Competence is the Basis

New Structure of Research at KIT

MATERIE UND MATERIALIEN

MATTER AND MATERIALS

UND GRIDRECHNEN

HIGH PERFORMA AND GRID COMPUTIN

DAS KIT-KOMPETENZPORTFOLIO STEHT FÜR DIE EXZELLENZ DER ÜBER 4000 AM KARLSRUHER INSTITUT FÜR TECHNOLOGIE BESCHÄFTIGTEN WISSENSCHAFTLERINNEN UND WISSEN-SCHAFTLER. ES IST DYNAMISCH UND WIRD NEUE WISSENSCHAFTLICHE FRAGESTELLUNGEN ENTWICKELN UND AUFGREIFEN. DIE 29 KOMPETENZFELDER SIND GEBÜNDELT IN SECHS KOMPETENZBEREICHE UND GRUNDLAGE DER FORSCHUNG DES KIT.

THE KIT COMPETENCE PORTFOLIO STANDS FOR EXCELLENCE OF THE MORE THAN 4000 SCIENTISTS WORKING AT THE KARLSRUHE INSTITUTE OF TECHNOLOGY. IT IS DYNAMIC AND WILL DEVELOP AND TAKE UP NEW SCIENTIFIC TOPICS. 29 FIELDS OF COMPETENCE ARE BUNDLED IN SIX COMPETENCE AREAS AND THE BASIS OF KIT RESEARCH.

VERWANDTE UND MATERIALIEN

KONDENSIERTE MATERIE

APPLIED AND MATERIALS

CONDENSED MATTER

INFORMATIO UND

INFORMATIO AND

KIT – University of the State of Baden-Wuerttemberg and National Research Center of the Helmholtz Association

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The Competence Portfolio of KIT

The Karlsruhe Institute of Technology (KIT) is an amalgamation of the former Universität Karlsruhe and the former Forschungszentrum Karlsruhe GmbH. The Competence Portfolio is a platform for presenting the scientific and technological expertise available at KIT to interested parties both inside and outside the institute. It provides a forum for trans- and interdisciplinary scientific exchange within KIT – this forum is central to the integration process between the two partners.

The Competence Portfolio aims at intensifying the scientific dialogue as well as improving the general conditions with regard to generating innovative research projects and developing new – particularly transdisciplinary – fields of research.

In addition, the Competence Portfolio paves the way for research collaborations between KIT and external partners from industry and academia. Upon request, specialist workshops can be arranged where representatives from the relevant Competence Fields will participate.

Competence Fields and Competence Areas

Currently the Competence Portfolio is divided into six Competence Areas. These Areas are subdivided into smaller sections called Competence Fields, of which there are thirty. Scientists at KIT were asked to affiliate themselves to one or more Competence Fields (max. three per person) according to their respective skills and proficiencies. To date, the vast majority of the approximate 5000 scientific staff members at KIT are affiliated to the Competence Portfolio (status: December 2009).

Due to the coming and going of scientists, the competences at KIT are in a constant state of change. Therefore the Competence Portfolio will be subject to a dynamic development in future as well.

30 Competence Fields bundled in 6 Competence Areas

Matter and Materials

- Elementary Particle and Astroparticle Physics
- Condensed Matter
- Nanoscience
- Microtechnology
- Optics and Photonics
- Applied and New Materials

Earth and Environment

- Atmosphere and Climate
- Geosphere and Risk Management
- Hydrosphere and Environmental Engineering
- Constructed Facilities and Urban Infrastructure

Applied Life Sciences

- Biotechnology
- Toxicology and Food Science
- Health and Medical Engineering
- Cellular and Structural Biology

Systems und Processes

- Fluid and Particle Dynamics
- Chemical and Thermal Process Engineering
- Fuels and Combustion
- Systems and Embedded Systems
- Power Plant Technology
- Product Life Cycles
- Mobile Systems and Mobility Engineering

Information, Communication, and Organization

- Algorithm, Software, and System Engineering
- Cognition and Information Engineering
- Communication Technology
- High-Performance and Grid Computing
- Mathematical Models
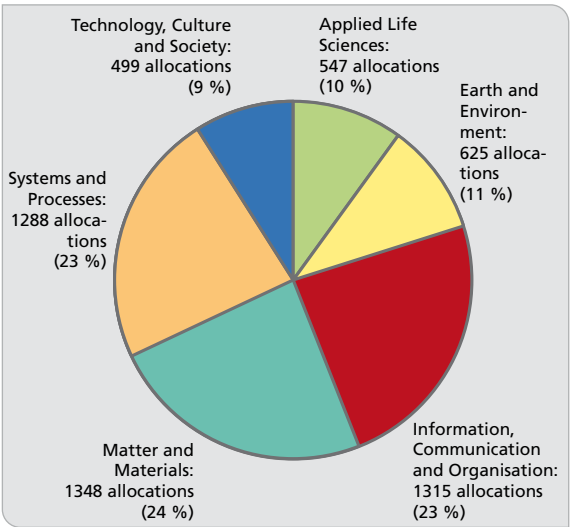- Organization and Service Engineering

Technology, Culture, and Society

- Cultural Heritage and Dynamics of Change
- Business Organization and Innovation
- Interaction of Science and Technology with Society

Competence Fields are interdisciplinary forums where scientists of thematically related competencies meet. All of the scientifically active KIT-members whose scientific-technical competence is directly related to a certain Competence Field may belong to that Competence Field.

