators was measured with a special benchmark application, the high-performance LINPACK. This was a requirement for nominating HoreKa for the list of the most energy-efficient computers. The benchmark measured the computing system's ability to solve a defined system of equations. The computing performance is determined from the time needed to calculate a solution, and the energy efficiency is derived from the amount of energy used. Measured at 63 gigaFLOPS per watt, HoreKa took 6th place in the global ranking.

For nearly ten years, KIT has used an efficient hot water cooling system for its high-performance computers. It minimizes the energy consumption for cooling the components throughout the year, and the waste heat can be used for things like heating our office buildings. ■

More information:
https://www.scc.kit.edu/en/services/horeka.php

The new HoreKa-Teal upgrade (right) with 88 hot-water-cooled graphics processing units next to the HoreKa computer (in the background), which was commissioned in June 2021. [67]



METAMATERIALS

New Development: Material with Novel Stretching Properties

Metamaterials are artificial materials that do not occur in nature. Their components function like atoms in conventional materials but have special optical, electrical, and magnetic properties. Interaction between the components is crucial to a metamaterial's functionality. Previously, a component could usually interact only with its immediate neighbors. Researchers at KIT have developed a mechanical metamaterial with which these interactions can also be triggered at greater distances within the material.

They had to overcome a limitation of metamaterials, which is comparable to human communication and an effect known from "telephone game": When people communicate through a chain of intermediaries, the message received by the last person can be completely different than if the first and last people had spoken to each other directly. This principle also applied to metamaterials, but here, it could be overcome. With special structures, individual components no longer 'communicate' only via their neighbors with components farther away, now they can also communicate directly with all other components in the material.

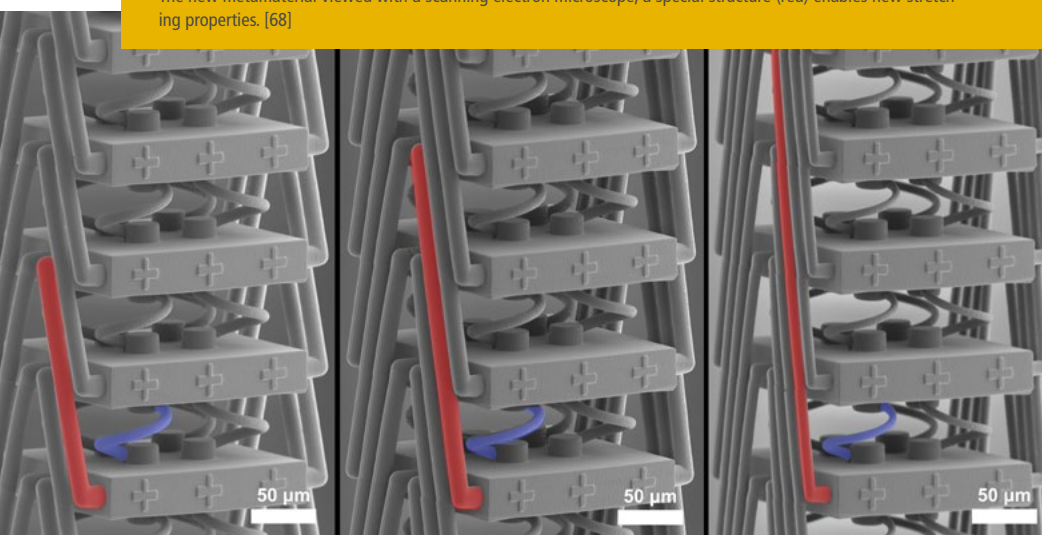
These structures give the material fascinating properties such as unusual stretching characteristics. The researchers were able to show this with micron-sized samples of the material, which they produced using 3D laser printing technology and examined with a camera-equipped microscope. Their analysis showed that a one-dimensional beam stretched in an irregular manner when pulled from one end. In contrast to an object such as a rubber band, which stretches uniformly when pulled, the metamaterial actually exhibited compression in some places, while some short sections stretched more than longer sections even though the same force was applied throughout.

Another interesting and potentially useful property of the material is that it is extremely sensitive to loads. Depending on the point at which force is applied in the material, completely different stretching reactions can result even at relatively distant points. According to the researchers, reactions in conventional materials are only observed directly at the point where force is applied, while only weak or negligible effects can be identified at distant locations in the material. The novel metamaterial could be valuable for engineering applications in which large-scale forces need to be measured, as in monitoring building deformations, or in biological research to characterize forces in cells.

This research was supported by the 3D Matter Made to Order Cluster of Excellence run by KIT and Heidelberg University. ■

More information:
Original publication:
https://www.nature.com/articles/s41467-024-52956-5

The new metamaterial viewed with a scanning electron microscope; a special structure (red) enables new stretching properties. [68]



MATERIALS RESEARCH

Photonic Space-time Crystals, an Important Step Toward New Optical Materials

Photonic space-time crystals consist of materials with uniform composition in space but properties that vary periodically over time. With this periodic variation, the spectral composition of light can be modulated and amplified as needed. This allows for an exact control of the light properties, key capabilities for optical information processing. These space-time crystals are materials that could increase the performance and efficiency of wireless communication or laser technologies.

Working with partners from Aalto University, the University of Eastern Finland, and Harbin Engineering University in China, scientists from KIT have shown how such four-dimensional materials – three dimensions in space and one in time – can be used in practical applications, paving the way for the use of these materials in information-processing systems that will be capable of using and amplifying light of any frequency.

The key parameter of a photonic time crystal is its bandgap in momentum space. Momentum is a measure of the direction in which light propagates, and a bandgap specifies the direction in which light has to propagate in order to be amplified. The wider the bandgap, the greater the amplification. Previously, the periodic variation of material properties, such as the refractive index, had to be intensified to achieve a wide bandgap. Only then, light is amplified at all. For the majority of materials, this is only possible to a limited extent.

The researchers' solution involved combining the photonic time crystals with an additional spatial structure. They created "photonic space-time crystals" by integrating photonic time crystals made from silicon spheres that "trap" and hold light longer than had previously been possible. The light then reacts much better to periodic changes in material properties. In such optimally tuned systems, the bandgap extends across nearly the entire momentum space, which means light can be amplified regardless of its direction of propagation.

This could be the crucial missing step on the way toward practical use of such novel optical materials. The underlying idea is not limited to optics and photonics; it can be applied to various physical systems and has the potential to inspire new research in other fields.

This research project was carried out in the "Wave phenomena: analysis and numerics" Collaborative Research Center, funded by the German Research Foundation (DFG), and is embedded in the Helmholtz Association's Information research field. ■

More information:
Original publication:
https://www.nature.com/articles/s41566-024-01563-3
"Wave phenomena: analysis and numerics" Collaborative Research Center:
https://www.waves.kit.edu/index.php

Interactions between light and matter can be exploited better with photonic space-time crystals. [69]

QUANTUM COMMUNICATION

Breakthrough for the Development of Diamond-based Quantum Computers Using Microwaves

Quantum computers and quantum communication are pioneering technologies for data processing and transmission that is much faster and more secure than with conventional computers. Qubits are the basic units of information in quantum computers; they are the quantum mechanical counterparts of the bits in ordinary data processing.

Where, for example, laser pulses in a glass fiber transport information from A to B in classical digital communication, quantum mechanics uses individual photons. In principle, this makes it impossible to intercept the transmitted data. Qubits that are optically addressable (can be controlled or read out with light) are suitable for storing the photons' information and processing it in quantum computers. The qubits can store and process quantum states, and absorb and emit them in the form of photons. A major challenge in qubit development is extending the coherence time – this is the time in which qubits can store information in a stable manner.

Scientists from KIT have investigated how to precisely control a special defect in diamonds known as the tin-vacancy (SnV) center. A defect in the lattice structure of a diamond's carbon atoms occurs if atoms are missing or are replaced by other atoms such as tin. Such defects have special optical and magnetic properties that enable states such as their electron spin to be manipulated in a targeted manner using light or microwaves. They can then be used as qubits that can store and process information and couple it with photons.

Diamond qubits have the advantage of existing in the solid phase, making them easier to work with than other quantum materials, such as atoms in vacuum. The researchers succeeded in precisely controlling the electron spins of tin-vacancy center qubits using microwaves, thus increasing their coherence times significantly to as long as ten milliseconds.

They did so with dynamical decoupling, which largely suppresses interference. The researchers were able to demonstrate for the first time that this type of diamond defect can be very efficiently controlled with superconducting waveguides, which efficiently direct microwave radiation to the defects without generating heat.

Their work was part of two projects funded by Germany's Federal Ministry of Education and Research: Quantum-Repeater.Link for secure fiber-based quantum communication and SPINNING, which aims to develop a diamond spin-photon-based quantum computer. ■

More information:
Original publication:
https://journals.aps.org/prx/abstract/10.1103/PhysRevX.14.031036

Precision control of diamond qubits is an important step for the development of quantum computers. [70]

CATALYST RESEARCH

Concept for Efficiency-enhanced Noble-metal Catalysts

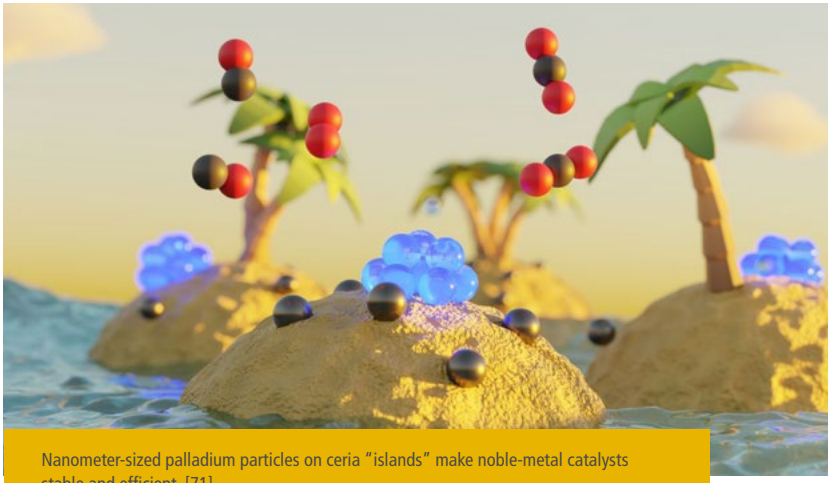
Noble-metal catalysts are used in many processes in the chemical industry. The production of more than 90 percent of all chemical products we use every day relies on catalysts. Catalysts speed up chemical reactions, can reduce the energy required for these processes, and in some cases, reactions would not be possible at all without catalysts. A reduction of the amount of noble metal required for their production is an important contribution to a sustainable resource use.

KIT researchers have developed a concept that dramatically increases the stability of noble-metal catalysts and requires less noble metal for their production. It ensures the formation of active noble-metal clusters even with a very low amount of noble metal used. To obtain an optimum catalytic performance using the smallest possible amount of noble metals, the researchers investigated frequently used supported catalysts atom by atom.

In these supported catalysts, the material where the reaction takes place is finely distributed on the support as small nanoparticles. These clusters are dynamic and change their structure depending on the reaction conditions. They can combine with each other and grow into larger particles so that fewer surface atoms are available for the reaction. However, they can also break down into single atoms that are ineffective on their own.

Both phenomena reduce the catalytic performance. The novel concept solves this problem by taking advantage of the varying interactions of noble metals with different support materials. Noble metals, such as palladium, tend to bond intensely with ceria, but hardly interact with aluminum oxide. This is why palladium was applied to tiny ceria 'nano-islands' which in turn were finely distributed on aluminum oxide.

The optimization of the support material ensures that the noble metal atoms preferably form sites on the ceria islands. The distance between the islands on the one hand and the limited mobility of ceria-bound palladium on the other hand prevent both the formation of large clusters and the decomposition of the palladium into single atoms.



Nanometer-sized palladium particles on ceria "islands" make noble-metal catalysts stable and efficient. [71]

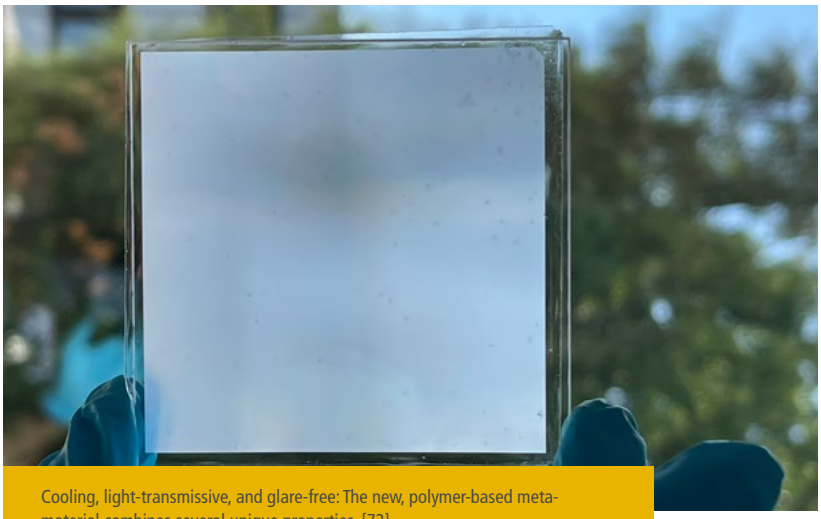
The size of the noble-metal clusters is defined by the number of noble-metal atoms on the individual ceria islands. The aim is to walk the fine line during the entire lifetime of the catalyst, and, if possible, to stabilize small particles consisting of only ten to 50 atoms.

This research project is embedded in the Collaborative Research Center (CRC) 1441, Tracking the Active Site in Heterogeneous Catalysis for Emission Control (TrackAct), which is funded by the German Research Foundation, where KIT is conducting research together with TU Munich and Deutsches Elektronen-Synchrotron DESY. ■

More information:
https://doi.org/10.1002/anie.202408511
(international version)
Videos (in German):
https://www.youtube.com/embed/DuuNxyhJPj8?si=m-TrcpkS8o7SjagKs
https://www.youtube.com/embed/2f9E7RiO_BQ?si=egW-wERwNXHWZD1VI

SUSTAINABLE BUILDING TECHNOLOGY

New Transparent Metamaterial for Energy-efficient Light and Temperature Control in Buildings



Cooling, light-transmissive, and glare-free: The new, polymer-based metamaterial combines several unique properties. [72]

Maximizing natural light in buildings is popular and can save on energy costs. However, traditional glass roofs and walls also present problems such as glare, lack of privacy, and overheating. Alternative solutions, such as coatings and light-diffusing materials, have not yet provided a comprehensive remedy.

KIT researchers have now developed a novel polymer-based metamaterial that combines various properties and could replace glass components in construction in the future. This Polymer-based Micro-Photonic Multi-Functional Metamaterial (PMMM) consists of microscopic pyramids made of silicone. These micro pyramids are sized about ten micrometers, which is about one-tenth the diameter of a hair. This design gives the PMMM film several functions: Light diffusion, self-cleaning, and radiative cooling while maintaining a high level of transparency. The material can efficiently radiate heat through infrared transmission, allowing for passive radiative cooling without electricity consumption.

In the lab and in experiments under open skies under real outdoor conditions, the researchers tested the material's properties and measured its light transmittance, light scattering, reflection properties, self-cleaning ability, and cooling performance using modern spectrophotometry. The results: The tests achieved cooling of 6 °C compared to the ambient temperature. Additionally, the material showed a high spectral transmittance, or transparency, of 95 percent. In comparison, glass typically has a transparency of 91 percent. At the same time, the micro pyramid structure scatters 73 percent of the incoming sunlight, resulting in a blurry appearance.

The material allows for bright yet glare-free and privacy-protected indoor spaces for work and living. In greenhouses, the high light transmittance could increase yields because the photosynthesis efficiency is estimated to be higher than in greenhouses with glass roofs. The micro pyramids also give the PMMM film superhydrophobic properties, similar to a lotus leaf: Water beads up in droplets and removes dirt and dust from the surface. This self-cleaning function makes the material easy to maintain and durable. The solution is scalable and can be seamlessly integrated into plans for environmentally friendly building construction and urban development.

For their work, the Karlsruhe research team had already been awarded first place in the Public Choice Award of the Helmholtz Best Scientific Image competition in 2023. ■

More information:
Original publication:
https://www.nature.com/articles/s41467-024-48150-2

CIRCULAR ECONOMY IN CONSTRUCTION

Half-timbered Structures Reinterpreted: Sustainable Architecture Thanks to Digital Construction Technologies

Emissions in the construction sector are increasing and so are the costs of raw materials. The construction sector produces more than 40 percent of all CO_2 emissions worldwide, air traffic just 2 to 3 percent. Circular economy and more sustainable architecture will require innovative approaches. An international and interdisciplinary team at KIT is rethinking historical craftmanship by not only automating and digitalizing, but by developing entirely new construction methods.

Such innovative fabrication strategies enable circular economy in the construction sector. KIT architects combine digital design and fabrication strategies with historical architecture and novel materials based on natural resources. In their demonstration project, researchers and students reinterpreted half-timbered houses accordingly. The building consists of a hybrid wooden carrier structure combined with ceiling parts based on a willow-clay composite. The façade of the half-timbered house is made of flax fibers.

The researchers were able to use this intelligent mix of local, rapidly regenerating materials, earth, and wood for construction purposes. Digital construction technologies are applied to upscale these natural construction materials to high-performance components. It was, for example, possible to develop digital design and automated fabrication methods for structural components based on the willow-clay composite.

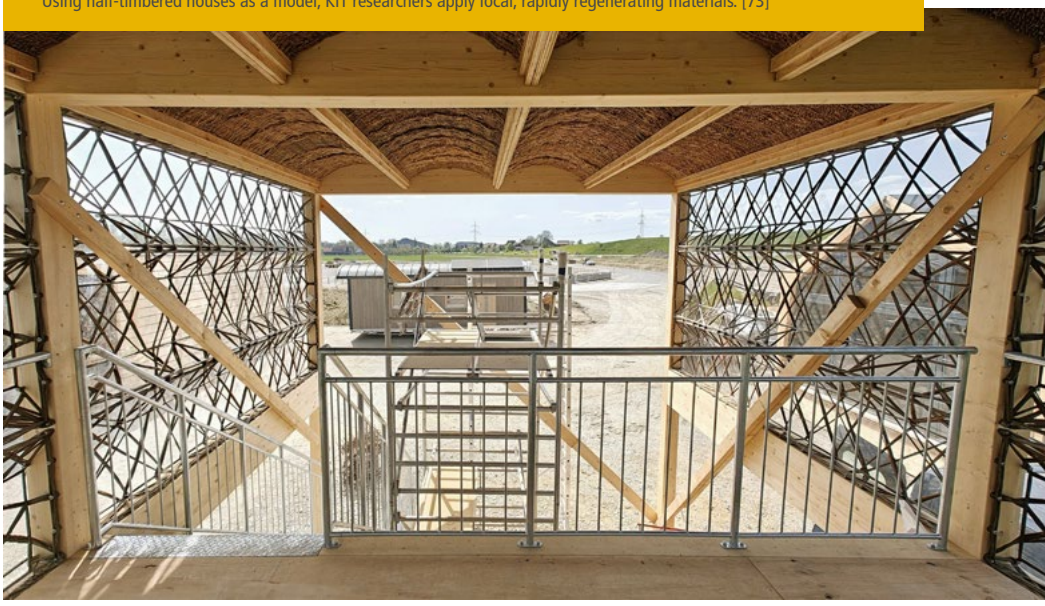
The researchers are also studying the material flow for the use of willow as a construction material. Their approach is to restore swamps and to grow willows there. Both the restored swamps and the rapidly growing willows are able to store large amounts of CO_2. This will enable low-energy processing of local material and diversify the use of renewable resources in the construction sector.

The students are involved in all project phases, starting with the brainstorming and concept development phases. In the beginning, the project lead is very open for new ideas as to which new circular and digital construction methods might be used. Students contribute entirely new perspectives. Until the project is completed, students help revise new concepts, generate digital models, and develop 1:1 prototypes.

The demonstration project was presented at the 2024 Baden-Württemberg State Garden Show in Wangen im Allgäu. ■

More information:
Digital Design and Fabrication at KIT:
https://www.ddf-kit.de/

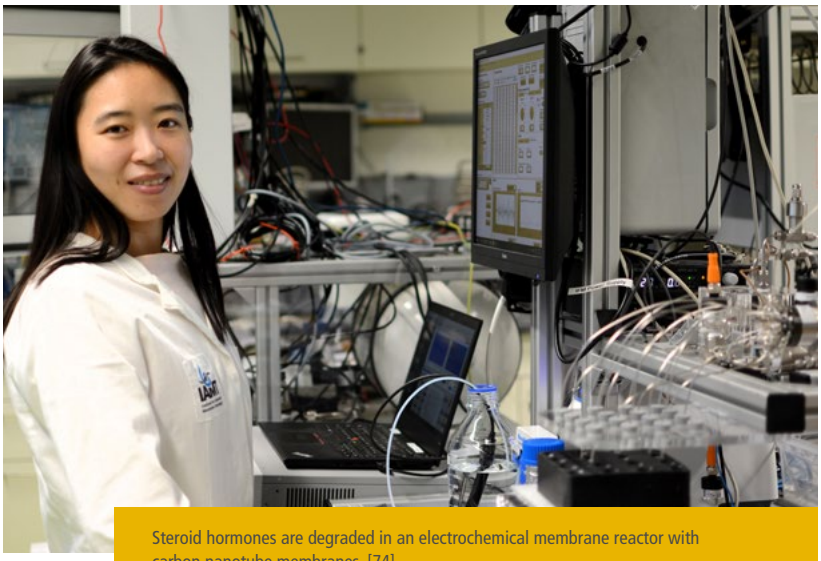
Using half-timbered houses as a model, KIT researchers apply local, rapidly regenerating materials. [73]



WATER TREATMENT

Catching Steroid Hormones with Nanotubes

Supplying clean water to people around the world is one of the great challenges of today and tomorrow. Various micropollutants (organic or inorganic substances) are present in low concentrations in wastewater but can still be harmful to humans and the environment. Considerable risks are posed by endocrine-disrupting substances, such as steroid hormones, which can affect the hormonal system. Such substances are present in pharmaceuticals, contraceptives, and other products. Though difficult to detect in water, they can seriously harm human health and disrupt the ecological equilibrium of aquatic environments.



Steroid hormones are degraded in an electrochemical membrane reactor with carbon nanotube membranes. [74]

Steroid hormones can be neither detected nor removed with conventional water treatment methods. Electrochemical oxidation (EO) is gaining recognition as a promising approach for their removal. EO systems consist of an anode and a cathode connected to an external power source. The electrical energy at the electrodes is varied (modulated), leading to the oxidation and degradation of pollutants at the anode's surface. EO can be exploited more effectively with electrochemical membrane reactors (EMR), in which a conductive membrane serves as a flow-through electrode, improving mass transfer and making active sites more accessible for the reacting molecules.

In collaboration with scientists from the University of California, Los Angeles, and Hebrew University of Jerusalem, researchers at KIT have announced progress in understanding the mysterious mechanisms at work in EMR: They investigated the degradation of steroid hormone micropollutants in an EMR with carbon nanotube membranes. With diameters in the nanometer range, carbon nanotubes have unique physical and chemical properties, such as a high electrical conductivity and an extremely large surface, giving them huge potential for adsorbing various organic compounds. That makes subsequent electrochemical reactions easier.

In their research, the scientists used state-of-the-art analytical methods to investigate the complex interactions of adsorption and desorption, electrochemical reactions, and byproduct formation in an EMR. They found that pre-adsorption of steroid hormones, i.e., their enrichment on the surface of the carbon nanotubes, did not limit the later degradation of the hormones. The study's analytical approach facilitates the identification of factors limiting hormone degradation.

The analysis explains some of the underlying mechanisms in electrochemical membrane reactors and provides valuable insights for the improvement of electrochemical strategies for eliminating micropollutants from water. ■

More information:
Original publication:
https://www.nature.com/articles/s41467-024-52730-7

CLIMATE RESEARCH

How a Fjord in Greenland Generated a Global Seismic Signal

Seismometers can be used to record vibrations that ring the Earth. The instruments usually measure the seismic waves, which are generated during earthquakes, but they can also record information about huge masses of water or earth moving on the planet's surface. In September 2023, seismometers all around the world detected a unique seismic signal that was measurable for up to nine days in some places.

It was an oscillation with a single dominant frequency, like a monotonous hum that died away very slowly. It was totally different from known earthquake signals. To investigate this phenomenon, scientists from KIT joined forces with researchers from 40 institutions in 15 countries. They combined seismometer and infrasound data, field measurements, ground and satellite images, simulations of tsunami waves, and photos from the Danish army.

This cooperation and the combination of local data and global remote observations enabled the researchers to retrace the extraordinary sequence of events. Measurement data as those recorded by KIT and the University of Stuttgart at the geoscientific Black Forest Observatory contributed greatly to this achievement. The signal had been caused by a massive landslide in the Dickson Fjord in Greenland. To find out what had triggered the landslide and why the signal lasted that long, they created a realistic high-resolution numerical model of the event, allowing them to reconstruct it and establish the cause of the signal. The model revealed that a so-called seiche, i.e. water slopping back and forth in the narrow fjord, had caused the measurable oscillations. The seiche had been caused by a massive rockslide in the fjord. It was produced by the collapse of a mountain peak that had previously risen 1,200 meters above the fjord. More than 25 million cubic meters had come crashing down.

The falling masses displaced a huge amount of water, which was pushed out of the fjord as a mega-tsunami with an initial height of 200 meters. The waves of water generated by the event, which lasted only a few minutes, then slopped back and forth in the narrow fjord for days, generating seismic waves that could still be measured nine days later at the nearest measuring stations. These seismic waves traveled around the Earth and could even be detected in Antarctica, which is almost 20,000 kilometers away.

The researchers also investigated how this massive landslide came about. Satellite images showed that the glacier at the foot of the mountain had thinned out considerably in recent decades. In addition, the rockslide and the tsunami were the first ones to be observed in the northeastern part of Greenland. The researchers attribute this phenomenon to climate change. ■

More information:
Original publication:
https://www.science.org/doi/10.1126/science.adm9247
More information on the Black Forest Observatory:
https://www.gpi.kit.edu/english/61.php

Photos showing the mountain peak and the glacier before and after the rockslide, which generated a signal that could be measured around the world. [75]

CLIMATE CHANGE

Rising Temperatures May Impact Groundwater Quality

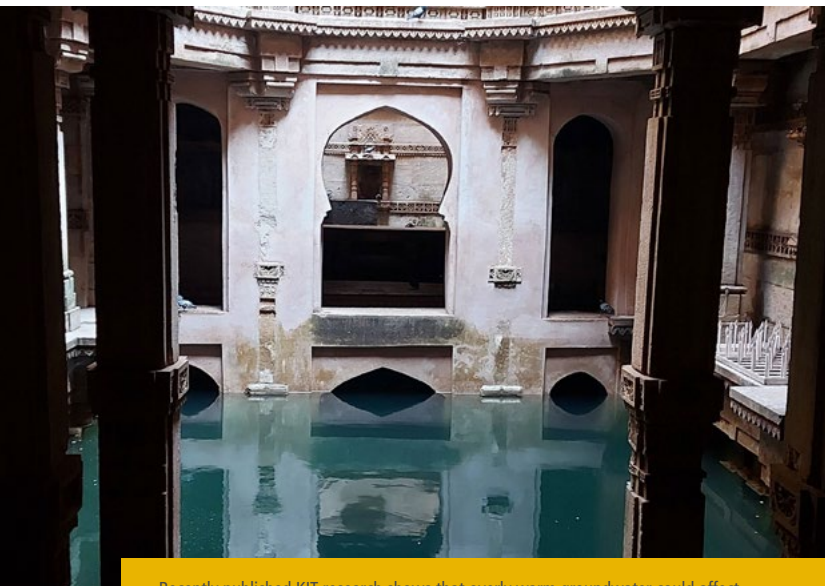
Earth's climate system is heating up due to the atmosphere's increased concentration of greenhouse gases, which limits the amount of heat that can be radiated away. The oceans absorb a substantial fraction of this heat, but soil and groundwater also act as heat sinks. However, little is known thus far about the effects Earth's surface warming has on groundwater over space and time. To close this gap, KIT scientists have simulated the projected changes in global groundwater temperatures through 2100. They can provide maps showing global groundwater temperatures at various depths beneath Earth's surface. The maps show that the world's highest groundwater warming rates can be expected at locations with a shallow groundwater table or high atmospheric warming. The researchers projected the lowest warming rates in mountainous regions with deep water tables, such as the Andes and the Rocky Mountains.

The researchers based their projections on the internationally recognized SSP 2–4.5 and SSP 5–8.5 climate scenarios. These predefined scenarios reflect different socioeconomic development pathways and different trends in the concentration of atmospheric greenhouse gases in the future. SSP 2–4.5 is in the middle range of possible future greenhouse gas concentration trends; SSP 5–8.5 is at the upper extreme. The study indicates that by 2100, groundwater temperatures will rise by 2.1 degrees Celsius in the SSP 2–4.5 scenario and by 3.5 degrees Celsius in the SSP 5–8.5 scenario.

As the world's largest unfrozen freshwater resource, groundwater is crucial for life on Earth. The temperature of groundwater plays a crucial role in water quality by influencing a number of chemical, biological, and physical processes. There are already about 30 million people living in regions where the groundwater is warmer than stipulated in the strictest drinking water guidelines. That means it may not be safe to drink the water there without treatment. It may need to be boiled first, for example. The drinking water also gets warmed up in water pipes by heat in the ground.

Depending on the scenario, as many as several hundred million people could be affected by 2100. According to the study, the figure would be 77 to 188 million people for SSP 2–4.5 and 59 to 588 million for SSP 5–8.5. The broad ranges are due to spatial variations in climate change and population trends. ■

More information:
Original publication:
https://www.nature.com/articles/s41561-024-01453-x



Recently published KIT research shows that overly warm groundwater could affect millions of people by 2100. [76]

HEALTH TECHNOLOGIES

Children's and Youth Fitness: Half-time for MoMo 2.0 Tests

Since 2003, the Motorik-Modul-Studie (MoMo) study has been investigating the course and development of physical fitness, activity behavior, and health of children and adolescents in Germany. The nationally representative study provides data and analyses that show how fit and active children and adolescents in Germany are, helping to identify trends, determine the influence of historical events and environmental factors, and reveal connections between socioeconomic and biomedical conditions.

The key finding of the first three waves of the survey from 2003 to 2020 was that the motor skills of children and young people in Germany are stagnating at a low level and that the majority of four to seventeen-year-olds are not getting enough exercise. As part of the fourth MoMo 2.0 survey wave, around 4,800 children and adolescents aged between 4 and 17 were tested in 185 cities and municipalities by the end of 2024.

The tests at the Karlsruhe University of Education (PHKA) on April 28 and 29, 2024 marked the successful completion of the first half of the current survey wave. The results, expected at the end of 2025, will show for the first time how fit and active children and young people are who have experienced the restrictions caused by the Covid pandemic.

For the current survey, the researchers expect a "Covid kink" that has generally already been diagnosed by comparable studies with slower and less persistent children. Initial results indicate that they are doing more sport again after the restrictions imposed by the Covid pandemic, but are less physically active in everyday life. The researchers suspect that this could be linked to changes in physical activity and leisure behavior, such as increased media consumption.

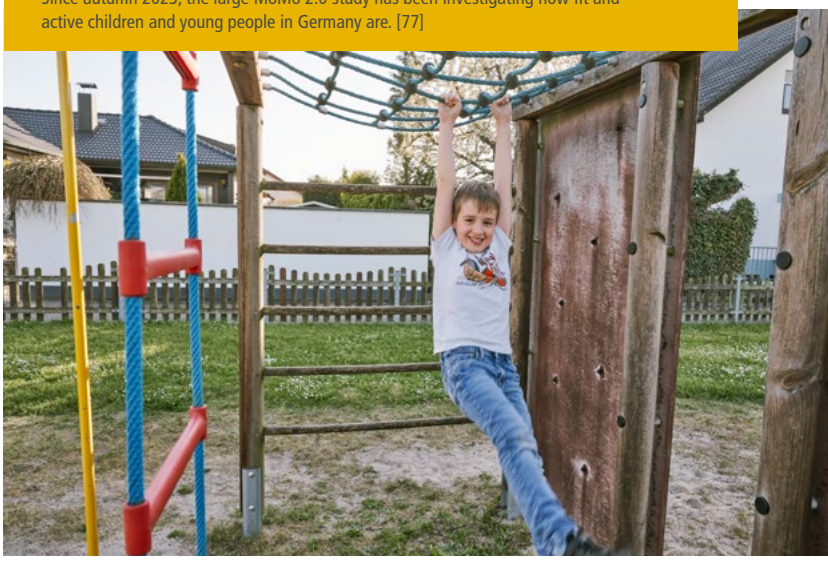
The study is a joint project of KIT, the Karlsruhe University of Education (PHKA), the University of Konstanz, and the Humboldt-Universität zu Berlin. The standardized tests for endurance, strength, speed, coordination, and mobility are organized and supervised by around 60 specially trained students from the PHKA and KIT. Data on weight, body composition, waist circumference, blood pressure, nutrition, and mental health are also included in the survey.

The KIT is primarily investigating physical and sporting activity as well as physical health and health behavior. The PHKA is focusing on recording and analyzing motor performance, anthropometry, and physical health. The University of Konstanz analyzes social inequality, migration, and education. The Humboldt-Universität zu Berlin is responsible for the statistical analysis of the collected data.

Embedding the MoMo study into the KIT Center of Health Technologies makes it possible to integrate innovative health technologies and methods directly into health research and thus seamlessly link scientific findings and practical applications. ■

More information:
MoMo study:
https://www.ifss.kit.edu/MoMo/english/index.php
KIT Center of Health Technologies:
https://www.healthtech.kit.edu/

Since autumn 2023, the large MoMo 2.0 study has been investigating how fit and active children and young people in Germany are. [77]



PARTICLE PHYSICS

Rare Decay and New Detectors

The KIT Elementary Particle and Astroparticle Physics Center bundles experimental and theoretical research at the interface between astrophysics, elementary particle physics, and cosmology. Large-scale international projects for knowledge-driven fundamental research form the basis and connecting elements of the various activities.

Detector Module for the Large Hadron Collider

The work in Karlsruhe on the upgrade of the CMS experiment (CMS = Compact Muon Solenoid) at the Large Hadron Collider of CERN near Geneva has reached an important milestone in October 2024: The first fully functional module for the new CMS tracking detector has left the production line at KIT. The new tracking detector will allow the selection of interesting particle tracks in real time for the first time and will make a significant contribution to unlocking further secrets from the smallest building blocks of nature from 2030.

The detector module consists of a double layer of silicon strip sensors and electronics for data readout and transmission. A team of scientists, doctoral researchers, and technicians from KIT assemble the sensitive components in six high-precision steps. After each step, the detector module is tested thoroughly. For this purpose, a production line has been set up in a clean room on KIT's Campus North over the last years, which can be used to build up to six modules a day. It takes at least eight days to produce a single module.

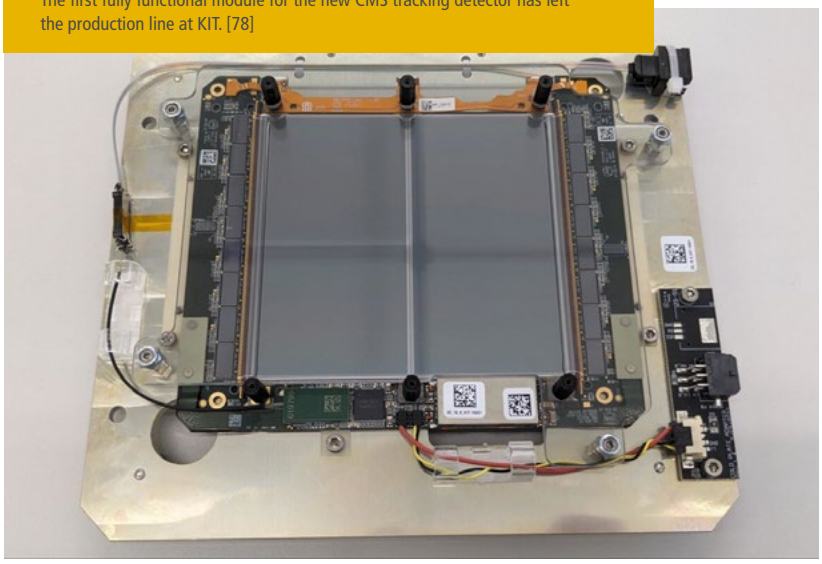
Rare Event in Belle II Experiment

The Belle II particle detector, which is operated by an international research team in the Japanese KEK research laboratory, has made a significant observation. For the first time, a charged B-meson was detected that decays into a kaon, a neutrino, and an antineutrino. While this aligns with predictions from the Standard Model of particle physics, the observed frequency of these decays is higher than expected.

Detecting such decays is challenging due to the elusive nature of neutrinos. They interact minimally, leaving no discernible traces in collision events. Researchers had to carefully sift through collision outcomes to identify tiny bits of missing energy. The rarity of these decays further complicated the process. To achieve this observation, the researchers used AI to purify the decay process as much as possible from background interference. ■

More information:
KIT Elementary Particle and Astroparticle Physics Center:
https://www.kceta.kit.edu/english/index.php

The first fully functional module for the new CMS tracking detector has left the production line at KIT. [78]



CELL BIOLOGY

Molecular Code Stimulates Pioneer Cells to Build Blood Vessels in the Body

In our body, a large network of blood vessels distributes blood across our organs and thereby ensures that our body cells are supplied with sufficient oxygen and nutrients to maintain body functions such as the heart beat and brain activities. Occlusion of blood vessels that impair oxygen delivery may cause neuronal or cardiac cell death, possibly culminating in a stroke or heart attack.

