Karlsruhe Institute of Technology

YINSIGHT 2023

Highlights from the Network of Young Research Group Leaders, Junior Professors, and Tenure Track Professors at KIT

Hot Topic
Reliable Careers in Changing Science System

Scientific Highlights
20 ERC grantees among YIN members & alumni
Science | Heisenberg | Nature Geoscience

YIN Statistics 2022/23
14.9 million euro subsequent funding
298 semester teaching hours per week

Editorial

Dear reader,

In 2023, the YIN turned 15! It is remarkable to see how YIN has grown as an independent association of young research leaders who care about actively shaping the future – not only for themselves, but for generations of young investigators to come. We like to dedicate this issue to Prof. Emeritus Detlef Löhe, former Vice-President for Research at KIT, who as Founding Father developed the concept for YIN and made it happen. Thank you!

In 2023, the draft for a reformed Academic Fixed-Term Contract Act was published and caused a lot of uncertainties. Therefore, the question of "Reliable Careers in a Changing Science System" was and still is as relevant as ever. It was widely discussed at the 15th YIN anniversary celebration and is also presented as the *Hot Topic* in this issue. Among the Acting President of KIT Prof. Oliver Kraft, the President of the Helmholtz Association Prof. Otmar Wiestler, the Vice-President of the German Research Foundation (DFG) Prof. Karin Jacobs, and YIN Alumna Prof. Kathrin Valerius, the challenges and opportunities were reflected from quite different angles.

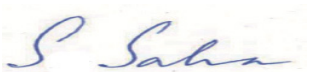
Moreover, we present the scientific highlights achieved by YIN members in 2023 showcasing the 20th ERC grant project in YIN history and the fourth Heisenberg professorship. In addition, three W1 professors received *KIT Faculty Teaching Awards* for their outstanding contributions – one of them was further honored by the *State Teaching Award 2023*.

In the facts and figures section, we take the 15th YIN anniversary as an occasion for a five-year-review and compare the current figures to those from the tenth anniversary in 2018. You might be surprised by some of the results.

Furthermore, we introduce three YIN grant projects, report from the YIN professional development program, and learn from the *Alumni in Portrait* how he fares with an ATTRACT research group at Fraunhofer. Last but not least, you can get to know the new YIN members and alumni – the latter raising the W2/W3 appointment ratio of former YIN members to 50%.

We wish you an enjoyable read!

The PR Committee


Dr. Somidh Saha


Dr. Susanne Benz


Dr. Simon Fleischmann


TT-Prof. Benjamin Schäfer


TT-Prof. Philip Willke

Contents

Dear members of the
KIT Young Investigator Network,

It has been a while now since I have worked on the concept for YIN, supporting its development and being the contact person for its members on the KIT Executive Board. It all began in 2005, during the first phase of the Excellence Initiative, with the submission of the draft proposal. In the outline of our future concept, YIN was an essential building block for the promotion of early career researchers at KIT.

The rationale behind creating YIN was the experience that the step into the responsibility for one's own junior research group is an important but also quite a difficult one. In addition to the necessity of further developing your research profile, come the challenges of supervising doctoral candidates and students – e.g. as part of a master thesis –, to acquire third-party funding, and to fulfill administrative tasks. Good advice from experienced colleagues is very welcome, but it is often not enough: aspects that are of great concern when starting a research group might have become just a matter of course to them. And this is precisely why KIT in its future concept introduced another idea which has proven to be a great success and a pioneering effort since: the Young Investigator Network, the YIN.

The basic idea is that scientists who have successfully founded a junior research group are best suited to give advice to others who are facing this hurdle or are about to overcome it. Since its foundation in 2008, YIN has been a key strategic component of KIT's promotion of young scientists: it brings together junior professors and tenure track professors alongside the heads of Emmy Noether, Helmholtz, and other funded junior research groups. The exchange between young people in the early stages of their scientific careers and the mutual support and advice given in this context are the key elements of YIN.

YIN has grown within KIT and with KIT and is a visible sign of a comprehensive willingness to change and of living this change. The network

stands for the self-organized and interdisciplinary representation of the interests of YIN members and represents the interests of junior group leaders and junior professors as a whole. YIN – represented by its board – presents its concerns to the KIT Executive Board via the Vice-President for Research as a direct contact person. YIN sets standards in the promotion of young scientists at KIT, their early independence, but also in strengthening the research profile of KIT.

Looking back on fifteen years of YIN is looking back on a success story. YIN is an element that characterizes KIT. An idea that was put on paper by a small core team as part of the full proposal for the Excellence Initiative has become a living reality that sets an example for the cooperation and representation of interests of junior professors and junior research group leaders in the German science system and beyond.

For me personally, working with YIN has always been enriching and stimulating. I am convinced that YIN, with the creativity, enthusiasm, and impartiality of its members, will continue to make a significant contribution to the future progress of KIT.

Professor Emeritus Dr.-Ing. Detlef Löhe
Former Vice-President for Research at KIT
Founding Father and Honorary Member of YIN

Reliable Careers in a Changing Science System

At the 15th YIN anniversary, stakeholders discussed the future of young talents in Germany

The German science system is in motion: new excellent universities have appeared, the WissZeitVG is under reform, and buzz words like work-life-balance, new work, or diversity have reached the university halls. At its 15th anniversary celebration, the Young Investigator Network (YIN) asked what all this means for academic careers in Germany. The two patrons of the event Acting President of KIT Oliver Kraft and the President of the Helmholtz Association Otmar Wiestler stepped on the podium to publicly address these issues. Together with Karin Jacobs, Vice-President at the German Research Foundation (DFG), and Kathrin Valerius, former YIN speaker and professor at KIT, they pictured a future for young talents in Germany.

Acting President of KIT
Prof. Oliver Kraft

"Young talents are the backbone and the most valuable resource of science."

How does the German science system need to adapt to stay competitive – do we need more permanent positions?

Jacobs We have permanent positions for permanent tasks. You might be a lab manager or expert for a large-scale research facility. In such a position, you are reliant on your boss. You would have a permanent position, but everyone has to think carefully about which career prospects are right for them.

Valerius I read about a really interesting concept proposed by the Volkswagen Foundation. They would like to break the rigid connection between third-party funding and temporary staff by introducing and giving incentive to introduce mixed teams where permanent staff and temporary staff work together on a funded project. This would reduce the number of staff working temporarily on a project basis and at same time give new purpose and new room for development to scientists on permanent contracts.

Kraft To compete on an international level, we need to attract young talents at the right stage of their career. From my point of view this would be after their first or second postdoc phase. The German system, in my opinion, is not too compatible with that. There are enough postdocs coming to Germany who can't find the right career options. Especially for international scientists coming from abroad, it is difficult to find their way among concepts that are unfamiliar to them – e.g. Habilitation, Akademische Ratsstelle, Außerplanmäßige Professur.

Hence, we introduced the tenure track at KIT and I think we need more strategic instruments like that. So, I would suggest to shift more money from "Mittelbau" towards having more tenure track opportunities on the professorial level. 5% of the university staff budget would suffice to make that change happen. This view needs to be debated of course as it is more or less the exact opposite of what the "I'm Hanna" initiative stands for. But, it is a debate that we would need to have.

President of the Helmholtz Association
Prof. Otmar Wiestler

"Reliability and competitiveness are the two pillars of a working science system."

Wiestler I think it is unrealistic to assume that we will be able to significantly increase the number of permanent positions. We also need to assure flexibility and a certain turnover. Nevertheless, we may increase the number of permanent positions to some extent according to clear rules. We probably need more positions for teaching and for experts serving highly specialized tasks, like taking care of data management or infrastructure.

>>> contents <<<

I find it most important to offer sound career advice. In the first four years as a postdoc, it is essential to come to a decision for yourself. And for those who enter an academic career, we must have clear rules: transparent and competitive career paths, stable funding, independence, and there must be a very transparent procedure on how to achieve tenure and a full professorship.

Flexibility is also important and we must recruit internationally on all levels. Science is global. So, we must improve reputation and marketing. We have invested quite heavily into the German research system over the last 20 years. With an excellent environment and often more stable funding than in the USA. If we couple this with active career development and clear rules for tenure options, we will be competitive in the end.

Vice-President of the German Research Foundation (DFG)
Prof. Karin Jacobs

"We have one of the best environments in Germany for conducting research."

Jacobs In the expert commission during the last round of the Excellence Strategy, we talked a lot about the German research system. Many international colleagues were amazed to learn about the details: what you can apply for according to certain rules without being content-dependent on funding bodies and their specifications. They also couldn't believe that we don't have tuition fees in Germany. And these were people who were supposed to evaluate our universities and their proposals, and they didn't know that. So these are, for example, issues that we need to highlight: communicating how science is done here in Germany!

We have statistics that show that every euro invested in the system pays for itself, and they show that we are globally competitive. But somehow the world doesn't know that. We have actually done some international advertising with the Excellence Strategy. This will not be reflected immediately in the lists of the best universities worldwide – we still have to work on that. But I am certain that we have one of the best environments in Germany for conducting research – and have had for many years.

What impacts do you anticipate from the drafted reform of the German Academic Fixed-Term Contract Act?

Valerius The law is not meant to design the academic system, it is meant to regulate contract periods. And there I can see arising difficulties, especially, in running young investigator groups – W1 professorships included – that are fixed term by definition. I am not so much worried about the group leader positions; they usually have funding for five to six years. I rather worry about how the group is supposed to operate. The responsibility and the independence of group leaders should be intact so that they are able to recruit their own team.

YIN Alumna
Prof. Kathrin Valerius

"Junior group leaders on fixed-term contracts cannot give their staff tenure perspectives."

This means that they have to find postdocs to be employed on fixed-term contract who would ideally support them for the duration of the group. However, being on fixed-term contracts themselves, junior group leaders cannot give their postdocs a tenure perspective after four years. While minimum contract terms and lawfully secured extension opportunities provide security and planability for doctoral students and postdocs, these terms might easily get in conflict with the duration and funding opportunities of

Reform of the German Academic Fixed-Term Contract Act
The draft from June 2023 proposes i.a.
- Three year minimum contract term for doctoral students + extensions, e.g. for parental leave, caring duties, etc.
- Two year minimum contract for first postdoc position
- Maximum of four years on fixed-term contracts after doctorate

>>> contents <<<

fixed-term research groups. Hence, junior group leaders will need the support of their institutes to staff their team, and in particular to remain competitive in attracting the best talents as their team members.

f.l.t.r. President of the Helmholtz Association Prof. Otmar Wiestler, YIN Alumna Prof. Kathrin Valerius, YIN Spokesperson TT-Prof. Julian Thimme, Vice-President of the German Research Foundation Prof. Karin Jacobs, Acting President of KIT Prof. Oliver Kraft, YIN Spokesperson TT-Prof. Nevena Tomašević at the YIN Day

Jacobs As a professor, I find all this challenging, too. I have to manage around with the different contracts and move this person from here to there, from basic budget to third-party budget and so on. What politicians and unions might consider is that with permanent contracts, you are usually not making a career in academia. It is not a career path. After one or two postdoc positions, you should aim for the next level – get a junior grant, a junior professorship, a junior research group, and work on getting a qualification for a professorship.

"After one or two postdoc positions, you should aim for the next level."

Kraft To me it is, in a certain way, a German phenomenon: Everyone is talking about deregulation and then one comes up with an idea that makes things more complicated but doesn't help. Not everybody will have the opportunity to have an academic career. That cannot be changed by law and should not be changed by law. We as universities should become more transparent and more reliable. We shall not put all the risk on young researchers.

