Karlsruhe Institute of Technology

YIN Insight 2021

Highlights from the network of young research group leaders, junior professors, and tenure track professors at KIT

Scientific Highlights
15 ERC grantees among YIN members & alumni
Carus Medal | Nature Materials | cirrus-hl

YIN Statistics 2020/2021
10 million euros of subsequent funding and
226 weekly teaching hours per semester

Hot Topic
Helmholtz Funding and KIT Careers
different career paths for postdocs at KIT

Editorial

Dear reader,

Let's not focus on the pandemic but rather on the positives aspects to bring into the year 2022: many of us now have state-of-the-art home offices and zero transit time to work; we can multitask on five video conferences simultaneously while juggling lunch, laundry, and childcare; and we conduct world-class cutting-edge research in our pajamas. However, for junior professors and research group leaders, the tenure clock has not stopped ticking and the present situation remains particularly challenging. With this issue, the Young Investigator Network (YIN) at KIT provides an insight into their lives and coping strategies.

Scientifically, 2021 marked the 200^{th} anniversary of the birth of Hermann von Helmholtz, the namesake of the Helmholtz Association to which KIT belongs. As a physician, mathematician, chemist, physicist and more, Hermann von Helmholtz is considered one of the greatest polymaths in history. This milestone afforded an ideal opportunity to be "Inspired by challenges" and to encourage personal and professional growth as we look to the future.

With this in mind, *YIN Insight 2021* begins with a welcome letter from the President of the Helmholtz Association Professor Otmar Wiestler. Following this theme, the Hot Topic "Helmholtz funding and KIT Careers" introduces YIN members who have benefited from either one or even both of these opportunities. This year's issue, thus, showcases the challenges and the chances faced by young academics before eventually obtaining a permanent position.

The Hot Topic is complemented as always by research highlights from the past year, a celebration of successful funding proposals and promising ideas. The "Facts & Figures" section indicates more than any individual report how the pandemic influences research: with new records in subsequently acquired funding and only half as many visited conferences compared to the previous year. Last but not least, remote leadership is *Under Review*, professional development goes virtual, and two YIN alumni talk about their career paths taking them to industry and across the Atlantic to the United States of America.

We wish you an enjoyable read and a healthy year 2022!

The PR Committee

Dr. Dominic Bresser   Dr. Thomas Sheppard   Dr. Philip Willke

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Dear members of the
KIT Young Investigator Network,

The mission of the Helmholtz Association is to contribute to solving major challenges facing society, science and economy. Helmholtz has a worldwide reputation for outstanding fundamental interdisciplinary research. Europe's leading research infrastructures build a structural backbone for some of our scientific activities. First and foremost, however, Helmholtz stands for outstanding, talented and creative minds that work together across research fields to develop systemic solutions.

To recruit the brightest people, but also to retain the talented scientists we train in the Helmholtz Association, it is of utmost importance to offer most attractive working conditions and career perspectives. We systematically align our career programs and funding lines to this key task.

To name a few: Within the Visiting Program of the Helmholtz Information & Data Science Academy (HIDA), we invite postdocs and data scientists from Germany and all over the world. The program can be the starting point for a career at Helmholtz and ensures that scientific talents get to know the Helmholtz Association early on.

Thanks to the critical but essential input of our young investigators, additional awareness has grown at Helmholtz concerning the topics of diversity, inclusion and equality. The postdoc period is a particularly sensitive career phase with multiple and potentially conflicting challenges in the professional and private lives of scientists.

Knowing that their expectations for an attractive working environment in research are fundamentally changing, we made an effort to adapt central funding lines, such as the Young Investigator Groups program, to the needs of this target group. The new format facilitates more flexible working conditions and is one of many important steps to position ourselves in a more inclusive and diversity-sensitive way.

President of the Helmholtz Association Otmar D. Wiestler.
(Photo: Phil Dera)

In addition to individual career development opportunities, we have in recent years established organizational structures to guarantee the best possible professional development for our scientists. At many of our Helmholtz institutions, Career Development Centers are central points of contact for career coaching, especially for postdocs. With this professional counselling, we support talented researchers to identify suitable career paths both inside and outside of research at a very early stage of their career.

We have made it our goal to offer promising scientific talents the best possible starting conditions for a successful career. There is no question that much remains to be done in this respect, but I am convinced we are on the right track. At KIT, you find particularly attractive conditions.

In this spirit, I wish you all the best and urge you to continue your dedicated work in Karlsruhe and beyond. Because one thing is certain: The future of Germany as part of the global scientific landscape does not primarily depend on additional funding or political demands, but first and foremost on its brilliant brains.

Otmar Wiestler
President of the Helmholtz Association

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Helmholtz Funding and KIT Careers

Different career paths for postdocs[1] at KIT – The Research University in the Helmholtz Association

KIT is the only German University of Excellence combining the large-scale research facilities of a Helmholtz center with a top-class university tradition. Hence, young scientists at KIT can benefit from both worlds: e.g. acquiring Helmholtz funding and getting access to new career options like the *KIT Excellent Tenure* program. The time between doctorate and full professorship is often described as the most precarious in an academic career – especially the quota of female scientists drops considerably after the doctorate. Therefore, this article focuses on support measures provided to bridge this difficult postdoctoral phase. A flagship in this regard certainly is the longstanding success model of the Helmholtz Young Investigator Group (HYIG). Funded in equal shares by KIT and the Helmholtz Association's *Initiative and Networking Fund*, these junior research groups have offered early independence and a tenure track towards a permanent senior scientist position since 2003.

Following a quick summary of the most important facts and figures about the Helmholtz Young Investigator Group program and its impact at KIT, further exemplary Helmholtz measures in support of scientists in the postdoctoral phase are reviewed – each in connection with a personal statement from a grantee within the YIN network. Thus, a particular focus is set on highly-competitive individual funding schemes that also relate to newly developed support measures at KIT[2] such as the *ERC Recognition Award*. Last but not least, the first group leader to be successfully appointed within the *KIT Excellent Tenure* program will share some of his experiences in an interview. To increase the attractiveness for outstanding young scientists by providing reliable academic career prospects, is also one of the four major objectives of KIT's University of Excellence concept.

current ***Helmholtz Young Investigator Group (HYIG)***
Helmholtz Initiative and Networking Fund (since 2003)
eligibility 2-6 years after doctorate | 1,5 Mio. euros over 5 years | tenure track towards scientist position
The Helmholtz Young Investigator Groups program is one of the most well-established schemes to offer young scientists a real tenure track option towards a permanent scientist position. Being granted early independence, group leaders get the opportunity to conduct excellent research and have a reliable career perspective after positive evaluation. Groups are set up as joint projects of a Helmholtz center and a German partner university. The funding is € 300,000 p.a. for a period of five years minimum.

Since the founding of KIT in 2008, 30 HYIG leaders have chosen KIT as their host institution. A vast majority (80%) still work at KIT today, speaking for the high attractiveness of the tenure track as well as the excellent research conditions at KIT. Among them, 5 are now full professors and 19 have become senior group leaders. The main reason to leave KIT seems to be the offer of a full professorship elsewhere: 83% of those few who left became professors – raising the W3 appointment ratio of former HYIG leaders from KIT to 33%. This also shows that HYIGs generate excellent research and successfully prepare for a professorship. The high research quality is further emphasized by the fact, that 5 HYIG leaders from YIN went on to win an ERC grant. They make up one third of now 15 successful ERC grant winners within the network. Moreover, one third of all HYIG leaders at KIT have been women. One of them is **Tonya Vitova** who has been leading her Helmholtz group *High Resolution X-ray Spectroscopy* since 2011. In 2020, she also secured an ERC Consolidator Grant.

"I came to KIT immediately after my PhD with a one year EU fellowship, when I learned about the existence of the HYIG program. I quickly recognized that this might be a unique chance to realize my research ideas. The permanent position promised as a "Happy End" made the HYIG highly attractive and gave me the security to also realize my family plans. I think that this maker of young research leaders with bright ideas and little experience is one of the best funding instruments existing in Germany and likely worldwide."

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The ***Initiative and Networking Fund*** is the Helmholtz president's strategic instrument for the further development of the Helmholtz Association. One aim is to establish "best practices" as a characteristic structural elements for all centers. As an incentive, funding is allocated to this task for a limited time and distributed in a competitive manner. A great example is the call for *Helmholtz Career Development Centers for Researchers* in 2019 with a focus on postdocs. KIT successfully applied and has since established its ***Postdoc Office*** under the roof of the Karlsruhe House of Young Scientists (KHYS). It provides individual orientation and counseling for career development inside and outside of academia, opportunities for career-specific qualifications, and grants promoting independence and networking. Another example is the ***Helmholtz Information & Data Science Academy (HIDA)*** – Germany's largest postgraduate training network in the field of information and data science, already mentioned in the opening *Greetings* by Helmholtz President Prof. Otmar Wiestler.

Beside initiating support structures on an organizational level, the *Initiative and Networking Fund* has also introduced highly-competitive individual funding schemes. Dipping into the recent past and connecting it to the future, this article will present two former Helmholtz funding schemes together with related new support measures at KIT[2].

former ***Helmholtz Postdoc Program*** (2012-2015)
within 1 year after outstanding doctorate | 300K euros over 2-3 years
The Postdoc Program aimed at helping promising young researchers to get established in their field and develop their scientific competences. It was moreover an excellent means of attracting talented young researchers to Germany, as former Helmholtz President Jürgen Mlynek said in 2013[3]. The money primarily paid the grantees salary and that of a technical assistant, if required, as well as any associated travel costs as participants were required to spend a period of time abroad.

Coming from Russia, for **Julia Syurik**, the program provided an opportunity to gain a foothold in German academia. She used the funding to build up her own independent junior research group at KIT. Read more about how and why her next step led her to a career in industry:
Alumni in Profile on pages 30-31.

current ***KIT Young Investigator Group Preparation Program (YIG Prep Pro)***
University of Excellence measure
within 0-3 years after doctorate | own position, equipment/consumables over 2 years
Not unlike the former Helmholtz Postdoc Program, YIG Prep Pro aims to attract young talents by providing an intermediate step after the doctorate to gain eligibility to apply for third-party funding. However, the mid-term goal to increase the number of junior research groups and junior professors is much more pronounced. Within the YIG Prep Pro, KIT offers funding and mentorship to pursue a research idea and prepare a proposal for a third-party funded junior research group with the goal of becoming professor.

Giovanni De Carne applied for the YIG Prep Pro to fund his postdoc at KIT and get to know the research environment. In 2021, he became the first YIG Prep Pro Fellow to successfully acquire a Helmholtz YIG on the topic of *Hybrid Networks: A multimodal design for the future energy system*.

"YIG Prep Pro allowed me to reach scientific independence and to develop my own research ideas. It also introduced me to the German and European funding instruments and connected me to previous grant winners. Applying for a Helmholtz YIG was a natural step for me, considering the start of the new program-oriented funding line "Energy System Design": my ideas integrate perfectly in the program goals which aim at "out-of-the-box" solutions for solving the next years energy challenges."

former ***Helmholtz ERC Recognition Award*** (2014-2020)
reaching step 2, but not funded | 200K euros | resubmission within 2 years with a Helmholtz host
Helmholtz ERC Recognition Award was designed to give support to outstanding ERC grant applicants when resubmitting an ERC project proposal, and at the same time show recognition of their academic achievements up to this date.

KIT senior group leader and YIN alumnus **Michael Hirtz** received the Helmholtz ERC Recognition Award in 2020 for reaching the second phase within the selection process for an ERC Consolidator Grant. He now had two years to rework and fine-tune his proposal for the next call in 2022. An extra challenge for him: He now has to apply for an Advanced Grant.

"I had to make a hard decision: should I immediately resubmit my proposal in the Consolidator scheme or go for the Recognition Award and reapply only two years later in the Advanced scheme? After careful considerations also with colleagues and mentors, I chose the second option. It seemed feasible to implement key aspects of what I wanted to do and, hence, make an even stronger application in the future. On an immediate resubmission, I could have only changed the description of the project with minor possibilities for additional experimental work.

In the last two years, the grant has been extremely helpful to me! It allowed me to finance two students and part of a postdoc position, so I really could leverage it for having a great team to implement parts of what I proposed in the ERC proposal. We were able to show the feasibility of key elements and could publish several papers on these results. This will help a lot in the reapplication, as now the results and publications can act as prior works to further underline the feasibility and possible impact of the revised proposal.

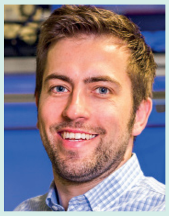
However, ERC proposals are generally aimed at "high risk – high gain" projects, and also emphasize the "first-of-a-kind" nature of the proposed work. Still, reviewers might have concerns about feasibility that can best be addressed by preliminary work. While now preparing the revised proposal, it is challenging to find the right balance between emphasizing that key parts have proved to be realizable, yet not invoking the impression that the full implementation of the idea would be trivial or just incremental work – which surely it isn't. Another aspect is, I'm now also in terms of peer community transitioning from being a rather senior member in the Consolidator candidate pool to an absolute junior among the Advanced candidates. Whether this will be a good thing or a bad thing remains to be seen."

KIT Recognition Award ERC *(since 2022)*
reaching step 2, but not funded | 100K euros | resubmission within 2 years with KIT as host
KIT 2025 measure
The KIT Recognition Award ERC supports excellent applicants in resubmitting an ERC proposal. Thus, the chances for innovative ideas to get funded increase, and at the same time, the appreciation for current achievements is expressed. The goal is to promote the advancement of excellent young scientists, internationalization, and the acquisition of top-class third-party funds.