Revascularization, i. e. restoring vascular perfusion and promoting tissue regeneration, requires functional blood vessels, but how to effectively revascularize organs is still an unsolved question. Since each organ fulfills its unique physiological function, vascular branching patterns differ from organ to organ. It has long been a mystery how such unique, organo-typical vascular structures develop.

Scientists of KIT have now discovered a new vascular cell type that plays a decisive role in the growth of blood vessels. Its activation is decisive for organ-dependent variability in vascular branching. Cells of this type, which were coined endothelial L-tip cells or pioneer cells, reside inside the inner layer that lines the blood vessel, the so-called endothelium.

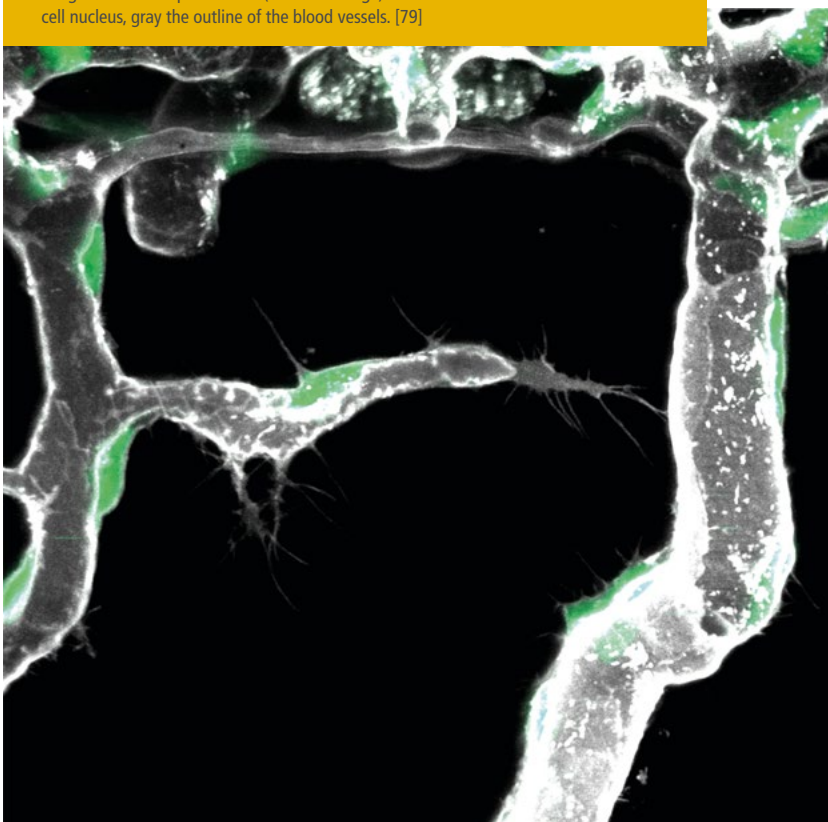
Using high-end imaging techniques, the scientists found that pioneer cells move inside the vascular wall. Once they come into contact with specific signals produced by cells in the surrounding organ, pioneer cells start to make new blood vessels. To elucidate the molecular identity of these signals, to identify the cells that produce such signals, and to find out how these signals are sensed to promote pioneer cell differentiation, the scientists used a technique called single cell sequencing. Single cell sequencing combines detailed RNA sequencing of individual cells with bioinformatic analyses and allows precise identification of cell subtypes and the molecules these cells produce for cell-to-cell communication. Using this technique, the scientists discovered that the vascular patterning is encoded by a distinct set of molecules that can only be sensed by a subset of endothelial cells to promote vessel growth.

This organ-specific set of molecules encodes the instruction how to make a new blood vessel. This molecular code can only be received by the prospective pioneer cells, which then decode it and initiate the vascular growth process. Several of these vascular growth code molecules are potentially drug-targetable, i.e. they will react to externally administered chemicals.

The scientists work at the 3R 3ROCKIT Center (Replace Reduce Refine Organismal Research by Computational and Cellular technologies@KIT) of the KIT Health Technologies Center where they strive to identify novel smart molecules that can influence the vascular growth process. This discovery might allow to find new therapeutic strategies for the treatment of diseases caused by ischemic tissue.■

More information:
Original publication:
https://www.nature.com/articles/s41467-024-47434-x
KIT Center of Health Technologies:
https://www.healthtech.kit.edu/

Image of an active pioneer cell (center of image). Green indicates the endothelial cell nucleus, gray the outline of the blood vessels. [79]



TEACHING

KIT is one of Europe's largest scientific institutions and one of its leading technical universities, where researchers work on solutions to the major challenges of our time. KIT is both a university and a large-scale research center where teaching and research are closely linked in a way that is unique in Germany. In research-based study programs, students can take part in exciting research projects at an early stage of their studies.

Working with scientists in many institutes, students at KIT can help in the fight against climate change, conduct research on safe and sustainable mobility solutions, and shape the digital transformation. Or they can work on the

development of next-generation batteries and environmentally friendly ways of generating energy.

The number of first-semester students at KIT in 2024, including those beginning master's degree programs, was 6,801. Thus, a total of 22,761 students were enrolled at KIT. Students at KIT could choose from among 44 bachelor's and 65 master's degree programs.

One of the ways to ease the start at KIT is the orientation phases (O-phases) organized by student representatives of the departments before the beginning of the semester. Campus life at KIT is enriched by more than 90 student associations for culture, sports, politics, and much more.

What makes KIT special and what it means to study at KIT are the subjects of a new five-part video series called "KIT – That's Why" with segments on the KIT campus, digitalization, energy, mobility, and sustainability and the climate. It was published for the 2024/2025 winter semester and is available on KIT's YouTube channel. And "Infos zum Studienstart" (a German-language brochure in postcard format) includes the most important things to know about beginning studies, key institutions, and services and counseling available at KIT.

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SUCCESSFUL START OF STUDIES

topMINT Orientation Semester Started at KIT

A topMINT orientation semester at KIT supports prospective students in their choice of the best-suited discipline. [91]

In the topMINT orientation semester, prospective students of sciences, technology, engineering, and mathematics who plan to take up a bachelor's program at KIT during the winter semester are given information that helps them decide which degree program to choose. In the orientation semester, which started in the 2024 summer semester, prospective students get to know the various STEM study programs.

They have the opportunity to get a deeper insight of the discipline they are about to choose. The participants obtain comprehensive information on the study requirements, which can help them for their decision and facilitate their access to one of the STEM programs.

The program of the topMINT orientation semester, which is entirely in German, consists of three modules: "Training", "Orientation", and "Trying." In preparation of a subsequent study program at KIT, the prospective students attend basic courses in mathematics, programming, physics, and chemistry that help them close knowledge gaps.

In mathematics, the students work on basic mathematic terms and statements that are used to describe scientific or engineering models. In addition, there is a hands-on introduction to mathematical procedures. The subject of informatics covers practical aspects of programming. Selected theoretical topics add to the practical contents of the course. In physics, basic physical concepts are covered, and research questions in the field of mechanics are introduced. The semester program for chemistry is targeted at anybody who would like to repeat or learn the basics of general and inorganic chemistry.

A series of lectures presents the various study programs at KIT, and other information events provide orientation on the courses of study offered at KIT. In selected special events, the participants can try their hands at specific matters and gain a realistic insight into the contents of a study program.

They can focus on their own interests, strengths, and weaknesses and get to know the program profiles and the field-specific requirements. The offer is completed by an insight into the STEM jobs given by the KIT departments so that every prospective student can select the program best suited for him or her.

The topMINT orientation semester is organized by MINT-Kolleg Baden-Württemberg, a joint institution of KIT and Stuttgart University, in close collaboration with the participating KIT institutions. ■

More information (in German):
https://www.mint-kolleg.kit.edu/topMINT.php

CREATIVE TEACHING APPROACHES

Making Learning Fun with Innovative Teaching Formats

In the contest to win the best minds, KIT is adopting unusual teaching approaches in its study programs, such as escape game development and a lecture with a glider flight, while continuing to give students unique insights into large-scale research projects.

An example of an unorthodox teaching format is the aerodynamics course held by the Institute of Fluid Mechanics in collaboration with Akaflieg Karlsruhe, a KIT student association that has been building and testing airplanes and airplane parts for nearly 100 years. The students learn basic theory in the lecture hall and apply what they have learned in a glider flight at the end of the semester, giving them first-hand experience in how theory and practice are intertwined.

Studying with fun factor: Theory and practice belong together at KIT, as in the aerodynamics course. [92]

Practical learning is also emphasized in the engineering sciences. At a workshop entitled "Hinter den Kulissen des KIT" (behind the scenes at KIT), students can meet KIT infrastructure professionals from various disciplines and gain insights into their work: How are technical facilities and their equipment planned and managed? How does a sustainable and economical energy supply work?

Students in civil engineering bachelor's programs can demonstrate their math skills in the "Brücke aus dem Sack" (bridge in a bag) contest. Teams of students bring all of the parts for a three-meter bridge in a trash bag. They have to build the bridge on the spot within 30 minutes. The bridge has to support the weight of a single person, but it has to break down under the weight of all team members.

In addition, students studying for master's degrees in structural wood or steel design can work with architecture students to design a load-bearing structure as they would in an everyday professional setting.

KIT promotes other ways to learn with programs involving cooperation between students and trainees: In the course entitled "Mechatronische Systeme und Produkte" (mechatronic systems and products), they work together for several weeks to design and build automated miniature excavators and sorting systems. The course fosters dialogue between different educational pathways and helps to overcome prejudices. Because of its success, the format is to be extended to some of the other 25 vocational training programs at KIT.

The Digital Learning Lab features innovative teaching approaches for teaching degree students, who can independently test hardware and software there to develop new teaching methods such as a math escape game or 360° teaching videos (see also page 56).

A unique aspect of KIT remains the opportunity it provides for students in bachelor's and master's degree programs to participate in large-scale research experiments without waiting until their doctoral studies. This aspect is unique in Germany because KIT is the only German University of Excellence that is also a member of the Helmholtz Association of German research centers. ■

More information:
Studying at KIT:
https://www.kit.edu/study/index.php
New aerodynamics course (in German):
https://www.clickit-magazin.de/vorlesung-im-himmel-wie-studierende-zu-ueberfliegern-werden.php
Collaboration between students and trainees (in German):
https://www.kit.edu/kit/202402-theorie-und-praxis-hand-in-hand-zum-erfolg.php
DigiMINT project and Digital Learning Lab: https://www.kit.edu/kit/english/pi_2023_107_teacher-degree-program-new-tools-for-digital-learning-in-stem-subjects.php

TEACHER EDUCATION

Karlsruhe School of Education Founded

With Karlsruhe School of Education (KSE), established in May and officially opened in December 2024, KIT and the Karlsruhe University of Education (PHKA) are augmenting their long-standing, successful collaboration. The purpose of their jointly operated academic institution is to develop new ideas for teacher education and expand their cooperation in learning, teaching, research, transfer, and promoting young talent.

KIT and the PHKA have been collaborating successfully in teacher education for many years, including the relevant academic disciplines and their didactic methodologies as well as education sciences and teaching internships. The shared structures of a school of education promise further long-term synergy effects. KSE's main fields of activity will be digitalization, sustainability, STEM, health, and democracy education.

KSE is headed by Professor Dr. Alexander Woll, Scientific Director of the Center for Teacher Education at KIT, and Professor Dr. Nadine Anskeit (PHKA). Collaboration with the other schools of education in Karlsruhe, the Baden-Württemberg Center for School Quality and Teacher Education, the Karlsruhe-based institutions offering training and continuing education for teachers, and other bodies is arranged through KSE's council and advisory board.

Jointly Operated Institution to Improve Teacher Education

Particular beneficiaries of KSE's offerings will be the students, with each partner planning to make its courses more accessible for the other institution's students and instructors, to enhance the appeal of their many teaching and learning labs as beacons of teacher education in Karlsruhe and beyond, and to cooperate in attracting teaching degree students. A further aim is to strengthen cooperation in multi-university research activities (especially in didactic methodologies and education sciences) and in raising funds for innovative educational research.

Knowledge transfer, primarily benefiting everyday classroom work, will take place through publications and presentations at conferences in Germany and abroad. KSE will strengthen all phases of teacher education in Karlsruhe and Baden-Württemberg.

Studies, Research, Transfer, and Teaching and Learning Labs

KSE offers various courses and services for teaching degree students at KIT and PHKA. Courses in various departments are opened up, extracurricular certificates are issued, and various event formats dealing with teaching degree programs are organized.

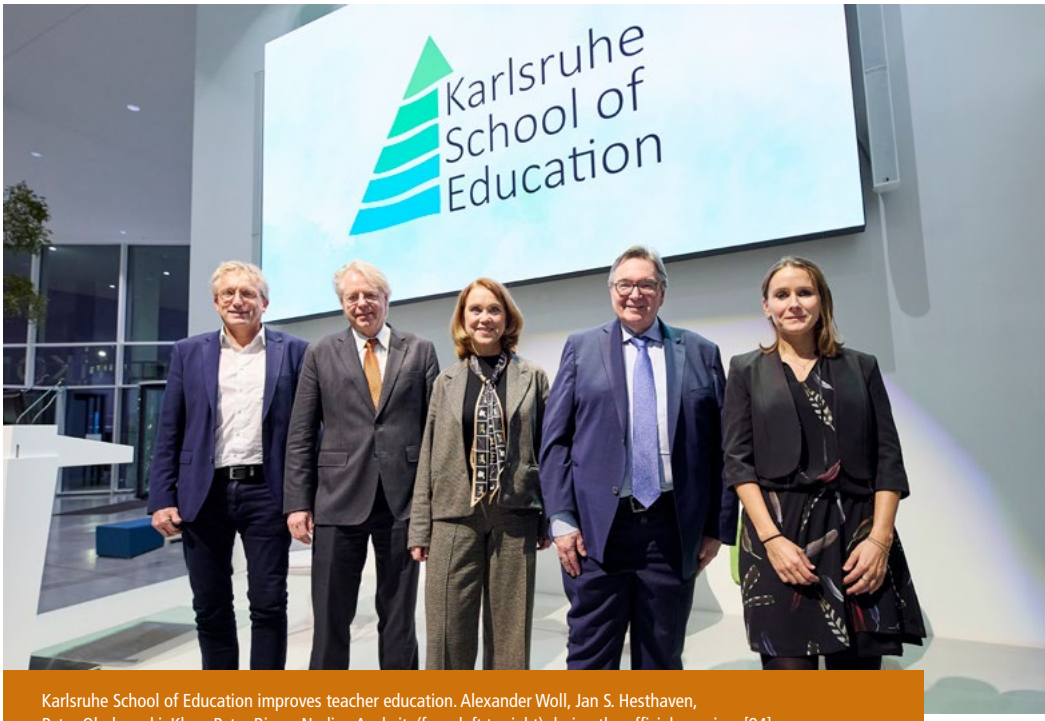
Panel discussion at the official opening of the KSE. [93]

The aim of research at KSE is to gain new insights into the education of instructors and for school teaching and to put them into practice, such as digitalization of teacher eduction. Research related to teaching degree programs including the relevant academic disciplines and their didactic methods as well as education sciences and teaching internships takes place in Karlsruhe.

Various transfer formats defined by the KSE in collaboration with a huge network of education partners impart scientific insights to school

practice, while being guided by its scientifically determined requirements.

In teaching and learning labs, for example in biomechanics and information technology, innovative teaching/learning settings for school classes can be developed, tested, and evaluated. They strengthen the "Connections of Education, Research, and Practice" innovation field and enable teaching staff to supplement their own subject teaching with excellent offerings taking place outside their school.



Karlsruhe School of Education improves teacher education. Alexander Woll, Jan S. Hesthaven, Petra Olschowski, Klaus Peter Rippe, Nadine Anskeit, (from left to right) during the official opening. [94]

Focus on Digitalization and Internationalization

"Qualified and dedicated teachers remain in high demand. Five established schools of education are making an important contribution to the scientific development of teacher education in Baden-Württemberg, with a focus on topical issues such as digitalization and internationalization," said Baden-Württemberg's Minister for Science, Research, and the Arts, Petra Olschowski, during the official opening of the KSE. "Now, PHKA and KIT are taking the next step; by opening the KSE, they expand their long-standing cooperation in the field of teacher education."

"The shared structures of the school of education provide ideal conditions for more capable and science-based teacher education and training," said Professor Jan S. Hesthaven, President of KIT. "With their practice-based combination of teaching and research, for example in the teaching and learning labs, KIT and the PHKA enable outstanding teacher education in the STEM subjects."

"Karlsruhe is a unique and important location for teacher education in Baden-Württemberg. With the Karlsruhe School of Education, the PHKA and KIT will set a new course with pioneering ideas for teaching, research, transfer, and internationalization. Our common focus will be on democracy education, digitalization, health, sustainability, and STEM," said Professor Klaus Peter Rippe, Rector of the Karlsruhe University of Education.

Karlsruhe is the only location in Baden-Württemberg that boasts all higher-education institutions involved in teacher education and many important institutions for teacher training and education, such as state-based seminars, Regierungspräsidium (regional authorities), and regional office of the Baden-Württemberg Center for School Quality and Teacher Education. ■

More information (in German):
www.kse-karlsruhe.de

TEACHING DEGREE PROGRAM

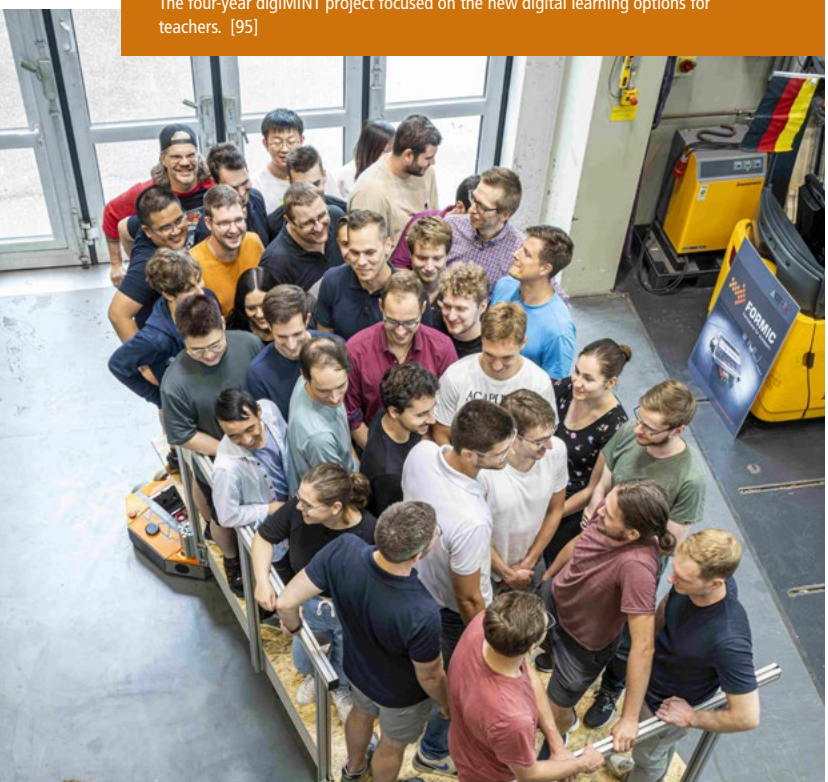
New Tools for Digital Learning in STEM Subjects

360-degrees sports videos, math escape games, or teaching-learning videos on biomechanics: In the digiMINT project, teacher degree students from KIT worked on the digitalization of the education of future teachers in the STEM subjects and tested a large range of options. Thanks to the newly established Digital Learning Lab and improved networking with external partners, KIT's teacher degree students will be able to test and integrate the use of digital tools in future studies.

Well-designed and digitally supported teaching uses the new tools that improve learning and explaining, opening up entirely new possibilities. It is more than just having a smart board instead of a blackboard in the classroom. Teacher degree students need to be able to use tablets, cameras, and apps in practice, to support pupils when conducting Internet searches, and to reflect and reassess the use of these tools constantly.

Development of these digital skills has hardly been part of teacher degree studies so far. With digiMINT, KIT has made a big step forward in the digitalization of teacher degree studies. The digiMINT project focused on the subjects of mathematics, computer science, and education science. The digiLAB project, funded by the Baden-Württemberg Ministry for Science, Research, and the Arts, extended digiMINT to also cover the subjects of sports and engineering, sports and health, and natural science and engineering.

The four-year digiMINT project focused on the new digital learning options for teachers. [95]



About 170 teacher degree students took part in digiMINT. They learned, among other things, how to create 360-degree videos, to program an escape room game with simple modules, or to design teaching-learning videos that explain complicated contents. Based on this set of tools, they designed teaching units for other students or school classes. The pros and cons of each tool were discussed critically.

The around 70 teaching concepts and seminars developed by the students have been tested and evaluated thoroughly. The places used to create the teaching contents included the new Digital Learning Lab at KIT. It provides both a real and a virtual learning environment, where the students can test the applications of the various technologies.

In the digiMINT project, an interdisciplinary team of KIT cooperated with the Seminar for the Education and Training of Teachers in Karlsruhe, the Baden-Württemberg Center for School Quality and Teacher Education, and the Karlsruhe Media Center. The project started on March 1, 2020, and ended on December 31, 2023. The Federal Ministry of Education and Research funded the project with EUR 1.7 million under the federal and state program of "Quality Campaign for Teacher Education." ■

More information (in German):
https://www.hoc.kit.edu/zlb/Forschung_DigiMINT.php

MAKING STEM STUDY PROGRAMS MORE ATTRACTIVE

FutureMINT BW: Program and Networking Center of the Higher Education Institutions

The new "FutureMINT BW Programm- und Vernetzungsstelle der Hochschulen" networking center, located at MINT-Kolleg Baden-Württemberg, KIT, has successfully started its operations in 2024. It accompanies the "Attraktives MINT-Studium" funding scheme for promoting STEM studies established by the Baden-Württemberg Ministry for Science, Research, and the Arts.

The aim of the funding scheme is to support higher education institutions in making their STEM study programs more attractive because graduates from the engineering sciences, mathematics, computer science, and natural sciences play a key role in addressing the ecological and technological change.

The universities want to attract more prospective students for these future-oriented disciplines and at the same time make the relevance of these subjects for pressing social issues such as sustainability and digitalization visible. Attracting qualified specialists is therefore of crucial importance, as they drive sustainable developments in society and the economy and ensure Baden-Württemberg's innovative capacity and competitive strength in the long term.

The networking center addresses all types of higher education institutions; it promotes the exchange and networking activities between projects and higher education institutions and ensures the transfer of knowledge between all HEIs in Baden-Württemberg regarding questions on STEM orientation and STEM studies. It supports systematic networking between the actors and activities of the HEIs in the context of the funding scheme, with a focus on the exchange of experiences, best practices, and innovative ideas. The aim is to actively support the collaboration and exchange between the various HEIs and to establish a network community that is open to interested representatives of all HEI types. The focus is on the provision of a central facility for information, networking, and knowledge transfer within the pertinent context of the funding scheme.

The aim of the "FutureMINT BW Programm- und Vernetzungsstelle der Hochschulen" is to attract more prospective students to take up studies in the STEM subjects. [96]

"Attraktives MINT-Studium" Funding Scheme

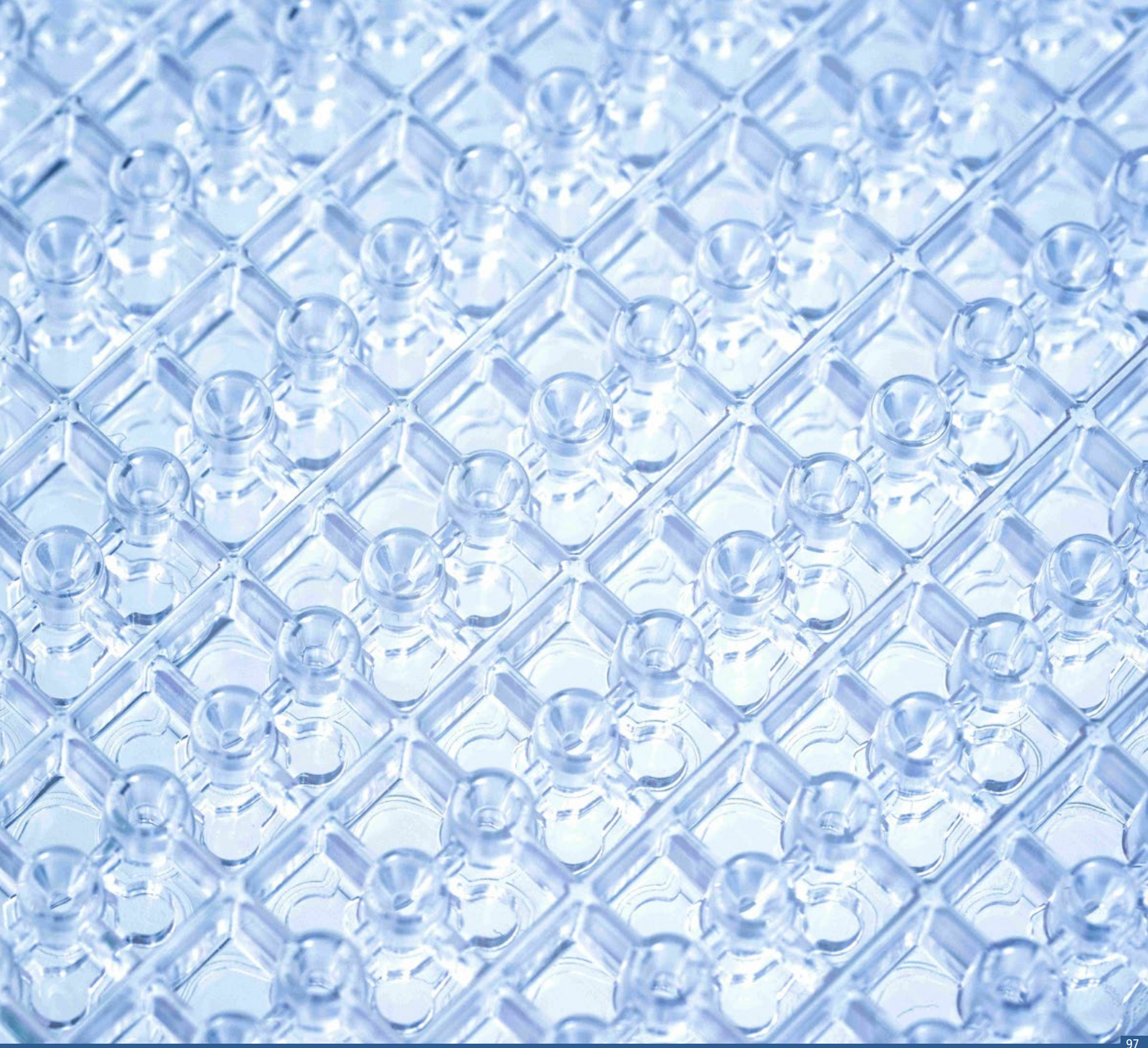
This funding scheme, which is intended to make STEM studies more attractive, is funded by the Baden-Württemberg Ministry for Science, Research, and the Arts. It has three main components: With a school-university interface, the higher education institutions are to provide a wide range of information and motivation offers to make STEM subjects accessible to pupils. A module on innovative STEM study programs supports universities in designing more attractive, future-oriented STEM study programs by means of innovative curricula and novel concepts. The purpose of the networking module is to promote the exchange between the Baden-Württemberg universities in order to improve their quality and align the study programs with each other. ■

More information (in German):
https://www.futuremint-bw.de/index.php

TRANSFER

At Hannover Messe 2024, KIT showed exhibits and presentations themed "Research for a Sustainable Future" in the Future Hub and in the Energy Solutions area. In addition, KIT was present at the international Baden-Württemberg booth, at other booths, and participated in the conference program.

KIT presented several projects in the Future Hub, including the AgiProbot project where researchers explore how factories can autonomously adapt to changing conditions. Two tasks were set up to demonstrate how robots learn in AgiProbot: Inspection of used products and documentation of disassembly processes. The innovative "Net-Zero Circular Concrete" circular economy meth-



od allows to produce concrete in a resource-saving and climate-friendly manner. The ANYMOS competence cluster (Anonymization for Networked Mobility Systems) showed how services for networked mobility, such as navigation systems or ticket purchasing via smartphone, can be performed in such a way that the data does not allow conclusions to be drawn about individuals. ANYMOS is a project conducted jointly with FZI Research Center for Information Technology, a KIT innovation partner.

The exhibits shown in the Energy Solutions area covered energy storage systems, which play a decisive role in the sustainable conversion of the energy system and the development of renewable energies. KIT presented various newly developed applications for power and heat supply and for industrial processes. The exhibits included liquid metals as heat accumulators, the hybrid BiFlow storage system that combines the specific advantages of lithium-ion batteries and redox flow batteries, the Litona startup, a KIT spinoff developing energy storage materials for sodium-ion battery cells, and technologies for safe hydrogen storage systems.

At both booths, the KIT technology market was present with over 70 other offers. It shows KIT innovations that might result in marketable products and processes.

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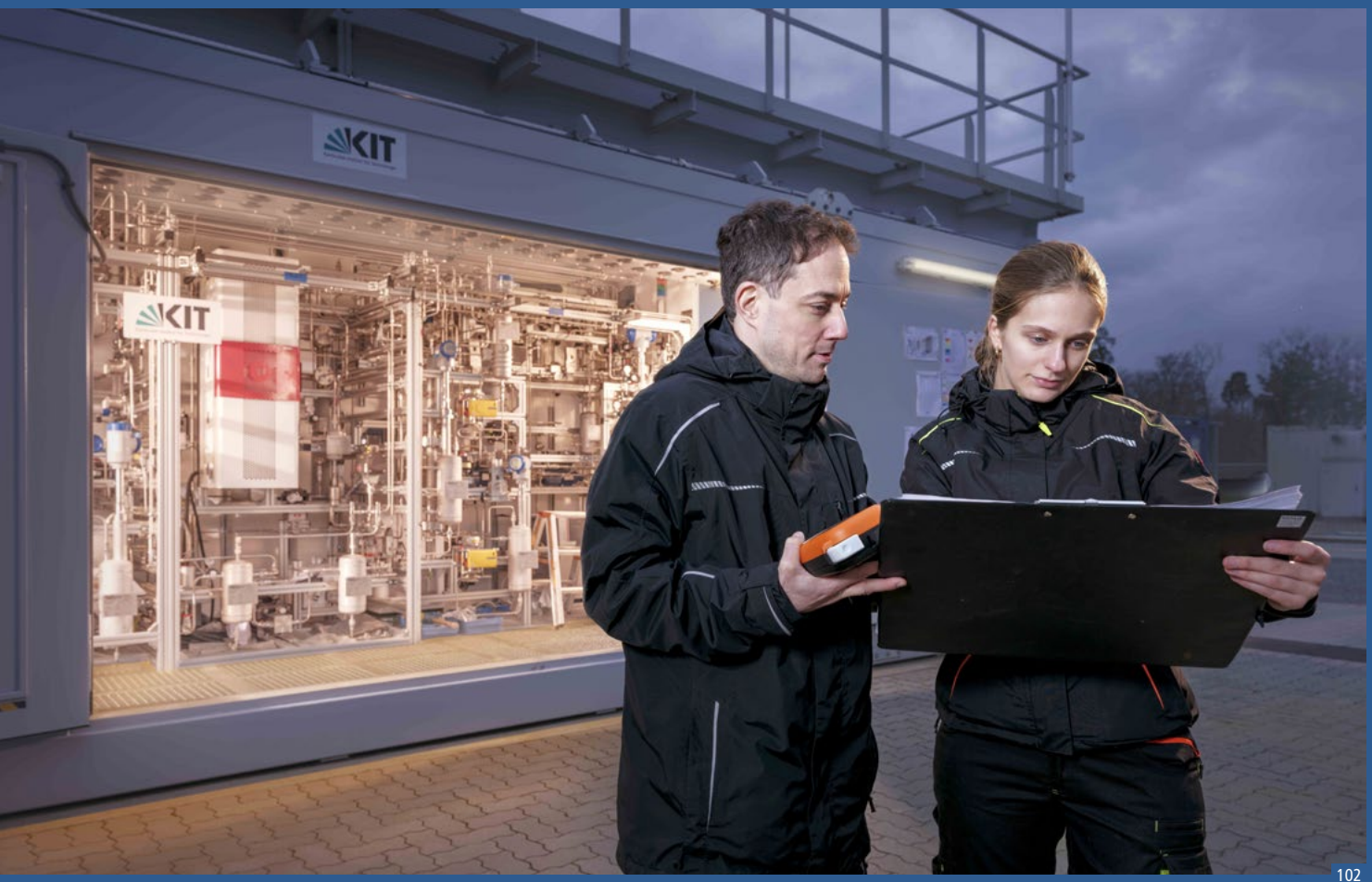

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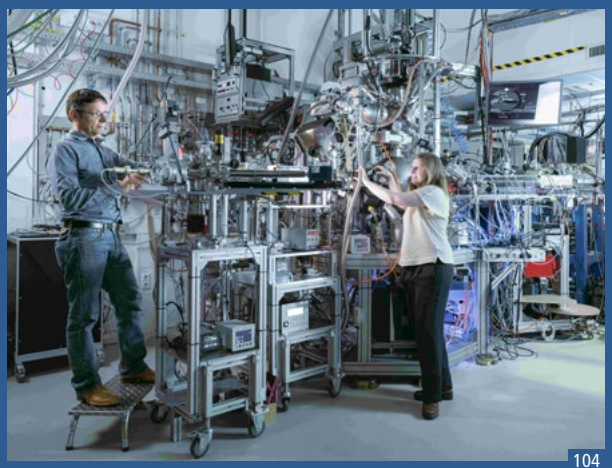
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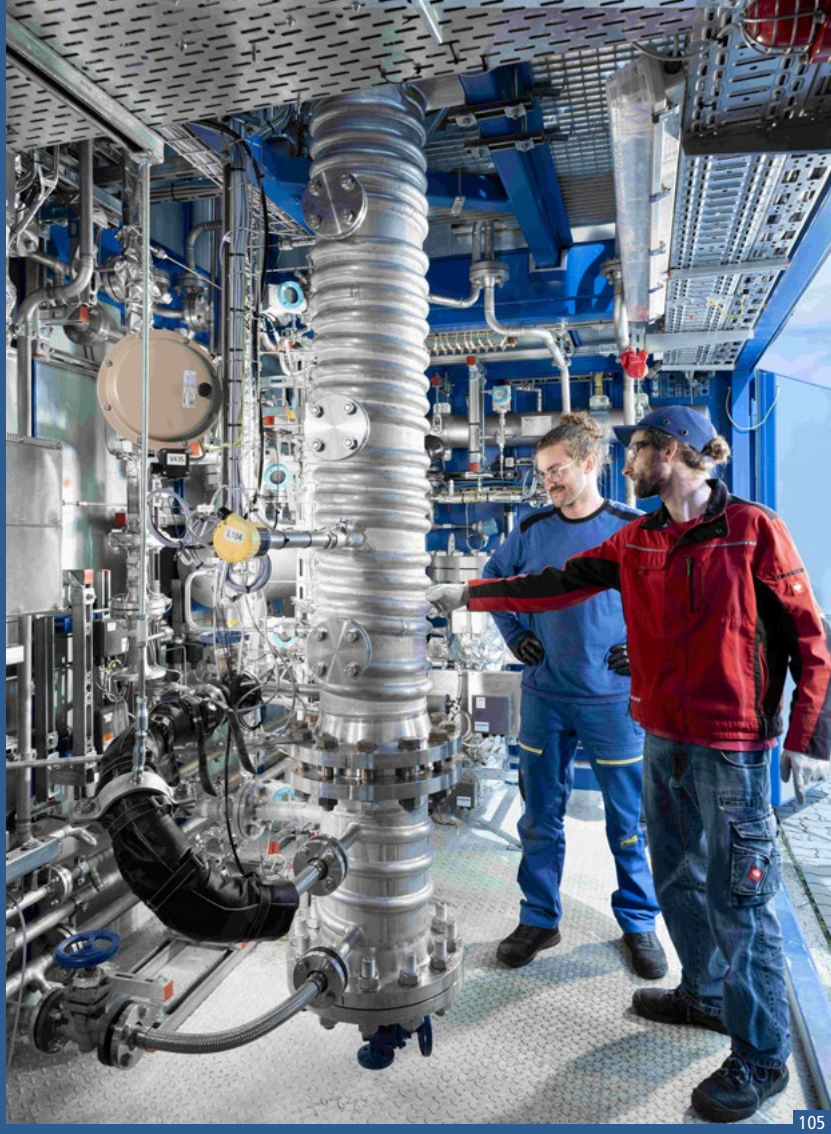
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NEW FORMAT OF THE KIT FOUNDERS FORGE

KIT Innovators Homecoming 2024 Connects the Alumni and Startup Communities

The first KIT Innovators Homecoming took place on January 31, 2024. It brought together more than 300 KIT alumnae and alumni from the startup community. Former students, who have written impressive success stories in the meantime, met up to share their experiences and knowledge.

Thomas Neumann, Head of KIT Founders Forge, and Thomas Hirth, Vice President Transfer and International Affairs at KIT, opened the event with inspiring speeches. They stressed the importance of networking between the generations and the role of KIT as an innovation enabler.