The Competence Field's task is to encourage scientific exchange at interdisciplinary level particularly with regard to the forming of new ideas through communicative and co-ordinating processes as well as the realization of new projects. Thereby additional financial resources shall be raised and multidisciplinary networks shall be established.

Each Competence Field elects a spokesperson who co-ordinates its activities and acts as a delegate to their respective Competence Area.

Technology, Culture and Society: 499 allocations (9 %)

Applied Life Sciences: 547 allocations (10 %)

Earth and Environment: 625 allocations (11 %)

Systems and Processes: 1288 allocations (23 %)

Matter and Materials: 1348 allocations (24 %)

Information, Communication and Organisation: 1315 allocations (23 %)

Distribution of the attributions to Competence Areas.
(As the scientific members of KIT-staff have defined their affiliation to one to three Competence Fields, these are numbers of cases rather than persons.)
Status: December 2009

Competence Areas group together Competence Fields that are thematically related. They are essential to the scientific profiling process of KIT. An elected spokesperson of the Competence Area represents the interests of the participating Competence Fields and responds to internal and external inquiries concerning their Competence Area.

Status within KIT

The Competence Portfolio is the breeding ground for new scientific ideas, projects, and networks. These can be either self-established or strategically guided.
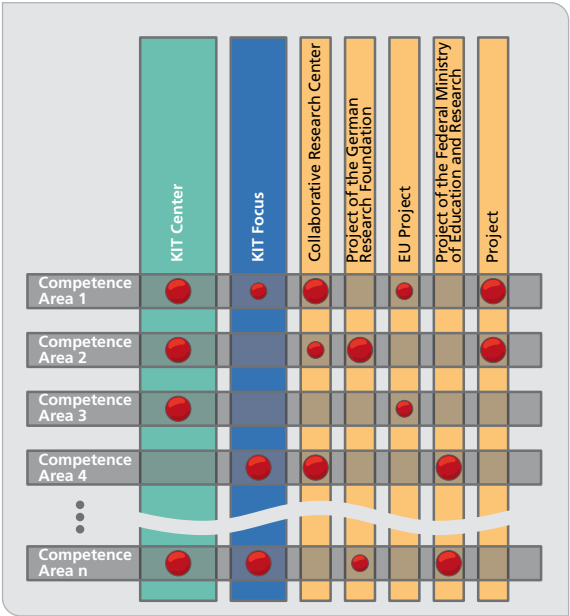
Interrelation between KIT Centers/Focuses and Competence Fields/Competence Areas

Competence Fields and Competence Areas form a structure, which runs across the new KIT Centers and KIT Focuses as well as national and international research projects. Further-more they encourage closer connections between the existing institutes, departments, and programs.

Applied Life Sciences

This Competence Area integrates common research interests in biology, chemistry, toxicology, medicine and engineering. It covers basic research in cell and structural biology, optimization of microbiological production processes and the use of information technology in health care. The fundamental research projects as well as the newly developed applied technologies are connected to investigations on functional biological interfaces at the KIT. Interdisciplinary cooperations and priority research programs focus on:

- Molecular interactions between cells and their environment
- Biological use of nanoparticles/nanostructures in medicine, food production, and biotechnology
- Computer- and robot assisted surgery, diagnosis, and therapy of cardiovascular diseases and telematics in medicine
- Evaluation of benefit-risk ratios of food components and contaminants
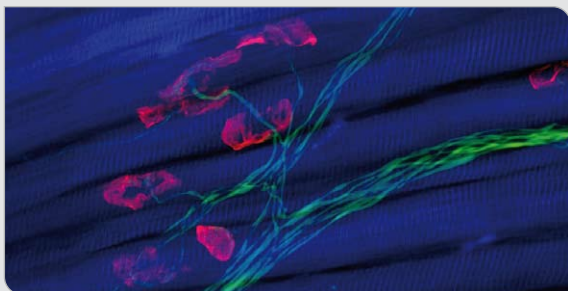
The Competence Area is subdivided in the four Competence Fields:

- Biotechnology
- Cellular and Structural Biology
- Health and Medical Engineering
- Toxicology and Food Science

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Earth and Environment

This Competence Area investigates the Earth system both in its natural state and under man-made influences and modifications. Structures of, and processes in and between, the

major compartments geosphere, hydrosphere, pedosphere, biosphere, and atmosphere are comprehensively studied in coupled and strongly interdisciplinary approaches. Human influences include the construction of settlements, landscape modifications through industry, agriculture or mining, final disposal of waste products, the release of pollutants into air, water, and soil, resource consumption, and climate change. Various research activities address these impacts on a wide range of scales from local effects to global change. The Competence Area therefore improves knowledge and provides basic process understanding in order to derive science based engineering and socio-economic solutions to problems as diverse as risk assessment and reduction, mitigation of and adaptation to climate change and infrastructure management.