[1] The term postdoctoral scientists is used in the broader sense of 0 to 12 years after the doctorate.
[2] Helmholtz-funded measures are indicated by a light blue background and the KIT-funded ones by the characteristic KIT green; active measures by black font on light gray and former measures by white font on dark gray.
[3] www.helmholtz.de/en/newsroom/article/twenty-candidates-selected-for-internationally-renowned-helmholtz-postdoc-programme

current **KIT Excellent Tenure** (since 2019)
for PIs within first half of an externally funded group | W1 position for 6 years | optional: tenure track for W3
University of Excellence measure
The KIT Excellent Tenure program is intended to considerably increase the number of tenure track professorships. KIT plans to recruit ten externally funded junior research group leaders of the highest international level every year. Fitting their profiles, KIT will then announce a junior or tenure track professorship position to which those group leaders can apply within the first half of their funding period. This way, KIT plans to appoint up to 60 junior professors within the next ten years as part of its 100 professorship program, among them 40% women. "By attracting an increasing number of highly motivated junior professors, KIT aims to enhance its scientific performance and, at the same time, to achieve a cultural change by rejuvenating the professorate," says Oliver Kraft, vice president for research at KIT.

In 2021, **Ulrich Paetzold** has become the first junior research group leader who was provided a reliable career path as tenure track professor at KIT. Simultaneously, he continues to lead his Helmholtz Young Investigator Group *Advanced Optics and Materials for Next Generation Photovoltaics* which already started in 2016.



"The tenure track provides me with a sustainable and reliable career perspective at KIT. Having three kids at home, this is exactly what I need to build a scientific career and simultaneously balance my family life."

Since 2016, Ulrich Paetzold and his team are realizing the potential of next-generation photovoltaic technologies at KIT. The end evaluation of his Helmholtz Young Investigator Group (HYIG) in September 2021 received top marks. He also became a tenure track professor (TT) in March of the same year – as part of the new KIT Excellent Tenure. In the interview with YIN insight, he talks about the transition to professorship and his experience with this new program.

Why a tenure track professorship about four years after you started your HYIG?
I belong to a interim generation. When I started my HYIG in 2016, TT professorships were not well established at the faculty that I am engaged in. The topic came up during the first and second year of my HYIG, but there was no model on how to proceed. In 2019, with the new Quality Assurance Concept for Tenure Track Professorships at KIT and the KIT Excellent Tenure program, the path was set and the wheels started turning. Finally, a position was advertised and I could apply for it.

Why was the position still attractive to you?
The most important asset of this position is the tenure track which provides a sustainable and reliable career perspective to a full professorship at KIT. Having build-up quite a large research group with good scientific output and industry collaborations, the next step for me would have been to apply for a faculty positions elsewhere. Having three kids at home, the tenure track is exactly what I need to build a scientific career at KIT and simultaneously balance my family life.

Did the concept leave room for negotiation?
There was not a lot of room to negotiate on top of my HYIG, but obviously the HYIG stops before the tenure track evaluation. So for that phase, I could negotiate. I am grateful for the overall support I received form all parties engaged (institute, faculty, presidential board, etc.). It is not a luxurious situation, but there was the willingness to provide me with the required resources needed to be successful during the Tenure Track phase.

How do the criteria for HYIG and tenure track evaluation compare?
The evaluation criteria for the TT professorship are quite precise in my case. They state explicit numbers for third-party funding, publications, and invited talks, as well as numbers of students to be supervised, SWS taught, and so forth. Of course, the criteria set a lower bound, but this gives already quite a clear orientation.

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For the HYIG, in contrast, the criteria were very loose. The evaluation in that case consisted of a self-report and a presentation at the Council for Research and Promotion of Young Scientists. Together with external evaluations from two international reviewers, this makes up the final mark. A lot of different aspects played in.

Did you advocate for strict criteria?

Having discussed the issue also with colleagues from other faculties, I am aware that this is handled a bit differently between the faculties. Of course, criteria have to vary because of different scientific communities and standards in terms of publications or the expected third party funding. Personally, I like to know what is expected of me. I prefer clear and unambiguous goals and I was pleased that my request to define these was accepted during the negotiation. Again, the involved parties were supportive and solution oriented.

I prefer clear and unambiguous goals so I know what is expected of me.

Will the achievements of the HYIG already account towards your TT evaluation?

In my case, only the time of the TT professorship counts towards the tenure track evaluation. Due to the time difference, it was not possible to combine the evaluations. I would have wished for the end evaluation of the HYIG to fall together with the tenure track or at least the interim evaluation. Now, I will basically get evaluated every second year. I feel a bit of pity for the external reviewers who need to write all the reports. On the plus side, I have the big advantage that my group is already up and running.

What changed with the TT professorship?

Frankly speaking, not much with regard to my daily schedule and obligations. The major change comes along with my new role as a tenure track professor in the faculty. Although I was a KIT Associate Fellow before and eligible to participate in the graduation of the doctoral students, now I am also their first supervisor on paper. Moreover, I now participate in PhD defenses of other research groups, which is something I quite like as it provides many novel and interesting insights into other fields. In addition, there are also further obligations at the faculty such as the "Professorengespräch" or the faculty Council. Since I like teaching and I was already previously engaged in giving lectures and seminars, the new role implied no major changes at this end.

The KIT Excellent Tenure program is quite new – do you see room for improvements?

Appointment procedures for professorships generally take a very long time everywhere. There are a lot of different players involved. One has to be prepared to be patient with this process. Especially, if you have already started your group, be aware that it will take months or years to get appointed. Always keep an eye on the process. You cannot force it to happen super-fast, but you can watch out for it and make sure that its moving continuously from one step to the next.

Improved synchronization of evaluations will also be beneficial for an efficient KIT Excellence Tenure program, I think. It will save time for the candidate, the reviewers, and the administrative units at KIT.

Moreover, there should be more flexibility in timing of the evaluations. I think the candidate should be able to freely choose when she or he wants to be evaluated. Of course, this is not interesting for everyone and there should certainly be also the possibility to just do it in the regular time frames, but I do not see a reason why early evaluations should not be possible.

Shorter appointment procedures, synchronizing evaluations, and flexibility in choosing the time of evaluation will benefit the Excellent Tenure program.

Last but not least, I want to emphasize the importance to well familiarize oneself with the details of the W1 concepts. I have to admit that for myself it was not clear in the beginning what the difference between a junior professorship and a tenure track professorship is. In hindsight, this is obviously of uttermost importance and I would probably not have applied for a W1 without a tenure track. In my opinion, the main value of the tenure track professorship is that you have a long-term perspective at KIT.

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Leopoldina Carus Medal for battery reseracher

At the Helmholtz Institute Ulm, Dr. Dominic Bresser develops better and more sustainable batteries.

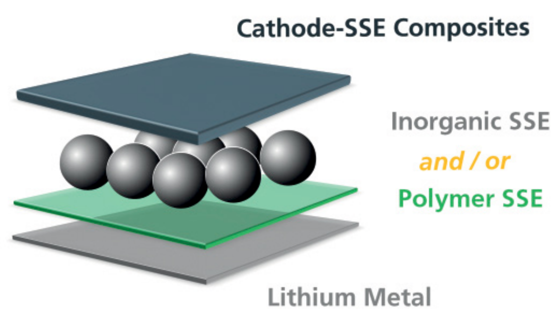
Dr. Dominic Bresser
KIT Junior Research Group

For his outstanding achievements in battery research, Dominic Bresser receives the Carus Medal of the Leopoldina – National Academy of Sciences. The physical chemist develops better and more sustainable electrochemical energy storage devices, including a variety of battery technologies such as lithium-ion, lithium-metal, sodium-ion and organic batteries. Thus, he contributes to improving energy storage, making it more sustainable and expanding the range of storage technologies. Among the former recipients of the Carus Medal are four subsequent Nobel Prize winners: biochemist Jacques Monod (1965), biologist Christiane Nüsslein-Volhard (1989), physicist Stefan Hell (2013) and, most recently, biologist Emmanuelle Charpentier (2020).

Today, at the Helmholtz Institute Ulm, Dominic Bresser heads a worldwide renowned group in the field of alternative electrode materials and novel electrolyte systems. He searches for safer, sustainable and organic battery technologies to replace critical raw materials like lithium, cobalt, or graphite. His research topics include the development of new active materials for the negative electrode and polymer-based electrolytes. A particular focus lies on the realization of improved energy and power densities based on a fundamental understanding of the underlying processes and the design of new charge storage and transport mechanisms. The ALANO project, recently granted by the BMBF, is one example for his work towards safer high-energy lithium batteries.

2010-2014 Doctoral studies at the Münster Electrochemical Energy Technology (MEET) Battery Research Center
During his PhD, Dominic Bresser focused on the impact of nanosizing lithium-ion battery electrode materials. He discovered several unknown phenomena and developed a completely new class of anode materials by partially replacing, for instance, tin and zinc in the corresponding oxides by transition elements. These enabled the fully reversible reoxidation upon delithiation.

BMBF Project: Alternative Anode Concepts for Safe Solid State Batteries (ALANO)
Solid-state batteries may push electric mobility to a new level: Lithium metal as the anode material and a solid-state electrolyte (SSE) make it possible to increase the energy density and thus extend the range of electric cars. "The safety will also significantly improve, as the battery cells no longer contain liquid and easily combustible components," explains Dominic Bresser. "In addition, the robustness of the cells increases, making handling, cooling and system integration easier." Thus, costs on the cell, module, and system level will be reduced. At the same time, the durability of the cells increases, hence, improving their sustainability.



Schematic illustration of solid-state lithium-metal batteries as targeted within the ALANO project. (graphic: Dominic Bresser, KIT)

Within the new application-oriented ALANO project coordinated by BMW AG, partners from industry and science look at the entire value chain: from selecting materials to manufacturing components, to producing cells, to battery scaling for use in vehicles and other applications, and finally to recycling. The ALANO collaboration works across branches and disciplines, also taking circular economy aspects into account. The Federal Ministry of Education and Research (BMBF) supports the ALANO project with 5.9 million euros under the "Battery 2020 Transfer" program – battery materials for future electro mobile, stationary, and other industrially relevant uses.

ERC Starting Grant goes to Dr. Dominic Bresser

1.3M euros for RACER – Redox-active Atomic Centers in Electrode materials for Rechargeable batteries

Energy storage is key to a successful transition to renewable energies. The RACER project aims at the development of novel battery materials to achieve enhanced energy and power densities at the full-cell level. "We want to take advantage of a new charge storage mechanism that favorably combines the intercalation/insertion-type mechanism for alkali-ion batteries with highly active atomic redox centers," says principal investigator Dr. Dominic Bresser. In addition, we will get the potential to discover ground-breaking new insights into the bulk-independent properties of the redox centers at the atomic scale owing to their confinement in the well-preserved crystal host structures. The European Research Council (ERC) funds the project *Highly Redox-active Atomic Centers in Electrode Materials for Rechargeable Batteries* (RACER) with a Starting Grant of more than 1.3 million euros for the next five years.

Lithium-ion batteries are the state-of-the-art electrochemical energy storage technology. They are based on a graphite electrode with lithium-ions functioning as charge carriers. While this match works, it is far from perfect: Graphite being rather slow in the uptake of lithium-ions results in long charging times and a reduction in power. Energy density is also an issue becoming apparent in the limited driving range of electric cars as well as in the size and weight of the battery modules. In addition, the demand for lithium as a rare raw material becomes increasingly more acute.

As a consequence, scientists are steadily on the lookout for alternative battery materials and new technologies. Thus, sodium-ion batteries are about to become commercial, and potassium-ion batteries are attracting rapidly increasing interest. All these alkali-ion battery technologies have one common characteristic making them so successful: the use of insertion-type electrode materials. These materials provide sufficient space in their crystal structure for the alkali ions to fit in

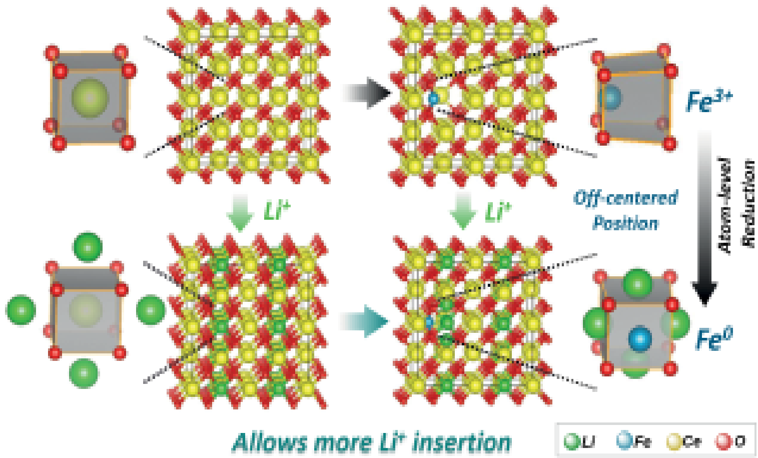
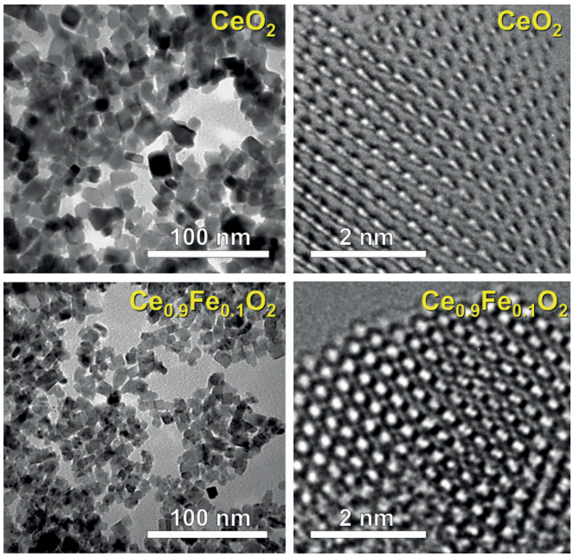


Illustration of the new „RACER" charge storage mechanism, exemplarily depicted for the Li^+ insertion into $Ce_{0.9}Fe_{0.1}O_2$ as the proof of concept. (Graphic: Dominic Bresser, KIT)

without causing substantial and irreversible rearrangements. Hence, upon charging and discharging, the ions are inserted and released without permanently altering the host structure.

