Karlsruhe Institute of Technology

YIN Insight 2022

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

Hot Topic
Job-Sharing for Professors – a real Alternative?

YIN Statistics 2021/2022
15.4 million euro subsequent funding
270 weekly teaching hours per semester

Scientific Highlights
19 ERC grantees among YIN members & alumni
7 publications within the Nature Family |
Heinz Maier-Leibnitz-Prize | Harald Perten Prize

Editorial

Dear reader,

As the Covid-19 pandemic began to fade in 2022, life slowly returned to normal for young research group leaders and junior professors. Conferences lost the supplement "online", video calls gave way to in-person meetings, and pajamas yielded to suits. However, just as things started to look like business as usual, a new crisis emerged: the Russian invasion of Ukraine. The knock-on effects have created new challenges for researchers as well. This includes rising energy prices to power the labs, inflation making it harder to reach target agreements on the available funding, and disruptions in the supply chains leading to a shortage in research materials.

Nonetheless, in 2022, YIN members have reaped the rewards earned during the long Covid-19 phase. They received several outstanding prizes, reached a new record in acquiring additional third-party funding, and published a significantly higher number of papers in peer-reviewed journals, including 7 publications in Nature Communications and Nature Energy.

The pandemic also gave rise to new work models. As the *Hot Topic,* YIN Insight presents "Job-Sharing for professors – a real alternative?" introduced by YIN member Dr. Claudia Niessner, who has applied for this novel work concept. In line with this theme, the greetings of this edition come from Dr. Birgid Langer, the equal opportunities officer at KIT.

Moreover, the facts and figures show that the number of YIN members has reached an all-time high of 67. Additionally, a remarkable 52% of YIN alumni were appointed to various kinds of professorships. YIN also bids farewell to its long-time head of the managing board Hartwig Anzt, who has moved on to become the director of the Innovative Computing Lab at the University of Tennessee. Last but not least, the KIT Associate Fellow status is *Under Review* and the *Alumni in Portrait* features Nadine Rühr's career paths from Emmy Noether group leader to Helmholtz professor.

We wish you an enjoyable read!

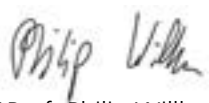
The PR Committee

Dr. Dominic Bresser

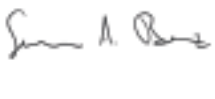
Dr. Simon Fleischmann

Dr. Somidh Saha

Dr. Benjamin Schäfer



TT-Prof. Philip Willke



Dr. Susanne Benz

Contents

Greetings 5

Hot Topic Job-Sharing for Professors – a real Alternative? 6-9

ERC Grantees from YIN 10

Scientific Highlights 11-19

- ERC StG for Subseasonal Weather Forecasts 11
- Twice rewarded: Harald Perten Prize & ERC StG 12
- Heinz Maier-Leibnitz Prize for Pascal Friederich 12
- BMBF project: Enhanced Code for ICON Weather Model 13
- Co-PI in a Collaborative Research Center 14-15
- DFG Research Group: AI in Production Processes 16
- Publications in Nature Communications & Nature Energy 16-19

YIN Pinboard 20-21

YIN Statistics 2021/2022 22-25

Young Investigator Future Fields at KIT 26

YIN Award & Grants 2021 27-29

Professional Development 30-31

Under Review 32

New YIN Members & Alumi 33-35

Alumni in Profile Emmy Group Head and Helmholtz Professor 36-37

Imprint 38

We are YIN what we stand for 39

Dear members of the
KIT Young Investigator Network,

Science thrives on the best minds and ideas, on fair competition, and unprejudiced curiosity. It depends on the diversity of perspectives to conduct innovative cutting-edge research. However, if only a certain spectrum of talent is promoted, other potential is by default excluded. This has a negative impact on the quality of research, teaching, and innovation. Underrepresentation of female scientists (combined with a lack of relevant gender research) or not allowing alternative life and work models is such an exclusion and leads to the loss of these perspectives. In this respect and also in regard to the changing labor market, universities need to offer possibilities to realize individual life-work models to continue to be perceived as attractive places to work.

New Work can be one approach to solving this problem, as it would allow a completely new understanding of work to be established. The opportunities are obvious: freedom, independence, and participation in the community as central values characterize alternative forms of work. Current developments, such as the home office or flexible working hours, help to better combine "care work" – which is still mostly performed by women – with full-time gainful employment. Such measures can also be implemented directly at the university workplace.

However, there must also be life-work models that make it possible to achieve responsible top positions on a part-time basis. One example would be a shared professorship, where two people share a professorship (job sharing) in order to be able to realize their life plans, whether it is reconciling work and family, or work and other life focuses. The advantages of the "shared professorship" are obvious: shared responsibility; carefully considered decisions resulting from different perspectives; broader teaching and research spectrum. A career can also be pursued despite, for example, a family phase or care work. The next step would then be for such services to be fully taken into account in pensions, as they

Dr. Birgid Langer
Equal Opportunities Officer at KIT

form an important basis for the existence of our society. In order to achieve this, certain framework conditions would have to be adapted and new challenges would be faced by the university. However, they should not be deterred by this.

In this sense, New Work offers effective approaches to completely redefine work. You just have to have the courage to implement them. But such a change of course is unavoidable, since it is above all young employees who are increasingly demanding a good work-life balance. In order to inspire these young professionals to pursue a career in research in the future, the working conditions in science must change significantly in this direction.

I find it very encouraging that the young group leaders and junior professors are already addressing these issues. They will be the ones to shape the future of academic life.

Dr. Birgid Langer

Equal Opportunities Officer at KIT and
Spokes Person at the Conference of Equal Opportunities Officers at universities and academic institutions in Baden-Württemberg (LaKoG)

Job-Sharing for Professors – a real Alternative?

Dr. Claudia Niessner talks about her motives and the experiences she made with German universities

Dr. Claudia Niessner
KIT JRG / Wrangell Fellow

Work-Life-Balance, New Work, and Equal Opportunities are buzz words on the job market today. The trend towards flexible working structures allowing more leisure time has also reached the university sector. It is expected to become even more prominent with the generation Z (born 1995-2009)[1] reaching academic employability. While the rigid academic system is generally slow to respond, a few universities in Germany and more commonly in Switzerland, the U.K., the U.S., and Australia are already several steps ahead: They have introduced shared professorship as a work model where two parties are equally involved in filling out one faculty position.[2] For Claudia Niessner such a concept is quite appealing and she has applied with it at several German universities. In the following interview, she shares a few insights into her motives and the experiences.

As University of Excellence, KIT addresses shared professorship and even professorial tandems – do they compare?
Unfortunately, there are many labels out there and they are not consistent. I think of a real job-sharing alternative for professors: two parties on one faculty position sharing leadership, responsibilities, and the work load that come with it. Both work in part-time and they complement each other. At KIT, shared professors work part-time at the institute and part-time in industry. It is one person with a full work load. The professorial tandems match the idea of complementing each other scientifically, but still work rather independent on two 100% positions.

MORE THAN PART-TIME two professors share the work load and the responsibilities that come with a faculty position.

Why not simply reduce your working hours?
This is what my mentors said! For me, however, it would not be what I mean by "shared leadership". Reducing hours is only one part. To live shared leadership means much more, for example shared responsibility, secured decisions, and two perspectives. Besides, I do not want to apply to a full position already knowing I cannot accomplish it in the current phase of my life. I think it is not fair to the employer and I would feel a constant pressure to somehow make up for it. Moreover, I would prefer to share the position with a partner on equal footing. It is hard to establish a constructive working atmosphere when the other party works on a temporary contract and constantly worries, I might want my hours back.

What is the legal basis in Germany?
It is legally possible to set up a shared professorship with two permanent positions in part-time. However, not in the civil servant law (Beamtenrecht)[3]. Fortunately, professors can also be appointed as salaried employees and get compensations. So far, there are no federal or even state-wide regulations that specifically address the issue. Therefore, each university individually needs to verify that a joint application is legit. It is, of course, easier to apply at a university which already went through this process. Usually, you can inquire at the equal opportunities office if this is the case or not.

Are there any open calls for such a shared professorship in Germany?
In principle, you can apply to any call that fits your scientific profile. To have a realistic chance, though, you should team up with your prospective other half and write a joint application. Make sure to include a cooperation concept addressing the requirements set by the guidelines of the University of Basel[3]. I would also recommend to inform the dean's office beforehand and provide them with the legal background. This way, you can make sure the application does not get sorted out directly. In my experience, such a joint endeavor creates quite an uproar at the respective university. In the end, it is up to the office for equal opportunities to ensure the application is at least considered.

>> Contents <<

With whom to share a professorship?
It will definitely not work with anyone. There are a lot of pieces that need to fit together for the idea to take off. Just writing a joint research concept is a challenge. As a recommendation, I would say that the scientific profiles should be close enough to apply for the same position but far enough apart to complement each other and, thus, cover a broader spectrum. An important aspect is that both partners are individually qualified for a professorship.

Most professors working part-time in Germany render about 40-60% of the full-time work hours. Thus, a shared professorship as a 50:50 arrangement would in principle suit the majority.[5]

And on a personal level?
You need to know your partner very well, I think. At least, if you plan to take the "shared part" seriously and don't want to end up with two independent 50%-positions. Especially shared leadership requires a lot of day-to-day communication. Open-mindedness and tolerance are crucial, but even more so the willingness to compromise, to define common ways to handle things and stick to them. In particular, when supervising staff and students.

So, you plan to also share supervision tasks?
Yes. If you want to have a joint team and not two independent sub-teams, shared supervision is essential. At least on the doctoral and postdoctoral level. The idea behind is to also share leadership responsibilities. Not in the way of reducing work load or accountability, but rather to profit from two perspectives, two sets of soft skills, and well thought out decisions. However, each professorial tandem might handle things differently and there should be enough space to figure out what works best for everyone involved.

This sounds very communication intensive?!
Partners in a shared professorship will certainly need extra time to communicate. I would argue, however, that some of this time would otherwise be spent in silent contemplation: How far did I come today and what are the next steps to be taken? How to best address the issue with my postdoc and what to present at the next conference? Discussing all these things with someone else brings in an additional perspective, allows time for self-reflection, and potentially leads to better decisions. I am also prepared to invest extra hours to make such an arrangement work. In part-time, this is easier done then as full-time professor working more than 50 hours a week.[4]

What are the benefits for the university?
The university profits from recruiting two scientific experts instead of one: they get two people, two research foci, two scientific networks, and two sets of hands writing papers and proposal. Especially with upcoming deadlines or evaluations, the working capacity can quite easily be doubled over a short period of time. For a single professor on a 100% contract, this would basically be impossible. The same is true in cases of illness or other short-time preventions: in a shared professorship, the other person can step in and provide high-quality deputy arrangements.

Moreover, two minds in exchange may come up with more creative ideas and can access a broader range of ressources and skills. This applys to research, but also to leadership, teaching, and innovation. Also, the much feared loss of expertise, know-how, and continuity is much less likely when two people are involved.

BENEFIT FOR UNIVERSITIES
- broader research spectrum
- two sets of skills
- increased capacity during peaks in workload
- more scientific output
- attractive work model
- family-friendlyness
- continuity

While the share of professors working part-time has increased from 6% to 9% over the last 15 years, the percentage of women among part-time professors has quite constantly been about 10% higher than among full-time professors.[5]

Another aspect is of course that a shared professorship offers a great opportunity to keep highly talented academics who want to work in a team, share responsibilities, and spend more time of their lives caring for children or parents, enjoying music and hobbies, or engaging elsewhere. They are still highly motivated in their jobs and very recilient. This particularly relates to women. When we take a look at the statistics, the share of women is about 10% higher among professors working part-time than among full-time professors. For professors with 60-80% of the regular hours, the average percentage of women has even been 45% over the last six years – this is about 20 percentage points higher than for professors in general.[5]

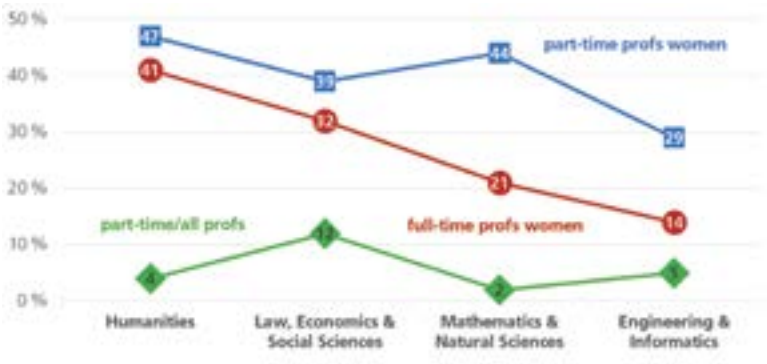
45% women among professors working 60-80% in part-time

As a mother of two, I can say that, though, universities do have many family-friendly support measures today, it is nonetheless a challenge to raise kids and be a 100% on top in the job. I know quite a lot of female colleagues who quit their academic career because it was all getting to much. Those who stay are often those who can afford to stay – e.g. if they have a partner with a stable, high-paying job or parents close by helping with the childcare.