Wiestler The Helmholtz Young Investigator Group was established 20 years ago. Our first step was to make sure that every young researcher who successfully leads a Young Investigator Group gets a tenure option. The question is what real tenure implies. Those who perform at a high level, reach their goals, and become a rising star in their field, should receive a full professorship and an independent research division at the end of the group period. This must be based on a fair and international peer review. Those who do not achieve this and this would be our proposal for the new law, should get a permanent staff position. They have done extremely valuable work, they have made important contributions to the Center and to the Helmholtz program. This achievement deserves a permanent position.

Coming back to the law, I agree that repeated short-term contracts should be a thing of the past. Another thing of the past should be someone who is in his or her late thirties and still on a temporary contract. To avoid this, we simply need to apply rigorous career advice. I would see no problem to even define it in a law to have mandatory, professional, competent career advice. Everyone, after four years of working as a postdoc should make up his or her mind for or against an academic career.

"We need rigorous career advice – mandatory, professional career advice."

How to increase the reliability of academic careers for young scientific leaders?

Jacobs Most important, in my view, is early mentoring. Ask people you trust for their opinion whether they see you working in science. Ask several people and find out what a typical career in your field is like. Don't just sit on the "position of an academic servant" (Akademische Ratsstelle) and wait for your professor to get the emeritus status. When I was studying physics at Konstanz University, it was made very clear to us what to do: publish some good research papers, coordinate an international workshop – possibly embedded in a Collaborative Research Center. Invite

>>> contents <<<

the big shots in the field, talk to them. Make an effort to ensure that your name is remembered and you start to build up your own network.

Then, write a topical review article e.g. for the Physik Journal. Make yourself known, do good research, and you will be recognized. There was a large number of Konstanz physicists of my generation who became professors and work for instance in Excellence Clusters now. This should be clearly communicated for each of your communities: How a career in your field typically succeeds. Ask around among your colleagues!

Kraft I would like to agree. It was also the most important part for my career to have two really strong mentors. For me, the question is how an organization like KIT can give the incentives for senior staff to take on such a mentoring role. A few years ago, we did an analysis at KIT and found out that several junior research groups depended to some extent on the scientific community, but more on a few professors, who made it their goal to support young investigators. This should not happen arbitrarily. We need incentives to support an institution-wide mindset that hosting junior research groups is beneficial for all parties involved.

How can academia become more accomodating to parents and international scientists?

Wiestler Life is individual and we have to respond to this with flexibility. Every format should be possible as long as it works for the family and for the institution as well. Another challenge is to consider the impact of part-time work or joint responsibilities in evaluation procedures. So far, when we compare candidates, we often refer to absolute numbers. We count the scientific publications or the amount of money from third-party funding. Though, in the end, it is about identifying people who are quick, who are smart, who are active and have the potential to achieve great things in science under quite different circumstances.

Kraft I fully agree with that. However, I would also like to point out that you have to be very dedicated when you go for an academic career. You should really enjoy doing science. If you do so, you would not leave science behind at the institute, but you might think about your next experiment while watching your children in the park. I think it is a privilege to do research and even get paid for it. If you don't feel that way, an academic career may not be the right path for you.

"For an academic career, you have to be very dedicated. For me, it was a privilege to do research and even get paid for it."

Jacobs When I came back to academia after two years in industry, I had three calls for a professorship: in Cambridge, at the Technical University Munich, and at Saarbrücken University. Saarbrücken had the best offer for me – for what I needed at that time. Among professors, women on average have children much later in their career. Usually in their mid-thirties when the biological clock is already ticking. In the first baby year, we spent half a salary on a baby-sitter, then, we had a wonderful Kindergarten. Therefore, take your privat life seriously and if it is important for you, then select a university that offers good childcare, ideally, you also select a federal state that offers daycare in schools. These are competitive advantages that are not necessarily named in the contract you sign.

Valerius You can only build a large, successful network when you get around, when you see other parts of the academic system worldwide. Hence, you need a minimum of mobility, especially early on in your academic career, to broaden your own horizon on how things work in different parts of the world. However, I welcome that funding agencies take a look at the individual profile instead of relying on strict criteria like a two year postdoc stay abroad.

"You need a minimum of mobility especially early on in your academic career."

>>> contents <<<

ERC Grantees from YIN

ERC STARTING GRANT
2-7 years after PhD | up to 1.5 million euro

2023: Philip Willke
On-Surface Atomic Spins with Outstanding Quantum Coherence

2023

2022: Julian Quinting
Advancing Subseasonal Predictions at Reduced computational Effort

2022

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

2021

2021: Katharina Scherf
Tracking Immunoreactive Peptides from the Grain to the Gut and Beyond

2020

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

2019

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

2018

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

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

2016

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

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

2011

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

2009

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

ERC CONSOLIDATOR GRANT
7-12 years after PhD | up to 2 million euro

2022: Frank Biedermann
Development of SupraSensors and Assays for Molecular Diagnostics

2022: Ulrich Paetzold
Laminated Perovskite Photovoltaics: large area processing of durable, high efficiency thin films

ERC SYNERGY GRANT (2-4 researchers)
2020: Benno Meier (YIN), J. Korvink, et al.
Highly Informative Drug Screening by Overcoming NMR Restrictions

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

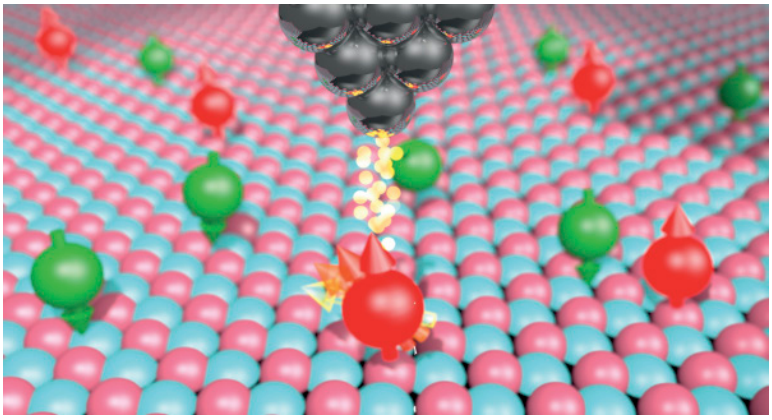
2016: Martin Weides
(University of Glasgow since 2018)
Interfacing Spin Waves with Super-conducting Quantum Circuits for Single Magnon Creation and Detection

>>> contents <<<

ERC Starting Grant for Quantum Nanoscience

Philip Willke on ATOMQUANT – On-Surface ATOMic Spins with Outstanding QUANTum Coherence

The stability of quantum bits or qubits is a fundamental yet challenging aspect of quantum computing and quantum sensing and is often shortened by interaction with the environment. The ATOMQUANT project, led by TT-Prof. Dr. Philip Willke at KIT's Physikalisches Institut (PHI), is set to address this challenge by significantly enhancing the coherence times of magnetic quantum states on surfaces. The project's goal is to establish a new quantum architecture based on atomic force microscopy (AFM) for quantum information processing and magnetic sensor technology on the atomic level. The European Research Council (ERC) has awarded him a Starting Grant now to tackle the quantum mechanical properties atom by atom and molecule by molecule.



Graphical representation of the metal tip of an atomic force microscope, which is used to coherently drive a single spin on a surface. (Graphic: Philip Willke, KIT)

ATOMQUANT aims to harness the quantum mechanical properties of individual atoms and molecules, paving the way for breakthroughs in quantum computing and sensor technology. Quantum mechanics, the fundamental theory that governs the behavior of particles at the atomic and subatomic levels, bears challenges and opportunities. While it offers the potential for computing speeds and sensing capabilities far beyond what is possible with classical physics, the quantum world is also notoriously delicate and difficult to observe and manipulate. Quantum states can be easily disrupted by their environment, a phenomenon known as "decoherence" which poses a significant obstacle for researchers.

TT-Prof Philip Willke
ERC Starting Grant

ATOMQUANT seeks to overcome these challenges by focusing on spins – the intrinsic angular momentum of particles like electrons that form the basic units of magnetism. They play a central role in a number of quantum systems and are central to the quantum mechanical properties of individual atoms and molecules. When spins are sufficiently isolated on the nanoscale, they can keep their quantum properties and remain oriented in a given direction for a long time. Within ATOMQUANT, Willke will work on improving these magnetic quantum states on surfaces by several orders of magnitude. "The results will have the potential to bring quantum research to the atomic scale. Potential systems with outstanding quantum properties can be studied in situ and atom by atom," the physicist explains.

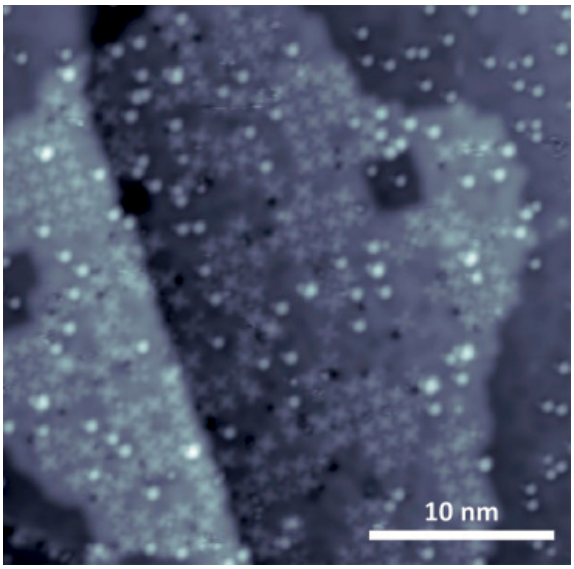
Philip Willke's expertise in scanning probe microscopy, combined with electron spin resonance, forms the backbone of this ambitious initiative. Atomic Force Microscopy (AFM) is a type of scanning probe microscopy that provides a three-dimensional profile of a surface, down to the atomic level, by measuring the force between a sharp probe and the surface. Electron Spin Resonance (ESR), on the other hand, is a spectroscopic technique used to identify and study materials with unpaired electrons, revealing the local electronic environments of atoms by detecting the spins of electrons.

The integration of AFM with ESR within ATOMQUANT leads to an unprecedented combination of spatial and energy resolution, allowing for addressing spins individually and setting a new

>>> contents <<<

standard for precision in quantum measurements. This could lead to the development of new types of quantum sensors with sensitivities high enough to detect the magnetic fields of single molecules, with profound implications for medicine, biology, and materials science.

Philip Willke's previous work has laid the groundwork for this innovative project, which stands at the intersection of quantum technology and nanoscience. The ERC's support of ATOMQUANT not only recognizes the potential of Willke's research but also underscores the importance of advancing our understanding of quantum mechanics at the most fundamental level. While Willke's approach is set to open new frontiers in quantum research, for the Young Investigator Network, ATOMQUANT marks the 20th ERC grant since 2009, highlighting the scientific excellence of KIT's young investigators.



Scanning Tunneling Microscopy topography image of individual iron atoms (dots) and iron phthalocyanine molecules (crosses) on a surface. In ATOMQUANT these will be used as novel quantum bits

Experience Report: **ERC StG Coaching Marathon**
On a thorough preparation journey for his ERC starting grant interview, Philip Willke engaged in various coaching formats. Although none are obligatory, each offers unique benefits for different aspects of the interview. Below, he recounts his experiences with these diverse formats.