The fact that the ions can only occupy specific sites in the host lattice, however, intrinsically limits the amount of ions it can hold. "To take up more ions and, thus, expand the energy density, we want to develop a new class of electrode materials characterized by an innovative storage mechanism," explains Dominic Bresser. This mechanism combines the benefits of a stable insertion-type host structure with an extended redox activity and additional available space for the alkali-ion charge carriers. All it takes, is the introduction of carefully selected atomic redox centers, primarily metals, within the lattice.

2015-2016 Postdoc at the Alternative Energies and Atomic Energy Commission (CEA), Grenoble, France
While researching in Grenoble, Dominic Bresser focused on the charge transport in macromolecular systems. He unveiled the structure-to-charge transport interplay for several different systems, including polymerized ionic liquids, single-ion conducting multiblock copolymers and organic liquid crystals. The latter system allows for completely decoupling the segmental relaxation and charge transport. His research in France was co-financed by the Enhanced Eurotalents Fellowship within the Marie Sklodoska-Curie Program.



Transmission electron microscopy images of CeO_2 (left) and $Ce_{0.9}Fe_{0.1}O_2$ (right) at different magnifications
https://onlinelibrary.wiley.com/doi/full/10.1002/aenm.202000783

In the journal *Advanced Energy Materials*, Dominic Bresser and his colleagues have already published a proof of concept. They showed how the partial replacement of cerium cations in a cerium dioxide host structure by iron cations leads to an improved power and energy density: The introduction of the metal resulted in an increase in capacity by more than 200%! This effect originates from the reduction of the iron ion Fe^{3+} to its metallic state and a significant off-centering of the these ions – away from the original cerium site. Thus, they provide additional space for the lithium ion insertion. In consequence, the maximum lithium uptake of one Li^+ per cerium cation has now been boosted to three Li^+ per iron cation. On laboratory scale, the iron-doped cerium dioxide lattice, thus, reaches a specific power of approximately 8.5 kilowatts per kilogram. An increase by a factor of 10 to 20 compared to commercial lithium-ion batteries.

An increase in specific power by a factor of 10 to 20 compared to commercial lithium-ion batteries.

Supported be the ERC Starting Grant, Dominic Bresser and his group now want to study and understand the underlying mechanisms in more detail: "Since we replaced just every 10th cerium cation with iron, we would have expected a rise in capacity by 20%," he says. "Instead we got more than 200% which is of course very fortunate, but we need to understand how and why this happens." The next steps to further improve the innovative storage mechanism will entail the development of new suitable host matrices in combination with different highly active redox centers and even alternative charge carriers. "We have already proven that the concept also works with other alkali-ions," Dominic Bresser adds. "Depending on the active redox center, we might actually fit in relatively more sodium or potassium-ions, despite them being larger than lithium ions." Even elements from the group of alkaline earth metals like magnesium could be an option.

New charge storage mechanism suited also for sodium and potassium-ions

Based on these preliminary results, new findings, and their comprehensive investigation, the scientists will develop and evaluate specific guidelines and design criteria for the realization of such novel electrode materials. Benefiting from the new charge storage mechanism, these will enable long-term stable insertion-type alkali-ion batteries with enhanced energy and power densities.

Moreover, the results obtained will allow for an improved understanding of the behavior of highly active redox centers at the atomic level. So far, the investigation of single-atom metallic elements has been limited to theoretical studies. "Metal atoms commonly come in large clusters and it is nearly impossible to separate them into individual atoms," explains Dominic Bresser. "Thus solitary confined within the host lattice, they make the perfect study object." This is basic fundamental research which might open up a completely new scientific branch.

ERC STARTING GRANT
researchers 2 to 7 years after PhD
funding up to 1.5 million euros

2021: Dominic Bresser
Highly Redox-active Atomic Centers in Electrode Materials for Rechargeable Batteries

2019: Katharina Schratz
(Heriot-Watt University, UK, since 2019)
Low-regularity and high oscillations: numerical analysis and computation of dispersive evolution equations

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

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

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

2016: Corinna Hoose
Closure of the Cloud Phase

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

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

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

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

ERC SYNERGY GRANT
groups of 2 to 4 researchers and their teams
funding up to 10 million euros

2020: Benno Meier
(KIT together with ENS and Radboud University)
Highly Informative Drug Screening by Overcoming NMR Restrictions

ERC CONSOLIDATOR GRANT
researchers 7 to 12 years after PhD
funding up to 2 million euros

2020: Tonya Vitova
THE ACTINIDE BOND properties in gas, liquid and solid state

2018: Bastian Rapp
(University of Freiburg since 2018)
The Capillary Lock Actuator: bistable microfluidic actuator for cost-effective high-density arrays suitable for large-scale graphical tactile displays

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

2016: Martin Weides
(University of Glasgow since 2018)
Interfacing spin waves with super-conducting quantum circuits for single magnon creation and detection

Writing a review for *Nature Materials*

First author Pascal Friederich talks about the work and the benefits involved

Pascal Friederich
TT Prof at KIT

The choice of simulation methods in computational materials science is driven by a fundamental trade-off: bridging large time- and length-scales with highly accurate simulations at an affordable computational cost. For *Nature Materials*, Pascal Friederich together with colleagues from Göttingen and Toronto reviewed the emerging field of "Machine-learned potentials for next-generation matter simulations". For YIN Insight, Pascal Friederich shares some insights into his research and the process of writing a review for such a highly rated journal. doi: 10.1038/s41563-020-0777-6

In December 2019, Pascal Friederich has become tenure track professor at KIT and started to set up his research group AiMat – Artificial Intelligence for Materials Sciences. His research focuses on data-driven prediction of material properties and computational material design; material simulations on atomic scale based on machine learning; and the direct coupling of machine learning methods with simulations and experiments.

What is the key behind machine learning?
Compared to conventional simulation methods based on classical or quantum mechanical calculations, machine-learning models learn from existing data to make predictions. They rely on neural networks specifically tailored to materials simulations. Once trained on large data sets of quantum mechanical calculations, such networks find and exploit correlations to come up with results on their own: though, with a significant speed advantage. They work up to 10,000 times faster and promise to soon reach the accuracy of quantum mechanical computations.

How did you manage to place a review article in a journal like Nature Materials?
Nature Materials contacted my postdoc supervisor at the University of Toronto, Professor Alán Aspuru-Guzik, and asked for ideas for review articles for a special edition about virtual materials design. At that time, I was still a postdoc in his group and he knew that I was interested in the topic and working on it. A review paper in any *Nature* journal is of course a great chance for a younger scientist to get attention. Alan usually involves postdocs and PhD students in projects like that. So, we chose a topic, discussed it with the editor and wrote the review paper.

How much was prescribed by Nature?
Nature did not interfere a lot with the content. They accepted our suggestion regarding the topic with the only condition that it fits into the special issue. Apart from the normal guidelines for review papers length and format-wise, they only gave us some feedback on the figures, redid parts of them, and suggested to add boxes for more background information.

Overall, how much work did you invest?
After initial discussions about the outline, the review paper was written in large parts by myself, with single sections coming from the co-authors. I also prepared the figures, of course, also with input and feedback from iterations with the co-authors. The time commitment is hard to compare to an original research paper. The writing itself is comparable, making the figures was much more work than in a normal article. An original research paper, of course, requires the actual research first which is the most time-consuming process. The review paper "only" required extensive literature research which, nonetheless, also took a significant amount of time. All in all, it probably took 1-2 months of full time work to write it.

All in all, it took about 1-2 months of full time work to write the review.

How much impact did you get from the review compared to a original paper?
It is hard to evaluate the direct impact. In the weeks after the review paper appeared, it led to a lot of attention. On twitter, I got hundreds of clicks and I received about 25 direct inquiries from scientists and media. The more important

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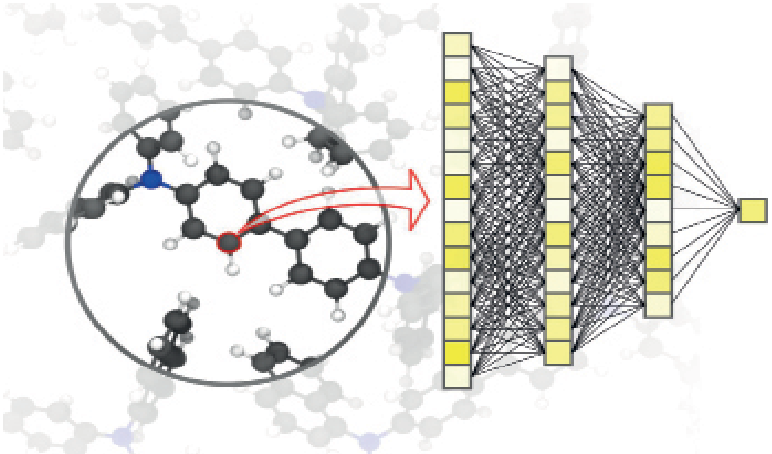
part, though, are probably the indirect effects regarding the long term perspective: for example, I already got applications for doctoral positions referring to the paper. I assume that they are from students that have not known about me and my research before. There might also be invited talks, not directly after the article but still potentially related to it, and so on.

Considering the time investment, would you do it again on hindsight?
Yes, definitely. I am currently preparing another review paper. This time with a lot of help from my research group. It is a great group project for us! We will publish it again in a special issue, guest-edited by a cooperation partner. We were invited to submit any paper – original, review, or perspective –, not particularly a review on a specific topic.



Neural networks enable precise simulations in material science – down to the level of individual atoms. (Illustration: Pascal Friederich, KIT)

So, why did you choose another review?
A lot of my group members are working on graph convolutional neural networks and their applications and we are not aware of a review paper specifically for the materials science and chemistry community. Writing it is not only a good exercise for the for the PhD students and postdocs in my group, but also encourages us to look closer into the work of other scientists working on related methods and applications which stimulates a lot of good ideas.

What would you advise to someone wanting to publish a review article in Nature?
As this review article was an invited article, it is hard to give advise on this special case. However, in general it is probably a good idea to contact the editors first and convince them that a topic is important enough to be published in a specific journal. I would not start writing before I don't know that I would at least pass the editor's desk with my idea.

Thank you!

excursus **Can scientists learn from machine learning?**
Machine learning algorithms find recurring patterns in the data they process and use them to make predictions. Instead of trying to improve the numerical accuracy, Pascal Friederich inquires what patterns and correlations machine learning models actually detect. Together with German and Canadian colleagues, he studies how to best extract machine learning-generated hypotheses. "We want to use them to inspire human scientists to increase their intuitions and understanding of natural systems," Pascal Friederich explains. "We apply gradient boosting in decision trees to extract human-interpretable insights from big data sets." The graph representation directly relates to real physical entities, like the atoms in a molecule or the set-up of an experiment, and allows to quantify the importance of features. Based on the features with the highest importance, the models generate a list of hypotheses.

To test the automated hypothesis generation workflow, the scientists performed experiments in molecular chemistry and quantum physics. They not only rediscovered widely known rules of thumb but also found new interesting motifs on how to control solubility and energy levels of organic molecules. In quantum physics, they gained a better understanding of the entanglement created in quantum optical experiments.

Thus, the ability to go beyond numerics and to enter the realm of scientific insight and hypothesis generation opens the door to use machine learning to accelerate the discovery of conceptual understanding in some of the most challenging domains of science.
doi: 10.1088/2632-2153/abda08

Airborne measurement campaign on ice clouds

NANO Science Magazine follows Helmholtz group leader Emma Järvinen into the sky

Dr. Emma Järvinen about to board the High Altitude and Long Range Research Aircraft HALO. (Photo: Shawn Wagner, KIT)

Cooling or warming – what is the overall effect of ice clouds on the climate? Do the ice crystals reflect more sunlight back into the sky or more radiation back to earth? Emma Järvinen repeatedly goes on airborne measurement campaigns to find the answer. In July 2021, she boarded the HALO research plane to collect data over the Arctic where cirrus clouds form naturally. Cirrus clouds are thin clouds of ice at high altitudes. Preliminary results show that the overall effect of such ice clouds is more cooling than theoretically expected. Thus, the empirical data will help improve the accuracy of current climate models.

While most rapid climate change occurs in high latitudes, direct observations are sparse and theoretical assumptions prone to errors. With her Helmholtz Young Investigator Group "Airborne Cloud Observations", Emma Järvinen wants to improve the current optical parameterizations in climate models in order to reduce the uncertainty related to the role of ice clouds. Whether they reflect sunlight or contribute to the green house effect, highly depends on the light scattering properties of individual ice crystals. One of them is the asymmetry parameter: for atmospheric particles and molecules, it ranges between 0 (reflecting all light) and 1 (scattering all light). Larger atmospheric particles, such as cloud particles, have asymmetry parameters approximately between 0.7 and 0.9.

More reflecting than expected

Being part of the research campaign on ice clouds in high latitudes, CIRRUS-HL, Emma Järvinen recently joined a measurement flight with the High Altitude and Long Range Research Aircraft HALO owned by the German Aerospace Center. Attached to one of its wings was the Particle Habit Imaging and Polar Scattering (PHIPS) probe. The instrument was specially designed at KIT for the stereo-imaging of individual cloud particles and the measurement of its scattering function that can be used to derive the asymmetry parameter. Measuring both the microphysical and optical properties on the same particle is important since for solar wavelengths these are closely linked. "Our observations show that cirrus clouds are more reflective than we thought", says Emma Järvinen. "We now estimate the asymmetric parameter for ice clouds over the Arctic to be around 0.72, instead of ranging between 0.8 and 0.9 as theoretical models suggest.

Particle Habit Imaging and Polar Scattering probe attached to a wing of the research plane HALO. (Photo: Emma Järvinen, KIT)

"This seemingly small deviation will have a much more pronounced overall effect. Some years ago we showed using a global climate model that reducing the ice crystal asymmetry parameter to 0.75 would change the ice cloud radiative effect by 1.2 Wm^2. This is significant if we think that the global ice cloud radiative effect is estimated to be 5 Wm^2.