In my view, equal opportunities for parents or employees taking on caregiving tasks should also involve breaking up rigid structures. To keep the best minds in academics, it should be made as easy as possible to combine family and work and to be open for sustainable work models such as that of shared leadership. A current Nature publication observes for U.S. universities that "the continued increase in women's overall representation can [...] be attributed to the disproportionate number of men among retiring faculty, across all domains. Continued increases in women's representation among faculty are therefore unlikely if the past decade's pattern remains stable."[6] I fear this will also be true for Germany if nothing changes.

What happens if one of the job-sharing partners quits?

There haven't been comparable cases in Germany, yet. I like the Swiss regulations and would try to negotiate accordingly. This mean, if one partner leaves, the other gets offered to take on the professorship in full-time first. Only after she or he declines, would the university publish an open call for a shared professorship in part-time.



In 2021, the share of women varies most between part-time and full-time professors in the fields of Mathematics and Natural Sciences – with a difference of 23 percentage points. In Mathematics and Natural Sciences, the percentage of all professors working part-time is with 2% also noticeably low.[5]

>> Contents <<

Regarding all the criteria mentioned before, wouldn't it be impossible to find another fit?
In my opinion, the real issue is why we get asked all these what-if questions? Do other professors have to answer what happens if they might reduce their working hours or if they might be suspended to take on another task? I am convinced, there is a solution to any problem. If my tandem partner left, I would probably take the 100% professorship position and reduce my hours.

Are you often confronted with skepticism?
Yes, you could say that. It is mostly the same two questions: What if one of you leaves? And what if you do not get along? I can understand that people have more concerns about things that are new to them. However, there is no absolute certainty anywhere. Where there are people there will be conflicts and changes: among scientists, between professors, within any team. What makes us grown-up professionals is our ability to deal with these issues competently and find workable solutions. What is absolutely certain, however, is that people who apply for a shared professorship are highly capable team players.

Interestingly, in the medical sciences, it is quite common to have two physicians sharing a professorship. They spend 50% of their time doing research at the university and 50% in the clinic. They might not be as devoted to jointly dealing with leadership responsibilities and keep their tasks more separate. Nonetheless, legally, it is exactly the same construct.

Dr. Claudia Niessner heads the indepent research group *Health Related Fitness and Physical Mobility in children, youth, and young adulthood* at KIT since 2021. In 2019, she was awarded a Margarete von Wrangell Fellowship for especially qualified women by the Ministry of Science, Research, and the Arts Baden-Württemberg. Based on her studies in sport science and sports therapy in Freiburg and Karlsruhe, her current research foci include:

- epidemiological sports science focused on health in childhood
- *Open Data* and *Open Science* at the interface between sports science, social science, and applied informatics in the field of *Digital Humanities* and *Digital Health*
- interrelationships between physical activity, motor development, mental and physical health across the lifespan against the background of socio-ecological determinants and contexts
- transfer of epidemiological results into practice as a basis for social, educational policy and school practice decisions in the context of sport and physical activity
- change (trends) and development (plasticity) of motor performance
- diagnostics of motor performance and physical activity across the lifespan

Handing in a joint application, do you forfeit any chance to apply individually?
It is allowed to hand in both: a joint and an individual application. In my view, however, it would weaken both cases to do so. If you really stand behind the idea of a shared professorship, why apply individually? It just casts doubts on your dedication. And the other way around, how can you convincingly say you are perfect for the job and want to work full-time, when you've also submitted a joint application?

[1] Cf. Baum, T.: A changing world of work. What can we learn from the service sector about employing Millennials (and Gen Z)? In: Organizational dynamics, 2020, Vol.49 (3), doi. 10.1016/j.orgdyn.2019.04.001

[2] Cf. e.g. ***University of Cologne*** (portal.uni-koeln.de/universitaet/beschaeftigte/jobsharing); ***University of Basel*** (vereinbarkeit.unibe.ch/unibe/portal/microsites/micro_vereinbar/content/e344119/e697782/e698273/files698274/RichtlinienJobsharing_29-06-15_ger.pdf); ***London's Global University*** (ucl.ac.uk/human-resources/recruitment-and-selection-procedure - 7.6); ***Duke University*** (hr.duke.edu/benefits/family-friendly/flexible-work-options/job-sharing); ***University of New South Wales*** (unsw.edu.au/content/dam/pdfs/governance/policy/2022-01-policies/flexibleworkpolicy.pdf - 3.4)

[3] Cf. forschung-und-lehre.de/karriere/professur/professur-in-teilzeit-1077

[4] Cf. forschung-und-lehre.de/karriere/wieviele-stunden-professoren-arbeiten-4251

[5] Data: Statistisches Bundesamt, Personal an Hochschulen - Fachserie 11 Reihe 4.4

[6] nature.com/articles/s41586-022-05222-x

ERC Grantees from YIN

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

2022: Julian Quinting
Advancing Subseasonal PredIctions at Reduced computational Effort

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

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

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

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

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

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

2016: Corinna Hoose
Closure of the Cloud Phase

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

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

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

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

2022 2021 2020 2019 2018 2017 2016 2013 2011 2009

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

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), Jan 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

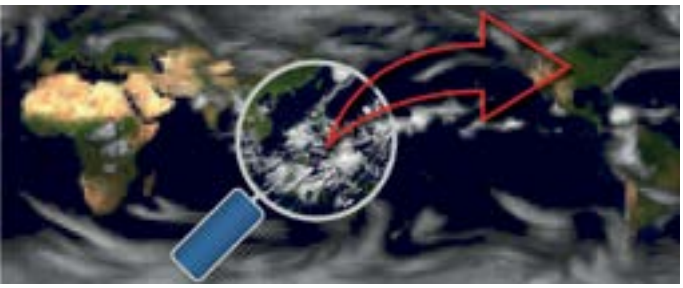
2017: Christian Greiner
Deformation Mechanisms are the Key to Understanding and Tayloring Tribological Behaviour

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

ERC StG for Subseasonal Weather Forecasts

Dr. Julian Quinting on ASPIRE – Advancing Subseasonal PredIctions at Reduced computational Effort

Improving weather forecasts and reducing their computational effort are the goals of the project ASPIRE. Principal investigator Dr. Julian Quinting plans to utilize highly predictable meteorological patterns in the tropics to advance the reliability of forecasts in Europe. To improve the representation of weather phenomena in the tropics, while keeping computing efforts reasonable, Quinting develops machine learning models to imitate the effects of a high resolution. Unique is the cross-disciplinary approach based on atmospheric dynamics and predictability, numerical modeling, and machine learning. The European Research Council (ERC) will fund the project with a Starting Grant for five years.



Improving the representation of physical processes in the tropics to make forecasts for the mid latitudes more precise – that is the goal of project ASPIRE (Data: NOAA)

Weather extremes such as heat waves, droughts, or floods are increasing in number and severity. To take preventive measures at an early stage, weather prediction for the subseasonal time scale of two weeks to two months become increasingly important for multiple socio-economic sectors. The weather patterns in Europe, however, are very volatile: they are determined by small-scale instabilities along strong westerly winds that grow very quickly and represent the chaotic nature of the atmosphere. Hence, Julian Quinting's idea is to make better use of sources with high intrinsic predictability that have a major influence on the atmospheric circulation in the mid-latitudes including Europe. Such a source are the recurring patterns of tropical convection over the Indian Ocean and the Western Pacific.

Dr. Julian Quinting
ERC Starting Grant

The tropics stretch like 5,000-kilometer-wide belt around the equator. 76% of the earth's surface in the tropics is covered by the oceans. Thus, the temperature of the underlying ocean has a major influence on the atmospheric circulation in the tropics – on convection and rainfall. "The ocean temperature itself varies on comparably long time scales meeting the two weeks to two months criterion," explains Julian Quinting. "Thus, it serves as a slowly evolving boundary condition for meteorological patterns with a long intrinsic predictability. A prominent example of a slowly varying phenomenon in the ocean is the El Nino Oscillation."

Atmospheric signals from the tropics are, however, only erroneously represented in numerical weather prediction models. Hence, their inherent predictability cannot be exploited and local forecast errors spread from their source region and degrade extra-tropical weather prediction with a time lag of 5 to 15 days. Meteorologically, the tropics and Europe are connected via the jet stream. High thunderstorm activity over the Western Pacific, for example, will pulse the jet stream. The impulse, then, travels westward along the jet stream like a wave bridging thousands of kilometers. If the wave breaks halfway around the globe, it increases the likelihood of a high pressure system over Greenland. For the winters in Europe, this usually means rather continental-type weather: cold and dry.

In ASPIRE, Quinting plans to improve the representation of the tropical signals by locally using a high spatial resolution. Such a high resolution, however, typically needs more computing power. To avoid this, Quinting and his working group develop machine learning models that imitate the effects of a high resolution, helping to reduce the computing effort. The innovative aspect of this approach is that information about changes in heat, moisture, and momentum from regions with kilometer-scale resolution are, then, transferred to the global picture.

Twice rewarded: Harald Perten Prize & ERC StG

TT-Prof. Katharina Scherf
ERC Starting Grant

In 2022, Katharina Scherf was awarded the prestigious ***Harald Perten Prize*** for her outstanding scientific achievements. Together with her team, she studies the complex interplay between structure, functionality, and bioactivity of food biopolymers and uses these fundamental insights to improve food security, quality and, safety. Her main research focus lies on the functional properties of gluten and the effect of enzymes on gluten and bread. Additionally, she puts specific efforts on analytical, immunological, and biochemical aspects of celiac disease, non-celiac gluten sensitivity, and wheat allergy. With the Harald Perten Prize, the International Association for Cereal Chemistry rewards outstanding achievements which serve the cereal sciences and technology – primarily in the areas of starch, gluten, and enzymes. The prize has been sponsored by the Harald Perten Foundation every other year since 1990.

For her research project GLUTENOMICS, Katharina Scherf has received a ***Starting Grant 2021*** from the European Research Council (ERC). Her aim is to track gluten immunoreactive peptides from the grain to the gut and beyond as wheat-related diseases are on the rise. While the complicated interaction of the human immune system with gluten, a protein found in some cereals, plays a crucial role, the exact molecular structures of the gluten components that occur in the human body are not yet known.

"We want to better understand how gluten is digested, which components are detectable in the human body, and how wheat-related diseases are triggered," explains Katharina Scherf. To analyze how these protein structures govern digestibility, she will for the first time comprehensively combine different methods. Another aim is to tailor grain-based foods towards better tolerability and, thus, prevent the initial onset of wheat-related disorders.

Heinz Maier-Leibnitz Prize for Pascal Friederich

TT-Prof. Pascal Friederich
Tenure Track Professor

In 2022, the German Research Foundation (DFG) has awarded the Heinz Maier-Leibnitz Prize to Pascal Friederich for his outstanding achievements. It is the most important recognition of early-career researchers in Germany. "Requirements to be met by new, highly performing materials – may it be for efficient energy storage systems or for applications in medicine – are further increasing. At the same time, development times have to be shortened. Tenure-track Professor Pascal Friederich takes on this challenge and perfectly combines machine learning methods with materials sciences," says the President of KIT, Professor Holger Hanselka. "The Leibnitz Prize is a great recognition of his outstanding work. We are proud and very happy!" At KIT, the last awardee was YIN alumnus Pavel Levkin in 2015. The Heinz Maier-Leibnitz Prize is named after the physicist and former president of the DFG.