The event demonstrated the potential of the alumnae and alumni to create even greater innovations jointly and to strengthen the founders' ecosystem. The event was enriched by inspiring keynotes and lively discussions with Elias Schneider, Nicolas Burkardt, Larissa Eger, Omar Hedeya, Tobias Grab, Daniel Stammler, and Janosch Kühn.

A special focus of the event was on the KIT spinoffs that presented themselves in the startup exhibition. They illustrated the enormous innovative strength and diversity that emerges from the KIT community. The startups covered a broad range of industries: Software and artificial intelligence, life sciences, materials sciences, energy and mobility, reflecting the technological focus of KIT.

KIT Innovators Homecoming is a new exchange format established by KIT Founders Forge. [110]

The event was not only an opportunity for former students and startups to exchange views, but also a living example of the strength of the KIT network. Besides the startup scene, several CEOs and KIT teachers were present. The participants from all generations made valuable contacts, exchanged their experiences, and promoted the innovative strength of both sides.

The day culminated in an after-hour party with music and drinks that continued until late. The event was organized by KIT Founders Forge, one of the largest university founder centers in Germany, which pools all activities around entrepreneurship.

KIT Innovators Homecoming was far more than just an alumni reunion – it was a manifestation of the strength of the community and the spirit of innovation characterizing KIT. The event was a full success and will continue to be held annually in the future.

KIT Founders Forge

KIT Founders Forge was established in 2013; it is one of the largest university founder centers in Germany. It pools all activities related to founding and entrepreneurship to achieve more impact for the founder teams. Being the initial point of contact for persons interested in founding a technology-based company, it accelerates innovative business ideas, and it accompanies startups with its offers in all development phases, supporting them to establish powerful technology companies. ■

More information (in German)::
https://innovators-homecoming.de/

DIALOGUE WITH SOCIETY

WISSENSWOCHEN and More in TRIANGEL Transfer | Culture | Space

With TRIANGEL Transfer | Culture | Space on Karlsruhe Kronenplatz, KIT has created a place of interaction in order to intensify the dialogue with society and to make research a tangible experience. Among last year's highlights were the WISSENSWOCHEN (knowledge weeks), a successfully established format that presents selected topics to the interested public over several days. In 2024, two of these events were realized: The "Maths" knowledge week and the "Mobility in the Data Rush" knowledge week hosted by the ANYMOS cluster of competence, which is funded by the Federal Ministry of Education and Research. Besides these, other events, such as the Days of Democracy, the 70th anniversary of CERN, the Real:lab Festival, and the Science Camps for children and adolescents, completed last year's calendar.

"Maths" Knowledge Week

Mathematics, often considered a dull subject, fascinated many visitors in November. In collaboration with the KIT MathSEE (Mathematics in Sciences, Engineering, and Economics) Center, TRIANGEL offered the opportunity to discover how art is made from formulas, get to know female NASA idols, or get to the bottom of mathematical models. Panel discussions, workshops for schoolchildren, and a science slam guaranteed for an interesting, varied program.

"Mobility in the Data Rush" Knowledge Week

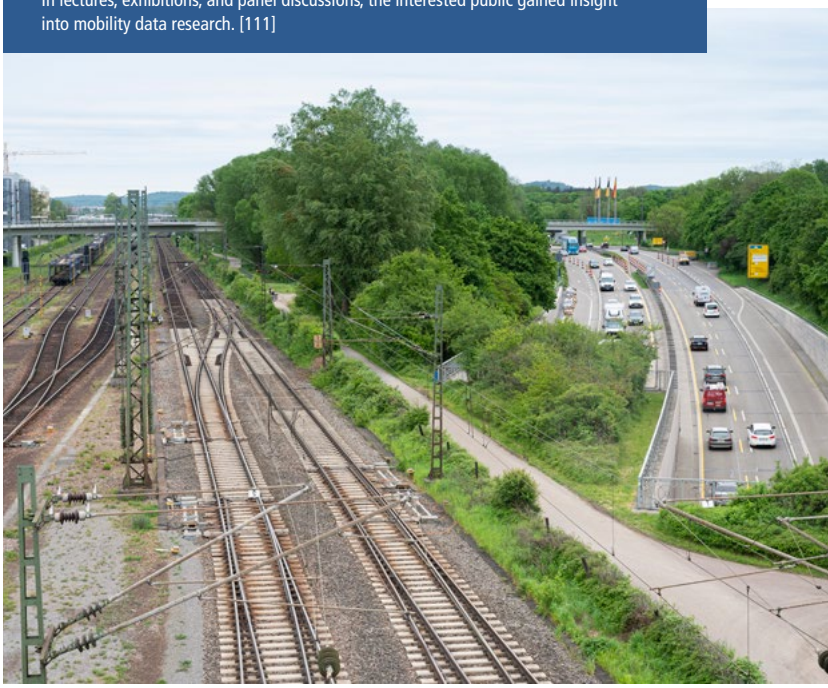
Whether you are planning your next journey by train or are navigating on the motorway – users of mobility services leave data everywhere. How do researchers collect and use this data and at the same time ensure the anonymity of the users? The ANYMOS competence cluster (Anonymization for Networked Mobility Systems), to which KIT belongs, is working on these issues.

Days of Democracy and 70 Years of CERN

Unrestricted exchange of opinions and open research create a close link between science and democracy. In the course of one week, KIT saw both the Days of Democracy, adopting the title of the Science Year 2024, "Freedom", and celebrations of 70 Years of CERN. On the occasion of the International Days of Democracy, the public was invited for the third time already to engage with issues on democratic values. In collaboration with Karlshochschule (Future Democracies) school, EU Dialogue Perspectives, and Junge Juristen Karlsruhe e. V. association, a varied program had been organized that included city walks, discussion formats, and the first issue of "STULLE – wissenschaftlich belegt", a late-night show dealing with scientific discoveries.

In parallel, CERN and KCETA, the KIT Elementary Particle and Astroparticle Physics Center, celebrated the anniversary of the famous research center in Geneva, providing interesting insight into the Higgs boson and particle physics. ■

In lectures, exhibitions, and panel discussions, the interested public gained insight into mobility data research. [111]



INTERREGIONAL KNOWLEDGE TRANSFER

Cooperation with Campus Schwarzwald

KIT scientists will be even more active in the Black Forest region in the future. To seal these efforts, Professor Thomas Hirth, Vice President Transfer and International Affairs at KIT, and Stefan Bogenrieder, Managing Director of Campus Schwarzwald, signed a cooperation agreement in August 2024. This partnership marks the beginning of an intensive collaboration between two leading educational and research institutions, pooling the expertise and resources of KIT and Campus Schwarzwald.

The collaboration of industrial partners and practice-oriented research will strengthen the transfer of technology and knowledge. Thus, significant progress in various scientific and industrial fields will be possible. KIT will benefit from the application-oriented research at Campus Schwarzwald and the joint use of resources and infrastructure. Both institutions attach great importance to sustainable development and technologies, particularly through relevant projects.

The collaboration starts with projects headed by Professor Mike Barth and Professor Sören Hohmann from KIT's Institute for Control Systems. Their joint research projects are about the digitalization of forests with autonomous robot swarms for optimized agriculture and the development of self-learning models for an assistance system for setting up complex machines. Cutting-edge research and entrepreneurial ingenuity meet at eye level, creating a continuous innovation chain.

The goal is to jointly provide important impulses for industry and science in research and development and to strengthen the region economically and technologically with specific projects. The collaboration of KIT with the network of industrial partners will strengthen practice-oriented research and the transfer of technology and knowledge.

Campus Schwarzwald benefits considerably from this cooperation by gaining access to cutting-edge research and highly qualified specialists, strengthening their local research and development activities. A special highlight will be joint research projects, where doctoral researchers will cooperate closely with industry partners at Campus Schwarzwald. Companies in the Black Forest region will benefit greatly from this cooperation. Access to cutting-edge research and highly qualified specialists strengthens their competitiveness and helps them to boost their innovative strength and product development. ■

More information (in German):
https://www.campus-schwarzwald.de/

Delegations from Campus Schwarzwald and KIT signed a cooperation agreement in August 2024. [112]

NEULAND INNOVATION CONTEST

The Winner: Laser-based Process Ensuring Eyesight from a 3D Printer

When the cornea becomes deformed or loses its transparency, vision is seriously impaired. Corneal disorders are a typical phenomenon of old age, and increasing numbers of people in our aging population suffer from them. A groundbreaking step in the fight against corneal disorders is about to become reality with a laser-based process using personalized bioink: While the patient is undergoing surgery, a new cornea is printed to restore a patient's eyesight.

Direct 3 D printing of customized cornea was developed by researchers at KIT in collaboration with Carl Zeiss Meditec AG and Evonik Healthcare. Their project won the idea award in this year's NEULAND innovation contest.

Instead of having to rely on cornea donations, the "VisioPrinTech" process uses bioink made from the patient's own stem cells and chemically modified collagen fibers. The laser-based process allows the team to precisely position these cells to generate transparent and functional corneas with minimal risk of rejection.

The method is set to provide a promising alternative to conventional transplantations and is also a crucial step toward personalized medicine. In a project involving industry partners, the technology will be scaled up in the next step, with initial production and testing in small batches.

In addition to "VisioPrinTech," two other innovative projects won awards in the NEULAND innovation contest. The "RareCycle" project investigating magnetochromatography for the future of rare earth recycling won the silver medal. The project involves a method that will revolutionize the recycling of rare earth metals and could be put to use in a wide range of industries. Another award went to the "HoStaBau" project on wood-steel hybrid construction methods for sustainable transformation of the construction industry.

About the NEULAND Innovation Contest

For the 12th time in succession, KIT called on its researchers and doctoral students to present the innovative projects resulting from their research activities. In addition to a chance to win cash prizes totaling EUR 9,000, the best ideas are accompanied during the transfer process by KIT innovation managers. ■

The winners of the idea awards at KIT's NEULAND innovation contest. [113]

More information:
Contest videos on YouTube (in German):
https://www.youtube.com/playlist?list=PL7uLSVpeOg9AW4sC-8_mkfdzlMKs7zcEK
NEULAND magazine (in German):
https://kit-neuland.de/de/magazin/

PROMOTING YOUNG TALENT

Attracting excellent young scientists and providing them with postdoctoral support are of great strategic importance to KIT.

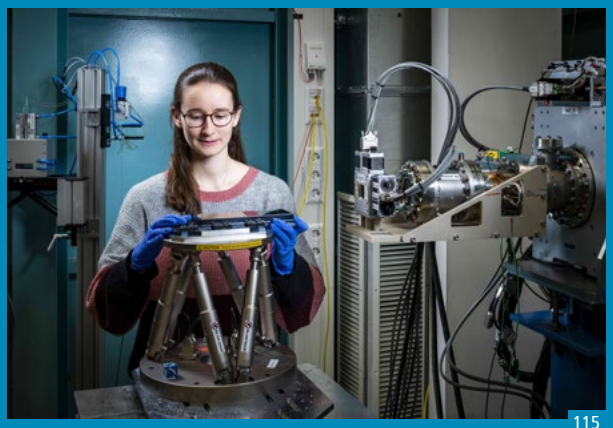
In the context of implementing the Institutional Strategy of the Excellence Initiative launched by the Federal and State governments, the Young Investigator Group Preparation Program (YIG Prep Pro) was launched at KIT in 2019. Its purpose is to recruit top-class postdocs, preferably with an international background, who are interested in setting up a junior research group and establishing their research at KIT. The program aims at increasing the number of junior research groups at KIT by providing targeted and compre-

hensive support in the preparation of the applications for establishing a junior research group.

In 2024, KIT succeeded in attracting nine excellent young scientists from the US, Ecuador, Israel, Poland, Great Britain, Bangladesh, Belarus, Russia, and Austria. KIT created new posts for five of these fellows, three of the fellows were supported remotely during the application process, one fellow was inducted into the program as KIT postdoc.

In 2024, the program boasted five successful applications by the fellows: Three Helmholtz research groups, one Emmy Noether junior research group of the German Research Foundation, and acceptance of one Nexus junior research group that had submitted its application even before starting its YIG Prep Pro fellowship.

In the five rounds of calls since the program's inception in 2019 until 2024, there have been 414 applicants from 65 countries, and KIT has gained a total of 69 fellows. The selection rate in the highly competitive process is 17 percent. 32 women (46 percent) were inducted altogether into the program. The share of foreign researchers is 67 percent. In 2024, only international researchers were inducted into the program.



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OUTSTANDING QUALIFICATIONS

Eight New Junior Research Groups at KIT

The objective of KIT's excellence and third-party funding strategy is to attract outstanding young scientists. The young researchers, who want to advance their scientific subjects at KIT, are supported in getting established through premium junior research group funding raised in competitive processes. A total of nine new junior research groups were established at KIT in 2024.

Emmy Noether Junior Research Groups

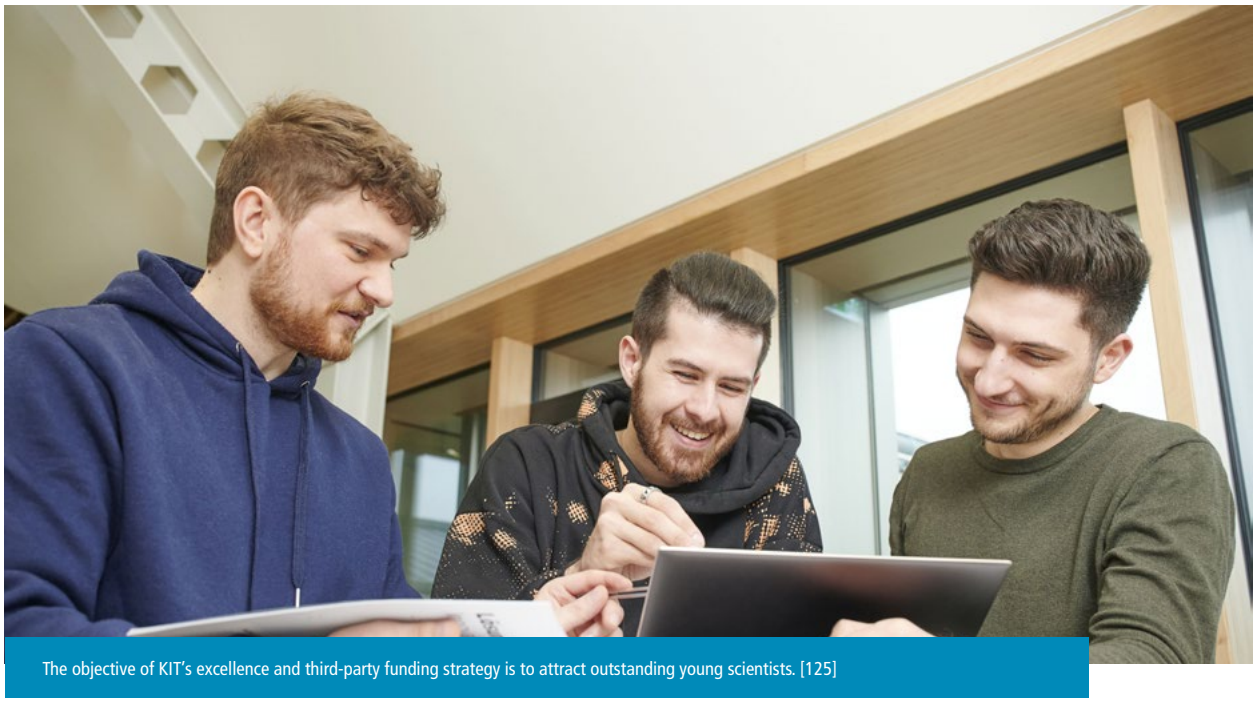
Emmy Noether junior research groups, a funding instrument of the German Research Foundation (DFG), support young, highly qualified scientists and untenured junior professors in an early phase of their scientific careers.

Dr. Martin Halla from the Institute for Applied and Numerical Mathematics works on the Emmy Noether project "T-coercivity and Target Signatures in Computational Wave Propagation," investigating wave-propagation phenomena using novel theoretical tools, so-called T-coercivity techniques.

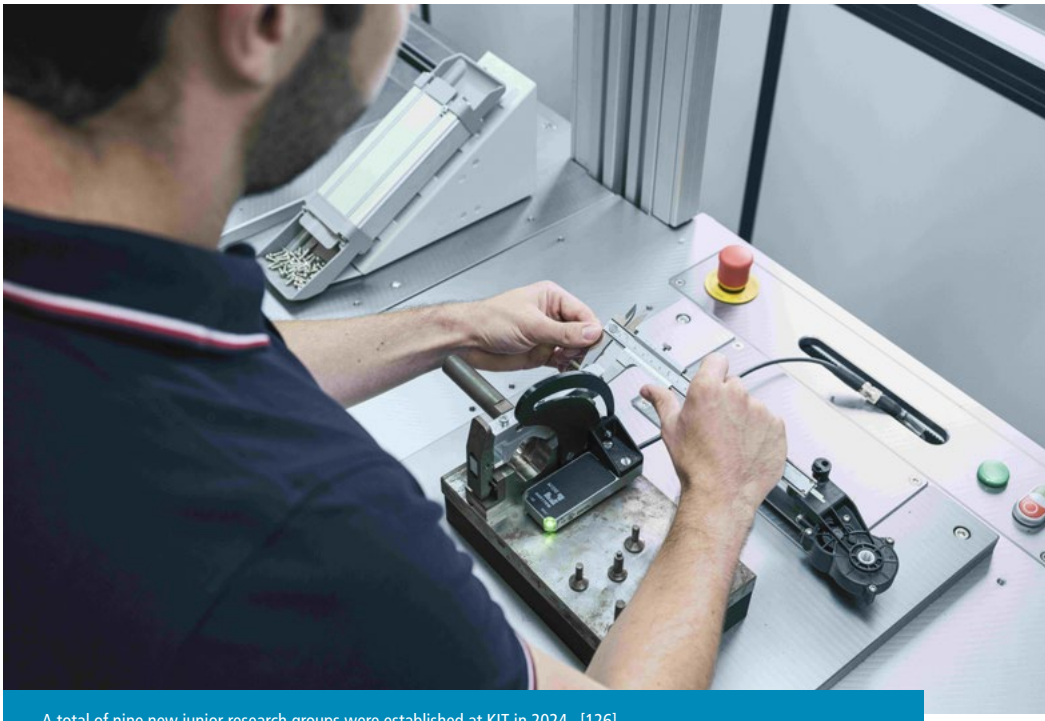
Dr. Alexander Fengler from the Communications Engineering Lab explores with his Emmy Noether group "Energy-efficient uncoordinated communication and modern statistical learning" to develop new protocols for uncoordinated communication in radio access networks that support a great density of cost- and energy-efficient transmitters.

Dr. Bjarne Kreitz from the Institute for Chemical Technology and Polymer Chemistry works on his Emmy Noether project entitled "Advancing catalytic plastic waste recycling through multiscale modeling with detailed chemical kinetics" to find a promising solution for a profitable closed-loop economy for catalytic upcycling of polyethylene waste.

Dr. Jan Christian Masell from the Institute for Theoretical Solid-State Physics deals on the Emmy Noether project with the research topic "Design and Functionalization of 3D Magnetic Textures," where he tackles multiple stages on the road from designing to functionalizing 3D magnetic textures and solitons.



The objective of KIT's excellence and third-party funding strategy is to attract outstanding young scientists. [125]



A total of nine new junior research groups were established at KIT in 2024. [126]

Helmholtz Research Groups

For the following topics, KIT obtained an approval of funding in 2024 in a call for proposals for Helmholtz Research Groups by the Helmholtz office.

Dr. Arik Beck from the Institute for Chemical Technology and Polymer Chemistry investigates "Dynamic Multi-Wavelength Photocatalysis" with his Helmholtz Research Group. CO_2 emissions of catalytic processes can be reduced dramatically with LED-operated photocatalysis. The aim is to demonstrate the selective activation of photocatalytic centers using special catalysts that react to different LED wavelengths.

Dr. Yanina Biondi from the Institute for Astroparticle Physics works on the research topic "Power it on: Large-Scale Frontier of Xenon Detectors for Dark Matter" with her Helmholtz Research Group. This is about developing and qualifying essential detector components and to perform sensitivity studies for the future xenon-based DARWIN detector for weakly interacting dark matter.

Dr. Gan Huang from the Institute of Microstructure Technology investigates the research topic "Harvesting the coldness of the universe for sustainable cooling under solar radiation." The objective is to develop sustainable cooling technologies for buildings and vehicles on the basis of polymer-based metamaterials that dissipate excess heat via thermal radiation into the cold universe.

CZS Nexus Junior Research Group

The Carl Zeiss Foundation is funding research and teaching in the STEM subjects (science, technology, engineering, and mathematics). The CZS Nexus funding scheme supports excellent young scientists who want to realize exciting ideas at the interfaces between the different STEM disciplines. Thus, they have the opportunity to build their own interdisciplinary research groups and are supported on their way to a scientific career.

Dr. Johanna Schröder from the Institute for Chemical Technology and Polymer Chemistry is researching on the development of materials and structural members for sustainable energy solutions. In the production of sustainable fuels via electrolysis, novel catalysts play a decisive role. Johanna Schröder intends to accelerate the production of cost effective, sustainable fuels by using resource-efficient catalysts that do not require noble metals. ■

AWARDS

Prize of the Leopoldina for Young Scientist Jingyuan Xu

Awardee Dr. Jingyuan Xu in her laboratory at KIT. [127]

With the Leopoldina Prize for young scientists 2023, German National Academy of Sciences Leopoldina honored Dr. Jingyuan Xu, who researches novel heating and cooling technologies for the energy transition at KIT. Jingyuan Xu received the EUR 5,000 prize at the Leopoldina Spring Reception in Halle (Saale) on March 18, 2024, and presented her research in a lecture.

Jingyuan Xu has been working at the Institute of Microstructure Technology (IMT) at KIT since 2021. There, she initially conducted research as a Humboldt Research Fellow and KIT Young Investigator Group Preparation Program Fellow. Since 2024, she has been leading the CZS Nexus research group "Emissions-free and Environmentally Friendly Heating and Cooling Technologies" (ZEco Thermal Lab), funded by the Carl Zeiss Foundation, for which she has raised EUR 1.5 million. In the ZEco Thermal Lab at the IMT, she and her team of eight are focusing on the development of high-performance, CO_2-neutral heating and cooling technologies.

Xu concentrates her very own research on novel, solid-state cooling processes that utilize shape memory alloys. In so-called elastocaloric cooling systems, temperature changes are achieved through mechanical force. Unlike conventional cooling using vapor compression, no environmentally harmful gaseous refrigerants are used.

Cooling based on elastocaloric materials is also considered low-maintenance, efficient, and – e.g. for electronics microcooling – a future option for various application areas.

Two other significant awards have recently been awarded to Jingyuan Xu: In February 2024, the Hector Fellow Academy (HFA) announced that the young scientist in energy engineering will be awarded the Hector Research Career Development Award. The sponsorship is endowed with EUR 25,000 and includes, among other things, funds for a doctoral position. It is awarded annually to three particularly promising researchers on their path to professorship.

Also in February 2024, it was announced that Jingyuan Xu would become a member of the Global Young Academy for five years. The Academy, founded in Berlin in 2010, aims to promote dialogue and collaboration among young scientists worldwide. The number of members is limited to 200; selection criteria include scientific excellence and social commitment. ■

More information:
Prize of the Leopoldina (in German):
https://www.leopoldina.org/presse-1/pressemitteilungen/pressemitteilung/press/3021/
Hector RCD Award:
https://hector-fellow-academy.de/en/news/new-winners-of-the-hector-research-career-development-awards/
Global Young Academy:
https://globalyoungacademy.net/new-members-2024/
ZEco Thermal Lab at the IMT:
https://www.imt.kit.edu/3484.php

PROMOTING YOUNG TALENT

KIT and Intel Develop Microchip for Research-oriented Teaching

Students and researchers at KIT, together with the US chip manufacturer Intel, have developed a microchip designed for research and teaching – starting from the design process to tape-out and eventually raw-die characterization. The chip is called "KIT-Callisto," it has a total area of four square millimeters and exploits state-of-the-art transistor technology from Intel.

Doctoral students Palak Gupta and Alexander Elsenhans at work on "KIT-Callisto." [128]

The project was enabled by the "Intel University Shuttle Program," in which the chip manufacturer cooperates with universities worldwide after a competitive selection phase. The KIT-Callisto test chip is the first microchip designed by a German university that has now gone into production at Intel. It was mainly developed by doctoral researchers and is to be used in research-oriented teaching for master's degree courses in electrical engineering and information technology.

The microchip contains a number of test structures and circuits developed in multiple research projects, including for example circuits for controlling time-critical processes, diodes for particle detectors, integrated noise suppression, and much more. The Finfet transistors used have been optimized for space and energy efficiency. The KIT-Callisto microchip will measure just two millimeters by two millimeters when leaving Intel's production site in the US, i.e. it is smaller than a grain of rice.

The Karlsruhe contribution to KIT-Callisto will allow to measure undesired current fluctuations in microchips more effectively. Even though these fluctuations are very small, they still cause problems, for example, in mobile phone data transmission or distance measurements with radar sensors.

Thanks to its ultramodern, powerful Finfet technology, KIT-Callisto is a unique microchip for research and teaching. Among other things, it includes various circuits for precise time measurement and particle detection.

Dr. Peter Baumgartner, head RF engineer at Intel, guided the students throughout the project and helped them conclude the successful tape-out on time. Bryan Casper, program coordinator at Intel, was particularly impressed by the commitment of the KIT students in the joint project. For him, it was confirmation that training future specialists should start early during their studies. ■

INTERNATIONAL AFFAIRS

Every year, KIT attracts a large number of international researchers who either work here or come as visiting scientists. The researchers and their hosting institutions are supported with individual, customized advice by the International Scholars & Welcome Office. Since the introduction of the mandatory registration of visiting scientists on May 1, 2024, they also have access to information tailored to their individual needs through their own account.

Registration of the visits serves as a basis for strategic measures taken by KIT to further strengthen international cooperation and better meet the needs of visiting scientists. This support, the excellent infrastructure, and

numerous high-ranking international cooperations underline the attractiveness and visibility of KIT on a global level.

With regard to the number of international students, KIT has observed a continuing positive development. While the total number of students decreased slightly in the 2024/25 winter semester, the number of international students increased by 9.2 percent compared to the previous year.

Especially students from India showed growing interest in KIT. This is due in particular to the extended range of master's degree programs held in English. KIT also remains a sought-after academic institution for Chinese and Turkish students.

The two big challenges that clouded the previous years – the introduction of tuition fees for international students in 2016/17 and the limitations caused by the Covid pandemic in 2020 – have been overcome in the meantime. The number of applicants for the 2024/25 winter semester has reached a new all-time high. These developments underline the growing international attractiveness of KIT and its signification as an excellent place of research and learning for the global science community.

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COSMIC RADIATION

Extension of the Collaboration with the Pierre Auger Observatory

With an area of 3,000 square kilometers, the Pierre Auger Observatory is the largest measuring facility for cosmic rays worldwide. It is operated by more than 400 researchers from 17 countries. A great number of scientists from KIT are involved in the research with the detector system. Highest-energy particles from cosmic radiation are detected here in order to understand their type, origin, and distribution over millions of light years. In 2024, the international joint project was extended: On November 16, representatives of the partner organizations, including KIT, signed a corresponding agreement. The Executive Board of KIT was represented by Thomas Hirth, Vice President Transfer and International Affairs.

KIT has been and still is a major actor in the planning, construction, and operation of the Pierre Auger Observatory. Dr. Markus Roth from KIT's Institute for Astroparticle Physics is a co-spokesperson for the collaboration. Within the Pierre Auger project, a sustainable scientific collaboration between KIT and the Universidad Nacional de San Martín (UNSAM) in Buenos Aires has been developed. Since 2018, the aim of this partnership has been to extend this research cooperation beyond astroparticle physics and to include various common research areas, such as nanotechnology, geosciences, and nuclear safety. Among other things, a double-doctoral degree program involving KIT and UNSAM was established in 2014. It has been pursued in the meantime by 18 doctoral researchers from Germany.

The task of the Pierre Auger Observatory in its former configuration, the so-called phase I, had been the collection of data for about 15 years until the end of 2021. This data revolutionized the understanding of high-energy phenomena related to processes in the universe. Scientific breakthroughs have been achieved in several areas.

With the new agreement, the project is beginning its second phase. The perspectives opened up by the research results required an upgrade of the observatory. The aim is to collect information on the primary mass of the highest-energy radiation on the basis of air showers. Data acquisition with an upgraded array will start in 2025 and continue for a further ten years. ■

More information:
https://www.auger.org/

Members of the Pierre Auger Collaboration in Malargue, Argentina. More than 400 researchers from 17 countries are involved in the collaboration. [142]

INTERNATIONAL EXCELLENCE AWARD

Climatologist Chris Funk Honored

In an official ceremony on November 25, Dr. Chris Funk, Director of the Climate Hazards Center at the University of California, was awarded the 2024 International Excellence Award of KIT and the Fellowship of SCHROFF Foundation. Funk's research is dedicated to optimizing the remote sensing methods used to monitor droughts, extreme precipitation events, and heat waves in tropical regions. Funk played a key role in developing a method for estimating precipitation. Because of its high quality, the method has been used in hundreds of studies on climate change adaptation. He has a special focus on Africa and has developed innovative methods for predicting rainy periods in the Horn of Africa that has been suffering from drought. These methods have significantly improved early warnings in recent years for the people of eastern Africa.

The awards include an invitation to a research stay of up to six months at KIT. Professor Thomas Hirth, Vice President Transfer and International Affairs, stressed that the awardee Chris Funk is a dedicated climatologist of international repute. In climate research, international cooperation is the key to studying and understanding the complex effects of climate change.

With the International Excellence Award, KIT is highlighting for the second time the attractive research environment at KIT, which provides outstanding opportunities for cooperation among researchers from all over the world. The award is primarily intended to promote scientific exchange. Not only will this open up new avenues for the transfer of research findings, it will also enable the development of solutions for global challenges.

In addition to the research stay, the prize includes several months' funding for accompanying junior researchers from Funk's group and up to EUR 50,000 for equipment for a research project to be conducted at the host institute of KIT. The conferral is to blend Chris Funk's expertise as a global leader in the field of the climate system's long-range effects on Africa with KIT's expertise on African weather systems. Awarding the prize to him also underscores a current strategic initiative at KIT to strengthen and expand research alliances with Africa; this effort will benefit from Funk's extensive network in Africa.

US climatologist Dr. Chris Funk (2nd from right) is awarded the International Excellence Award of KIT and Fellowship of SCHROFF Foundation 2024. [143]

The award is part of the International Excellence Grants initiative within the framework of KIT's successful University of Excellence concept. It is aimed at promoting international collaboration in top-level research and attracting international researchers to KIT. ■

More information:
https://www.intl.kit.edu/ischolar/13474.php

INTERNATIONAL COOPERATION

25 Years of Partnership with Tongji University in Shanghai

Tongji University in Shanghai and KIT have been partners since 1999. On November 5, 2024, KIT and Tongji University celebrated 25 years of partnership with a two-day event in Karlsruhe. Professor Jan S. Hesthaven, President of KIT, and Professsor Dr. Fang Shouen, Chairman of the University Council of Tongji University, opened the ceremony renewing their cooperation agreement and extending it to a strategic partnership.

In 2007, the first exchange agreement between both universities was concluded, and in 2012, the agreement on a double-master's program for mechanical engineering was signed. Both universities founded the Advanced Manufacturing Technology Center on the Jiading Campus in 2013. KIT's Institute of Production Science is the scientific partner in this cooperation. In 2015, the strategic partnership of both universities was confirmed. The I4TP research project established in 2018 was funded jointly by the Federal Ministry of Education and Research and the Chinese ministry of science and technology. In 2021, both parties signed a memorandum on the collaboration in the Sino-German Joint Research Center. The cooperation has been pursued consequently and continuously, including new topics. Thus, the two universities opened the Sino-German Environmental Center at Tongji in 2023. Its focus is on developing joint research projects on water treatment and management, soil decontamination, raw materials, and closed-loop economy. In the long run, joint programs for students and early career researchers might be established.

Today, the cooperation extends across all five Divisions of KIT and almost all eleven KIT Departments. Scientists from both universities do research and teaching together on topics in mechanical engineering, automotive engineering, batteries of the future, mathematics, economics, chemical processes in plastics recycling, and German studies. On the occasion of the anniversary, a delegation from Tongji University toured several research facilities of KIT. ■

More information:
Strategic partnership with Tongji University:
https://www.intl.kit.edu/english/21776.php
Tongji University:
https://en.tongji.edu.cn/p/#/

Representatives from Tongji University and KIT celebrating the anniversary in Karlsruhe. [144]

EPICUR AND EUCOR

International Research and Teaching Expanded at KIT

Since 2019, EPICUR has stood for an attractive and innovative alliance of European universities. The association of nine partner universities, offering a diverse interdisciplinary course program, is shaping a new student generation in Europe. Within EPICUR, an new central service unit was established in 2024: The Centre for International Teaching and Learning (EPiC TLC) for teachers and teaching support staff. The virtual EPiC TLC offers a wide range of opportunities for networking, professional development, and inspiration. It thus strengthens internationalization, innovation and, last but not least, the joy of high-quality university teaching. The resources and offers provided support teachers in the didactic design of courses with intercultural groups and innovative teaching formats.

During the online opening on February 23, 2024, around 180 participants from all partner universities had the occasion to discover the offers at the new service center. Following the introduction to and presentation of EPiC TLC, a red ribbon was cut symbolically at all EPICUR universities. The platform is developed and maintained by a task force with members from all institutions of the alliance, headed by Dorthe Hutz-Nierhoff and Dr. Lisa Hüther-Pape from University of Freiburg. KIT participates in the task force with members from the Center for Technology-Enhanced Learning and the Human Resources Development and Vocational Training as well as the International Affairs business units.

EUCOR, the three-nation confederation including five universities in the Upper Rhine region, is also being expanded: A third cross-border professorship has been established. Since September 2023, Professor Karl Matthias Wantzen holds the joint "Water and Sustainability" EUCOR professorship. This position creates a further bridge between KIT and the University of Strasbourg in cooperation with the École Nationale du Génie de l'Eau et de l'Environnement de Strasbourg. At KIT, Matthias Wantzen works at the Institute for Water and Environment.

The new professorship strengthens water research at KIT and the cooperation on the strategic "Sustainability" topic of the EUCOR – The European Campus confederation. The aim of this professorship is to expand interdisciplinary research and teaching on sustainable water management

During the online opening of the Centre for International Teaching and Learning on February 23, 2024, a red ribbon was cut symbolically at all EPICUR universities. [145]

with a focus on the Upper Rhine region, and the development of projects together with private and public partners in order to react jointly to global challenges, such as the water and biodiversity crises. It is planned to establish a cross-border, transdisciplinary master's degree program on "Continental Water Sustainability" that is to start in September 2026. In preparation of this program, an EUCOR Fall School was offered.

Establishing cross-border professorships is an EUCOR pioneer project. KIT is involved in all cross-border professorships. The extension of cross-border professorships is one of the major goals stipulated in the EUCOR strategic plan 2024 to 2030. ■

More information:
EPICUR:
https://epicur.edu.eu/
EUCOR:
https://www.eucor-uni.org/en/
Eucor Fall School:
https://www.eucor-uni.org/en/news/eucor-fall-school-on-sustainable-water-use-on-the-rhine

KIT AS AN EMPLOYER

With 10,107 employees, KIT is one of the largest employers in the Karlsruhe technology region. Its workforce comprises 5,872 scientific and 4,235 administrative and technical staff. Women make up 40 percent of the workforce. There are about 2,000 foreign citizens, mostly scientific staff, employed at KIT. KIT employs 415 professors, of whom 19 were new appointees in 2024.

Moreover, there are 337 young people receiving vocational training for over 25 professions at KIT; this includes people studying at Baden-Württemberg Cooperative State University, preparing for their future jobs in twelve study programs. This three-year studies combine

scientific theory at the Cooperative State University with on-the-job practice.

With its students and researchers coming from more than 120 countries, KIT stands for open-mindedness, dialog, and tolerance, and therefore rejects any discriminatory, racist, anti-Semitic, or Islamophobic statements or actions. As a member of the alliance for democracy and human rights Karlsruhe, which was founded in April 2024, KIT, jointly with more than 40 initiatives, churches, religious communities, political parties, associations, clubs, and institutions from Karlsruhe, advocates our free democratic basic order and an open dialogue.

The dissolution of the special funds for the large scale-research and university sectors as part of the 2nd KIT Further Development Act paved the way for a common annual financial statement for the financial year 2023 under commercial law. Besides a combined financial statement, segment reports for the large-scale research and university tasks were submitted in the form of a balance sheet and a profit and loss statement. These were reviewed by auditors in the first half of 2024 and given an unqualified audit opinion.

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"NEW WORK" FOLLOW-UP PROJECT

New Mobile Work and Desk Sharing Service Agreement

October 2023 saw the start of the implementation phase of the "New Work" follow-up project, a sequel to the "New Work" lead project. The objective is to shape a working environment that secures the long-term efficiency of the organization and the well-being of the employees, enables a good work-life balance for the employees, and takes individual needs into account while complying with the requirements of the organization.

The "New Work" follow-up project comprises work packages for work time and workplace flexibilization, sustainable space management by flexibilization, managerial advancement, as well as cultural change and a widespread introduction of the New Work formats. In 2024, a new mobile work and desk sharing service agreement was concluded to enable the flexibilization of work time and workplace. It became effective at the beginning of July, 2024.

The most important regulations encompass, on the one hand, the extent of mobile work. Depending on the suitability of the activity and the functionality of the organizational unit, it can amount to up to 80 percent of the contractually agreed work time. The previous rate was 40% in comparison. Here, KIT counts on a culture based on a high level of trust and responsible acting of executives and employees.