Micro-scale structures more decisive than crystal shapes

Idealized hexagonal ice crystals would scatter most of the sun light onwards towards the earth. The ice crystals in clouds, however, seem to stray quite far from this ideal. What makes them different? "Scientists have long been focused on the varying shapes of crystals to explain their light scattering behavior," explains Emma Järvinen. Depending on the speed in which crystals grow, they form more complex, elaborate designs or rather simple structures. Experimental measurements, however, have shown that structural differences like surface roughness, hollow air bubbles, or trapped particles play a much larger role on the ice crystal optical properties than their shape. "We have shown that when enough deformations and complexities are present, the underlying crystal shape does not matter anymore: the light scattering properties are dominated by these microscale features."

Scientific TV broadcast NANO on the 200th anniversary of Hermann von Helmholtz – with Emma Järvinen

On her latest measurement campaign, Emma Järvinen and her colleagues were joined by a SWR camera crew. As a physician, mathematician, chemist, physicist and more, Hermann von Helmholtz is considered one of the greatest polymaths in history. He combined theory, experiments, and technological applications. Thus, the SWR complemented a biographic essay on Helmholtz with a glimpse into the HALO measurement campaign CIRRUS-HL: a joint venture by the Helmholtz Association of German Research Centers, the German Research Foundation, the Leibniz Association, and the Max Planck Society uniting – as Hermann von Helmholtz did – theory, experiments, and technological application in research.

The report on CIRRUS-HL starts at 15:30 min: www.br.de/fernsehen/ard-alpha/programmkalender/sendung-3186682.html

Ice crystals captured by the PHIPS probe over the Arctic.

Similar effects on global scale

Emma Järvinen has also sampled clouds over the Southern Ocean and the mid-latitudes. The overall effects are surprisingly similar. She explains: "Our results demonstrate that an overwhelming fraction (between 61% and 81%) of atmospheric ice crystals sampled in the different regions contain a significant degree of mesoscopic deformations." As a consequence of these crystal complexities, scattering is more diffuse and a similar flat and featureless angular scattering function is observed. And more importantly, the resulting asymmetry parameter is lower than for pristine counterparts.

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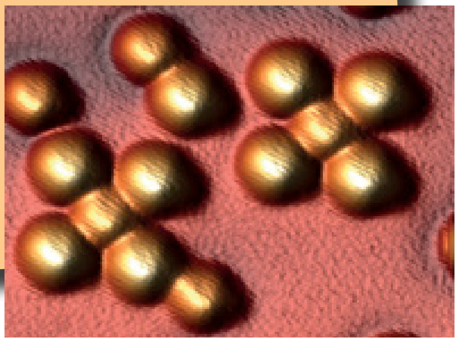
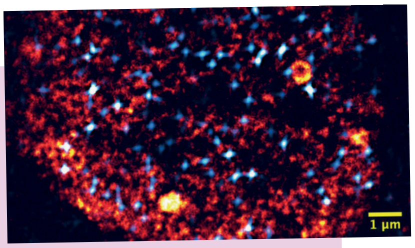
The Gaede Award 2022 of the German Physical Society goes to Philip Willke

Philip Willke is recognized for "his outstanding experimental work on the study of single electron and nuclear spins using electron spin resonance on single atoms on surfaces". With his Emmy Noether group, he conducts research at the frontier of quantum technologies and nanoscience. The single-atom electron spin resonance technique, which he helped to develop to maturity, is currently an exciting field in solid-state and surface physics. The individual measurement of the quantum mechanical properties of single atoms and molecules on surfaces opens up completely new possibilities to manipulate atomic structures and create artificial quantum systems. "With the help of a scanning tunneling microscope, atoms can be positioned on surfaces very precisely – like Lego – and their properties can be determined atom by atom. Here, their magnetic properties can be used in particular as building blocks for new methods in sensor technology and for computer architectures – so-called quantum bits or qubits for short.



Gap in IT Security: Optical Computer Attacks using Laser Light on build-in LEDs

Computer networks in critical infrastructures are often physically isolated to prevent external access. Having neither wired nor wireless connections to the outside, they are air-gapped. By directing laser light at build-in LEDs, researchers could now establish an optical communication to these systems – bridging the gap. Data transfer then works in both directions over a distance of up to 25m. "Optical attacks are possible in commercially available office devices used at companies, universities, and authorities," says Christian Wressnegger, head of the Intelligent System Security Group of KASTEL. In the LaserShark project, he cooperates with researchers from TU Braunschweig and TU Berlin.



Molecular Systems Biology: How Cells Correctly Choose Active Genes

Cells have to control precisely which genes they use to avoid wild cell growth or even cancer. Researchers have now found that the formation of transcription factories in cells resembles the condensation of liquids: liquid-coated areas of the genome allow for the adhesion of relevant gene sequences and additional molecules that eventually activate the adhering genes. "Our work shows how the biological cell organizes such processes rapidly and reliably. The computer simulations and functional concepts developed by us can be transferred directly to artificial DNA systems and can support their design," says Lennart Hilbert, one of the corresponding authors.

doi: 10.15252/msb.202110272

Frank Biedermann receives Life Sciences Bridge Award from the Aventis Foundation

With the Life Science Bridge Award, the Aventis Foundation supports talented young researchers and encourages them to pursue to bold and unconventional scientific ideas. Frank Biedermann and his Emmy Noether group have tested an alternative receptor design principle ensuring high binding affinities for synthetic macrocyclic compounds. Thus, they recently introduced the strongest and most selective fluorescent artificial receptor for the neurotransmitter serotonin known so far. He hopes for his invention to become clinically relevant to help real patients. With Frank Biedermann, Zeynep Altintas and Lucas Jae, three postdoctoral scientists received the award in 2021.

YIN Day 2021: Science Walk, Alumni Reunion and Panel Discussion

As a hybrid event with over 40 participants, the YIN Day was again a great success. The day started off with an interactive Science Walk, followed by the first online reunion for alumni. Highlight of the afternoon was the panel discussion on "Choosing different Career Paths" with YIN alumni Chris Eberl (Fraunhofer), Connie Lee-Thedieck (Leibniz University Hannover), Martin Nöllenburg (TU Wien) and Julia Syurik (industry). Thanks a lot for your outspokenness and great advice!

Study shows: Urban forests as cultural ecosystems reduce corona stress

In Karlsruhe and Rheinstetten, the number of forest visits increased significantly during the COVID 19 pandemic. Urban and peri-urban natural spaces have contributed significantly to subjective well-being, especially in a time of confinement and restriction, says Somidh Saha. He is the lead author of the study on the importance of forests as cultural ecosystems, published in the internationally respected journal *Sustainable Cities and Society*. While respondents made more use of nearby sites, they placed a higher value on forests close to cities. The participatory mapping method used is also suitable for incorporating the needs of the population into the planning of urban forests.

"I knew Zoom before Corona"

YIN alumni share their experiences on how to remotely lead a Helmholtz group

Helmholtz Young Investigator Groups (HYIGs) allow young postdocs to independently build up a research group at a Helmholtz center of their choice. The prospect comes together with a tenure track "light" – offering a permanent scientist position after positive evaluation, but not a professorship. Thus, it happens that HYIG leaders change institutions while the Helmholtz groups are still running. As the groups are bound to a Helmholtz center, remote leadership is often the only practical solution to continue the group.

Prof. Alexander Schug
Helmholtz group leader at KIT and in Jülich

YIN alumnus Alexander Schug and his group focus on questions of theoretical biophysics and material science related to machine learning – mostly on the molecular level. For example, they generate molecular dynamics simulations of biostructures and biomolecules. Alexander Schug started his HYIG at KIT in 2011 with a seed funding of about 1.5 million euros. After his evaluation in 2016, he got a permanent position as senior scientist at KIT.

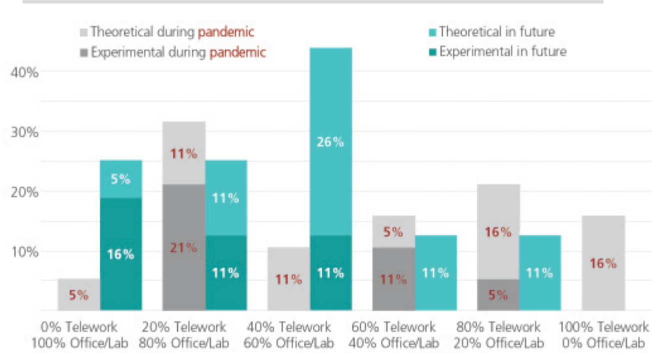
Alex, you, then, got an offer from Jülich!?
I got the offer from the Research Center in Jülich to head a research group at the Neumann Institute for Computing – a temporary group with excellent funding. For me it was very attractive to get the chance to work at the supercomputer in Jülich. Since, it is a temporary position, I negotiated to keep my group at KIT. This is how I ended up having basically two groups in parallel. My main group is at the Research Center Jülich, but I still had about 5 doctoral students at KIT.

So, you ran your KIT group remotely?
Yes, but remotely still means that I was traveling quite a bit. I think one of the most important points is that you keep in touch with your students and I met my students at KIT regularly. My family lives in Karlsruhe and, thus, I am here at the weekends anyway. I also have an apartment in Jülich where I stay during the week.

What about tools for online communication?
Back in the day, I already used video tools. In fact, I knew Zoom before Corona. But I did not use it as frequently as I do now. Instead, I really tried to meet my students in person as much as possible. In my view, the most productive discussions are still those in front of a real chalk board.

Do you use any other online tools?
We use *Overleaf* for article writing, *github* for sharing software codes, and cloud storage such as *bwSync&Share* to exchange documents. We did try other tools, but nothing really added much. In the end, I am still an old fashioned pen and paper person and like to talk sitting in the same room. A big advantage of physical presence is that students can just walk in. To talk via zoom, you always have an organizational overhead to set up the meeting.

excursus **YIN hopes for New Work at KIT**
In a global and digitalized society, alternative concepts of work and working together are continuously developing. With the Covid pandemic, however, almost everything changed over night: Home became the new office, work was scheduled around family hours, and video conferences regularly took up the whole network capacities. For YIN members, the productivity of research depended decisively on the degree of theoretical versus experimental work: Do you have your lab on a laptop or your laptop in the lab? Accordingly, also the preferences for tele work vary. While more flexibility was generally appreciated, especially the hiring process of new staff was quite difficult to accomplish.



YIN survey 2021 with 19 participants

What is special about a remote group?
Well, you need to make sure from the start that the members are somewhat self-organized. There is a maximum number of students that you can effectively supervise before you need to start sub-groups. I don't really like the idea to have solely postdocs taking care of doctoral students and the doctoral students rarely talking to me. I still want to be involved in their projects and once I reached 8-10 people, this was getting challenging. In the corona situation, we established weekly meetings where everyone in 2-3 minutes quickly reported about their work of the last couple of days. I don't like micromanagement, but I want everyone to be informed about the different projects.

Is this a joint two-group-meeting?
Yes, with both groups. I consider it as one group actually. I can only encourage the students to talk to each other, for example in virtual coffee meetings. I think this is very helpful for them. On many technical issues, you don't want to talk to your professor. I also have some projects that are cross-center. So, talking to each other is important for the projects to succeed.

Do your students travel between the groups?
Yes, but not so often. When the corona numbers were better, we had one big meeting for everyone with 3G plus, etc. I want to make sure that they know each other in person and not just from screen. When I started in Jülich, I invited my entire group from KIT so that they could see the infrastructure and meet the people. I think this is also a big advantage for the students: they have access to the resources of both places.

Did the pandemic change anything at all?
Well, suddenly online meetings were the only option – not just one option. Both places where I work are computing centers. So, for us the most sane and safe way was to work from home. Before the pandemic, I have to admit, I was always a bit skeptical of home office – that there might be too many distractions from work. During the pandemic I saw it work. My students really did a remarkable job and we got great science done. What has really changed, though, is that you need to take care that group members are not too isolated. We work in theoretical physics, so some of them are quite introvert. There, you really need to pay attention.

So, home office works for your group?
Yes. Of course, working in a computational field makes things easier. All we do is computer work; we don't have a lab. I myself only use ONE powerful notebook so I can always take my lab with me. Thus, some days my students are in the office and some days they are at home. I don't track it. Nonetheless, each week, I have fixed time slots to talk to each doctoral student for about half an hour, just to discuss.

Thanks a lot!

HYIG leader Anna Böhmer got a call from Bochum
YIN alumna Anna Böhmer started her Helmholtz Young Investigator group "Strain Tuning of Correlated Electronic Phases" at KIT in 2017. By 2021, she became Professor for Solid State Physics at the Ruhr-University Bochum. As her new place of activity is not part of the Helmholtz Association, she could not take her group with her – at least not the funding. Thus, she still holds a working contract over 10% at KIT managing the remaining budget and supervising her last postdoc. "Fortunately, he is quite independent and now even funds his own position," Anna Böhmer states. Nevertheless, she still works with him on joined publications and theoretical problems: "Zoom is our all-purpose weapon. I also use *Slack* for chatting, *Overleaf* for joint paper-writing, and of course your standard e-mailing." When she used to be on campus, Anna Böhmer also helped with technical problems in the lab. "This kind of support can hardly be given remotely," she continues, "but, thankfully, there are enough other people at KIT to help with such problems." As an experimental physicist, Anna Böhmer and her group cannot work without regular lab access. Adhering to high safety regulations, they fortunately have been able to continue their research even during the pandemic.

Prof. Anna Böhmer
Ruhr-University Bochum
HYIG leader at KIT

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Facts and figures from 2020/2021

The data was compiled from the YIN survey on 2020 (30 participants) and the YIN database 2021

YIN members

YIN members lead scientifically and financially independent research groups that consist of at least one staff member holding a Master's or doctoral degree. This position or the group leader's position must have been acquired in a competitive process or granted competitively (e.g. appointment procedure). Hence, junior and tenure track professors are equally part of YIN.

