Karlsruhe Institute of Technology

YIN Insight 2017/18

The strong network of junior professors and junior research group leaders at KIT

Young Investigator Network (YIN)

Hot Topic
The What and Why of Young Investigator Programs – Interviews with the main funding agencies

Scientific Highlights
10 ERC grantees among YIN members & alumni

10 years of YIN Statistics
100 million of initial third-party funding
4,000 weekly teaching hours per semester

Editorial

Dear Reader,

Today's world is changing. The climate change or the rise in artificial intelligence bear new challenges both for our society in general and for science in particular. Young scientists have to pick their career paths carefully, take responsibility for their research and their group members. At KIT, the Young Investigator Network (YIN) connects and supports along this difficult path towards scientific leadership. We are more than grateful that now, 10 years after it has been founded, YIN is still greatly developing thanks to the active involvement of its members.

In October, we celebrated the decadal jubilee under the patronage of the Federal Minister of Education and Research Anja Karliczek and the President of KIT Holger Hanselka. In the frame of this jubilee, we had a vivid discussion about the present changes for young scientists – not least with regard to the increasing number of tenure track positions, targeting an enhanced projectability. Tenure track professorships stand for an alternative as well as for an addition to the well-established programs of major funding agencies to support research in Germany and Europe, which have been interviewed for this edition.

On occasion of the 10th YIN jubilee, we briefly review milestones and main achievements and present the founding fathers and YIN honorary members, which laid the base for the presence and future of YIN. In this light, we also report a few highlights for the work of the current members and show that science can be beautiful. Finally, we take the chance of this jubilee edition to present the work of all YIN members in more detail to connect the term YIN with the faces that are building its fundament and who are breathing life into this – our network.

We wish you an interesting and enjoyable read,
the PR Committee


Dr. Dominic Bresser


Dr. Kathrin Valerius


Dr. Aiko Voigt


Dr. Karsten Woll

Contents

Anja Karliczek, BMBF
Federal Minister of Education and Research, Germany

How heavy are neutrinos? How safe and how effective will our future energy systems be? How can large data volumes be analyzed in real time? These are just some of the forward-looking questions which the Karlsruhe Institute of Technology (KIT) addresses. KIT carries out cutting-edge research in fields such as cyber security, artificial intelligence, autonomous systems and particle physics.

When I visited Karlsruhe I was not only impressed by the depth and variety of the science, but also by the high-tech facilities which KIT operates, including the high performance computing centre for applications such as mechanical engineering and materials research, the Grid Computing Centre Karlsruhe for the analysis of big data from experiments conducted at the CERN Large Hadron Collider in Geneva, and the Tritium Neutrino Experiment KATRIN which is expected to provide important insights into the universe and cosmology.

Such work can only be achieved in large, interdisciplinary teams. It can only succeed with national and international research collaboration. And it also depends on effective promotion of young talent – such as that undertaken at KIT. The range of fields and the currency of the tasks and research questions offer excellent study conditions for young researchers from around the world. Many of them write theses and dissertations for their degrees that attract international attention and they use this opportunity to start their scientific careers at KIT.

It is also thanks to the Young Investigator Network (YIN), which has been connecting younger with more experienced junior research group leaders and junior professors for ten years now, that young talent thrives so well at KIT. I am delighted by the level of commitment and involvement.

It is the level of scientific achievement, variety and openness, evident at KIT and also at many other institutions, which helps put Germany among the world's most innovative countries. As the Federal Government we invest large amounts so that the science and research system can continue to develop – whether it be by funding cutting-edge research, by numerous internationalization initiatives, or by promoting young scientific talent. One example for the latter is the "Tenure-Track Program" which we have established in order to attract the best young academic and research talent from Germany and around the world for our universities and institutes. Under this program we are providing one billion euros for 1000 extra professorships until 2023. KIT is one of the beneficiaries of this program which is enabling it to fill nine tenure-track positions this year alone.

Let us jointly continue to ensure that Germany is able to perform outstanding research and science. By doing so, we can shape the future to the benefit of society and help contribute to finding solutions for global problems.

Anja Karliczek
Federal Minister of Education and Research

Dear Young Investigators,
Dear colleagues, friends and supporters of YIN,

The Young Investigator Network (YIN) – with outstanding success – supports and connects excellent young scientific leaders at the Karlsruhe Institute of Technology, „the Research University in the Helmholtz Association". The YIN members, as top junior scientists, are an essential part of the future of KIT and make excellent contributions to research, teaching and innovation. YIN combines theory, practice and exchange at KIT in a balanced and fruitful way. Through an extensive vocational training program, custom-made for this group, we offer target-oriented support for the members, furthering their qualification for future management tasks in research and teaching or in industry.

The YIN members bring practical experiences – from their research as well as from their new leadership practice – into the network, where, in exchange with their peer group, they find joint solutions to challenges and further develop their ideas. From the network, the YIN members foster contacts to decision makers from other scientific institutions and the economy far beyond the borders of KIT and build research bridges to national and international partners. Networking beyond KIT is particularly effective because YIN alumni remain connected to the network. The majority of alumni hold professorships or conduct research as group leaders or senior scientists at universities in Germany and abroad. Others hold distinguished positions in research and management in industry.

YIN is the central contact point for excellent young scientific leaders at KIT. It serves junior research group leaders and junior professors as a platform to form opinions and as an official mouthpiece. It has established itself as an important and valued contact for the executive board and for the service units at KIT in all matters of promoting young talent. The network's spokespersons are involved in various participation processes. They provide – for example for the implementation of the umbrella strategy KIT 2025 – valuable impulses and experiences on how to best consider the concerns and needs of our top junior staff at KIT. In this way, as KIT, we can become even more attractive for this important target group.

Holger Hanselka, KIT
President

The concept of YIN as a flexible, self-governing network was developed as a central element for the promotion of young scientific leaders at KIT within the framework of the institutional strategy of the first Excellence Initiative. This concept at that time also contributed to our successful performance in the competition and it is still unique in its form throughout Germany. YIN lives and changes with the ideas and the commitment of its members. I would like to thank our young investigators and all those actively involved in the network for their commitment.

I wish you continued success, so that the decade ahead will be at least as successful as the previous ten years.

On behalf of the executive board of KIT

Prof. Dr.-Ing. Holger Hanselka
President of the Karlsruhe Institute of Technology

Career in Science – Promoting Research

On October 8th 2018, YIN celebrated its 10th anniversary with supporters and friends

Founding Father of YIN,
Prof. Detlef Löhe
Vicepresident of Research at KIT 2009-2015

Our basic idea for the concept of YIN was quite simple: „We give help through self-help, the members of the YIN help themselves".

In October 2018, the Young Investigator Network (YIN) celebrated its 10th anniversary under the patronage of the Federal Minster of Education and Research Anja Karliczek and the President of KIT Holger Hanselka. The official part at the Tulla lecture hall at KIT, started with a look back towards the very beginning of the network. The past came vividly alive through personal anecdotes of the founding YIN spokesmen Timo Mappes, Chris Eberl, and Dominic von Terzi. Starting off as junior group leaders on temporary contracts themselves, they have become distinguished scientific leaders in academia and industry. The YIN spirit of comradery and trust, however, still connects them to the current YIN members, which made it easy for YIN speaker Achim Rettinger to pick up the threads where they left off. Together with the Founding Father and first member of honor Detlef Löhe, he welcomed the three founding speakers as new honorary YIN members. They had made an outstanding contribution in setting the base and enlivening the spirit of YIN.

Founding Speaker of YIN
Prof. Timo Mappes
Friedrich Schiller University Jena and
Founding Director of Deutsches Optisches Museum

With YIN we created a common voice to represent our interests beyond scientific topics. With YIN we enabled efficient publicity work, we introduced continuing education on the highest level, and peer advice without competition. Mutual support in an atmosphere of collegiality and trust was always the key component.

Scientific Lecture

Linking the network's political history with cutting-edge science, YIN alumna Erin Koos gave an inspiring lecture on "Smart Materials Designed with Capillary Suspension Networks". Having joined the network as awardee of a Starting Grant by the European Research Council (ERC), she is now professor at the KU Leuven. In her talk, she addressed the physical interactions in ternary liquid-liquid-solid multi-phase systems and their dependency on the (tunable) porosity of the solid phase.

Prof. Erin Koos, Professor for Material science capillary suspensions at the Catholic University in Leuven.

Panel Discussion

The panel discussion "Career in Science – Promoting Research" presented the third highlight of the day. Moderated by Beate Scholz, an expert in higher education politics herself, the panelists dared to take a look into the future of science. Invited guests were Oliver Kraft (Vice President for Research at KIT), Marlis Hochbruck (Vice President of the German Research Foundation, KIT), Felix Krahmer (Head of the German Society Junior Professorship), and Korinna Strobel (Head Strategy / Initiative and Networking Funds of the Hermann von Helmholtz Association of German Research Centers). They spoke as representatives from higher education politics, science institutions, and the large third-party funding organizations, respectively. With this prominent line-up, a lively and highly informative discussion involving also the auditorium was guaranteed. Key questions were how to enhance the attractiveness of an academic career versus a mostly better-paid position in economy with certain promotion opportunities. The answer might entail increasing the

The KIT spin-off *kites GmbH*, founded by YIN alumnus Dr. Sebastian Stüker, provided a simultaneous translation from available via internet.

Founding Speaker of YIN
Prof. Chris Eberl
University of Freiburg and Deputy Director at the Fraunhofer Institute for Mechanics of Materials

Professional development, scientific networking, and personal peer-connections were the three components holding us together. I believe in the unique spirit of YIN!

transparency and predictability of career paths for young scientists and/or promoting the academic career of mid-level faculty rather than establishing extensive dependencies on a few high-level academics. As a matter of fact, this has been the motivation behind one of the most recent decisions in higher education politics in Germany: the allocation of 1,000 new tenure track professorships to sustainably raise the number of permanent professor positions. Thereby, the German science system is supposed to become more competitive in attracting international top researchers.

In other European countries as well as in North America and Asia assistant and associated professorships are already customary intermediate career steps. While the introduction of tenure track professorships was certainly a well-motivated political action, one questions remains: What does this mean for established funding programs providing alternative career paths towards professorship through financial support for a young investigator research group? Especially, as their awardees are in general further along on their career path, with at least of two postdoc years and the scientific results to show for it. Will such groups simply run in parallel to junior professors? Will there be a partial, significant, or substantial overlap – or even an interdependency? Will the funding agencies adapt their programs? How will their awardees be positioned compared to the newly established tenure track professors? And will there be any open professorship positions left in academia or will they all be "blocked" for tenure track professors?

Founding Speaker of YIN
Dr. Dominic von Terzi
Manager at GE Global Research (until July 2018)

My company is recognized as a role model in global leadership development and spends huge sums on training each year. Still, I regard the leadership program that was developed with and specifically for YIN as second to none. I believe that I have a competitive advantage over many of my peers from skills developed and insights learned there.

From left to right: **Dr. Beate Scholz**, **Prof. Oliver Kraft**, **Prof. Marlis Hochbruck**, **Prof. Felix Krahmer**, and **Dr. Korinna Strobel**.

Funding agencies on young scientist support

While the 10th anniversary of the YIN network eventually proceeded to a festive reception with music, food, and drinks – YIN Insight picked up the threads and addressed the main funding agencies for research in Germany. How they see their funding schemes evolve in the foreseeable future will be presented on the following pages herein.

Liane Horst, BMBF
Head of Division
Materials Innovations,
Batteries; HZG, KIT

BMBF NanoMatFutur

Federal Ministry of Education and Research

What rationale is behind the funding?
The ability of qualified staff to translate ideas and research results into commercial applications is a major factor for successful innovation. The creativity and inventiveness of young scientists are unique building blocks for our future. The Federal Ministry of Education and Research (BMBF) has been supporting career opportunities for outstanding young materials researchers under its "NanoMatFutur" competition for many years now. This competition is paying off in two respects: not only does it support our talented young scientists, it also secures Germany's position as a technology hub. Important factors here are interdisciplinarity between the natural and engineering sciences and the application orientation of the research performed.

Interdisciplinarity between the natural and engineering sciences and the application orientation of the research are pivotal.

What status should junior research group leaders have within the research institution?
The young researchers are free to choose the institution in Germany which suits them both personally and with regard to their research. The funding is issued to the host institution but is tied to the group leader. The research institution provides the junior research group with a suitable infrastructure and can involve the young scientists in its teaching and management activities. Conditions are not stipulated and can be agreed between the individual group leader and the institution. The selection process evaluates particular commitment on the part of the institution to support the group leader positively.

How should their status, rights and duties compare to a junior professorship?
The BMBF supports the personal development and individual career objectives of the young researchers under "NanoMatFutur". These objectives must not be geared solely towards gaining a professorship. The BMBF also supports people aiming for a career in industry or intending to set up a company of their own. However, anyone intending a career in academia should obtain teaching experience at an early stage as this can be helpful for appointment procedures. The host institution should provide support in this context and enable the group leader to gain teaching and examination experience. This can by all means be linked to a junior professorship. The host research institution must determine the corresponding framework.

Host institutions should enable group leaders to gain teaching and examination experience.

Do you explicitly consider examination rights, when providing the funding?
The focus when selecting junior research groups is not on granting examination rights because this is the responsibility of the institutions of higher education and thus of the federal states of Germany. However, particular support from the host institutions is evaluated positively.

Do you foresee changes or future developments regarding the funding principles?
Funding began in 2006 with the "NanoFutur" program. Once nanotechnology had found its way into so many fields of materials research, we extended the scope to cover materials research under "NanoMatFutur". The junior researchers competition has been held at intervals of two to three years and constantly adapted to meet current challenges. This enables us to react flexibly to changing conditions in the young researchers' working environments as well as to economic and political conditions. For example, the fields of application have been made more specific and the duration and level of funding were adjusted.

How do you ensure sustainability within your funding scheme?
The continuous development of the funding model and regular funding by the BMBF make it possible to react flexibly to the need for skilled staff in the field of high technology and at the same time provide sustainable support.

Thank you!

DFG Emmy Noether Program

German Research Foundation[1]

What rationale is behind the funding?
The Emmy Noether Program gives exceptionally qualified early career researchers the chance to qualify for the post of professor at a university by leading an independent junior research group for a period of six years and performing relevant teaching duties. We also want to attract outstanding early career researchers (back) to Germany from abroad.

How should the status of an Emmy Noether awardee compare to a junior professorship?
Successful applicants for the Emmy-Noether scholarship are free to organize their research projects and to apply for the needed staff and budget at the place of their choosing. This freedom is quite different to e.g. a junior professorship on a certain subject at a given university. Moreover, Emmy Noether awardees can solely focus on research. Of course, teaching remains an important qualifier for professorship, but we count on voluntary rather than on obligatory commitment. This flexibility is of very high value to most.

Maximal flexibility to choose topic and the right place for research.

Besides, more and more universities offer Emmy Noether awardees the option to be employed as junior professors, even with tenure track. We welcome these opportunities as they combine an attractive career perspective with the very generous endowment provided by the DFG. It is a win-win situation for all. Aptly, the elongation of the funding period for Emmy Noether groups from five to six years matches this development. Our goal was again to allow the group leaders more flexibility and planning security, e.g. to employ two cohorts of PhD students within the frames of the "Wissenschaftszeitvertragsgesetz". Moreover, we only ask for an interim report after three years to secure funding for the coming three. This takes off pressure to publish results early and makes it easier to reconcile work and family life.

Do you explicitly consider examination rights, when providing the funding?
Formal examination rights are given exclusively by universities not by the DFG. Nevertheless, we highly appreciate that many universities installed options to issue these rights to the group leaders. At KIT this is established by awarding the status of a KIT Associate Fellow.

Prof. Marlis Hochbruck
German Research Foundation, Vice President

Do you foresee changes or future developments for the funding principles?
With the recently modified Emmy Noether program, we are very well-prepared for the future. Besides adapting the duration of the funding period, we have also discarded the formal verification of a research stay abroad in favor of evident substantial international research experience. Research institutions have become much more international: You don't necessarily need a working contract abroad anymore to get involved in international research projects and be part of an international team. We now consider each application individually and take into account the specific culture of the respective discipline. This also benefits the compatibility with family life and equal opportunities. There are, however, still legal restrictions that need to be overcome: The federal travel expense laws for example don't allow to refund a child carer's expenses to accompany a nursing scientist.

How do you ensure sustainability within your funding scheme?
With the comparative study Research Funding and Career Paths, we have demonstrated that, after seven years, almost two thirds of Emmy Noether awardees are appointed professors. After ten years, this is true for over 80 percent. This is an excellent quota. Though, the German Research Foundation doesn't offer a tenure track, it is known for only selecting the best young scientists and it provides them with a funding basis from which they can strive and develop to full potential. Thus, being successful in the Emmy Noether program gives you excellent prospects of attaining a professorship.

Thank you!

[1] Cf. forschung. Das Magazin der Deutschen Forschungsgemeinschaft 4/2017 (Vol. 42). WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, p. 22ff. www.dfg.de/dfg_magazin/wissenschaft_oeffentlichkeit/forschung

Dr. David Krása, ERC
Head of Sector Physical Sciences & Mathematics

ERC Starting Grant
European Research Council

What rationale is behind the funding?
The overall mission of the ERC has not changed since its inception at the beginning of the 7th framework program in 2007: to encourage the highest quality research in Europe through competitive funding and to support investigator-driven frontier research across all fields, on the basis of scientific excellence only. On a more long-term basis, the ERC also looks to substantially strengthen and shape the European research system. The Starting Grant funding scheme, specifically, aims to provide excellent Principal Investigators (PIs) at the start of their career with the means to gain early scientific independence, to enable them to set up their first independent research team, and to enhance their visibility.

What status should junior research group leaders have within the research institution?
This is strongly dependent on national and host institution practices and on the particular scientific discipline. Within our set of Starting Grantees, there's a large spectrum of positions that successful PIs hold. Some do not have any position at all at their chosen host institution at the time of their ERC application, beyond the formal agreement of the institution to host the researcher in case their application is successful. On the other side of the spectrum, we also have some PIs who already hold a permanent professorship at their institution when they apply for a Starting Grant.

How should their status, the rights and duties compare to a junior professorship?
The ERC expects from the host institution that it hosts and engages the PI for the duration of the grant, and that it guarantees their full scientific independence, in particular for the use of the project budget, their authority to publish the results of the project, and in the selection and supervision of team members employed in the project. So while it is difficult to compare these obligations to any given national scheme such as the German junior professorship, we do expect that PIs are put in a position where they have the best conditions and the necessary independence to successfully carry out their projects.

Full scientific independence includes free use of budget, authority to publish, selection and supervision of team members.

Do you consider examination rights?
No, we do not consider examination rights at all; this does not correspond to any of our PI evaluation criteria.

Do you foresee changes or future developments regarding the funding principles?
The Commission recently published proposals for the next EU Framework Program for Research and Innovation which will start in 2021. For the ERC, two important keywords in this context are "continuity" and "agility". The first means that the Scientific Council does not wish to make any fundamental changes to our funding principles, which have proven so successful over the last 11 years. With the second keyword, the Scientific Council expresses its determination to continue to show the necessary agility to respond to the changing needs of the European scientific community. In this spirit, the Scientific Council has for example re-introduced in 2018 the Synergy Grant scheme which enables groups of two to four PIs to jointly address ambitious research problems.

How do you ensure sustainability?
The ERC Starting Grant is part of the overall portfolio of ERC funding schemes and it is embedded within all the other funding opportunities of Horizon 2020. So when Starting Grantees approach the end of their grant, further ERC opportunities to continue their successful work do exist. PhD students and postdocs who have been employed in the team of an ERC grantee tend to be in a very good position to apply for one of the Marie-Skłodowska-Curie-Actions opportunities, which are primarily directed at more junior researchers. We also see that Starting Grantees are rather successful in applying for other funding sources, such as the national funding bodies.

Thank you!

Helmholtz Young Investigators

Helmholtz Association of German Research Centers

What rationale is behind the funding?
A key objective of the Helmholtz Association's mission is the individual promotion of talented young researchers. Through the Helmholtz Young Investigator Groups, we enable the best young international and German scientists to set up and lead their own research group under excellent scientific working conditions. Young Investigator Group leaders are given early independence and have attractive career prospects, including the option of permanent employment and support and flexibility during the family phase.

Holding examination rights benefits Helmholtz group leaders applying for jobs in the sciences.

What makes a Junior Group Leader?
I am always impressed by the enthusiasm of junior group leaders and their ability to work on a fascinating project, to plan their career strategically and to lead their research group – all at the same time! This is of course a very crucial and challenging moment in one's career. Postdocs should have a strong motivation to set up and lead their own research group and take the responsibilities that are associated with a group leader position.