Helmholtz Coaching
Unique to Helmholtz center candidates, this coaching involves an online mock interview with a panel of peers and coaching experts. In addition, it allows for the invitation of subject matter experts who can pose challenging, field-specific questions, followed by comprehensive feedback.

Coaching by the National Contact Point European Research Council (NCP ERC)
The NCP ERC's online coaching program comes in two parts. The first part is a webinar (1.5 hours, no participation limit) that provides general information and tips to all applicants. It features professional coaching on engaging online presentation skills ("how to be interesting online"), insights into the interview process, success stories from previous grantees, and a Q&A session. The second part is more personalized, offering small-group coaching where candidates can rehearse their presentations in a mock panel setting, followed by feedback. Both parts are highly recommendable and in combination probably the best coaching I received.

KIT in-person Preparation Meeting
We also had an in-person preparation meeting with the FOR research office, the vice-president for research, and other previously successful applicants from KIT. This session offered a platform to discuss strategic approaches and benefit from the collective experience of all attendees.

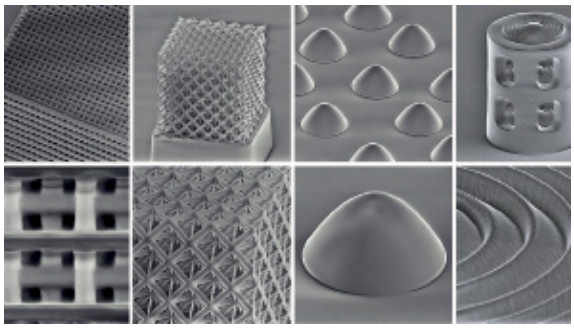
Support from YIN Office and YIN ERC Coach
The YIN office will assist you along the way. In my case, this included help with the technical equipment such as a background lighting, a quality microphone, or a high-resolution camera. They can also connect you to previous successful YIN ERC grantees which can be a big help in the preparation. Moreover, if needed, they organize an experienced ERC coach, that will go through your proposal in detail and, thus, can give you in-depth feedback for your interview process. In my case we met twice before the interview for around 1 hour.

Organizing Your Own Mock Panel?
Something I skipped was to organize a mock panel in my own institute. In hindsight, I see that this can be valuable, since at least from my experience, most of the questions (in my case all) are technical subject matter questions about your research. These are difficult for a general coach to ask and requires experts that are working closely to your field.

Sinterless 3D Printing of Glass on Nanoscale

Science publiction: Jens Bauer et. al. present a novel, low-temperature approach to print glass

Glass is one of the most important materials for modern engineering applications, ranging from optics over microelectromechanical systems to microfluidics and biomedicine. With its superior transparency and its excellent mechanical, chemical, thermal, and electrical resistance, glass uniquely unites many valuable characteristics. However, the high temperature required to make glass, poses a key limitation for many applications. Hence, Jens Bauer and colleagues have developed a novel process for printing of nanometer-scale quartz glass at considerably lower temperatures. Simultaneously, they achieved a fourfold resolution enhancement which enables visible-light nanophotonics. The researchers report in *Science*. doi: 10.1126/science.abq3037



The new low-temperature process enables fabrication of a large variety of nanoscale quartz glass structures. (image: Jens Bauer, KIT)

Until now, three-dimensional (3D) printing of silica glass is dominated by techniques that rely on traditional particle sintering at temperatures above 1,100°C. At the nanoscale, this limits the adoption within microsystem technology and, thus, prevents technological breakthroughs. With the new process, Jens Bauer and his team manage to produce transparent, fused silica at only 650°C. This temperature brings silica 3D printing below the melting points of essential microsystem materials.

"Demonstrating excellent optical quality, mechanical resilience, ease of processing, and coverable size scale, our material sets a benchmark for micro and nano 3D printing of inorganic solids," says Jens Bauer. In *Science*, he and his colleagues from the University of California and the Edwards Lifesciences company in Irvine present the process. They use a hybrid organic-inorganic polymer resin as the feedstock material. This liquid resin consists of polyhedral oligomeric silsesquioxane (POSS) molecules, which are small cage-like silicon-oxygen molecules equipped with organic functional groups.

Jun.-Prof. Jens Bauer
Nanoarchitected Metamaterials Laboratory

Contrary to particle-loaded sacrificial binders, the POSS resin itself constitutes a continuous silicon-oxygen molecular network. After cross-linking the material via 3D printing to form a 3D nanostructure, it is heated to 650°C in air to remove the organic components. At the same time, the inorganic POSS cages coalesce and form a continuous quartz glass micro- or nanostructure.

The researchers from Karlsruhe and Irvine used the POSS resin to print various structures, including photonic crystals of free-standing, 97-nanometer-wide beams, parabolic microlenses, and a multi-lens micro objective with nanostructured elements. "Our process produces glass objects that remain stable even under harsh chemical or thermal conditions," Jens Bauer says. "The nearly unconstrained 3D design freedom at nanometer resolution grants two-photon polymerization 3D printing the potential to radically transform microsystem technology, which today is largely constrained to planar structures."

Hence, the novel process makes many new applications in optics, photonics, and semiconductor technologies possible. Most immediately the low temperature allows to manufacture optical and photonic micro- and nanostructures from high-quality glass directly on a chip. More generally, the achievable high print quality and the ease of processing open up vast potentials for robust small-scale optical devices, micro-electromechanical systems, and novel metamaterial concepts.

Heisenberg Professorship at KIT

YIN alumnus Gerardo Hernandez-Sosa about his experience with the DFG Heisenberg Program

In 2023, Gerardo Hernandez-Sosa was appointed Professor for Printed Electronic Materials and Systems at KIT. Within the Heisenberg Program, the German Research Foundation (DFG) now funds his research on printed bio- and soft optoelectronics for the next five years. His holistic approach convinced the jury with its high scientific quality and originality at international level. To realize biodegradable, biocompatible, and mechanically flexible optoelectronic systems, Gerardo Hernandez-Sosa uses advanced functional printing technologies. Having started off as junior research group leader funded by the Federal Ministry of Research and Education, Gerardo Hernandez-Sosa has now reached the goal of every YIN member: a lifetime professorship.

Prof. Gerardo Hernandez-Sosa
Printed Electronic Materials and Systems

Why apply for the Heisenberg Program?
I was mainly motivated to apply as a way of obtaining a professorship position in Germany.

How challenging would you rate the application process for the Heisenberg Program?
The Heisenberg Program requires a different type of proposal than an ERC or a conventional research project. You have to demonstrate that you have a consolidated research profile. That means you have performed independent research for a number of years, you have successfully applied for grants, and you have published high quality publications.

The real challenge, however, is to explain your future research plan by laying out your research focus and strategy in the context of your current achievements and how you fit in an international environment. You do not write work packages and tasks like in an ERC proposal, you need to explain your short and long terms research goals and highlight their originality. The selection of the host institution should also be in line with the research you want to pursue.

In terms of length, it is around the typical 20 pages. Success rates are higher than ERC, but it strongly depends on which discipline you are in.

For the Heisenberg Program, you apply independent from a host institution?!
For me, one of the main motivations was that you can in a way influence the place where you will work. Since I already had my laboratory up and running at KIT and had created a very nice research network with colleagues at KIT and Heidelberg University, KIT was always my first option.

Once successful within the program, what are the next steps to become a professor?
The first step is to discuss within KIT how a possible professorship will be funded in the long term. There were some ideas before I applied but everything started really catching speed once I was accepted into the program. The process for the budget planning requires a lot of time and support from all levels at KIT. Once a plan is set, the professorship needed to be created so I could apply for it. Then, I had to go through the interview with the search committee and all the formal steps.

Was the criteria of bringing (Heisenberg) funding part of the call?
Yes. In the end, it was an *ad personam* appointment, but it was not automatic, as it had to be approved by the relevant authorities.

How much funding comes with a Heisenberg Professorship from the DFG?
The DFG funds your salary and some money for research expenses for the first 3 years and after an evaluation for two more.

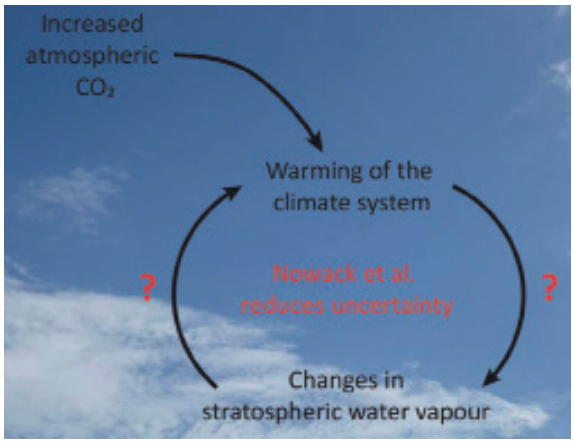
What are the biggest benefits of the Heisenberg Program?
The biggest benefit is that it gave me more security and planning perspectives in my personal life. Furthermore, it allowed me to have a choice on the place I wanted to continue my career. I am happy it allowed me to keep working at KIT.

Tackling Climate Change Uncertainty

Nature Geoscience reports on a novel data-driven observational constraint framework

Informing society about future climate risks requires high-quality information from scientists. However, given the complexity of the Earth system, current climate change projections are still subject to substantial uncertainties. Recently, Peer Nowack tackled a longstanding uncertainty factor relating to the composition of the stratosphere, building on a new data-driven statistical learning framework. The study appeared in *Nature Geoscience*, in collaboration with colleagues from the US, UK, Switzerland, and the Netherlands. doi: 10.1038/s41561-023-01183-6

Without the natural greenhouse effect, Earth's average surface temperature would plunge to about -18°C. Water vapor is the most important naturally occurring greenhouse gas. Under global warming, its contribution to the overall greenhouse effect – the natural plus the human-induced part – is set to increase further, because the gradually warming air in the lower part of the atmosphere can hold more water vapor. This "feedback effect" amplifies global warming in response to human emissions of other greenhouse gases such as carbon dioxide and methane.



Sketch of the uncertain two-way coupling between global warming and stratospheric water vapor under increasing atmospheric CO_2 concentrations. (Graphic: Nowack, KIT)

However, the relationship between water vapor and global warming is far more complicated for the stratosphere, the region of the atmosphere stretching from ca. 10 to 50 km above the Earth's surface. Due to an interplay of several mechanisms, air reaching the stratosphere is extremely dry, with concentrations of just a few parts per million volume (ppmv). Despite these low concentrations, changes in stratospheric water vapor can have major impacts on life on Earth. For example, increases from its low levels today would also amplify global warming and could – due to a system of coupled chemical reactions – delay the recovery of the stratospheric ozone layer, which is another key environmental concern of this century.

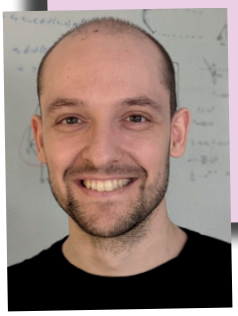
TT-Prof Peer Nowack
Artificial Intelligence in Climate and Environmental Sciences

Current computer models used to simulate climate change strongly disagree on how water vapor in the stratosphere might change in the future. To reduce this uncertainty, Peer Nowack developed a statistical learning method that combines information from satellite observations with state-of-the-art climate model data. The results suggest that stratospheric water vapor concentrations will increase by 0.31 ± 0.39 ppmv per each degree of global warming with 90% confidence. "This change is expected to further amplify global warming in the future. However, large changes that could significantly delay ozone recovery, as implied by some of the most recent climate model projections, are highly unlikely," explains Nowack.