The following facts and figures are the outcome from the YIN statistics survey 2021 collecting data on 2020 and the YIN database. Numbers in brackets indicate the change compared to the year before. Please, be aware that 27 YIN members filled in the survey in 2020, while in 2021 there were 30 (+3).

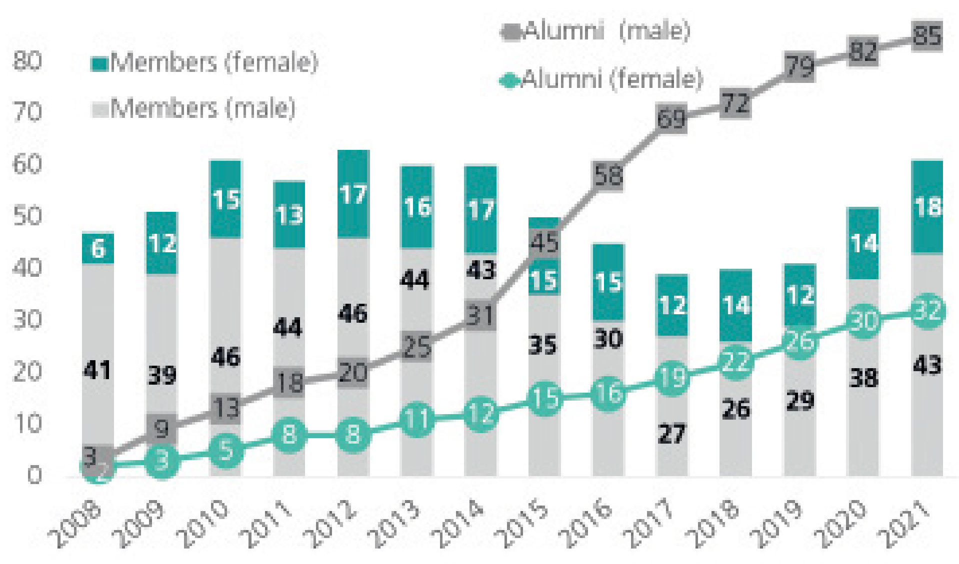

Fig. 1: Number of YIN members and alumni since the foundation of YIN in 2008. (YIN database)

In 2021, the number of YIN members has been further increasing, mainly due to the appointment of more tenure track professors and further KIT junior research groups. Having reached 61 (+9) YIN members by the end of 2021, the number of members is close to the maximum level that was reached around ten years ago (Fig. 1). The decline between 2014 and 2018 corresponded to the conclusion of KIT groups funded by the first Excellence Initiative.

YIN is an international network. In 2021, 25% (+1%) of all members have an international background coming from Europe, America, Asia, and Australia. The share of women has reached the 30% mark (+3%) once again in 2021. The average age of new YIN members joining the network was 32.6 (-0.8), with the youngest being 28 (-1) and the oldest 40 (+2). As the duration of groups is typically between four and six years, the average age of the current YIN members is 37.2 (+ 0.2), ranging from 30 (-1) to 43 (+1). Junior and tenure track professors in YIN, at the time of their appointment, were on average 34 years old.

30% women and 25% of international origin in YIN

Besides progressing in their career, many YIN members also start a family and consider (temporary) part-time work. On account of the YIN survey, more than half of the YIN members have at least one child and took an average of 5.3 (-1.2) months parental leave. The total amount of part-time work decreased from 49 to 46 months taken by 6 (-1) members.

Areas of research

YIN members cover four areas of research. In 2021, 40% (-7%) of YIN members were working in the field of natural sciences, followed by 26% (+4%) in engineering and material sciences, 21% (+7%) in computer science and mathematics, and 13% (-4%) in economics and humanities (see Fig. 2).

Types of research groups in YIN

YIN unites a variety of group types with different funding sources. In 2021, YIN counted 20 (+5) KIT junior research groups. In addition, there were 8 (+1) YIN members leading Helmholtz Young Investigator Groups that are in equal

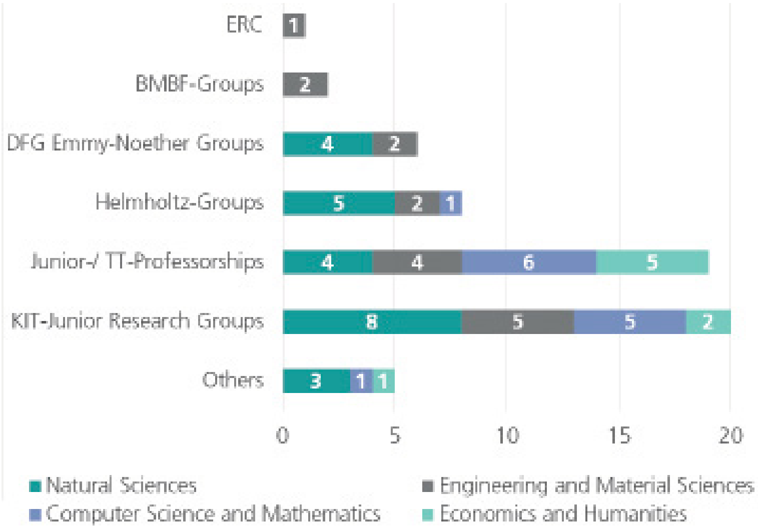

Fig. 2: Distribution of YIN research groups according to the funding program and areas of research (YIN database in December 2021).

Subsequent funding
In addition to the initial funding of their groups, YIN members acquire substantial subsequent funding. On average, each member raises roughly 334.000 (+84.000) euros extra a year. In 2020, subsequent funding amounted to 10 (+3.2) million euros in total. With 71% (-8%), the majority of these grants is provided by external funding agencies. 7.5% (-10.5%) are contributed by KIT and 21.5% (+18.5%) by industrial partners.

parts funded from the *Helmholtz Initiative and Networking Fund* and by KIT. There are also many YIN groups that are funded entirely from external sources such as 2 (-2) by the Federal Ministry of Education and Research (BMBF) and 6 by the German Research Foundation (DFG) via its Emmy-Noether-Program (+/-0). Finally, there are 19 (+6) junior or tenure track professors who are members of YIN. Other YIN groups are funded by the State of Baden-Württemberg (Margarete von Wrangell Program) or by the EU (Marie Curie Grant, ERC Starting Grant). An overview together with the area of expertise is shown in Fig. 2.

Initial funding
The 2021 survey shows that in 2020, YIN members raised a total of 31.4 (+3.4) million euros distributed over 3 to 6 years (4.5 years average) for research projects at KIT by their initial funding. This results in a contribution of about 6.9 (+0.6) million euros per year. The funding volume of the different groups varies between 68.000 (-102.000) and 6 (+4) million euros. Roughly 9 (+1) million come from KIT, whereas the remaining 22.4 (+2.4) million euros are externally funded. On average, each YIN group starts with a 226.000 (-6.000) euros yearly budget.

31 M initial funding
10 M subsequent funding in 2020

Staff
YIN research group leaders supervise a large number of employees, namely a total of 439.5 (+133.5) people. The average size of a junior research group represented in YIN was 14.65 (+3.65) members in 2020. The YIN research group leaders employed 64.5 (+32.5) postdoctoral researchers, 144 (+20) doctoral candidates, 84 (+29) Master students, 46 (+2) Bachelor students, and 66 (+28) student assistants. The groups further encompassed 13 (+8) technicians, 11 (+11) trainees, and 11 (+5) guest scientists as shown in Fig. 3.

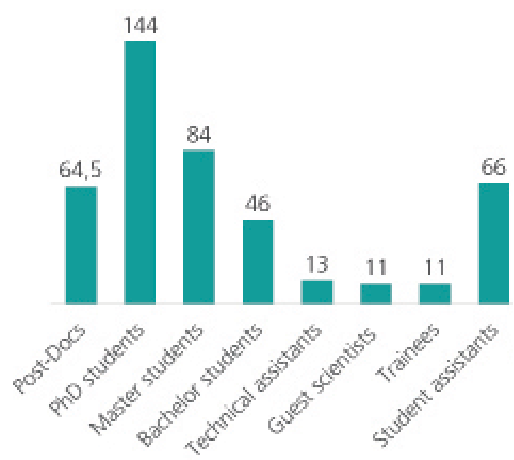

Fig. 3: Number of people working in YIN research groups.

Publications and conferences

A total number of 197 (+9) peer-reviewed scientific papers have been published in 2020 by the 30 YIN members that participated in this survey. This includes publications in prestigious journals such as *Advanced Materials*, *Chemical Science*, and *Nature Catalysis*. The average Hirsch-index (h) of a YIN member is 18.4 (+0.4). Due to different publication traditions in different disciplines, the h-index of the YIN members varies significantly. Moreover, controversial discussions criticize the h-index as an inaccurate performance metric and susceptible to manipulation. In addition to publications, YIN members show their scientific work and represent KIT on numerous occasions. In 2020, they presented their research at 54 (-48) international conferences. This reduction is clearly associated with the pandemic. Furthermore, 2 (-2) patent applications were filed by YIN members in 2020.

197 publications
18.4 average h-index
54 conferences

Teaching and thesis supervision

For most YIN members, teaching forms a substantial part of their activities. About 94% (+5%) of all YIN members from the survey contribute actively towards teaching at KIT. Interestingly, however, only 42% (+17%) of the YIN members have an obligatory teaching assignment. For 45% (-15%), the teaching assignment is completely voluntary and mainly unpaid (Fig. 4).

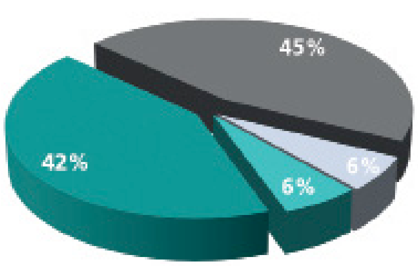

Fig. 4: Teaching assignment of YIN members in summer term 2020 and winter term 2020/21.

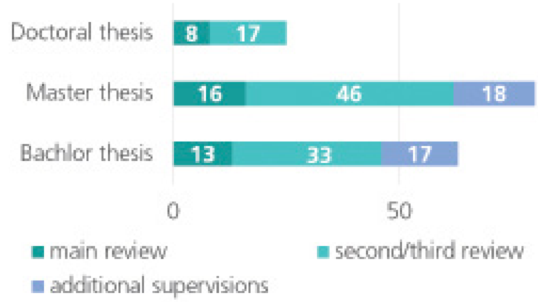

Fig. 5: Number of thesis officially supervised by YIN members as main or second/third reviewers in 2020 as well as additional supervisions.

YIN members gave lectures accounting for a total of 226.2 (+57.7) weekly teaching hours per semester (SWS) during the summer term 2020 and the winter term 2020/21. The 226.2 SWS comprised lectures (131.2 SWS, +10.7), seminars (56 SWS, +16), exercises (24 SWS, +15) and practical trainings (15 SWS, +5).

In addition to teaching, YIN members supervise doctoral as well as Master and Bachelor students. In 2020, 25 (-11) doctoral theses, 80 (-36) Master theses and 63 (-13) Bachelor theses were prepared in YIN research groups, as is illustrated in Fig. 5. This reduction might also be in consequence with the early phase of the pandemic when there was a lot of uncertainty in regard to the procedures.

226 SWS in 2020/21
25 doctoral theses
143 Master and Bachelor theses

The examination entitlement granted to YIN members is very heterogeneous depending heavily on their status and the respective KIT department. 36% (+28%) have full examination rights and roughly 12% (+6%) of the YIN members have no entitlement at all. About 15% (-13%) of the YIN members have examination entitlement for thesis of group members (doctoral, Master, and Bachelor students); another 21% (+2%) only for doctoral thesis of group members, and 12% (-21%) for lectures they give (Fig. 6). These changes are significantly influenced by the increasing amount of junior and tenure track professors at KIT who have full rights.

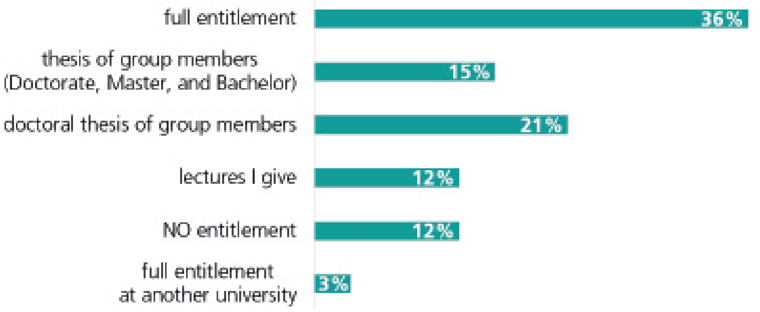

Fig. 6: examination entitlement of YIN members

Habilitation

The status of junior group leader and junior professor were once thought to replace the habilitation. However, the significance of the habilitation is perceived differently across disciplines, KIT departments, universities, and even countries.

KIT-Associate Fellow

The KIT Associate Fellow temporarily grants restricted teaching and examination rights. Thus, junior group leaders acquiring the status may gain experience in independent teaching, supervision, and examination procedures. At some KIT departments, KIT Associate Fellows can be first reviewers for their doctoral researchers. At others, they may only serve as an additional third reviewer. Despite these differences, the KIT Associate Fellow is a valuable instrument to recognize the structural and scientific independence of junior group leaders. For research group leaders with access to the KIT Excellent Tenure program, the status can be helpful to bridge the time between the start of the research group and the appointment as junior or tenure track professor. By 2020, two KIT departments still have not appointed any Associate Fellows (Fig. 7).

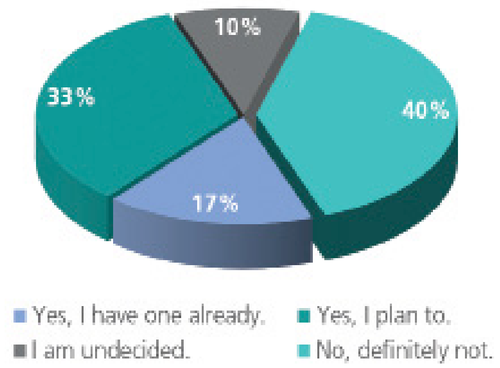

Fig. 8: Status and view regarding the habilitation as seen by YIN members.