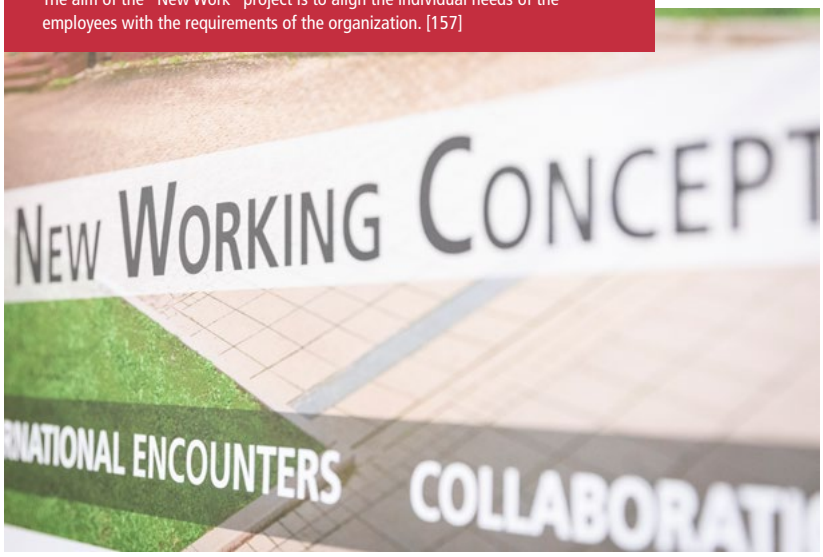
On the other hand, the process of granting mobile work conditions by the direct manager is done in ten-percent steps. Mobile work is granted permanently and can be terminated by either party giving three months' notice. For operational reasons, such as events and appointments, employees may be compelled to work on-site at any time.

By introducing a desk-sharing model, KIT intends to support a sustainable and efficient use of the spaces available at KIT. From now on, the managers of organizational units can opt for taking part in the three-pillar model described below. Exceptions in the form of other usage models are nevertheless possible.

The first pillar represents the fixed workplace, the second shared offices with more workplace users than workplaces. The employees themselves take care of scheduling workplace allocation. The third pillar is the so-called flex office where the workplaces can be booked through an electronic system.

The choice of pillar depends on the proportion of mobile work of each employee. Up to 40 percent of mobile work, the employee can choose any of the three pillars freely. Employees who were granted more than 40 percent of mobile work can be obliged to freely choose either pillar two or pillar three.

The aim of the "New Work" project is to align the individual needs of the employees with the requirements of the organization. [157]



The project is supplemented by activities for sustainable space management and flexibilization. Moreover, there are various formats for the majority of employees, such as virtual "continued education workshops", for example for team development in "New Normal," and the "Leadership now" workshop series for executives. ■

DIVERSITY

Employer Branding and Diversity Monitoring

Diversity is to be anchored as a cross-sectional task all over KIT and a periodic monitoring is to be conducted for this. [158]

Employer Branding

The "Excellence Through Diversity - Increasing Employer Attractiveness Through Diversity-sensitive Employer Branding and HR Marketing" project, for which funds were acquired from the Initiative and Networking Fund of the Helmholtz Association, started successfully in 2024. It has two funding phases and has the goal of making KIT more visible as an attractive employer, especially to win over women and international top talent. What is more, diversity-sensitive processes in recruitment should be strengthened.

The first funding phase focuses on developing an employer branding coordinated within KIT. In the second funding phase, human resources marketing is to be expanded in a diversity-sensitive way and made usable for the organization.

Relying on external support, an analysis of the actual state of how KIT is perceived as an employer was conducted in 2024. For this purpose, "Why@KIT" workshops were conducted with the participation of KIT employees: In four focus groups in German and English, a representative sample of employees, managers, and stakeholders was involved in this analysis. Interviews with executives and the Executive Board of KIT augmented the comprehensive analysis of the actual state, contributing to the development of a diversity-sensitive employer brand for KIT.

Diversity Monitoring

The "Introduction of diversity mainstreaming at KIT" project, which is funded by German Rectors' Conference, has the aim to anchor diversity as a cross-sectional task all over KIT and to implement periodical diversity monitoring for this purpose. Moreover, it is intended to develop diversity competencies and to integrate diversity aspects also in research projects.

This led to the development of an employee survey on diversity and collaboration at KIT, which was conducted in September 2024. 17.5% of the KIT employees, 1,756 persons altogether, took part in the survey and shared their thoughts about topics such as participation, sense of belonging, and work-life balance at KIT. The objective of the survey was to assess the current situation at KIT with respect to the mentioned topics and the state of implementation of the core areas of the KIT Diversity Statement.

All told, the majority of the queried aspects at KIT were rated positively. A highlight were the results for the statement that working together with people that have different skills, interests, and backgrounds is an enriching experience. More than 90 percent of the participants agreed. More result highlights can be viewed in the Diversity Dashboard created by the Equal Opportunities and Diversity Management. In addition, a detailed report will be published in the course of 2025. ■

EQUAL OPPORTUNITIES AT KIT

Results of the 2023 Gender Monitoring Report and 2030 Female Professors Program

The annual gender monitoring report describes the current state regarding the shares of women at the executive level, in bodies, among scientists, research assistants, and students. The purpose of gender monitoring at KIT is to establish a reporting and control instrument that focuses, besides a fact-based representation of the equal opportunities situation and the implementation of measures promoting equal opportunities, on the realization of the equal opportunities goals.

As part of the current equal opportunities plan for 2022 until 2026, KIT achieved significant progress: The share of women could be increased successfully across various levels of qualification. Special significance here is attributed to the top positions in science.

As for the professorships, the proportion has risen by five percentage points to 19 percent since 2019. (W1-W3 positions without deputy professorships). The intensified recruitment of women proved to be successful and becomes evident when looking at the age structure of the professorate: In the age group until 49 years, the proportion of women has reached 27 percent.

Regarding the appointments, the share of women was at 44 percent in 2023; nominations have risen to 34 percent. Thus, compared to the previous year, the proportion of appointments could be increased by 14 percent, while it was still at 28 percent in 2019. This proves the success of active recruitment and gender-equitable appointment procedures.

All in all, for the gender ratio at the individual qualification and career levels, the data for 2023 show that the proportion of women from the entry-level to completed doctorates ranges between 28% and 33%. Since 2019, there has been a 3 percentage point increase in the number of female doctorates.

2030 Female Professors Program

With its equality concept proposed for the 2030 Female Professors Program launched by the Federal and State Governments, KIT was very successful in 2024. Under this program, it is now possible to receive startup financing for up to three first-time appointments of female W3 professors and to develop and implement equal opportunities measures at KIT. Funding per professorship amounts to up to EUR 165,000 for a maximum of five years. In return, every university is obliged to invest the funds released in equal opportunities measures. At KIT, this will include measures for a better reconciliation of family and working lives as well as gender competence development and scouting of female scientific excellence.■

More information:
https://www.peba.kit.edu/english/2281.php

Increasing the proportion of women in all stages from studies to professorship is one of the goals at KIT. [159]

CONSTRUCTION PROJECTS AT KIT

Owner Builder Status Ensures More Flexibility for Construction Projects

Assuming the Owner Builder Status

So far, the State of Baden-Württemberg was usually responsible for all constructional measures in connection with the Campus South, East, and West state properties, whose cost was more than EUR 15,000. With the assumption of the owner builder status, initiated by the 2nd KIT Further Development Act and adopted by the Council of Ministers of the State of Baden-Württemberg on April 9, 2024, KIT has become responsible officially for all construction projects within the scope of its university task. KIT thereby becomes completely autonomous in an area where until then, it could neither take decisions independently, nor control any processes.

Thus, KIT bears full responsibility for the construction projects, it can award contracts, apply for approvals, oversee projects, ensuring fire protection in construction, and for the testing for harmful substances as well as for constructing new buildings including the design and execution of the constructional measures. All these responsibilities associated with the buildings, the majority of which had been managed by the building authority, were transferred from the state, represented by the Karlsruhe branch of the Baden-Württemberg Landesbetrieb Vermögen und Bau (state office for assets and construction), to KIT. This helped to reduce interfaces and streamline decision paths. The execution of building projects can now be simplified and accelerated. As of 2024, KIT is vested with an annual sum of EUR 35 million and twelve full-time jobs funded by the state. This support will increase to EUR 40 million and 18 full-time jobs until 2029. Major building projects will be supervised by KIT's Planning and Construction Projects business unit, while building maintenance tasks will mainly be assumed by Facility Management. For Campus North, i.e. as regards the large-scale research task, the responsibility for constructional measures has been borne by KIT right from the start.

Laying the Foundation Stone for a New Research Building

The cornerstone ceremony on November 20, 2024 marked the start of construction of the new research building for the Institute of Catalysis Research and Technology (IKFT). On roughly 6,800 square meters, new laboratories, a flexibly usable pilot plant as well as offices, workshops, and field warehouses will be built. Commissioning of the building is planned for 2028.

The new IKFT building will house theoretical and experimental research from the molecule level up to pilot scale. The new building will be used for the research on catalysts and process technologies that are required for the production of chemical energy carriers based on renewable energies and alternative raw materials, chemical hydrogen storage, and products for basic and specialty chemistries. In addition, the IKFT is developing catalysts that will play a role in the future carbon cycle and in achieving net-negative CO_2 emissions. The work of the institute is further increasingly dedicated to the data-based acceleration of catalyst material development. ■

Cornerstone ceremony for the new research building for the Institute of Catalysis Research and Technology: Volker Staab, Staab Architekten GmbH; Egbert Kehrwecker, KIT; Jörg Sauer, Managing Director of the Institute at KIT; Vice President Stefan Schwartze, KIT; Heike Suhren-Streckwall, Staab Architekten GmbH; Tobias Zeller, KIT. [160]

More information:
Institute of Catalysis Research and Technology:
https://www.ikft.kit.edu/english/index.php
Planning and Construction Projects business unit:
https://www.pb.kit.edu/english/index.php

LIFE AT KIT

KIT originates from the Excellence Initiative launched by the Federal and State Governments. In 2006, the former Karlsruhe University was awarded the status of a University of Excellence as one of only three universities in Germany. The future concept of Karlsruhe University was geared towards the merger with the Karlsruhe Research Center to become Karlsruhe Institute of Technology, The Research University in the Helmholtz Association.

A thing that appeared to be almost impossible in the first place – the merger of a university funded by the State of Baden-Württemberg and a large-scale research institution funded by the Federal Government of Germany – devel-

oped into the most courageous project in the German research landscape.

The founding agreement could be signed already in December 2007. At first, this agreement did not yet change the status of the two separate institutions, each with its own legal form, but the Federal and State governments had finally approved of the merger project. At the same time, the institution remained a member of the Helmholtz Association. KIT thus overcame the separation between university and non-university research.

In July 2009, the Baden-Württemberg state parliament in Stuttgart passed the "Act on Merger of Universität Karlsruhe and Forschungszentrum Karlsruhe GmbH into the Karlsruhe Institute of Technology." The so-called KIT Act laid the foundation for the administrative agreement between the Federal and the State governments for the merger. The merger took place on October 1, 2009 – the vision of KIT had become reality.

Even though KIT as an institution celebrated only its 15th anniversary in 2024, its history goes back much further: The first predecessor institution of KIT, the Polytechnische Schule (polytechnic school), was founded in Karlsruhe in 1825. This is why KIT can celebrate its 200th anniversary in 2025. The preparations for the forthcoming 200 Years of KIT celebrations were already in full swing in 2024.

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200 YEARS OF KIT

KIT Celebrates Its 200th Anniversary in 2025 – Highlights from Research, Teaching, and Transfer

In 2025, KIT – as one of the oldest technical universities – celebrates a milestone anniversary. 200 years have passed since the foundation of the Karlsruhe Polytechnic School. In the spirit of the jubilee year's theme, "Shaping the Future. Research | Teaching | Transfer," KIT will be hosting a wide variety of events throughout the year. Lectures, readings, and discussion panels; exhibitions, lab tours, and hands-on exhibits and experiments; concerts, light shows, and parties; a major open house event and the third KIT Science Week will present KIT to its visitors as an open, diverse, and exciting place.

To kick off the anniversary year, a New Year's concert will be given on January 6, 2025 featuring the KIT Philharmonic Orchestra, and there will be a symbolic jubilee flag-raising in front of the Audimax. About 2,000 guests will honor KIT on February 20, 2025 as a stronghold of research, teaching, and innovation. Both on-site at the Center for Art and Media and online, the exhibition entitled "200 Years of KIT – 100 Objects. Parts of the Whole. Selected Objects from the History of KIT" will be open from April 11 until October 19, 2025. It features historic scientific equipment, models used for teaching, works of art, everyday items, objects with special stories, and rarities.

On May 17, 2025, the Open Day and Campus Day on Campus South as well as the opening of EFFEKTE, Karlsruhe's science festival, will take place. A lot of attractions including lab tours, lectures, and a variety of stage acts, games, and interactive science activities – for young and old, for nerds and newbies – will captivate the visitors. At Campus Day, prospective students can learn about KIT's wide range of study programs. What is more, the EFFEKTE science festival will open in Karlsruhe's Schlossgarten park with an exciting program extending through the following week.

At the "Dîner au KIT" on July 4, 2025, KIT employees and students will meet to dine and celebrate together at a table stretching several hundred meters across the entire Campus South. The "Art |Summer | Technology" event will take place from July 11 until October 19, 2025. It is organized by KIT together with the City of Karlsruhe, the Center for Art and Media, and numerous galleries, institutions, as well as art and project spaces, and will present its visitors with an exciting program featuring exhibits, workshops, lectures, and discussion panels. KIT will also be featured at the Karlsruhe Light Festival from August 15, 2025.

Between October 4 and 19, 2025, the KIT Science Week, themed "City of the Future" will be held, inviting visitors to take part in over 60 events including workshops, discussions, movie nights, readings, open labs, and experiments. On November 8, 2025, the Schwarzwaldhalle and the Gartenhalle in Karlsruhe's convention center will be hosting another highlight: "DER BALL. Wir feiern das KIT" is a festive dance ball organized by KIT, the City of Karlsruhe, and other partners. ■

Throughout the year, details will be available at *https://www.200jahre.kit.edu/english/index.php*.

Throughout the whole year 2024, preparations for the Jubilee Year 2025 were in full swing. [171]

CHANGE OF NAME

ZAK Becomes FORUM

A key academic institution at KIT changed its name and sharpened its focus. Effective October 1, 2024, the former ZAK | Center for Cultural and General Studies is now called "General Studies. Forum Science and Society (FORUM)." With its new name, the institution is positioning itself as a central platform for interdisciplinary teaching at KIT, dialogue, and scientific analysis of societal problems, and is raising its profile as an intermediary between academia and the public.

In times of global crisis and upheaval, scientific knowledge is the object of both rising expectations and growing skepticism. An important factor in effectively guiding the process of democratic opinion formation is understanding what scientific expertise can and cannot do. The ZAK program's years of refinement and its renaming to FORUM are an acknowledgment of this situation.

Using specific science- and technology-related debates as a basis, FORUM aims to promote ongoing discussion about the tensions between academia and the public among students, scientists, actors in journalism, government and industry, and interested members of the public, and to provide all sides with the skills they need to work with scientific knowledge in public debates.

With interdisciplinary teaching, public events, and innovative social research, FORUM strives to provide new ideas for nuanced and fact-based discussion of pressing issues between academia and the public and thus introduce more objectivity into polarized discussion.

A key course offering at FORUM is its new interdisciplinary program on science, technology and society that was launched in the 2024/25 winter semester. This is a supplementary course of study that prepares students and doctoral researchers to deal with the challenges that arise where science meets society. Gaining perspectives from philosophy, psychology, and social and cultural sciences will empower students to make informed research, development, and management decisions.

Research activities at FORUM are focused on the relationship between academia and the public. Current projects are looking at how the attitude of the German public toward the energy transition is changing and how moralizing in public communication influences the discourse on issues such as climate change, energy security, or food security.

Where science meets society, FORUM at KIT is taking a fresh approach to research, teaching, and public debate. [172]

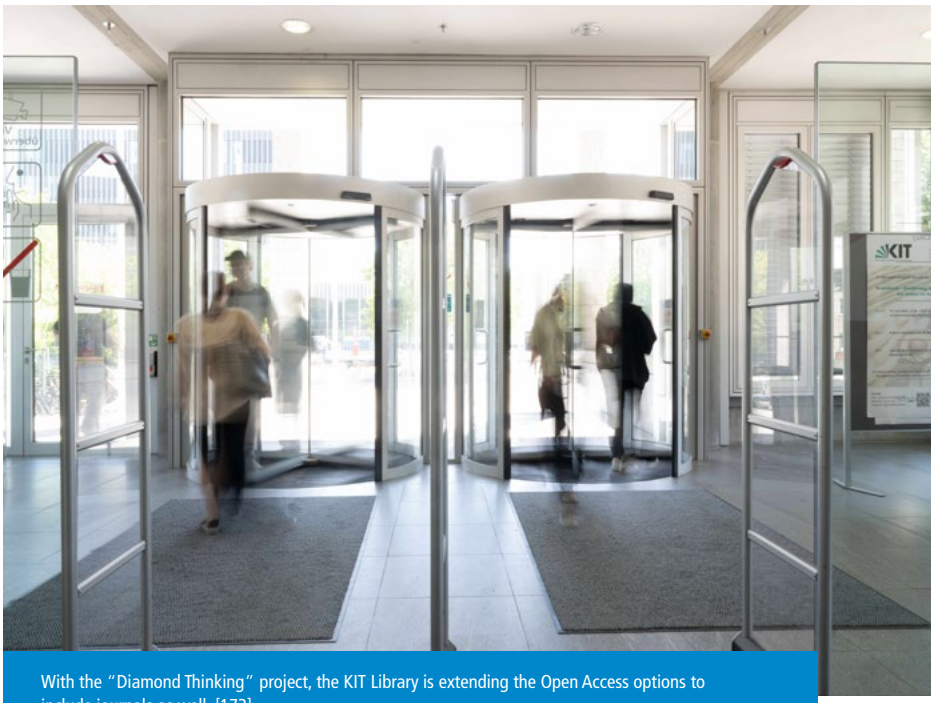
FORUM will build on the tradition established by the ZAK, promoting dialogue between academia and the public on socially relevant issues. Lectures and discussions at KIT encourage those in attendance to reflect on the relationship between academia and society and to look for solutions to the pressing issues affecting our future. This includes, for example, the "Colloquium Fundamentale", an important KIT series of lectures on pressing topics of society and science, or the "KIT im Rathaus" (KIT at the City Hall) series where the KIT Centers give interested members of the public insights into their field of research. ■

More information (in German):
On the FORUM realignment:
https://www.forum.kit.edu/umbenennung.php
On the "Science, Technology, and Society" additional studies:
https://www.forum.kit.edu/begleitstudium-wtg.php
Public FORUM events:
https://www.forum.kit.edu/oeffentliche_veranstaltungen.php

DIAMOND THINKING

KIT Library Extends Open Access Options for Researchers

Open Access (OA) has dramatically changed the way scientific publications are issued: An estimated nigh on half of all specialist publications worldwide are available via the Open Access model. With 15 percent of the peer-reviewed articles available under Open Access, Germany is well above average internationally, primarily in natural sciences and medicine. Institutions funding research increasingly even request publications to be available as Open Access documents.



With the "Diamond Thinking" project, the KIT Library is extending the Open Access options to include journals as well. [173]

71 percent of the publications at KIT have been available freely in 2024, proving KIT's strong commitment to open science.

In this conjunction, the libraries of large research centers are increasingly taking the role of decentralized nodes where literature is not only made available, but also published. This approach has been pursued by the KIT Library for a long time now: Besides the publishing house established in 2004 and specialized on monographs and proceedings, it has been running the KITopen repository for quite a few years. The freely accessible document server is packed with publications that are elsewhere "protected" by paywalls.

Under the "Diamond Thinking" project started in 2023 with funds provided by the Federal Ministry of Education and Research, the KIT Library is extending the Open Access options for researchers to include journals and magazines as well. In the Open Access standard favored in the project, authors can publish their high-quality scientific work for free, and readers can access and reuse the content freely. The project aims to either establish high-quality scientific journals for all major disciplines at KIT or to release the ties that bind them to the large publishing houses and make them independent. Supported by the new DONAU4KIT library service, the "Hydrogen Safety" journal was established in September in diamond mode with the collaboration of the international HySafe association and KIT Scientific Publishing. In the first year already, some noticeable works could be published. Hydrogen safety is a topic of public interest and plays a significant role for the acceptance of the energy system transformation to be implemented in a short time. The international studies intended to further the technological advancement should therefore be accessible with as few restrictions as possible, not least to students and young scientists. The shift opens up new possibilities to close existing gaps in the publication paths and to achieve greater diversification on the international level.

The origins of Open Access lie in the 1990s when the first online archives emerged that allowed digital filing of scientific works. Various forms of free access have been developed ever since. These differ in terms of access rights, conditions of use, and cost structures. ■

EVENT MANAGEMENT

Sustainability in Minor or Major Events

KIT hosts far more than 1,000 events every year – from specialist workshops to the Open Day with about 30,000 guests. The team of the Campus Services (CSE) business unit increasingly not only addresses organizational issues, but also questions of sustainability. How can we organize the event in a way that saves resources and is climate-friendly? How do we keep ecological and social issues in the focus?

All information required in this respect is summarized in the "Guidelines for Sustainable Event Management at Karlsruhe Institute of Technology" document that was adopted in 2024. It helps employees and students at KIT with tips on the entire process from planning to holding of an event.

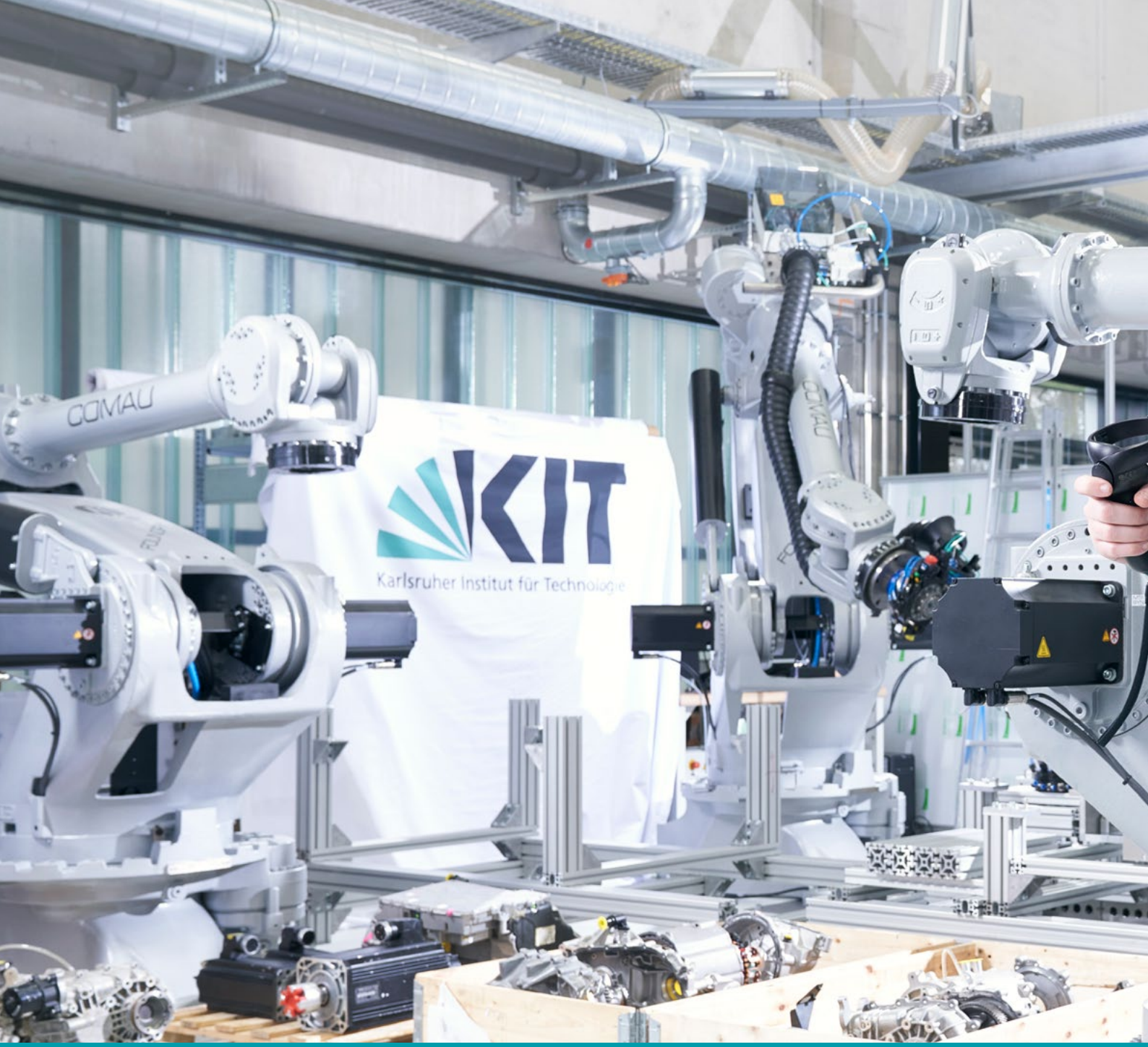
Sustainability plays a role in the whole cycle of an event and must be considered right from the beginning, i.e., planning. This is the point when the important decisions are made as to how sustainable an event will be. The new guidelines provide detailed recommendations for events of any size in a total of eleven fields of action. For example, is the site of an event easily reachable by public transportation and are overnight accommodations nearby? The range of fields of action to be taken into account spans from travel, the consumption of energy, water, or paper, to considerations on how to reduce the amount of waste. Another essential aspect refers to the supply of goods and services.

It is also worth to inquire about the sustainability standards of locations, hotels, and service providers – CSE will provide lists on request. The use of reusable dishes and waste separation should go without saying nowadays. Other aspects are less obvious: Can decorations and temporary constructions be reused? Is paperless invitation management sufficient? Are give-aways dispensable, or are they at least environmentally friendly? Spending some thoughts on the volume of catering helps to avoid leftovers. In addition, the guidelines recommend to switch to vegetarian and vegan dishes or at least to prefer produce from organic and local providers.

Besides organizational issues, events management focuses even more on sustainability. [174]

Other fields of action address the fact that sustainability goes beyond ecological matters, by considering the societal effects and the issue of "participation". For example, KIT offers to provide for sign-language interpreters. What is more, the accessibility of Internet sites and rooms or childcare during the event allow more people to participate. As regards evaluation, the guidelines provide links, for example, to the Federal Environment Agency's CO_2 calculator. This way, emission savings of an event can be ascertained in retrospect. ■

More information:
https://www.cse.kit.edu/english/events.php



DIGITALIZATION

The Digital Office Staff Unit, which also takes care of information security, is the central office that supports KIT in terms of digitalization and advises and assists the executives in assuming their responsibility with respect to this topic. It also has the Information Security Officer in its ranks.

The Digital Office also has a mediating and overarching function. It is associated with the Digitalization and Sustainability Executive Board Department and supports the Executive Board with the further development of the Digitalization area of action under the KIT 2025 Strategy.

The Digital Office investigates the options and the benefit of digitalization for KIT in a general way and drives it for-

ward. This includes the registration of the users' technical needs, taking them into account for the further development of the digital infrastructure.

Digitalization influences and changes both the fulfillment of KIT's core tasks and the actual work. This applies in particular to the design of the associated structures and standards for centralized and decentralized services as well as their support at KIT.

Besides research, studying and teaching are also shaped by the use of digital media. For the students, it has become an everyday matter of course. Teaching and studying at KIT mean acting jointly on-site by using digital media. KIT's digitalization governance controls the identification of needs for research, transfer, teaching, as well as administrative tasks.

The increasing digitalization of processes and workflows at KIT entails a growing dependency on IT systems. Therefore, the focus must be set even more on the risks of computing and information security in the future in order to guarantee that the goals can be achieved in a reasonable manner.

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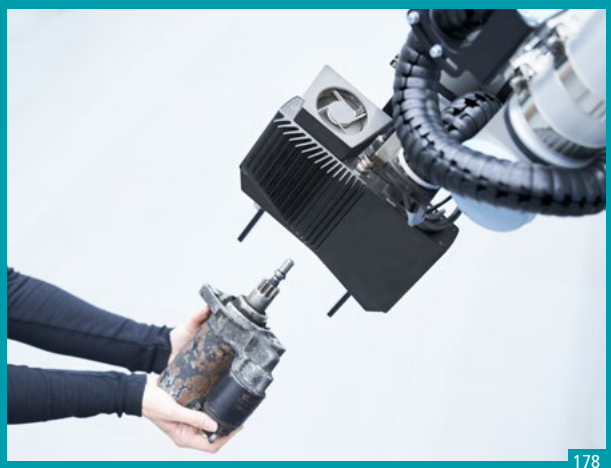
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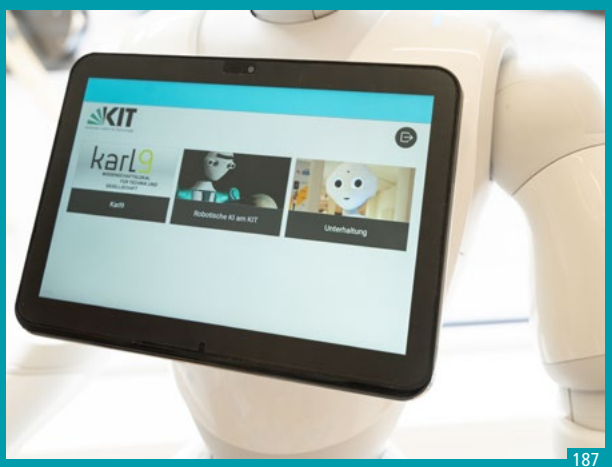

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DIGITAL TRANSFORMATION

"Digitalization and Sustainability" Interface Project

Digitalization and sustainability are among the key transformation targets of our days and age. Digital transformation entails profound changes of the production, mobility, and energy systems and of our consumption patterns. To avoid undesirable developments, this transformation must be shaped in a sustainable and responsible way. At the same time, digital solutions are essential for overcoming sustainability problems such as climate change, resource shortages, and the loss of biodiversity.

Digitalization and sustainability issues have long been researched, taught, and implemented together at KIT. For example, HoreKa, a supercomputer in operation at KIT since June 2021, is one of the fastest computers in Europe. After an upgrade, it ranked 6th on the semiannual Green500 list of the world's most energy-efficient supercomputers in spring 2024 (see also page 35).

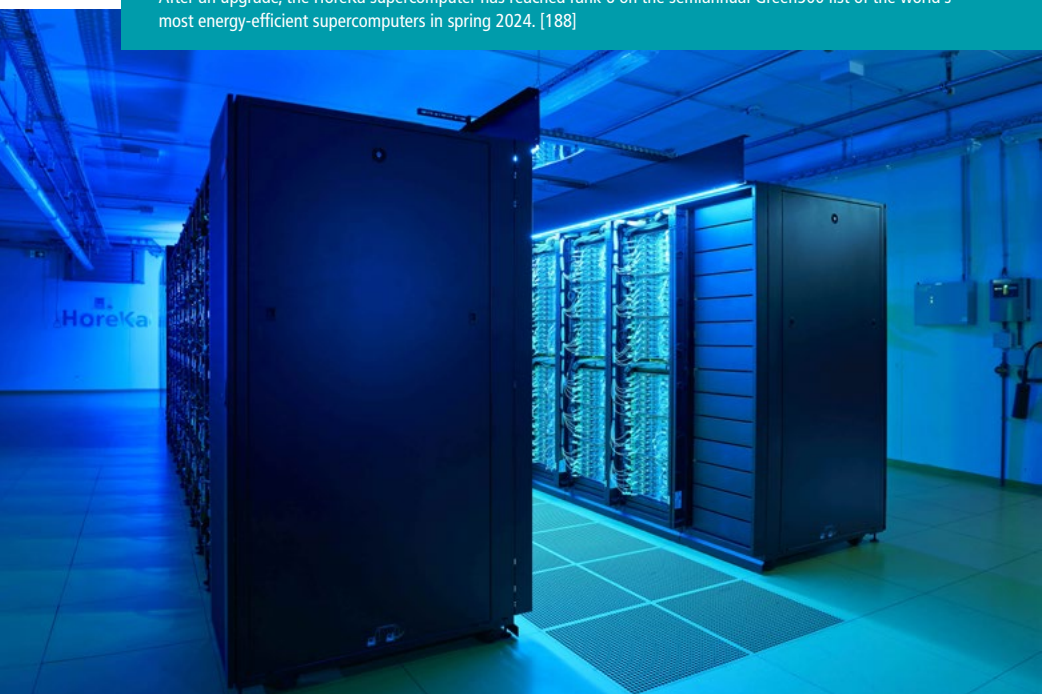
The two cross-cutting topics are also closely linked on the strategic level: On the one hand, the aim of the "Digitalization and Sustainability" interface project launched in October 2024 is to achieve more synergy effects between these two topics in order to drive the sustainable and digital development of KIT, thus ensuring a future-proof design of the research, teaching, and transfer core tasks as well as for KIT internally, and living up to KIT's social responsibility.

On the other hand, the aim of this project is to support KIT in making even more substantial contributions at the interface of digitalization and sustainability for the future. It is also intended to strengthen KIT's role model position as a competence center for the integration of the two transformations. As part of a ideas competition, KIT encouraged its employees and students to identify important potentials for research, teaching, transfer, and for the internal processes at KIT.

All employees and students could submit substantial ideas. The suggestions had to be short and precise and be focused on the most important points: What is it all about? Why is the idea particularly effective? An interdisciplinary team will sift and bundle the ideas in the course of the project and check whether they fit with the interface between sustainability and digitalization. Then, the ideas will be prioritized in workshops involving the Executive Board members based on suitable criteria. Concepts for tangible implementation and pilot projects will be elaborated that will be acted on in the KIT bodies. ■

More information:
HoreKa:
https://www.kit.edu/kit/pi_2024_038_KIT Supercomputer One of the World's Most Energy-Efficient.php
"Digitalization and Sustainability" interface project:
https://www.do.kit.edu/english/interface_project.php

After an upgrade, the HoreKa supercomputer has reached rank 6 on the semiannual Green500 list of the world's most energy-efficient supercomputers in spring 2024. [188]



DIGITALIZATION BOOST AT UNIVERSITIES

The State of Baden-Württemberg Is Funding Eight Initiatives for the Digitalization of Teaching, Research, and Administration

Eight initiatives are supposed to significantly boost the digitalization of teaching, research, and administration at the Baden-Württemberg universities. The aim is to enable modern, flexible, and individual university studies and facilitate the application of digital teaching and learning formats for the teachers. The State of Baden-Württemberg is funding the selected projects with about five million euros.

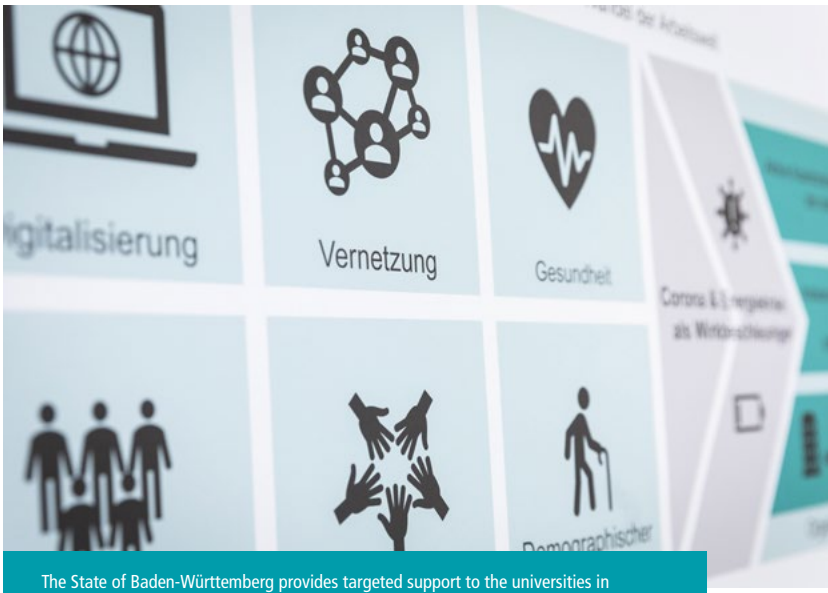
KIT is participating in five of these eight initiatives, assuming the leadership role in three of them:

The aim of the "bwJupyter for Education" project is to establish a new state service for teaching that enables all universities in Baden-Württemberg to integrate software code into their teaching contents. The JupyterHub software is an internationally proven, effective tool for data analysis, AI applications, and scripting languages. Students can use it to develop their digital skills regardless of the hardware equipment they have available. JupyterHub is particularly suited for the collaboration with other teams, sustainable documentation of software, or to initiate teaching projects.

Initially, "bwGPT" will provide 15 universities with access to a GPT4-based chatbot, which complies with the Data Protection Act. Teachers and students of the pilot universities can thus test the use of AI as a working tool in courses. KIT is managing the project jointly with Aalen University.

The GitLab state service supports research teams with developing their software and coordinating projects. The main purpose of the web-based version management is to store and document all modifications to files and to their source code so that they can be traced at any time. Thanks to these functionalities, the service can also be used for the management, versioning, and publication of research data or for leveraging it in teaching.