By combining information from satellite observations with extensive climate model archives, the novel statistical learning method allows the derivation of climate-invariant mathematical relationships. "After validating these relationships across the range of climate models, we applied them to Earth observations, constraining the uncertainty in model projections under climate change," says Nowack. This approach can easily be adapted to tackle other climate related uncertainties. Hence, the innovative observational constraint framework promises to refine projections across various aspects of Earth's climate, including potential changes in the ozone layer but also extreme temperatures, floodings, or droughts.

Three KIT Faculty Teaching Awards for Outstanding Teaching go to W1 Professors

Thomas Bläsius (l.), Moritz Dörstelmann (r.) and team, and Claudio Llosa Isenrich (lr.) received Faculty Teaching Awards in 2023. Thus, the KIT Faculties of Computer Science, of Architecture, and of Mathematics each honor the commitment and use of creative teaching methods with which the young professors succeed in inspiring students and familiarizing them with the complexity of their subject.



Thomas Bläsius, for example, offers application exercises and online question sessions. Moritz Dörstelmann has students experimenting with natural materials and digital construction technologies. Claudio Llosa illustrates why a cup and a donut are the same in elementary geometry.

YIN Award 2023

Can the mitigation of cathode volume changes enable stable solid-state batteries?
Dr. Simon Fleischmann and Dr. Florian Strauss

YIN Grants 2023

Data-driven weather models: towards improved uncertainty quantification, interpretability and efficiency
Dr. Charlotte Debus, Dr. Sebastian Lerch and Dr. Julian Quinting

Patient-Specific Preoperative Flow Analysis of Mitral Valve Regurgitation Through Experimental Measurements and Numerical Simulations
Dr. Alexander Stroh

Carl-Zerbe Prize honors Moritz Wolf's work on Catalyst Materials for Energy Transition

With the Carl Zerbe Prize, the German Scientific Society for Sustainable Energy, Mobility and Carbon Cycles (DGMK) recognizes outstanding scientific work by younger scientists in the fields of processing and application of carbon carriers. TT-Prof. Moritz Wolf focuses on the development of catalysts and processes for the storage of renewable energies in form of chemical energy carriers and the production of intermediates from synthesis gas (CO_2/CO and H_2). "Our goal is to develop technologies to enable chemical energy storage with high efficiency," says Moritz Wolf. "To achieve this, we conduct fundamental research on heterogeneous catalysis as well as applied engineering research on advanced reactors and systems."

Maria Gräfin von Linden Prize for Dr. Charlotte Debus and Dr. Claudia Niessner

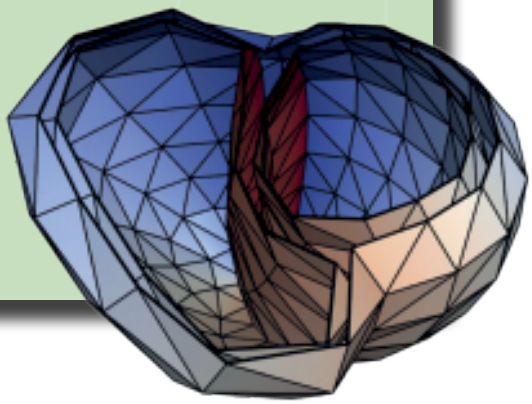
With the Maria Gräfin von Linden Prize, the Association of Baden-Württemberg Women Scientists honors particularly qualified young female scientists from the life sciences as well as the humanities and social sciences. In 2023, the prize went to KIT – for the first time in both categories: Charlotte Debus (l.) and Claudia Niessner (r.) convinced the jury with their presentations on "AI in the Natural Sciences: from ChatGPT to the Energy Transition" and "Data for Action: Corona kink in children's motor skills?" The prize has been awarded every two years since 2001. The last winner from KIT was YIN alumna Stefanie Speidel in 2011 – today professor in Dresden.

State Teaching Award 2023 for Innovation/Transformation goes to TT-Prof. Moritz Dörstelmann

Moritz Dörstelmann's research-oriented teaching revolves around recyclable and resource-friendly construction. Together with students from various disciplines, he creates digital models and experiments with test buildings made of natural materials such as clay and willow to investigate the digital prefabrication of components as a prototype. With his innovative concept, he contributes to the transformation of the construction industry as a socially relevant response to the climate, resource, and energy crisis. For this, the Baden-Württemberg Ministry of Science, Research, and the Arts has awarded him the 2023 State Teaching Award in the category innovation/transformation.

AI in Medicine: Artificial neural networks localize heart stumbling

Additional heartbeats can be associated with rapid cardiac arrhythmias and can become life-threatening, especially in the presence of heart insuffiencies. Triggers are electrical signal sources that, unlike in a normal heartbeat, do not originate from the sinus node. They can be obliterated with high-frequency current using a special catheter. To determine the point of origin non-invasively, researchers at KIT use artificial neural networks trained on data from a realistic simulation model. "After further optimization based on clinical data, our method has the potential to speed up medical interventions, reduce risks, and improve outcomes," says co-author Dr. Axel Loewe.



Facts and Figures – Changes over Five Years

The data was compiled from the YIN survey and the YIN database

15 years of YIN sums up to over 167 million euro of initial funding and 200 million euro of subsequent funding acquired by 225 active and former members of the Young Investigator Network. In addition, they published about 3,100 publications, supervised 2,950 theses, and taught 5,300 weekly hours per semester.[1] This set of statistics speaks for itself and is a joint success of the young investigators at KIT. 50% of all former YIN members hold a full professorship (W2/W3) today.

15 years of YIN also gives time to pause and take a closer look on how YIN has changed during the last five years. For the network's tenth anniversary in 2018, 40 YIN members filled in the statistics survey and the same number of participants answered in 2023. In consequence, absolute numbers can be compared between the 2017/2018 and the most recent 2022/2023 statistics. The following data was compiled from the annual YIN statistics and the YIN database of October 2023. Numbers in brackets indicate the change compared to the statistics five years ago.

YIN network

YIN connects and supports scientifically and financially independent research groups leaders. A group must consist at least of one staff member holding a master 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). Therefore, junior professors and tenure track professors ("W1 professors") are equally part of YIN.

Counting 66 (+24) YIN members in October 2023, the number of members is stabilizing at the level that was present ten years ago. In 2018, with only 42 members, YIN membership was almost at its lowest point. The decline between 2014 and 2018 corresponds to the conclusion of KIT groups funded by the first Excellence Initiative including Young Investigator Groups (YIGs) and (Shared) Research Groups ((S)RGs). Since then, the increase in KIT Junior Research Groups (KIT JRG) and even more so in junior professorships (JProf) and tenure track professorships (TT) make up for this loss. Compare Fig. 1.

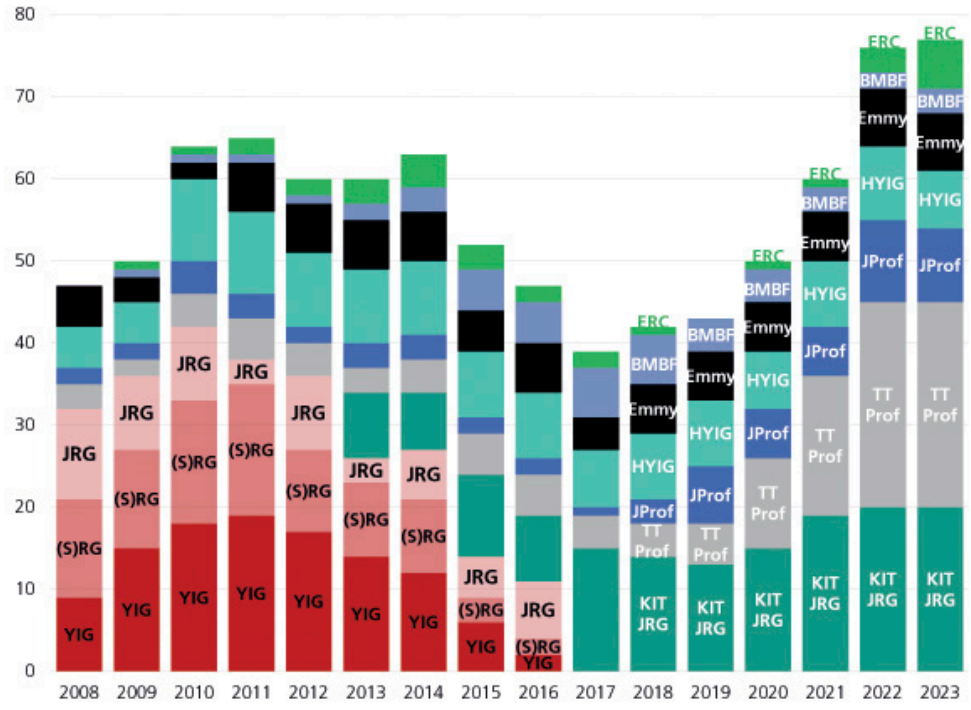


Fig. 1: Evolution of research groups in YIN. Abbr.: Young Investigator Group (YIG), (Shared) Research Group ((S)RG), KIT Junior Research Group (JRG), junior professorship (JProf), tenure track professorship (TT Prof)

YIN is an international network. About one fifth of its members come from abroad and English is the common language in YIN. In 2023, 18% (+2%) of all members had an international background coming from Europe, America, and Asia. This is an increase compared to 16% in 2017. However, both values lie below the ten-year-average of 20%.

YIN members on average

Despite the international ambiance in YIN, the average YIN member in 2023 is still male (71%), German (82%), and about 37.3 years of age (compare Fig. 2). In terms of assets, in 2022, every YIN

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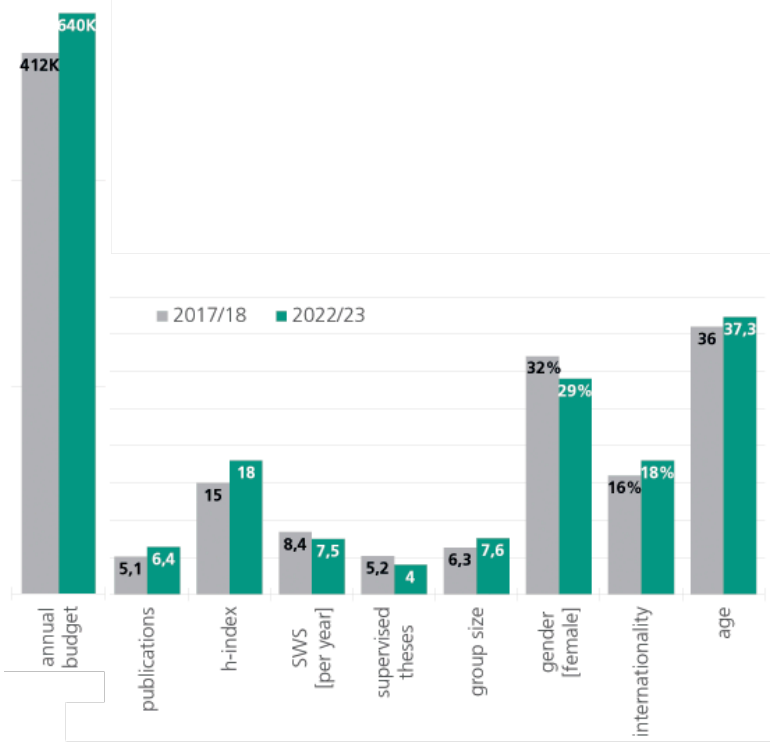


Fig. 2: The average YIN member in 2017/18 and 2022/23.

member wielded an annual budget of on average 640,000 (+228,000) euro – comprised of the initial grant for the group and subsequently acquired third-party funding. Moreover, she or he published an average of 6.4 (+1,35) publications in renown scientific journals and obtained an h-index of 18 (+3). YIN members also significantly contribute to teaching at KIT. In the academic year 2022/23, every YIN member gave 7.5 (-0.85) weekly semester hours on average and supervised 4 (-1,15) doctoral, master, or bachelor theses. Furthermore, YIN members hold personnel responsibility for their research groups, which, in 2022, consisted of 7.6 (+1.3) members of staff on average.