How should the status of HYIG group leaders compare to a junior professorship?
Young Investigator Group leaders are expected to work closely with a university partner, gathering teaching and supervision experience. The President of the Helmholtz Association supports every endeavor to establish professorships jointly with a partner university. We always recommend that the faculties are involved in the selection process at an early stage in order to allow joint appointments and to integrate the Young Investigators Group leaders into the faculties.

The Helmholtz Association supports jointly established professorships with partner universities.

Do you explicitly consider examination rights, when providing the funding?
Helmholtz Young Investigator Groups have been a central pillar of the successful and close collaboration of Helmholtz Centers and the universities. Many universities already understand the benefits of integrating Helmholtz Young Investigator Group leaders into their professorate, by offering teaching responsibilities, examination rights and the authority to supervise doctoral candidates in completing their doctorates. Young investigator group leaders also benefit a lot from such rights when they apply for jobs in the sciences, but, in the end, it is the decision of the faculties to whom they offer examination rights.

Dr. Johannes Freudenreich
Helmholtz Association
Promotion of young and early-stage researchers

Do you foresee changes or future developments regarding the funding principles?
The Helmholtz Young Investigator Group program is a true success story. In the beginning of the year, we have published the 15th call of application. Thus, there are no plans to change the basic funding principles. We do want, however, to improve the visibility of the program to attract the best talents from around the world. And the Helmholtz Association especially wishes to attract even more promising female scientists to apply to group leader positions.

Does KIT as the Research University in the Helmholtz Association stand out among the HYIG hosting institutions?
KIT is in many respects unique in the German science system as it was created as a merger of a state university and a national research center. This brings a lot of potential for young group leaders as they directly understand the importance of the strong collaboration of universities and non-university research centers. I especially like the Young Investigator Network which is also unique in the Helmholtz Association, encouraging and supporting the independence and personal responsibility of junior group leaders.

Thank you!

Vector Research Project

Vector Foundation

Edith Wolf
Vector Foundation
Managing Director

What rationale is behind the funding?
The mission of the Foundation is to proactively foster and support future-directed, technology-oriented research in Baden-Wuerttemberg as well as to promote new insights and an improved scientific and technological understanding in order to sustainably ensure and maintain economic wealth. The research funding activities of the Foundation particularly support innovative and inventive science in the field of informatics, science, technology, engineering, and mathematics.

Martin Litschel **Dr. Helmut Schelling** **Eberhard Hinderer**
Vector Foundation Council

Is there a particular motivation to support postdocs to establish a research group?
The support of research groups is of particular importance for us. Based on our experience, an investment in a research group has multiple and multiplicative impacts. In fact, we are frequently surprised by the extremely high engagement of the group leaders as well as the involved PhD students. Not least as the outcome of the joint research activities of a group is always greater than simply the sum of the single inputs.

Is advancing a (scientific) career an objective or solely the research project itself?
In our opinion these two aspects are highly complementary and cannot be considered separately. When reviewing the research proposal, the focus is initially on its scientific quality and relevance. The resulting outcome, however, contributes to the progress in the specific field and the researchers develop for themselves a future-oriented academic and personal perspective and further career possibilities. Thus, a project can still be a great success, even if the initially targeted objective may not be achieved.

Do you consider the aspect of the applicant educating or transferring knowledge?
The main mission of our Foundation is the generation of knowledge, ideally with a clear perspective towards potential applications. Nonetheless, we also consider the transfer of knowledge as an important asset, which is frequently discussed with our project partners.

How do you ensure sustainability?
The Foundation is continuously, in fairly long intervals, defining the thematic focus of its research funding in order to sustainably use the given resources, while targeting maximum output. Thus, on the one hand, we ensure the required continuity and reliability for our project partners and, on the other hand, maintain the capability to react to changing circumstances by adjusting the focus of our funding activities accordingly.

Do you foresee changes or future developments regarding the funding principles?
Within the next years, the Vector Foundation will focus on two main funding programs: on "Sustainable private transport" and "STEM[1] Innovations". It may occur that we will adjust the topical focus of the first program in three to five years, depending on the future development of the field. For the latter, we presently do not foresee any need to adjust the focus and overall scope. Compared to the previous years, we have modified only one formal aspect for the call in 2018: The maximum start-up funding was increased by a factor of two to 100,000 euro. We realized that it is often PhD students who carry out the "STEM Innovations" research. The doubling of the funding allows for an enhanced long-term planning reliability for their PhD studies.

Thank you!

[1] STEM: Science, Technology, Engineering and Mathematics.

Wrangell Habilitation Program

Ministry of Science, Research and the Arts of the State Baden-Württemberg

What rationale is behind the funding?
The „Margarete von Wrangell Habilitation Program for Women" aims at encouraging excellent female academics in Baden-Württemberg to complete their habilitation. At the same time, it provides the financial security necessary to focus on the habilitation thesis. It secures employment for up to five years, which is a rarity in the German academic system. Support for equal opportunities for female and male researchers is one of the main goals in higher education politics in Baden-Württemberg. As a result, the percentage of women holding full professorships in Baden-Württemberg has risen to almost 20%. The Margarete von Wrangell Habilitation Program is one instrument used to overcome the structural discrimination of women in academia. Financial support is complemented by the necessary infrastructure and the involvement of the fellows in university teaching, both organized by their institution of higher education.

What makes a Junior Group Leader?
As MvW-Fellows, junior research group leaders can use the infrastructure and administration of the research institute at which they are based. They also have access to their own funds for human resources and materials that enable them to realise an independent research project and lead a team of doctoral students and postdoctoral researchers. If the position is based at a university, MvW-Fellows are involved in the supervision and examination of doctoral students and candidates and have teaching duties. All these factors are important to gain eligibility for a professorship. MvW-Fellows are usually very well equipped and have generous budgets. They are very successful in receiving third party funding.

How should the status of MvW-Fellows compare to a junior professorship?
Both MvW-Fellows as well as junior professors are regular members of university committees and the faculty. They work as team leaders and gain leadership skills by participating in leadership trainings and leadership discussions. They should also be eligible for family care support.

Dr. Dagmar Höppel
LaKoG,
Stuttgart University

Do you explicitly consider examination rights when providing the funding?
The guidelines of the program statute provide that MvW fellows get the authorization to examine students including the PhD level. This is a great achievement from the perspective of the fellows. The Baden-Württemberg university law allows this already, but many faculties still follow more conservative traditional codes of practices, allowing this right only to scientists with a professorship. The MvW regulation opens up hierarchical structures and paves the way for a more democratic culture. It also rewards the actual work done by the fellows supervising PhD students and puts them on an equal footing with junior professors. This is one sustainable contribution to the high attractiveness and the reputation of the MvW-Program and its fellows.

Do you foresee changes or future developments regarding the funding principles?
With a history of more than twenty years, the program has proven to be successful, so there are no reasons for changing the funding principles. The program has encouraged many additional women on their way to a professorship or a leading position in industry.

How do you ensure sustainability?
The MvW program has an enduring effect on the fellows' careers. Most funded women complete their habilitation thesis and approximately 50% of the former fellows hold a professorship.
It can also be observed that during the fellowship, they are highly successful in raising third party funding and many receive scientific awards. The fellows work very successfully on their habilitation thesis, manage to gain independence as researchers and build up an (often international) network. Therewith they are well-equipped for a successful career in academia.

Thank you!

Milestones on a 10 year journey

2008
YIN part of KHYS Steering Committee

2008 | May
YIN Kick-Off Meeting

2009 | May
1st YIN Day

2009 | Nov
1st YIN Grants

2011 | Sep
1st YIN-Certificate *Academic Leadership*

2012
HEiKA Board of Directors

2012
YIN in Sounding Board Economics and Finances

2011 | 2012
1st YIN Annual with Statistics

2012 | Jan
1st YIN Strategy Workshop

2014 | Nov
Fire Side Chat with Ministerial Director at the Ministry of Science, Research and the Arts Baden-Württemberg

2015 | Jul
YIN presentation for State Prime Mnister & Minister for Science, Research and the Arts Baden-Württemberg

2015 | Dec
1st Honorary YIN member
Prof. Detlef Löhe

YIN Speaker 2008-2018

Timo Mappes
Chris Eberl
Dominic von Terzi
Irina Nazarenko

Chris Eberl
Martin Dienwiebel

Martin Dienwiebel
Alexander Nesterov-Müller

Steffen Scholpp
Corinna Hoose
Jörg Overhage

Peter Orth

2015 | Nov
Panel discussion with Minister for Science, Research and the Arts of Baden-Württemberg

2015-2018
Sounding Board Excellence Strategy

2018 | Oct
10th Jubilee of the Young Investigator Network

2016 |
Debut YIN industry Portfolio at KIT Venturefest

2016-2018
Strategy KIT 2025 Key Projects II, V

2018 | Oct
Founding Fathers become honorary YIN members

2016 | xxx
1st YIN Award

2016 | Kick-Off
YIN Lecture Series with three Nobel Laureates

2017 | 01
Article in DPG Physics Journal

2017 | xxx
YIN White Paper

2017 | 08
Fire Side Chat with PlosONE editor

Dominic v. Terzi Timo Mappes Detlef Löhe Chris Eberl

Peter Orth

Stefanie Speidel
Christian Greiner

Achim Rettinger
Julia Syurik

Achim Rettinger
Kathrin Valerius

Manuel Hinterstein
Kathrin Valerius

Facts and figures from 2017/18 and before

The following data was compiled from the YIN survey 2018 (40 participants) and the YIN database.

One decade of YIN sums up to over 100 million euro of initial third-party funding, 2,000 publications, and 4,000 weekly teaching hours per semester. This set of statistics speaks for itself and is a joint success of about 155 active and former members of the Young Investigator Network.

A YIN member on Average

YIN is much more than the sum of its members and each member is quite unique. But what makes up a YIN member in general? We can image someone in her or his mid-thirties, doing independent research at KIT. On average, a YIN member holds personnel responsibility for a research group of 10 scientists, students, and technicians. She or he wields a yearly budget of 360,000 euro – equally comprised of the initial grant for the group and subsequently acquired third party funding. In addition, YIN members contribute significantly to teaching at KIT. Per year, each member gives about 7 weekly semester hours and supervises 4 PhD, master, or bachelor thesis. Furthermore, she or he publishes on average 5 papers a year in renown scientific journals or at conferences and obtains an h-index of 13.

360,000 euro/year
10 group members
7 weekly semester hours
5 scientific papers

The Junior Research Groups in YIN

When YIN was founded in 2008, almost half of the members let groups funded by KIT from the budget of the first Excellence Initiative of the German federation and the federal states. There were Young Investigator Groups (YIG), Research Groups (RG), and Shared Research Groups (SRG). Latter were funded together with partners from industry. By the end of 2017, the last of these groups has been concluded. Meanwhile, KIT has introduced the concept of *KIT Junior Research Groups* in 2013. Applicable are young investigators who are scientifically independent, have raised third-party funding, and hold staff responsibility. Thus, while the number of groups funded by the first excellence initiative has steadily been declining, the amount of KIT junior research groups has risen, reaching a peak in 2018. Nonetheless, YIN observes, a slight drop in the overall number of junior research groups since the first excellence initiative phased out. In September 2018, YIN counted 6 BMBF groups, 1 group each funded by an ERC starting grant, a Sofja-Kovalevskaja startup grant, and Margarete-von-Wrangell fellowship, 6 Emmy-Noether groups, 8 Helmholtz Young Investigator groups, 5 junior professorships, and the 12 KIT junior research groups with third-party funding from other sources.

Fig. 1: Development of research groups of YIN members from 2008-2018 (YIN database Oct. 2018).

Areas of expertise

YIN members cover four areas of research: In 2018, with 40% the majority of YIN members work in the field of engineering and material sciences, followed by 28% in natural sciences, and 23% in computer science and mathematics. The last 10% are employed in the area of economics and humanities (see Fig. 2). Compared to the preceding years, the number of groups in material sciences and computer science has increased, whereas the number of funded projects in the natural sciences has declined. Moreover, while still representing a minority in YIN, the research groups from economics and humanities also have gained footage. Although, it is yet too early to speak of a trend, the observed shift in focus seems to correspond to the strategical objectives set by KIT: Global challenges in the fields of energy, mobility, and information might favor engineering and computational approaches as well as research on their impact on society.

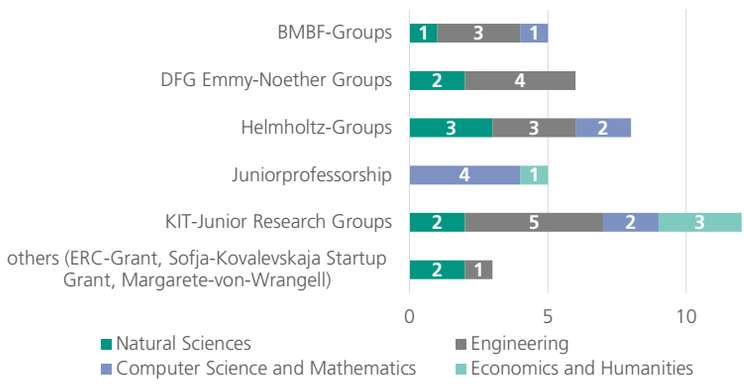


Fig. 2: Distribution of YIN research groups according to the funding program and area of expertise (YIN database Oct 2018).

Professorship appointments

2018 has been an exceptionally successful year in terms of professorship appointments. In total, 7 YIN members and 2 alumni have answered a call: among them 2 assistant professors, 1 associate professor, and 6 full professors. This is an absolute high in YIN history (see Fig. 3). Three new alumni went to work and live abroad, continuing their research at international universities in Scotland, Spain, and the United States of America.

Fig. 3: New members, alumni, and appointed professors (YIN database Oct 2018).

During the past years, 50 former YIN members have become professors, raising the appointment ratio to 50%. Among them, the percentage of female professors lies by 27%, whereas just 15% come from an international background. Nearly one fifth chose a professorial career abroad.

Upward trend in initial funding

Since 2008, YIN members have acquired over 100 million euro of initial third-party funding. Fig. 4 shows the average initial funding of group leaders joining YIN in the corresponding year.

Beside some ups and downs, a general trend towards higher initial funding can be observed. In 2017, a peak was reached: Every new YIN member having raised over one million euro on average. This development is at least partly due to the decline in KIT Young Investigator Groups (YIG). They received a total budget of either 240,000 euro over three or 320,000 euro over four years. A relative small amount compared to ERC Starting Grants, Emmy Noether, or Helmholtz Young Investigator Groups each accounting for roughly 1-1.5 million euro over five to six years. The level of initial funding mirrors the academic maturity and responsibility a group leader holds. Thus, to qualify for a YIG, the dissertation had had not to date back further than a year at the time of application. For any of the other groups, applicants should at least have two postdoc years and relevant scientific publications to show for it.

Fig. 4: Average initial funding per new YIN member (YIN database).

In 2017, YIN members contributed a total of roughly 36 million euro (distributed over 3 to 6 years) towards research at KIT by their initial funding. This results in roughly 9 million euro per year. The funding volume of the various groups varies between 200,000 and 4 million euro. As some of the junior research groups are totally or partially funded by KIT roughly 8 million come from KIT. The remaining 28 million euro are externally funded.

Subsequent funding

In addition to the initial funding of their groups, YIN members acquire a substantial amount of subsequent funding. On average, each member raises roughly 180,000 euro extra a year. Thus, the initial amount of third-party funding is almost doubled. In 2017, subsequent funding accounted for 7,3 million euro in total. The majority, about 77% of these grants, was provided by external funding agencies such as the German Research Foundation (DFG). 13% were contributed by industrial partners, and the remaining 10% by KIT.

Publications, h-index and conferences

A total number of 202 papers and articles has been published in 2017 by the 40 groups that participated in this survey. Significant research by YIN members has been published in prestigious journals such as Nature Communications, Advanced Functional Materials, European Physical Journal Special Topics, ACS Applied Materials and Interfaces, JACS, Science Advances and the Journal of Physical Chemistry Letters.

The average Hirsch-index of a YIN member is h = 14,68. Due to different publication traditions in the different disciplines, the h-index of the YIN members varies significantly. In addition to publications, YIN members show their scientific work and represent KIT at numerous occasions. In 2017, the 40 YIN members of this survey presented their work at 186 international conferences. Furthermore, 11 patent applications were filed by YIN members in 2017.

Habilitation

The status of a junior group leader was thought to replace the habilitation which has long been the gold standard in Germany but almost nowhere else. Over the last four years, however, about half of all YIN members have acquired or meant to acquire a habilitation in addition to their junior research groups. Even among the junior professors, a habilitation is not uncommon. In 2017, 42,5% of the YIN members planned to pursue a habilitation and 7,5% have been already successful. 37,5% were undecided and only 12,5% considered the habilitation unnecessary for their career. Of course, the significance of a habilitation versus a junior group leader position varies among different scientific fields: In engineering, a habilitation is generally less important. In humanities as well as in mathematics and natural sciences the amount of habilitations has noticeably declined over the last ten years coming almost head to head with the increased numbers in economics and social sciences.

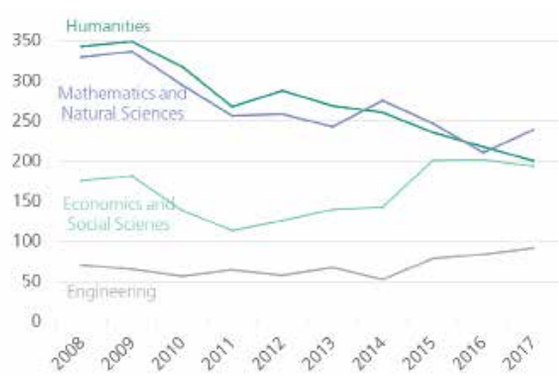


Fig. 5: Development of habilitation in Germany (Data from the Federal Bureau of Statistics,Subject-matter series 11, series 4.4 - 2017: Staff at universities).

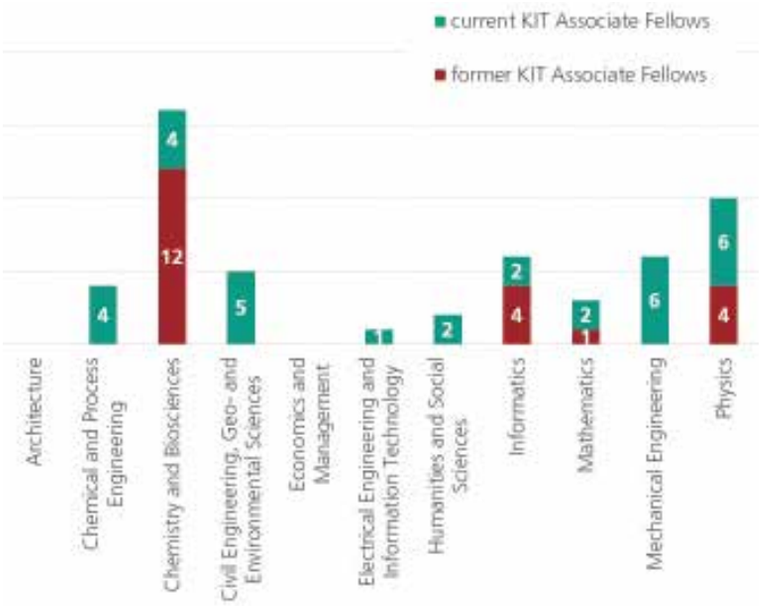


Fig. 6: Number of Associate Fellows at the KIT Departments in July 2018 (Data from YIN survey among the KIT Departments).

five years after the introduction of the KIT Associate Fellow, six out of the eleven KIT departments had never assigned the status to a junior group leader. In 2018, only two KIT departments were still lacking Associate Fellows (see Fig. 6). For the previous issue Vice Dean Prof. Andreas Wagner stated that at the KIT Department of Architecture, most students chose a practical career and the few remaining in academics mostly worked individually. Thus, eligible candidates are missing.

Associate Fellow

The status *KIT Associate Fellow* temporally assigns some rights of habilitated lecturers to independent junior group leaders. They get the opportunity to gain experience in independent teaching, supervision, and examination procedures for the duration of their groups. While at some KIT departments, group leaders can be first reviewers for their PhD, Master, and Bachelor students, at others, they may only serve as additional third reviewers for their PhD students and may not examine Bachelor and Master students at all. To write a third review is certainly a good exercise, however, as an add-on, it is of little practical relevance. Especially for leaders of larger, well-funded groups, the status is not always fully satisfactory. Having to ask professors to supervise and/or examine students working for them somehow limits the responsibility for their group as well as their scientific integrity. Therefore, KIT plans to appoint more externally evaluated group leaders as junior professors in the future.