KIT is further involved in the "bwDigiRecht" and "Prozessorientierter Aktenplan" initiatives. "bwDigiRecht" addresses the introduction of a statewide intermediary office that provides legal information for digital teaching, while "Prozessorientierter Aktenplan" tackles the elaboration



The State of Baden-Württemberg provides targeted support to the universities in the digitalization of teaching, research, and administration. [189]

of a process-oriented sample record plan for the digital workflow management that is aligned with the needs of the universities.

Other initiatives deal with incentives for the (further) development and testing of digitally based teaching and examination formats, a central service for storing, processing, and deploying course recordings and other video formats, as well as the possibilities for learning management systems to directly release teaching materials online and to transfer them to central publication platforms. ■

More information (in German):
https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/schub-fuer-digitalisierung-an-hochschulen

DIGITALIZATION OF TEACHING

Information Day of the Center for Technology-Enhanced Learning

On December 4, 2024, the e-learning team of the Center for Technology-Enhanced Learning (ZML) gave a comprehensive overview of the wide range of services on offer. Brief 15-minute presentations each informed the participants about important facets of the use of media in teaching and about the assistance provided by the ZML. The presentations offered insights into the didactic approaches, technical framework conditions at KIT, and topics such as inverted classroom, gamification, the ILIAS teaching platform, the production of tutorial videos, the use of generative AI in teaching, and much more. The ZML also gave details on e-learning trends and the available services.

During the information day, the ZML further presented the Digital Maker Space established the same year jointly with the KIT Library. The Digital Maker Space located in the InformatiKOM building at KIT enables students and teachers to produce and record media clips in a professional environment. It accommodates two media production rooms, a sound studio, and two large video studios, which were developed specifically for the needs of productions made by KIT and for teaching purposes. Here, members of KIT and students can realize their creative ideas. The video production studios provide modifiable light settings and teleprompter support for an optimum presentation of the contents: Whether live streaming, podcasts, or vodcasts – the studios are flexibly designed for a wide range of requirements.
The media production rooms allow the independent recording of audio and video clips. A professionally equipped cutting room is also available where the users can individually edit their products.

In the InformatiKOM, the ZML also operates the Digital Learning Lab, an innovative learning environment that consists of a real and a virtual room. This enables students to discover various technologies and test them directly. Not only specialist knowledge is imparted here, but the students are also given the opportunity to conceive, test, and reflect on media products oriented to specific target groups and to practical teaching.

The ZML is the central contact and coordination point for questions on digital teaching at KIT and actively contributes to designing the latter. It also assumes research and development tasks related to digital transformation in teaching and knowledge transfer. The research done at the ZML promotes the evaluation of new and the further development of existing digital and transdisciplinary options. In this process, new solutions are developed and piloted and their distribution and transfer to the normal operations at KIT are driven forward.

Moreover, the ZML accommodates the offices of the "Baden-Württemberg Digitalization of Teaching" University Network (HND-BW), a network of the State universities of Baden-Württemberg dedicated to cooperatively advancing digital teaching and learning. ■

More information:
Center for Technology-Enhanced Learning:
https://www.zml.kit.edu/english/index.php
Digital Maker Space:
https://www.zml.kit.edu/english/digitalmarkerspaceKIT.php

The video production studios at the ZML enable users to realize creative projects in a professional environment. [190]

PARADIGM SHIFT IN LIBRARY MANAGEMENT

KIT Library Is the First University Library in Germany to Use the Open Source Library Management System Koha

The KIT Library was the first university library in Germany that introduced the free library management system Koha. The open source management system promises library users better functionality, easier usability, and a better user experience. In this way, KIT also supports the efforts of the Baden-Württemberg State Government to increasingly use Open Source solutions.

The Koha open source software allows to integrate the library procedures into the institution's IT infrastructure. The consequence: Users of KIT, Karlsruhe University of Applied Sciences, and the Baden-Württemberg Cooperative State University Karlsruhe can now register with the access data of their universities to use all services, such as the library catalog or borrowing services. It is no longer required to have a separate account with the KIT Library. Another important novelty is an English user interface for international users.

The migration of the previously used, custom-developed system "i3v-Library", which had been operated very successfully for 26 years, was implemented in a 20-months project without the need for additional funds. This complex project was supported by the Koha community and the Baden-Württemberg library service center.

The KIT Library supports research, teaching, and studies at KIT, at the Karlsruhe University of Applied Sciences, and the Baden-Württemberg Cooperative State University Karlsruhe. The Library with its about 100 employees offers 36,000 students and 12,000 researchers daily 24-hour access to 1,679 learning places.

Koha, an integrated library software developed in New Zealand in 1999, is the most widely used library system in the world. "Koha" is Māori for a gift that requires a return service. This is also the core idea of free software: Koha can only exist because the users actively share their user experience with the big, international Koha community and thus contribute to the continuous further development of the system.

At the beginning of November 2024, the first so-called "Koha-DACH-Hackfest" event was held in the KIT Library: More than 30 members of the German-speaking Koha community gathered there. The focus there was on getting to know each other and exchanging views and knowledge. Together, exciting topics were discussed, new ideas were presented, and planned features were introduced. ■

KIT Library was the first German university library to introduce the Koha open source library management system. [191]

More information:
KIT Library:
https://www.bibliothek.kit.edu/english/index.php
Koha:
https://koha-community.org/

SUSTAINABILITY

2024 was characterized by KIT's broad participation in and commitment to sustainability. The "Basis Project Sustainability" lead project for the implementation of the sustainability area of action under "KIT 2025 Strategy" is aimed to drive forward and strengthen the sustainable development of KIT's research, teaching, and transfer core tasks and of the organization of KIT in all areas from everyday work and study routines to infrastructural matters in a substantial way.

In an action-oriented participation process based on broad participation, sustainability issues are developed, prioritized according to key criteria, and firmly established at KIT through implementation concepts. All KIT employees

and students were called upon and invited to participate in this project. The four work packages addressing research, teaching, transfer, as well as sustainability in KIT's organizational structures embraced all relevant actors and status groups at KIT: These included the Executive Board, the Senate, the various Divisions and KIT Departments, Helmholtz programs, KIT Centers, the General Students Committee / student representatives, the technically responsible Service Divisions, organizational units, and business units, as well as randomly selected KIT employees and students.

The participants discussed the many ideas, suggestions, and "good practice examples" critically in various formats and consolidated them into proposals for measures prioritized on the basis of previously defined criteria and then prepared for decision in the various KIT bodies.

The measures include strengthening research in the prioritized sustainability topics, sustainability-oriented teaching, education for sustainable development, transformative transfer activities, research and teaching formats, and the sustainable development of KIT as an organization. The following pages offer insight into the work to be accomplished in the four work packages of the Basis Project Sustainability and feature exemplary activities at KIT related to sustainability.

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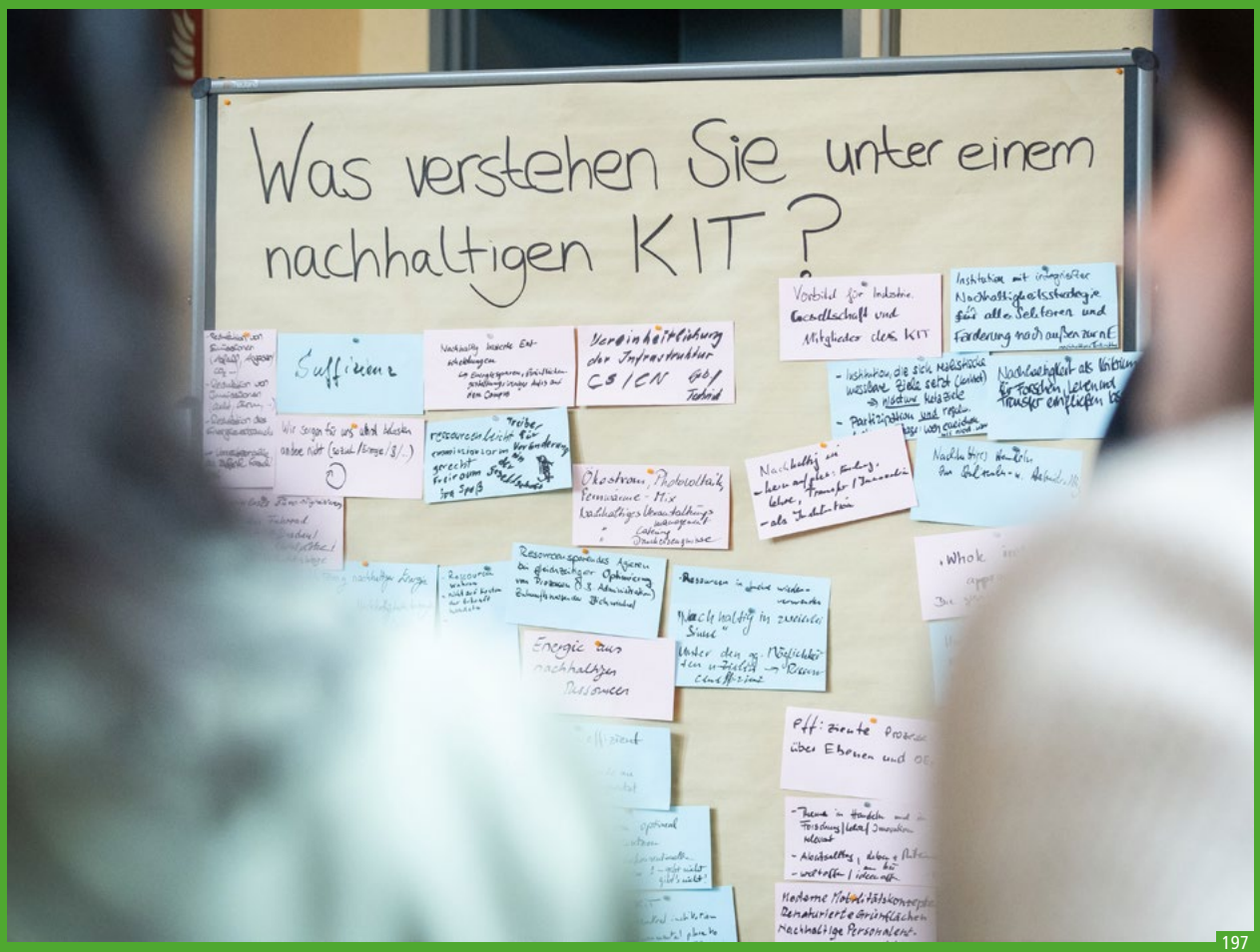

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SUSTAINABILITY IN RESEARCH

New Focus Areas in the Basis Project Sustainability and Examples from Circular Economy

In the pilot plant, belite cement clinker is produced from previously seldom-used fine-grained crushed concrete and limestone at less than 1,000 degrees Celsius in an electrically heated rotary kiln. [203]

Research Topics Prioritized in the Basis Project Sustainability

How can sustainability research be shaped further at KIT? This question was addressed in the Research work package of the Basis Project Sustainability in a series of group interviews and three workshops, commenting rounds, and a Delphi survey. Researchers from various disciplines and career levels from the KIT Centers and Helmholtz programs jointly developed approaches and thematic questions. The prioritized research topics focus on the heat and energy transition, measures for adapting to climate change, sustainable mobility, circularity, and resource conservation. The KIT bodies subsequently deliberated on the results of the participation process and adopted suggestions that have the potential to substantially advance research, and will be fed into the ongoing processes at KIT, such as program-oriented funding by the Helmholtz Association, the proposal for the University of Excellence status, professorship planning, and KIT's specific strategy process on the topics of mobility and circular economy.

Circular Economy and Environmental Technologies in the KIT Climate and Environment Center

For the Circular Economy and Environmental Technologies research focus, a new topic was set up in the KIT Climate and Environment Center in order to pool the expertise accordingly and create synergies. This way, it is intended to design a generic approach that extends from basic research to application. In this process, cycles should be closed across system borders, thereby minimizing the demand for raw materials, emissions, and waste from industrial core processes.

Pilot Plant for Carbon-neutral Circular Concrete

A clinker material based on recycled concrete and one part limestone was developed at KIT. The associated production step is being tested in a pilot plant for belite-cement clinker at KIT. Using this carbon-neutral circular concrete might considerably reduce greenhouse gas emissions in the construction sector. Six to nine percent of all anthropogenic CO_2 emissions are caused by concrete production. Circular economy on a regional level, the use of renewable energies, and a reduction of the process temperature from about 1,400 to 1,000 degrees Celsius enable energy savings in the order of up to 40 percent. By binding CO_2 emissions from the limestone reaction in the recycled concrete, the production can take place in a sustainable resource cycle. Thus, concrete is recycled and reused for high-grade construction materials, instead being landfilled or used in road construction. The fact that CO_2 from clinker production is bound in the process provides for a high-grade admixture with reduced porosity. This is another advantage besides the more favorable CO_2 balance. ■

More information:
Basis Project Sustainability:
https://www.so.kit.edu/english/28.php
KIT Climate and Environment Center:
https://www.klima-umwelt.kit.edu/english/index.php
Pilot plant for carbon-neutral cement clinker:
https://www.kit.edu/kit/english/pi_2024_046_pilot-plant-produces-climate-friendly-cement-clinker.php

SUSTAINABILITY IN TEACHING

Education for Sustainable Development

"Teaching" Work Package in the Basis Project Sustainability

In the Teaching work package, three workshops were held, involving representatives of the KIT Departments and the General Student's Committee / student representation, lecturers, and teaching staff. In addition, estimations and experiences of students and employees were obtained via a KIT-wide survey. These were used to derive ideas and measures for the further development of sustainability-oriented teaching in the study programs and for the cross-discipline qualifications to better establish education for sustainable development (ESD) at the most diverse levels – from the design of new courses to the modules and focus areas.

Led jointly by KIT's House of Competence and the Institute for Technology Assessment and Systems Analysis, the concept for a new additional Sustainability studies program will be set up, closely linked to the suggestions from the participation process and including the development of certificates. It consists of modules built on each other that support the structured acquisition of sustainability competences in a targeted way and building a bridge to specialist studies.

Various ESD Offerings

The International Seasonal School for education on environmental and sustainability matters offered a dialog platform on transformative learning processes and sustainability topics via interdisciplinary and artistic teaching approaches to 25 junior scientists from 13 countries. It was organized by the Interdisciplinary Didactics of STEM Subjects and Sports research area at the Institute for School Pedagogy and Didactics, together with the European Educational Research Association.

With the School of Transformation, which is part of KIT's House of Competence, and the Karlsruhe Transformation Center for Sustainability and Cultural Change, an offer for students was launched that addresses sustainability transformation as the big challenge of the present time. It uses experiments and innovative educational formats to pool the competences of KIT as regards sustainability and transformative education. During the Day of Action, the dialog for actively shaping the future together was started. For transformation in everyday life, the transdisciplinary #climatechallenge project offers an innovative educational format for multipliers to reduce their personal CO_2 footprint and kick off structural changes (handprint).

At the "Markt der Zukunftsmöglichkeiten" (market of future possibilities) at the "Station Zukunft" (station for the future), in front of Karlsruhe Palace, the Karlsruhe Real-World Lab for Sustainable Climate Protection (KARLA) showed contributions for a sustainable future. During the Karlsruhe light festival, a go-motion projection devised by KARLA, showing the road to the metropolis of the future, created a poetic atmosphere of change on the palace façade. As part of the Karlsruhe Climate Pact, multiple educational events took place – among them were so-called climate talks and climate walks. ■

More information:
Basis Project Sustainability:
https://www.so.kit.edu/english/28.php
Education for sustainable development:
https://www.bne-portal.de/bne/en/home/home_node.html

Offers for students at KIT also address the sustainability transformation as the big challenge of the present time. [204]

SUSTAINABILITY IN TRANSFER

Dialogue with Society

"Transfer" Work Package in the Basis Project Sustainability

The Transfer work package of the Basis Project Sustainability deals with the question which transfer formats are particularly suited to transfer sustainability innovations. In two workshops, actors from the transfer and innovation sectors elaborated conditions for success and future development potentials regarding eight topic fields as defined in the transfer barometer established by the Stifterverband (donors' association for promoting science and education). As an intermediate result, it can be stated that key for a successful sustainability transfer are good networking of the persons responsible for the transfer and suitable advanced training formats for researchers, students, and external partners.

Sustainability Innovation Campus Launched Jointly with the University of Freiburg

Sustainability Innovation Campus is a new innovation platform that was launched by KIT and the University of Freiburg. Its objective is to establish an innovation ecosystem encompassing science, economy, civil society, and public administration in the climate change mitigation, resource conservation, and well-being innovation fields. Transfer into society and the actual implementation of these innovations are crucial for making the Upper Rhine region a beacon region of sustainability transformation.

2024 Hannover Messe – Focus on Resources, Circular Economy, and Energy

At Hannover Messe, KIT featured innovative exhibits and presentations in the Future Hub and Energy Solutions area. With resource-saving production methods and contributions to the supply with renewable energies and industrial process automation, the researchers presented interdisciplinary approaches to accomplish the transformation towards a more sustainable industry in a joint effort of science, innovators, and economy. New thinking is necessary to create a truly circular economy. The circular factory of the future and the use of robots, such as KIT's AgiProbot for agile production systems, enable automated disassembly, reconditioning, and reassembly processes for the reuse of used products in new products.

In the BiFlow project, researchers are developing hybrid storage systems that combine different battery types for cost- and space-efficient combined heat and power generation in the energy transition. The Litona KIT startup has designed energy storage materials for the automobile sector to lower the cost of batteries and reduce Europe's dependency on imported raw materials. KIT also presented the HYKA test center, the only test infrastructure for hydrogen release and combustion scenarios worldwide. By means of 3D simulation programs, the researchers can perform targeted examinations of safety-related situations and devise improvements. ■

More information:
lookKIT edition "Resources. Circular Economy. Energy":
https://www.sts.kit.edu/english/archive-lookit_7615.php

The KIT booth at 2024 Hannover Messe, with a focus on resources, circular economy, and energy. [205]

SUSTAINABILITY IN OPERATIONS AND INFRASTRUCTURE

Sustainable Action at the KIT Sites

"KIT Internal & KIT Sustainability Performance Work Package" in the Basis Project Sustainability

The activities of KIT contribute to a sustainable development of society. For a sustainable development of KIT as an organization, a KIT-wide survey was conducted under the Basis Project Sustainability to collect suggestions, proposals, and estimations by students and employees. In addition, an ideas competition and two workshops were held. The results were consolidated in bundles of measures and assigned to the nine main clusters – sustainability as a basic mindset, personal acting on the job and during studies, mobility, events, procurement, green spaces and adaptation to climate change, supply and disposal infrastructures, building infrastructures as well as sustainability management – and assessed in a first prioritization session.

Owner Builder Status for State Buildings

In the KIT organization, important arrangements were made in 2024 to set KIT's course towards sustainability, including net greenhouse gas-neutrality. By assuming the owner builder status, KIT, being a state university, is now also responsible for the construction and refurbishment processes of the state buildings run on Campus South, East, and West. This role, which was stipulated in the 2nd KIT Further Development Act, involves a lot of creative leeway, but at the same time, a lot of work. Refurbishment and new (replacement) construction projects are controlled by the Planning and Construction Projects business unit – from the initial concept to the actual construction work. Prioritization within the annual budget directly at KIT will simplify and accelerate the related procedures.

Sustainable Development at the KIT Sites

A decision made by the Executive Board in 2024 set the course for a significantly more effective use of the surfaces across all campuses. At the KIT sites, the implementation of photovoltaics and the exchange of lamps in favor of LED technology is advancing. Solar energy systems with an overall output of 2 MWp have been installed at KIT, and a further 2 MWp are planned for 2025. For Campus North, a concept for a partially regenerative cold-water supply was developed. Its implementation will be funded with Helmholtz investment resources of about EUR 6.1 million. The aim is to reduce the number of decentralized cooling units and to benefit from the near-surface geothermal potential to provide regenerative heating and cooling for the central supply systems. In 2024, a project for heat supply decarbonization at KIT was launched. Furthermore, garden maintenance was shifted to promote biodiversity. For the inner-city Campus South, which is characterized by bicycle and pedestrian traffic, the decision was made to suggest to the municipality to set up a bicycle zone. It is intended to give higher priority to environmentally friendly mobility and privilege it over motorized individual traffic. ■

With its 450 buildings and a power demand of more than 125,000 megawatt hours, KIT is an energy-hungry institution. It is all the more important to generate electricity in climate-neutral way. [206]

More information:
Basis Project Sustainability:
https://www.so.kit.edu/english/28.php
Planning and Construction Projects business unit:
https://www.pb.kit.edu/english/57.php

PRIZES, HONORS, AWARDS, AND APPOINTMENTS

In 2024, KIT's Executive Board and Senate decided again on awarding honorary titles on the basis of KIT's code of honor.

KIT granted a Needle of Honor to two personalities: Professor Frank Herrlich rendered outstanding services to KIT. He has worked with outstanding dedication as a scientist in research and, as an extraordinarily committed university teacher, he contributed greatly to promoting young scientists. He also held positions in KIT bodies for many years with outstanding commitment. Professor Olaf Dössel is in high esteem nationally as well as internationally and contributes significantly to the visibility of KIT. Moreover, he dedicated much of his time to his work in many KIT bodies,

for example as Chairman of the "Studentenwohnheim des Karlsruher Instituts für Technologie (KIT) e. V." (Student Residences Association of KIT) or as a liaison teacher for the students in the German Academic Scholarship Foundation.

Furthermore, KIT awarded Medals of Merit to two alumni: Professor Nicolas Moussiopoulos, Emeritus of Aristotle University of Thessaloniki (AUTh) in Greece, personifies outstanding commitment to KIT, in particular to the German-Greek cooperation and networking in research and teaching, as well as alumni activities linking KIT and AUTh. Dr. Erwin Plett, founder and managing partner of Low Carbon Chile SpA, was awarded the Medal of Merit for his exceptional commitment to KIT, in particular for the German-Chilean cooperation and networking in research and teaching, as well as the promotion of alumni activities between KIT and various institutions in Chile.

Berti Müller-Czerwenka was nominated KIT Honorary Citizen. She received this award in recognition of her extraordinary commitment for the benefit of KIT by promoting young KIT scientists. She founded the "Prof.-Dr.-Ing.-Fritz-Peter-Müller-Stiftung" in commemoration of her late husband and topped up the assets of the foundation by testamentary decree.

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ALEXANDER VON HUMBOLDT PROFESSORSHIP FOR CHRISTOPHER BARNER-KOWOLLIK

Macromolecular Chemistry Specialist Receives Germany's Best-funded Research Prize

Christopher Barner-Kowollik, a macromolecular chemistry specialist, was awarded the Alexander von Humboldt professorship in 2024. With up to EUR 5 million, it is Germany's best-funded international research prize. With this award, the Alexander von Humboldt Foundation recognizes leading international researchers of all disciplines who have previously been working abroad. They are expected to conduct forward-looking research at German universities in the long term. The award is financed by the German Federal Ministry of Education and Research.

With his research, Professor Christopher Barner-Kowollik makes it possible to develop high-precision materials and surfaces for special applications in nanotechnology and materials science. He will do research on new materials and polymer-based systems at KIT from 2026 on.

With his workgroup, the chemist and materials scientist made a groundbreaking discovery that challenged a basic assumption that has been accepted in traditional photochemistry for 200 years: It had been assumed that molecules are most reactive at the wavelength where they absorb the most light. In that case, if a molecule absorbs light especially well at a certain wavelength, it should also exhibit the greatest chemical conversion rate at that wavelength.

Christopher Barner-Kowollik received an Alexander von Humboldt professorship, Germany's best-funded research prize.[217]

But Barner-Kowollik and his team found that a molecule does not necessarily exhibit maximum quantum yield at the wavelength where it absorbs the most light. Thanks to this discovery, photochemical processes can now be optimized significantly, which enables new types of reactions.

Barner-Kowollik investigates how light can be manipulated to create new soft matter materials, for example using light-driven 3D printing methods. He is already putting this expertise to work in the 3D Matter Made to Order (3DMM2O) Cluster of Excellence, a joint initiative of KIT and Heidelberg University.

As the Director of KIT's Institute of Functional Interfaces (IFG), he is expected to scientifically realign it as an agile and innovative "multi-team platform institute" focused on investigating next-generation materials.

Christopher Barner-Kowollik studied at the University of Göttingen, where he earned a doctorate in physical chemistry in 1999. After his post-doctoral studies at the University of New South Wales in Sydney, Australia, he was appointed professor of polymer chemistry there. He came to KIT as a professor of molecular chemistry in 2008 and returned to Australia in 2017, where he established the Soft Matter Materials Laboratory at the Queensland University of Technology, Brisbane. ■

More information:
Institute of Functional Interfaces:
https://www.ifg.kit.edu/english/index.php

COMMITTED TO HELPING INTERNATIONAL STUDENTS

Elisé Wamen Was Awarded the "Karlsruher Integrationspreis"

For the 26th time, the Karlsruhe integration prize was awarded in the Bürgersaal of Karlsruhe City Hall on October 24, 2024. The idea behind the prize is to take a stand for equal opportunities and participation and help to overcome prejudices and racism. Elisé Wamen, officer for international affairs at AStA (General Students Committee) was awarded one of the two prizes for 2024.

Elisé Wamen received the integration prize to recognize and honor his particular commitment and activities for the integration of people with a migration background in society and business.

The International Affairs unit of the General Students Committee is the student body's central coordination point for all matters relating to international students. For more than four years, Elisé Wamen, who is studying civil engineering at KIT, has been the initial contact person in this AStA office when it comes to improving the legal situation and study conditions of international students.

The office assists international students in every situation, for example with overcoming social and legal problems such as work permit issues, it helps with financial difficulties, house hunting, job search, insurances, official procedures, or filling in forms. It also gives advice on study-related issues such as admission, starting and organization of the studies, difficulties during the course of studies, or changing the field of study.

Moreover, the office coordinates and supports the work of student groups with an international context, in particular the many international university groups. It is also in permanent dialogue with the offices responsible for international students such as the International Students Office and the KIT Studienkolleg or the International Student Center of Karlsruhe Studierendenwerk (student services). The office further supports international students in matters of higher education policy, for example, the abolition of tuition fees for international students.

Elisé Wamen during the awarding ceremony of the "Karlsruher Integrationspreis" in the Bürgersaal of Karlsruhe City Hall. [218]

About the "Karlsruher Integrationspreis"

This prize is intended to take a stand for equal opportunities and participation of all people living in Karlsruhe and help to overcome prejudices and racism. It is awarded to honor individuals, organizations, and companies standing up in a extraordinary way for the coexistence of people with or without a migration background. The activities should be exemplary and go beyond matters of course. They are meant to set an example that might stimulate others to follow. The "Karlsruher Integrationspreis" is awarded by the "Internationales Begegnungszentrum Karlsruhe e.V." international meeting center and the "Kuratorium Karlsruher Integrationspreis" board of trustees. ■

NEO INNOVATION AWARD FOR KIT SPINOFF

Rement Spinoff Wins NEO2024 Prize of TechnologieRegion Karlsruhe with Concrete Recycling

The KIT Rement spinoff project identified concrete from demolition sites as a valuable raw material, processing it to produce new construction material in a climate-friendly way. In early December 2024, this approach earned the founders the jury prize of the NEO2024 Innovation Award conferred by TechnologieRegion Karlsruhe and endowed with EUR 20,000. The finalists presented their groundbreaking approaches during the award ceremony of the 15th edition of the NEO Innovation Award in the presence of nearly 200 guests from business, academia, and politics. Rement also won over the listeners and received the Audience Award.

Closing the material cycles in industry is one of the most challenging tasks on the way to climate neutrality in Germany. The founders at Rement demonstrated how this task can be accomplished. Their innovative technology represents a crucial step towards a more sustainable circular economy.

The KIT spinoff won the day with its CO_2-negative technology for concrete upcycling. This innovative method enables recycling of unmixed sand from demolition concrete and, by adding CO_2, convert it into ultrapure calcium carbonate – a breakthrough for sustainable construction.

In the Rement technology, waste from construction and demolition sites is first crushed mechanically and then processed using CO_2 to recover valuable ingredients such as minerals and admixtures that can be reused in concrete. Overall, the process is CO_2-negative, i.e. it consumes more CO_2 than it generates.

The team is currently operating a prototype facility at lab scale. A pilot plant is in the planning stage and scheduled to begin operation next year. The Rement spinoff is funded by the Federal Ministry for Economic Affairs and Climate Action and the European Union under the EXIST research transfer.

Besides Rement, NECOC was also among the five NEO finalists. The aim of this research project launched by KIT is to develop a climate-friendly method with negative emissions for the production of carbon as a high-tech raw material from carbon dioxide.

With its NEO Innovation Award, TechnologieRegion Karlsruhe (TRK) honors innovative solutions and future-oriented developments that will influence our future lives. Every year, the TRK chooses a different topic for this award. This year's focus was circular economy. By selecting a future-oriented topic, the Innovation Award emphasizes its role as a prestigious platform for decision-makers from business and science. The award is endowed with EUR 20,000; it is awarded throughout Germany and across the border in Alsace. ■

More information:
https://trk.de/en/events/neo/

The Rement technology disintegrates crushed concrete sand from demolition concrete by binding unmixed carbon dioxide. [219]

Other Prizes, Honors, Awards, and Appointments

People

■ **Dr. Martin Angerer**, Karlsruhe School of Elementary Particle and Astroparticle Physics: Science and Technology, received the Helmholtz Doctoral Award for his dissertation. He wrote his doctorate thesis about new ultrasonic conversion systems for 3D imaging in early breast cancer diagnostics.

■ Minister-President Winfried Kretschmann presented **Professor Dr. Almut Arneth**, Institute of Meteorology and Climate Research, with the Order of Merit of the Federal State of Baden-Württemberg. The award is granted for outstanding services to the state and its population.


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■ **Dr. Matthias Bandtel**, Baden-Württemberg Digitalization of Teaching University Network at KIT, and Svenja Geißler, Center for Technology-Enhanced Learning at KIT, received a "Fellowship for digital university teaching in Baden-Württemberg" for an advanced training series with the aim to strengthen AI skills at universities.

■ **Jan Niklas Blötz** and **Laura Bosch**, both from the Innovation and Relations Management business unit, received an award from the KIT Freundeskreis und Fördergesellschaft e. V. association. Jointly with the Badisches Staatstheater Karlsruhe, they successfully planned and realized science performances that represented current KIT research topics in an artistic way.


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■ **Doreen Brinker**, student at the KIT Department of Architecture, received the Young Talent Award at the Badischer Architekturpreis 2024 awarding ceremony for her master's thesis entitled "Über den Dächern der Stadt" (above the city roofs).

■ **Lennard Busch**, KSETA fellow at the Institute for Technical Thermodynamics and Refrigeration, received the Poster Award at the Einstein Telescope Symposium.

■ **Professor Dr. Klaus Butterbach-Bahl**, Institute of Meteorology and Climate Research, was conferred the Sustainability Award by the Nobel Sustainability Trust in recognition of his research on the environmental impact of global agriculture.

■ In cooperation with the KIT Freundeskreis und Fördergesellschaft e. V. association, the BLANC & FISCHER family holding awarded a BLANC & FISCHER Innovation Prize for outstanding dissertations at KIT's engineering departments to **Dr. Sara Claramunt**, Institute for Micro Process Engineering, and two other KIT scientists.


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■ **Professor Dr. Luisa de Cola**, Strasbourg University, guest scientist at the Institute of Functional Interfaces, was honored with the Royal Society of Chemistry 2024 Centenary Prize for Chemistry and Communication for her innovative research on the production of photophysically active materials and nanostructures for use in active biological systems.

■ Chemistry Europe, an alliance of 16 chemical associations from 15 European countries, welcomed **Professor Dr. Stefanie Dehnen**, Institute of Nanotechnology, to the "Class of 2022/23 Fellows", honoring her remarkable contributions and top achievements in research, support, creativity, and innovation.

■ **Stefanie Dehnen**, Institute of Nanotechnology, was also accepted as a foreign corresponding member to the Class of Mathematics and Natural Sciences of the Austrian Academy of Sciences.

■ In addition, **Stefanie Dehnen** was nominated Honorary Fellow of the Chinese Chemical Society.


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■ Arbeitgeberverband Südwestmetall, an employers' association, awarded the Südwestmetall Prize to **Dr. Ali Riza Durmaz**, Institute for Applied Materials, for his dissertation "Experimental and Data-driven Workflows for Microstructure-based Damage Prediction."

■ **Dr. Elisabeth Eiche** received the Hermann-Credner Award from the German Geological Association (DGGV). The award is given to outstanding young scientists to promote and fund further research work.

■ **Yannick Erb**, Institute of Applied Informatics and Formal Description Methods, received the IT Innovation Award 2023 from Fujitsu NEXT e. V. association for his master's thesis "From Affordances to Business Value – How Can Organizations Use Fog Computing to Create Business Value?"

■ **Professor Dr. Maximilian Fichtner**, Institute of Nanotechnology and Director of the Ulm Helmholtz Institute, was honored with the Ulm Science Award. He won the award for his research in the field of sustainable battery storage units as well as for his merits on science communication.

■ **Viktoria Fitterer**, Head of the Campus Services business unit, was elected Chairwoman of the Board of the Messearbeitskreis Wissenschaft e. V. association.


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■ The Eberhard Schöck Foundation granted the Schöck Bau-Innovationspreis award to **Moritz Fünkner**, Institute of Vehicle System Technology and Fraunhofer Institute for Chemical Technology, for his master's thesis "Development of an inline profiling method for in-situ pultruded fiber composite plastic reinforcement bars."

■ The general assembly of the European University Information Systems network organization elected **Dr. Isabel Gallin**, Digital Office, to the Board.

■ **Svenja Geißler**, Center for Technology-Enhanced Learning at KIT, and Dr. Matthias Bandtel, Baden-Württemberg Digitalization of Teaching University Network at KIT, received a "Fellowship for digital university teaching in Baden-Württemberg" for an advanced training series developed at KIT with the aim to strengthen AI skills at universities.

■ The US Institute of Mathematical Statistics honored **Professor Dr. Tilmann Gneiting** with the Wald Memorial Award and Lectures.

■ The Geological Society of America appointed **Professor Dr. Nico Goldscheider**, Institute of Applied Geosciences, a Honorary Fellow.

■ Together with Sparkasse Karlsruhe, the KIT Climate and Environment Center conferred, during its annual conference, the Sparkasse Environmental Award 2023 to **Dr. Lisa-Lou Gracia**, Institute of Organic Chemistry, for her dissertation entitled "Novel Transition Metal Complexes for the Photocatalytic CO_2 Reduction."


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■ **Professor Dr. Armin Grunwald**, Institute for Technology Assessment and Systems Analysis, is one of the 100 most influential figures in the German-speaking science scene. This was the conclusion reached by the editorial team of Table.Media in Berlin.

■ **Armin Grunwald** also held a speech at the United Nations (UN), addressing issues related to technology assessment. On invitation of the commission on "Science and Technology for Development," he spoke at a meeting in Geneva to around 120 representatives from all over the world.


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■ **Patricia Guerra-Balboa**, KASTEL – Institute of Information Security and Dependability, finished second in the preliminary round of the FameLab competition in Karlsruhe and won the Audience Award with her contribution on the role of mathematics in the protection of privacy.

■ **Dr. Fabian Hagen**, Engler-Bunte Institute, received the Doctoral Award for Environmental Engineering awarded by the Friedrich and Elisabeth Boysen Foundation.

■ KIT Distinguished Senior Fellow **Professor em. Dr. Horst Hahn**, formerly of the Institute of Nanotechnology, was accepted as a Foreign Fellow by the Indian National Academy of Engineering and the Indian National Science Academy.

■ **Professor Dr. Gudrun Heinrich** was elected member of the Review Board of the German Research Foundation.


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■ The general assembly of the professional association of German geoscientists (BDG) nominated **Professor Dr. Christoph Hilgers**, Institute of Applied Geosciences, as new First Chairman.

■ On January 1, 2024, **Professor Dr. Thomas Hirth**, Vice President Transfer and International Affairs, was elected to the board of the DECHEMA Association for Chemical Engineering and Bioengineering. In addition, the board delegated him to the DECHEMA coordination committee. For his long-term commitment as chairman of the German platform for process engineering, Thomas Hirth was also honored with the DECHEMA medal.

■ In addition, the board of trustees of the German Foundation for the Environment elected **Thomas Hirth** for two years to the jury of the German Environmental Award as of January 1, 2024.

■ The Elite Network of Bavaria appointed **Professor Dr. Marlis Hochbruck**, Institute for Applied and Numerical Mathematics, to the International Expert Commission.


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■ **Dr. Maxi Hoffmann**, Institute for Chemical Technology and Polymer Chemistry, was honored with an FCTKA prize by the "Freunde der Chemischen Technik Karlsruhe" association for her doctoral thesis on the synthesis of PS-PI derivatives and their dielectric spectroscopy.

■ **Professor Dr. Michael Hoffman**, retired professor from the Institute for Applied Materials, was nominated Honorary Member by the German Society for Materials Science.

■ **Felix Huber**, technical product designer, was honored as Baden-Württemberg's best graduate of his year by the Karlsruhe Chamber of Industry and Commerce.

■ The International Science Council appointed **Dr. Alik Ismail-Zadeh**, Institute of Applied Geosciences, to the scientific committee of its Integrated Research on Disaster Risk program. The committee supports the United Nations Office for Disaster Risk Reduction.


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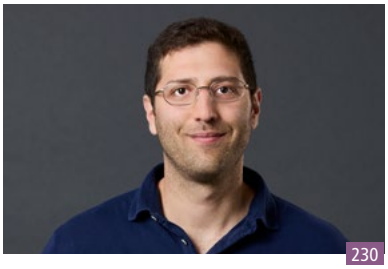
■ **Julia Jager**, biology lab assistant was honored by the Karlsruhe Chamber of Industry and Commerce as the state's best graduate of her year.