In Germany, the habilitation still ensures the longterm eligibility to teach and to promote doctoral students as "Privatdozent/-in" (private lecturer) or "außerplanmäßige/-r Professor/-in" (extraordinary professor). To secure these opportunities, can be relevant especially for group leaders and junior professors on temporary contracts who plan to stay involved in teaching even if they don't attain a full professorship. Professors at university of applied sciences may also profit depending on the German state they work for. In 2020, 33% (-7%) of the YIN members planned to pursue a habilitation and 17% (+13%) have already successfully completed this process (Fig. 8). 10% (-16%) were undecided while 40% (+10%) considered the habilitation as not necessary for their career.

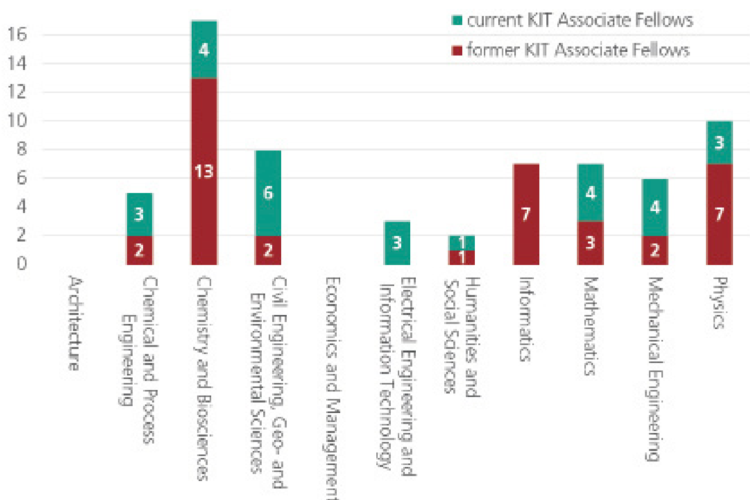

Fig. 7: Number of Associate Fellows at the KIT Departments in November 2021 (Data from YIN survey among the KIT Departments).

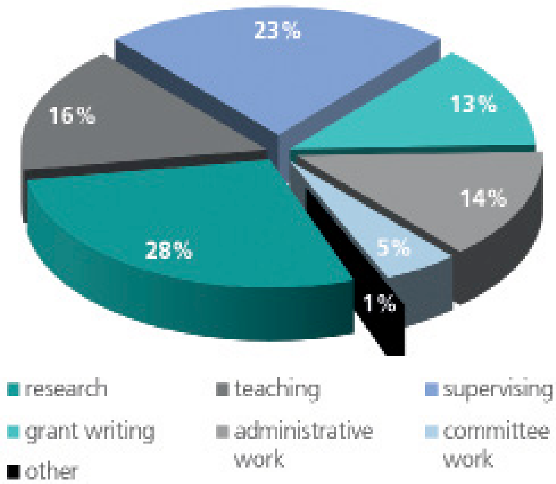

Fig. 10: Distribution of working hours of YIN members

Distribution of work hours

In 2020, the time that YIN group leaders spent on independent research and writing papers has with 28% (+/-0) not quite reached one third of their working hours. As all YIN members have personnel responsibility, they devoted 23% (-4%) of their work hours to supervising and mentoring. In addition, they invested almost equal amounts time in teaching (16%, +2%), grant writing (13%, +3%), and administrative obligations (14%, +/-0). Only 5% (-1%) of their time was dedicated to committee work.

YIN alumni

After concluding their junior research groups or junior/tenure track professorships or leaving KIT, many former YIN members choose to apply for a YIN alumni membership. Their number is constantly growing and has reached 117 (+5) by the end of 2021. Of these 117 YIN alumni, 27% (+/-0%) are women and 18% (+/-0%) have an international background.

Moreover, four YIN alumni were newly appointed to a full professorship last year. Thus, the appointment ratio for YIN alumni has thus risen to 54% (+2%) – counting 43 (+3) university professors, 7 (+1) professors at universities of applied sciences, 8 (+1) associate, 2 (-1) assistant, and 3 (+/-0) extraordinary professors. Out of these 63 YIN alumni who now hold a professorship, 17 (27%) are women (+2%) and 8 (13%) have an international background (-1%). In total, 11 YIN alumni have accepted a professorship outside Germany – among them, only 1 (9%) female professor and 2 (18%) with an international background.

W2/W3 appointment ratio for YIN alumni has reached 49%

YIN Award 2021

Benchmarking artificial photosynthesis by comparing it to natural photosynthesis
Dr. Claudia Bizzarri and Dr. Somidh Saha

YIN Grants 2021

A machine learning approach to high frequency macroeconomic data
TT-Prof. Julian Thimme

Biocompatible hydrogels for 3D printing with light
Dr. Zbigniew Pianowski

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Modelling microstructural volume variations and the resulting mechanical properties in Li-ion batteries

Rechargeable lithium-ion batteries have revolutionized individual electrified transportation. New materials promise to further decrease the weight and volume of batteries by enabling greater energy densities. With regard to faster recharge, this concerns especially the negative electrode. Alternative materials to the state of the art graphite, however, suffer extensive volume variations upon charge and discharge, which need to be buffered by the overall electrode design. To tackle this issue, Dominic Bresser and Katrin Schulz initiated the joint development of a suitable electrode model: by gaining an in-depth understanding of the critical parameters defining volume changes, electrode architectures can eventually be tailored to minimize this effect.

Dr. Dominic Bresser
physical chemistry

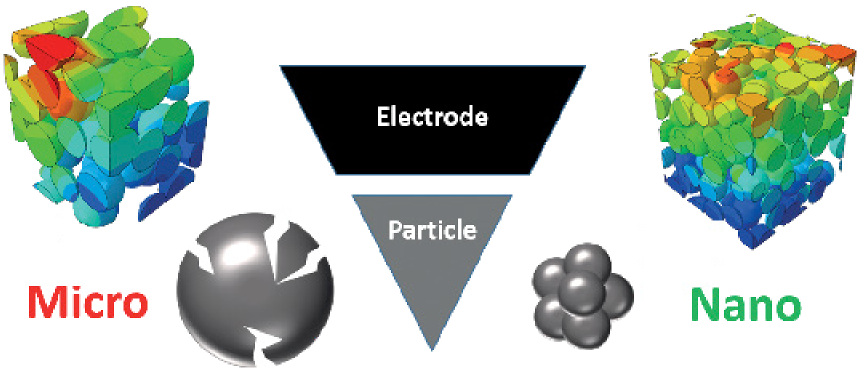
So far, clear guidelines how to address the changes in volume are missing – especially for commercially viable solutions. When considering the essentially needed and potentially added electrode components and important parameters such as the electrode porosity as well as the active material particle size and morphology, this task can become arbitrarily complex. We need to understand how volume changes at the particle level translate into volume changes at the electrode level.

Dominic Bresser is head of one of the worldwide leading experimental groups in the field of conversion/alloying materials that provide greater lithium storage capacities and faster charge rates compared to graphite as the state of the art.

Katrin Schulz and her group focus on reliable numerical methods for materials simulation. Based on high performance computing, they aim at multiscale approaches to represent different materials' length scales in their models. Thus, physically based bottom-up formulations can yield new insights into material processes on micro and nano scale that are not or only with high effort accessible by experimental methods.

Prof. Katrin Schulz
material science

As a first outcome of their YIN grant collaboration in 2020, Dominic Bresser and Katrin Schulz together with their groups have developed an electrode model consisting of two phases: It simulates the evolution of the electrode as a function of the varying particle size upon discharge and charge. The results are in good agreement with the experimental findings and will be reported in a joint paper that has been submitted for publication. Further investigations will focus on the material behavior upon extensive cycling of the electrode, the introduction of additional phases, and the potential evolution of cracks in the electrode as well as in the single particles. The final goal is to develop a model that allows for predicting ideal electrode architectures for high-energy anode materials that enable negligible volume variation at the electrode level and, thus, long-term stable cycling of the resulting battery cells.



Upon cyling, micro-sized particles reveal cracking and the corresponding electrode rather localized, but severe volumetric changes. In contrast, nanoparticles do not show any apparent degradation and the electrode reveals a much more homogeneous volume variation. (graphic: Dominic Bresser, KIT)

Orbital energies in supramolecular donor-acceptor complexes & data digitalization

What have biological organisms capable of photosynthesis and organic solar cells in common? They are based on photoelectron transfer processes or charge transfer: Moving charges between different energy levels even determines the color of many materials and molecular mixtures. Describing these processes accurately is still very challenging. Especially, when we look at realistic systems from chemistry or biology. There, we always have a combination of at least two molecular species, called donor and acceptor. If we also have a host as in a larger molecule encasing the donor-acceptor contact, we speak of a supramolecular complex.

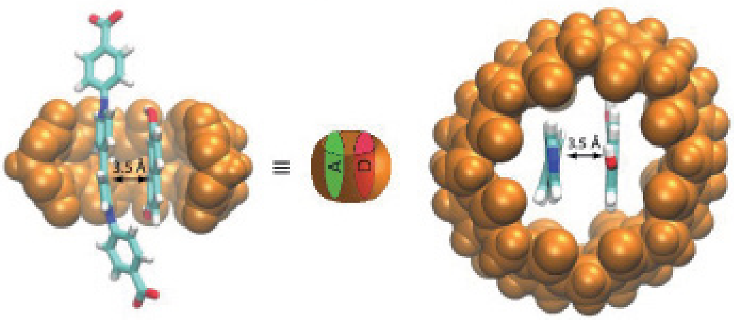
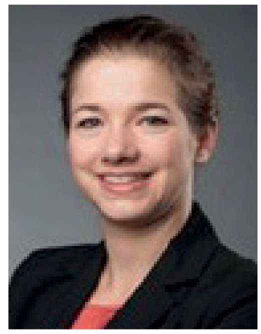


Fig. 1: The macrocyclic host cucurbit[8]uril acts like a molecular "hand-cuff" and ties aromatic donor and acceptor molecules in a stacking arrangement together.

With the YIN Grant, we aim to establish a systematic approach to determine the energy level offset relevant for charge transfer processes in such supramolecular complexes. An important aspect of the project is also to provide the data in a publicly accessible repository following the FAIR principles.

Dr. Frank Biedermann
chemistry

Frank Biedermann's group has expertise in the chemical synthesis of macro-cyclic systems and dyes which form functional supramolecular complexes. They are used e.g. for optical sensing applications in water or biofluids. The group has also developed the open-access repository *SupraBank.org* which allows to deposit supramolecular interaction parameters, including those needed to describe self-assembled donor-acceptor complexes of interest in this project.

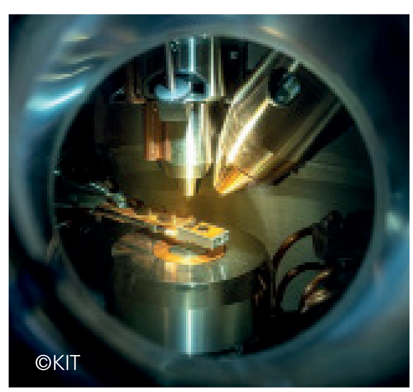


TT-Prof. Julia Maibach
energy

Julia Maibach in turn is an expert in photoelectron spectroscopy characterization for energy materials. With this powerful surface science technique, it is possible to obtain both qualitative and quantitative composition information of surfaces and interfaces. Using UV light for excitation, even electronic information such as the position of the relevant donor levels for charge transfer processes can be determined.

We started with a defined supramolecular system based on cucurbit[8]uril as host with indole and methyl viologen dichloride as donor and acceptor (see Fig. 1). At first, we characterized the individual components and in a next step the mixtures of host, donor, and acceptor. Different approaches to fabricate thin films were investigated until homogeneously coated surfaces were preparable. However, due to poor electronic conductivity of the obtained thin films for the analyses, we ran into experimental problems which could not be solved during the duration of the YIN grant. Regardless of this obstacle, we are undeterred bridging the gap between (organo)chemical and physical data and both groups will continue working together.

Moreover, we have identified key parameters that are essential to be stored for X-ray and UV photoelectron spectroscopy and introduced the option to report them into the *SupraBank* interface. Finally, the option to bundle data packages on *SupraBank* has been implemented.



Analyzing chemical and electronic information of a sample within a photoelectron spectrometer.

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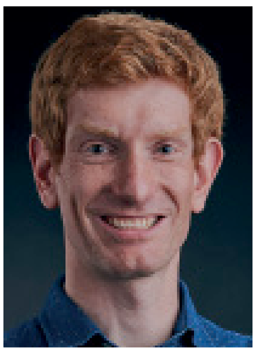
YIN Grant paves the way for Horizon 2020 project on Cardiac Simulations

Cardiovascular diseases are the most frequent cause of death worldwide. Cardiac arrhythmia, disorders of the heart's electrical synchronization system, give rise to half of them. To overthrow technical limitations in simulation, biomedical engineer Axel Loewe joined forces with Hartwig Anzt and his team who specialize in algorithms for high performance computing. Together, they decided to tackle the challenge of designing algorithms and software that are capable of simulating the electrophysiology of the human heart on cellular level. Starting out with a YIN grant, the effort soon evolved into something much larger: a joint Horizon 2020 project together with 9 partners from 6 European countries.