Pascal Friederich's interdisciplinary work concentrates on the use of artificial intelligence for the simulation of materials, virtual materials design, and autonomous experimental platforms for automatic materials recognition. With his research group AiMat – Artificial Intelligence for Materials Sciences, he investigates data-based prognosis of materials properties, computer-based materials design, and the use of machine learning methods to simulate materials on the atomic scale. In doing so, he successfully combines artificial intelligence methods with laboratory experiments. On a meta level, Pascal Friederich is also concerned with the question what science can learn from machine-learning. For example, how advanced computational systems, and specifically artificial intelligence, can contribute to new scientific understanding or gain it autonomously.

>> Contents <<

Enhanced Code for ICON Weather Model

The problem is well-known: Highly effective software code that has matured over decades becomes increasingly harder to maintain. The initial software was not designed to run on today's supercomputers. This is also true for ICON – one of the most important simulation models for global weather and climate prediction. Thus, the European ICON consortium decided to start a large-scale effort to enhance the software and prepare it for the next generation of computing systems. Being mainly meteorologists, they consciously reached out to Hartwig Anzt whose research group excels in developing sustainable code for scientific high performance computing. Together, they successfully applied for 14 million euro funded by the German Federal Ministry for Education and Research (BMBF) in the *WarmWorld* project.

The project consortium strives to deploy recent advances in information technology to predict global warming on a kilometer scale for the first time. It includes 12 German research institutions and universities, such as the German Meteorological Service, the Max Planck Institute for Meteorology, the research center Jülich, and also KIT. Close collaborations exist with Switzerland and other European partners. The WarmWorld project will advance the ICON model along four different trajectories, making it:

- *Better* in terms of simulation accuracy;
- *Faster* by being ready for exascale computers;
- *Easier* to use for domain scientists; and
- *Smarter* thanks to algorithm improvements.

Weather and climate predictions are some of the most prominent and economy-critical fields based on computer simulations. Until today, ICON has grown to multiple million lines of code modeling the underlying physical and chemical processes. The engine bringing the simulations to life are supercomputers composed of millions of processing units. The supercomputer type that ICON was initially designed for is now on the edge of disappearing.

Currently, the hardware landscape is changing fast. Upcoming exascale computing systems can do 10^{18} calculations – that is one billion times a billion – in a single second! This is a hundred times more than KIT's HOREKA cluster. Making ICON more sustainable and increase its portability to such new architectures is a major undertaking. It requires excellent software quality, modularity, and abstractions which allow the adoption of new parallel programming technologies with minimal impact, and not tied to a specific vendor.

Hence, the research group of Hartwig Anzt takes on a major role in the WarmWorld project: Terry Cojean, a senior scientist in the group, leads the technical realization of the efforts consolidating the memory management in ICON as part of the *Faster* effort. Here, the aim is to enable portability on new hardware and introduce new parallel programming paradigms. At the same time, this transition should improve the code's modularity and facilitate interaction with other programming languages. As a constraint, the changes need to be introduced progressively on ICON's big code base, rather than re-implementing the code all at once. This task requires close interaction with all ICON developers and users and will certainly enhance the visibility of the sustainable software development efforts at KIT.

Prof. Hartwig Anzt
UT Knoxville

Farewell and onwards to new challenges

Recently, Hartwig Anzt has taken on the role as director of the *Innovative Computing Lab* at the University of Tennessee, Knoxville. He is the direct successor of Prof. Jack Dongarra, the latest winner of the *Turing Award* – the so-called "Nobel Prize of Computing". Nonetheless, Hartwig Anzt will still be part of his research group at KIT and the *WarmWorld* project.

For the last four years, Hartwig Anzt has been a very active member of the YIN managing board. YIN thanks him for his great ideas, his engagement, and his many hours of voluntary work! We expect to hear great things from Hartwig Anzt in the future!

Co-PI in a Collaborative Research Center

Schirin Hanf and Alexander Hinz talk about their part in the new CRC *4f for Future*

Complex materials based on rare earths are important for many high-tech applications such as permanent magnets or displays. The goal of the new Collaborative Research Center (CRC) *4f for Future* is to significantly advance knowledge concerning the chemistry of molecular and nano-sized rare-earth compounds and to push forward our understanding of their physical properties towards novel applications. As Co-principal investigators (Co-PIs), Schirin Hanf and Alexander Hinz will both lead independent sub-projects within this collaborative effort. KIT coordinates the interdisciplinary research center, which also involves the Philipps University of Marburg, LMU Munich, and the University of Tübingen. The German Research Foundation funds it with more than ten million euro over the next four years.

What opportunities does an flagship project like a CRC offer to young investigators?

Schirin Hanf Obviously, through the CRC, we as junior PIs, really benefit in terms of visibility. Not only do we get in touch with the main experts in the field of lanthanide chemistry in Karlsruhe and beyond, but we also work closely together with them. As part of the CRC, every individual project is connected with other subprojects to combine expertise. These collaborations really strengthen our individual projects and will definitely help us to extend the expertise within our groups.

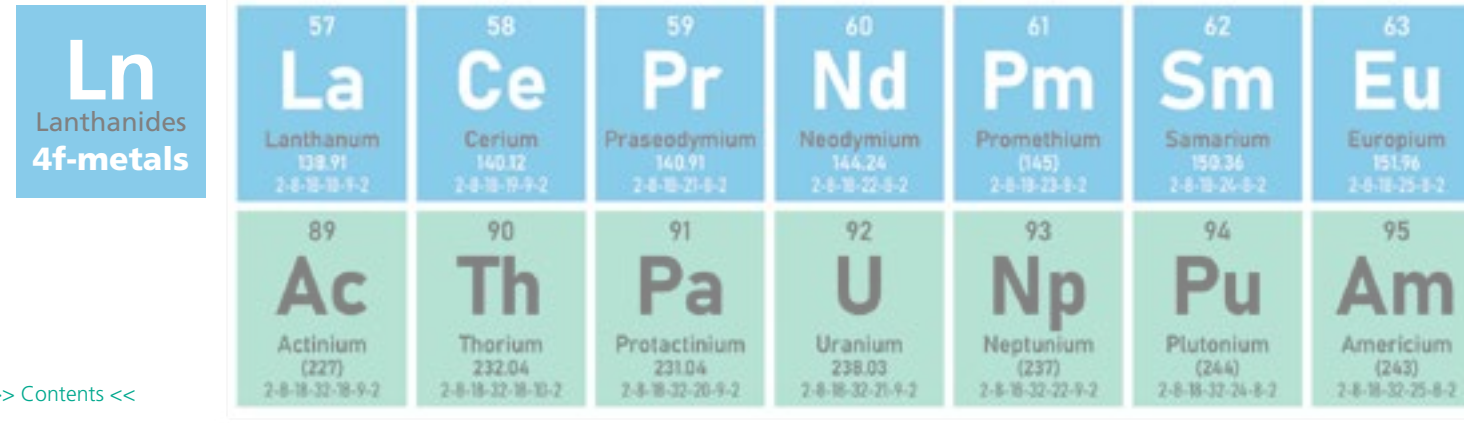
Alexander Hinz Each of us young investigators created a project proposal as a single principal investigator. Thus, we are in a special position compared to the established PIs, as they are involved two or three per project. I think this is a courtesy to both of us emphasizing our independence. If there is only one person responsible, there can be no "wheeling and dealing". Otherwise, we are as full members of the CRC basically on equal footing with the senior PIs.

I also appreciate the initiative to promote research data management, including an electronic lab book and an online repository via Chemotion. In addition, laboratory exchanges of the doctoral students are planned within collaboration – an excellent means to acquire new skills and methods.

Heterometallic Rare-Earth/Transition Metal Complexes for Catalytic Applications

by TT-Prof. Schirin Hanf

The subproject investigates the heterometallic rare earth (Ln)/transition metal (TM)-containing complexes with respect to their synthetic accessibility, stability, and reactivity. Another focus lies on the magnetic and photo-optical properties of these heterometallic complexes. Heterobimetallic complexes are especially interesting since the combination of two metals within one molecule result in very unique properties and cooperative effects. These can be employed with respect to the application as single molecule magnets or as homogeneous catalysts. In terms of catalysis, the combination of a rare earth and transition metal within one coordination complex is very promising, since we can tailor the catalytic properties specifically via the choice of metal centers. Over time, a synthetic toolkit will be provided for the synthesis of various Ln/TM-containing heterometallic complexes, including a variety of rare earth/transition metal combinations.



Sterically Shielded Single Metal Lanthanide Complexes
by Dr. Alexander Hinz
My team and I aim to place the lanthanide ions in unusual coordination environments in order to generate special properties of the complexes in terms of reactivity, magnetism, and luminescence. "Unusual coordination environment" in this context means a low coordination number. Lanthanides are large atoms, which is why they typically have high coordination numbers. Hence, we use a sterically challenging carbazole-based mono-anionic substituent that can itself be redox active and exhibit luminescence due to its electronic structure. This ligand has a pocket of well-defined coordination environment into which we hope to squeeze the lanthanide ions.

As a result, we hope to achieve unusual reactivity, which we hope to exploit with the activation of small molecules such as CO_2. In addition, the combined luminescence of ligand and metal should allow modulation of typical lanthanide emissions. And the coordination environment has direct consequences for the magnetic behavior of the complexes, which has led to single molecule magnets with magnetic hysteresis at up to 80 K in the last 5 years. We hope to use our ligand system to arrive at other types of single-molecule magnets that are also functional at high temperatures.

What about the scientific benefits?
Schirin Hanf We not only get to know all of the well-established other PIs of the CRC but we can also benefit scientifically from their knowledge and their equipment. At this point I really have to thank Peter Roesky, the spokesperson of the CRC, who always has time to discuss any problem over a cup of coffee! Through the CRC we also have access to very advanced machinery. For example, we will be able to study the binding situation within Ln/TM complexes by X-ray absorption and emission spectra using the KIT beamline.

Alexander Hinz Being part of the CRC has enabled me to tackle a topic variation that I probably wouldn't have dared to approach so quickly otherwise. Since the step to *4f for Future* was the biggest for me, I benefit most from joining the already collaborating group of established PIs. This includes the transfer of knowledge and experience, measurement time and instrument access, as well as theoretical underpinnings. Without a mentor, it is difficult to enter a new subject area, and so an entire group is readily available.

How much funding do you get?
Alexander Hinz There is of course a whole lot of money attached to an CRC, which is always welcome. As junior PIs, we got a fully funded doctoral position each and financial supported to cover our running costs.

Was it a proposal like any other or were there special requirements?
Schirin Hanf This proposal was kind of special to me, since it really had to fit into the whole CRC structure. One the one hand, it had to be a very unique project, but on the other hand connections and collaborations of our projects within the CRC had to be demonstrated. However, this challenge is making the individual projects and the CRC on itself very interesting!

DFG Research Group: **AI in Production Processes**

Dr. Tobias Käfer
KIT Junior Research Group

To bring new products faster to market, companies need to improve immature production processes on the fly. The goal of the new DFG research group at KIT is to make process adjustments cheaper, faster, and more efficient with the systematic use of artificial Intelligence (AI). However, the high complexity and stochastic nature of real-world manufacturing processes, coupled with a limited number of expensive real-world samples, requires methodological improvements also in the field of artificial intelligence itself. Hence, this research group will create a broadly applicable methodology for the AI-assisted maturation of an immature manufacturing process. Ingredients are inter alia a temporary systematic over-instrumentation, a process modularization, and an iterative maturation procedure. This is a step towards professionalizing AI in the sense of an engineering discipline with procedures and tools that can scale to large and heterogeneous teams.

In the subproject *Management and Quantification of Process Maturity Improvement*, Tobias Käfer uses knowledge graph-based methods to model data and knowledge around the process and make it available to experts. To address challenges like the distribution of data, its heterogeneity, and the integration of physical knowledge, the scientists combine semantic data processing with qualitative reasoning.

YIN alumna Luise Kärger is likewise involved leading the subproject *Physics-based process evaluation and decision support for structural process improvement*. She was just recently appointed full professor at KIT funded by the DFG *Heisenberg Program*.