Women in YIN

The share of women in YIN slightly decreased to 29% (-3%) in 2023. In 2018, it had reached an absolute high with 32%. Over the last ten years, the share of female YIN members has stabilized around 30%. While external funding agencies decide on the applicants for junior research groups, KIT decides on the candidates for junior professorships and tenure track professorships. Here, the share of women appointed in 2023 has risen to 38% (+5%) in relation to 2018. While the percentage of women among all W1 professors was 27% in 2023, it was 38% among junior professors without tenure track.

Age & family status

While they are academically still young investigators, most YIN members are in the age where they also start a family. In 2023, the every age was 37.3 (+1.3) ranging between 30 (-1) and 45 (+1). Newly appointed junior professors and tenure track professors in YIN were on average 35,6 (+2,1) years old.

About a half (55%) of the YIN members have at least one child and took an average of 2.2 months parental leave in 2022. For attracting the best future scientific leaders, it, therefore, becomes increasingly crucial to address issues like predictable careers, child-care, parental leave, and flexibility of working hours.

Research groups in YIN

YIN unites a variety of group types with different funding sources (see Fig. 3). In 2023, YIN counted 20 (+6) KIT junior research groups (JRG). In addition, there were 7 (-1) YIN members leading Helmholtz Young Investigator Groups that are in equal parts funded by the Helmholtz Initiative and Networking Fund and by KIT. There are also many YIN groups that are funded entirely from external sources. Most prominently 3 (-3) are funded by the Federal Ministry of Education and Research (BMBF), 7 (-1) by the German Research

Fig. 3: Distribution of YIN research groups according to the funding program and research divison at KIT (YIN database in October 2023). 8 YIN members unite group leadership and W1 professorship and 4 lead two externally funded groups at once.

11.9 M initial funding
14.9 M subsequent funding in 2022
255 publications

Foundation (DFG) via its Emmy-Noether program, and also 7 (+6) by the European Research Council (ERC) – 4 Starting Grants, 2 Consolidator Grants, and 1 Synergy Grant. The ERC usually funds more mature research proposals. Thus, only one person joined YIN with an ERC grant, while 6 were already YIN members when they acquired the ERC funding. Finally, in 2023, there were 9 (+6) junior professors and 25 (+21) tenure track professors in YIN. Among them 8 (+8) – 6 with tenure track and 2 without – who were additionally leading an externally funded junior research group .

In 2023, 21% of YIN members were assigned to Division I (Biology, Chemistry, and Process Engineering), 29% in Division II (Informatics, Economics, and Society), 17% in Division III (Mechanical and Electrical Engineering), 14% in Division IV (Natural and Built Environment), and 20% in Division V (Physics and Mathematics). For the distribution of groups compare Fig. 3.

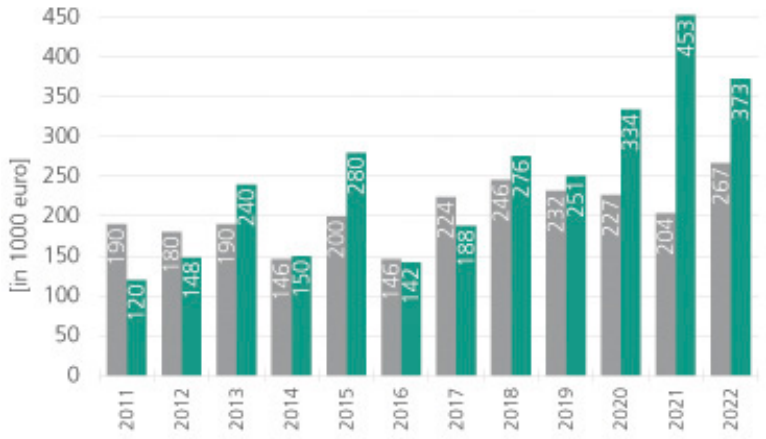


Fig. 4: Average annual initial (grey) and average annual subsequent (green) funding per YIN member between 2011 and 2022. This data was not collected before 2011.

Initial funding

In 2022, YIN members raised a total of 50.1 (+14.1) million euro initial funding distributed over 2 to 6 years (4.2 years average) for research projects at KIT. This results in a contribution of about 11.9 (+2.9) million euro per year. The funding volume of the different groups varies between 125.000 (-75.000) and 4.5 (+0.5) million euro. Roughly 14.75 (+6.75) million come from KIT, whereas the remaining 35.4 (+7.4) million euro are from external funding.

On average, each YIN group starts with a 267.000 (+43.000) euro annual budget based on initial funds. It is hard to tell which factors account for this substantial growth in initial funding compared to 2017. It is not the ERC grants as they are mostly subsequent funding that came on top. One might suspect the growing number of tenure track professors, however, 15 of them were funded by the joint initiative of the Federal Government and the States (Bund-Länder-Programm). They got a standard endowment that wouldn't account for the observed increase.

Subsequent funding

In addition to the initial funding of their groups, YIN members acquire substantial subsequent funding. In 2022, each member raised on average an extra of 373.000 (+185.000) euro a year. This is almost twice as much as in 2017. Here, the ERC grants coming on top of the initial grant certainly make an impact. Likewise, the YIN members who combine leading an externally funded group with a junior or tenure track professorship. In total, the 40 YIN members who answered the survey on 2022 raised 14.9 (+7.6) million euro. With 77% (+/-0), most of the money was provided by external funding agencies. 12.2% (+2.2%) were contributed by KIT and 10.8% (-2.2%) by industry partners. Fig 4. shows the evolution of average annual subsequent funds.

Publications and conferences

In 2022, 40 YIN members published a total number of 255 (+53) peer-reviewed scientific papers – an increase of 26% compared to their predecessors in 2017. This includes publications in prestigious journals such as Advanced Functional Materials, Nature Energy, Global Change Biology, and Nature Communications. The average Hirsch-index (h) of a YIN member was 18 (+3). Due to different publication traditions in different disciplines, the h-index of YIN members varies significantly. Moreover, the h-index is a controversial topic: critical voices say it is an inaccurate performance metric, susceptible to manipulation.

In addition to publications, YIN members show their scientific work and represent KIT on numerous occasions. In 2022, they presented their research at 143 (-43) international conferences, 37 of these being remote participations. This decrease might still be a late after-effect of the Covid-19 pandemic. The number of patents also dropped to 7 (-4), whereas in 2017, there were 11 patents filed.

Teaching and supervised theses

For most YIN members, teaching forms a substantial part of their activities. About 91% (+1%) of all YIN members from the survey contribute actively towards teaching at KIT. Interestingly, however, only 40% (+2.5%) have an obligatory teaching assignment. For 51% (+8%), the teaching assignment is completely voluntary and mainly unpaid. Interestingly, the rising number of W1 professors who have a mandatory teaching assignment doesn't show an impact here.

YIN members contributed a total of 298 (-36) weekly teaching hours per semester (SWS) during the summer term of 2022 and the winter term of 2022/23. The 298 SWS comprised lectures (149 SWS, -22), seminars (94 SWS, +16), tutorials (47 SWS, +/-0), and practical trainings (9 SWS, -29).

Besides teaching, YIN members supervise doctoral as well as master and bachelor students. In 2022, 30 (+6) doctoral theses, 83 (-19) master theses and 47 (-33) bachelor theses were completed in YIN groups. The decline in supervised master and bachelor theses is even more astonishing than the decline in weekly teaching hours. While in 2017, most YIN member had to fight for their supervision rights, they come for granted to W1 professors. Consequently, in 2022, 53% (+48%) of the 40 participants in the YIN survey had full examination rights, while roughly 13% (-12%) had no entitlement at all. The examination entitlement granted to junior research group leaders is very heterogeneous and depends on their status and the respective KIT department.

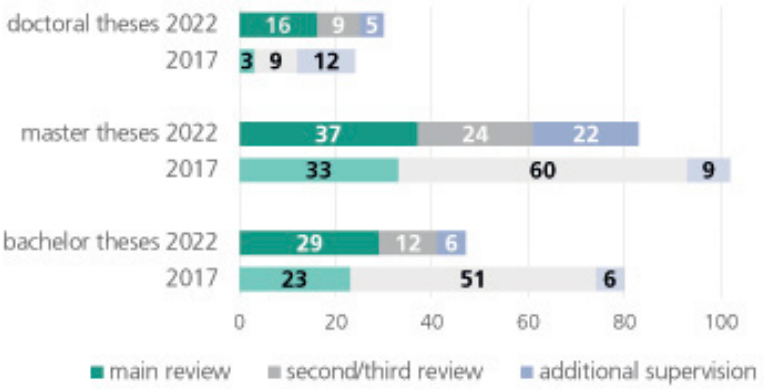


Fig. 5: Number of theses officially supervised by YIN members in 2022 and 2017 as well as additional supervisions.

KIT-Associate Fellow

The KIT Associate Fellow status temporarily grants restricted teaching and examination rights. Thus, junior group leaders who obtainded 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 further recognize the independence of junior group leaders. Fig. 6 shows that the status has not become superfluous: while the number of W1 professors has significantly increased since 2018, the number of KIT Associate Fellows stayed roughly the same (-1).

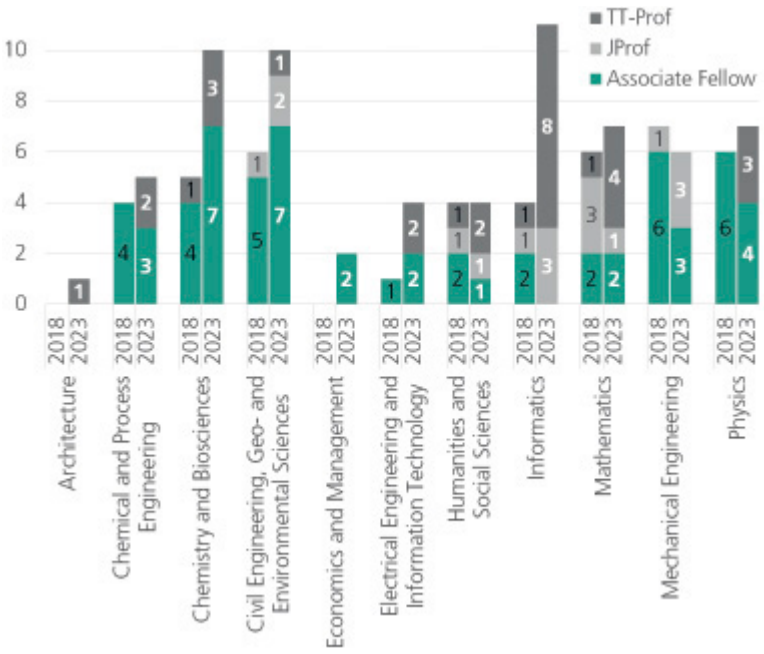


Fig. 6: Number of Associate Fellows at the KIT Departments in 2018 and 2023 (data provided by the KIT Departments) as well as the number of W1 professors.