Dr. Axel Loewe
biomedical engineering

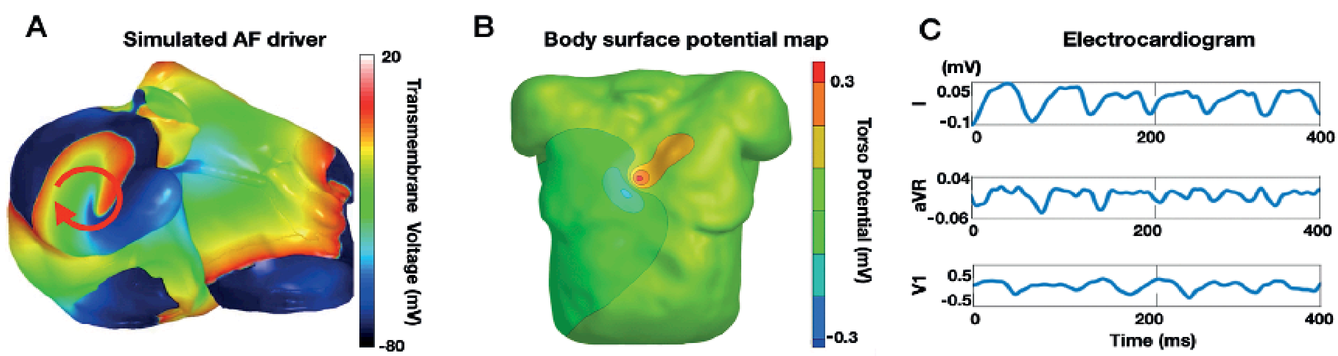
Computer models are essential to understand the behavior of the human heart and its diseases. Like the openCARP simulation framework co-developed by Axel Loewe and his team, they are already very sophisticated and widely used. However, current models are not powerful enough to take the heart's 2 billion (!) individual cells into account. They, therefore, assume that hundreds of cells are doing approximately the same. Due to this limitation, existing models cannot represent the events in aging and structurally diseased hearts. In both cases, reduced electrical coupling leads to large differences in behavior between neighboring cells – with possibly fatal consequences.

After getting promising early results on accelerating the simulation workflow, Axel Loewe and Hartwig Anzt teamed up with 9 partner institutions from 6 European countries and successfully applied for the MICROCARD project. From the Horizon2020 EuroHPC initiative, they received a total of 4.3 million euros in funding.

Dr. Hartwig Anzt
mathematics

Cell-by-cell modeling of the heart poses a mathematical problem that is 10,000 times larger and much harder to solve than what has been done so far. A challenge that needs to be addressed by exascale supercomputers, which will be more powerful and probably run on ultra-parallel computing elements like graphic processing units.

Even though the MICROCARD project is a multi-national project, the research groups of the YIN members are in the spotlight: The openCARP software co-developed by Axel Loewe at the Institute of Biomedical Engineering will be used as central modeling framework. Moreover, the Ginkgo software ecosystem, Hartwig Anzt developed at the Steinuch Center for Computing will provide the basis for developing the powerful numerical methods that are necessary to realize the large-scale cardiac simulations.



A simulated episode of atrial fibrillation, the most common sustained cardiac arrhythmia: The transmembrane voltage gradients in the heart (A) lead to an electrical field on the body surface (B). The time course of the electrical potential at electrodes on the body surface are visualized in the ECG (C). (Fig.: Luongo et al., Cardiovascular Digital Health Journal 2021;2:126-36. doi:10.1016/j.cvdhj.2021.03.002)

Continually towards Leadership Excellence

Insights from the tailor-made professional development program exclusivly for YIN members

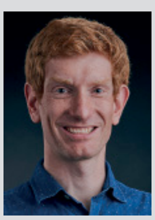
How to acquire DFG at KIT – full egilibility and simplified procedure since July 2021
by Dr. Thomas Sheppard, KIT JRG

The German Research Foundation (DFG) offers a range of funding opportunities which are relevant to scientists from postdoc level all the way to established professors. For junior group leaders and those without permanent positions, a particularly attractive entry point is the 'Sachbeihilfe' or 'individual grant' program. This typically provides sufficient funding for a 3-year PhD project plus materials and travel expenses, thus, offering an excellent opportunity to establish a small research group. The funding is normally not restricted to a specific topic or call for proposals, meaning virtually any high quality research of fundamental scientific importance can potentially be supported. Even better, first time applicants (typically junior researchers) are particularly encouraged to apply and are given special consideration during the selection process.

Another alternative is funding through a dedicated research program, such as DFG Priority Programs ('Schwerpunktprogramm' or SPP), or Collaborative Research Centre (CRC). Setting up such a program is definitely out of scope for a junior scientist, and funding through these programs is therefore strongly dependent on the topic and the background activities of established research groups at KIT. On the other hand, if you are lucky enough to find an SPP or CRC proposal aligning with your individual research, these offer an excellent opportunity to enter a larger research framework with other groups. This in turn provides fantastic opportunities to network and collaborate with scientists working in neighboring fields, but not too far removed – given the central research focus.

Previously, applicants from Campus North or the large scale research sector of KIT encountered additional restrictions when applying for DFG funding. Luckily, however, in July 2021 the DFG and KIT agreed to simplify requirements, with the result that all KIT scientists are now able to apply to DFG funding schemes without additional restrictions as long as the general eligibility conditions are met. The best way to acquire further information, discuss proposal ideas, or check eligibility is simply to call the relevant contact person at DFG. They are in general very happy to discuss and advise at any stage of proposal preparation. They also direct applicants to the most appropriate funding program.

YIN Certificate *Academic Leadership*
After various seminars, workshops, and coaching – mounting up to 200 academic units – Axel Loewe and Aiko Voigt have proven themselves as exceptional leader personalities. At the hybrid YIN Day 2021, they were virtually awarded the Certificate *Academic Leadership* by Ernst Aumüller, head of the Leadership Personnel and Top Management section at the Service Unit for Human Resources Development and Vocational Training.



„I think it is really a great program because it gives so many impulses to reflect during the seminars and in personal exchange with peers. In contrast to many other programs, a key distinguishing feature is the follow-up part later on that allows to check what has really changed and to further improve on it," says Axel Loewe.

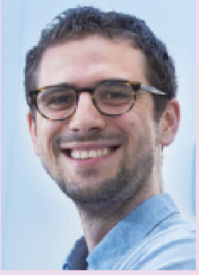
Aiko Voigt continous: "One of the many wonderful aspects of YIN is to create a space full of trust that allows for exchange between YIN members, in particular, during the workshops and courses that lead to the Leadership Certificate. Learning from others as well as from professional trainers has proven extremely valuable for me."

ERC Support Package: Workshop, Individual Training, Peer-Coaching
by Dr. Dominic Bresser

Specially for members, YIN has for the first time organized the workshop "How to plan and write a competitive proposal for ERC Starting and Consolidator Grants" in 2020, thus complementing the offers of the Research Office at KIT. As a consequence, the number of applicants for these two grants of greatest reputation in Europe has been impressively high this year – resulting in six successful propsals reaching the second stage.

To further support all successful applicants and to best prepare them for the second stage, i.e., the presentation and interview, YIN has provided an extensive support package. This included an exchange with previous successful applicants, YIN-internal coaching and critical analysis of the presentation by specialized coaches, as well as the organization of an intensive and mutually supportive peer exchange among the successful applicants. In fact, there could have been hardly any better preparation for the second stage, especially when attending also the trainings provided by the Helmholtz Association and the National Contact Point ERC.

Digital Self-Marketing – Twitter your Science
by Dr. Philip Willke



Gaining visibility is crucial for young academics to show independence, to extend one's academic network and to boost the next academic career steps. It goes without saying that digital visibility and self-marketing is getting more and more important – in particular during and post COVID19. The twitter coaching was a follow-up to the digital self-marketing in science workshop. The latter dealt with several platforms that allow to make our research visible online, including blogs, personal homepages, LinkedIn, Youtube or Instagram. The separate coaching however, put an exclusive focus on Twitter as probably the most important platform for scientists to interact.

The coaching took place – of course – online. Time-efficiently but also intense, a small groups of 4 participants met with our Twitter coach three times for 1.5 hours each via zoom. Getting down to business, the homework between the sessions allowed to use the concepts in practice right away. The homework consisted of 5 tweets that needed to be sent out over the course of the week. In the subsequent weeks the impact was analyzed using the twitter analytics tools, and each tweet was discussed with the coach and the group. In addition, we took a deep dive into all the hidden secrets of twitter: How do I use hashtags? What metrics are important? How do I use pictures best? How do I effectively increase my followers? When do I tweet? With the short time investment, the learning curve is steep and the coaching highly recommendable. The program is suitable for all YIN members and the coach is an expert in the field, that adjusted successfully to all knowledge levels of the participants.

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From Russian to German academia to industry

An interview with YIN alumna Julia Syurik, today project engineer at *Flexa Ltd.*

Dr.-Ing. Julia Syurik
Project engineer at Flexa Ltd.

Julia Syurik followed an exemplary academic career: In 2012, at the early age of 25, Julia Syurik already got her doctorate in material engineering at the Southern Federal University in Russia. During her studies, she had visited the Eindhoven University of Technology and the University of Glasgow, before settling on Germany as the country of choice for her postdoc. She identified the *Biomimetic Surfaces and Scanning Probe Technologies* group at KIT as the one best suited for her research. She joined as a guest scientist and soon after successfully acquired funding from the Postdoc Program of the Helmholtz Association in 2013. Subsequently, she built up and led an independent KIT junior research group until 2017, when she accepted a position in industry. Why, at the age of 30 still a really young but, nonetheless, already experienced scientist, did she leave academia?

Why did you choose to join KIT?
I decided to come to Germany in autumn 2011 after a short vacation in Berlin. I just fell in love with the country and its people – fair, open-minded, well educated, and friendly. Then, in parallel with writing my PhD Thesis, I began to look for research groups in which I would like to work as a postdoc. The *Biomimetic Surfaces and Scanning Probe Technologies* group at the Institute of Microstructure Technology (IMT) awoke my strongest interest. So, I sent my CV and cover letter to the head of the group, Prof. Hendrik Hölscher, although there was no official position open. After a very short time and a Skype interview I got an offer to visit IMT for one year as a guest scientist sponsored by KIT.

Working at IMT has turned out to be very interesting and inspiring. I liked the atmosphere in the group and got some good results and further ideas to check. Thus, we started looking for opportunities for me to stay and the Postdoc Program of the Helmholtz Association turned out to be a suitable option.

What were the greatest challenges when coming to Germany?
I was lucky to find a position within weeks, but the bureaucracy took months. As Russian citizen, I needed a working visa which required a rather long list of supporting documents. Some were difficult to obtain, some I had never heard of before. For example, to get an apostille (a notarial certification in the international authentication procedure) on my engineering diploma was not trivial. The German Academic Exchange Service in Moscow helped me with getting a special visa for scientists, which did not require knowledge of the German language.

I found a position within weeks, but the bureaucracy took months.

How do the German and Russian academic systems compare?
What I can clearly say is that, at Russian universities, there is still quite a lot of permanent positions for lab personnel, scientists without teaching load, and teaching scientists. The basic salary is lower than in Germany, but it can be topped up by acquiring research grants. Thus, scientists are highly motivated to write proposals but have much less stress to lose their job. As a result, the scientific community in Russia is less mobile than the European one and it is less common to teach one semester here and the next semester there.

Why did you decide to leave the academia?
It was not my active decision to leave academia. Shortly before my Helmholtz funding ended, a new head of institute came to IMT, accompanied by his own postdocs and group leaders. Obviously, they fit into his development plans for the institute way better than me or other postdocs from existing groups. Though, I am by no means implying that my contract would have been extended, had the new director not come. That's just how the situation was, and in the end there was no money for my position at IMT. Coming from Russia, I did not know that it is difficult to get a permanent position in German academia. I was assuming that if you want to stay, you could.

I was disappointed that it wasn't enough to have good ideas and do my research well. So, I wrote a couple of grant applications in a hurry, which were unsuccessful at the time. In 2017, there was no YIG Preparation Program, no KHYS Postdoc Office for guidance and support. I am very happy for the postdocs who can benefit from it now. In the end, I felt like a little burned out and lost all motivation to look for another postdoc position with the next limited contract. I also thought it was safer to start a career in industry at the age of 30 – not 40 or 50. Given the opportunity in 2017, I would have stayed and continued my research at KIT. In 2022, I believe, it was a good decision to leave.

How do the daily work and the working atmosphere differ from those at KIT?
Every company is different and I can only speak about my experience. Similarly to academia, my current position gives me the freedom to plan my day and solve technical problems the way I prefer. I have a budget for laboratory equipment and it takes less administrative effort to get it. The tasks, however, are set from above and this is different from when you work on self-set challenges in science. Nevertheless, in science it is often necessary to find funding for the project, which is also a kind of approval from above.

In industry, people work in a different rhythm – faster, a little more focused on efficiency. It struck me very much at first. Moreover, my work is more connected to the work of other departments and my expertise is required there as well. Hence, there are days when I mostly help colleagues from other departments to solve their more urgent tasks.

In industry work has a different rhythm: faster, more focused on efficiency – also across departments

Do you profit from your experience as Helmholtz postdoc and group leader?
During my time at IMT, I got my first experience as a group leader. The group members were great, motivated, self-driven smart persons

Julia Syurik in her office at the company Flexa in Hanau.

(graduate students, student assistants, and one PhD Student). Such a group is a dream of every project leader in the industry!

I also became a YIN member and could enjoy the *Academic Leadership Program*, which is a great combination of theoretical basics and practice. I find the obtained skills in communication, allocation of tasks, and influencing group dynamics very helpful for my current position. Another bonus are contacts from the Helmholtz, but also the YIN network, which one can use for work. For example, in 2021 we used IMT cleanroom facilities to analyze microstructures of some of our products.

If you could change one thing in the academic environment, what would it be?
To return permanent non-professorial positions in German academia. This would make work in science less stressful. A true motivation to work (in academic setting) should not come from the stress of losing a job, but from the love of discovery, invention, and creativity.

Would you consider accepting a position in academia again?
Not at the moment, but maybe in 20 years, if I will have an inner need to teach.

Where do you see yourself in 10 years' time?
I love what I am currently doing: part-time project engineer, part-time yoga-teacher, wife and mother. And I would love to do the same in 10 years. Maybe with a different distribution of time.