The KIT Associate Fellow is nonetheless a valuable instrument to recognize the structural and scientific independence of junior research group leaders in general. Moreover, the acceptance of the status by the KIT departments has significantly improved over the last two years. Still in 2016,

Teaching and supervised theses

Although the majority of YIN members has no teaching obligation, for most of them teaching is a substantial part of their work life. About 90% of all YIN members contribute actively towards teaching at KIT. To better illustrate this: YIN members give lectures accounting for a total of 334 semester credit hours (SWS) during the past winter (2017/18) and summer semester (2017). The 334 SWS comprise lectures (171 SWS), seminars (78 SWS), exercises (47 SWS) and practical trainings (38 SWS). Interestingly enough, however, only 37.5% of the group leaders and junior professors in YIN have an obligatory teaching assignment. For 32.5% the teaching assignment is just voluntary and mainly unpaid. Two thirds of the remaining 30% without official teaching assignment hold lectures anyway (see Fig. 7).

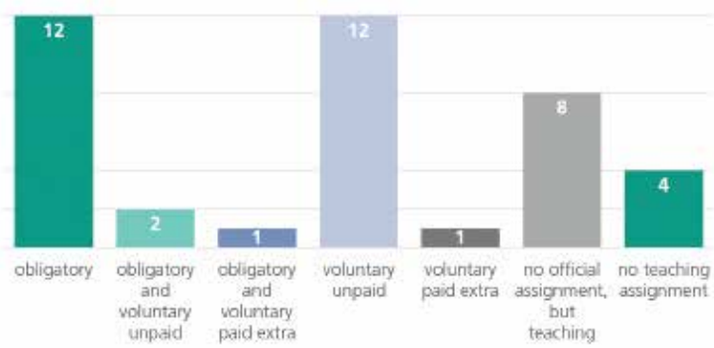


Fig. 7: YIN teaching assignment of YIN members in 2017/18 in absolut numbers.

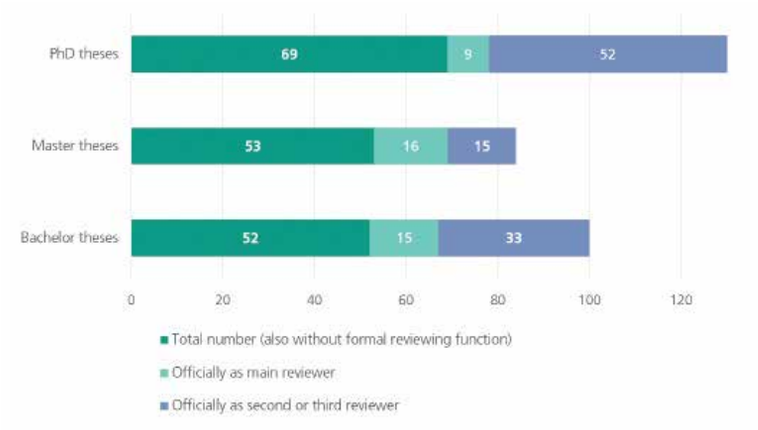


Fig. 8: Number of theses supervised by YIN members in 2017.

Staff

The YIN groups, represented by the group leaders, provide funding for a large number of employees, a total of 418 people. The average size of a junior research group represented in YIN is 10 members. The YIN junior group leaders employ 37 postdoctoral researchers, 146 doctoral candidates, 100 Diploma/Master students, 55 Bachelor students and 46 student assistants. The groups further employ 17 technicians, 12 guest scientists and 4 trainees, as shown in Fig. 10.

In addition to teaching, YIN members supervise PhD as well as Master and Bachelor students. In 2017, 24 doctoral theses, 102 Diploma and Master theses as well as 80 Bachelor theses were prepared by students in YIN groups. See Fig. 8 above.

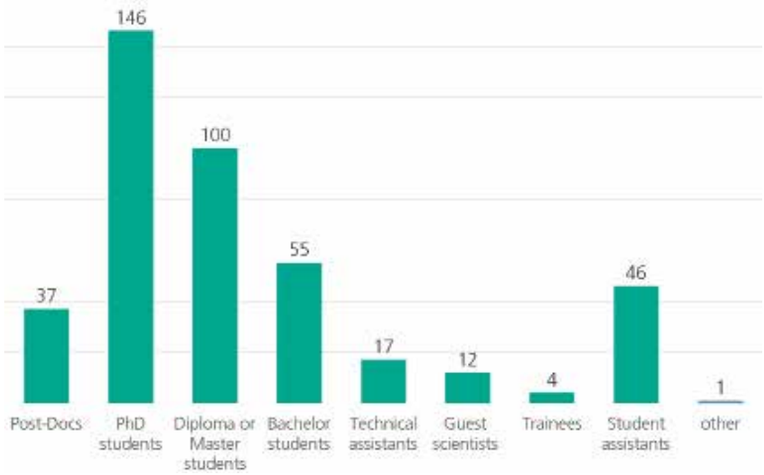


Fig. 10: Number of people working in YIN groups.

Unfortunately, the examination entitlement granted is not the same at all KIT Departments. Only 5 % of the junior group leaders have full examination rights. In contrast, almost 26 % of the YIN members have no examination entitlement at all which is very difficult to handle, when you otherwise teach independently. Roughly 49 % have examination entitlement only for doctoral students; another 49 % only for Bachelor / Master students (see Fig. 9).

Among the doctoral and postdoctoral researchers within the YIN groups, 62% originate from Germany. However, the groups are very international. 12% come from Europe, 17% from Asia, 5% from North and Central America, 3% from Africa, and 1% from Australia/ Oceania.

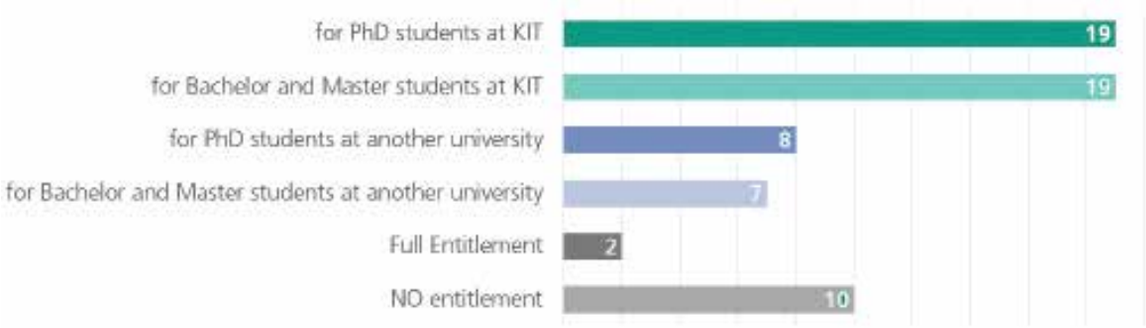


Fig. 9: YIN examination entitlement.

Nature of working hours

At this stage of their careers, the time that young group leaders spend in their labs or writing papers diminishes as other activities take more and more time and precedence. As all YIN members have personnel responsibility, 25% of their time is taken by supervising and mentoring, 17% by teaching and 12% by grant writing. Since all YIN members are third party funded this last point is a very important part of their job. Furthermore, there are increasing administrative duties and committee work that they have to fulfill, which takes 20% of their time on average.

Fig. 11: Distribution of working hours of junior group leaders with personnel responsibility (YIN survey 2018).

Age and family status

The average age of YIN members at the start of their junior research group is 33, varying between 28 and 38. The term of these groups is typically between four and six years. Thus, the average age of all current YIN members is 36, with the youngest member being 31 and the oldest member 44 years old. For this age group, it is not surprising that starting a family and aspiring the right balance between science and family are important topics. More than half of the YIN members have at least one child. This means that for attracting more outstanding junior group leaders, it becomes increasingly crucial to address issues like predictable careers, child-care, parental leave, and flexibility of working hours.

Fig. 12: Percentage of women and YIN members with an international background since 2008 (YIN Database).

Rising percentage of women

The proportion of women has been slightly rising since YIN was founded in 2008 (see Fig. 12). Since then, it has almost steadily increased, reaching an absolute high of 32% in 2018. Compared to only 13% of female professors at KIT in 2017, this is an impressive number, showing that there are young women interested and accomplished in the subjects studied and taught at KIT.

Internationality

YIN is an international network. Pages 22 and 23 show this very graphically. In 2018, 16% of the current members have an international background (including members from Europe, America, and Australia). This is a drop by 4% compared to the previous year. The percentage of YIN members having held a position abroad prior to coming to KIT, however, has increased from 35% in the previous year to almost 45% in 2018. 8 YIN members have been postdoctoral researchers in North America, 7 in Europe, and 1 in Asia. From the 3 having worked in industry, 2 stayed in Germany and in North America (see Fig. 13).

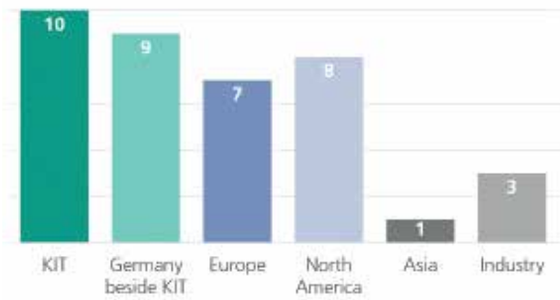


Fig. 13: Latest position of YIN members before coming to KIT (YIN survey 2018).


2008-2018
Incoming young investigators
Outgoing young investigators

© Thomas Frank

European Research Council Grants

YIN members / alumni
KIT scientists who are not members of YIN

ERC STARTING GRANT

2018: Prof. Frank Schröder
(University Delaware, USA, since 2018)
"Digital Radio Detectors for Galactic PeV Particles"

2017: Prof. Cornelia Lee-Thedieck
(University of Hannover since 2018)
"BloodANDbone – conjoined twins in health and disease: bone marrow analogs for hematological and musculoskeletal diseases"

2017: Prof. Lars Pastewka
(University of Freiburg since 2017)
"Emergence of Surface Roughness in Shaping, Finishing and Wear Processes"

2016: Prof. Corinna Hoose
"Closure of the Cloud Phase"

2013: Prof. Erin Koos
(University of Leuven since 2016)
"Capillary Suspensions: A Novel Route for Versatile, Cost Efficient and Environmentally Friendly Material Design"

2013: Dr. Pavel Levkin
"DropletMicroarrays: Ultra High-Throughput Screening of Cells in 3D Microenvironments"
2015 & 2017 Proof of Concept Grant each 150K€

2011: Prof. Christian Koos
"Energy-Efficient Multi-Terabit/s Photonic Interconnects"
2015 & 2016 Proof of Concept Grant each 150K€

2011: Prof. Alexander Nesterov-Müller
"Combinatorial Patterning of Particles for High Density Peptide Arrays"
2015 & 2017 Proof of Concept Grant each 150K€

2010: Prof. Peter Knippertz
(At the time of approval grantee did not yet work at KIT)
"Desert Storms - Towards an Improved Representation of Meteorological Processes in Models of Mineral Dust Emission"

2010: Dr. Matthias Schneider
"Multi-platform remote Sensing of Isotopologues for investigating the Cycle of Atmospheric water"

2009: Dr. Regina Hoffmann-Vogel (University of Konstanz since 2018)
"Structural and Electronic Properties of Nanoscale Metallic Contacts Fabricated by Thermally Assisted electromigration"

2018

2017

2016

2013

2011

2010

2009

ERC CONSOLIDATOR GRANT

2017: Dr. Christian Greiner
"Deformation Mechanisms are the Key to Understanding and Tayloring Tribological Behaviour"

2017: Prof. Christian Koos
"Terahertz Waveform Synthesis and Analysis Using Hybrid Photonic - Electronic Circuits"

2016: Prof. Martin Weides
(University of Glasgow since 2018)
"Interfacing spin waves with superconducting quantum circuits for single magnon creation and detection"

2016: Prof. Dennis Hofheinz
"Preparing Cryptography for Modern Applications"

With an ERC grant to the USA?!

YIN Alumnus Frank Schröder has received an ERC starting grant and a call from overseas.

The European Research Council (ERC) funds Frank Schröder's research on radio measurements of high-energy cosmic rays with EUR 1.6 million for a period of five years. With the proposed antenna array at the IceCube Observatory near the South Pole, Frank Schröder hopes to catch the highest-energy photons ever measured.

The sources and mechanisms accelerating particles of highest-energy in our galaxy are still unknown. Their energies by far surpass those reached by huge man-made accelerator facilities, such as the Large Hadron Collider (LHC) of the European Nuclear Research Center CERN in Geneva. Cosmic rays at ultra-high energies of more than 10^{15} eV are too rare to be measured directly in space in sufficient quantity. When colliding with the Earth's atmosphere, however, they set free cascades of secondary particles and, thereby, produce light as well as radio waves.

Complemenentry to particle detectors and optical telescopes, Frank Schröder and his colleagues have developed a radio measurement technique with certain advantages: "We can observe radio waves all around the clock, whereas optical detectors work in clear nights only. Moreover, measurement with antennas is cheaper," Schröder explains. Compared to antenna fields used so far, the future setup will have a significantly better sensitivity, enabling it to search for photons originating from our galaxy, the Milky Way. "At the location of the IceCube experiment near the South Pole, we will arrange antennas on a field of about 1 km². Within a measurement period of three years, I expect to obtain indications as to where the highest-energy particles are formed."

Frank Schröder had just accepted an assistant professorship by the University of Delaware in the United States of America (USA), when the European Research Council announced that his proposal is among the 12.7% supported with a Starting Grant. The dilemma: The ERC only funds research in Europe. Working in the USA and at KIT? Not impossible for Frank Schröder: "The University of Delaware was very supportive. Together we found a solution reducing my time commitment and teaching load such that I can spend every other semester at KIT." Frank Schröder funds his corresponding 50% scientist position at KIT from his ERC grant. This will foster the existing collaboration between KIT and University of Delaware in astroparticle physics. A win-win-situation for all involved.

Frank Schröder focuses on astroparticle physics and in particular on radio measurement of high-energy cosmic rays. (Photo: Markus Breig, KIT)

Most of his new U.S. colleagues at the Bartol Research Institute and at the Department of Physics and Astronomy have not heard of the European Research Council before. "They were, however, impressed by the comparatively high amount of funding," Frank Schröder recounts. "It is more than three times higher than the funding offered by the prestigious NSF career grants for assistant professors in the USA." He will still apply for one of those to fund his research group in Delaware. In the end, he will lead two groups on different continents, but with synergy for his research.

This way, Frank Schröder enjoys the best from both worlds: In Delaware, he joined some of the leading scientists in the field of cosmic rays and profits from the tenure track system. At KIT, he can realize his ERC project, works with world experts on astroparticle physics, and has access to an outstanding technical infrastructure.

„200-ton baby“ takes up its job – measuring

The inauguration of the Karlsruhe Tritium Neutrino Experiment (KATRIN) from the personal perspective

As "ghost particles of the universe”, neutrinos pervade every cubic centimeter of the cosmos in large numbers but very rarely interact with surrounding matter. They are by far the lightest species among the particles known in the standard model of elementary particles. Nonetheless, they are considered “cosmic architects”. The exact role neutrinos play in shaping the large-scale structures in our universe depends on their rest mass, which is unknown at present. In pursuit of this secret, researchers and engineers all around the globe have formed an international collaboration to design and build the world’s most precise particle scale: the Karlsruhe Tritium Neutrino Experiment (KATRIN), located at KIT’s Campus North site. After long years of preparations, the inaugurating data-taking run was finally celebrated in June 2018.

Data-taking with KATRIN officially commenced with the inaugurational ceremony on June 11, 2018. (Photo: Markus Breig, KIT)

For Dr. Kathrin Valerius the fascination with neutrinos began during her undergraduate studies: "I picked Bonn University, because they have a strong focus on astrophysics and astronomy and also on elementary particle physics. I studied both subjects intensely, but, eventually, I had to pick one of my favorite topics for my diploma thesis and my potential future research work. I just couldn’t decide. But then, it occurred to me that the newly arising field of astroparticle physics offered a perfect solution: Neutrino physics, in particular, is situated right at the intersection of astrophysics and cosmology on one side and the particle physics, the look into the subatomic world, on the other side."

Once the path towards neutrino physics was set, the opportunity to join a large-scale research project in Karlsruhe arose: The KATRIN experiment was still in its planning stage, then. Kathrin Valerius had the good fortune to get an internship at an associated neutrino physics group in Bonn, got hooked immediately on the research topic, and stayed on for her diploma thesis: "They needed someone to look into the electromagnetic design of the KATRIN spectrometer through numerical simulations, in order to optimize the size, the diameter, and to fine-tune the shape of the vessel. This mainly involved field computations and charged-particle trajectory calculations." With the end of her thesis, in 2004, the KATRIN design was fixed and the order for manufacturing the 24 m long, 200-ton stainless steel vessel was placed with a company in Deggendorf, Bavaria.

The spectrometer must be able to hold an ultra-high vacuum as well as allowing the setup of precise electrostatic and magnetic fields to filter out all but the highest energy electrons. The principle behind the KATRIN experiment is the ß-decay of Tritium to Helium where an electron and a neutrino are released. The transition energy is divided between the two in the form of kinetic energy and rest mass. When the electron obtains nearly the entire energy, Einstein´s famous equation $E=mc^2$ tells us that the invisible neutrino has to carry away at least its rest mass, which the electron then lacks. It is this minute amount of missing energy in the electron energy spectrum that the neutrino scale hunts for. At a level of 0.2 electronvolt (corresponding to the inconceivably small mass of 3.6×10^{-37} kilogram) KATRIN is an order of magnitude more sensitive than previous experiments.

When the KATRIN spectrometer was finally delivered in fall 2006, for Kathrin Valerius a sketch had come to life: "It was a very emotional moment for me. I am personally attached to this big device I have come to think of as a ‘200 ton baby’." On that Saturday morning, she had come

the lightest known particles: Neutrinos

of YIN member Dr. Kathrin Valerius

all the way from Bonn to watch the spectrometer being lifted off the pontoon barge at Leopoldshafen harbor, scheduled for eight o'clock. "We followed it all day over the last seven kilometers to the gates of the Research Center Karlsruhe, today KIT Campus North."

In November 2006, Kathrin Valerius followed the KATRIN spectrometer over the last seven kilometers to the gates of the Research Center Karlsruhe, today KIT Campus North.

By that time, Kathrin Valerius was a PhD student at Münster University working on KATRIN's inner electrode system. "We ended up building 250 module frames which had to be mounted inside the spectrometer. They were to carry about 22,000 individual wires arranged in two layers. The precise alignment on the scale of a few hundred micrometers was a highly sophisticated technical challenge. For me, it was really interesting not only to work on the physics and computer simulations, but also to get to know the technical side of a life-scale setup and installation. I also got to travel to Karlsruhe a lot for extended research stays, especially after the spectrometer had been delivered."

Such a large scale research project can be quite challenging, however, demanding high persistence and adaptability from the dedicated scientists. Kathrin Valerius, for instance, had to adjust her thesis work to match the schedule of the experiment. In 2009, she successfully completed her dissertation on spectrometer-related background processes and their suppression. Thereafter, she moved on to pursue postdoctoral studies in the field of gamma-ray astronomy, before picking up her neutrino research. In 2014, she joined KIT to start a Helmholtz Young Investigator Group dedicated to the analysis of KATRIN data. Thus, she was right on site, when the biggest success of the experiment so far took place: "It was amazing, to actually see the first tritium-ß-spectrum measured by KATRIN in May 2018. It was actually an engineering run at lower statistics, targeted at carefully characterizing the behavior of the system. To realize that everything was running according to design plans, gave us a lot of confidence in moving ahead to the first neutrino mass measurement."

Finally, on June 11th, 2018, the scientific symposium marking the first injection of tritium gas took place. "It was fantastic to celebrate not only within our collaboration, but also with many colleagues from the international research community," Kathrin Valerius recalls. After this highly successful campaign, the KATRIN collaboration is about to launch the long-term neutrino mass measurements in March 2019. Well into the next decade, every second of run time about 100 billion ß-decay processes of molecular tritium will be generated in KATRIN's molecular gaseous tritium source. The ß-decay energy spectrum will be statistically processed to produce long awaited results. Kathrin Valerius' group will continue their analysis and search for new physics beyond the established Standard Model. Neutrinos seem to hold a lot of promise in this regard - the discovery of their non-zero rest mass is a clear indication that some puzzle piece is still missing in the Standard Model of elementary particles!

A view of the wire electrode system lining the interior walls of the vacuum vessel of the KATRIN main spectrometer. (Photo: Michael Zacher, KATRIN Collaboration)

Excellence Cluster

Energy Storage beyond Lithium –

On that sunny Thursday afternoon in September, it was a big relief to read the name of our cluster among the ones selected for funding. I could not have foreseen that I would be part of the celebration when I joined KIT a little over a year ago, since the cluster proposal "Energy Storage beyond Lithium – New storage concepts for a sustainable future" had already passed the first screening and was selected for the final application round. To be none the less asked to be one of the researchers presenting the cluster during the evaluation meeting in Munich was therefore both unexpected and exciting. It was inspiring to work in this team of battery researchers and for me, the transition from "the" cluster as a rather abstract proposal to "our" cluster filled with excellent research ideas came quickly.