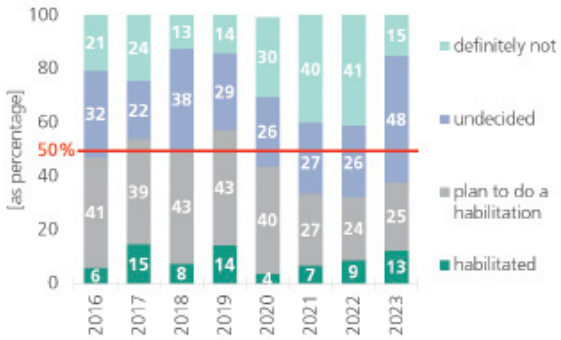


Fig. 7: Status and view regarding the habilitation as seen by YIN members. Before 2016, there is no recorded data.

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 countries. In Germany, the habilitation still ensures the long-term eligibility to teach and to promote doctoral students as "Privatdozent/-in" (private lecturer) or "außerplanmäßige/-r Professor/-in" (extraordinary professor). Securing 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 university professorship.

In 2023, 25% (-18%) of the YIN members planned to pursue a habilitation and 13% (+5%) already successfully completed this process. 48% (+10%) were undecided, while 15% (+2%) considered the habilitation as not necessary for their career. Thus, compared to 2018, when about half definitely were in favor of a habilitation, the YIN members who were undecided reached a new peak with 48% (see Fig. 7).

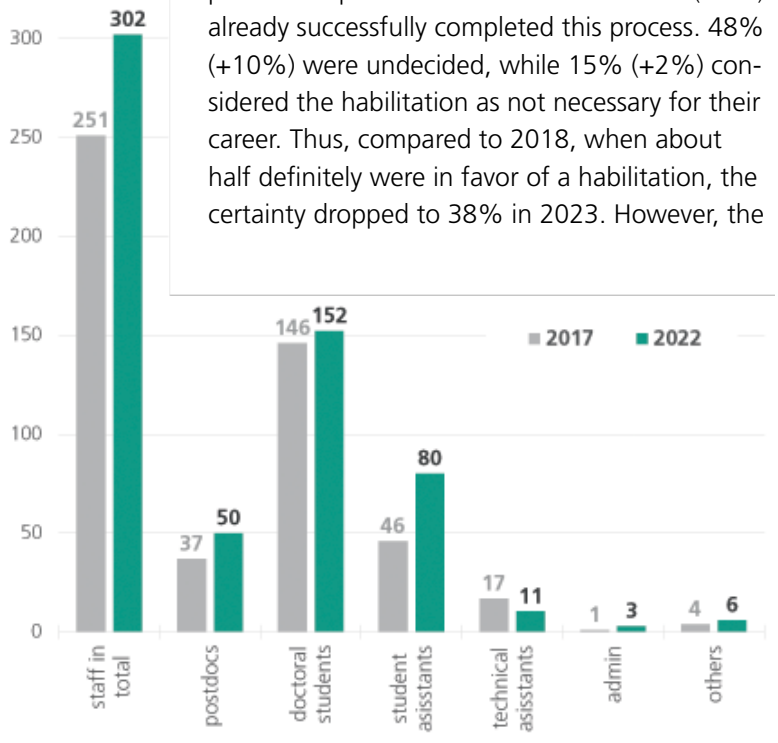


Fig. 8: Number of people working in YIN research groups in 2017 and 2022.

Staff

YIN members employed a total of 302 (+51) people in 2022 – including: 50 (+13) postdoctoral researchers, 152 (+6) doctoral candidates, and 80 (+34) student assistants. The groups additionally encompassed 11 (-6) technicians, 3 (+2) administrative staff, and 6 (+2) other members of staff as shown in Fig. 8. The average size of a junior research group represented in YIN was 7.6 (+1.3). In comparison to 2017, there are notably more postdocs and student assistants working in YIN groups. This coincides with a higher annual budget from which more expensive postdoc contracts can be paid. It also allows to employ the students doing their master or bachelor theses in these groups.

YIN Alumni

In 2023, nine YIN members were newly appointed as full professors. Four stayed at KIT – two with an early tenure evaluation, one ensuing a KIT Industry Fellowship, and one with a Heisenberg professorship. In total, 86 former YIN members currently hold a professorship. As a result, the appointment ratio has reached 55% (+5%) – counting 65 university professors, 5 professors at universities of applied sciences, 9 associate, 4 assistant, and 3 extraordinary professors. The W2/W3 appointment ratio lies at 50%. It is expected to further rise with the increasing number of tenure track professors. Out of the 86 former YIN members who now hold a professorship, 25 (30%) are women and 15 (18%) have an international background. Only 9 (10%) hold a professorship outside of Germany .

W2/W3 appointment ratio lies at 50%

From the 131 YIN alumni, 38 (29%) stayed at KIT or came back – among them 18 professors: 5 former tenure track professors; 4 with a Heisenberg professorship; 3 with Helmholtz funding for first-time appointed female scientists; one with an ERC Consolidator Grant; 2 with an extraordinary professorship; one as W2 professor, and 2 other.

Innovative Approaches in CO_2 Capture and Conversion via Photoactive MOFs

In an era where climate change poses a significant challenge to our world, innovative solutions to mitigate carbon dioxide (CO_2) emissions are an urgent imperative. This YIN award project aims at creating functional materials capable of adsorbing CO_2 from various gaseous mixtures and catalyzing its chemical reduction upon light absorption. This approach innovatively combines CO_2 capture with its conversion into valuable chemicals using renewable energy sources like visible light, thus closing the carbon cycle. The collaboration between Dr. Claudia Bizzarri and PD Dr. Manuel Tsotsalas was born out of a mutual recognition of the potential to harness each other's strengths for a common goal: tackling the CO_2 challenge.

Dr. Claudia Bizzarri
photochemistry

Claudia Bizzarri, leading an independent junior research group, brings a wealth of knowledge in the design of sustainable, photoactive metal complexes. Meanwhile, Manuel Tsotsalas, at the helm of a Helmholtz Young Investigator Group, contributes his extensive experience in designing and synthesizing porous materials, including Metal-Organic Frameworks (MOFs).

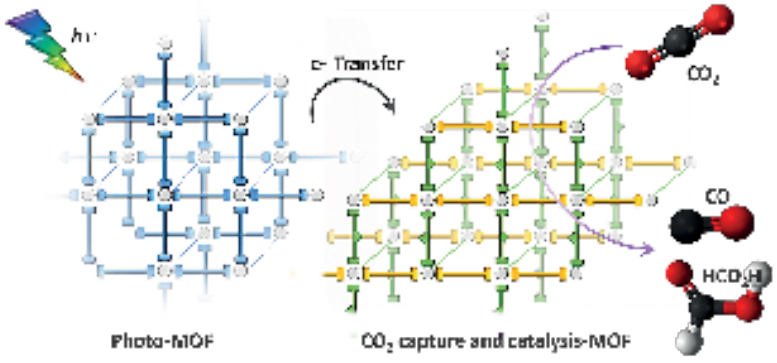
By pushing the boundaries of material science and chemistry, the project highlights the immense potential of collaborative research in developing sustainable solutions for our planet. As the project continues to evolve, it can lead to groundbreaking advancements in environmental stewardship. Among the key highlights so far is the development of new MOFs. By integrating various polar functional groups, the project team has successfully created MOFs with enhanced CO_2 affinity including amine groups, known for their strong interaction with CO_2.

Moreover, the project has broken new ground by synthesizing MOFs based on accessible, earth-abundant metals like copper and iron, marking a shift away from reliance on noble metals. In particular, new building-blocks based on diimines, which are able to coordinate several metals, are now available. The isolated metal-based complexes have been investigated by means of UV-vis absorption and electrochemistry to dive into their photoredox properties and select the most promising candidates to build novel MOFs for photocatalytic CO_2 reduction.

PD Dr. Manuel Tsotsalas
chemistry of oxydic and organic interfaces

One of the project's most significant milestones is the establishment of a test station for CO_2 capture. Additionally, the successful synthesis of MOFs based on earth-abundant metals stands as a testament to the project's innovative approach. The team's efforts have already begun to bear fruit, with a student from Bizzarri's group winning a poster award at the "V Autumn Meeting of the Polish Photochemistry Group" in Cracow.

The collaboration between Claudia Bizzarri and ManuelTsotsalas continues to thrive. The project has laid a strong foundation for a future proposal, bolstering its chances with these initial findings.



Schematic representation of the project. New MOFs with distinct properties (i.e. light-harvesting, CO_2 capture and catalysis) employed in CO_2 conversion (designed by Caludia Bizzarri and Manuel Tsotsalas).

Atoms and Molecules on Surfaces Explored by Machine Learning

TT-Prof. Philip Willke
quantum coherent control for spins on surfaces

High-resolution scanning tunneling microscopy (STM) constitutes one of the best ways to access the nanoworld. In simple terms, it is an atomic sized finger that can scan a sample surface with atomic precision. Thus, it can identify individual atoms and molecules on top of a surface and determine their electronic and magnetic properties. However, finding connections between property variations and the individual local environment is cumbersome. Moreover, STM operation is still a time-consuming effort and requires skilled students and experienced researchers. With this challenge in mind, Philip reached out to Pascal. The idea for the YIN grant was born: a machine learning assisted, systematic analysis of data generated by STM techniques would offer the opportunity for automation and speed-up. In addition, it has the potential to unravel new physics by utilizing the additional leverage of machine learning (ML).

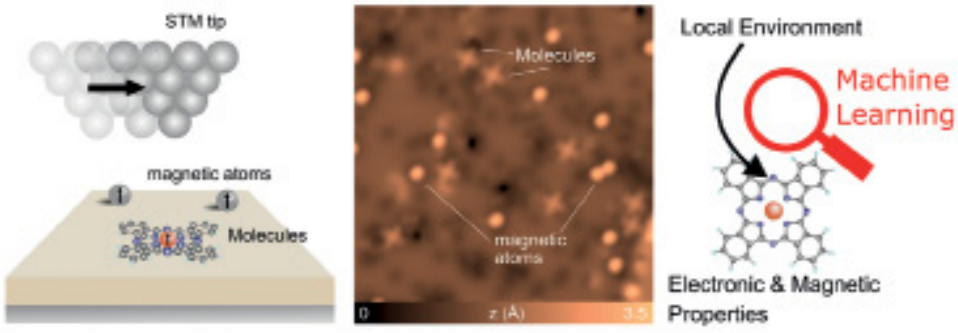
The project combines the expertise of Philip Willke and Pascal Friederich – that is of high-resolution low-temperature STM on the one side and ML methods on the other. Philip's team took datasets from a system, studied in detail with a great variety of STM techniques (see picture; comp. X. Zhang et al., Nat. Chem. 14, 2022), which constitutes a well-established model system for the application of ML techniques.

While on the atomic scale each molecule or atom is technically identical to others of the same kind, the local environment – geometric and electronic – is never the same. As shown in the picture, local defects or strains in the substrate might change the physical properties of the individual molecules or atoms in the vicinity. Finding connections and identifying the hidden physical laws in the data is difficult for human operators: Here lies the potential for ML-based data processing and data acquisition.

TT-Prof. Pascal Friederich
artificial intelligence for materials science

Since the start of the project, Philip and his team generated a large amount of high-quality STM data of molecules and atoms on surfaces. The data was transferred to the team of Pascal, where machine learning models were trained to identify and extract single objects on surfaces. Object detection models, widely used in computer vision, were used for this task. Two bachelor theses have already been finished on this project. The students developed protocols of image recognition and task automation using ML and deep learning on neural networks.