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Associate Professor in the United States

An interview with YIN alumnus, Peter P. Orth, associate professor at Iowa State University

Peter Orth has crossed the Atlantic Ocean several times before settling at the Iowa State University as Associate Professor for Theoretical Condensed Matter Physics. After getting his diploma in Heidelberg in 2007, he hopped over the Big Pond to do his doctorate at the renowned Yale University. Shortly afterwards, in 2011, he came back to Germany and soon headed his own independent Young Investigator Group (YIG) at KIT. In 2015, he moved to the United States accepting a postdoc position at the University of Minnesota before relocating to Iowa in 2016. In the interview, he talks about the different academic systems and his time as a YIN member.

Peter P. Orth
Associate Professor at Iowa State University and scientist at Ames Laboratory

What fascinates you about your research?
My research is about the theory of quantum materials: that is materials that show behavior governed by the theory of quantum mechanics. I am fascinated by quantum materials because they show effects that are counterintuitive on the one hand, but also practically relevant on the other hand. Their behavior can be used for new generations of computers – potentially quantum computers – or also the next generation of classical computers. When going to smaller and smaller length scales, the theory of quantum mechanics starts to play an important role and we need to understand it to further miniaturize devices. I am interested in fundamental research, but I find this aspect very fascinating.

What brought you to KIT originally?
At first, I mostly came to work with my postdoc advisor Jörg Schmalian. At the Institute for Theoretical Condensed Matter Physics, he worked for instance on superconductivity and frustrated magnets, which are systems where competing interactions make it impossible for all magnetic moments to be in their preferred state. Finding a compromise in quantum mechanics turns out to lead to an extremely rich set of phenomena such as emergent relative ordering of moments and spin liquids. In retrospect, KIT had a lot to offer like the young investigator groups (YIG) for which I applied within the first year. It was funded by the first Excellence Initiative and as KIT lost the status in 2012, I only got funding for three years. After that I moved on to do another postdoc at the University of Minnesota.

Why did you decide to go back to the U.S.?
I did my PhD at Yale, so going back to the U.S. was not such a big step. I just felt that this postdoc in Minnesota was a great opportunity to continue. After being a KIT YIG leader, I really felt like either securing an independent position in the near future or going to industry instead. I also applied for the Emmy-Noether program during my time in Minnesota. So I was not planning to never come back.

However, I got offered an assistant professorship with tenure track at Iowa State – a very attractive place in my field due to the Ames Laboratory, one of the Department of Energy National labs. At that time, the concept of tenure track was not really common in Germany and it appealed to me.

A tenure track position in the U.S. was more attractive than leading an Emmy Noether group.

This was the main reason why I chose to stay in the U.S. and declined the interview for the Emmy-Noether group. Leading an Emmy-Noether group is a great opportunity, but for me it would have meant that after four to five years, I would have had to leave again and find myself in a similar situation as I was in before – still looking for a permanent position. I wanted at least an option to stay.

How do you compare the German and U.S. academic systems?
Most of my experiences, I now made with the U.S. system. Thus, I can only say that I had a really good experience at KIT as a postdoc. Though, it was clear that it was a temporary position. However, I knew people who have been looking

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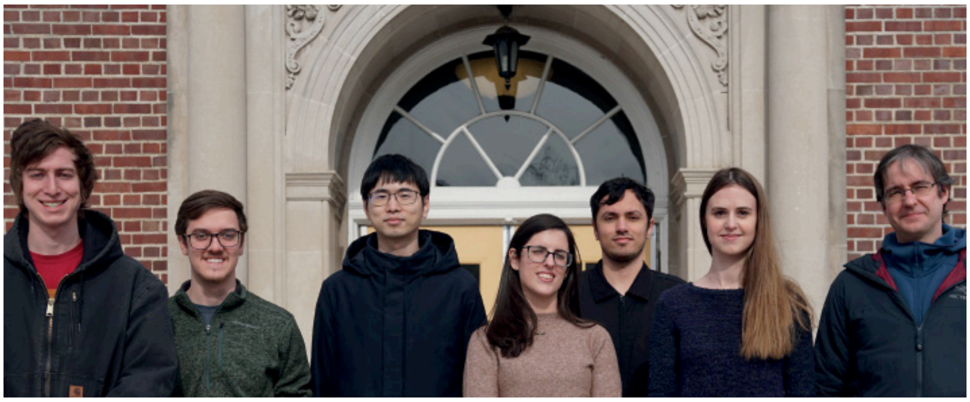


Peter Orth and his research group in front of Physics Hall at Iowa State University. Fltr: Daniel Buser, Benjamin Burdick, Yihua Qiang, Thaís V. Trevisan, João C. Getelina, Ana-Marija Nedić, Peter P. Orth

for permanent positions in Germany for a long time: eventually getting one or not. It is easier if the system helps you to make the decision to stay or move on. For me, the U.S. system was an answer to that. I think the tenure track is a really great thing. One aspect of it is that your department wants you to be successful, since a tenure track professorship is an investment for them. They do not tell you on day one to find a position somewhere else in the next 5 years. That was my experience when I interviewed in Germany for a temporary group leader position. I also enjoy the departmental structure in the U.S., which is very democratic. Everybody has one vote.

What about funding?

For sure, you need to apply for funding. The university gives you a start-up funding, which in my case as a theorist generously included a postdoc for 2-3 years and one graduate student for 5 years, some travel money and some money for buying computers. If you need to buy equipment, that is part of the negotiation. Still, it is expected for tenure and also to sustain your group to apply for grants. This is my daily life. I apply for all sorts of grants, typically for 1-2 grants per year.

Was it different to build up your new group?

It is hard to compare. KIT is a very good place for students. During my time there, the PhD students were excellent, absolutely terrific. At Iowa State University, the undergraduates have very different levels of knowledge from high-school: When you are from Iowa, you basically come here, so we get a broad spectrum. As a teacher I find this very interesting and stimulating to have such a diverse audience. For research, I have been lucky to get really good undergraduate students via the university honors program. Concerning graduate students, it is very international here. We have many people from Asia. I guess this is generally a big pool of applicants in the U.S.

How did leading a YIG at KIT prepare you for a professorship?

Very well indeed. I also want to highlight the professional development offered by YIN. It really stands out. Especially, the input from the *Leadership Excellence* workshop was a real asset and still is to me now. It emphasized the responsibility it brings to be a group leader and we practiced several key techniques of good leadership: how to take a bird's view of a situation, how to coach students, how to give and receive feedback, how to resolve conflicts. It helped me a lot to build up my group here.

Anything that could be improved for young scientists in Germany?

Well, I do not understand the issue of officially giving young principal investigators the responsibility of supervising their own PhD students. My postdoc supervisor gave me all the support and academic freedom I needed. What I criticize is the official status, which was tied to having completed the habilitation at the time. I always felt that it was unfortunate not to be one of the official advisor for the students I paid for and worked with every day. At that time, the status of KIT Associate Fellow was not open to KIT YIGs, but I think this changed when I was about to leave.

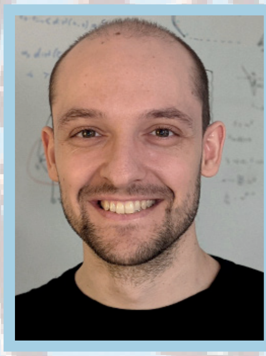
Where do you see yourself in 10 years?

Hopefully not in the middle of a pandemic. Academically, I am very happy here at the moment. Iowa is, however, very remote from my family in Germany. It will depend on how much these private reasons will develop and also on whether there are attractive opportunities.

New YIN MEMBERS

TT-Prof. Moritz Dörstelmann
Institute of Design and Building Technology

Tenure Track Professorship
Digital Design and Fabrication



TT-Prof. Thomas Bläsius
Institute of Theoretical Informatics

Tenure Track Professorship
Scalable Algorithms

TT-Prof. Schirin Hanf
Institute of Inorganic Chemistry

Tenure Track Professorship
Molecular chemistry

Dr.-Ing. Michael Färber
Institute of Applied Informatics and Formal Description Methods

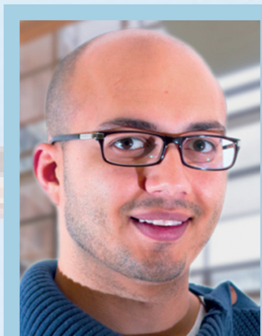
Deputy Professorship
Web Science

Dr.-Ing. Tobias Käfer
Institute of Applied Informatics and Formal Description Methods

Deputy Professorship
Artificial Intelligence

TT-Prof. Christoph Klahn
Institute for Micro Process Engineering

Tenure Track Professorship
Additive Manufacturing for Process Engineering



Dr. Rudolf Lioutikov
Institute for Anthropomatics and Robotics

Emmy Noether
Robot Learning

JProf. Reza Maalek
Institute of Technology and Management in Construction

Junior Professorship
Digital Engineering and Construction

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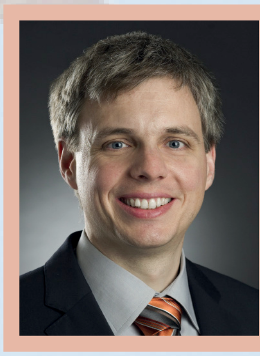
Dr. Alexander Knebel
Carl-Zeiss Foundation Junior Research Group Leader
Friedrich Schiller University Jena

previously
KIT Jr RG
Metal-Organic Framework Membranes



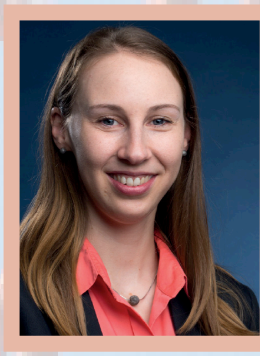
Prof. Christian Greiner
Professor for Additively Manufactured Components and Microstructure Design
KIT

previously
Emmy Noether
Materials Tribology

ongoing
ERC CoG

Dr. Roswitha Zeis
Group Leader
Helmholtz Insitute Ulm

previously
Helmholtz Young Investigator Group
Electrochemistry

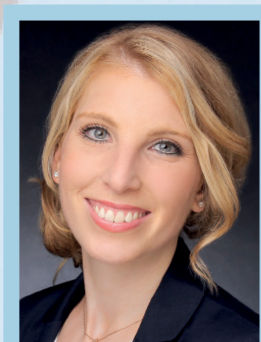


Prof. Nicole Stricker
Professor for Operations Management and Engineering Principles
Aalen University

previously
KIT Jr RG
Production Systems Planning

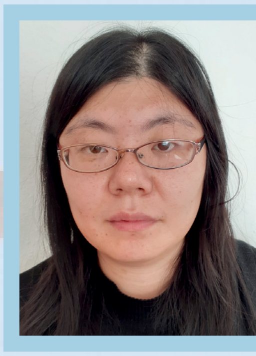
TT-Prof. Nevena Tomašević
Institute of Applied Geoscience

Tenure Track Professorship
General Geology



Dr. Claudia Niessner
Institute of Sport and Sport Science

Margarete von Wrangell Fellowship
Health Related Fitness and Physical Mobility in children



Dr. Ruming Zhang
Institute for Applied and Numerical Mathematics

KIT Junior Research Group
Waves in Periodic Structures

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Editorial office
Karlsruhe Institute of Technology (KIT)
Young Investigator Network (YIN)
Straße am Forum 3, Bldg. 30.96, R. 010
76131 Karlsruhe

Editorial board
Dr. Dominic Bresser
Dr. Thomas Sheppard
Dr. Philip Willke
Janine Pallasch
Lilith C. Paul
Gunnar Seemann

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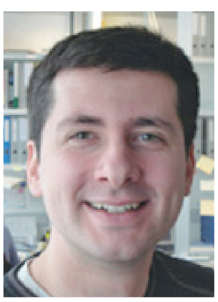
What we stand for

YIN connects independent junior research group leaders and junior professors on an early stage of their scientific careers. As in 2008, when YIN was initiated, we, the members, still occupy a very critical career niche between postdocs and tenured professors. As YIN, we speak with a single voice and our voice is heard. For example, YIN representatives are involved in the shaping of the upcoming Overarching KIT 2025 strategy, which aims to bring clearness into career perspectives of young scientists besides other issues. The continued existence of YIN is a testament to the role it plays within the academical hierarchy and to the services it provides for members. Our mission, comprised of the following three statements, has and will continue to guide YIN.

JProf. Dr. Hartwig Anzt
Representative

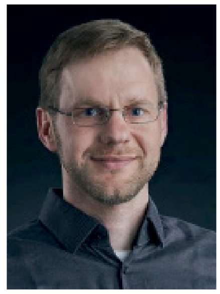
TT.-Prof. Dr. Katharina Scherf
Representative

We encourage each YIN member to become a better group leader. YIN members can take part in continuing education courses tailored to the needs of young group leaders in cooperation with PEBA. These courses include topics such as developing leadership abilities, improving research and teaching performance, as well as personal coaching. Rather than a static offering of courses, our members suggest and vote on desired themes to ensure that these courses directly meet their needs.



Dr. Zbigniew Pianowski
Alumni

We represent the interests of independent young investigators at KIT. Young group leaders and untenured junior professors face an uncertain future given the changes in higher education politics, the academic landscape and leadership priorities at KIT. YIN represents our interests by working with and persuading the administration to best define our official standing, the supervision of doctoral students, and other rights and responsibilities. YIN has also hosted discussions with representatives from politics and various funding sources to understand and shape the policies affecting our members.



Dr. Christian Grams
Finance

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 can discuss research opportunities.

Dr. Dominic Bresser
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. To that end, this journal has been prepared to provide you with an update on our members and activities.

YOUNG
INVESTIGATOR
NETWORK

Contact

Karlsruhe Institute of Technology (KIT)
Young Investigator Network (YIN)
Straße am Forum 3, Bldg. 30.96, R. 10

76131 Karlsruhe

Phone: +49 721 608 46184
Email: info@yin.kit.edu
www.yin.kit.edu

Issued by

Karlsruhe Institute of Technology (KIT)

President Professor Dr.-Ing. Holger Hanselka
Kaiserstraße 12
76131 Karlsruhe, Germany
www.kit.edu