The cluster ideas center around the question: What comes after Lithium in terms of energy storage technologies? To find the answers, researchers from KIT and Ulm University come together across disciplines to develop fundamental understanding of post-Li electrochemical energy storage and pave the way for practical applications of these new technologies.

The ambitious goals of the cluster require manpower and new talents and, therefore, open many possibilities for young researchers. Starting on the doctoral researcher level, the "Graduate School Electrochemical Energy Storage (GS-ESS)" will be established as part of CELEST, the joint Center for Electrochemical Energy Storage of Ulm University and KIT. The cluster will also offer starting funds for junior research group leaders to pursue their research ideas in the field of post-Li energy storage. To create more reliable career paths in academia, in total four tenure track professorships will be established at KIT and Ulm University together with permanent senior researcher positions in key research topics.

Dr. Julia Maibach
BMBF group

The now present excitement about the coming research opportunities almost makes me forget the long hours and countless meetings before the evaluation. Preparing for the evaluation meeting was intense and hard work up to the final days if not hours, but it was motivating to see the level of commitment in the team in preparing the presentation, posters, and exhibition pieces to showcase our cluster. In contrast to the interview process for young investigator grants, you are not facing the reviewers alone when working on such a major proposal but in a team. And from my personal point of view, it is comforting to know that even the most established professors prepare rigorously when the stakes are this high.
In the end, the efforts paid off and the cluster "Energy Storage beyond Lithium" will take up its research tasks from 1 January, 2019. But it came to life much earlier.

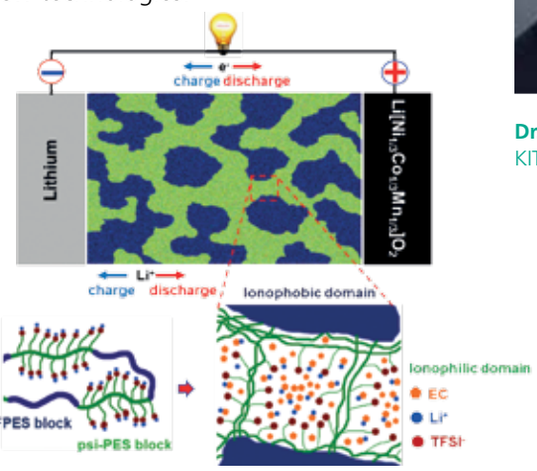
new storage concepts for a sustainable future

CELEST – Center for Electrochemical Energy Storage Ulm-Karlsruhe

Aiming at extending and reinforcing their collaboration in the field of electrochemical energy storage, in 2018, KIT, Ulm University, and the Centre for Solar Energy and Hydrogen Research Baden-Wuerttemberg have founded the Center for Electrochemical Energy Storage Ulm-Karlsruhe (CELEST). The joint activities will range from fundamental research toward the development of new battery technologies and technical applications with a particular focus on training early career researchers and tailored qualification opportunities for graduate students. Among the (co-)spokespersons, the early career researchers are in particular represented by Dr. Julia Maibach and Dr. Dominic Bresser, both also YIN members. www.celest.de

The successful transition from fossil fuels to renewable energy sources is one of the greatest challenges for current and future generations. The key motivation is essentially twofold: The switch to potentially unlimited power sources like wind, solar, and biomass on one side and the avoidance of reconverting fossil fuels like coal, oil, or gas into CO_2 and, thus, limiting the ongoing climate change on the other. In fact, fossil fuels are essentially CO_2 which has been absorbed by biomass using solar energy over millions of years. Thus, they are excellent energy storage materials. Renewable energy sources, in contrast, provide energy directly and, therefore, require efficient storage technologies to ensure a continuous and stable energy supply comparable to fossil fuels.

One of the most successful "energy carriers" are batteries: They do not require extensive energy conversion steps and, hence, allow for highly efficient energy storage. Simultaneously, they can power small-, mid-, and large-scale devices, ranging from smartphones, to electric vehicles, and even to stationary storage applications. Especially lithium-ion batteries have been very successful due to their outstanding combination of energy and power density as well as cycle life. Nonetheless, challenges regarding their further enhancement as well as alternative energy storage and conversion technologies remain.[1] CELEST addresses these issues in a comprehensive multi-strategy approach, combining the highly complementary strengths and competencies in Ulm and Karlsruhe to foster new technologies.



A novel nanostructured electrolyte provides very efficient lithium-ion conduction along well-defined ionic channels.[2]

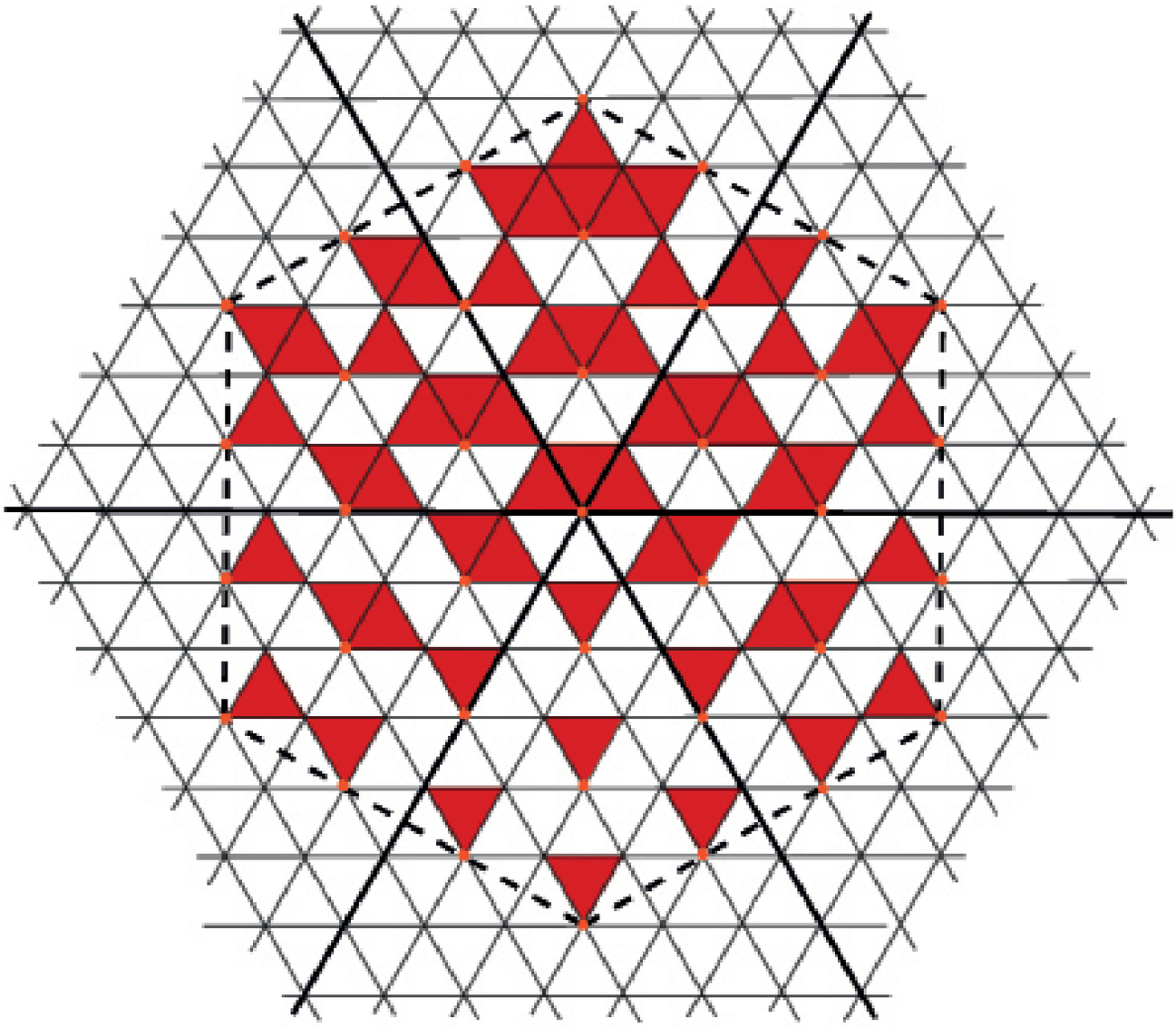
CELEST member Dominic Bresser and his group focus on technological and scientific progress in the field of lithium-based batteries, covering inter alia alternative anodes, optimized cathodes, new binder systems, and advanced electrolyte systems. They have recently addressed the safety issues related to the commonly employed liquid organic electrolytes. Together with scientists in France and Germany, they developed a nanostructured electrolyte which provides very efficient lithium-ion conduction along well-defined ionic channels (see figure) and approaches conductivity values close to liquid organic systems. In addition, these polymers show self-extinguishing properties and an excellent stability towards metallic lithium as high-energy anode and state-of-the-art high-energy cathode materials.[2] While still being at an early developmental stage, the new electrolytes may well lead to intrinsically safer, high-energy lithium batteries in the future and, thus, contribute to one of the main targets of the CELEST network: the ongoing electrification of our society.

Dr. Dominic Bresser
KIT Jr Research Group

[1] D. Bresser, et al.: Perspectives of automotive battery R&D in China, Germany, Japan, and the USA, Journal of Power Sources 2018 (382) 176-178.
[2] H.-D. Nguyen, et al.: Nanostructured multi-block copolymer single-ion conductors for safer high-performance lithium batteries, Energy & Environmental Science 2018 (11) 3298-3309.

Science is beautiful

YIN Best Scientific Picture Competition 2018



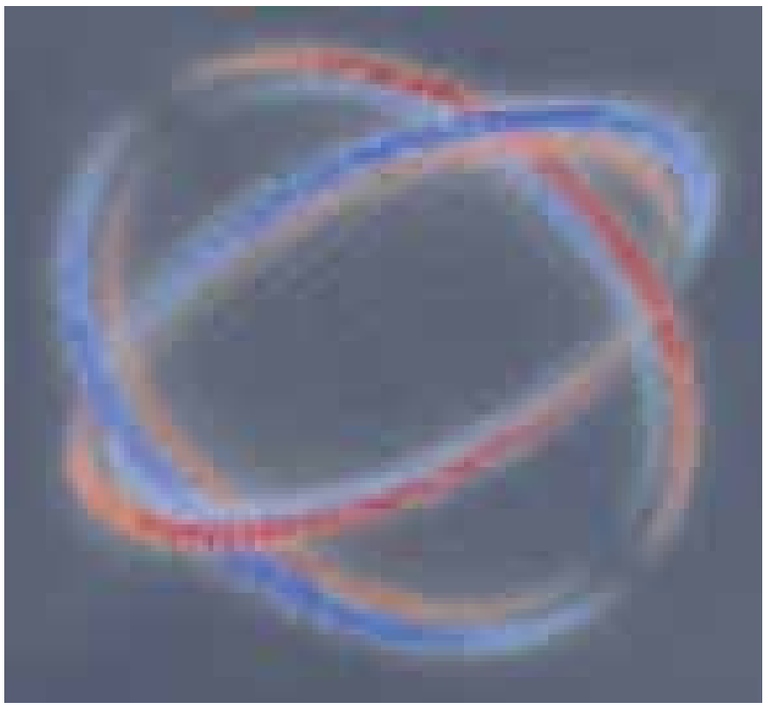
Prize 1: "Shadows"

by JProf. Dr. Petra Schwer, now professor at the University Magdeburg:
To me this close interplay is deeply fascinating!

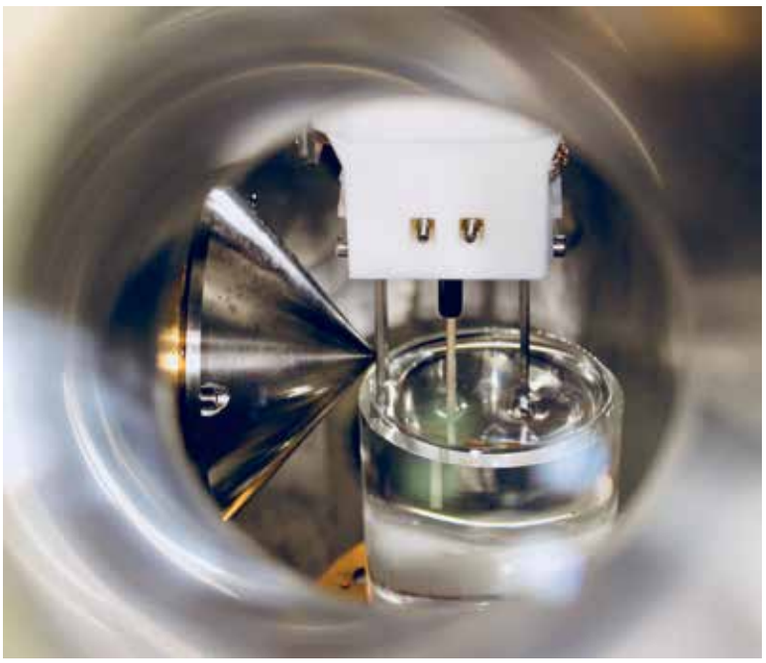
This picture shows two types of LS-shadows (the set of red vertices and the set of dark red triangles) of elements in an affine Coxeter group. An affine Coxeter group is a collection of reflections of the plane which, in this case, keeps the underlying triangle tiling of the plane invariant and describes its symmetries. LS-shadow, geometric objects themselves, are closely linked to algebraic phenomena in arithmetic geometry and combinatorial representation theory. They describe certain highest weight representations and, simultaneously, nonemptiness of so called affine Deligne-Lusztig varieties. Many geometric properties of the shadow, for example its invariance under the reflection along the vertical middle line, have algebraic interpretations in these other areas of mathematics.

Prize 2: "Married with Science"

by Dr. Katrin Schulz, Wrangell Fellow



Two dislocation loops evolve on different inclined slip systems in a crystalline material. The depiction of the screw part of the geometrically necessary dislocation density in a continuum model shows a snapshot right before the "lines" meet and interact at the intersections. The ambiguous image allows for two different perceptions of the system.



Prize 3: "When Water meets Vacuum..."

by Dr. Julia Maibach, BMBF group

To study the surface of materials with photoelectron spectroscopy, we shine x-rays on a sample, causing it to emit electrons. Once these photoelectrons hit the detector, their energy levels tell us from which element they come and how much of it is present on the surface. To avoid energy loss in collisions, the technique usually requires vacuum. To analyze iquids, however, the pressures inside the vacuum chamber need to be high enough to keep them from evaporating. In the presented image, we peek into such an ambient-pressure vacuum chamber: a beaker is filled with water-based solution and three electrodes are dipped into this electrolyte to study surface electrochemical reactions as they happen. The instrument is located at the synchrotron MAX IV in Sweden, one of the brightest x-ray sources in the world.

YIN receives guest status at the Council for Research and Promotion of Young Scientists (CRYS)

With a permanent visitor's seat for YIN in CRYS, KIT recognizes the voice of junior group leaders and junior professors in a committee which deals with concerns that directly address their peer group. The representative YIN speakers take alternately part in the council's meetings. What were their impressions?

Dr. Kathrin Valerius: "As YIN representatives, we very much value the opportunity to be directly involved in CRYS topics, which range from fostering young talent at KIT to collegial advice on both individual and collaborative research grant proposals."

PD Dr. Achim Rettinger: "It is a great opportunity to see how various aspects of group or project proposals can be reviewed and discussed beyond scientific disciplines. I learned a lot about factors that I didn't have in mind before when writing my own grants."

YIN Grants 2018

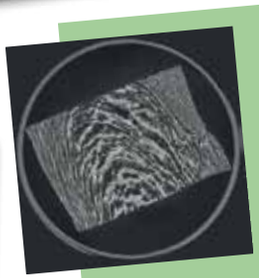
Computational Perception Models of Scientific Presentations
Dr. Philipp Niemann and PD Dr. Achim Rettinger

Accompanying simulation of synthetic cell surfaces
Dr. Christian Brandl, PD Dr. Dr. Michael Hirtz, and Prof. Cornelia Lee-Thedieck

Utilizing 2-D lattice defects to design novel reinforcements for nanocrystalline metals
Dr. Christian Brandl and Dr. Karsten Woll

Two HEiKA projects for YIN members in 2019

Dr. Frank Biedermann and Dr. Ulrich Paetzold each successfully applied for a collaborative project supported by the Heidelberg Karlsruhe Strategic Partnership (HEiKA). Frank Biedermann and Prof. Thomas Kuner plan to use artificial neurotransmitter receptors for the monitoring of dopamine levels in neuronal tissues as well as in prefrontal cortex and basal nuclei of intact mice. Ulrich Paetzold and JProf. Yana Vaynzof aim to utilize the inkjet printing deposition method for fabrication of high-yield and high-performance perovskite solar cells. Since the funding scheme started in 2013, YIN members have been involved in 11 HEiKA projects.



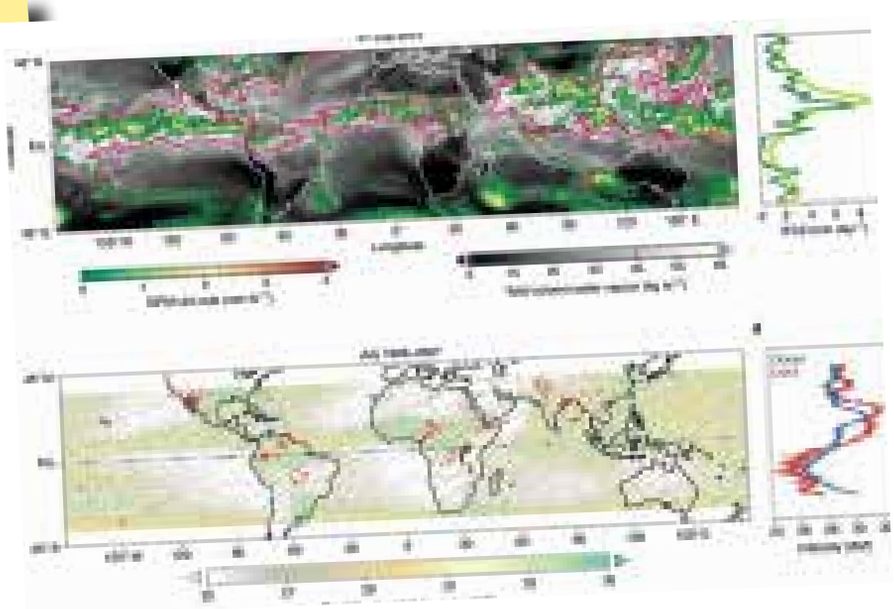
Plant proteins for meat lovers

Scientists at KIT and the TU Berlin develop a better meat texture for plant substitutes. The typical impression when chewing, the mouth feeling, is based above all on the fibre-like texture of meat," explains YIN member Dr. Azad Emin. The process engineer heads the KIT junior research group „Extrusion of Biopolymers". During the extrusion process, a dough-like mass is pressed through a nozzle. The researchers are now analysing the interactions between pressure, temperature, current, and shear forces in order to specifically modify the structure of plant proteins.

Nature Geoscience: Towards better predictions of tropical rainfall

Predicting the response of tropical rainfall to global warming is a grand challenge in climate science with great socioeconomic importance. The challenge arises from the interactions across scales: tropical rainfall is linked to small-scale cloud processes on the one hand, and is orchestrated by the planetary-scale circulation of the atmosphere on the other hand.

A review paper in Nature Geoscience, co-authored by YIN member Aiko Voigt, highlighted the need for a theory that addresses these scale interactions. As a way forward, the article argues for research that distills the local articulations of global constraints on energy and momentum balances. The work has further led to the organization of an international climate model intercomparison project and two international conferences on tropical rainfall changes.
doi:10.1038/s41561-018-0137-1



First Associate Fellows in Mathematics and in the Humanities

Since 2018, two more KIT-Departments have awarded the status of "KIT Associate Fellow" to early-stage academic leaders with personnel responsibility: the KIT-Department of Mathematics and the KIT-Department of Humanities and Social Sciences. The young scientists are, thus, temporarily granted some rights of habilitated lecturers: They may take part in supervising and examining their PhD sutdents and gain experience in independent teaching. Both are important assets for future professors.

Alternative: professor at a uni of applied sciences

Becoming professor at a university of applied sciences can be an appealing alternative career option. For three YIN alumni, it has become reality. At the YIN fireside chat in April, Prof. Romana Piat (Darmstadt), Prof. Stefanie Betz (Furtwangen), and Prof. Oliver Waldhorst (Karlsruhe) talked about getting appointed and about the differences and similarities between working at a university of applied sciences and a regular one. While industry experience is crucial for a career in applied sciences, for some it may be attained project-wise or at a research center. The teaching load can be reduced.