■ **Dr. Noémie Jaquier**, Institute for Anthropomatics and Robotics, was awarded the Prize of the Hector Foundation. Her research pursues the long-term goal of providing robots with human-like learning, adaptation, and movement capabilities.

■ **Dr. Joel Joseph**, Institute of Microstructure Technology, received the Helmholtz Doctoral Award 2023 for his dissertation. In his doctorate thesis, he investigated the innovative use of thermo-magnetic thin-film drives to develop thermal energy harvesters with very high power per footprint.

■ The German Association for Materials Science awarded the Masing Memorial Prize to **Dr. Alexander Kauffmann**, Institute for Applied Materials.

■ At the "Kerntechnik 2024" specialist conference organized by the Kerntechnische Gesellschaft e.V. association, **Siavash Kazemi**, Institute for Technology and Management in Construction, finished third in the poster competition, presenting a poster on the ROBDEKON research project.


230

■ **Dr. Marc Keller**, Institute of Thermal Turbomachinery, received the Sponsorship Award 2023 offered by the Friedrich and Elisabeth Boysen Foundation for his outstanding dissertation.

■ **Vanessa Mercedes Kind**, Institute of Concrete Structures and Building Materials, excelled in the preliminary round of the FameLab competition with her presentation on problems of bridges in wintertime and won the first place.

■ **Natascha Kindsvogel**, Financial Management business unit, received an award from the KIT Freundeskreis und Fördergesellschaft e. V. association.

■ The Karlsruhe bar association awarded the Baden-Württemberg Staufer Medal to **Professor Dr. Christian Kirchberg**. The award honors persons who have rendered particular services to the Federal State and its population.

■ The board of directors of the German Renewable Energy Research Association (FVEE) elected **Professor Dr. Joachim Knebel**, Head of Division III – Mechanical and Electrical Engineering at KIT, as deputy spokesman.

■ The general assembly of the professional association of German geoscientists (BDG) elected **Professor Dr. Jochen Kolb**, Institute of Applied Geosciences, as Deputy Chairman of the association's universities and research institutions division.

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■ **Professor Dr. Oliver Kraft**, Vice President Research at KIT, was appointed voting member of the Lower Saxony scientific commission, effective as of January 1, 2025.

■ **Professor Dr. Harald Kunstmann**, Institute of Meteorology and Climate Research, received the German Hydrology Award. The award is offered annually by the Deutsche Hydrologische Gesellschaft (DHG) and is linked to the grant of a honorary DHG membership.

■ **Tobias Länge** and Philipp Matheis, both from the Institute of Applied Informatics and Formal Description Methods, received an award each from the Verein für Angewandte Informatik Karlsruhe e. V. association for their master's theses.

■ The general meeting of the German Research Foundation (DFG) elected **Professor Dr. Gisela Lanza**, wbk Institute of Production Science, for a second term in the DFG senate.

■ In its constitutive meeting for the eighth term of office, the Deutschlandradio Hörfunkrat (radio service council) elected **Professor Dr. Annette Leßmöllmann**, Institute of Technology Futures, second Chairperson.

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■ **Dr. Patrick Lott**, Institute for Chemical Technology and Polymer Chemistry, was honored with an FCTKA prize by the Freunde der Chemischen Technik Karlsruhe association for his extraordinary commitment regarding the conversion of building 30.45.

■ Together with Sparkasse Karlsruhe, the KIT Climate and Environment Center conferred, during its annual conference, the Sparkasse Environmental Award 2023 to **Dr. Roman Lyubimenko**, Institute for Advanced Membrane Technology.

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■ Tobias Länge and **Philipp Matheis**, both from the Institute of Applied Informatics and Formal Description Methods, received an award each from the Verein für Angewandte Informatik Karlsruhe e. V. association for their master's theses.

■ **Hannah Meyer**, doctoral student in the Mineral Dust Helmholtz research group at the Institute of Meteorology and Climate Research, received an "Outstanding Student and PhD candidate Presentation" award during the 2024 general meeting of the European Geosciences Union.

■ **Raffaela Mirandola**, KASTEL – Institute of Information Security and Dependability, received the Most Influential Paper Award during the 15th ACM/SPEC International Conference on Performance Engineering in South Kensington, UK.

■ **Fabian Mockert** was given the Climate Award of the Reinhard-Süring Foundation. The award honors his research work on dark doldrums in Germany and their connection with large-scale weather conditions.

■ **Mattia Mossano** and three other scientists of the Institute of Applied Informatics and Formal Description Methods were granted the Distinguished Paper Award at the 14th International Conference on Network of the Future, Izmir, Turkey.

■ At the annual conference of the German Particle Physicists association in Bad Honnef, **Professor Dr. Margarete Mühlleitner**, Institute for Theoretical Physics, was elected Deputy Chairperson of the elementary particles committee.


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■ **Dr. Clifford Patten**, Institute of Applied Geosciences, received the Young Scientist Award from the Society for Geology Applied to Mineral Deposits.

■ Both the Leopoldina – National Academy of Sciences and the Academy of Europe (Academia Europaea) elected **Professor Dr. Holger Puchta**, Joseph Gottlieb Kölreuter Institute for Plant Sciences, a member.

■ **Professor Dr. Clemens Puppe**, Institute of Economics, was appointed Invited Distinguished Research Fellow for the academic year 2024/25 by the Scientific Council of the Corvinus Institute for Advanced Studies.


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■ At the "Kerntechnik 2024" specialist conference organized by the Kerntechnische Gesellschaft e.V. association, **Eric Rentschler**, Institute for Technology and Management in Construction, finished second in the competition for the best presentation of the EKONT-2 research project.

■ Together with Sparkasse Karlsruhe, the KIT Climate and Environment Center conferred, during its annual conference, the Sparkasse Environmental Award 2023 to **Andrea Cecilia Santos Rodríguez**, Institute of Architectural Design, Art, and Theory.

■ In cooperation with the KIT Freundeskreis und Fördergesellschaft e. V. association, the BLANC & FISCHER family holding awarded a BLANC & FISCHER Innovation Prize for outstanding dissertations at KIT's engineering departments to **Dr. Tobias Röddiger**, Institute of Telematics, and two other KIT scientists.

■ Furthermore, **Tobias Röddiger** was honored with a Helmholtz Doctoral Award 2023 for his dissertation, focusing on "earables," i.e. devices that can be worn at or in the ear. By providing earphones with different sensors, their functionality can be extended.

■ At the 20th European Informatics Leaders Summit, **Tobias Röddiger** also received the Informatics Europe 2024 Best Dissertation Award for his dissertation.


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■ The German Society for Biochemistry and Molecular Biology awarded **Dr. Michelle Rönspies**, Joseph Gottlieb Kölreuter Institute for Plant Sciences, the Bayer Pharmaceuticals PhD Prize for her work on the CRISPR/Cas system.

■ Furthermore, the Society for Genetics honored **Michelle Rönspies** with the Elisabeth Gateff Prize in recognition of her outstanding doctoral thesis.


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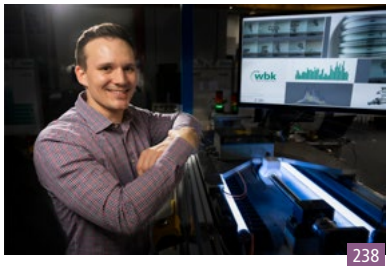
■ **Professor Dr. Peter W. Roesky**, Institute for Inorganic Chemistry, received the Marianne Baudler Prize from the German Chemical Society for his scientific achievements and his commitment to the community of chemists.

■ **Professor Dr. Wilhelm Schabel**, Institute of Thermal Process Engineering, was awarded the John A. Tallmadge Award in Coating Technology by the International Society of Coating Science and Technology and the American Institute of Chemical Engineers.

■ **Gunther Schiefer** and three other scientists of the Institute of Applied Informatics and Formal Description Methods received the Distinguished Paper Award at the 14th International Conference on Network of the Future, Izmir, Turkey.

■ In cooperation with the KIT Freundeskreis und Fördergesellschaft e. V. association, the BLANC & FISCHER family holding awarded a BLANC & FISCHER Innovation Prize for outstanding dissertations at KIT's engineering departments to **Dr. Tobias Schlagenhauf**, wbk Institute of Production Science, and two other KIT scientists.



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■ For his outstanding contributions on particle physics and the internationalization of research, the Heisenberg Society honored **Professor em. Dr. Herwig Schopper**, founding director of the Institutes of Experimental Nuclear Physics of the former Karlsruhe Technical University and the then Karlsruhe Nuclear Research Center with the Heisenberg Medal 2024. During the spring conference of the German Physics Association, he was also awarded an honorary doctorate by the KIT Department of Physics. (See photo on pages 114/115)

■ **Dr. Dominik Schreiber**, Institute of Theoretical Informatics, was honored by the Gesellschaft für Informatik e. V. association, the Austrian Computer Society, and the Swiss Informatics Society, with their joint PhD award for his dissertation themed "Scalable SAT Solving and its Application".


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■ **Elke Siedentopp**, Institute of Building Design and Technology, received an award from the KIT Freundeskreis und Fördergesellschaft e. V. association. She supported and managed the RoofKIT project that was victorious in the most important architecture competition for universities, "Solar Decathlon Europe 21/22."

■ The participants of the Germany-wide science communication event "I'm a Scientist, Get me out of here" voted **Dr. Volker Stelzer**, Institute for Technology Assessment and Systems Analysis, the "most convincing scientist".

■ **Alexander Streilin**, Institute of Meteorology and Climate Research, received an award from the KIT Freundeskreis und Fördergesellschaft e. V. association. As workshop supervisor, he supports the establishment of the IAGOS-CARIBIC system.

■ Together with Sparkasse Karlsruhe, the KIT Climate and Environment Center conferred, during its annual conference, the Sparkasse Environmental Award 2023 to **Dr. Simon Ternes**, Institute of Microstructure Technology.

■ **Karina Trindade** was honored with the Applied Photonics Award of the Fraunhofer Institute for Applied Optics and Precision Engineering in the "Special Jury Prize for Application in Sustainability" category for her master's thesis at the Institute of Microstructure Technology.

■ **Tim Niklas Uhl**, Institute of Theoretical Informatics, received the Golden Spike Award for his outstanding research work on scalable algorithms for big data applications.

■ The German Research Foundation elected **Professor Dr. Marliese Uhrig-Homburg**, Institute for Finance, Banking, and Insurance, to the selection committee for the Heinz Maier-Leibnitz Prize.


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■ **Maxime Veit** and three other scientists of the Institute of Applied Informatics and Formal Description Methods received the Distinguished Paper Award at the 14th International Conference on Network of the Future, Izmir, Turkey.

■ **Professor Dr. Melanie Volkamer** and three other scientists of the Institute of Applied Informatics and Formal Description Methods received the Distinguished Paper Award at the 14th International Conference on Network of the Future, Izmir, Turkey.


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■ The North Rhine-Westphalia Academy of Sciences and Arts accepted **Professor Dr. Dorothea Wagner**, Institute of Theoretical Informatics, as corresponding member.

■ **Dorothea Wagner** was further appointed first KIT Senior Professor after retirement.

■ **Dr. Benjamin Walter**, Institute of Applied Geosciences, was honored with the Victor Moritz Goldschmidt Prize 2023.

■ **Elisé Wamen**, officer for International Affairs of the General Students Committee (AStA) at KIT, has been presented with the "Karlsruher Integrationspreis" award.

■ Deutsches Institut für Erfindungswesen awarded **Professor Dr. Marion A. Weissenberger-Eibl**, Institute for Entrepreneurship, Technology Management, and Innovation, a Rudolf-Diesel Medal, the oldest European innovation award, in the "Beste Innovationsförderung" category.

■ **Dr. Karina Winkler**, Institute of Meteorology and Climate Research, received the Helmholtz Doctoral Award 2023 for her dissertation. In her doctoral thesis, she explored land-use changes on earth during the last 60 years using satellite data, land-usage statistics, and maps.


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■ **Dr. Jannik Wilhelm**, Institute of Meteorology and Climate Research, graduation year 2021, finished second in the competition for the Otto Haxel Award, which is bestowed by the KIT Freundeskreis und Fördergesellschaft e. V. association in cooperation with KIT, the universities of Heidelberg and Göttingen, and the German Physics Association.

■ The National Academy of Sciences Leopoldina honors **Dr. Jingyuan Xu**, Institute of Microstructure Technology, with the 2023 Leopoldina Prize for young scientists. She further received the Sponsorship Award of the Hector Fellow Academy and was accepted to the Global Young Academy.

■ **Jingyuan Xu** was also granted the ecology award of the Viktor & Sigrid Dulger Foundation for her research on sustainable thermo-acoustic combined cooling, heating, and power generation systems.

■ **Dr. Karl-Friedrich Ziegahn**, former Head of Division IV – Natural and Built Environment, and Distinguished Senior Fellow of KIT, was elected Chairman of the Augsburg University council.

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Institutions and Groups

■ As the winning team of the Enactus National Championships, a team of the **Enactus Karlsruhe e. V** students group represented Germany in October in the Enactus World Cup in Kazakhstan and reached a shared third place in the competition with 29 other teams.

■ With a new concept on concrete recycling, **Rement**, a KIT spinoff won the NEO2024 competition of the Karlsruhe Technology Region and additionally won the Audience Award.

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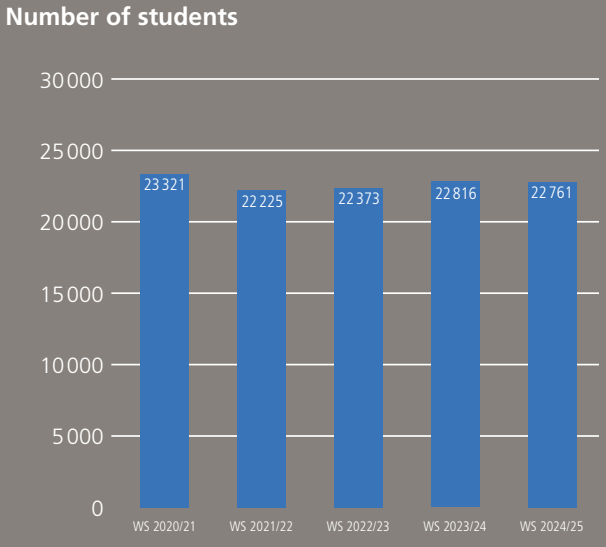
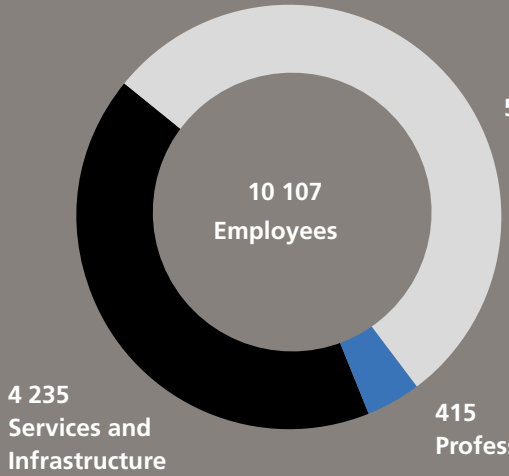
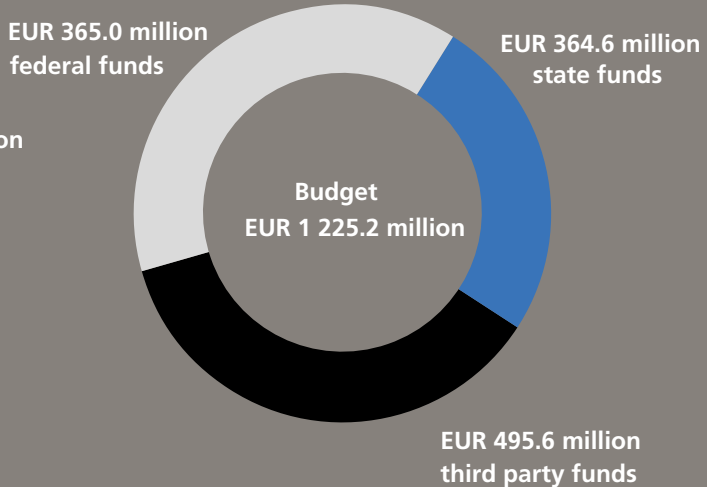
FACTS AND FIGURES



Employees 2024



Total budget 2024



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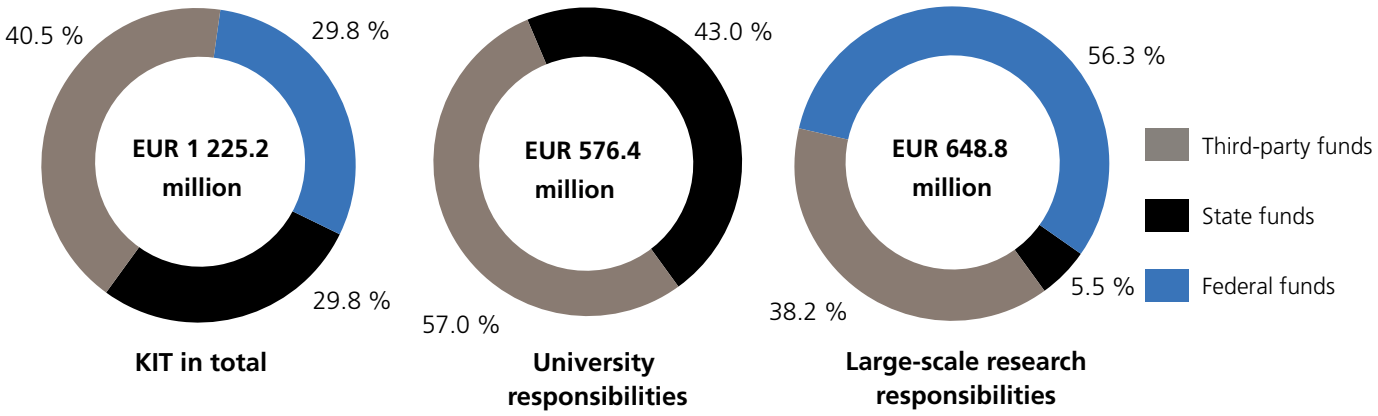
Funding

Federal, State, and Third-party Funds Acquired



Sources of Funding

KIT in Total

Income in total	955.8	1 071.3	1 101.1	1 147.6	1 225.2
Third-party funds	388.4	432.6	457.0	487.0	495.6
State funds	278.5	304.9	312.4	315.9	364.6
Federal funds	288.9	333.7	331.7	344.7	365.0

University Responsibilities

Income in total	480.4	510.1	531.4	539.4	576,4
Third-party funds	230.9	237.0	250.4	255.7	247,7
State funds	249.5	273.1	281.0	283.7	328,7
Federal funds*	0.0	0.0	0.0	0.0	0,0

* Federal funds for university responsibilities are included in the third-party funds, as they are granted for special projects rather than for basic funding.

Large-scale Research Responsibilities

In million euros	2020	2021	2022	2023	2024
Income in total	475.4	561.2	569.7	608.2	648,8
Third-party funds	157.5	195.6	206.6	231.3	247,9
State funds	29.0	31.8	31.3	32.2	35,9
Federal funds	288.9	333.7	331.7	344.7	365,0

Federal and state funds for large-scale research responsibilities also include the revenues/outstanding sums from the previous year.

Sources of Third-party Funding

KIT in Total

Third-party funding in total	388.4	432.8	457.0	487.0	495.6
Third-party funding by DFG, incl. CRC	53.6	63.9	70.6	62.4	74.8
Third-party funding by EU	30.9	26.4	43.3	38.0	44.9
Third-party funding by Fed. and State	169.1	195.0	205.0	212.0	224.9
Other income	134.8	147.5	138.1	174.6	151.0

University Responsibilities *

Third-party funding in total	230.9	237.0	250.4	255.7	247.7
Third-party funding by DFG, incl. CRC	41.3	47.1	47.5	41.4	49.8
Third-party funding by EU	11.9	8.6	13.2	14.2	10.2
Third-party funding by Fed. and State	105.9	108.2	114.8	112.1	112.2
Other income	71.8	73.1	74.9	88.0	75.5

* Third-party funds shall be all income and allowances granted for university responsibilities under the University Funding Agreement I in addition to basic funding.

Large-scale Research Responsibilities

Third-party funding in total	157.5	195.8	206.6	231.3	247.9
Third-party funding by DFG, incl. CRC	12.3	16.8	23.1	21.0	25.0
Third-party funding by EU	19.0	17.8	30.1	23.8	34.7
Third-party funding by Fed. and State	63.2	86.8	90.2	99.9	112.7
Other income	63.0	74.4	63.2	86.6	75.5

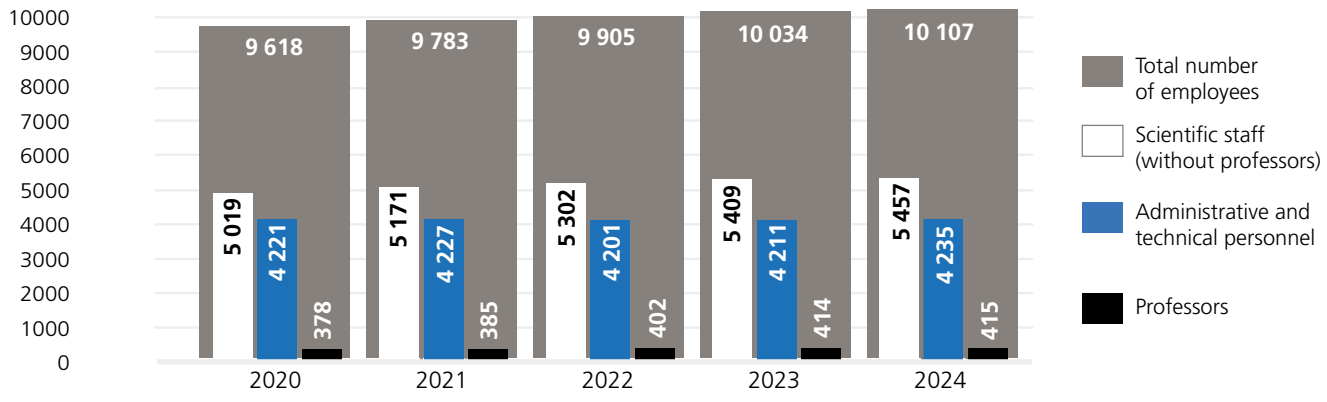
Use of Funds

In million euros	KIT in Total	University Responsibilities	Large-scale Research Responsibilities
Expenses in total	1 225.2	576.4	648.8
Investments in total	143.7	41.4	102.3
of these, major investments	32.9	0.0	32.9
of these, ongoing investments	110.8	41.4	69.4
Personnel expenses	731.4	388.4	343.0
Material expenses	350.1	146.6	203.5

Personnel Information

KIT Staff in Total

Staff (headcount)	2020	2021	2022	2023	2024
Total number of employees	9 618	9 783	9 905	10 034	10 107
of these, female employees	3 636	3 754	3 857	3 961	4 024
Professors	378	385	402	414	415
of these, female professors	59	63	72	81	81
of these, junior professors	17	24	31	31	30
of these, female junior professors	5	8	9	8	10
of these, international professors	44	46	50	53	51
of these, endowed professors	10	9	8	8	10
Scientific staff (without professors)	5 019	5 171	5 302	5 409	5 457
of these, female scientists	1 385	1 478	1 570	1 637	1 678
of these, staff financed from third-party funds	2 543	2 614	2 652	2 604	2 763
of these, international employees	1 240	1 359	1 481	1 633	1 679
of these, employment contracts of limited duration	3 925	4 049	4 141	4 225	4 263
of these, part-time employees	1 634	1 638	1 670	1 757	1 775
Administrative and technical personnel	4 221	4 227	4 201	4 211	4 235
of these, female staff	2 192	2 213	2 215	2 243	2 265
of these, staff financed from third-party funds	679	713	759	730	834
of these, international employees	237	246	255	267	276
of these, employment contracts of limited duration	859	876	870	883	870
of these, part-time employees	1 172	1 169	1 204	1 229	1 289
of these, trainees and students of Baden-Württemberg	370	367	368	358	337
of these, female trainees and students	140	136	135	139	135
Trainees' share in the total number of employees [%]	4	4	4	4	3



Habilitations

Total	9	13	12	17	7
Men	7	11	9	11	7
Women	2	2	3	6	0

Appointments to W-3 University Professor at KIT

Name, division	Professorship	Previous employer
Prof. Dr. Dominic Bresser, Division I	Elektrochemie	KIT
Prof. Dr. Giovanni de Carne, Division III	Echtzeitsysteme in der Energietechnik	KIT
Prof. Dr. Andreas Diepold, Division I	Angewandte Biologie	Max-Planck-Institut für terrestrische Mikrobiologie
Prof. Dr. Jan S. Hesthaven, Division II	Computational Science	Eidgenössische Technische Hochschule Lausanne
Prof. Dr. Lennart Hilbert, Division I	Systembiologie/Bioinformatik	KIT
Prof. Dr. Felix Kahlhöfer, Division V	Theoretische Teilchenphysik	KIT
Prof. Dr. Nadja Klein, Division II	Methods for Big Data	Technische Universität Dortmund
Prof. Dr. Simone Mayer, Division I	Systemische Zelluläre Neurobiologie	Eberhard Karls Universität Tübingen
Prof. Dr. Ulrich Wilhelm Paetzold, Division III	Next Generation Photovoltaics	KIT
Prof. Dr. Arne Rönnau, Division III	Intelligente Maschinen	FZI Forschungszentrum Informatik
Prof. Dr. Frederik Scheiff, Division I	Verfahrenstechnik chemischer Rohstoffe und Energieträger	BASF SE
Prof. Dr. Peter Schossig, Division IV	Technologien für klimagerechte Gebäude und Quartiere	Fraunhofer ISE
Prof. Dr. Henriette Sudhaus, Division V	Seismo-Geodäsie	Christian-Albrechts-Universität zu Kiel
Prof. Dr. Florian Weigend, Division V	Theoretische Chemie schwerer Elemente	Philipps-Universität Marburg
Prof. Dr. Tim Zeiner, Division I	Thermische Verfahrenstechnik	TU Graz

Personnel Information

Appointment* to W-1 University Professor at KIT

Name, division	Professorship	Previous employer
TT-Prof. Dr. Johannes Bracher, Division II	Health Statistics	KIT
Jun.-Prof. Dr. Emilia Graß, Division II	Operations of critical Infrastructures in Health Care	Universität Mannheim
TT-Prof. Florian Kaiser, Division IV	Kreislaufgerechter Holzbau	Atelier Kaiser Shen
TT-Prof. Dr. Franziska Meinherz, Division IV	Sozialgeographische Stadt- und Mobilitätsforschung	Technische Universität München

* Appointment or entry into service

Appointments* to Apl. Professor and Honorary Professor

Name	Type	KIT department	Division
Prof. Dr. Igor Gornyi	APL-Professoren	PHYSIK	Division V
Prof. Dr. Siegfried Waldvogel	Honorarprofessoren	CHEMBIO	Division I

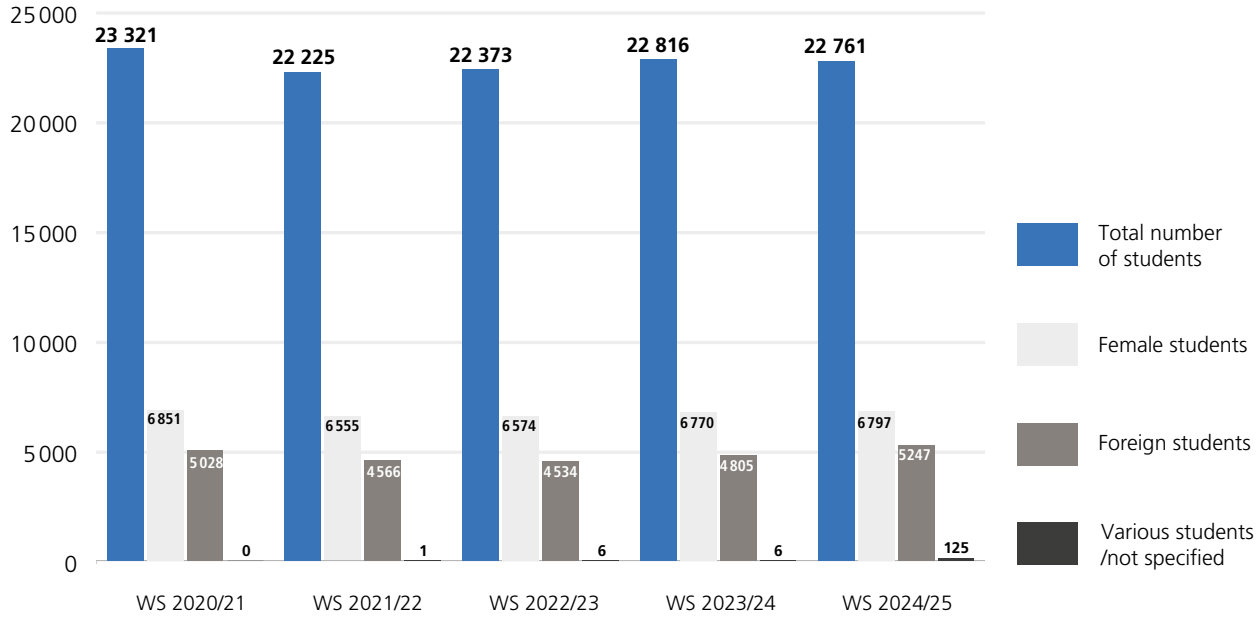
* Appointment or entry into service

Emeriti/Retirements

Name	Insti-		Division
Prof. Dr. Frank Gauterin	FAST	Fahrzeugtechnik	Division III
Prof. Dr. Heike Karbstein	BLT	Lebensmittelverfahrenstechnik	Division I
Prof. Dr. Matthias Kind	TVT	Thermische Verfahrenstechnik	Division I
Prof. Dr. Thomas Kolb	EBI	Gemeinsame Instititutseinrichtung	Division I
Prof. Dr. Bernhard Neumair	SCC	Scientific Computing	Division II
Prof. Dr. Dorothea Wagner	ITI	Inst. f. Theoretische Informatik	Division II
Prof. Dr. Alexander Waibel	IAR	Wissensbas. Sys. u. Wissensvera.	Division II

Students

Students in Total



Students and Desired Degrees

Desired degree	WS 2020/21	WS 2021/22	WS 2022/23	WS 2023/24	WS 2024/25
Bachelor	13 086	12 454	12 329	12 434	12 147
Master	8 548	8 089	7 928	8 042	8 132
Teacher (secondary and vocational schools)	964	960	959	973	899
Doctorate	355	325	720	950	1 126
State examination	0	0	0	0	0
Diploma	22	4	0	0	0
Studienkolleg	148	114	168	173	188
No degree*	198	279	269	244	269
Total	**23 321**	**22 225**	**22 373**	**22 816**	**22 761**

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

Students

Allocation of Students to Subject Groups

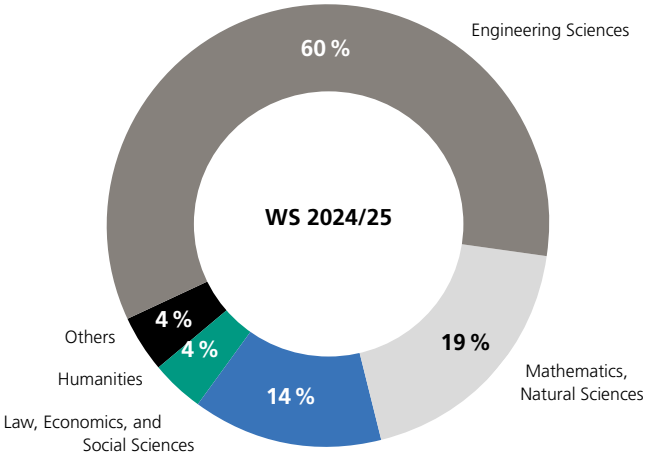
Engineering Sciences	14 025	13 170	13 170	13 448	13 668
Mathematics, Natural Sciences	3 933	3 841	4 098	4 236	4 240
Law, Economics, and Social Sciences	3 678	3 571	3 467	3 429	3 163
Humanities	830	818	866	953	896
Sports, Arts, and Others	855	825	772	750	794
Total	**23 321**	**22 225**	**22 373**	**22 816**	**22 761**

Allocation of Foreign Students* to Subject Groups

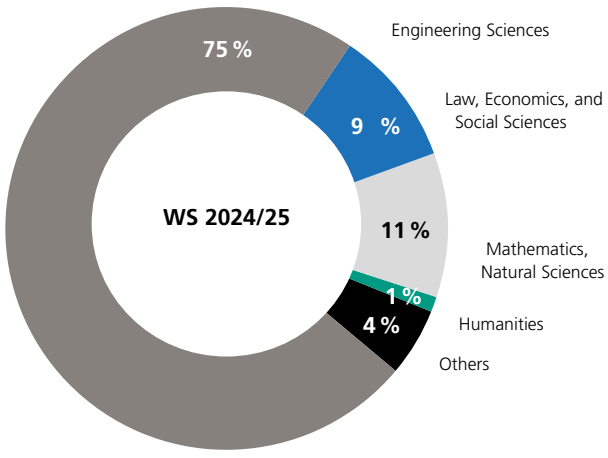
Fächergruppen	WS 2020/21	WS 2021/22	WS 2022/23	WS 2023/24	WS 2024/25
Engineering Sciences	3 819	3 400	3 337	3 546	3 938
Mathematics, Natural Sciences	472	445	476	504	554
Law, Economics, and Social Sciences	487	486	446	478	455
Humanities	61	57	64	73	70
Sports, Arts, and Others	189	178	211	204	230
Total	**5 028**	**4 566**	**4 534**	**4 805**	**5 247**

*Foreign students: Not of German nationality

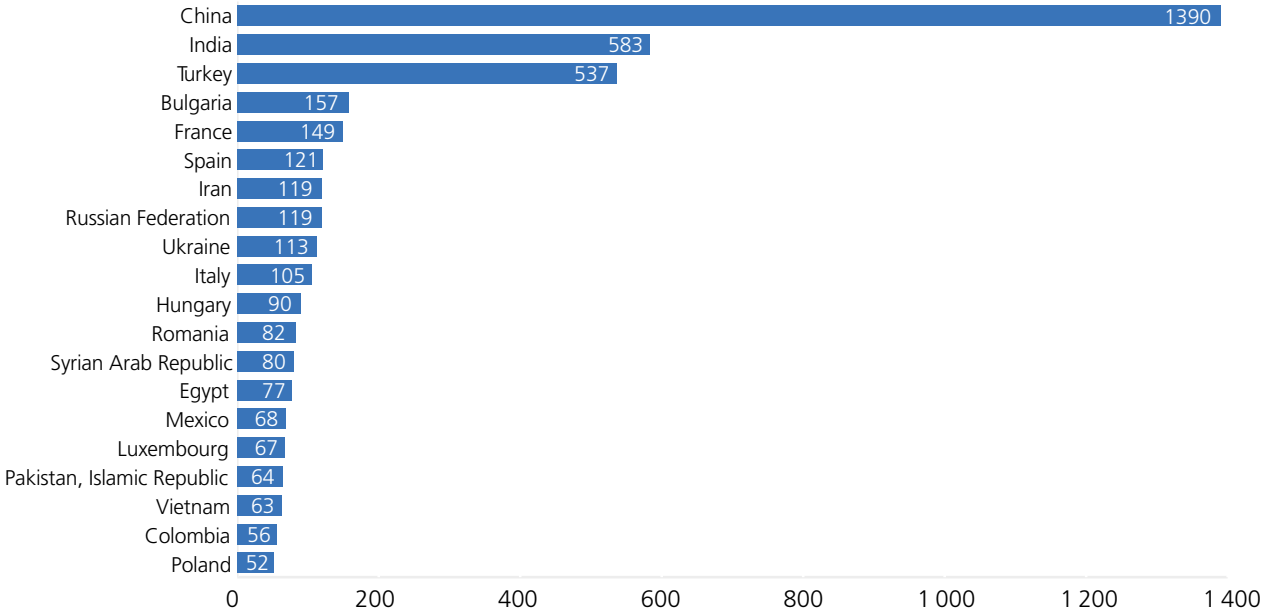
Allocation of Students to Subject Groups



Allocation of Foreign Students to Subject Groups



Home Countries of Foreign Students (Top 20 of 127)



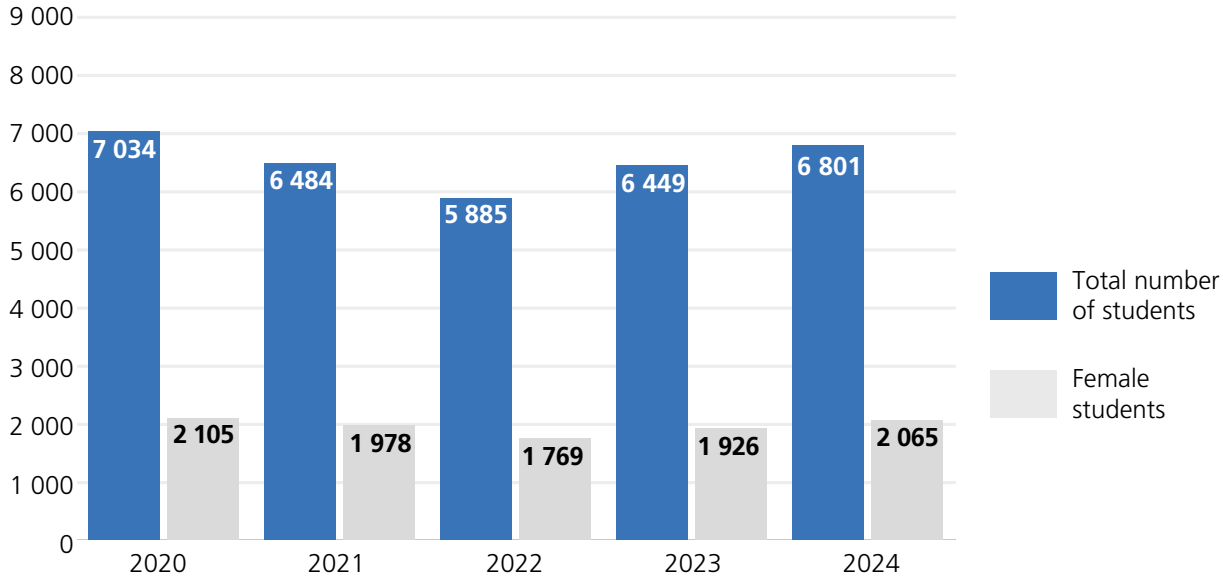
Student Beginners and Degrees Targeted in the 1st Semester*

Desired degree	2020	2021	2022	2023	2024
Bachelor	3 935	3 454	3 071	3 430	3 690
Master	2 602	2 596	2 403	2 550	2 609
Bachelor's degree in teaching at secondary schools	185	173	178	160	182
Bachelor's degree in teaching at vocational schools	17	12	8	9	6
Master's degree in teaching at secondary schools	50	83	81	89	88
Master's degree in teaching at vocational schools	22	22	17	21	9
Studienkolleg	223	144	127	190	217
Total	**7 034**	**6 484**	**5 885**	**6 449**	**6 801**

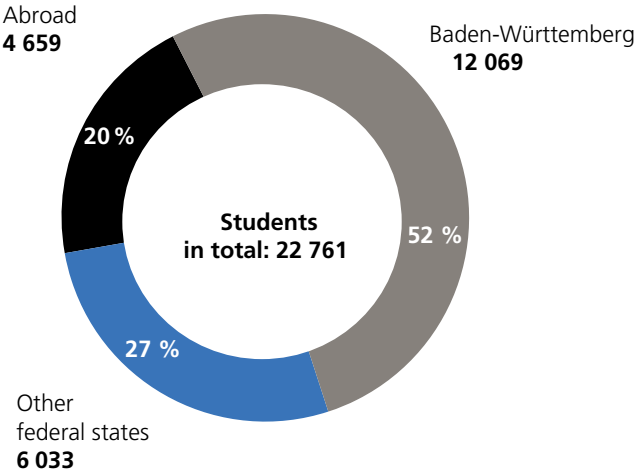
*Without doctoral students and exchange students, who do not pursue a degree at KIT.