Prof. Luise Kärger
Professor for Digitization in Lightweight Design at KIT

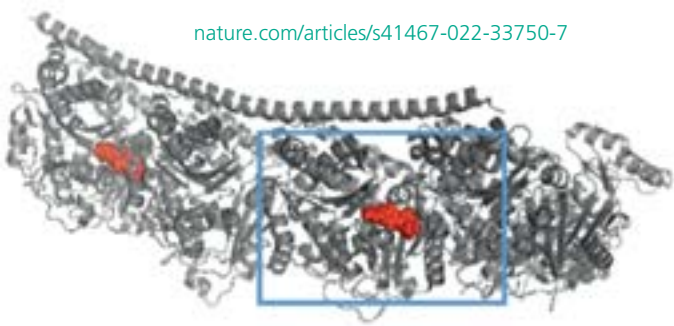
nature.comm. **Anticancer Drug as Photoswitch**

Dr. Zbigniew Pianowski
KIT Junior Research Group

To strengthen therapeutic effectiveness and reduce side effects, it is desirable for drugs to become active upon reaching their target region only. Zbigniew Pianowski and his group have now found that the biological activity of plinabulin – an anticancer drug candidate – can be triggered by visible light. Thus, the pharmacological agent itself works as a photoswitch without modification of its original structure. This makes plinabulin a perfect candidate for selective cancer phototherapy, as local photoactivation strongly reduces systemic side effects. Using violet and cyan light, the scientists can switch between two thermally stable compositions of the anti-cancer agent: Violet light reversibly changes the shape of the molecule, so that it does not match its cellular target (tubulin) anymore. Cyan light restores the "active" shape. The de- and reactivation can be performed multiple times, and the inactive form can be stored for months to be used as a "pro-drug".

The newly discovered molecular photoswitch embedded in plinabulin also reversibly changes its fluorescence making it applicable for super-resolution microscopy. Moreover, plinabulin makes a convenient tool for investigation of organismal development – it enables mitotic arrest of selected cells or tissues with high spatiotemporal precision. Finally, the new photoswitch may find non-biological applications in photomodulating physical properties of variable materials (polymers, hydrogels), or solar energy conversion.

nature.com/articles/s41467-022-33750-7



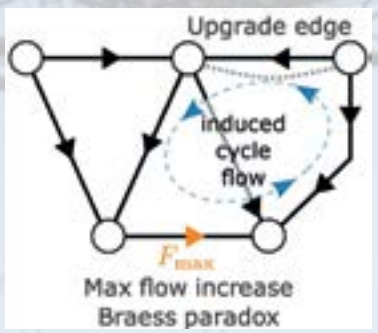
>> Contents <<

Twice published in *Nature Communications*

Adding only the Right Lines in Energy Networks

The ongoing energy transition requires power grid extensions to connect renewable generators to consumers and to transfer power over long distances. Increasing the capacity of existing lines or adding new lines, however, may counter-intuitively also reduce the overall system performance and even promote blackouts. The phenomenon that adding to a network may cause a decrease in performance was first described in traffic networks where additional streets might lead to traffic jams. It is named "Braess' paradox". Whether this effect also occurs in power girds, though, was unclear.

"In our study, we thoroughly demonstrate that Braess' paradox in power systems is not a purely academic idea," so first author Benjamin Schäfer. "We present an experimental setup displaying the paradox and also show how the paradox may arise in the German power grid when including planned grid extensions. Finally, we developed a topological theory that reveals the key mechanism behind it: Any upgrade of a grid that induces a cycle flow in alignment with the flow on the most highly loaded line will further increase the load and thereby cause the paradox." The results offer a theoretical method to understand and practical guidelines to support the systemic planning of grid extensions.



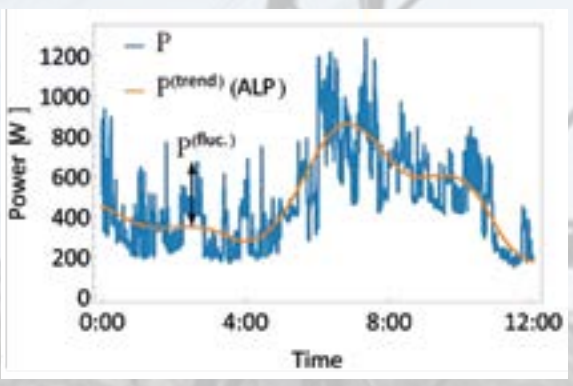
nature.com/articles/s41467-022-32917-6

Dr. Benjamin Schäfer
Helmholtz YIG

Data-driven Dynamics in Electricity Consumption

The dynamics of power consumption constitutes an essential building block for planning and operating sustainable energy systems. "Whereas variations in the dynamics of renewable energy generation are reasonably well studied, a deeper understanding of the variations in consumption dynamics is still missing," says Benjamin Schäfer, shared first author of the study. "We have now analyzed highly resolved residential electricity consumption data of Austrian, German and UK households and propose a generally applicable, data-driven load model."

"Specifically, we disentangle the average demand profiles from the demand fluctuations based purely on time series data. We introduce a stochastic model to quantitatively capture the highly intermittent demand fluctuations. Thereby, we offer a better understanding of demand dynamics, in particular its fluctuations, and provide general tools for disentangling mean demand and fluctuations for any given system, going beyond the currently used "standard load profile (SLP)". Our insights on the demand dynamics may support planning and operating future-compliant (micro) grids in maintaining supply-demand balance."



Disentangling trend and fluctuations allows better forecasting and analysis of demand.
nature.com/articles/s41467-022-31942-9

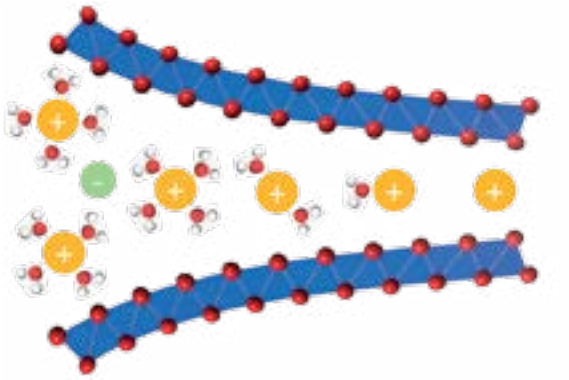
>> Contents <<

nature energy **Battery merges with Capacitor**

Dr. Simon Fleischmann
BMBF Jr. Research Group

Bridging the divide between battery and capacitor technologies, scientists propose a continuous transition between the two energy storage mechanisms. Their work breaks with the long-held view of electrochemical charge storage mechanisms being either fully capacitive or fully Faradaic. Instead, they argue that the transition between these mechanisms can be continuous and is determined by the degree of solvation of the charge carrying ion.

The implication of this concept is that the best out of both worlds could be combined: Batteries store a lot of energy but take time to charge; supercapacitors charge very quickly, but their energy density is limited. "By increasing the space for the electrolyte in the battery electrode, charge carriers can be embedded there with parts of their solvent shell," explains first author Simon Fleischmann. "Being increasingly covered by this shell, the interaction of the ions with the electrode continuously decreases and we observe the gradual transition to a double-layer behavior as in a supercapacitor."



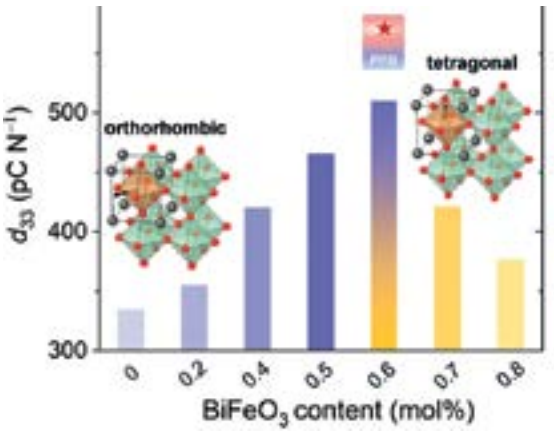
Continuous transition from double-layer to Faradaic charge storage in confined electrolytes
(graphic: nature.com/articles/s41560-022-00993-z)

nature comm **Phase transition in piezoceramics**

Dr. Manuel Hinterstein
Emmy-Noether Group

Piezoelectric materials convert mechanical into electrical energy and vice versa under an electric or mechanical stimulus. They have a broad range of applications such as wireless sensor networks, diagnostic ultrasound imaging, or actuators in the automotive industry. While lead-containing piezoceramics are widely in use today, more environmentally friendly alternatives will be crucial for a sustainable future. Manuel Hinterstein and his Emmy Noether group have now for the first time deciphered the fundamental structure-property relationship of a lead-free piezoceramic.

In the analyzed (K,Na)NbO3-based ceramics, the piezo effect manifests in a dramatic volume change induced by an electric field. Their study shows that the change in volume is up to 5 times larger in compositions with structural instabilities at phase boundary than in compositions without. In (K,Na)NbO3-based piezoceramics, it is the crystalline structure that changes between orthorhombic and tetragonal upon stimulation. This phase transition triggers the increase in volume which can be utilized to harvest large electrostrain. Thus, composition engineering is key to design lead-free high-performance ceramics.



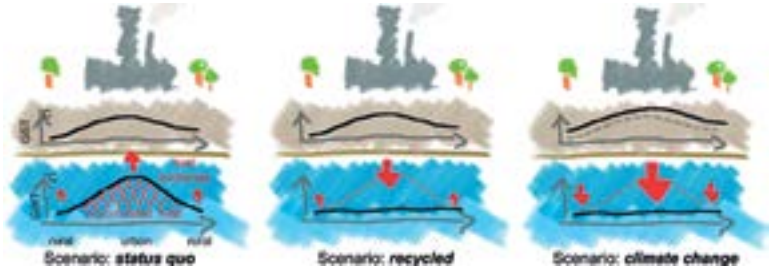
The optimal piezoelectricity is obtained at the orthorhombic-tetragonal phase boundary, known as the PPB.
nature.com/articles/s41467-022-31158-x

nature communications **Subsurface Heat Recycling**

Dr. Kathrin Menberg
KIT Junior Research Group

More than 60% of the residential energy consumption in the European Union is used for space heating; another 15% for water heating. Most of this energy is generated by burning fossil fuels which contribute to climate change and are an expensive resource – particularly right now. In our search for low-carbon alternatives, so far little attention has been given to the viability of recycling the heat accumulated in the shallow underground due to urbanization, industrialization, and climate change. We can extract this resource using very shallow geothermal systems. This involves pumping groundwater through a heat exchanger and returning it to the reservoir cooled. Researchers, including Susanne Benz and Kathrin Menberg, suggest that extracting this heat from the underground would not just reduce underground temperatures but could also easily supply annual heating demands. In addition, the volume of heat absorbed in the ground each year is expected to rise significantly as temperatures continue to rise. If the heat continues to accumulate in the ground, it will adversely affect water quality and ecosystems.

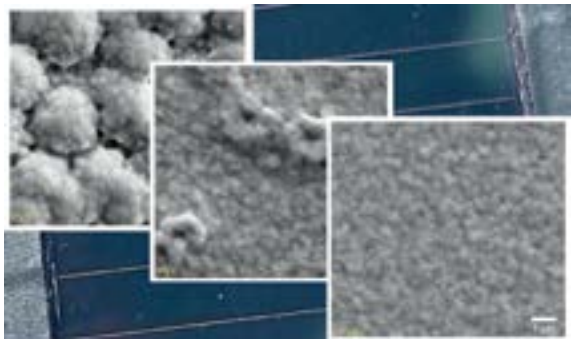
Dr. Susanne Benz
Freigeist Fellowship



nature.com/articles/s41467-022-31624-6

nature energy **Perovskite Tandem Photovoltaics**

Researchers at KIT have developed a prototype all-perovskite tandem solar module with an efficiency of up to 19.1 percent on an aperture area of 12.25 square centimeters – a technological breakthrough! "The result motivates further work in research and industry to bring this equally sustainable and seminal technology to market maturity by upscaling as well as improving stability," explains team leader Ulrich Paetzold. The remarkable result is based on three key innovations.