Continually towards Leadership Excellence

YIN Certificate "Academic Leadership"
by Prof. Christoph Eberl, YIN honorary member
Deputy Director at the Fraunhofer Institute for Mechanics of Materials IWM

The meticulously-made advanced training program „Academic Leadership - Leadership in Science" has proven to be a successful instrument of individual potential development, as YIN honorary member Professor Chris Eberl emphasises: „As a leader in science, there is hardly any opportunity to systematically acquire knowledge in management and personnel management. YIN closed this gap with its qualification courses. For my personal development as a scientist, it was very important to find out what motivates people and what good leadership looks like. At YIN I could learn these experiences in an extraordinary, trusting space and exchange with others. I have profited enormously from this for my scientific career." said the former founding spokesman and current deputy director of the Fraunhofer Institute for Mechanics of Materials.

Leadership Excellence
by Dr. Aiko Voigt, BMBF group

Leading a Young Investigator Research Group is a tremendous opportunity for young scientists, and ideally prepares them for future roles in academia or industry. At the same time, it is a step change in their career. It is often the first time that they are responsible for Master students, PhD students and Postdocs, and it comes with a series of new tasks and challenges for which there is typically no real training beforehand. The modular workshop "Leadership Excellence", led by Stefan Dörr and Karin Funk, fills this gap by providing training in established management tools on the one hand, and a platform for intensive exchange with peers and the discussion of their experiences on the other hand. The tools include guidelines for personnel development, change management, conflict resolution, providing feedback, and structuring a research group.

The workshop further allows the participants to critically reflect on their personality and how they are perceived by their group members. The hands-on design is paired with candid discussions among the peers and coaches and benefits greatly from the complementary experience levels of the participants. This makes the "Leadership Excellence" workshop a central component of the YIN educational program. The three modules provide practical guidance for short-, mid-, and long-term measures to further develop and improve the organization and management of the group, so as to allow the group to do better science and to prepare the Young Investigator Group Leaders for the next steps in their career path. As a matter of fact, all participants found this workshop exceptionally helpful and frequently reported on the many changes and the resulting progress within their groups that were stimulated by the discussions and insights from the previous modules. On a personal note: I wholeheartedly recommend this workshop to every YIN member.

Sparking Interdisciplinary Collaborations
by Dr. Dominic Bresser, Vector research group

Over the course of their career, scientists develop into experts in their own field, with special and unique expertise that sets them apart from others. Given the complexity of today's science and its development into many sub-disciplines, such specialization appears quite natural and and a common (since necessary) strategy. At the same time, many scientific breakthroughs have resulted from interdisciplinary collaboration between experts who, at first sight, live in disjoint worlds. This shows that looking across borders and joining forces is apparently also a promising path to success. However, such collaborations are neither easily established, nor kept alive – because of the different "scientific languages" spoken, the focus on one's own research field (known as the "curse of knowledge"), and the hindsight bias. All of these complicate the communication between experts of different disciplines, hindering interdisciplinary collaborations.

The workshop "Sparking Interdisciplinary Collaborations", led by Stefan Götze, addresses these challenges by providing a brief, though comprehensive overview on the sociological aspects regarding the interdisciplinary collaborations and introducing the concept of analogies to present the own work in a manner accessible to scientists from other disciplines as well as laymen. Participants then have the opportunity to practice these tools during the second part of the workshop by presenting their research and work to the other participants. Here, the participants not only have the opportunity to get to know about the work of other YIN members, but to identify common grounds and possibilities for interdisciplinary joint research activities, which in a next step may be supported by a YIN grant. Thus, by fostering the scientific exchange and out-of-the-box thinking, this workshop presents a highly valuable contribution to the YIN curriculum and the overall mission of YIN.

The **YIN Certificate Academic Leadership** was awarded to

YIN member **Dr. Katrin Schulz**,
YIN alumnus **Prof. Frank Schröder** and
YIN alumna **Dr. Julia Syurik**

At the 10th YIN Day, Anke Diez, Head of the Service Unit Human Resources Development and Vocational Training, presented Dr Katrin Schulz (l.) and Dr. Julia Syrik (r.) with their YIN Certificates. (photos: Markus Breig, KIT)

High-energy water release model applied to adsorption of guest molecules

Dr. Frank Biedermann
supramolecular chemistry

The non-covalent complexation of small organic molecules in aqueous media remains challenging because water as a solvent is highly competitive for any polar non-covalent bond. Thus, artificial receptor candidates designed to strengthen direct receptor-ligand interactions (Emil Fischer's lock and key model) typically afforded only moderate binding affinities in water, by no means reaching that of protein receptors. Unlike the lock-and-key model, the high-energy-water release model states that poorly solvated host cavity are a guarantor for strong host-guest binding, whereas direct host-guest interactions are often of secondary importance.[1] We believe, it can be extended to systems that bind small molecules in concave cavities in water, e.g. to protein-ligand binding and to functional materials, designed for uptake of molecules in aqueous media,such as metal-organic frameworks (MOFs), covalent organic frameworks (COFs) and imprinted polymers. **At the end of the YIN grant project, we found first evidence that the high-energy water release model is also applicable to nanoporous MOFs**.

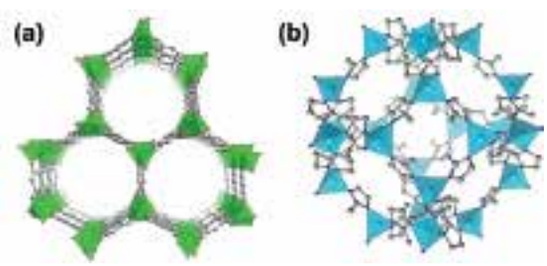


Fig. 1 (a) CPO crystalline framework with inorganic SBUs[2], (b) single crystal x-ray structures of ZIF 8[3].

First, we synthesized two different MOF classes, namely CPO-27 and ZIF-8 (Fig. 1). The candidates were chosen for the stability in water, similar chemical structure, but differing pore sizes. We then screened for suitable analytes to be encapsulated by the MOF structures. To follow the analyte uptake by sensitive spectroscopic methods, a range of fluorescence dye molecules was first tested. Out of many, the dyes MDAP and MDPP (Fig. 2) showed the highest fluorescence response upon encapsulation by CPO-27.

Dr. Manuel Tsotsalas
material chemistry

Through titration, we extracted the thermodynamic binding constants for both dyes. The values are high compared to their affinities with non-charged hosts in water. Hence, the extra binding stabilization by the non-classical hydrophobic effect seems to play a role. Eventually, the dyes bound so tightly, as not be replaced by competitive binders like salts, amino acids, or steroids. However, first evidence for co-binding of small analytes was observed. Consistent with the suspected dye-uptake (as opposed to a dye-surface binding), the dyes did not show spectroscopic changes in the presence of the smaller pore-sized ZIF-8. As a result of the high binding affinity, we also observed remarkably slow uptake kinetics (~30 min). Though, hampering direct calorimetric investigations, they can be of great practical utility for the design of non-equilibrium based chemical sensors (patent submitted by KIT). In short, nanoporous MOFs proved to be excellent platforms to study analyte-receptor interactions in aqueous media and offer great potential for developing wet-sensing devices.

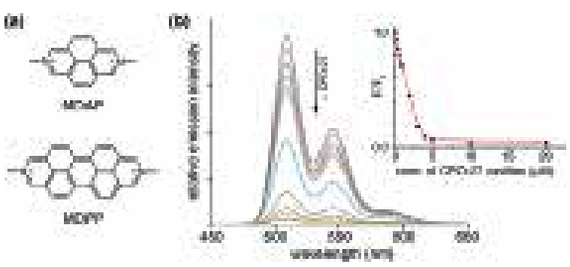


Fig. 2: (a) Chemical structures of MDAP and MDPP; (b) Emission spectrum of MDPP in water upon addition of CPO-27. The inset shows the normalized and fitted binding isotherm.

[1] *F. Biedermann,et al. Angew. Chem. Int. Ed. 2014, 53, 11158-11171, P. Snyder, et al. Eur. Phys. J. Spec. Top. 2014, 223, 853-891*
[2] *L. Rosi et al. J. Am. Chem. Soc., 2005, 127, 1504–1518.*
[3] *X.-C. Huang et al. Angew. Chem. Int. Ed., 2006, 45, 1557 – 1559; K. S. Park et al. Proc. Nat. Ac. Sci., 2006, 103, 10186-10191.*

Sustainability aware Enterprise Information Systems Modeling and Analysis

Prof. Stefanie Betz
systems engineering

In modern society sustainability, the capacity to endure, is a daily life issue. For modern enterprises, software is one of the major drivers and, thus, needs to be sustainable. The problem is, however, that sustainability design is not (sufficiently) supported when designing enterprise systems. This is due to sustainability effects being often long term and cumulative and manifest themselves in different domains (social, economical, environmental). Therefore, sustainability effects are often difficult (and sometimes even impossible) to measure. Nevertheless, organizations have understood that sustainability needs to be integrated into their daily business. In our proposal we want to investigate how to develop a holistic approach for integrating sustainability into enterprise systems design.

Our approach is to integrate sustainability into enterprise system modeling and analysis. We need a holistic approach to tackle the issue of sustainability, starting from the goal models, going to the business processes over to the systems architecture, because, without sustainable processes, no sustainable systems will be achieved and vice versa. Also, only when looking at the complete picture it can be decided if only the processes need to be improved or the system of both to achieve a global optima. In addition, goal models are needed to define the enterprise strategy, thresholds and constraints for the global optima.

In this initial project, we followed two aims: First, we conducted a systematic literature review to base our research on[1] and identified use cases for modeling and analysis sustainability-aware enterprise information systems. Second, we have extended a community case study and modelled a selected identified use case to explore the capabilities and limitations of existing modeling and analysis tools[2]. In particular, we extended the model for the sales process of a supermarket chain via an online shop with a new feature to support online receipts, which aims at saving paper and thus supporting environmental sustainability.

Prof. Anne Koziolek
software engineering

We found that existing goal modeling and traceability techniques already support our use case well. Sustainability goals can be modelled as so-called "soft goals", i.e. quality goals, and be operationalized to concrete design options.

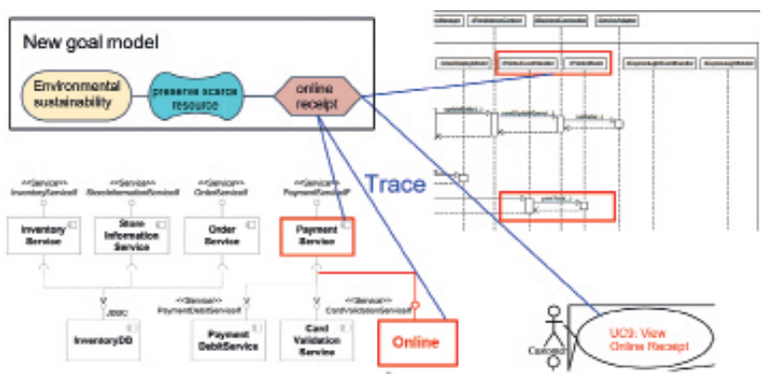


Fig. 1 Extended Sales Process with Sustainability Goal

However, the impact of the concrete design options to sustainability goals can currently only be modelled as positive, negative, or neutral. To close this gap, we devised an approach for modeling the qualitative impact of design options on overall system quality, using so-called qualitative reasoning[3].

[1] Venters, Colin C.; Rafael Capilla, Stefanie Betz, et al.: Software sustainability: Research and practice from a software architecture viewpoint. Journal of Systems and Software 138: 174-188 (2018)
[2] Fritsch, Andreas; Stefanie Betz: Envisioning a Community Exemplar for Sustainability in and by ICT. ICT4S 2018: 100-111
[3] Schneider, Yves; Axel Busch, Anne Koziolek. Using Informal Knowledge for Improving Software Performance Trade-off Decisions. In Proceedings of the 12th European Conference on Software Architecture (ECSA ,18), Madrid, Spain, 2018, Lecture Notes in Computer Science. Springer. 2018. Accepted to appear.

YIN Grants stimulate follow-up research

Enhanced printing procedure for controlled growth of carbon nano fibres on a substrate

PD Dr. Dr. Michael Hirtz
nanotechnology

The annual YIN Grants are meant as a targeted measure to enable a YIN member (or even better an interdisciplinary team of YIN members and/or alumni) to pursue an innovative scientific idea. Ideally, first research funded by the YIN Grant becomes a seed for longer-standing collaborations and bigger follow-up projects. Here we show an example for how the impulse set by a small YIN Grant can lead to nice results years later.

The story starts more than 3 years ago, when in 2015 Julia Syurik and Michael Hirtz won a YIN Grant for their proposal "Towards Massively Parallelized Electrochemical Dip-Pen Nanolithography" (YIN Insight 2015/2016). In general, in electrochemical dip-pen nanolithography (DPN), an electric field is applied to the sharp tip of an atomic force microscope. This setup is used in conjunction with metal salts to deposit highly localized metal nanostructures. Aim of the initial YIN Grant was to demonstrate, that this technique can be parallelized by using arrays of tips with the prospect of speeding up the process of structure generation. The YIN Grant allowed us to hire a student assistant and some needed materials to modify our existing DPN setup with a custom-made holder for parallelized writing.

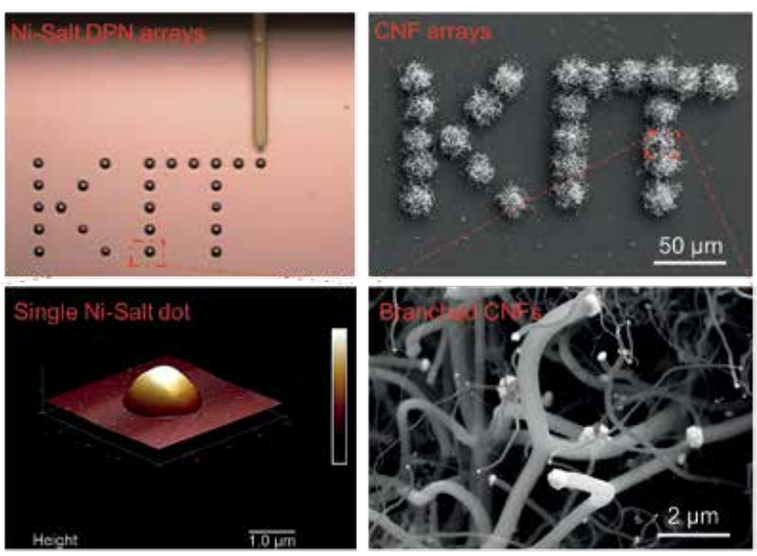


Fig.1. Example of CNF "bushes" grown on a silicon substrate in arbitrary patterns.

However, our joint story did not stop there! Initially just being an elusive afterthought, we used the protocols for the deposition of nickel salts, a byproduct of the initial project, to tackle a different problem: how to grow carbon nano fibers (CNF) in a controlled wav and at controlled positions on a substrate, e.g. an electronic device or an electrode? The difficulty lies in the precise positioning of CNFs which involves rather expensive and slow techniques (such as E-beam lithography), making fabrication of big CNF-arrays nearly impossible in a feasible time.

Dr. Julia Syurik
material science

A PhD student supervised by Julia Syurik found the perfect solution in the deposition processes initially developed during the YIN Grant. Based on these results, we optimized the printing procedures for the nickel salt that now acts as a catalytic center for the growth of CNFs in a facile open flame procedure. Interestingly, a new type of CNF morphology in form of Λ and λ shapes could be observed for which a growth model was developed. By tuning the size of the spotted metal salt catalyst features, we could obtain control down to the point where only single CNFs grow at the specific deposition points. The details of the printing and growth process are topic of the student's PhD thesis and a publication in the research journal *Small*[1]. Our findings beckon for future projects to exploit the procedure for tailored deposition of CNFs on functional devices. Thus, the initial YIN Grant stimulated a long-standing collaboration between our groups that is still far from over.

[1] Lutz, Christian et al. (2019). Locally Controlled Growth of Individual Lambda-Shaped Carbon Nanofibers. Small. 1803944. 10.1002/smll.201803944.

What we stand for

YIN connects independent junior research group leaders and junior professors on an early stage of their scientific careers.

Dr. Kathrin Valerius
Representative

As in 2008, when YIN was initiated, we, the members, occupy a very critical career niche between postdocs and tenured professors. As YIN, we speak with an united representing the interests of our peer group. Our mission, comprised of the following three statements, has and will continue to guide YIN.

We encourage each YIN member to become a better group leader. YIN offers an exclusive continuing education program tailored to the needs of young group leaders in cooperation with PEBA. The courses include topics such as developing leadership abilities, improving research and teaching performance, as well as personal coaching. Instead of a static course program, YIN members suggest and vote on topics to ensure that these courses directly meet their needs.

Dr. Manuel Hinterstein
Representative

We represent the interests of independent young investigators at KIT. Given the changes in higher education politics, the academic landscape, and leadership priorities at KIT, the future of junior group leaders and junior professors face an ever-shifting future. YIN enters discussions, working groups, and sounding boards to best define our official standing, our rights and responsibilities. YIN has also hosted discussions with editors, representatives from politics and various funding agencies to understand and shape the policies affecting our members.

Dr. Hartwig Anzt
Alumni

YIN strives to make KIT an ideal place for young scientists. YIN helps its members thrive in their research pursuits by encouraging collaborative discussions and projects. Interdisciplinary proposal coordination meetings help to bring members of related disciplines together to share their respective expertise and resources. YIN Grants provide a further incentive to pursue these collaborative projects. In addition, YIN has invited leading scientists to speak to YIN members directly and to an open audience as part of the YIN Lecture Series. The network also maintains connections to alumni and contacts with industry to exchange ideas and discuss research opportunities.

Dr. Dominic Bressser
Public Relations

While our three mission statements have remained relatively unchanged throughout the years, our interpretation has evolved in response to member interests. We sincerely hope that YIN will continue to help our members grow, prove their independence, and receive recognition in their respective fields. We also want KIT to remain an attractive place for young investigators. These goals require the active participation of our members and the support of the KIT community.

Dr. Karsten Woll
Finance

YIN lives and changes with the engagement and interests of its members. On the following pages, you will learn more about our members, their groups, and their research.

Dr. Hartwig Anzt
hartwig.anzt@kit.edu

Helmholtz Young Investigator Group

Fixed-Point Methods for Numerics at Exascale

at the Steinbuch Centre for Computing
2017-2022

Special Expertise

Numerical Linear Algebra
High Performance Computing
Scientific Software Development
Algorithm Engineering

The tremendous increase in computing power in recent years has become the driving force for breakthroughs in all fields of scientific research. Computer simulations based on mathematical models and tools can exploit available information generated by large data collections, often referred to as "Big Data," and are proven solutions that provide knowledge and progress beyond traditional laboratory experiments. However, to continue this trend, the increasing gap between the algorithm properties and the explosion in parallelism in the hardware systems requires the development of new numerical methods and algorithms, able to cope with the fine-grained concurrency and its implications. These methods need to include solutions for reducing the communication between the distinct computing instances, an improved resilience against persistent and transient errors, and the ability to leverage the energy-saving techniques provided by the hardware. FiNE will focus on the consequent reformulation of numerical problems in terms of asynchronous fixed-point iterations. This algorithmic reformulation may require changes in the underlying model, the advantages in terms of increased robustness, scalability, and energy efficiency are significant. In close cooperation with partners from academia and industry, FiNE will address the reformulation in terms of fixed-point iterations for scientifically relevant problems.

www.scc.kit.edu/en/aboutus/jrg-fine.php

Emmy-Noether Group

Analyte Detection with High Affinity Chemosensors

at the Institute of Nanotechnology
since 2016

Special Expertise

Supramolecular and self-assembled systems
High-affinity receptors for in vitro and in vivo sensing applications

Dr. Frank Biedermann
frank.biedermann@kit.edu

Helmholtz Young Investigator Group

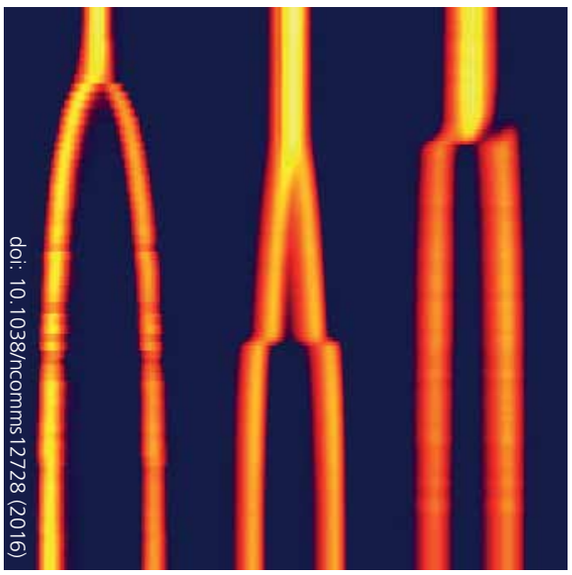
Strain Tuning of Correlated Electronic Phases

at the Institute for Solid-State Physics
since 2017-2022

Dr. Anna Böhmer
anna.boehmer@kit.edu

Special Expertise

Magnetism and superconductivity
Iron-based superconductors
Thermodynamic and transport properties of materials at low temperatures
Strain effects in correlated electron materials



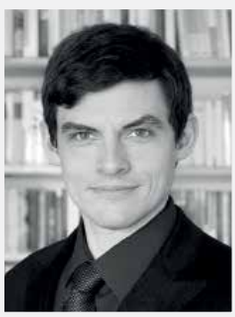
doi: 10.1038/ncomms12728 (2016)

Electronic interactions in condensed matter lead to an intriguing variety of fascinating phenomena such as magnetism or superconductivity, that arise from the collective behavior of electrons. They are often closely linked to structural, or lattice, properties of the material. The group investigates how the material's crystallographic structure can be used as a 'tuning knob' to manipulate electronic interactions and different ordered phases. We combine single-crystal growth with low-temperature transport, thermodynamic and structure determination measurements. Our study of the influence of the lattice on material properties enables us to control the collective behavior of electrons and will also support the targeted design of new materials.