Students

Number of Student Beginners in the 1st Semester



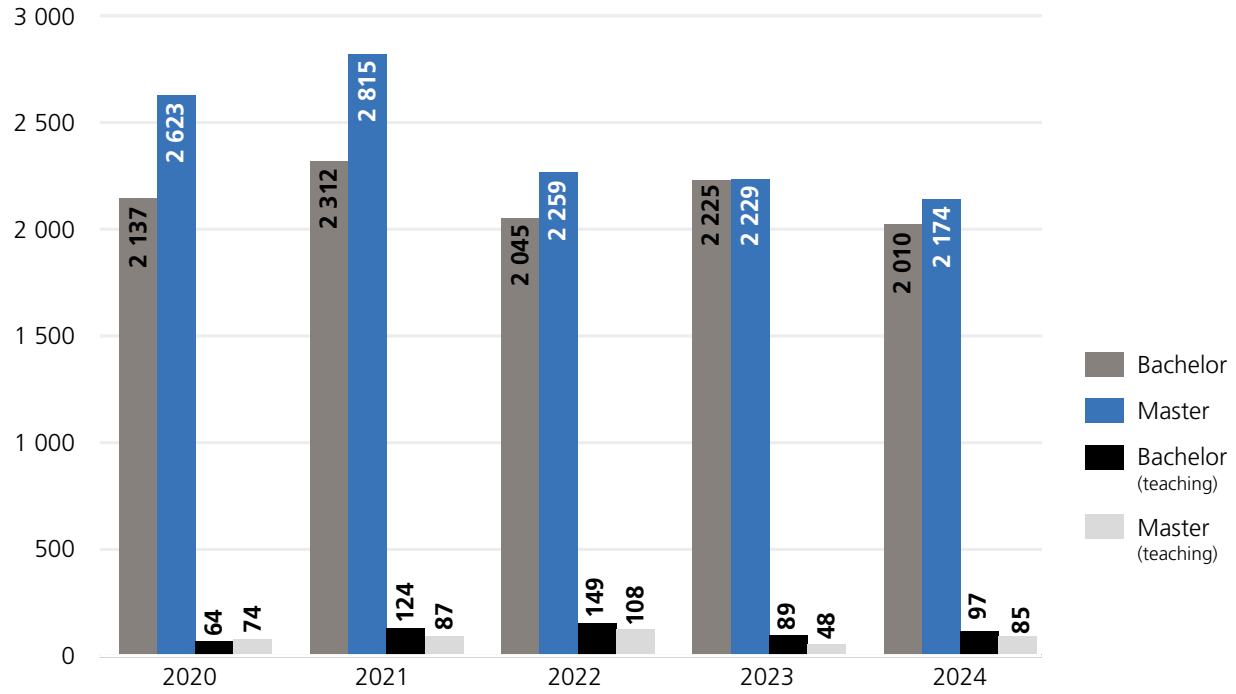
Origin of Students in the 2024/25 Winter Semester*



*Place of acquisition of university entrance qualification.

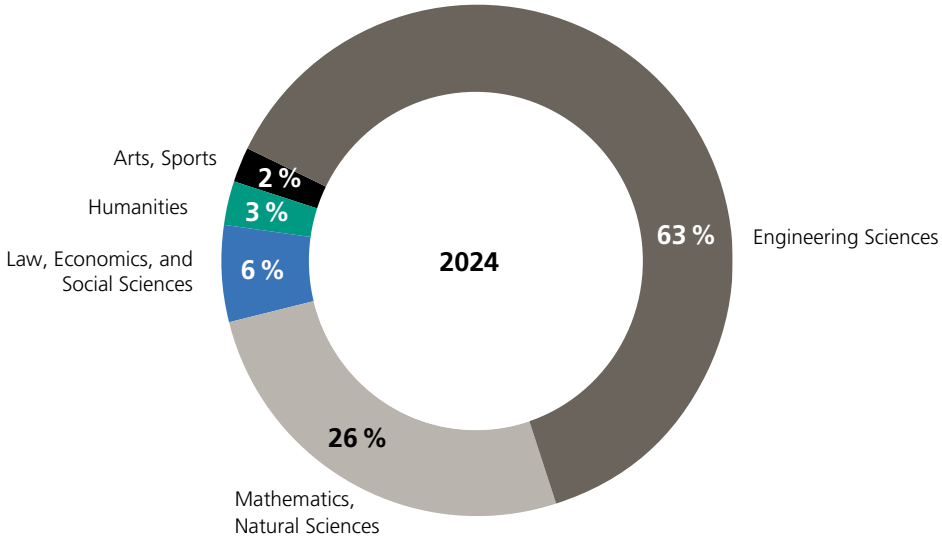
Region	Students
Karlsruhe city and district	3 334
Karlsruhe Regional Council District	3 408
Rest of Baden-Württemberg	5 327
Baden-Württemberg in total	12 069
Rhineland-Palatinate	1 748
Bavaria	1 033
North Rhine-Westphalia	948
Hesse	866
Lower Saxony	406
Other federal states	1 032
Germany without Baden-Württemberg	6 033
Asia	2 669
Europe	1 403
Africa	173
America	406
Australia and Oceania	8
Abroad	4 659
KIT in total	22 761

Number of Graduates



Doctoral Candidates in the Different Subject Groups

Subject group	Male	Female	Non-binary	Total
Engineering Sciences	1 771	558	0	2 329
Mathematics, Natural Sciences	582	379	3	964
Law, Economics, and Social Sciences	124	86	0	210
Humanities	60	50	0	110
Arts, Sports	27	39	0	66
Total	3	1	0	4
Gesamt	**2 567**	**1 113**	**3**	**3 683**



Students

Study Programs in the Area of Engineering Sciences

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Architektur	●	●			Deutsch-Französischer Doppelmaster *(École Nationale Supérieure d'Architecture de Strasbourg, France)*
Bauingenieurwesen	●	●			
Bioingenieurwesen	●	●			
Chemieingenieurwesen und Verfahrenstechnik	●	●			
Elektrotechnik und Informations-technik	●	●			Deutsch-Französische Doppelabschlüsse B.Sc. und M.Sc. *(Institut National Polytechnique Grenoble, France)* Deutsch-Ungarischer Doppelbachelor (*Budapest University of Technology and Ecomonics, Hungary)*
Energy Engineering and Management				●	
Financial Engineering				●	
Funktionaler und Konstruktiver Ingenieurbau – Engineering Structures		●			
Geodäsie und Geoinformatik	●	●			Deutsch-Französische Doppelabschlüsse B.Sc. und M.Sc. *(Institut National des Sciences Appliquées Strasbourg, France)*
Information Systems Engineering and Management				●	
Informatik	●	●	●		Doppelmaster Informatik *(Institut National Polytechnique Grenoble, France)*
Management of Product Development				●	
Mobility Systems Engineering and Management				●	
Maschinenbau	●	●			Deutsch-Französisches Bachelor-Master-übergreifendes Programm *(Arts et Métiers ParisTech, France)* Deutsch-Französisches Bachelor-Master-übergreifendes Programm *(Institut National des Sciences Appliquées Lyon, France)* Dual-Master-Programm *(Korea Advanced Institute of Science and Technology, Korea)* Doppelmaster Fahrzeug- oder Produktions-technik *(CDHK, Tongji Universität, China)* Dual-Master-Programm *(Instituto Tecnológico de Buenos Aires, Buenos Aires, Agentina)*

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

Subject (program)	Bachelor	Master (consecutive)	Teacher	Master (cont. education)	Double degree
Materialwissenschaft und Werkstofftechnik	●	●			
Mechanical Engineering (International)	●				
Mechatronik und Informationstechnik	●	●			Deutsch-Bulgarischer Doppelabschluss B.Sc. *(Technische Universität Sofia)* Doppelbachelor *(Budapest University of Technology and Economics, Hungary)*
Medizintechnik	●				
Mobilität und Infrastruktur		●			
Mobility Systems Engineering and Management				●	
Naturwissenschaft und Technik			●		
Optics and Photonics		●			Doppelmaster Programm EUROPHOTONICS *(Aix Marseille Université, France; École Centrale de Marseille, France; Barcelona Universities, Spain; Tampere University of Technology, Finland; Vilnius University, Lithuania)*
Production and Operations Management				●	
Regionalwissenschaft/Raumplanung		●			Deutsch-Chilenisches Double-Degree-Masterprogramm *(Universidad de Concepción, Chile)* Deutsch-Argentinisches Double-Degree-Masterprogramm *(Universidad Tecnológica Nacional, Argentina)*
Remote Sensing and Geoinformatics		●			
Technologie und Management im Baubetrieb		●			
Water Science and Engineering		●			
Wirtschaftsinformatik	●	●			

Study Programs in the Area of Arts, Art Science

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 / Geophysics	●	●			
Lebensmittelchemie	●	●			
Mathematik	●	●	●		
Meteorologie und Klimaphysik/ Meteorology and Climate Physics	●	●			
Physik / Physics	●	●	●		Deutsch-Französischer Doppelmaster *(Université Grenoble Alpes, 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
Digital Economics	●	●			
Ingenieurpädagogik	●	●			
Ingenieurpädagogik für Ingenieurinnen und Ingenieure			●		
Pädagogik	●	●			
Technische Volkswirtschaftslehre (expiring)	●	●			
Wirtschaftsingenieurwesen	●	●			Deutsch-Französischer Doppelmaster M.Sc. *(Institut National Polytechnique Grenoble, France)*

Study Programs in the Area of Sports

Sport			●		
Sportwissenschaften	●	●			

Study Programs in the Area of the Humanities

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

Research

Coordinated Research Programs

Clusters of Excellence as Part of the Excellence Strategy Launched by the Federal and the State Governments

Prof. Dr. Maximilian Fichtner, Helmholtz-Institut Ulm für Elektrochemische Energiespeicherung, Division I Prof. Dr. Helmut Ehrenberg, Institut für Angewandte Materialien, Division III	EXC 2154: POLiS – Post Lithium Storage Cluster of Excellence – Energiespeicherung jenseits von Lithium	01/2019 – 12/2025	Universität Ulm
Prof. Dr. Martin Wegener, Institut für Angewandte Physik, Division V	EXC 2082: 3D Designer Materialien / 3D Matter Made To Order	01/2019 – 12/2025	Ruprecht-Karls-Universität Heidelberg

Collaborative Research Centers with KIT Representing the CRC

Number	Title	Spokesperson	Duration
SFB 1173/3	Wellenphänomene: Analysis und Numerik	Prof. Dr. Marlis Hochbruck, Institut für Angewandte und Numerische Mathematik, Division V	2015 – 2027
SFB-TRR 257/2	Phänomenologische Elementarteilchenphysik nach der Higgs-Entdeckung	Prof. Dr. Gudrun Heinrich, Institut für Theoretische Physik, Division V	2019 – 2026
SFB 1441/2	Verfolgung der aktiven Zentren in heterogenen Katalysatoren für die Emissionskontrolle / Tracking the Active Site in Heterogeneous Catalysis for Emission Control (TrackAct)	Prof. Dr. Jan-Dierk Grunwaldt, Institut für Technische Chemie und Polymerchemie, Division I	2021 – 2028
SFB 1527/1	High Performance Compact Magnetic Resonance – HyPERiON	Prof. Dr. Jan Gerrit Korvink, Institut für Mikrostrukturtechnik, Division III	2022 – 2026
SFB 1573/1	4f for Future	Prof. Dr. Peter Roesky, Institut für Anorganische Chemie, Division I	2023 – 2026
SFB 1608/1	Konsistenz in der sichtenbasierten Entwicklung Cyber-Physikalischer Systeme / Consistency in the View-Based Development of Cyber-Physical Systems	Prof. Dr. Ralf Reussner, KASTEL – Institut für Informationssicherheit und Verlässlichkeit, Division II	2023 – 2027
SFB 1574/1	Kreislauffabrik für das ewige Produkt	Prof. Dr. Gisela Lanza, Institut für Produktionstechnik, Division III	2024 – 2027

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

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

FOR 2383	Erfassung und Steuerung dynamischer lokaler Prozesszustände in Mikroreaktoren mittels neuer in-situ-Sensorik	Prof. Dr. Roland Dittmeyer, Institut für Chemische Verfahrenstechnik, Division I	2019 – 2024
FOR 5230	Finanzmärkte und Friktionen – ein intermediärsbasierter Ansatz im Asset Pricing	Prof. Dr. Marliese Uhrig-Homburg, Institut für Finanzwirtschaft, Banken und Versicherungen, Division II	2021 – 2025
FOR 5339	KI-basierte Methodik für die schnelle Ertüchtigung unreifer Produktionsprozesse	Prof. Dr. Jürgen Beyerer, Institut für Anthropomatik und Robotik, Division II	2022 – 2026
FOR 2824	Amorphe molekulare Materialien mit extrem nichtlinearen optischen Eigenschaften	Prof. Dr. Stefanie Dehnen, Institut für Nanotechnologie, Division V	2023 – 2025
FOR 5715	Entwicklung gemeinsamer Konzepte in der Thermo- und Elektrokatalyse zur Wasserstoffperoxid-Direktsynthese / Bridging Concepts in Thermo- and Electro-Hydrogen Peroxide Catalysis (HyPerCat)	Prof. Dr. Silke Behrens, Institut für Katalyseforschung und -technologie, Division I	2024 – 2028

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 indicates the funding period approved to date and refers to the complete project. Partial projects at KIT may deviate.

Collaborative Research Centers with Institutional Participation of KIT

Number	Title	Spokesperson / KIT participation	Duration
SFB-TRR 150/3	Turbulent chemisch reagierende Mehrphasenströmungen in Wandnähe	Prof. Dr. Andreas Dreizler, TU Darmstadt (Spokesperson), Prof. Dr. Olaf Deutschmann, Institut für Technische Chemie und Polymerchemie, KIT, Division I	2015 – 2026
SFB-TRR 165/3	Waves to Weather: Wellen, Wolken, Wetter	Prof. Dr. George C. Craig, LMU München (Spokesperson), Prof. Dr. Volkmar Wirth, JGU Mainz Prof. Dr. Peter Knippertz, Institut für Meteorologie und Klimaforschung Troposphärenforschung, KIT, Division IV	2015 – 2024

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

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➔ Collaborative Research Centers with Institutional Participation of KIT

Number	Title	Spokesperson / KIT participation	Duration
SFB-TRR 288/2	Elastic Tuning and Response of Electronic Quantum Phases of Matter (ELASTO-Q-MAT)	Prof. Dr. Roser Valentí, Unversität Frankfurt (Spokesperson) Prof. Dr. Jairo Sinovar, JGU Mainz Prof. Dr. Jörg Schmalian, Institut für Theorie der Kondensierten Materie, KIT, Division V	2020 – 2028

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

DFG-funded Research Units with Institutional Participation of KIT

Number	Title	Spokesperson / KIT participation	Duration
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, Zoologisches Institut, KIT, Division I	2016 – 2024
FOR 2063	The Epistemology of the Large Hadron Collider	Prof. Dr. Gregor Schiemann, Bergische Universität Wuppertal (Spokesperson) Prof. Dr. Rafaela Hillerbrand, Institut für Technikfolgenabschätzung und Systemanalyse, KIT, Division II	2016 – 2024
FOR 2589	Zeitnahe Niederschlagsschätzung und -vorhersage	Dr. Silke Trömel, Rheinische Friedrich-Wilhelms-Universität Bonn (Spokesperson) Dr. Christian Chwala, Institut für Meteorologie und Klimaforschung, KIT, Division IV	2018 – 2025
FOR 2730	Umweltveränderungen in Biodiversitäts-Hotspot-Ökosystemen Süd-Ecuadors: Systemantwort und Rückkopplungseffekte (RESPECT)	Prof. Dr. Nina Farwig, Philipps-Universität Marburg (Spokesperson) Prof. Dr. Wolfgang Wilcke, Institut für Geographie und Geoökologie, KIT, Division IV	2018 – 2025

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Research

➔ DFG-funded Research Units with Institutional Participation of KIT

Number	Title	Spokesperson / KIT participation	Duration
FOR 2936	Klimawandel und Gesundheit in Afrika südlich der Sahara	Prof. Dr. Ina Danquah, Rheinische Friedrich-Wilhelms-Universität Bonn, (Spokesperson) Prof. Dr. Harald Kunstmann, Institut für Meteorologie und Klimaforschung Atmosphärische Umweltforschung, KIT, Division IV	2019 – 2024
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, Institut für Meteorologie und Klimaforschung, KIT, Division IV	2019 – 2025
FOR 5199	Suche nach Verletzung der Lepton-Familienzahl mit dem Mu3e-Experiment	Prof. Dr. André Schöning, Universität Heidelberg (Spokesperson) Prof. Dr. Ivan Peric, Institut für Prozessdatenverarbeitung und Elektrotechnik, KIT, Division V	2021 – 2025
FOR 3010	Multifunktionale, grobkörnige, refraktäre Verbundwerkstoffe und Werkstoffverbunde für großvolumige Schlüssel-Bauteile in Hochtemperaturprozessen	Prof. Dr. Christos Aneziris, TU Bergakademie Freiberg (Spokesperson) Dr. Torben Boll, Prof. Dr. Martin Heilmaier, Prof. Dr. Michael Hoffmann, Dr. Peter Franke, Prof. Dr. Hans Jürgen Seifert, Dr. Susanne Wagner, Institut für Angewandte Materialien, KIT, Division III	2020 – 2026
FOR 5639	Land-Atmosphäre Feedback Initiative (LAFI)	Professor Dr. Volker Wulfmeyer, Universität Hohenheim (Spokesperson) Prof. Dr. Harald Kunstmann, Institut für Meteorologie und Klimaforschung Atmosphärische Umweltforschung, KIT, Division IV	2024 – 2026
FOR 5455	Deformationsanalyse mit Messungen terrestrischer Laserscanner	Prof. Dr. Heiner Kuhlmann, Rheinische Friedrich-Wilhelms-Universität Bonn (Spokesperson) Prof. Dr. Corinna Harmening, Geodätisches Institut, KIT, Division IV	2023 – 2027

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➔ DFG-funded Research Units with Institutional Participation of KIT

Number	Title	Spokesperson / KIT participation	Duration
FOR 5507	ExRef: Explosionsgefahren von Kältemitteln mit geringem Treibhauspotenzial	Dr. Detlev Markus, Physikalisch-Technische Bundesanstalt (Spokesperson) Prof. Dr. Ulrich Maas, Institut für Technische Thermodynamik, KIT, Division III	2023 – 2027
FOR 5595	Öl-Kältemittel-Mehrphasenströmungen in Spalten mit bewegten Berandungen – Neuartige mikroskopische und makroskopische Ansätze für Experiment, Modellierung und Simulation	Prof. Dr. Markus Richter, Technische Universität Chemnitz (Spokesperson) Dr. Jochen Kriegseis, Institut für Strömungsmechanik, KIT, Division III	2023 – 2027
FOR 5682	Mechanismen der Adaptation an die Wirts-Nische in Pflanzen-besiedelnden Pilzen	Prof. Dr. Gunther Döhlemann, Universität zu Köln (Spokesperson) Prof. Dr. Natalia Requena Sanchez, Joseph Gottlieb Kölreuter Institut für Pflanzenwissenschaften, KIT, Division I	2024 – 2028

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 indicates the funding period approved to date and refers to the complete project. Partial projects of KIT may deviate.

ERC Grants

Name, institute, division	Title of project	Duration
Dr. Frank Biedermann, Institut für Nanotechnologie, Division I	ERC Consolidator Grant SupraSense: Development of Suprasensors and Assays for Molecular Diagnostics	07/2023 – 06/2028
Prof. Dr. Dominic Bresser, Helmholtz-Institut Ulm für Elektrochemische Energiespeicherung, Division I	ERC Starting Grant RACER: Highly Redox-active Atomic Centers in Electrode Materials for Rechargeable Batteries	09/2022 – 08/2027
Prof. Dr. Johannes Brumm, Institut für Volkswirtschaftslehre, Division II	ERC Starting Grant SOLG for Policy: The Old, the Young, and the Uncertain Future: Using High-Dimensional Stochastic Overlapping-Generations Models to Evaluate Fiscal Policies that Shift Risk and Resources Across Generations	10/2022 – 09/2027
Prof. Dr. Stefanie Dehnen, Institut für Nanotechnologie, Division V	ERC Advanced Grant BICMat: Bismuth Cluster-Based Materials	10/2022 – 05/2027
Dr. Xufei Fang, Institut für Angewandte Materialien, Division III	ERC Starting Grant MERCEDIS: Mechanics-Tailored Functional Ceramics via Dislocations	04/2024 – 03/2030

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Research

➔ ERC Grants

Name, institute, division	Title of project	Duration
Prof. Dr. Kathrin Gerling, Institut für Anthropomatik und Robotik, Division II	ERC Starting Grant AccessVR: Developing Experience-Centric Accessible Immersive Virtual Reality Technology	01/2024 – 12/2028
Prof. Dr. Christian Greiner, Institut für Angewandte Materialien, Division III	ERC Consolidator Grant TriboKey – Deformation Mechanisms are the Key to Understanding and Tayloring Tribological Behaviour	09/2018 – 08/2024
Prof. Dr. Steffen Grohmann, Institut für Beschleunigerphysik und Technologie, Division V	ERC Advanced Grant GRAVITHELIUM: Gravitational wave detectors cooled with superfluid helium	10/2024 – 09/2029
Dr. Lars Heinke, Institut für Funktionelle Grenzflächen, Division I	ERC Consolidator Grant DYNOCON: Dynamic Ions under Nano-Confinement for Porous Membranes with Ultrafast Gas Permeation Control	07/2022 – 06/2027
Prof. Dr. Inge Hinterwaldner, Institut Kunst- und Baugeschichte, Division IV	ERC Consolidator Grant COSE: Coded Secrets: Artistic Interventions Hidden in the Digital Fabric	09/2022 – 08/2027
Prof. Dr. Christoph Kirchlechner, Institut für Angewandte Materialien, Division III	ERC Consolidator Grant TRITIME: Isolation, observation and quantification of mechanisms responsible for hydrogen embrittlement by TRITIum based microMEchanics	11/2022 – 10/2027
Prof. Dr. Christian Koos, Institut für Photonik und Quantenelektronik, Division III	ERC Consolidator Grant TeraSHAPE – Terahertz Waveform Synthesis and Analysis Using Hybrid Photonic-Electronic Circuits	05/2018 – 01/2024
Prof. Dr. Jan G. Korvink, Institut für Mikrostrukturtechnik, Division III Dr. Benno Meier, Institut für Biologische Grenzflächen, Division I	ERC Synergy Grant HISCORE: Highly Informative Drug Screening by Overcoming NMR Restrictions	05/2021 – 04/2027
Prof. Dr. Moritz Kreysing, Institut für Biologische und Chemische Systeme, Division I	ERC Starting Grant GHOSTS: Genetically enhanced, optically superior tissues	02/2023 – 05/2025
Prof. Dr. Ulrich Lemmer, Lichttechnisches Institut, Division III	ERC Advanced Grant ORTHOGONAL: Origami inspired thermoelectric generators by printing and folding	07/2023 – 06/2028
Tenure-Track-Prof. Dr. Ulrich W. Paetzold, Institut für Mikrostrukturtechnik, Division III	ERC Consolidator Grant LAMI-PERO: Laminated Perovskite Photovoltaics: Enabling large area processing of durable and high efficiency perovskite semiconductor thin films	10/2023 – 09/2028

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➔ **ERC Grants**

Name, institute, division	Title of project	Duration
Dr. Julian Quinting, Institut für Meteorologie und Klimaforschung, Division IV	ERC Starting Grant ASPIRE: Advancing Subseasonal Predictions at Reduced computational Effort	09/2023 – 08/2028
Prof. Dr. Peter Sanders, Institut für Theoretische Informatik, Division II	ERC Advanced Grant ScAlBox – Engineering Scalable Algorithms for the Basic Toolbox	01/2020 – 08/2025
Prof. Dr. Katharina Scherf, Institut für Angewandte Biowissenschaften, Division I	ERC Starting Grant GLUTENOMICS: Tracking gluten immunoreactive peptides from the grain to the gut and beyond	09/2022 – 08/2027
Prof. Dr. Laurent Schmalen, Communications Engineering Lab, Division III	ERC Consolidator Grant RENEW: Reinventing Energy Efficiency in Communication Networks	06/2021 – 05/2026
Prof. Dr. Frank Schröder, Institut für Astroteilchenphysik, Division V	ERC Starting Grant PeV-Radio – Digital Radio Detectors for Galactic PeV Particles	02/2019 – 01/2025
Prof. Dr. Mehdi Baradaran Tahoori, Institut für Technische Informatik, Division II	ERC Advanced Grant PRICOM: Printed Computing: Enabling Extremely Low Cost Pervasive Near Sensor Computing	10/2022 – 09/2027
Prof. Dr. Alexey Ustinov, Physikalisches Institut, Division V	ERC Advanced Grant MILLI-Q: Millimetre-Wave Superconducting Quantum Circuits	10/2022 – 09/2027
Dr. Tonya Vitova, Institut für Nukleare Entsorgung, Division III	ERC Consolidator Grant ACTINIDE BOND properties in gas, liquid and solid state	02/2021 – 01/2026
Prof. Dr. Wolfgang Wernsdorfer, Physikalisches Institut, Division V	ERC Synergy Grant DarkQuantum: Quantum Technologies for Axion Dark Matter Search	10/2024 – 12/2030
Tenure-Track-Prof. Dr. Philip Willke, Physikalisches Institut, Division V	ERC Synergy Grant ATOMQUANT: On-Surface Atomic Spins with Outstanding Quantum Coherence	01/2024 – 12/2028

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
Jun.-Prof. Dr. Jens Bauer, Institut für Nanotechnologie, Division V	Gerichtete Architektur in Tensegrity Fachwerken: Hin zu „Muskel-Knochen" Metamaterialien	08/2022 – 07/2028
Tenure-Track-Prof. Dr Johannes Bracher, Institut für Volkswirtschaftslehre, Division II	Multi-Modell Nowcasting und Kurzzeitvorhersage der Ausbreitung von Infektionskrankheiten / Multi-Model Nowcasting and Short-Term Forecasting of Infectious Disease Spread	03/2023 – 02/2026
Dr. Elia Fioravanti, Institut für Algebra und Geometrie, Division V	Grobe Mediane als Ersatz für Hyperbolizität / Coarse Medians as Hyperbolicity Surrogate	09/2023 – 08/2026
Dr. Alexander Hinz, Institut für Anorganische Chemie, Division I	Niedrig koordinierte Hauptgruppenelement-Verbindungen und deren Einsatz in der Aktivierung von H_2, CO, CO_2 sowie NH_3	07/2020 – 09/2026
Tenure-Track-Prof. Dr. Felix Kahlhöfer, Institut für Theoretische Teilchenphysik, Division V	Methoden und Werkzeuge für die Analyse und Interpretation von Experimenten und kosmologischen Beobachtungen zum Nachweis Dunkler Materie	04/2022 – 03/2024
Prof. Dr. Nadja Klein, Scientific Computing Center, Division II	Regression Models Beyond the Mean – A Bayesian Approach to Machine Learning	08/2024 – 07/2025
Dr. Sören Lehmkuhl, Institut für Mikrostrukturtechnik, Division III	Der PHASER im Fokus / The PHASER in focus	10/2023 – 09/2026
Tenure-Track-Prof. Dr. Rudolf Lioutikov, Institut für Theoretische Teilchenphysik, Division V	Intuitive Robot Intelligence: Efficiently Learning and Improving of Explainable Skills and Behaviors for Intuitive Human-Robot Interaction	04/2021 – 05/2025
Dr. Jan Masell, Institut für Theoretische Festkörperphysik, Division V	Design and Functionalization of 3d Magnetic Textures	12/2024 – 11/2027
Dr. Maryna Meretska, Institut für Nanotechnologie, Division V	Holografische Videoanzeige in Echtzeit: Meta-SLM	01/2024 – 12/2026
Prof. Dr. Anja Metelmann, Institut für Theorie der Kondensierten Materie, Division V	Direktionalität in Quantensystemen / Directionality in Quantum Systems	03/2024 – 03/2025
Prof. Dr. Belina von Krosigk, Institut für Astroteilchenphysik, Division V	Suchen nach Dunkler Materie jenseits des WIMPs und Verbesserung des Trigger und DAQ Systems von SuperCDMS SNOLAB	07/2022 – 06/2025

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

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➔ Emmy Noether Junior Research Groups

Name, institute, division	Title of group	Duration
Tenure-Track-Prof. Dr. Philip Willke, Physikalisches Institut, Division V	Quantenkohärente Kontrolle atomarer und molekularer Spins auf Oberflächen	10/2023 – 09/2026

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
Tenure-Track-Prof. Dr. Giovanni De Carne, Institut für Technische Physik, Division III	Hybrid Networks: a multi-modal design for the future energy system	07/2021 – 06/2026
Prof. Dr. Torben Ferber, Institut für Experimentelle Teilchenphysik, Division V	Searches for Dark Matter and Axion-Like Particles at Belle II	01/2022 – 02/2024
Jun.-Prof. Dr. Emilia Graß, KASTEL – Institut für Informations-sicherheit und Verlässlichkeit, Division II	Building Network Resilience in Healthcare against Cyber-Attacks	09/2023 – 08/2028
Dr. Emma Järvinen, Institut für Meteorologie und Klimaforschung, Division IV	Solving the Cirrus Cloud Puzzle – Do Cirrus Warm or Cool Our Climate?	05/2020 – 09/2024
Dr. Martina Klose, Institut für Meteorologie und Klimaforschung, Division IV	A big unknown in the climate impact of atmospheric aerosol: Mineral soil dust	11/2020 – 10/2026
Dr. Benno Meier, Institut für Biologische Grenzflächen, Division I	Hyperpolarized Magnetic Resonance	03/2019 – 02/2025
Tenure-Track-Prof. Dr. Benjamin Schäfer, Institut für Automation und angewandte Informatik, Division II	Data-Driven Analysis of Complex Systems for a Sustainable Future	01/2022 – 12/2026

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

BMBF Junior Research Groups

Name, institute, division	Title of group	Duration
Dr. Simon Fleischmann, Helmholtz-Institut Ulm, Division I	InfinBat: Zwischenschicht-funktionalisierte Materialien für neuartige elektrochemische Interkalationsbatterien	11/2021 – 10/2026
Dr. Florian Strauß, Institut für Nanotechnologie, Division V	MELLi: Maßgeschneiderte Elektrolyte für Lithium Feststoffbatterien	03/2022 – 02/2027

The annual budget of a group typically is EUR 1.5 to 3.2 million.

Freigeist Fellowship

Name, institute, division	Title of group	Duration
Dr. Susanne Benz, Institut für Photogrammetrie und Fernerkundung, Division IV	Large scale assessment of the effects of sustainable heat recycling in the shallow sub-surface on above ground temperature	10/2022 – 09/2028

Typical total budget per group: EUR 1 to 2.2 million.

NEXUS Program of the Carl Zeiss Foundation

Name, institute, division	Title of group	Duration
Dr. Nadja Alina Henke, Institut für Bio- und Lebensmitteltechnik, Division I	BiOSCALE – Etablierung von biologischen Scale-UpParametern zur Skalierung biotechnologischer Prozesse	02/2024 – 01/2029
Dr. Gözde Kabay, Institut für Funktionelle Grenzflächen, Division I	Interdigitated electrode biosensor decorated with artificially imprinted polymer receptors for rapid diagnosis of Acute Kidney Injury (IDEart)	10/2023 – 09/2028
Dr. Jingyuan Xu, Institut für Mikrostrukturtechnik, Division III	Toward Zero-Carbon, Net-Energy Refrigeration Using Elastocaloric Cooling (ELASTO COOL)	01/2024 – 12/2028

Typical total budget per group: EUR 1.5 million.