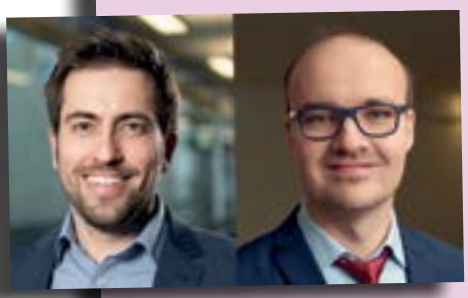
Scanning electron microscopy (SEM) images of perovskite produced at different growth conditions..
(SEM images: nature.com/articles/s41560-022-01059-w)

The KIT researchers increased the efficiency by optimizing the light path and reducing reflections in the solar cell architecture. They implemented an efficient layout for tandem solar modules using high-throughput laser scribing that enables the production of functional tandem solar mini-modules with two-terminal interconnected cell strips. Lastly, they used coating processes that are established industrial practice.

TT-Prof. Ulrich Paetzold
Helmholtz YIG

Tandem solar cells use a broader range of the spectrum and generate more electricity, making them more efficient. Perovskite solar cells with a tunable band gap are ideal tandem partners for other materials or for all-perovskite tandem solar cells. They feature low-cost production, solution-based processing methods, mechanical flexibility, and the freedom to combine cells with different perovskite band gaps. Researchers expect all-perovskite tandem solar cells to gain a high market share in the future.

>> Contents <<



Two ERC Consolidator Grants 2022 for two YIN members

Physicist Ulrich W. Paetzold (l.) and chemist Frank Biedermann (r.) have each received one of the prestigious Consolidator Grants of the European Research Council (ERC CoG). Their projects in the fields of photovoltaics and medical sensor technology respectively will be funded with approximately two million euro over the next five years.

With the *LAMI-PERO* project, Ulrich W. Paetzold aims to develop a radically new manufacturing process for highly efficient and stable perovskite thin films over large areas. This bears the potential to solve fundamental challenges of perovskite photovoltaics and prepare their economic breakthrough.

In the *SupraSense* project, Biedermann plans to develop highly specific yet easy-to-manufacture sensors for medical diagnostics. To this purpose, he combines the principles of molecular recognition through materials science with chemistry-based deep learning. The focus lies on the detection of metabolites, e.g. neurotransmitters and amino acids, that are important disease indicators.

YIN Award 2022

CO_2 capture and conversion via photoactive MOFs
Dr. Claudia Bizzarri and Dr. Manuel Tsotsalas

YIN Grants 2022

Atoms and Molecules on Surfaces explored by Machine Learning
TT-Prof. Pascal Friederich and TT-Prof. Philip Willke

Oleogels from pectin particles for fat reduction in fine bakery goods - OLEOBAKE
TT-Prof. Katharina Scherf and Dr. Ulrike van der Schaaf

New KIT Statutes 2022 have taken up YIN Guest seat at KIT Senate

In July 2022, KIT published its revised Joint Statutes which are the constitution of KIT: they regulate the entire organization, from the question of who may participate in KIT Senate elections to the structure of institutes or the tasks of various commissioners. The revision was an important milestone for implementing the 2nd KIT Further Development Act and newly electing the modified bodies at KIT.

For the Young Investigator Network, it is a huge success that the Joint Statutes name a YIN representative among the permanent guests at the KIT Senate! Though guests have no voting rights, the status provides the opportunity to learn about major developments going on at KIT and speak up if issues affecting the YIN members are addressed. YIN has worked hard to earn this privilege which is now for the first time officially documented in the Joint Statues of KIT. It is a strong signal that the voice of young academic leaders is highly appreciated at KIT.

29th Young Scientist Symposium Bioorganic and Organic Chemistry came to KIT

YIN members Frank Biedermann and Manuel Tsotsalas brought the 29th Young Scientist Symposium Bioorganic and Organic Chemistry to KIT. It unites junior researchers and scientists from Germany and neighboring countries with a common interest in bioorganic and organic chemistry. One Highlight of the three-day event was the plenary lecture of Nobel Laureate in Chemistry (1987) Jean-Marie Lehn on supramolecular chemistry. Moreover, the Editor-in-chief of the scientific journal *ChemBioChem*, Dr. Ruben Ragg, gave a frank and open talk on publication strategies. From the *Fonds der Chemischen Industrie* (FCI), Dr. Sonja Wendenburg provided an overview of the different funding schemes for all stages of early-stage researchers. One topic in the following Q&A session was how to better compensate for the disadvantages of stipend holders in terms of public insurance and pension contributions.

The Symposium Bioorganic and Organic Chemistry itself was founded about three decades ago by junior researchers who were looking for ways to connect and share their career experiences among peers, in addition to talking about science and developing joined project ideas – similar to the spirit of YIN. In her welcome address, head of Division I – Biology, Chemistry, and Process Engineering at KIT, Andrea Robitzki, covered the history of the Symposium and gave a short overview of YIN's mission and role at KIT. The Symposium was supported by the FCI and YIN.

Hybrid YIN Day 2022 with Project Blind Dates and Exemplary Career Paths

Personal presence was a huge asset facilitating lively exchange and interaction at this year's YIN Day. Highlights were project blind dates to find innovative collaborative ideas, greetings from Vice President Oliver Kraft and the Head of Division I Andrea Robitzki as well as three scientific career talks: YIN member Susanne Benz shared a glimpse into the YIG Preparation Program and her Freigeist Fellowship; alumna Anna Böhmer, Professor of Experimental Physics, especially Solid State, spoke of her research at the Ruhr University Bochum; and Martin Dienwiebel, long-standing YIN alumnus and Professor for Applied Nanotribology, talked about tribology at the cross section between Fraunhofer, KIT, and industry.

SWR Science Talk with Katharina Scherf: How healthy is Our Daily Bread?

What are wheat-related diseases and what will our future bread look like? SWR presenter Ralf Caspary talks about this with food chemist Katharina Scherf. Cereals are among the world's most important sources of nutrients, but they also contain gluten and other immunoreactive components. Why more and more people are reporting wheat intolerance has not yet been conclusively clarified. In addition to the ingredients in wheat itself as well as the cultivation and processing methods, the human immune system and its reaction to changing environmental influences also play a role. For example, the number of allergy and stress-related diseases has increased, says Katharina Scherf, while the protein content in wheat has rather decreased.

Facts and Figures from 2021/2022

The data was compiled from the YIN survey on 2021 (34 participants) and the YIN database 2022

YIN members

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

The following facts and figures are the outcome from the YIN statistics survey 2022 collecting data on 2021 and the YIN database of October 2022. Numbers in brackets indicate the change compared to the year before. Please, be aware that 30 YIN members filled in the 2020 survey, while for 2021 there were 34 (+4).

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

In 2022, the number of YIN members has been further increasing, mainly due to the appointment of more tenure track professors and further KIT junior research groups. Having reached 67 (+6) YIN members in October 2022, the number of members is higher than the maximum level that was reached around ten years ago (Fig. 1). The decline between 2014 and 2018 corresponded to the conclusion of KIT groups funded by the first Excellence Initiative.

YIN is an international network. In 2022, 21% (-4%) of all members have an international background coming from Europe, America, Asia, and Australia. The share of women decreased to 27% (-3%) in 2022. The average age of new YIN members joining the network was 34 (+1.4), with the youngest being 31 (+3) and the oldest 38 (-2). As the duration of groups is typically between four and six years, the average age of the current YIN members is 36.8 (-0.4), ranging from 31 (+1) to 44 (+1). Junior and tenure track professors in YIN, at the time of their appointment, were on average 34 years old.

27% women and 21% of international origin in YIN

Besides progressing in their career, many YIN members also start a family and consider (temporary) part-time work. On account of the YIN survey, almost half of the YIN members have at least one child and took an average of 3 (-2.3) months parental leave. The total amount of part-time work decreased from 46 to 18 months taken by 2 (-4) members.

Areas of research

In 2022, 39% (-1%) of YIN members were working in the field of natural sciences, followed by 26% (+5%) in computer science and mathematics, 24% (-2%) in engineering and material sciences, and 11% (-2%) in economics and humanities (see Fig. 2).

Types of research groups in YIN

YIN unites a variety of group types with different funding sources. In 2022, YIN counted 20 (+/-0) KIT junior research groups. In addition, there were 9 (+1) YIN members leading Helmholtz Young Investigator Groups that are in equal parts funded from the *Helmholtz Initiative and Networking Fund* and by KIT. There are also many YIN groups that are funded entirely from external sources such as 2 (+/-0) by the Federal Ministry of Education and Research (BMBF) and 7 by the German Research Foundation (DFG) via its Emmy-Noether program (+1). Finally, there are 25 (+6) junior or tenure track professors who are members of YIN. Other YIN groups are funded by the State of Baden-Württemberg (Margarete von Wrangell Program) or by the EU (Marie Curie Grant, ERC Starting Grant). Compare Fig. 2.

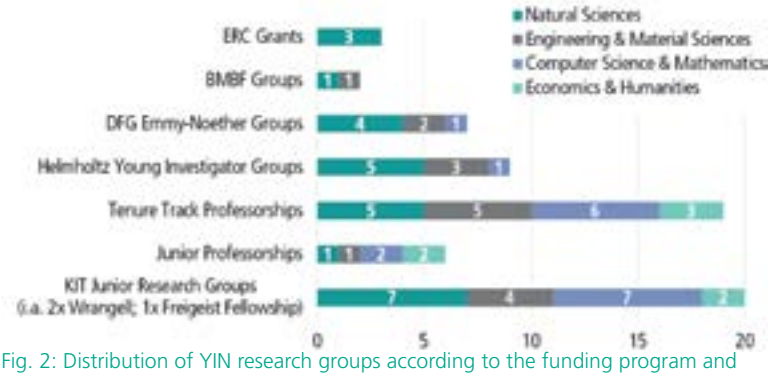


Fig. 2: Distribution of YIN research groups according to the funding program and areas of research (YIN database in October 2022).

Initial funding

The 2022 survey shows that in 2021, YIN members participating raised a total of 32.8 (+1.4) million euro distributed over 2 to 6 years (4.7 years average) for research projects at KIT by their initial funding. This results in a contribution of about 6.9 (+/-0) million euro per year. The funding volume of the different groups varies between 93.000 (+25.000) and 2.48 (-3.52) million euro. Roughly 8 (-1) million come from KIT, whereas the remaining 24.8 (+2.4) million euro are externally funded. On average, each YIN group starts with a 204.000 (-22.000) euro yearly budget.

33 M initial funding
15.4 M subsequent funding in 2021

Subsequent funding

In addition to the initial funding of their groups, YIN members acquire substantial subsequent funding. On average, each member raises roughly 453.000 (+119.000) euro extra a year. In 2021, subsequent funding amounted to 15.4 (+5.4) million euro in total. With 67% (-4%), the majority of these grants is provided by external funding agencies. 11% (+3.5%) are contributed by KIT and 22% (+0.5%) by industrial partners.

Publications and conferences

A total number of 257 (+60) peer-reviewed scientific papers have been published in 2021 by the 34 YIN members that participated in the survey. This includes publications in prestigious journals such as *Advanced Functional Materials*, *Molecular Systems Biology*, and *Nature Communications*. The average Hirsch-index (h) of a YIN member is 18.8 (+0.4). Due to different publication traditions in different disciplines, the h-index of the YIN members varies significantly. Moreover, controversial discussions criticize the h-index as an inaccurate performance metric and susceptible to manipulation. In addition to publications, YIN members show their scientific work and represent KIT on numerous occasions. In 2021, they presented their research at 82 (+28) international conferences. This increase is clearly associated with the end of the pandemic. Furthermore, 2 (+/-) patent applications were filed by YIN members in 2021.

257 publications
18.8 average h-index
82 conferences

Staff

YIN research group leaders supervise a large number of employees and students, namely a total of 388 (-52) people. The average size of a junior research group represented in YIN was 11.4 (-3.25) members in 2021. The YIN research group leaders employed 35 (-29.5) postdoctoral researchers, 133.5 (-10.5) doctoral candidates, 68 (-16) Master students, 40 (-6) Bachelor students, and 97 (+31) student assistants. The groups further encompassed 7.5 (-5.5) technicians, and 3 (-19) other as shown in Fig. 3.