Juniorprofessorship

Risk Oriented Regional Development

at the Institute of Regional Science
2015-2021



JProf. Andreas Braun
andreas.braun3@kit.edu

Special Expertise

Social-environmental risks in regional development
Remote sensing as a method of environmental monitoring

Dr. Tom Brown
tom.brown@kit.edu

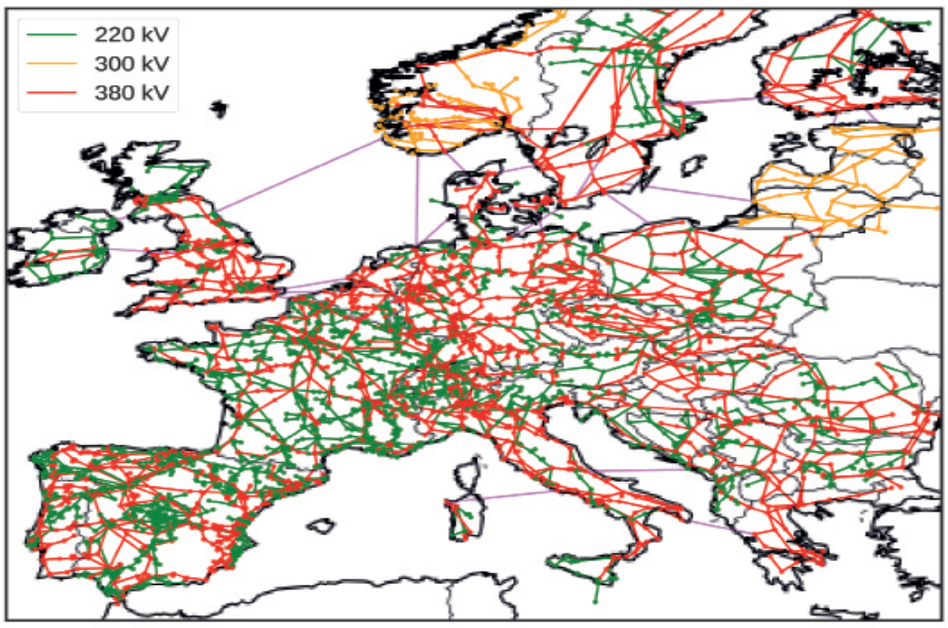
Helmholtz Young Investigator Group

New Methodologies to Master Complexity in Energy System Optimisations

at the Institute for Automation and Applied Informatics
2018-2024

Special Expertise
Energy Systems
Renewable Energy Integration
Electricity Network Modeling
Complexity Reduction

Reducing man-made greenhouse gas emissions will require a complete reorganisation of our energy infrastructure: electricity generators, storage, energy networks, heating supply, transport and industrial processes. To avoid catastrophic global warming, this also has to happen fast: net carbon dioxide emissions should drop to zero by 2050 in order to meet the Paris climate accord targets. Furthermore, hundreds of billions of euro of spending per year in Europe on energy are at stake, so accurate modeling and simulation of future energy systems are crucial.



Our research group leverages cutting-edge research from a variety of disciplines to understand the most cost-effective pathways to reduce greenhouse gas emissions in the energy system. This involves building models of the energy system and optimizing the investment in and operation of the necessary infrastructure. Maintaining sufficient model detail and interdependencies is crucial to avoid misallocation of investment and bad policy advice, but it also presents an extreme computational challenge.

To tackle this challenge we're developing new algorithms and methodologies so that we can capture these details in a manageable way and therefore provide the best possible policy guidance for the transition to a sustainable energy future.

https://nworbmot.org

KIT Young Investigator Group

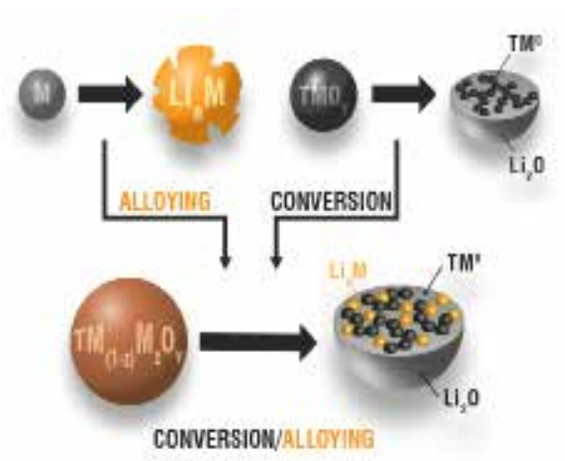
NEW E2

at the Helmholtz Institute Ulm (HIU)
2017-2020

Special Expertise
Electrochemical Energy Storage
Lithium-Ion Batteries
Anode Materials
Polymer Electrolytes

Dr. Dominic Bresser
dominic.bresser@kit.edu

The research activities within NEW E² focus on the development of alternative anode materials for Li-ion batteries, which reversibly host lithium ions by a combination of alloying and conversion – so called conversion/alloying materials. The target is to develop materials offering a synergistic combination of these two mechanisms, by this, enabling the respective advantages and, thus, overcoming the intrinsic drawbacks of each single mechanism.

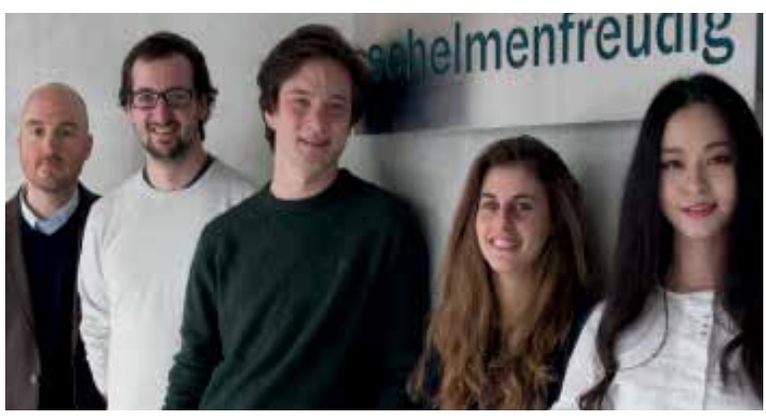


Energy Environ. Sci., 2016, 9, 3348ff, doi:10.1039/C6EE02346K

Alloying compounds, for instance, commonly reveal higher energy densities and energy storage efficiencies, but suffer extensive volume variations upon de-/lithiation. Conversion materials, however, show less pronounced volume variations and frequently superior power performance, but also inferior energy densities and relatively lower round trip energy efficiencies.

The combination of these two mechanisms in one single compound provides substantially reduced volume changes while simultaneously offering enhanced energy and power densities along with more efficient energy storage.

To achieve this, the group investigates a variety of conversion/alloying materials to understand the impact of the different alloying and conversion elements as well as their complex interplay. A series of electrochemical methods is combined with various in situ/operando characterization techniques, targeting the comprehension of the underlying reaction mechanisms and, thus, enabling the development of new anode materials for high-performance Li-ion batteries.



/www.hiu-batteries.de/battery-research-center-in-germany/research/hiu-young-investigator-groups/young-investigator-group-new-e2/

Dr.-Ing. M. Azad Emin
azad.emin@kit.edu

KIT Young Investigator Group

Extrusion of biopolymeric materials

at the Institute of Process Engineering in Life Sciences
2016-2019

Special Expertise

Numerical simulation and modeling of biopolymeric material flow
Rheological characterization of biopolymeric material flow
Analysis of dispersive and distributive mixing during extrusion processing
Measurement of thermal stress profile during extrusion

Extruders have evolved from simple forming devices and become very sophisticated in the last decade. Extrusion is commonly defined as a continuous thermomechanical process relying on combination of multiple unit operations such as the transport, mixing, shearing, plasticizing, melting, cooking, polymerization, and fragmentation.

Recent trends in food extrusion technology and research have been mainly directed to the development of sustainable and functional foods, which address the increased consumer awareness of the role of food products and processes on environment, health, and well-being. Extrusion technology offers the flexibility to process a wide range of raw materials to desired product characteristics and functional properties. However, although the history of food extrusion processing goes back to the late-1800s, the control of this process and design of new extruded products are still mostly based on empirical knowledge.

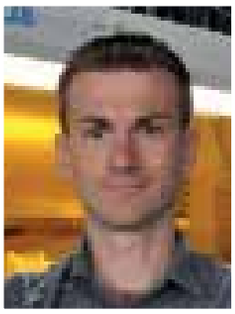
In our research group, we work on developing an approach and tools which may practically enable the food research to analyze the extrusion processing at a mechanistic level and characterize the decisive process parameters crucial for complex food design and scale-up purposes. Furthermore, we use these research-tool-kits to develop strategies on delivering sustainability and functionality into complex foods and biopolymeric systems.

Figure shows the brief overview to the mechanistic research approach used in our group (Emin, M.A. & Schuchmann, H.P. Trends in Food Science and Technology 60, pp. 88-95, 2016).

DFG Heisenberg Group

Carbon Nanotubes for Energy and Electronics

at the Institute of Nanotechnology (INT)
2011-2021



PD Dr. Benjamin Flavel
benjamin.flavel@kit.edu

Special Expertise

Carbon Nanotubes
Separation of Single and Double Walled Carbon Nanotubes
Solar Cells
Organic Electronics

Currently the use of carbon nanotubes (CNTs) for energy applications is limited by several factors. These challenges include the development of new methods to prepare and enrich CNTs in large quantities and with high purity, the development of methodologies to manipulate carbon nanotubes into 2D and 3D structures and their interface with appropriate acceptor/donor materials.

In our work we develop new organic and aqueous based separation processes for CNTs and prepare chirality pure CNT-aerogels for use in bulk heterojunction solar cells. Furthermore, we investigate coupling between carbon systems, either between two walls of a double walled carbon nanotube or by small molecule endohedral functionalization of large diameter CNTs.

ACS Nano (2019), doi: 10.1021/acsnano.8b09579

Dr. Christian Grams
grams@kit.edu

Helmholtz Young Investigator Group

Large-scale Dynamics and Predictability

at the Institute for Meteorology and Climate Research (IMK-TRO)
2017-2022

Special Expertise

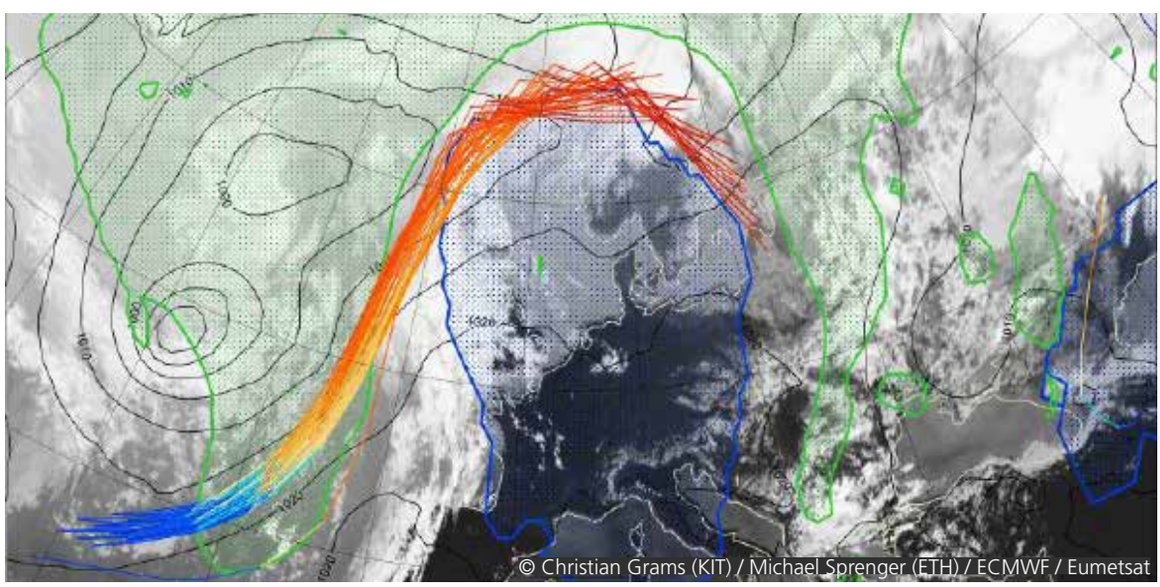
sub-seasonal weather forecasting
atmospheric dynamics
energy meteorology
numerical modeling

Our group investigates sub-seasonal predictability (several days to a few weeks) from an atmospheric dynamics' perspective. On these time scales, large-scale flow regimes govern the character of weather over continent-sized regions. From a weather perspective, the life cycles of these regimes are influenced by synoptic-scale weather systems. From a climate perspective, modes of the climate system (e.g. ocean, soil moisture, stratosphere) are potential sources of sub-seasonal predictability.

Within the framework of the Helmholtz Young Investigator group "Sub-seasonal Atmospheric Predictability: Understanding the Role of Diabatic Outflow (SPREADOUT)" we aim to improve the fundamental understanding of the physical and dynamical processes that control predictability and forecast skill on sub-seasonal time scales. We focus on the role of so-called diabatic outflow in the life cycle of large-scale flow regimes in the Atlantic-European region. Such a better understanding will help to improve sub-seasonal weather forecasts.

In contrast to classical weather forecasts, these sub-seasonal forecasts inform about the character of weather over a longer period (typically a few days to a week) and a larger region (e.g. Central Europe). However, these forecasts can be issued weeks ahead (1-6 weeks) which is useful for various socio-economic activities, e.g. in the energy sector, transport, agriculture, tourism. Our group collaborates internationally and with national weather services.

www.imk-tro.kit.edu/english/7425.php



© Christian Grams (KIT) / Michael Sprenger (ETH) / ECMWF / Eumetsat

Emmy-Noether Group

Materials Tribology

at the Institute for Applied Materials (IAM)
2014-2023

Special Expertise
Materials Science
Tribology
Bio-inspiration
Electron microscopy

Dr. Christian Greiner
greiner@kit.edu

The focus of my research group is to experimentally reveal the basic materials science mechanisms for microstructural changes in materials under a tribological load. Currently, we focus on metal contacts as we are convinced that this is one of the most interesting areas, both from an application as well as from a basic science point of view. Especially a microstructure properties-relation, the basic principle of materials science and engineering, has not yet been established for metals under a tribological load. Gaining more insight into those relationships will potentially allow to improve or tailor both properties. Examples for possible applications range from nano- and micro-electromechanical systems (NEMS/MEMS) over implant materials to automotive systems.

Developing materials with superior friction and wear performance will results in dramatic reductions in the energy necessary to overcome friction and wear. Currently about 30 % of the world wide use of primary energy is wasted to overcome friction. Additionally, we fabricated a snake skin-like surface morphology by means of laser texturing. This bio-inspired surface morphology has attracted a lot of interest from both academia and industry. A recent highlight of my group's research include the discovery that already at the very beginning of a sliding contact, the position where future failure occurs is determined. Similarly, we could show which mechanisms carry tribologically induced oxidation of metals.
www.yin.kit.edu/We_are_YIN_1320.php

KIT Young Investigator Group

Economic Inequality & Labor Markets

at the Institute of Sociology, Media and Cultural Studies
2015-2019

Dr. Andreas Haupt
andreas.haupt@kit.edu

Special Expertise
Poverty and wealth in modern societies
Causes of the gender wage gap
Occupation specific labor market processes
Further development of methods for distributional analysis

Dr. Robert Heinrich
robert.heinrich@kit.edu

BMBF Group

Quality-driven System Evolution

at the Institute for Program Structures and Data Organization
2018-2019

Special Expertise
System Architecture
System Evolution
Simulation and Analysis
Model-driven Engineering

Quality properties like performance and dependability are success criteria for software-intensive systems. Several techniques have been developed to model and reason about quality properties. The very different nature of these properties has led to the use of different techniques and mostly independent tools for modeling and analyzing the quality properties. Recent innovations like Internet of things and cyber physical systems combine several domains. In consequence, also analyzes for the single domains need to be combined to consider mutual dependencies in estimating quality. The composition of systems and their analyses is a challenging but unavoidable issue for today's complex software-intensive systems. Existing approaches to modeling and analysis are not sufficient to compose modular analyses over domain-specific languages. In our research, we target more flexibility in Model-Driven Engineering by investigating the modularization and composition of modeling languages and analyses.

https://sdq.ipd.kit.edu/people/robert_heinrich

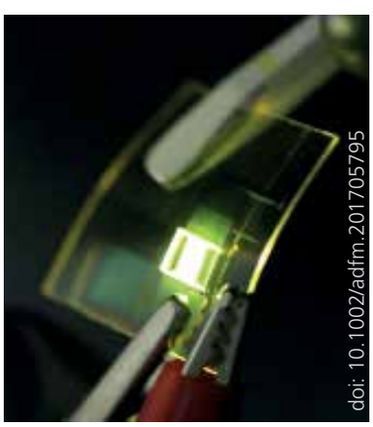
BMBF Group

Printed Electronics – BioLicht

at the Light Technology Institute
2014-2020

Special Expertise
Organic - Hybrid Electronics
Printed Electronics
Bio-Friendly Electronics

Dr. Gerardo Hernandez-Sosa
gerardo.sosa@kit.edu



doi: 10.1002/adfm.201705795

The Printed Electronics group of LTI investigates materials and advanced device architectures for the fabrication of optoelectronic and sensor systems by industrially relevant techniques. A central part of the research activities is the development of ink formulations and printing processes to control the performance of printed devices. Moreover, we investigate the integration of printed organic electronic devices in complex systems. The BMBF funded junior research group works on the use of biodegradable/biocompatible materials for the fabrication of optoelectronic devices. The rationale is the combination of state-of-the-art high-throughput printing techniques with the topic of more sustainable and bio-friendly technologies.

www.innovationlab.de/en/research/device-physics/lti

Juniorprofessorship

Computational Architectures in the Cell Nucleus

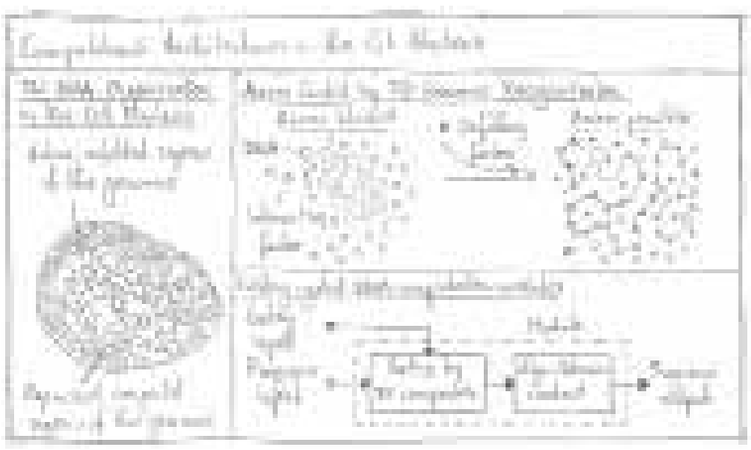
at the Institute of Toxicology and Genetics (ITG) and the Zoological Institute
2018-2024

JProf. Lennart Hilbert
lennart.hilbert@kit.edu

Special Expertise

Applied live and super-resolution microscopy
Computational image analysis
Mathematical modeling of biological systems

The increasing need for data storage and ambitions for bio-compatible computing mark DNA computation as a critical future technology. DNA-based hardware, however, will be rooted in physical principles that fundamentally differ from electronic hardware. For example, information processing in dense suspensions of DNA will be severely limited by slow transport of information and occurs in a liquid, rather than in a static architecture. Also, like electronic computer chips in cellular devices, DNA hardware will only achieve its full potential once it can be ubiquitously embedded in biological cells and biotechnological devices.