The Competence Area „Earth and Environment" covers the following Competence Fields:
- Atmosphere and Climate
- Geosphere and Risk Management
- Hydrosphere and Environmental Engineering
- Constructed Facilities and Urban Infrastructure

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Information, Communication, and Organisation

This Competence Area is dedicated to information and communication technologies and its realization in economic and social organizations. It covers all aspects of communication systems and information engineering, its formal foundations, algorithms, software systems, and cognitive systems, high-performance computing, and its applications in robotics, medical engineering, and automotive systems.
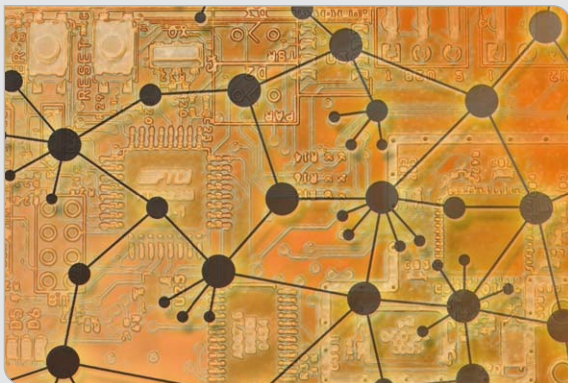
The Competence Area consists of the following Competence Fields:

- Algorithm, Software, and System Engineering
- Cognition and Information Engineering
- Communication Technology
- High-Performance and Grid Computing
- Mathematical Models
- Organisation and Service Engineering

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Matter and Materials

KIT scientists in elementary particle and astroparticle physics pursue in international collaborations basic questions on the origin and evolution of the universe as well as on the fundamental building blocks of nature. Experts in condensed matter physics and chemistry deal with the interactions between many particles leading to novel many-body phenomena in solids and liquids. Research in materials science is focused on development, synthesis, characterization, and modeling of materials. In nanoscience such research is extended to nanomaterials including biological systems and processes. In addition, functional devices are fabricated and characterized with features on a scale of less than 100 nanometers. Processes and methods for the fabrication of micro-components and of entire micro-systems are pursued in the field of microtechnology with the goal of applications in products. Research in the field of optics and photonics is focused on the generation and manipulation of photons and on the interaction of light with matter.

These Competence Fields belong to the Competence Area „Matter and Materials":

- Elementary Particle and Astroparticle Physics
- Condensed Matter
- Nanoscience
- Microtechnology
- Optics and Photonics
- Applied and New Materials

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Systems and Processes

The Competence Area „Systems and Processes" covers the wide range of mechanical, electrical and plant engineering for transport, power plant or process technologies. On the one hand, it includes the required basic technologies like advanced

methods of fluid mechanics of single and multiphase systems, research on combustion or other forms of chemical reactions, as well as basic research on integrated product development, information management, and numerical tools for design, simulation or control of technical systems. Application oriented research topics, on the other hand, are using these technologies for the development of vehicles, high voltage power supplies, high power microwave heating systems, turbine machinery, plant components and many other engineering products. Finally, the complex interaction of all these systems in the product life cycle is complemented by methodical research on the basis of Life Cycle Assessment with regard to environment and resources on the one hand, and on the other hand by research on basics, methods, processes, and IT-systems for a life cycle oriented support of all product phases and activities in terms of Product Lifecycle Management. Their industrial applications are subject of a third column of this Competence Area.

The Competence Area „Systems and Processes" covers the following Competence Fields:
- Systems and Embedded Systems
- Power Plant Technology
- Mobile Systems and Mobility Engineering
- Product Life Cycle
- Fluid and Particle Dynamics
- Chemical and Thermal Process Engineering
- Fuel and Combustion

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Technology, Culture, and Society

The Competence Area is dedicated to the complex inter-play between human and societal actions, the process of knowledge creation as well as the development and use of technologies.

It analyzes the mutual impact of scientific and technical progress on man, natural environment, culture, and society.

The Competence Area „Technology, Culture, and Society" covers the following Competence Fields:
- Cultural Heritage and Dynamics of Change
- Business Organization and Innovation
- Interaction of Science and Technology with Society

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Spokespersons and their deputies for the Competence Areas; together with the Vice President of KIT, Prof. Detlef Löhe (r.), and Prof. Oliver Kraft (l.)

The **KIT Research Office** is in charge of the administration and organization of the Competence Portfolio and coordinates external collaborations with industry and universities.

Further information on the Competence Portfolio can be obtained from:

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