"In the next step, we plan to use unsupervised learning methods to identify groups of similar objects that are detected in the images. We expect the majority groups to be in different oxidation states of iron atoms as well as the FePc molecules. Though, there might be additional objects that occur frequently, which remain to be identified. Once the objects can reliably be detected, we plan to correlate their local environment to magnetic properties measured in Philip's group," says Pascal Friederich.



Single iron phthalocyanine molecules (FePc) and iron atoms on a magnesium oxide (MgO) surface constitute a well-established model system for the application of ML techniques. (Graphics: Philip Willke, KIT)

>>> contents <<<

Oleogels from pectin particles for fat reduction in fine bakery goods – OLEOBAKE

In high-income countries, obesity and overweight are key risk factors for heart diseases, stroke, and type 2 diabetes. One possibility to lower the calorie intake is the reformulation of existing food products. This is particularly interesting in high-fat products, such as fine bakery goods. Here, it is mostly the high amount of butter that poses the highest risk factor. However, butter also provides the typical taste and texture. Hence, the challenge is not only to replace butter, but also to find alternatives that preserve its typical baking qualities. With their YIN grant OLEOBAKE, Ulrike van der Schaaf and Katharina Scherf investigate how liquid plant oils structured by pectin-based microgel particles perform in fine bakery goods.

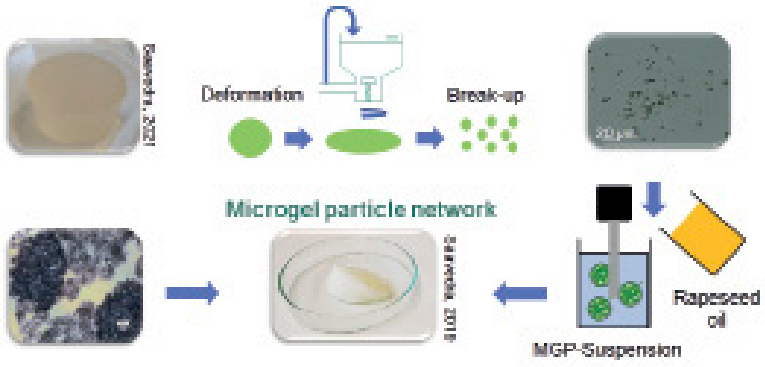
Dr. Ulrike van der Schaaf
food technology

Butter, but also hardened plant oils and fats, mainly consist of saturated fatty acids that are a specific high-risk factor for heart diseases. Yet, they also possess several unique technological features that lend baked goods their desired product properties: they are solid at room temperature, melt at body temperature, are spreadable, and give structure and texture to doughs and baked products. Liquid plant oils are a healthier alternative: built from unsaturated fatty acids, they have been identified to reduce inflammatory and ischaemic heart diseases.

In order to provide liquid oils with some essential technological features of fats, they need to be immobilized. Typical gelators are waxes, e.g. from bees or rice bran, or ethylcellulose. Ulrike van der Schaaf and colleagues recently showed that pectin microgel particles can also be used to gel a liquid oil phase (Saavedra/Schaaf, 2020). Pectins are polysaccharides found in the cell wall of higher plants. Obtained from side and waste streams of the food industry, they make a sustainable and cheap alternative.

TT-Prof. Katharina Scherf
bioactive and functional food chemistry

"We will prepare microgel particle suspensions using amidated and sugar beet pectin to modulate particle hardness and two different homogenization processes to vary particle size," says Katharina Scherf. The microgel suspensions will further be used to prepare oleogels by high shear mixing with 10%, 20%, 30%, and 40% rapeseed oil. All oleogels will be characterized for the following features: microstructure, flow properties, lubricating properties, and spreadability. In a second step, they will take the place of butter at 10%, 25%, 50%, and 100% in standard recipes for cake, cookies, and brioche.



Schematic oleogel preparation with rapeseed oil (compiled by Schaaf/Scherf, KIT).

Testing this approach on sand cake has already led to first results: with increasing substitution of butter, baking loss and density increased as well as elasticity and cohesion. A trained sensory panel rated products with the gel containing 30% rapeseed oil most similar to the control sample baked according to the original recipe. Odor, mouthfeel, and taste were comparable, only the appearance of the crumb was less appealing. The latter varies with baking time and temperature and can be adapted. That makes pectin-based oleogels suitable as a butter substitute in sand cake and the project is to continue. The first results were published in *Food Chemistry Supplement* Volume 3, doi: 10.1002/lemi.202359147

Continually towards Leadership Excellence

Insights from the customized professional development program exclusive to YIN members

Personal Assessment & Peer Coaching
by TT-Prof Moritz Wolf

The *Personal Assessment* is usually the first workshop after the YIN Welcome Meeting and serves as a starting point for professional development within YIN. Before choosing among the offered workshops on management, leadership, and personal development, it is important to determine the status quo: Where am I on my career path? Where am I in life? What is important to me? What makes me special? All areas of life should be examined here, because they are inevitably connected with each other and with the work life.

The manager of the YIN professional development program Anka Schneider herself guides the *Personal Assessment* in a small group of three to five new YIN members. After short introductions, the first task is to graphically record the current life situation on a blank DIN A2 sheet. This seemingly simple exercise turned out to be quite complex. The private environment should (no one is obliged to!) be depicted together with the current situation at KIT with teaching, research, the institute, and all links amongst those components. The artistic contortions with wax crayons – alternative colored pencils were ignored by all participants – thus, turned into an intensive half hour in which the current situation was studied in detail and structured in its entirety.

After a break to relieve the artist's cramped hands, the participants presented their pictures to the group and further reflected on their individual situation. This part of the *Personal Assessment* is enormously valuable for each individual, since one comprehensively discusses everyday problems and successes with the other YIN members. In addition, the artworks of the other participants are illuminated, whereby many of one's own challenges and everyday situations are recognized. The open approach of the YIN members together with Anka's empathic facilitation lead to intense and deep conversations. Step by step, the group is introduced to collegial coaching in the process. We learned how to coach each other with skillful questions and targeted brainstorming – without coming with a generic advice club.

The second task is the adaptation of the graphical representation of the current state into a realistic future situation in the private and daily work routine one year ahead. In this future picture, the individual elements should be recognizable and the focus is on the (hoped-for) changes. Together with the picture of the current situation, possible ways to achieve the outlined goals are discussed together.

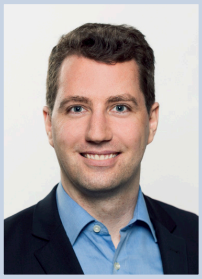
In addition, the small peer group of the first session is encouraged to maintain the unique level of confidence and meet semi-annually for a follow up. This can best be done while having coffee together, a longer lunch break or simply a relaxed chat online. So you witness each other's developments on your particular career paths and can reflect, give feedback and support each other.

YIN Professional Development Program
Manager Anka Schneider

YIN Certificate *Academic Leadership*

After various seminars, workshops, and coachings – mounting up to 200 academic units – TT-Prof. Pascal Friederich has proven himself as an exceptional leader personality.

"The YIN Certificate *Academic Leadership* is a great program because it offers extremely valuable insights due to professional trainers from various backgrounds. In addition, I appreciated the trustful exchange between YIN members through which important networks emerged or were intensified," states Pascal Friederich.



Type and Style Consultation for Scientists
by Dr. Michael Färber

The significance of non-verbal presentation, particularly through our choice of clothing, is often underestimated. It is not about following fashion trends, but rather about choosing clothes that reflect our personality and the impression we want to convey.

In the workshop *Type and Style Consultation for Scientists*, the participants learned all about nuances and developed a deeper understanding of color and style. The workshop was designed to offer personalized advice and demonstrated how specialized style advice can have a transformative effect. Participants underwent a color style analysis where they matched their clothing choices with a scheme. Through the lens of established color theories, participants learned the impact of colors and their combinations on one's image and how they can be used strategically to enhance or mute certain features. For example, the selection of classic, elegant colors like black, white, or navy can project authority, cleanliness, and competence, making them ideal for formal business environments. Conversely, dynamic colors like red or yellow, while vibrant and attention-grabbing, may need to be used sparingly in professional settings due to their potential to convey unintended messages.

Essential aspects such as the correct fit of a shirt, the selection of suitable glasses, and the ability to match shoes and pants were also covered. Beyond clothing, the workshop also provided general advice on behavior and appearance, especially in front of an audience. The overarching message was clear: a well-thought-out wardrobe is a crucial tool for effective personal and professional representation.

>>> contents <<<

ATTRACT research group at Fraunhofer

YIN alumnus Manuel Hinterstein on his grant at the Fraunhofer Institute for Mechanics of Materials

Dr. Manuel Hinterstein
Group leader at the Fraunhofer Institute for Mechanics of Materials

Linking fundamental science and applied material research is the recipe for success for the academic career of Manuel Hinterstein. This combination led the former YIN speaker on a journey all across Germany and around the globe. His most recent transition made him cross over to the other end of the Black Forest – to the Fraunhofer Institute for Mechanics of Materials (IWM) in Freiburg. The career step was prompted by a Fraunhofer ATTRACT grant which offers outstanding external scientists the opportunity to develop an innovative idea towards application.

Briefly introduce yourself and your research.
My name is Manuel Hinterstein and the overarching topic of my research is energy conversion using functional ceramics. They play a crucial role in devices as insulators, semi- or ionic conductors. My team and I work on the synthesis and processing of functional electro-ceramics, using additive manufacturing for complex material systems. Moreover, we use characterization techniques that correlate microscopic properties with crystal and microstructure in materials. Our research is important, for instance, for electromechanical applications, solar energy, fuel cells, and electrolysis.

I studied Material Science in Darmstadt and worked during my PhD and first postdoc as a beamline scientist at DESY, where I developed a new beamline and several sample environments. Afterwards, I did a second postdoc in Sydney with a Feodor Lynen Fellowship from the Alexander von Humboldt Foundation. Finally, I started an Emmy Noether group in 2016 at the Institute for Applied Materials at KIT. Since July 2022, I now lead a Fraunhofer ATTRACT group at IWM.

Why leave KIT and move on to Fraunhofer?
Regarding my career, I started my affiliation with KIT in 2016. After about six years, I sought stability and long-term security, which I did not see at KIT.

Besides, I always tried to combine both fundamental science – like analyzing crystal structures at large-scale facilities – and applied materials research, sometimes even on commercial materials. Here, not every chemical detail is known, but it is actually functionality that matters and useful properties are maximized. This is the philosophy in Fraunhofer society, where the focus is more on industrial applications than academic research. We work closely with industry developing research towards real-life applications, which I find appealing.

Even in this industrial context, I continue to use my advanced characterization methods to address research challenges. You have to readjust of course and have to focus more on improving properties and performance to make it interesting for the industry partners. While academic research might explore topics of general interest, industrial research is driven by practical outcomes and societal benefits.

Lets talk about the Fraunhofer ATTRACT grant: what makes it so attractive?
The ATTRACT grant targets group leaders in my career stage with specific expertise. The application process is collaborative, involving both the applicant and the director of the institute. The grant aims to create synergy between the applicant's expertise and the institute's focus. It's essential for the research to align with the overall organizational goals. The grant lasts for five years and the general idea is to establish new expertise at the institute with long-term stability.

At our institute, there was a need for an X-ray group leader, as the previous leader had retired. This created an opportunity for me to also bring in my expertise in 3D printing of functional ceramics. Regarding the review process, it is similar to other schemes, involving proposal, presentation, and discussion with a committee. There is an interim evaluation after three years and a final one before potentially securing a permanent position.