Luckily, these challenges have already been overcome by the nucleus of the biological cell. The cell nucleus stores and manages access to more than 1 GB of DNA-encoded information. This genetic information is accessed in a massively parallel fashion, and processes that are based on this genetic information are fully integrated with cellular functions. Recent work, including our own, revealed that the targeted read-out of genetic information is closely connected to the three-dimensional (3D) organization of DNA in the cell nucleus: regions of the genome that are expressed become unfolded, regions that are repressed become compacted. Assuming that this adaptive 3D organization of DNA is central to effective information processing in the cell nucleus, we will:

- explore the physical principles driving this adaptive 3D organization, using major gene regulatory transitions as biomimetic examples,
- investigate how this adaptive 3D organization can gate the access of regulatory factors to the genome, or, in other words, how 3D organization can gate the information flow into and out of different regions of the genome,
- exploit the above physical principles in the development of cell-embedded DNA computing modules that are switched on/off by 3D unfolding/compaction, and, potentially, the in vitro synthesis of DNA-based hardware.

http://hilbertlab.org

Dr. Manuel Hinterstein
manuel.hinterstein@kit.edu

Emmy-Noether Group

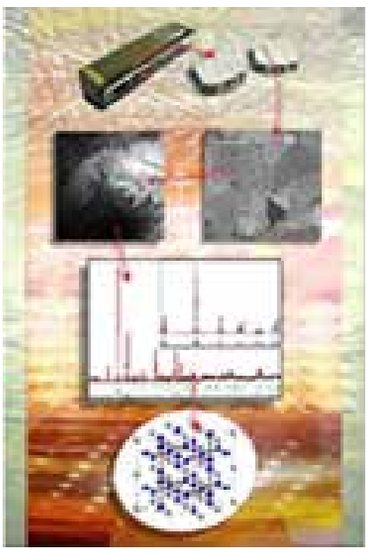
Functional Electroceramics

at the Institute for Applied Materials, Ceramic Materials and Technologies
2016-2021

Special Expertise

In situ techniques using photons, electrons and neutrons
Multiscale characterisation of piezoceramics
Advanced semiconducting ceramics
Domain wall engineering

My research focusses on multiscale characterisation of functional electroceramics. This includes piezoceramics, ionic conductors, semiconducting ceramics, lithium ion battery materials and other energy storage materials. In my group, we cover the full range from synthesis and processing over characterisation to simulation and modeling. Special focus lies on in situ and in operando characterisation techniques using photons, electrons and neutrons. Since the properties and applications of functional electroceramics depend on the crystal structure, chemical homogeneity as well as the microstructure, we take special care of close control of the synthesis and processing parameters. A combination of electro-mechanical characterisation and investigations of the structure properties relationships allows studies over a broad range of length scales. This research is combined with simulations and modeling in order to correlate theory and experiment.



www.iam.kit.edu/kwt/399_2877.php

KIT Junior Research Group

Corporation Financing

at the Department of Finance and Banking
since 2016

Special Expertise

Theoretical/empirical corporate finance
Intersection of finance, accounting, and strategy
Research on corporate investment, risk management, and capital structure
Household finance / economics of household decisions

Dr. Daniel Hoang
daniel.hoang@kit.edu

KIT Junior Research Group

Molecular electronic-structure methods in complex environments

at the Institute of Physical Chemistry
2017-2020

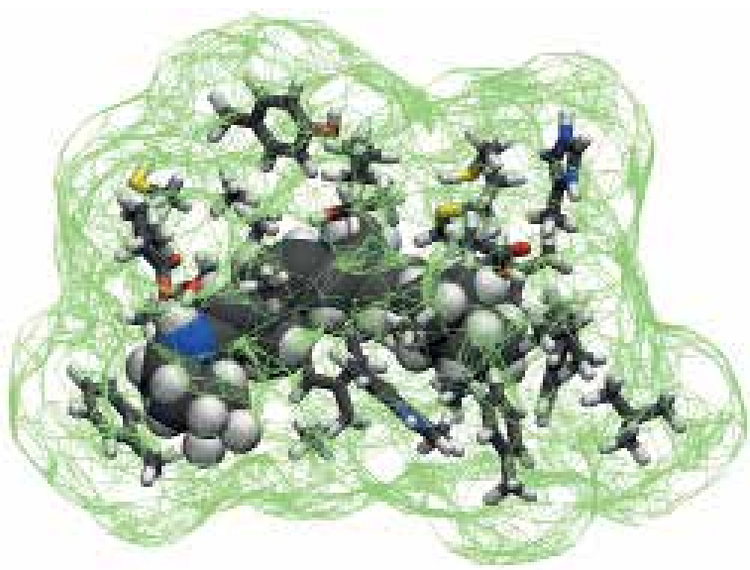
Dr. Sebastian Höfener
sebastian.hoefener2
@kit.edu

Special Expertise
Quantum chemistry
Exciton transport
Embedding
Ab-initio methods

Our research is concerned with the development and application of quantum-chemistry methods applicable for medium-sized systems consisting of up to several hundred atoms. One important ansatz is frozen-density embedding (FDE), in which the total system, consisting of one or more "active" molecules and dozens of environment molecules, is partitioned into subsystems, which can be reated separately. This leads to significant reduction in computation time so that the sampling of snapshots becomes available for increased system sizes.

The newly developed methods have been employed to study different chemical problems, including absorption spectra of ligands in solution, the investigation of relaxed excited states, or biologically active chromophores in protein environments. The FDE ansatz is not only favorable in terms of efficiency but also leads to molecular properties that are intrinsically localized to the subsystems, facilitating a chemical interpretation. In order to be able to describe properties arising due to an interaction of the molecules, it is possible to compute coupling matrix elements in an additional coupling step.

www.ipc.kit.edu/theochem/english/852.php



J Chem Phys. 2018,148(14), doi: 10.1063/1.5026651.

Dr. Luise Kärger
luise.kaerger@kit.edu

Vector Foundation Young Investigator Group "Green Mobility"

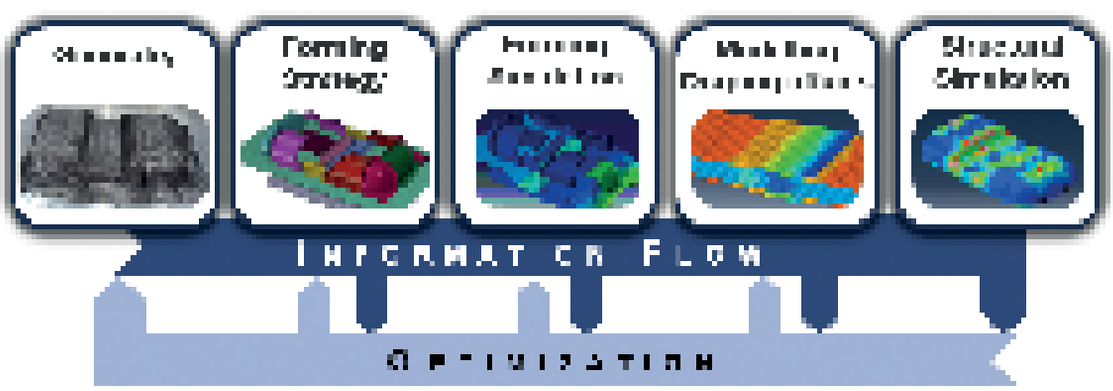
Tailored high-performance composites for weight-optimized automotive structures

at the Institute of Vehicle System Technology
2014-2021

Special Expertise
Simulation of composites
Draping simulation of textiles
Modeling of manufacturing effects
Process and structural optimization of composites

Development of high-performance composite structures is very cost intensive, mainly caused by numerous manual iteration steps which are still necessary to find the optimal design in conjunction with the optimal process control. Additionally, composite components are often highly oversized due to the discrepancy between the real material behavior, largely influenced by the processing history, and the idealized models used in structural simulation. During the draping process, the fiber architecture is considerably modified, resulting in varying fiber orientations and local draping effects. These changes in material characteristics influence the mechanical performance and need to be considered for sizing and virtual validation of composite structures. The Vector Stiftungs-YIG „Green Mobility" pursues these objectives by developing efficient draping and structural simulation models, by holistically combining both simulation domains via data transfer, and by providing general solutions to determine optimized draping strategies in conjunction with optimized structural design.

www.fast.kit.edu/lbt/4590_yig.php



Juniorprofessorship

Architecture-driven Requirements Engineering

at the Institute for Program Structure and Data Organization
2013-2018

JProf. Anne Koziolek
koziolek@kit.edu

Special Expertise

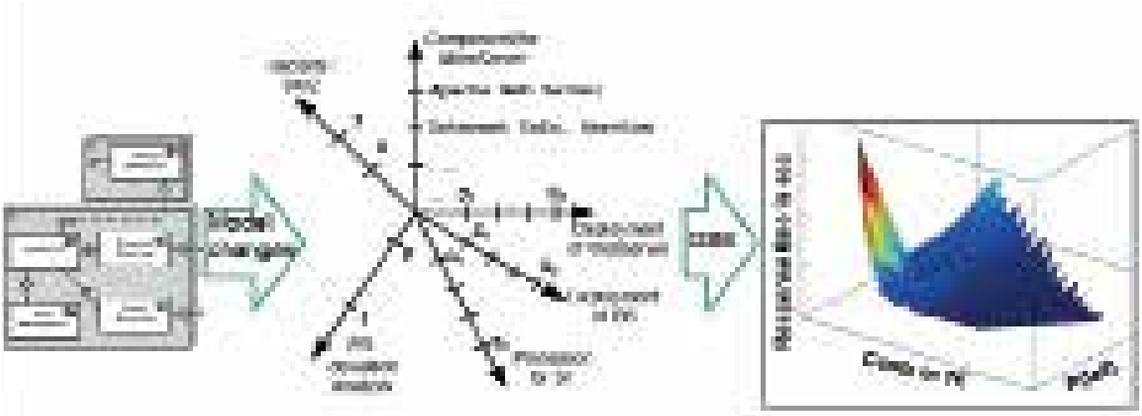
Requirements Engineering
Software Engineering
Software Architecture

Our research in software engineering is concerned with the early activities in the development of software, or more general software-intensive technical systems. These early activities are concerned with the elicitation and validation of the software and systems requirements. It is known, that the removal of errors in these phases can be extremely costly. In fact, requirement errors are among the main reasons for software project failures today.

More specifically, the motivation of my research is the insight that requirements engineering and design of software systems are inevitably intertwined. Swartout and Balzert described the "inevitable intertwining of specification and design" already in 1982. But even today, there is a perceived mismatch between agile, code-centric software development with concurrent requirements engineering and software design on the one hand and model-based software engineering with systematic transformations between requirements, design, and code on the other hand.

To conciliate both approaches, we are interested in providing systematic, yet low-cost model-based design space exploration to support making good design decisions, which are a major success factor for mission-critical software-intensive technical systems. This support shall enable well-informed trade-off decisions in software design, in requirements elicitation and in requirements analysis while at the same time incurring minimal overhead for the developers.

are.ipd.kit.edu



Dr. Julia Maibach
julia.maibach@kit.edu

BMBF NanoMatFutur Group

Designed Interfaces for Electrochemical Energy Storage (InSEIde)

at the Institute for Applied Materials - Energy Storage Systems Herman

2017-2022

Special Expertise

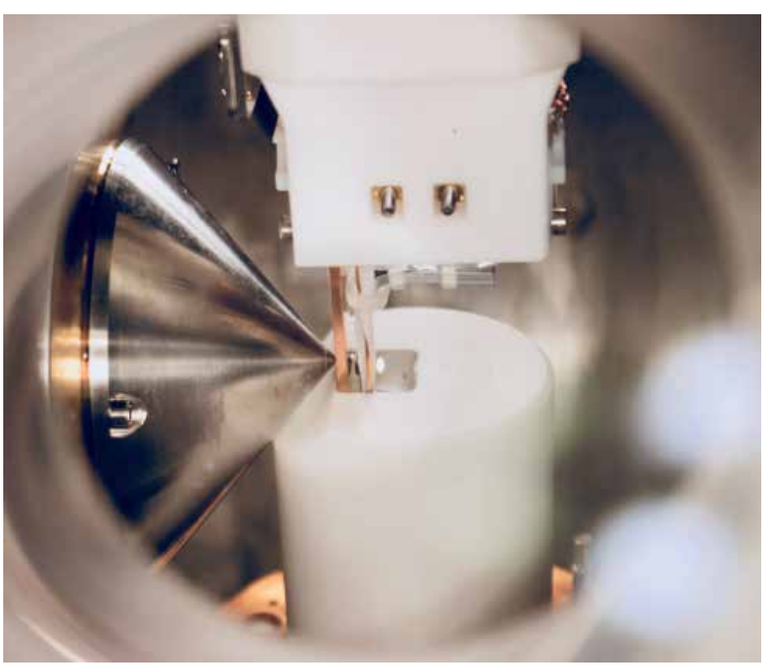
Lithium Ion Batteries
Interfaces
Surface Science
Photoelectron Spectroscopy

Lithium ion batteries have become almost indispensable from our daily lives as mobile power sources and there is a rising need to improve their performance as our current and future electronics become more and more energy consuming.

In the project InSEIde, we address this issue by studying important interfaces inside the battery that enable high energy densities to be stored in a controllable manner. One crucial interface is the solid electrolyte interphase (SEI) which forms on the negative electrode and protects it during battery operation. While the importance of the SEI is well established, the exact mechanism of how it forms remains in question. Using advanced surface and interface characterization tools we study this SEI layer on a fundamental level to be able to design an artificial SEI that can better protect the electrode. This aim becomes increasingly important as we look into future electrode materials such as silicon/carbon (Si/C) that can replace the currently used graphite electrode. Si/C electrodes offer increased energy density, however at the cost of poor reversibility, meaning the battery loses capacity during long term operation. This problem originates at an instable interface that is put under severe mechanical stress due to large volume changes of the Si/C material during battery charge and discharge.

Our goal is, therefore, to develop chemically stable and mechanically flexible electrode protection layers that can make Si/C anodes a true competitor to the current commercial electrode systems.

www.iam.kit.edu/ess/1124.php



KIT Young Investigator Group

Science in Presentations

at the Institute for German Studies. Department of Science Communication

2015-2018

Special Expertise

Science Communication
Audience Research
Eye Tracking

Dr. Philipp Niemann
philipp.niemann@kit.edu

Oral presentations addressed to non-expert audiences have always been an issue in science. Various methods of visualisation have long since been added to the classical presentation. Besides real objects, pictures, diagrams, videos and animations illustrate the content and give an insight into scientific research. However, which kind of presentation do scientists prefer when appearing in public? And what is the difference between a PowerPoint-based presentation at an Open Day and a Science Slam or an online presentation?

These and other questions form the basis of the KIT junior research group's "Science In Presentations" work. The group is part of the Department of Science Communication at the Institute for German Studies at the KIT. The National Institute for Science Communication (Nationales Institut für Wissenschaftskommunikation-NaWik), which provides communication seminars for scientists is also involved in the research project. The Klaus Tschira foundation provides financial support. Besides developing a typology of various forms of presentation, the project focuses on the audience – the people who use these presentations. What do they expect? How do they deal with the presentations and where do problems of communication arise? For the empirical exploration of those questions, innovative scientifical methods are being used – from several forms of surveys to eye tracking.

www.science-in-presentations.de

Juniorprofessorship

Visualizing complex relations for distributional analyses

at the Computer Graphics Group
since 2016

Special Expertise

visual computing

JProf. Boris Neubert
neubert@kit.edu

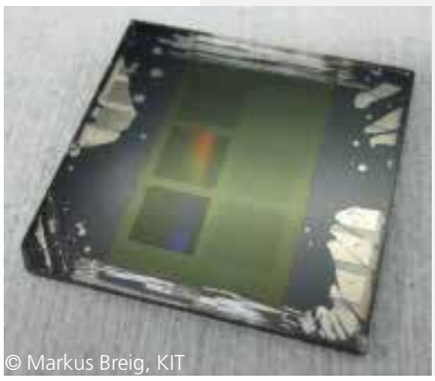
Hellmholtz Young investigator Group

Advanced Optics and Materials for Next Generation Photovoltaics

at the Institute of Microstructure Technology / the Light Technology Institute
2016-2021

Dr. Ulrich W. Paetzold
ulrich.paetzold@kit.edu

Special Expertise
Next Generation Photovoltaics
Perovskite Optoelectronics
Light Management and Nanophotonics



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My research focusses on the interaction between light and structured matter for the purpose of engineering novel optical concepts and nanophotonic materials for low-cost solar energy harvesting and lightning. I am currently particularly interested in perovskite thin-film solar cells and perovskite based multijuntion photovoltaics. My research involves the fabrication, characterization, simulation and understanding of the device physics of perovskite optoelectronic devices.

www.imt.kit.edu/paetzold.php

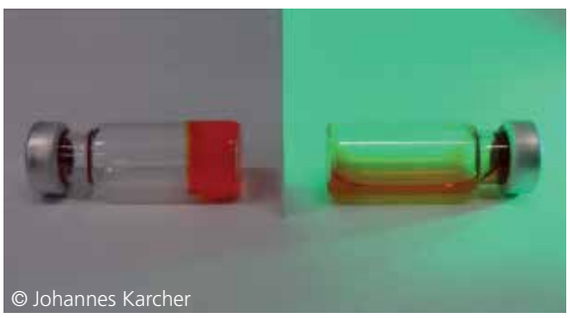
KIT Young Investigator Group

Chemical biology, supramolecular systems and prebiotic chemistry

at the Institute of Organic Chemistry
2016-2020

Dr. Zbigniew Pianowski
pianowski@kit.edu

Special Expertise
Molecular photoswitches
Supramolecular materials
Photopharmacology
Genetic polymers



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Our research focuses on applications of molecular photoswitches to modulate activity or behavior of biological systems. We have investigated photochromic supramolecular hydrogels based on cyclic dipeptide units as materials for light-controlled release of encapsulated drugs. Using our gel filled with an antibiotic, we were able to selectively suppress growth of bacterial cultures with green light. Furthermore, we are interested in photopharmacology. There we attempt to create drugs with light-dependent activity. Finally, we investigate photomodulation of the oligonucleotide hybridization process. There we aim at creating cell-penetrating antisense agents, which activity will be reversibly modulated with light.

www.ioc.kit.edu/pianowski

Humboldt Sofia Kovalevskaja Group

Superconducting Quantum Circuits

at the Physics Institute
since 2015

Special Expertise
Experimental Quanteninformatics

Dr. Ioan Pop
ioan.pop@kit.edu

KIT Junior Research Group

Cognitive Systems and Information Processing

at the Institute of Applied Informatics and Formal Description Methods
since 2014

Special Expertise
Adaptive Data Analytics

PD Dr. Achim Rettinger
rettinger@kit.edu

Emmy-Noether Group

Plant Ecophysiology

at the Institute of Meteorology and Climate Research
2016-2021

Special Expertise
Climate Change
Terrrestrial carbon and water cycle
Stress physiology
Forest ecology

Dr. Nadine Ruehr
nadine.ruehr@kit.edu

The main focus of the group is to provide a detailed process understanding of carbon and water cycling in trees and forests exposed to varying stress scenarios, intensities and timing of stress.

The main study object, Scots pine, one of the most widespread trees within Europe, has already shown significant decline in response to extreme drought events. We are particular interested in the underlying physiological responses governing changes in tree hydraulics, gas exchange, carbon allocation and growth of pine seedlings during heat and drought stress including post-stress recovery. We use controlled experiments to study the underlying mechanisms, which will provide base for an improved model framework to assess forest responses to future climate extremes.

Dr.-Ing. Andy Rupp
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KIT Junior Research Group

CyPhyCrypt

at the Competence Center for Applied Security Technology (KASTEL)
2016-2019

Special Expertise

Provable Security
Privacy-Enhancing Technologies
Cryptographic Protocols

The Junior Research Group „CyPhyCrypt" aims at bridging the gap between novel cryptographic theory and security and privacy mechanisms suitable for real-world application scenarios such as Mobile Payments, Smart Traffic, Smart Grid, Smart City.