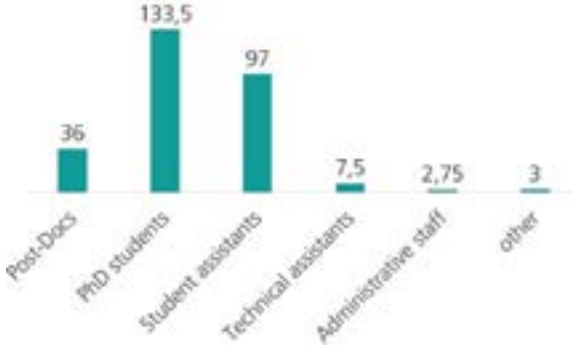


Fig. 3: Number of people working in YIN research groups.

Teaching & thesis supervision

For most YIN members, teaching forms a substantial part of their activities. About 86% (-8%) of all YIN members from the survey contribute actively towards teaching at KIT. Interestingly, however, only 38% (-4%) of the YIN members have an obligatory teaching assignment. For 43% (-2%), the teaching assignment is completely voluntary and mainly unpaid (Fig. 4).

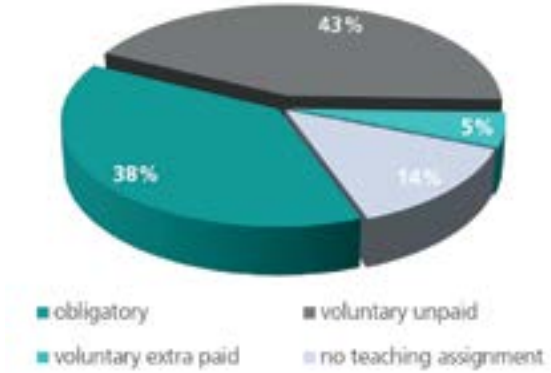


Fig. 4: Teaching assignment of YIN members in summer term 2021 and winter term 2021/22.

YIN members gave lectures accounting for a total of 270.3 (+44.1) weekly teaching hours per semester (SWS) during the summer term 2021 and the winter term 2021/22. The 270.3 SWS comprised lectures (138.3 SWS, +7.1), seminars (72 SWS, +16), exercises (40 SWS, +16) and practical trainings (20 SWS, +5).

270 SWS in 2021/22
28 Doctoral theses
108 Master and Bachelor theses

In addition to teaching, YIN members supervise doctoral as well as Master and Bachelor students. In 2021, 28 (+3) doctoral theses, 68 (-12) Master theses and 40 (-23) Bachelor theses were prepared in YIN research groups, as is illustrated in Fig. 5. This reduction might also be in consequence with the pandemic when there was a lot of uncertainty in regard to the procedures.

The examination entitlement granted to YIN members is very heterogeneous depending heavily on their status and the respective KIT department. 31% (-5%) have full examination rights and roughly 6% (-6%) of the YIN members have no entitlement at all. About 26% (+13%) of the YIN members have examination entitlement for theses of all group members (doctoral, Master, and Bachelor students); another 11% (-10%) only for doctoral thesis of group members, and 23% (+11%) only for lectures they give (Fig. 6). These changes are significantly influenced by the increasing amount of junior and tenure track professors at KIT who have full rights.

Fig. 6: Examination entitlement of YIN members

Fig. 5: Number of thesis officially supervised by YIN members as main or second/third reviewers in 2021 as well as additional supervisions.

Habilitation

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

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

nities can be relevant especially for group leaders and junior professors on temporary contracts who plan to stay involved in teaching even if they don't attain a full professorship. Professors at university of applied sciences may also profit depending on the German state they work for. In 2021, 24% (-9%) of the YIN members planned to pursue a habilitation and 9% (-8%) have already successfully completed this process (Fig. 8). 26% (+16%) were undecided while 41% (+1%) considered the habilitation as not necessary for their career.

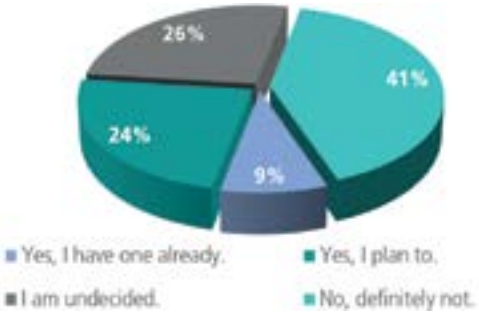


Fig. 8: Status and view regarding the habilitation as seen by YIN members.

KIT-Associate Fellow

The KIT Associate Fellow status temporarily grants restricted teaching and examination rights. Thus, junior group leaders acquiring the status may gain experience in independent teaching, supervision, and examination procedures. At some KIT departments, KIT Associate Fellows can be first reviewers for their doctoral researchers. At others, they may only serve as an additional third reviewer. Despite these differences, the KIT Associate Fellow is a valuable instrument to recognize the structural and scientific independence of junior group leaders. For research group leaders with access to the KIT Excellent Tenure program, the status can be helpful to bridge the time between the start of the research group and the appointment as junior or tenure track professor. By 2021, only one KIT department has still not appointed any Associate Fellows (Fig. 7).

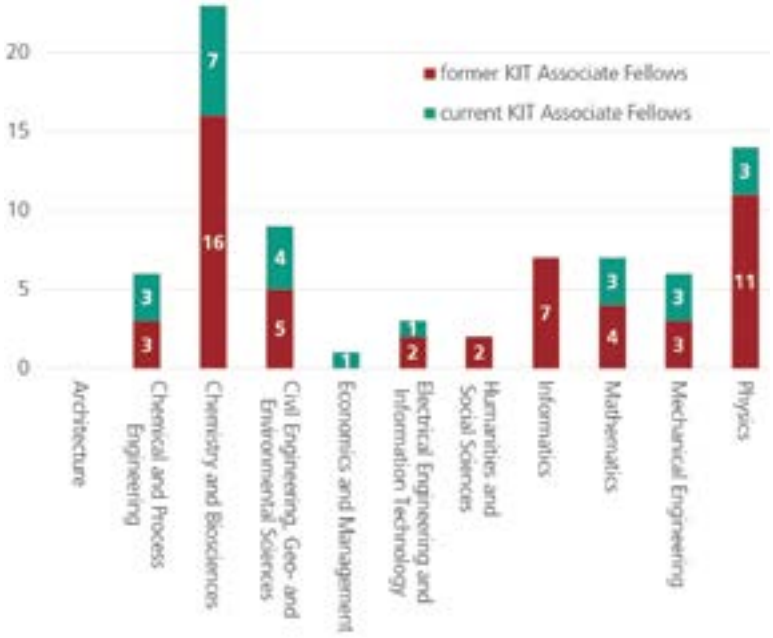


Fig. 7: Number of Associate Fellows at the KIT Departments in October 2022 (Data from YIN survey among the KIT Departments).

YIN alumni

After concluding their junior research groups or junior/tenure track professorships or leaving KIT, many former YIN members choose to apply for a YIN alumni membership. Their number is constantly growing and has reached 123 (+6) in October 2022. Additionally, we have 23 former YIN members without alumni status. Of these 146 former YIN members, 38 (26%) are women and 24 (16%) have an international background.

W2/W3 appointment ratio for YIN alumni has reached 47%

Moreover, six former YIN members were newly appointed to a full professorship last year with one Heisenberg Professorship and one Helmholtz Professorship at KIT. In total, 76 former YIN members hold now a professorship. Thus, the appointment ratio for YIN members is at 52% – counting 53 university professors, 6 professors at universities of applied sciences, 10 associate, 4 assistant, and 3 extraordinary professors. Out of these 76 former YIN members who now hold a professorship, 22 (29%) are women and 13 (17%) have an international background. In total, 15 former YIN member have accepted a professorship outside Germany – among them, 3 (20%) female professor and 4 (27%) with an international background.

Young Investigator Future Fields at KIT

The *KIT Future Fields* – funded within KIT's university of excellence concept – support scientists at KIT who pursue highly innovative, high-risk projects. In 2022, KIT set up a special call to promote excellent young scientists at KIT. The *Young Investigator Future Fields* call aims at an early thematic development, in particular with regard to the strengthening of outstanding, promising research topics and the support of young scientists in either participating in coordinated research projects at KIT or preparing proposals for visible outstanding individual grants.

Novel nano-3D-printable materials
by Dr. Jens Bauer

3D-printing with nanometer resolution has produced nanostructured materials with unprecedented functionalities. A major obstacle, however, is the limited bandwidth of useable materials, excluding many technologically important inorganic solids. This project demonstrates a novel route to 3D-print inorganic free-form nano-architectures; it develops 3D-printable precursors and thermal post-print conversion processes, which enable the fabrication of inorganic structures with controllable porous sub-morphologies. This could pave the way towards smart metamaterials with cross-disciplinary multifunctionality.

"Young Investigator Future Field provides me with the ideal framework to probe and advance an unconventional yet promising approach."

Mobile AEROsol measurement kit (AERO-KIT)
by Dr. Martina Klose

Understanding (dust) aerosol emissions, transport, and interactions is critical to predict weather, air quality, and incoming solar radiation for renewable energy generation. With the funding, Martina Klose will design an aerosol measurement kit that is flexible, induces minimal disturbance to the atmospheric flow, and can be combined with existing measurement systems, e.g. the KITcube integrated atmospheric observation system. The set-up will enable the study of (dust) aerosol emission processes and near-surface aerosol concentrations beyond what is currently possible with the available infrastructure at KIT.

"This gives us a new independence and allows long-term planning and the design of new, unconventional measurement strategies."

PRESCAN – PREvention of Sudden CArdio-renal-Neuronal death
by Dr. Axel Loewe

Chronic kidney disease carries a 100x increased risk for sudden cardiac death. Main causes are a massive slowing of the heart rate and an ultimate breakdown of the heartbeat. This suggests that electrolyte changes due to kidney failure affect cardiac pace-making. With the grant, Axel Loewe and his group will experimentally test the hypothesis that decimated extracellular calcium levels reduce the frequency of the primary cardiac pacemaker to critically low heart rates. Computational modeling allows them to dissect the influences of electrolyte changes under very controlled conditions.

"The focus on high risk, high gain projects and the lean application format were very attractive."

Atomic-Scale Investigation of Novel Molecules for Quantum Applications
by TT-Prof. Philip Willke

Quantum information technologies have gained momentum: besides quantum computation, quantum systems allow for enhanced sensing, imaging, and quantum mechanical simulation. In this project, Philip Willke and his team will study four different classes of molecules with novel molecular structures and their quantum properties at atomic-scale. All of them promise highly interesting properties for quantum information processing, i.e. interspin coupling, a unique magnetic structure, as well as potentially long coherence times. Identifying novel routes for quantum research in these systems is the main objective.

"The grant allows us to jumpstart a new project. For our Cluster of Excellence proposal, it fosters the collaboration between different partners in chemistry and physics"

Benchmarking Artificial Photosynthesis by Comparing it to Natural Photosynthesis

Global warming and climate change are among the major environmental issues today. One of the causes is the increased concentration of CO_2 in the atmosphere. Forests are able to consume 7.6 billion metric tons of CO_2 each year[1] via natural photosynthesis; nevertheless, the carbon cycle remains unbalanced because of human activities. Artificial photosynthesis products, such as methane, methanol or carbon monoxide, and molecular hydrogen, have a high potential for a successful transition towards renewable energy sources. However, artificial photosynthesis is still emerging, and knowledge of the entire process's efficiency and environmental footprint is limited. Thus, Dr. Claudia Bizzarri and Dr. Somidh Saha teamed up to answer the question: How sustainable is artificial photosynthesis in reality? With support of the *YIN Grant*, they want to use natural photosynthesis as a direct benchmark to evaluate artificial photosynthesis efficiency.

Dr. Claudia Bizzarri
photochemistry

Claudia is an organic chemist with a fondness for photochemistry. She has worked on the design and fully characterizing new coordination metal complexes that are photoactive in regard to the CO_2 reduction to other reactive molecules. In particular, she is committed to working only with earth-abundant materials (not rare and expensive metals) to approach a sustainable way of closing the carbon cycle.[2] Thanks to the YIN grant, Claudia's team has tested some known and some new metal complexes in their role as photocatalysts for the reduction of CO_2 to CO. Their performance was evaluated under different light sources and in prototype reaction conditions under a solar simulator.[3] Moreover, Claudia's team develops new photocatalytic systems in water.