Other Recognized KIT Young Investigators Groups (Junior Research Groups) and Funding

Name, institute, division	Title of group	Duration	Funding
Dr. Cihan Ates, Institut für Thermische Strömungsmaschinen, Division III	Machine Intelligence in Energy Systems (MAI)	03/2022 – 03/2024	DFG and Baden-Württemberg-Stiftung
Dr. Mohammad Azari, Institut für Wasser und Umwelt, Division IV	Innovative und nachhaltige Abwassertechnik und -management	07/2024 – 10/2025	MWK, Fraunhofer

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➔ Other Recognized KIT Young Investigators Groups (Junior Research Groups) and Funding

Name, institute, division	Title of group	Duration	Funding
Dr. Benjamin Dörich, Institut für Angewandte und Numerische Mathematik, Division V	Numerical methods for nonlinear optics	04/2024 – 06/2027	DFG, IANM
Dr. Richard Fuchs, Institut für Meteorologie und Klimaforschung Atmosphärische Umweltforschung, Division IV	Land Use Data Analysis and Modelling	07/2024 – 12/2029	EU
Dr. Jan Haußmann, Institut für Produktentwicklung, Division III	Sensorbasierte Brennstoffzellenentwicklung	05/2022 – 11/2025	MWK
Dr. Tobias Käfer, Institut für Angewandte Informatik und Formale Beschreibungsverfahren, Division II	Knowledge Graph-based Artificial Intelligence Systems	02/2021 – 12/2026	BMBF
Dr. Carla-Olivia Krauß, Institut für Technologie und Management im Baubetrieb, Division IV	Validation of a continuous magnetic filter and sieving system for the treatment of particulate mixtures	11/2024 – 06/2027	BMBF
Dr. Mathias Krause, Institut für Angewandte und Numerische Mathematik 2/ Institut für Mechanische Verfahrenstechnik und Mechanik, Division V und III	Lattice Boltzmann Research Group	05/2018 – 04/2024	DFG and others
Dr. Sebastian Lerch, Institut für Volkswirtschaftslehre, Division II	Artificial Intelligence for Probabilistic Weather Forecasting	05/2021 – 03/2025	Vector Stiftung
Dr. Wilfried Liebig, Institut für Angewandte Materialien, Division III	Hybride Werkstoffe und Leichtbau	02/2023 – 12/2024	DFG, Federal Ministries and others
Dr. Axel Loewe, Institut für Biomedizinische Technik, Division III	Computational Cardiac Modelling	11/2018 – 12/2024	DFG and MWK
Dr. Ralf Loritz, Institut für Wasser und Gewässerentwicklung, Division IV	Energy and information flows in hydrological systems	10/2022 – 03/2028	VolkswagenStiftung

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Research

➔ Other Recognized KIT Young Investigators Groups (Junior Research Groups) and Funding

Name, institute, division	Title of group	Duration	Funding
Dr. Kathrin Menberg, Institut für Angewandte Geowissenschaften, Division IV	Nachhaltige Geoenergie	05/2022 – 09/2025	MWK and others
Dr. Klarissa Niedermeier, Institut für Thermische Energietechnik und Sicherheit, Division III	Wärmespeicher auf Flüssigmetallbasis – Schlüssel für CO_2-freie Hochtemperaturprozesse	04/2022 – 11/2026	BMWK
Dr. Claudia Niessner, Institut für Sport und Sportwissenschaft, Division II	Health Related Fitness and Physical Mobility in children, youth and young adulthood	12/2021 – 03/2027	MWK, BMBF and others
Dr. Annika Oertel, Institut für Meteorologie und Klimaforschung, Division IV	Erhöhung des Wertes von Kampagnenbeobachtungen durch Datenassimilation zur Verbesserung der konvektiven Vorhersagefähigkeit	04/2023 – 04/2027	BMDV
Dr. Pierre Picchetti, Institut für Nanotechnologie, Division V	Multifunctional nanomaterials for healthcare applications	07/2024 – 02/2027	Fonds der Chemischen Industrie
Dr. Frank Rhein, Institut für Mechanische Verfahrenstechnik und Mechanik, Division I	Particle Dynamics in Heterogeneous Systems	07/2024 – 09/2027	DFG
Dr. Björn de Rijk, Institut für Analysis, Division V	Stability of Nonlinear Waves	08/2022 – 12/2024	SFB „Wellenphänomene", DFG
Dr. Philipp Röse, Institut für Angewandte Materialien, Division III	Elektrokatalyse	12/2023 – 01/2026	BMBF
Dr. Somidh Saha, Institut für Technikfolgenabschätzung und Systemanalyse, Division II	Sylvanus	08/2019 – 12/2024	BMBF and others
Dr. Ulrike van der Schaaf, Institut für Bio- und Lebensmitteltechnik, Division I	Interfacial properties of pectinbased biopolymers	10/2020 – 11/2026	Arbeitsgemeinschaft industrieller Forschungsvereinigungen
Dr. Thomas Sheppard, Institut für Technische Chemie und Polymerchemie, Division I	X-ray Microscopy in Catalysis	02/2020 – 03/2025	BMBF, DFG

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➔ Other Recognized KIT Young Investigators Groups (Junior Research Groups) and Funding

Name, institute, division	Title of group	Duration	Funding
Dr. Christian Sprau, Lichttechnisches Institut, Division III	Druckbare semitransparente organische Solarzellen für Photovoltaikflächen der Zukunft	07/2023 – 03/2027	Vector Stiftung
Dr. Alexander Stroh, Institut für Strömungsmechanik, Division III	Multiphase flows and heat transfer	05/2022 – 06/2025	DFG and BMBF
Dr. Oliver Townrow, Institut für Nanotechnologie, Division V	Iron (0) Single-Atom Sources for Sustainable Catalysts (Thema YIG Prep Pro-Projekt)	11/2024 - 08/2027	Fonds der Chemischen Industrie
Dr. Rebekka Volk, Institut für Industriebetriebslehre und Industrielle Produktion, Division II	Projekt- und Ressourcenmanagement in der bebauten Umwelt	02/2023 – 06/2027	Federal Ministries, Helmholtz, EU and others
Dr. Christian Zillinger, Institut für Analysis, Division V	Stabilität und Instabilität in Flüssigkeiten und Materialien	08/2022 – 07/2024	SFB „Wellenphänomene“

Junior Professorships

Name, institute, division	Area	Duration
Jun.-Prof. Dr. Jens Bauer, Institut für Angewandte Materialien, Division III	Metamaterialien	10/2023 – 09/2029
Tenure-Track-Prof. Dr. Thomas Bläsius, Institut für Theoretische Informatik, Division II	Skalierbare Algorithmik und Verfahren für große Datenmengen	10/2020 – 09/2026
Tenure-Track-Prof. Dr. Johannes Bracher, Scientific Computing Center, Division II	Health Statistics	04/2024 – 03/2030
Tenure-Track-Prof. Dr. Barbara Bruno, Institut für Anthropomatik und Robotik, Division II	Künstliche Intelligenz für Autonome Systeme	05/2023 – 04/2029
Tenure-Track-Prof. Moritz Dörstelmann, Institut Entwerfen und Bautechnik, Division IV	Digital Design and Fabrication	04/2021 – 03/2027
Tenure-Track-Prof. Dr. Yolita Eggeler, Laboratorium für Elektronenmikroskopie, Division V	Elektronenmikroskopie	10/2020 – 09/2026

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Research

➔ Junior Professorships

Name, institute, division	Area	Duration
Tenure-Track-Prof. Dr. Pascal Friederich, Institut für Theoretische Informatik, Division II	KI-Methoden in der Materialwissenschaft	12/2019 – 12/2025
Jun.-Prof. Dr. Emilia Graß, Institut für Informationssicherheit und Verlässlichkeit, Division II	Operations of Critical Infrastructures in Health Care	02/2024 - 01/2030
Tenure-Track-Prof. Dr. Schirin Hanf, Institut für Anorganische Chemie, Division I	Fundamentale Anorganische Chemie: Nachhaltige Nutzung von Metallen	11/2021 – 10/2027
Tenure-Track-Prof. Florian Kaiser, Institut Entwerfen und Bautechnik, Division IV	Kreislaufgerechter Holzbau	10/2024 – 09/2030
Tenure-Track-Prof. Dr. Christoph Klahn, Institut für Mechanische Verfahrenstechnik und Mechanik, Division I	Prozessintensivierung in der Verfahrenstechnik durch Additive Fertigung	05/2021 – 05/2027
Tenure-Track-Prof. Dr. Manuel Krannich, Institut für Algebra und Geometrie, Division V	Geometrie	04/2022 – 03/2028
Tenure-Track-Prof. Dr. Sebastian Krumscheid, Scientific Computing Center, Division V	Uncertainty Quantification	08/2022 – 08/2025
Tenure-Track-Prof. Dr. Xian Liao, Institut für Analysis, Division V	Analysis partieller Differentialgleichungen	11/2018 – 07/2025
Tenure-Track-Prof. Dr. Rudolf Lioutikov, Institut für Anthropomatik und Robotik, Division II	Maschinelles Lernen und Robotik	12/2022 – 11/2028
Jun.-Prof. Dr. Claudio Llosa Isenrich, Institut für Algebra und Geometrie, Division V	Geometrie	10/2020 – 09/2026
Jun.-Prof. Dr. Reza Maalek, Institut für Technologie und Management im Baubetrieb, Division IV	Digital Engineering and Construction	11/2020 – 10/2026
Tenure-Track-Prof. Dr. Roland Maier, Institut für Angewandte und Numerische Mathematik, Division V	Numerik partieller Differentialgleichungen	07/2023 – 09/2027

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➔ **Junior Professorships**

Name, institute, division	Area	Duration
Tenure-Track-Prof. Dr. Franziska Meinherz, Institut für Geographie und Geoökologie, Division IV	Sozialgeographische Stadt- und Mobilitäts-forschung	10/2024 – 09/2030
Tenure-Track-Prof. Dr. Peer Nowack, Institut für Theoretische Informatik, Division II	KI in den Klima- und Umweltwissenschaften	03/2023 – 02/2029
Jun.-Prof. Dr. Rania Rayyes, Institut für Fördertechnik und Logistiksysteme, Division III	Hochwandlungsfähiges, flächen- und raumbewegliches System für die Produktion	12/2022 – 12/2028
Tenure-Track-Prof. Dr. Benjamin Schäfer, Institut für Automation und angewandte Informatik, Division III	Künstliche Intelligenz für das Energiesystem	05/2023 – 04/2029
Jun.-Prof. Dr. Maike Schwammberger, KASTEL – Institut für Informationssicherheit und Verlässlichkeit, Division II	Modellierung und Analyse im Mobility Software Engineering	12/2022 – 12/2028
Jun.-Prof. Dr. Jan Stühmer, Institut für Anthropomatik und Robotik, Division II	Maschinelles Lernen	09/2022 – 08/2028
Tenure-Track-Prof. Dr. Julian Thimme, Institut für Finanzwirtschaft, Banken und Versicherungen, Division II	Finance	08/2019 – 07/2025
Tenure-Track-Prof. Dr. Nevena Tomašević, Institut für Angewandte Geowissen-schaften, Division IV	Allgemeine Geologie	04/2021 – 03/2027
Tenure-Track-Prof. Dr. Philip Willke, Physikalisches Institut, Division V	Quantenkontrolle von Spins auf Oberflächen	05/2022 – 04/2028
Tenure-Track-Prof. Dr. Moritz Wolf, Engler-Bunte-Institut, Division I	Katalysatormaterialien für die Energiewende	05/2022 – 04/2028
Tenure-Track-Prof. Dr. Christian Wressnegger, KASTEL – Institut für Informationssicherheit und Verlässlichkeit, Division II	KI-Methoden in der IT-Sicherheit	12/2019 – 11/2025
Tenure-Track-Prof. Dr. Frederike Zufall, Institut für Informations- und Wirtschaftsrecht, Division II	Öffentliches Recht und Informatik	06/2023 – 05/2029

Research

Graduate Schools Funded by the German Research Foundation (DFG), Helmholtz Association (HGF) or Federal Ministry of Education and Research (BMBF)

Graduate School	Funded by	Spokesperson / participant	Duration
Graduate School „Electrochemical Energy Storage“	DFG	Prof. Dr. Jürgen Behm, Universität Ulm (Spokesperson) apl. Prof. Christine Kranz, Universität Ulm (Co-Spokesperson) Prof. Dr. Rolf Schuster, Institut für Physikalische Chemie, KIT (Co-Spokesperson)	2019 – 2025
HEiKA Graduate School „Functional Materials“	DFG	Prof. Dr. Martin Wegener, Institut für Angewandte Physik/ Institut für Nanotechnologie, KIT (Spokesperson) Prof. Dr. Uwe Bunz, Universität Heidelberg (Co-Spokesperson)	2019 – 2025
HIDSS4Health: Helmholtz Information and Data Science School for Health	HGF	Prof. Dr. Ralf Mikut, Institut für Automation und angewandte Informatik, KIT	2019 – 2029
MPSP: Max Planck School of Photonics	BMBF	Prof. Dr. David Hunger, Physikalisches Institut, KIT Prof. Dr. Christian Koos, Institut für Mikrostrukturtechnik, KIT Prof. Dr. Ulrich Lemmer, Lichttechnisches Institut, KIT Prof. Dr. Gerd Ulrich Nienhaus, Institut für Angewandte Physik, KIT Prof. Dr. Carsten Rockstuhl, Institut für Theoretische Festkörperphysik, KIT Prof. Dr. Martin Wegener, Institut für Angewandte Physik, KIT	2019 – 2025

Graduate Schools of KIT

Graduate School	Funded by	Spokesperson / participant	Duration
CyberSec: KIT Graduate School Cyber Security	Funded in the Framework of the Excellence Strategy	Tenure-Track-Prof. Dr. Christian Wressnegger, KASTEL – Institut für Informationssicherheit und Verlässlichkeit, KIT Prof. Dr. Thorsten Strufe, KASTEL – Institut für Informationssicherheit und Verlässlichkeit, KIT	2021 – 2026 5-jährige Förderdauer
KCDS: KIT Graduate School Computational and Data Science	Funded in the Framework of the Excellence Strategy	Prof. Dr. Martin Frank, Scientific Computing Center, KIT	2021 – 2026 5-jährige Förderdauer
ENZo: KIT Graduate School Enabling Net Zero	Funded in the Framework of the Excellence Strategy	Prof. Dr. Jörg Sauer, Institut für Katalyseforschung und -technologie, KIT	2021 – 2026 5-jährige Förderdauer
KSQM: KIT Graduate School of Quantum Matter	Funded in the Framework of the Excellence Strategy	Prof. Dr. Markus Garst, Institut für Theoretische Festkörperphysik / Institut für QuantenMaterialien und Technologien, KIT	2021 – 2026 5-jährige Förderdauer
UpGrade Mobility: KIT Graduate School UpGrade Mobility	Funded in the Framework of the Excellence Strategy	Prof. Dr. Eric Sax, Institut für Technik der Informationsverarbeitung, KIT	2021 – 2025 5-jährige Förderdauer
CuKnow: KIT Graduate School Cultures of Knowledge	Funded in the Framework of the Excellence Strategy	Prof. Dr. Ingrid Ott, Institut für Volkswirtschaftslehre, KIT Prof. Dr. Darko Jekauc, Institut für Sport und Sportwissenschaft, KIT	2021 – 2025 5-jährige Förderdauer
KSOP: Karlsruhe School of Optics & Photonics	KIT	Prof. Dr. Ulrich Lemmer, Lichttechnisches Institut, KIT	Since 2006 Meanwhile perpetuated
KSETA: Karlsruhe School of Elementary Particle and Astroparticle Physics: Science and Technology	KIT	Prof. Dr. Ulrich Nierste, Institut für Theoretische Teilchenphysik, KIT	Since 2012 Meanwhile perpetuated
GRACE: Graduate School for Climate and Environment	KIT	Prof. Dr. Stefan Hinz, Institut für Photogrammetrie und Fernerkundung, KIT	Since 2011 Meanwhile perpetuated
BIF-IGS: BioInterfaces International Graduate School	KIT	Prof. Dr. Nicholas Foulkes, Institut für Biologische und Chemische Systeme, KIT	Since 2011 Meanwhile perpetuated

Research Training Groups Funded by the DFG or Helmholtz Association

Research training group	Funded by	Spokesperson / participant	Duration
Molecular Architectures for Fluorescent Cell Imaging	DFG	Prof. Dr. Hans-Achim Wagenknecht, Institut für Organische Chemie, KIT	2015 – 2024
Integrated Engineering of Continuous-Discontinuous Long Fiber Reinforced Polymer Structures	DFG	Prof. Dr. Thomas Böhlke, Institut für Technische Mechanik, KIT jointly with: University of Waterloo, University of Western Ontario, University of Windsor (all of them: Canada)	2015 – 2024
Energy Status Data – Informatics Methods for its Collection, Analysis and Exploitation	DFG	Prof. Dr. Klemens Böhm, Institut für Programmstrukturen und Datenorganisation, KIT	2016 – 2025
Asymptotic Invariants and Limits of Groups and Spaces	DFG	Prof. Dr. Roman Sauer, Institut für Algebra und Geometrie, KIT jointly with: Prof. Dr. Anna Wienhard, Ruprecht-Karls-Universität Heidelberg	2016 – 2025
Simulation of Mechano-Electro-Thermal Processes in Lithium-Ion Batteries	DFG	Prof. Dr. Thomas Wetzel, Institut für Thermische Verfahrenstechnik, KIT	2017 – 2026
HIRSAP: Helmholtz International Research School for Astroparticle Physics and Enabling Technologies	HGF	Prof. Dr. Ralph Engel, Institut für Astroteilchenphysik, KIT	2018 – 2024
Tailored Scale-Bridging Approaches to Computational Nanoscience	DFG	Prof. Dr. Marcus Elstner, Institut für Physikalische Chemie, KIT	2019 – 2028
MatCom-ComMat: Materials Compounds from Composite Materials for Applications in Extreme Conditions	DFG	Prof. Dr. Martin Heilmaier, Institut für Angewandte Materialien, KIT	2020 – 2029
KD²School: Designing Adaptive Systems For Economic Decision-Making	DFG	Prof. Dr. Christof Weinhardt, Institut für Wirtschafts-informatik und Marketing, KIT	2021 – 2026

Innovation

Innovation Characteristics

Year	Invention disclosures	Priority-establishing patent applications	Property rights (existing)	Royalties [million euros]	New companies (spinoffs)	Participation in spinoffs
2020	105	50	1 772	2.05	28 (7)	9
2021	120	51	1 677	4.42	37 (12)	9
2022	91	43	1 654	1.79	48 (18)	9
2023	70	38	1 577	1.58	49 (19)	12
2024	95	48	1 463	1.46	58 (16)	13

Establishments of New Companies

Spinoffs
BioWerkz GmbH
CAVIGEN UG (limited liability)
Datin GbR
Enersoul GbR
Genitor GbR
Industrial AI UG, Karlsruhe
KCP GbR
milli IC GmbH
NPS Nano Polymer Solutions GbR
PrioOptics GmbH
Rement Tech GbR
REVYVE Technologies GmbH
SUNEO GbR
Teragear GmbH
Validaitor UG (limited liability)
varmo UG (limited liability)

Startups
Adapt2Move GmbH
Alfa ATC Communications GmbH
Apium 3D Technologies GmbH
Arkons Consulting GmbH
Artjom & Eve GbR
AvoLabs Inc.
BeFIDL UG
Betterlead UG
Cansyno GmbH
ConCard UG (limited liability)
Desoltik GbR
Emaschow Tech GmbH
Fundermedicals GmbH
GenAI GmbH
I&B Haferwelt - Grainu GmbH
IB-Beese GmbH
Implyt Gbr
Innosoft Future UG
kalebru GmbH
Liftwise GbR
Linity GmbH
MARTUS.ING (engineering office)
neoBIM GmbH

Startups
neuralux UG
onsector GmbH
Pladion GmbH
prefiro GmbH
Puerro GbR
Razo Energy GbR
Rinke Solutions UG
SATE UG (limited liability)
SquareNeo Solutions GmbH
Straight Up GbR
Streamlingo GbR
Syndiode GbR
Testbedded GmbH
VAISTO GmbH
VCS Vision Control Solutions GmbH
Vrakos Grid GbR
WEGO Vision GmbH
XLCloud GmbH
YureiSec UG

Awards

External Awards

(see separate chapter in this Annual Report from page 114)

KIT Department Teaching Awards

KIT Department	Award winners
Architecture	Prof. Dr. Christian Inderbitzin and his team
Civil Engineering, Geo- and Environmental Sciences	Dr. Michael Mayer und Dr. Malte Westerhaus
Chemistry and Biosciences	Dr. Andreas Rapp
Chemical and Process Engineering	Dr. Johannes Schneider
Electrical Engineering and Information Technology	Dr. Ioannis Anapolitanos
Humanities and Social Sciences	Prof. Dr. Britta Klopsch
Informatics	Dr. Torsten Ueckerdt
Mechanical Engineering	Dr. Alexander Stroh
Mathematics	Jun.-Prof. Dr. Sebastian Krumscheid
Physics	Physics student body, c/o Academic Dean Prof. Dr. Günter Quast
Economics and Management	Prof. Dr. Ann-Kristin Kupfer

Awards for Doctoral Researchers
KIT Doctoral Awards

Name	Institute
Dr. Sina Brückner-Amin	Institut Entwerfen, Kunst und Theorie
Dr. Marvin Carl May	wbk Institut für Produktionstechnik
Dr. Jiaming Zhang	Institut für Anthropomatik und Robotik

Other Doctoral Awards

Name	Institute	Institution
Dr. Fabian Peter Hagen	Engler-Bunte-Institut	Promotion award of Friedrich und Elisabeth Boysen-Stiftung
Dr. Ali Riza Durmaz	Institut für Angewandte Materialien	Südwestmetall promotion award
Dr. Joel Joseph	Institut für Mikrostrukturtechnik	Helmholtz doctoral award
Dr. Karina Winkler	Institut für Meteorologie und Klimaforschung Atmosphärische umweltforschung	Helmholtz doctoral award
Dr. Tobias Röddiger	Institut für Telematik	Helmholtz doctoral award
Dr. Martin Angerer	Institut für Prozessdatenverarbeitung und Elektronik	Helmholtz doctoral award

Media/Publications

Development of Visibility in the Media

Printed articles	17 837	20 384	19 298	18 127	17 945
Online articles	15 598	20 109	22 851	21 049	19 685

* Due to the pandemic, interest of the media mainly focused on medical issues / KIT has no Department of Medicine.

Publikationen

Publications over the year	2020	2021	2022	2023	2024
Publications of researchers of KIT	8 675	9 717	9 714	9 600	9 014
of these, books and proceedings	1 067	1 289	1 386	1 325	1 168
of these, articles in proceedings	1 082	1 404	1 295	1 539	1 340
of these, articles in journals	4 427	4 692	4 356	4 313	4 291
of these, in WoS- or Scopus-referenced journals	4 073	4 441	4 145	4 083	4 115
of these, open access articles	3 246	3 632	3 513	3 556	3 429

Rankings

National Rankings

Wirtschaftswoche	Electrical Engineering	5	5	5	7	9
	Informatics	4	4	4	7	8
	Mechanical Engineering	3	4	4	4	5
	Natural Sciences	10	9	8	-	-
	Business Engineering	2	2	3	3	3

International Rankings

		2020	2021	2022	2023	2024
National Taiwan University Ranking	International – Overall	251	249	276	346	355
	International – Natural Sciences	70	80	102	123	113
	International – Engineering Sciences	101	115	154	301-350	301-350
	National – Overall	21	20	25	27	27
	National – Natural Sciences	1	1	3	5	4
	National – Engineering Sciences	1	1	4	5	4
QS World University Rankings	International – Overall	131	136	141	119	102
	International – Natural Sciences	58	53	48	50	46
	International – Engineering Sciences & IT	68	70	56	50	48
	National – Overall	6	6	6	6	6
	National – Natural Sciences	4	3	3	4	3
	National – Engineering Sciences	4	4	4	2	3
Times Higher Education	International – Overall	201-250	180	189	140	166
	International – Natural Sciences	70	77	100	86	88
	International – Engineering Sciences	78	56	64	64	71
	National – Overall	19-23	18-20	19-20	14	17
	National – Natural Sciences	7	8	8	8	8
	National – Engineering Sciences	4	4	4	3	3
Academic Ranking of World Universities	International – Overall	201-300	201-300	201-300	301-400	201-300
	International – Natural Sciences	-	-	-	-	-
	International – Engineering Sciences	-	-	-	-	-
	National – Overall	11-19	11-20	11-20	20-24	12-22

Sustainability

CO_2 Emissions, CO_2 Equivalents Incl. Upstream Chains Resulting from Energy Supply of All KIT Campuses in Tons per Year [t CO_2eq/a], Dual Reporting According to the Greenhouse Gas Protocol (GHGP) for Electric Power

Campus North	2020	2021	2022	2023	2024
Use of natural gas for heat/cold/power	41 644	50 141	39 767	39 273	43 966
Power consumption (according to current supplier – market-specific)	9 309	7 141	11 320	10 315	9 899
Reference power (federal power mix – site-specific)	13 311	12 942	17 187	10 223	9 811

Campuses South, West, East	2020	2021	2022	2023	2024
Use of natural gas for heat/cold/power	548	635	338	249	296
Power consumption (according to current supplier – market-specific)	2 800	2 679	2 793	3 328	2 975
Reference power (federal power mix – site-specific)	21 900	22 795	23 765	25 896	23 226
District heat consumption	2 911	4 840	4 136	3 995	3 825

Campus Alpin	2020	2021	2022	2023	2024
Use of natural gas for heat/cold/power	384	410	343	279	319
Power consumption (according to current supplier – market-specific)	33	33	34	37	31
Reference power (federal power mix – site-specific)	257	284	290	291	240

Energy Consumption and Energy Production of KIT

Type of energy / Campus North	2020	2021	2022	2023	2024
Primary energy consumption (natural gas)* [GWh]	168.6	203.0	161.0	159.0	178.0
Electricity from the public grid* [GWh]	76.3	68.0	78.9	68.2	60.8
Installed el. capacity, cogeneration/trigeneration plants [MW]	13.0	13.0	13.0	13.0	13.0
Electricity produced by own cogeneration/trigeneration plants [GWh]	47.0	58.9	45.5	47.3	53.3
Installed photovoltaics capacity [MW]	1.2	1.2	1.4	1.4	1.8
Electricity produced by own photovoltaics facilities [GWh]	0.9	1.2	1.1	1.2	1.2
Heat produced* (excluding heat for thermal refrigeration plants) [GWh]	76.0	83.0	67.0	57.0	58.6
District heating from public grid [GWh]	-	-	-	-	-

* For CN, including third institutions on campus

Type of energy / Campuses South, West, East	2020	2021	2022	2023	2024
Primary energy consumption (natural gas) [GWh]	2.2	2.6	1.4	1.0	1.2
Electricity from the public grid [GWh]	50.0	47.0	49.0	52.7	52.2
Installed el. capacity, cogeneration/trigeneration plants [MW]	0.2	0.2	0.2	0.2	0.2
Electricity produced by own cogeneration/ trigeneration plants [GWh]	0.7	0.8	0.4	0.3	0.3
Installed photovoltaics capacity [MW]	-	0.0	0.1	0.1	0.2
Electricity produced by own photovoltaics facilities [GWh]	-	-	-	0.0	0.0
Heat produced (excluding heat for thermal refrigeration plants) [GWh]	0.8	0.9	0.6	0.5	0.6
District heating from public grid [GWh]	41.0	55.0	47.0	47.0	45.0

Type of energy / Campus Alpine	2020	2021	2022	2023	2024
Primary energy consumption (natural gas) [GWh]	1.6	1.7	1.4	1.1	1.3
Electricity from the public grid [GWh]	0.6	0.6	0.6	0.6	0.5
Installed el. capacity, cogeneration/trigeneration plants [MW]	0.1	0.1	0.1	0.1	0.1
Electricity produced by own cogeneration/ trigeneration plants [GWh]	0.4	0.4	0.3	0.3	0.3
Installed photovoltaics capacity [MW]	-	-	-	-	-
Electricity produced by own photovoltaics facilities [GWh]	-	-	-	-	-
Heat produced (excluding heat for thermal refrigeration plants) [GWh]	0.7	0.8	0.5	0.5	0.5
District heating from public grid [GWh]	-	-	-	-	-

Supply and Waste Management Services

Type of service / Campus North	2020	2021	2022	2023	2024
Electricity consumption KIT (excl. grid losses) [GWh]	74	82	76	67	72
Heat consumption KIT* [GWh]	35	42	35	31	33
Heat consumption KIT (excl. grid losses, weather-adjusted) [GWh]	40	38	39	36	35
Water supply [m³]	74 182	81 407	91 289	82 994	86 365
Compressed air generation [10^6 m³]	5.8	6.0	6.3	6.3	5.9
Wastewater disposal** [m³]	83 702	77 501	82 270	76 861	82 734
Waste disposal KIT**/*** [t]	4 664	4 073	5 515	14 944	11 374

* excluding grid losses and without heat consumption of thermal refrigeration plants
** For CN, including third institutions on campus
*** Quantities of residual waste CS, CW, CE, for recyclables CW, CE, and for data-protected material on all campuses are lacking. Companies are not able to provide any weights of these wastes.

Type of service / Campuses South, West, East	2020	2021	2022	2023	2024
Electricity consumption KIT (excl. grid losses) [GWh]	50	47	49	53	52
Heat consumption KIT* [GWh]	41	55	47	47	45
Heat consumption KIT (excl. grid losses, weather-adjusted) [GWh]	46	49	52	54	50
Water supply [m³]	198 573	165 027	201 188	202 966	196 294
Waste disposal KIT** [t]	1 125	1 115	1 001	3 099	1 350

* excluding grid losses and without heat consumption of thermal refrigeration plants
** Quantities of residual waste CS, CW, CE, for recyclables CW, CE, and for data-protected material on all campuses are not considered. Companies are not able to provide any weights of these wastes.

Type of service / Campus Alpine	2020	2021	2022	2023	2024
Electricity consumption KIT (excl. grid losses) [GWh]	0.99	0.98	0.93	0.90	1
Heat consumption KIT* [GWh]	0.73	0.78	0.53	0.46	0
Heat consumption KIT (excl. grid losses, weather-adjusted) [GWh]	0.65	0.71	0.58	0.50	1
Water supply [m³]	865	605	875	805	727
Compressed air generation [10^6 m³]	-	-	-	0	0
Wastewater disposal [m³]	-	-	-	805	727

* excluding grid losses and without heat consumption of thermal refrigeration plants

Central Fleet of KIT Vehicles on CN, CS, CW, CE, Including Trucks for Transporting Loads and Special Vehicles

	2020	2021	2022	2023	2024
Vehicles (centrally administrated cars, mini-buses/vans, buses, trucks, special vehicles)	134	129	129	124	124
Vehicles with a combustion engine (of these, hybrid)	114 (1)	104 (8)	104(9)	97 (10)	99 (7)
Battery vehicles	18	23	23	31	29
Fuel cell vehicles (H2 buses for KIT shuttle services)	2	2	2	2	2
Average CO_2 emission factor of the fleet [gCO_2/km]	147	136	133	125	123
Gasoline consumption of the fleet [l]	16 626	17 097	21 724	21 819	21 004
Diesel consumption of the fleet, including truck diesel [l]	41 980	38 676	32 945	33 355	40 299
Hydrogen consumption of the fleet [kg]	1 830	6 567	5 734	5 110	2 170

➔

➔ **Central Fleet of KIT Vehicles on CN, CS, CW, CE, Including Trucks for Transporting Loads and Special Vehic-**

Driven kilometers of the fleet	541 073	618 383	738 018	687 883	682 170
CO_2 emissions resulting from fuel use, including upstream chains [tCO_2 p.a.]	203	253	237	231	214

Use of Shared Cars

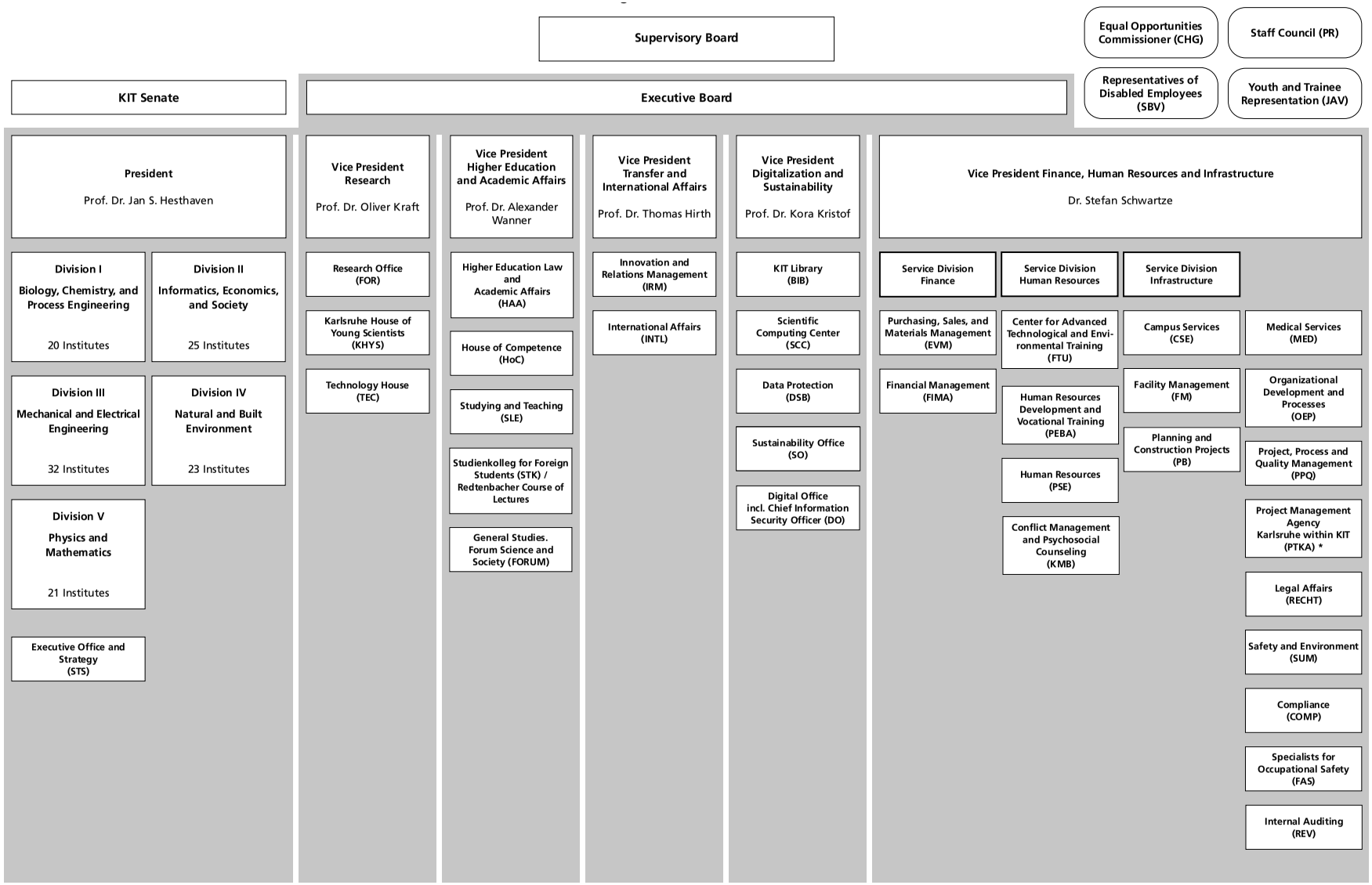
	2020	2021	2022	2023	2024
Trips	887	1496	3016	3884	3971
Km	216 533	384 259	771 274	958 169	1 011 137
CO_2 emissions [tCO_2 p.a.]	27	48	97	122	119
Company ebikes	6	6	6	6	6

Areas

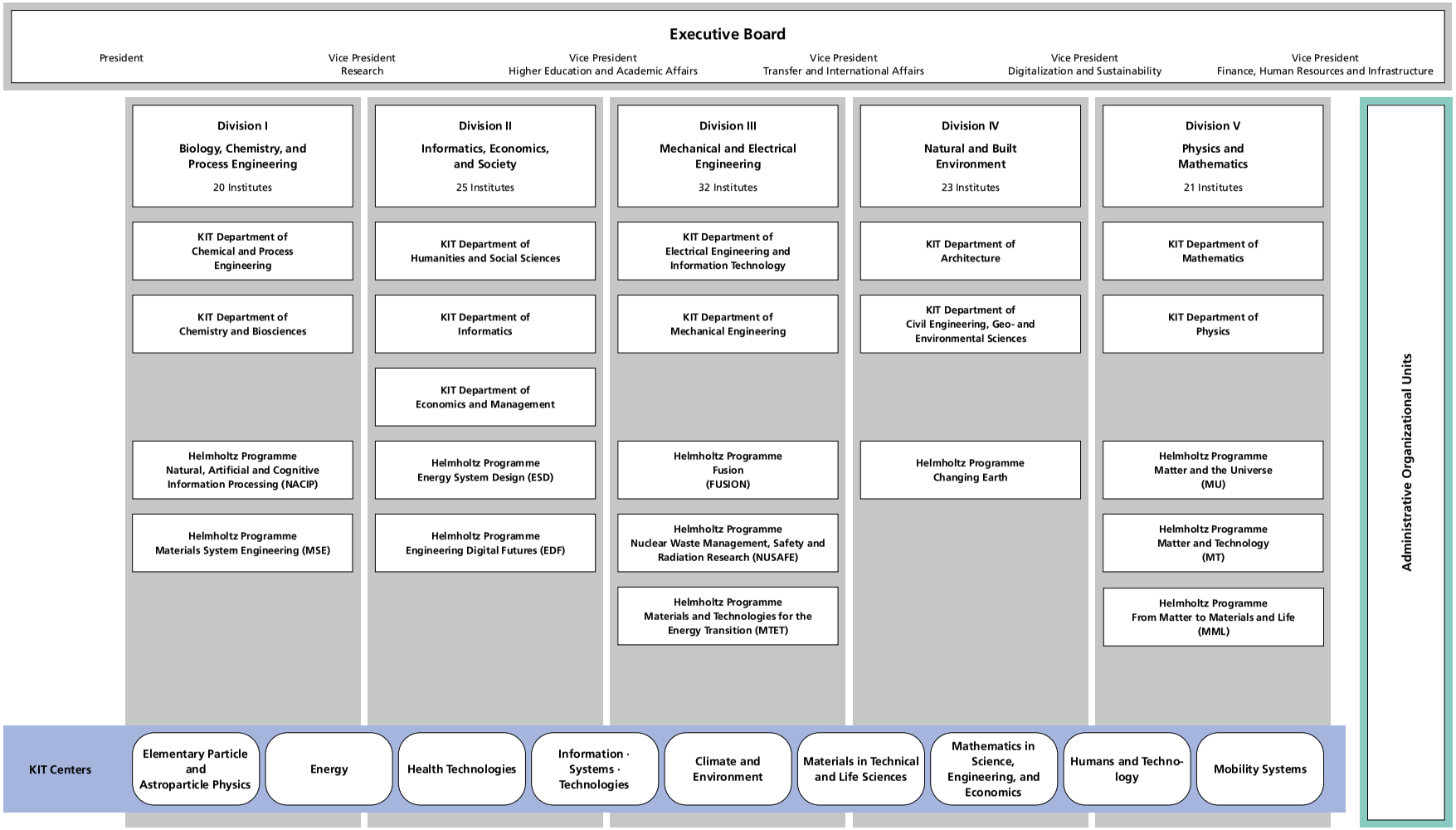
Type of area [m²]	KIT in total		Campus South*		Campus North**	
	[m²]	%	[m²]	%	[m²]	%
Office areas (including conference rooms, rooms for copiers and servers)	168 837	35.5%	101 389	34.8%	67 448	36.6%
Laboratories, workshops, experiment halls	167 914	35.3%	86 172	29.6%	81 742	44.4%
Storage and similar facilities	66 142	13.9%	38 556	13.2%	27 586	15.0%
Teaching and studies (lecture halls, seminar rooms, practice rooms)	56 900	12.0%	50 917	17.5%	5 983	3.2%
Library areas (central + decentralized libraries)	12 029	2.5%	10 760	3.7%	1 269	0.7%
Sports areas	3 863	0.8%	3 647	1.3%	217	0.1%
Total usable area	475 685	100.0%	291 440	100.0%	184 245	100.0%
of this, rented areas			20 657 m²		3 219 m²	

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

Organizational Structure



Science Organization



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