To this end, we develop dedicated security models, crypto primitives, and protocol building blocks which are then composed very carefully to obtain provably secure, yet practical systems. Our research is funded by KASTEL and the German Research Foundation (DFG).

www.kastel.kit.edu/english/rupp.php

Margarete-von-Wrangell Group

Dislocation-based Continuum Modeling of Crystal Plasticity

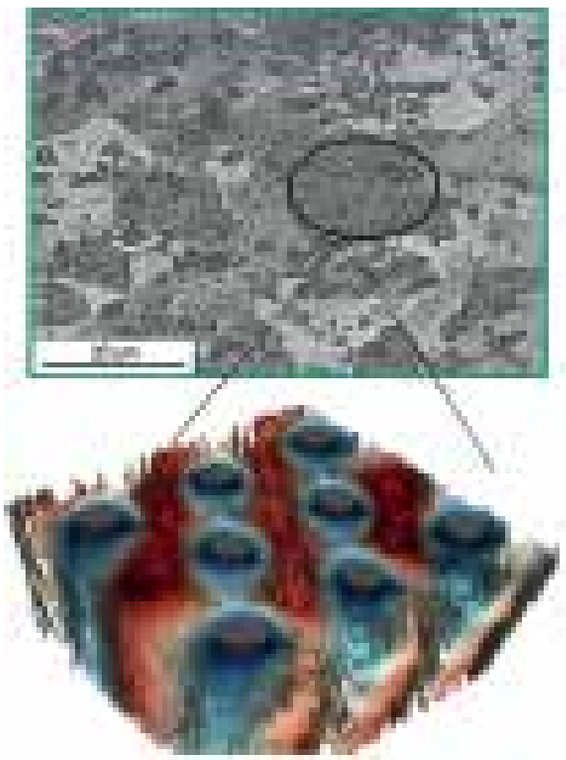
at the Institute for Applied Materials - Computational Materials Science
2016-2020

Dr.-Ing. Katrin Schulz
katrin.schulz@kit.edu

Special Expertise

Micromechanics and Failure Mechanisms
Computation and Simulation
Dislocation based Plasticity and Homogenization
Metallic Composite Materials

The research group focuses on the predictability of materials behavior and the reliability and safety of components with a special interest in metals. We use multi-scale material modeling and numerical simulation to combine small scale microstructural behavior and continuum mechanical analysis. Our goal is to enable insights into materials and structures in order to optimize the composition of materials as well as the shape of devices and investigate resource efficient systems.



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Considering the evolution of dislocations as fundamental physical effects causing plasticity as intentional or destructive deformation, we want to introduce a computational engineering tool which bridges the scales from micro to macro. Using physically based formulations, the evaluation of high risk areas in materials, e.g. interfaces in composites, and the investigation of fundamental failure mechanisms lead to new prospects in the assessment of materials and components.

Due to the multidisciplinarity of the topic, the group is composed of engineers, mathematicians, physicists, and material scientists, who bridge the issues from modeling physical phenomena, mathematical and numerical formulations, and efficient implementation to engineering applications.

JProf. Petra Schwer,
now professor at the
University Magdeburg
petra.schwer@ovgu.de

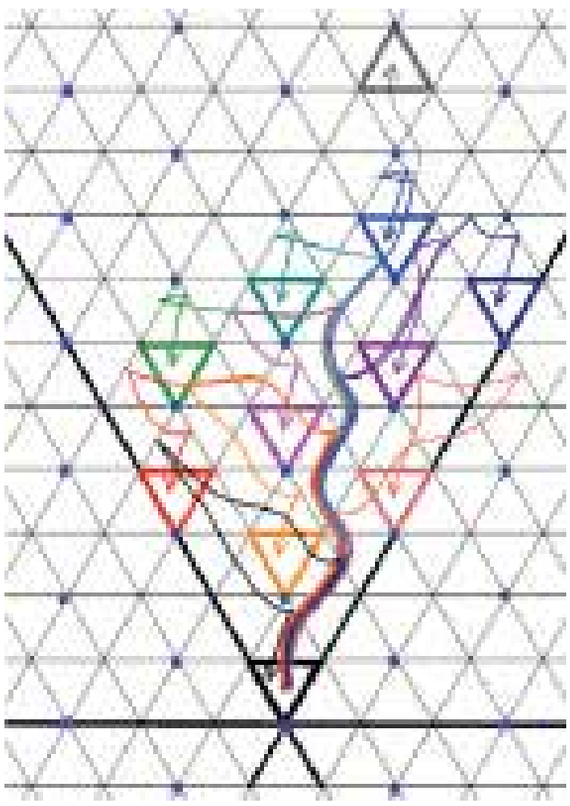
Juniorprofessorship

Geometric methods in the study of algebraic varieties

at the Institute of Algebra and Geometry
2014-2018

Special Expertise
Reflection groups and associated combinatorial structures
(affine) flag varieties and affine Grassmanians
spaces of nonpositive curvature
geometric group theory

We use geometric and combinatorial methods to study algebraic varieties and spaces of non-positive curvature as well as their groups of symmetries. This is inspired by geometric group theory phenomena, where often the interplay between geometric and algebraic properties of groups are studied. The main focus is in using these techniques to solve problems which are not typically studied in geometric group theory. Various notions of non-positive curvature, such as systolic complexes (which discretely capture curvature on complexes) and Gromov hyperbolic or CAT(0) spaces (which are metric characterizations) play an important role here.



Moreover we are interested in reflection groups and associated combinatorial structures and new applications of geometric methods to questions related to combinatorial representation theory. Among other things we work on non-crossing partitions, (Bruhat-Tits) buildings, affine Deligne-Lusztig varieties as well as rigidity-type questions for (non-discrete) affine buildings.

www.geometry.ovgu.de

KIT Junior Research Group

Robust Production Systems

at the wbk Institute of Production Science

2018-2019

Dr. Nicole Stricker
nicole.stricker@kit.edu

Special Expertise

Production Systems Planning
Production Controll
Risk and Cost Estimation
Integration of AI in Production Systems

In today's globally connected world with ever-shorter product life cycles and fluctuating customer demands, production must constantly adapt to changed requirements. Despite the changes and frequent disruptions (e.g. late vendor parts) productions systems have to achieve high performance at any time. Especially in production lines these disruptions propagate quickly and lead to higher down-times and, thus, to significant performance losses. For competitive production, production systems have to work at a stable and high performance in spite of disruptions – they have to be robust. The aim of the research group is the development of methodologies to identify suitable measures to in-crease the robustness of production system.

To reach this aim, certain steps have to be taken:

- Identification of KPIs to measure the production lines performance
- Creation of a comprehensive catalogue of measures
- Create a learning system to estimate the impact of improvement actions
- Establish a methodology for action selection for individual production systems

www.wbk.kit.edu/21_1919.php

Dr. Manuel Tsotsalas
manuel.tsotsalas@kit.edu

Helmholtz Young Investigator Group

Hierarchically structured biomaterials

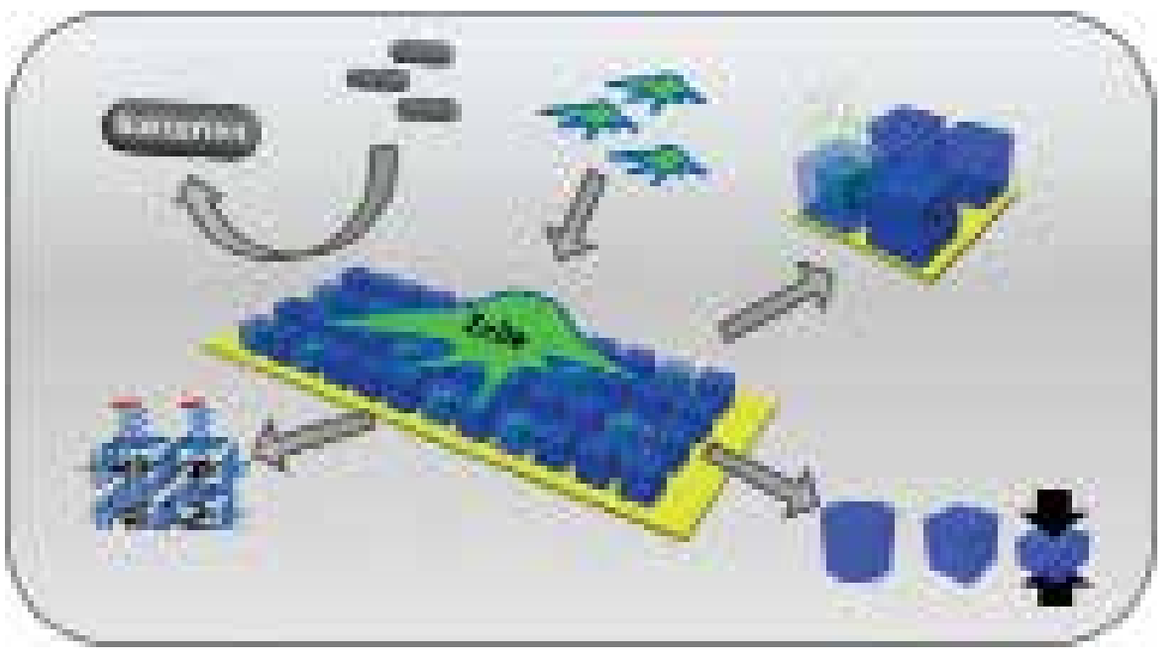
at the Institute of Functional Interfaces and Institute of Organic Chemistry
2016-2020

Special Expertise
polymer networks
microporous polymers
drug delivery
bio-functionalization

My young investigator group is highly interdisciplinary where biologists, chemists and physicists work together to develop novel materials for applications in biotechnology, medicine and membrane separation. The materials are based on a new class of multifunctional network polymers, which are prepared via conversion of a crystalline template structure (metal-organic frameworks, MOF). The materials combine the advantages of MOFs, namely their precise molecular structure and high compositional and structural variability, with the advantages of polymer networks, namely their stability in physiological media and their biocompatibility. Such highly structured materials can be optimized and functionalized at all length scales relevant for cellular activity, to offer the necessary micro-environmental cues for cellular proliferation or differentiation. These biomaterials are therefore ideal candidates for applications in cell culture, tissue engineering, medical implants or wound dressing.

In addition to biological applications, when prepared as freestanding nanomembranes the described materials can find application in gas and liquid phase separation.

www.ifg.kit.edu/english/2440.php



Helmholtz Young Investigator Group

Analysis of KATRIN data to measure the neutrino mass and search for new physics

at the Institute for Nuclear Physics (IKP)
2014-2019

Dr. Kathrin Valerius
kathrin.valerius@kit.edu

Special Expertise

Precision beta-electron spectroscopy for neutrino-mass search
Numerical simulation and modeling methods
Data analysis techniques and tools

Neutrinos are the most abundant massive particle species in the universe. Thus, their as yet unknown mass scale plays a key role in our understanding of nature at cosmological as well as subatomic scales. Given the smallness of neutrino masses, their determination is a challenging experimental task.

The Karlsruhe Tritium Neutrino Experiment (KATRIN) at KIT is targeted to improve the sensitivity for the neutrino mass in kinematic studies of tritium beta decay by one order of magnitude.
During the construction and commissioning phase of KATRIN the work of the YIG was focused on the detailed study of systematic effects related to the properties of the gaseous tritium source.

© Michael Zacher, KATRIN Collaboration

The group is also strongly involved in preparing strategies and tools for the analysis of neutrino mass data. These tools have been succesfully applied and tested in a commissioning run of the full 70-m long beamline of the experiment in 2017 and during the inaugurating run with tritium in May and June 2018. Looking ahead to high-statistics and high-precision beta spectra to be recorded with KATRIN, the YIG is also investigating opportunities to study "new physics" phenomena that might reach beyond the established picture of the Standard Model of elementary particle physics.

www.katrin.kit.edu

Dr. Aiko Voigt
aiko.voigt@kit.edu

BMBF Junior Research Group

Clouds and storm tracks

at the Institute of Meteorology and Climate Research
2016-2021

Special Expertise

Climate and climate change
Clouds and midlatitude cyclones
Atmospheric circulation
High-resolution atmosphere models

We study climate and climate change. In particular, we are interested in understanding how clouds and their radiative effects couple with the atmospheric circulation of the extratropics. This will have an important effect on how global climate change will manifest regionally in Europe. We use a combination of global climate simulations, high-resolution regional simulations of individual North Atlantic weather systems, and the analysis of in-situ and remote-sensing observations.

Our work also includes other aspects of global climate dynamics and modeling. Together with colleagues from the US, we are leading an international climate model intercomparison project on tropical rain belts. We are further interested in how atmospheric aerosol impacts the atmospheric circulation, and in the dynamics of the extreme climate of a Snowball Earth.

The group contributes to the German-wide research initiative HD(CP)2: High Definition Clouds and Precipitation for Advancing Climate Prediction and it receives most of its funding from the German Ministry of Education and Research (BMBF) and FONA. In addition, we receive funding from DFG, DAAD and NSF.

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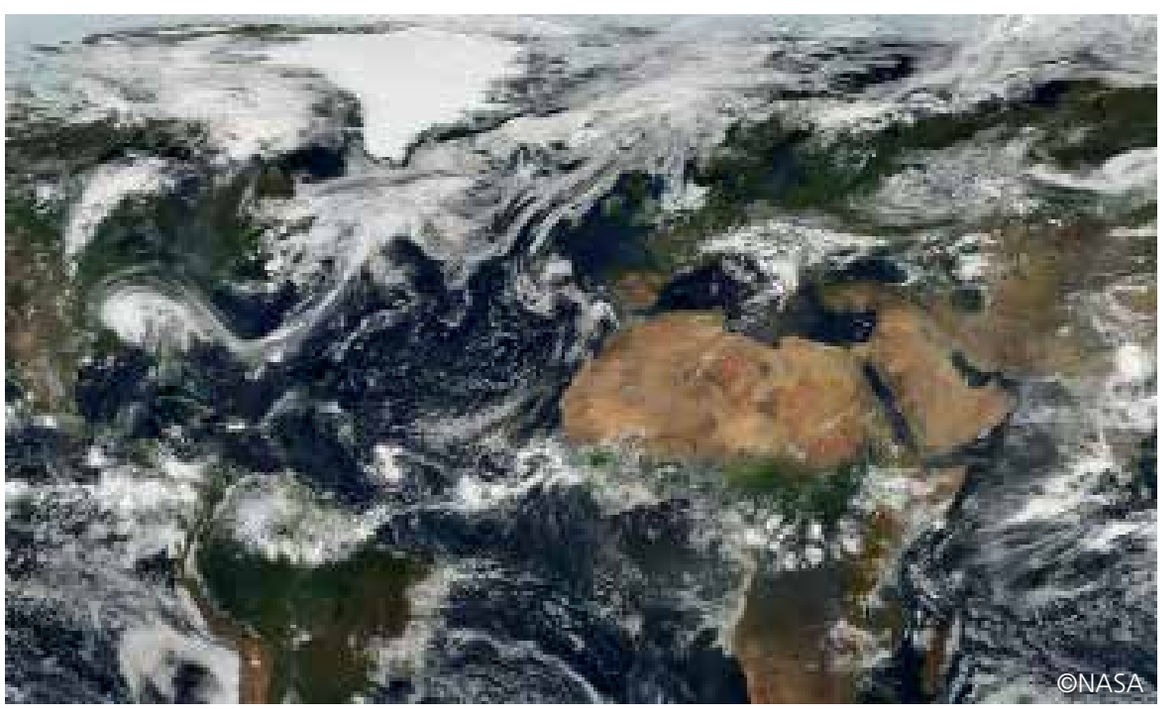


Emmy-Noether Group

Pulsed Metallurgy on Metallic Thin Films

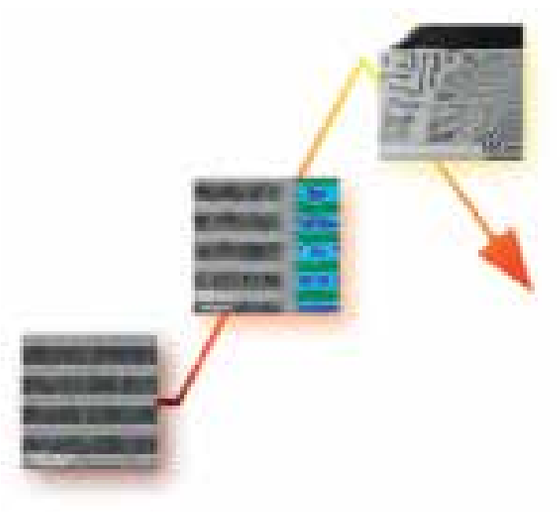
at the Institute for Applied Materials
2016-2021

Dr. Karsten Woll
karsten.woll@kit.edu

Special Expertise

Thin film metallurgy
Phase transformations in metals and alloys
Reactive Materials
Nanocalorimetry, X-ray diffraction, Transmission Electron Microscopy

The development of next generation metallic materials aspires the combination of conflicting properties, such as high strength and maximal deformability, which makes their fabrication highly challenging and requires novel processing routes. This demand motivates our research where we explore a novel rapid and robust pathway to fabricate new types of metallic nanocomposites. We consider the microstructure design at the nanoscale as crucial. Hence, our research focuses on microstructure tailoring of the nanocomposites. This allows us to effectively harness microstructure-property relationships to adjust properties.



In greater detail, we use binary multilayer thin films as initial templates and transform them into hard/soft composites utilizing pre-defined thermal pulses down to several microseconds. We develop microstructure design rules based upon heating and cooling rate effects on phase nucleation and growth. In addition to fundamental materials research, we also develop new in situ and ex situ measurement strategies to trace the transformation. Eventually, pulsed metallurgy integrates the design rules and will enable us to tailor phases, their fraction and morphology at the nanoscale.

www.iam.kit.edu/wbm/1417.php

Dr. Roswitha Zeis
roswitha.zeis@kit.edu

Helmholtz Young Investigator Group

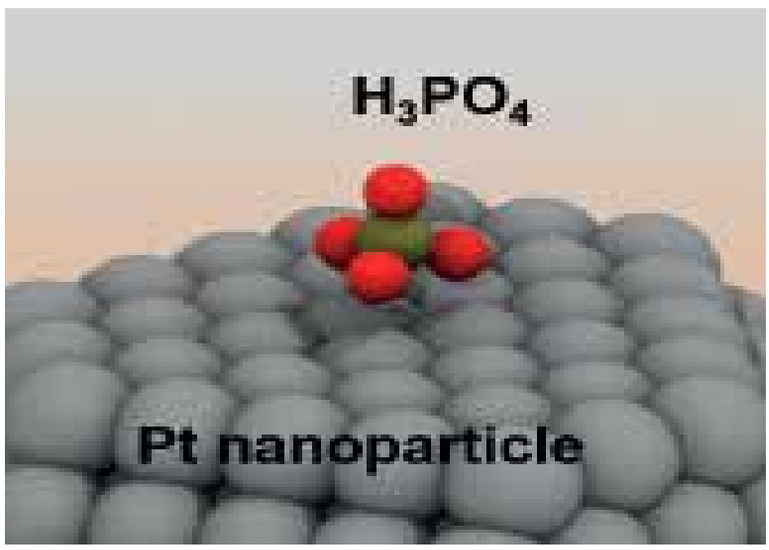
Investigation of Overpotentials in High Temperature PEM Fuel Cells

at the Helmholtz Instiute Ulm
until 2020

Special Expertise

Characterization techniques for proton exchange membrane fuel cells
Novel materials for fuel cell membrane electrode assemblies
Oxygen reduction reaction in various electrolytes
X-ray radiography and tomography

Fuel cells are among the enabling technologies toward a safe, reliable, and sustainable energy solution. Yet the lack of clean hydrogen sources and a sizable hydrogen infrastructure limits the fuel cell applications today. Due to their elevated operating temperature, between 150°C and 180°C, the high temperature proton exchange membrane fuel cells (HT-PEMFCs) based on phosphoric acid doped polybenzimidazole (H3PO4/PBI) membranes can tolerate fuel contaminants such as carbon monoxide (CO) and hydrogen sulfide (H2S) without considerable performance loss. It allows the HT-PEMFC to run on hydrogen produced on-site by reforming hydrocarbon fuels. The higher operating temperature also drastically simplifies water and heat management of the fuel cell (humidification not required in HT-PEMFCs) allowing a simpler system layout compared with a conventional PEMFC.



At this moment, however, no commercial HT-PEMFCs have been developed to meet the reliability and cost requirement. The young investigator group is exploring this field to understand the performance limiting mechanisms and try to find effective solutions.

www.hiu-batteries.de/batterieforschungszentrum-in-deutschland/forschung/hiu-nachwuchsgruppen/nachwuchsgruppe-zeis

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Helmholtz Young Investigator Group
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Bastian Rapp
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Fluoropor
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Indirect microfluidic systems

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KIT
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BMBF Group
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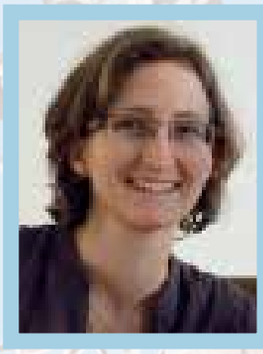
Cornelia Lee-Thedieck
Professor for Cell Biology
University Hannover

ERC Starting Grant
BloodANDbone: bone marrow analogs for hematological and musculoskeletal diseases

BMBF NanoMatFutur
Stem Cell-Material Interactions



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previously
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Geometric and combinatorial representation theory

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Scientist at KIT

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Digital Radio Detectors for Galactic PeV Particles

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Senior Scientist
KIT

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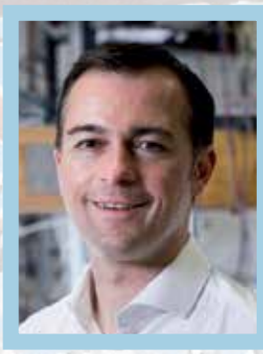
Structural analysis of the protein translocase Tat



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