Somidh is a forest ecologist fascinated by trees' smartness and capacity to efficiently utilize light, water, and soil nutrients in natural forest ecosystems and artificial urban forests. Therefore, one of his research interests is how the photosynthesis of different tree species reacts to light. For example, he and his colleagues showed that oak (Quercus petraea) saplings could maximize their photosynthetic capacity or rate of carbon assimilation when they get at least 50% of solar radiation. This requires a gap size of 0.2 ha in forests.[4]

Dr. Somidh Saha
forestry and social sciences

In 2021, Somidh's team studied light conditions in forest change after a forest fire and how increasing levels of solar radiation influence photosynthetic capacity and quantum use efficiency. They also tested the effect of light availability in controlled laboratory conditions on fast-growing plant species such as sorghum. A comparative analysis of photosynthesis performance from the collected data is currently under way.

Meanwhile, Claudia and Somidh have prepared a protocol for evaluating the synthetic photocatalytic approach compared to natural photosynthesis. Learning and biomimicking natural photosynthesis will help benchmark the efficiency of artificial photosynthesis and understand the factors that increase the carbon footprint.

[1] wri.org/insights/forests-absorb-twice-much-carbon-they-emit-each-year
[2] C. Bizzarri Eur. J. Org. Chem 2022, e202200185
[3] L.-L. Gracia, C. Bizzarri et al. ChemCatChem 2022, 14, e202201163
[4] Modrow, T., et al 2019 European Journal of Forest Research doi.org/10.1007/s10342-019-01238-7

Biocompatible Hydrogels for 3-Dimensional Printing with Light

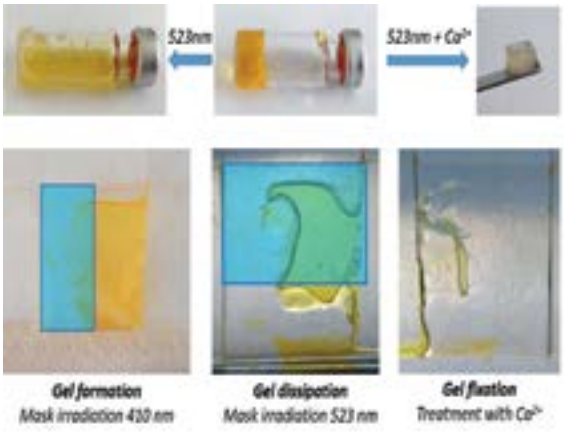
Dr. Zbigniew Pianowski
chemistry

3D-printing recently emerged as a very useful technology for producing complex shapes – from models of human organs to fully functional elements of cars. The printing is typically performed using layer-by-layer deposition of molten polymers. However, these conditions are incompatible with biological entities. Therefore, new biocompatible printing methods are sought for to produce tailor-made implants or for 3D cell cultures.

The group of Zbigniew Pianowski had developed supramolecular hydrogels containing molecular photoswitches, which are molecular "antennas" that enable conversion of the light energy into molecular motion. These hydrogels can be reversibly dissipated with visible light.[1] They are biocompatible, and have been used as drug-delivery materials.[2] The YIN Grant 2021 enabled us to perform preliminary investigation of the properties of our material in the 3D-bioprinting direction.

First, we have optimized the structure of molecular photoswitch, to enable dissipation with low-energy red light compatible with complex biological systems – these frequencies can deeply penetrate soft human tissues.[3] Then, we developed a composite hydrogel, where the photochromic component is blended with an oppositely charged alginate (covalent non-photochromic sugar polymer). This formulation enables reduced loading of the photochromic agent. The resulting material can be reversibly photodissipated and forms defined shapes.

Once formed (e.g. with desired type of living cells inside), it can be treated with aqueous solutions of calcium salt – a strong cross-linker specific for alginate. This, together with general irradiation, liquefies the remaining photochromic component that is further washed away. The remaining shaped material contains only properly shaped fully biocompatible calcium alginate with the desired cells suspended in it.[4]



Green light turns the hydrogels into liquid. Calcium salts cross-link the alginate, which retains the original gel shape while photochromic components can be washed away.

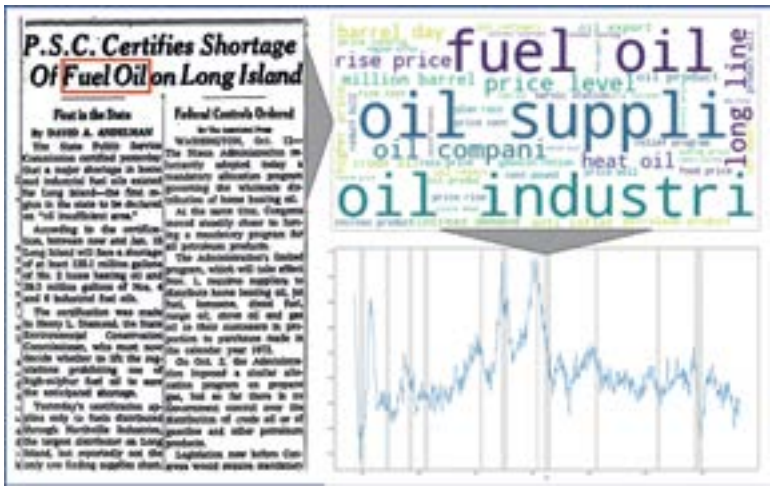
Currently, with the support of a DFG grant[5], we explore the use of our material for 3D-bioprinting of tailor-made implants for regenerative medicine. We also test our material as a smart support for growing organoids – functional 3D models for human tumors (tumoroids). It is known that mechanical properties of hydrogels are much more optimal for growing fragile cell and tissue cultures, in comparison to glass or plastic supports. And our goal is to dissipate the hydrogel with light after finished growth – so that the organoid can be isolated for further experiments in liquid media.

[1] Karcher J., Pianowski Z. "Green light-induced drug release from supramolecular hydrogels" Chem. Eur. J., 2018 24, 11605-11610.
[2] Karcher J., Kirchner S., Leistner A.-L., Hald C., Geng P., Bantle T., Gödtel P., Pfeifer J., Pianowski Z. "Selective release of a potent anticancer agent from a supramolecular hydrogel using green light" RSC Adv., 2021 11(15), 8546-8551.
[3] Leistner A.-L., Kirchner S., Karcher J., Bantle T., Schulte M. L., Gödtel P., Fengler C., Pianowski Z. "Fluorinated Azobenzenes Switchable with Red Light" Chem. Eur. J., 2021 27, 8094-8099.
[4] Leistner A.-L., Kistner D. G., Fengler C., Pianowski Z. "Reversible photodissipation of composite photochromic azobenzene-alginate supramolecular hydrogels" RSC Adv., 2022 12, 4771-4776
[5] DFG Sachbeihilfe PI 1124/6-3 "Photochromic cyclic dipeptides as biocompatible smart materials" Z. Pianowski Jul.2021-Jun.2024

A Machine Learning Approach to High-Frequency Macroeconomic Data

Economic theories often link macroeconomic and financial data. They help us understand decisions of individuals, mechanisms of how these translate into aggregate flows or resource allocation, and the consequences for wealth, prosperity, and equality in our society. Hence, they play an important role in informing policy makers. It is crucial to test these theories with high-quality data. While financial data are available at high frequencies of up to milliseconds, a problem in the field of financial economics is the low frequency of macroeconomic data. For example, aggregate consumption flows are very difficult to measure and good quality data are only available at annual frequencies. This circumstance hampers the testability of economic theories. With support of the YIN Grant, Julian Thimme follows up on the idea to combine big data and machine learning techniques to bring low-frequency macroeconomic data up to high frequencies by "predicting" the variation during the years.

To work on this challenge, Julian Thimme – himself an expert in macro finance – has teamed up with two fellow scientists: Viktoria Klaus dedicates her doctoral studies to machine learning applications in financial economics; and Alexander Hillert, professor at the Goethe University Frankfurt, brings in his expertise in the field of textual analysis.



Their goal is to find predictor variables that are informative of variations in macroeconomic time series and, at the same time, available on high frequencies such as daily. These high-frequency predictors are time-aggregated to a low frequency and used in training a machine learning algorithm that selects the most important features to explain the low-frequency variations. The original high-frequency predictors can then be used to come up with a high-frequency macroeconomic time series.

TT-Prof. Julian Thimme
economics

In addition to the technical and methodological hurdles, the approach obviously hinges upon the selection of appropriate predictor variables. Here, the team opted for a text-mining approach based on articles from a leading US newspaper. These data have been available on a daily frequency for more than a century and are likely informative about economic circumstances that have influenced the decisions of consumers and policy makers.

With the financial support of the YIN Grant, the teams installed three powerful computers that downloaded all newspaper articles of this outlet between 1923 and 2022. For more than half of the sample, only images of newspapers are available, which had to be translated into machine-readable text using optical character recognition software. With the great help of two student assistants, 12 terabytes of data were gathered, translating into a text corpus of approximately 10 billion words. This extensive data set will play an important role not only in this project (which is still work-in-progress), but also in future projects.

Continually towards Leadership Excellence

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

Conflict Management
by Dr. Claudia Bizzarri

Even if you have a friendly attitude, different types of conflicts may arise in your daily work. Maybe there was a misalignment between your understanding of how a specific job should be done and that of your colleague. Perhaps, there is this collaborator who is late in providing you with the agreed experiment or that student who continues to make same mistake over and over. Just close your eyes and think about what bothers the working environment around you. Most of the time, it is just an inadequate communication or some unclear instructions that might cause this kind of conflict. Yet, the idea that a conflict will dissolve itself over time alone is wrong.

Within the two-day online workshop on *Conflict Management*, we have revised some basic rules of communication, among which transparency is vital. In a very cozy atmosphere, as always in workshops with YIN members, we shared our issues and worked out possible solutions with the moderation of the coach. To do so, the information about the five steps for a sustainable solution and the concept of "non-violent communication" was beneficial. We analyzed the various types of conflicts and recognized their distinct phases. Thanks to this workshop, we better understand the role of the team leader in moderating conflicts that might arise within the team, and got the necessary tools to deescalate and solve them.

YIN Certificate *Academic Leadership*

After various seminars, workshops, and coachings – mounting up to 200 academic units – Jun.-Prof. Ingo Wagner has proven himself as an exceptional leader personality. At the hybrid YIN Day 2022, he was awarded the Certificate *Academic Leadership* by Ernst Aumüller, head of the Leadership Personnel and Top Management section at the Service Unit for Human Resources Development and Vocational Training.

„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 Ingo Wagner.

Teaching Award 2022 by the KIT Faculty for Humanities and Social Sciences

Complementing his achievements in academic leadership, Ingo Wagner was also honored for his outstanding contribution to teaching. Awarded by the Executive Board of KIT since 2007, the Faculty Teaching Award is a visible sign to emphasize the high value of teaching at KIT. As Head of the Interdisciplinary Didactics Division, STEM & Physical Education, Ingo Wagner shapes the future of education through innovative perspectives such as research-oriented teaching and interdisciplinary teaching-learning laboratories combining STEM subjects and physical education.

Steering Team-Development
by Jun.-Prof. Dr. Ingo Wagner

Starting and building up a team as a young PI can be a challenge – not only in times of a pandemic. Moreover, new uncertainties might arise, once your team reaches a certain size: tasks need to be delegated or the teamwork restructured. Thankfully, YIN supports thriving junior research groups with a moderated team-development workshop.

The first step to get a realistic picture of the working group, identifying both strengths and further development potentials, was an anonymous evaluation done by each team member. For this purpose, we used a research-oriented group feedback survey. Our coach discussed the results first with the group members and afterwards with me. Based on this, we defined development priorities like group structure and meeting schedules. In a moderated day-retreat with the whole group, we worked on the selected topics intensively using the tool "Team Radar". The retreat included activating outdoor exercises to strengthen cohesion and to promote team spirit despite the pandemic. I ensured a sustainable team development through regular follow-up sessions. Almost one year later, my group and I still benefit from the time and effort we invested. Overall, this approach seems to be a recommendable path for (young) scientists to build up their own happy and successful groups within YIN.