How much funding cames with the grant?
The ATTRACT grant is typically around 2.5 million euro. While this seems like a substantial amount, one must consider the high costs associated with each position on full-cost accounting. In comparison: my previous Emmy Noether grant at KIT was about 2 million, but allowed me to fund more full-time equivalents. At Fraunhofer the ATTRACT grant requires additional projects to build up my group as planned. My current group consists of three people directly funded by the grant.

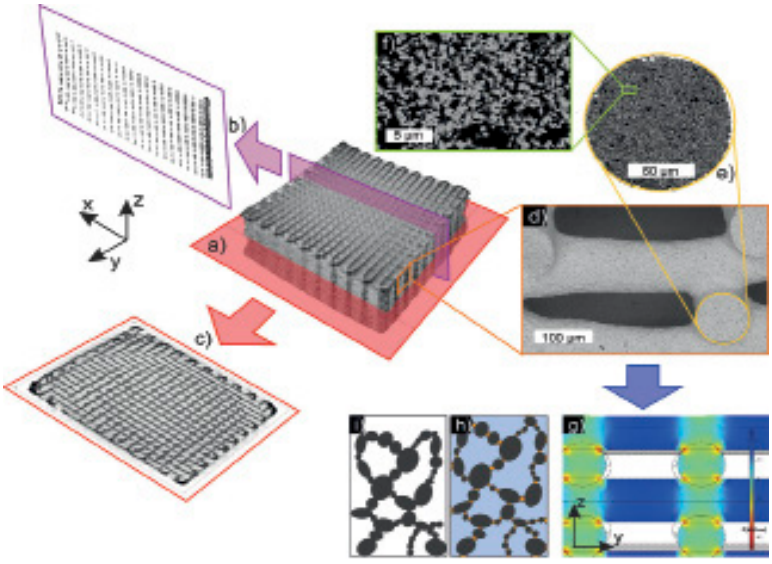
How international is it?
Our team is quite international, with members from Brazil, India, Iran, and Germany. While English is commonly used at Fraunhofer, most industry collaborations and larger meetings are in German. Historically, working predominantly with German industry partners has influenced this.

What are the success criteria for your group?
The dissemination of results is still important, so it is encouraged to write papers – though, sometimes difficult due non-disclosure agreements with industry projects. The biggest focus is on acquiring third-party funding. Funding from the German Research Foundation is less desirable for us as it is more suited for universities. The rates and structures are not always compatible with our needs, since we use full-cost accounting. Thus, we often target other funding schemes like the ones from the federal ministries or European projects, which better cover the full costs. Industry funding is also highly desirable. The larger the industry contribution, the more funding we receive from the central Fraunhofer office.

Are patents important?
Patents are important, though, their use varies. A famous example is the MP3 patent from Fraunhofer, which was lucrative. In industry, patents are often used for control rather than selling licenses. They dictate who can and cannot use the technology. Fraunhofer generally prefers licensing patents. Although, I am not certain about the extent of active licensing, having a patent means that others who are interested in the subject need to engage with the patent holder. It is an essential aspect of our work, that facilitates collaboration and opens up licensing opportunities.

How is daily life different compared to KIT?
In my daily work, proposal writing and project coordination remain an important part. A key difference in my current role as the leader of the X-ray group is handling many small projects from industry partners. These projects often involve gaining more insights into materials. For instance, a device is failing and we investigate the origins of fatigue or develop a lifetime analysis. We typically combine diffraction and microscopy to study both local and average structures. A recent example was the renovation of a museum in Freiburg. This involved analyzing the exterior wooden walls to match the original. To understand the material composition, I had to refresh my geological knowledge back from my undergrad studies.

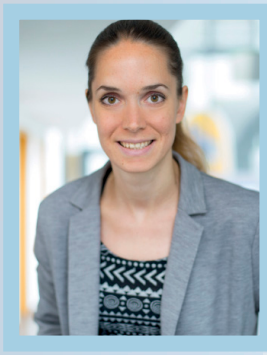
I am very happy with my current position. The work environment is great, most colleagues are around my age, and the focus on material mechanics aligns well with my interests. At the institute, we have more than 300 people specializing in simulations, characterizations of mechanical and electrical properties, thin film characterizations, or synthesis. It is a broad spectrum of materials and techniques, allowing for collaboration on almost any research idea. However, we do not have every sophisticated technique. For transmission electron microscopy, for instance, we still collaborate with the laboratory at KIT.



Computer tomography scan of a 3D-printed BT log-pile structure with its electric field intensity simulated with COMSOL Multiphysics-software, and schematic illustration of capillary suspensions. DOI: 10.1021/acsami.1c19297

Jun.-Prof. Jan Stühmer
Heidelberg Institute for Theoretical Science

Junior Professor
Machine Learning and Artificial Intelligence



Jun.-Prof. Maike Schwammberger
Institute of Information Security and Dependability – KASTEL

Junior Professor
Modelling and Analysis in Mobility Software Engineering

Dr. Johannes Bracher
Institute of Economics

Emmy Noether Junior Research Group

Health Statistics / epidemiology

Dr.-Ing. Florian Stamer
Institute of Production Science

KIT Junior Research Group
Dynamic quality control for the sustainable production of mobility solutions

Dr. Elia Fioravanti
Institute for Algebra and Geometry

Emmy Noether Junior Research Group
Coarse medians as a hyperbolicity surrogate

Dr.-Ing. Rebekka Volk
Institute for Industrial Production

KIT Junior Research Group
Project and Resource Management in the Built Environment

TT-Prof. Peer Nowack
Institute of Theoretical Informatics

Tenure Track Professor
AI for Climate and Environmental Sciences

Dr. Nadja Henke
Microsystems in Bioprocess Engineering

Carl Zeiss Nexus Junior Research Group
BIOSCALE – Establishment of a Biological Scale-Up Concept for Upscaling of Biotechnological Processes

Dr.-Ing. Christian Sprau
Light Technology Institute

KIT Junior Research Group
Printable semitransparent organic solar cells for photovoltaic applications of the future

Jun.-Prof. Rania Rayyes
Institute for Material Handling and Logistics

Junior Professor
AI and Robotics (AIR)

Dr. Annika Oertel
Institute for Meteorology and Climate Research

KIT Junior Research Group
Mesoscale Processes and Predictability

TT-Prof. Roland Maier
Institute for Applied and Numerical Mathematics

Tenure Track Professor
Numerics of PDEs with a focus on multiscale methods

TT-Prof. Barbara Bruno
Institute for Anthropomatics and Robotics

Tenure Track Professor
Socially Assistive Robotics with Artificial Intelligence

Jun.-Prof Emilia Graß
Institute for Operations Research

Junior Professor
Building Network Resilience in Healthcare against Cyber-Attacks

Helmholtz Young Investigator Group
Building Network Resilience in Healthcare against Cyber-Attacks

Dr.-Ing. Wilfried Liebig
Institute for Applied Materials – Materials Science and Engineering

KIT Junior Research Group
Hybrid and Lightweight Materials

Dr. Jingyuan Xu
Institute of Microstructure Technology

Carl Zeiss Nexus Junior Research Group
ZEco Thermal Lab

>>> contents <<<

Dr. Manuel Hinterstein
Fraunhofer ATTRACT Group
Development and structural characterization of complex material systems for energy conversion
Fraunhofer IWM, Freiburg

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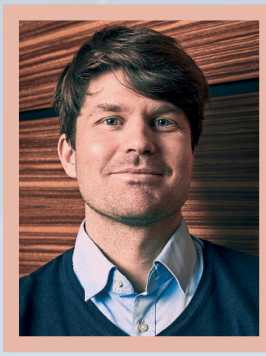
IAM – Ceramic Materials and Technologies



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Institute of Economics

Prof. Franziska Mathis-Ullrich
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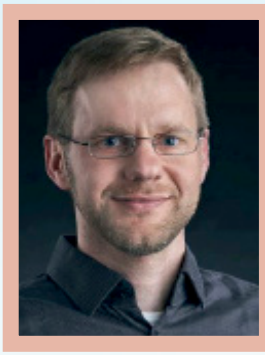
Institute for Finance



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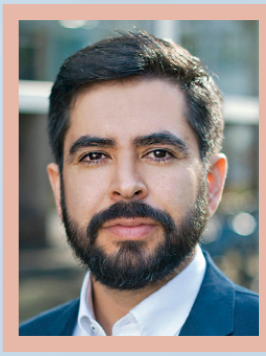

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Professor for Printed Electronic Materials and Systems
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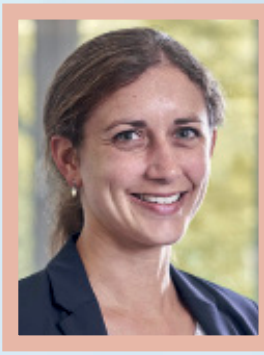
BMBF Junior Research Group
Light Technology Institute



Prof. Katharina Scherf
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>>> contents <<<

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Markus Brock (moderation) / YIN (questions) (p. 6f), Dr. Simon Fleischmann (p. 14), TT-Prof. Benjamin Schäfer (p. 15), TT-Prof. Philip Willke (p. 28f)

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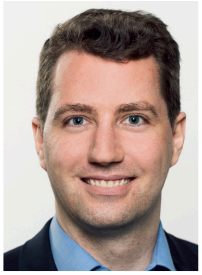
What We Stand For

TT-Prof. Benjamin Schäfer
Representation

YIN connects independent junior research group leaders as well as junior and tenure track professors on an early stage of their scientific career. As in 2008, when YIN was initiated, we, the members, still occupy a very critical career niche between postdoc and full professor. As YIN, we speak with a single voice and our voice is heard. For example, YIN representatives have a guest seat at the KIT Senate and are involved in the KIT Excellence Strategy *Living the Change*. The continued existence of YIN is a testament to the role it plays within the academic governance and to the services it provides for its members. Our mission, comprised of the following three statements, has and will continue to guide YIN.

Dr. Susanne Benz
KIT Senate



Dr. Michael Färber
Finance Committee
CRYS, KHYS

We encourage each YIN member to become a better group leader. YIN members can take part in the professional development customized 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.

We represent the interests of independent young investigators at KIT. Young group leaders and non-tenured junior professors face an uncertain future given the changes in higher education politics and the academic landscape. YIN represents our interests by working with and persuading the administration to best define our official standing, the supervision of doctoral students, teaching rights and staff responsibilities. YIN has, moreover, hosted discussions with representatives from politics and various funding agencies to understand and shape the policies affecting its members, their career paths, and their funding opportunities.

TT-Prof. Julian Thimme
Representation

YIN strives to make KIT an ideal place for young scientists. YIN helps its members to develop their research pursuits by encouraging collaborative discussions and projects. Interdisciplinary scientific meetings help to bring members of related disciplines together to share their respective expertise and resources. YIN Grants provide a further incentive to pursue collaborative projects. The network also maintains connections to alumni in academia and industry to exchange experiences, ideas, and research opportunities.

TT-Prof. Moritz Wolf
CRYS

TT-Prof. Nevena Tomašević
Event Committee

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 its members grow, prove their independence and receive recognition in their respective fields.

We also want KIT to remain an attractive place for young investigators. This goal requires active participation from our side and support from the KIT community. To that end, this journal has been prepared to provide an update on YIN members, their achievements and activities.

Dr. Somidh Saha
Public Relations
KIT Convention

YOUNG INVESTIGATOR NETWORK

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