Teaching Compact
by Dr. Simon Fleischmann and TT-Prof. Philip Willke

Excellent teaching is a crucial part for a young research group leader – to establish your own field, to educate the next generation, and most of all to attract students for your group. Nevertheless, often no formal training is required at a university – which leaves you to jump into cold water As a last safeguard, YIN has established the one-day workshop *Teaching Compact* to get you jump-started into teaching mode. It gives you a quick survival guide including different roles of teachers, how to plan a course, as well as different teaching and activation methods. For instance, do you know the best technique on how to capture the students' attention, how long it takes them on average to start playing with their phones, and – crucially – how to best win back their interest? Moreover, the crucial interplay between the learning goals, the course, and the exam is dissected in detail. But, don't expect a theoretical lecture about teaching strategies. During the course you will directly apply the introduced concepts to your own lecture in an interactive format with the group.

The leader of the workshop is an extraordinary teacher! She creates a very interactive working atmosphere where active participation is mandatory. An asset which is also desirable for the classroom after all. Your acting talents will be tested during role play exercises on real-world scenarios. Not only may they teach you about potential conflict situations in the classroom but will surely create some laughs as well. At the end of the course, you will have learned where you and your colleagues find themselves on the spectrum from directing to nurturing and whether your role is best described as Midwife or Mountain Guide. With the short time investment, the learning curve is steep and participation is highly recommendable.

1st Associate Fellow at the KIT Department of Economics and Management

In 2021, the KIT Associate Fellow concept had its 10th anniversary and, fittingly, the 10th of the eleven KIT departments assigned the status for the first time. The idea behind the concept is to allow scientifically independent, not yet habilitated, young group leaders to supervise their doctoral students and participate in their examination procedures.

Dr. Sebastian Lerch
KIT Junior Research Group

Sebastian Lerch started his independent group with funding from the Vector Stiftung. After having been successful within their "MINT für die Umwelt" scheme, in 2021, he also became KIT Associate Fellow. The Vector Stiftung had specifically asked for Lerch to get the right to take part in the doctoral proceedings of his group members. Encouragingly, more and more funding agencies take proactive measures to secure the independence of the research groups they invest in.

Lerch works on improving probabilistic weather forecasts using artificial intelligence. So, how is he the first Associate Fellow at the KIT Department of Economics and Management? While he initially worked in the math department at the Institute for Stochastics, he is now to be found at the Institute of Economics. "At KIT, as it is common in Germany, research in statistics happens at multiple departments," Lerch explains. "More theoretical approaches are often closer to mathematics; more applied research might be associated with economics." As his research combines both sides in about equal measures, Lerch feels at home at both KIT departments. His research lives and strives through interdisciplinarity. Besides, research at the intersection of mathematics and statistics, meteorology, physics, and computer science plays a crucial role on the way to a next generation of probabilistic weather forecasts.

Have you ever consulted 5 weather apps and gotten 5 different forecasts? What makes the weather so hard to predict, is the chaotic system we call atmosphere: physical variables like temperature, humidity, and cloud coverage are constantly changing and interacting with each other. Nonetheless, physical models attempt to replicate and predict what is happening in the atmosphere. Nowadays, forecasts are based on repeated model runs generating a collection of different forecast scenarios. These ensembles provide a likely description of future weather events and have become widely used in practice. However, they are often characterized by systematic errors that require correction via statistical post-processing methods.

Neural networks recognize non-linear correlations in large amounts of data.

The work of Sebastian Lerch's group starts, where established statistical methods reach their limits in the face of large data sets and complex interrelationships. His team uses neural networks to develop novel post-processing methods. The advantage: neural networks can find non-linear relationships in complex datasets.

"We don't want to replace physical models as the core element for weather prediction", Lerch continues. "Instead, we incorporate neural networks as tools to provide improved predictions, for example, by correcting systematic errors due to the coarse spatial resolution of the physical models. So far, we have been successful at significantly improving over established techniques from statistics." With his group, he now plans to develop novel approaches to incorporate new sources of information into models and to address challenges in the use in operations.

Many of the underlying methodological questions and developments are not only relevant for probabilistic weather prediction but will also provide insights into the use of neural networks in other areas of application such as energy forecasting, economics, and epidemiology. This is where the strong interdisciplinary research environment at the Institute of Economics and KIT in general offers fruitful opportunities for collaboration.

Dr. Benjamin Schäfer
Institute for Automation and Applied Informatics

Helmholtz
Data-Driven Analysis of Complex Systems

Dr. Simon Fleischmann
Helmholtz Institute Ulm

BMBF
Nanoconfined Electrochemical Interfaces

Dr. Kathrin Menberg
Institute of Applied Geosciences

Margarete von Wrangell Fellowship
Sustainable Geoenergy

TT-Prof. Manuel Krannich
Institute of Algebra and Geometry

Tenure Track Professorship
Algebraic and Geometric Topology

Dr.-Ing. Klarissa Niedermeier
Institute for Thermal Energy Technology and Safety

KIT Junior Research Group
Heat Storage on Liquid Metal Basis

Dr. Florian Strauss
Institute of Nanotechnology

BMBF
Electrochemical Energy Storage

Dr.-Ing. Cihan Ates
Institute of Thermal Turbomachinery

KIT Junior Research Group
Machine Intelligence in Energy Systems

Dr.-Ing. Alexander Stroh
Institute of Fluid Mechanics

Helmholtz
Multiphase Flows with Heat Transfer

TT-Prof. Felix Kahlhöfer
Institute for Theoretical Particle Physics

Tenure Track Professorship
Particle Physics

>> Contents <<

New YIN Members

Dr. Susanne Benz
Institute of Photogrammetry and Remote Sensing

Freigeist Fellowship
Geospation Datascience

TT-Prof. Moritz Wolf
Institute of Catalysis Research and Technology & Engler-Bunte-Institute

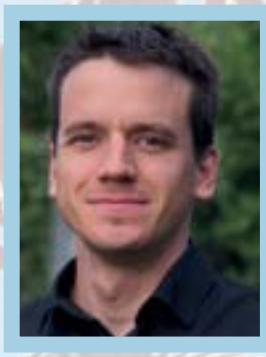
Tenure Track Professorship
Chemical Energy Conversion

TT-Prof. Sebastian Krumscheid
Steinbuch Centre for Computing & Institute for Applied and Numerical Mathematics

Tenure Track Professorship
Uncertainty Quantification

Dr. Christian Zillinger
Institute of Analysis

KIT Junior Research Group
Partial Differential Equations



Dr. Julian Quinting
Institute of Meteorology and Climate Research

ERC Starting Grant
Advancing Subseasonal PredIctions at Reduced Computational Effort

Dr. Jens Bauer
Institute for Nanotechnology

Emmy Noether
Nanoarchitected Metamaterials

Dr. Björn de Rijk
Institute for Analysis

KIT Junior Research Group
Partial Differential Equations

Dr. Charlotte Debus
Steinbuch Centre for Computing

BMBF
Robust and Efficient Artificial Intelligence

Dr. Ralf Loritz
Institute of Water and River Basin Management

KIT Junior Research Group
Energy and Information Flows in Hydrological Systems

YIN Guest
Prof. Corinna Harmening
Geodetic Institute

Professorship
Geodetic Sensor Systems

Prof. Hartwig Anzt
Professor in the Electrical Engineering and Computer Science Department & Director of the Innovative Computing Lab
University of Tennessee

previously
Helmholtz
Applied Computer Science

Prof. Nadine Rühr
Professor for Climatic Ecophysiology
KIT

previously
Emmy Noether
Plant Ecophysiology

Prof. Luise Kärger
Professor for Digitization in Lightweight Design
KIT

previously
Vector Foundation-YIG
Lightweight Design

Dr. Gabriel C. Rau
Lecturer
University of Newcastle

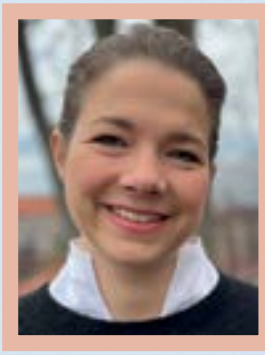
previously
Marie Skłodowska-Curie Fellow and 2x DFG grant holder
Engineering Geology

Prof. Barbara Verfürth
Professor for Numerical analysis
University of Bonn

previously
Emmy Noether
Numerical Analysis

PD Dr. Andreas Haupt
Akademischer Rat
KIT

previously
KIT Jr RG
Sociology



Assistant Prof. Julia Maibach
Assistant Professor for Materials Physics
Chalmers University of Technology

previously
BMBF
Battery Research

>> Contents <<

Emmy Group Head and Helmholtz Professor

YIN alumna Nadine Rühr's professorial appointment is funded by the Helmholtz Association

Prof. Nadine Rühr
Professor for Climatic Ecophysiology, KIT

In 2022, Nadine Rühr became Professor of Climatic Ecophysiology at the Institute of Geography and Geoecology at KIT. The Helmholtz Association supports her professorial career with the F*unding of First-time Professorial Appointments of Excellent Women Scientists (W2/W3)*. Having already established her Emmy Noether group in 2016, Nadine Rühr, thus, profited from the unique career opportunities at KIT. Only at The Research University in the Helmholtz Association, could she have received funding from the German Research Foundation alongside her professorial career at a Helmholtz Center. Beside her, two other YIN alumni and former *Helmholtz Young Investigator Group* leaders were succesful in the first-time appointment programm of Helmholtz and are now professors at KIT: in 2013, Anke-Susanne Müller become Professor for Accelerator Physics followed by Kathrin Valerius, since 2020, Professor of Experimental Astroparticle Physics.

With her research team at the KIT-Campus Alpin, Nadine Rühr strives to understand mechanisms of tree and forest responses to climate change. Her aim is to increase forest resilience to extreme events and integrate physiological, biogeochemical, and ecological methods and modeling approaches.

Following your PhD at the ETH Zurich and your postdoc in the US, why come back to Germany to pursue your scientific career?
We left the US as we were planning to have kids and wanted to move closer to family again.

Why did you choose KIT, the Campus Alpin?
Simply: Interesting job offer, just at the right moment. I also prefer smaller towns over bigger cities and like the setting in the Alps very much. I must admit I did not know much about Helmholtz back then, but thought it an advantage to be able to focus primarily on research. Also, I was very intrigued about designing experiments for the advanced technical greenhouse facility. It had been newly built and just needed to be filled with exciting research projects.

How would you rate the path towards professorship via the Emmy Noether Program?
An Emmy Noether grant by the DFG (the German Research Foundation) gives you great opportunities and freedom to pursue your own research ideas. It provides the necessary funding and personnel, while giving you also flexibility in terms of family commitments. For instance, I worked part-time during parental leave and got the period extended through the DFG without much bureaucracy. Also at KIT, it was straightforward to become a member at YIN and to receive the Associate Fellow status via the KIT Department of Civil Engineering, Geo and Environmental Sciences. I felt very much supported both scientifically and personally through both the DFG and KIT.

What distinguishes a Helmholtz professorship from "regular" professorships?
I received a prestigious grant through the Helmholtz Association, which provides one million euro seed funding for my professor position at KIT. For this I had to compete internally at KIT, then write a full proposal that was submitted by KIT to the Helmholtz Association. The proposal was externally reviewed and I was invited to an interview. End of 2020, KIT got informed that I was successful and if I get appointed as full professor within the next 18 months the grant would be approved – providing one million euro for the next five years. Meanwhile, the professor position had been established at the Institute of Geography and Geoecology. I applied and went through interviews with the search committee. I received the official offer by KIT early in 2022.

Do you benefit from being a "professor at KIT" according to the KIT 2.0 law?
Yes, my teaching load is reduced analog to the Jülicher model. Though, I am no longer "on leave" but a regular professor at KIT which I find very positive.

How would you rate networks such as YIN on the way to a successful scientific career?
I clearly benefited through the exchange with other YIN members and felt overall supported by the network. I very much enjoyed the activities offered by YIN and think I grew as mentor and leader in participating in the various programs like Leadership Excellence Seminar or Feedback Course. I am convinced that this helped me in perusing a successful scientific career.

In regard to climate change, your research is of utmost importance – what fascinates you?
I am fascinated by trees and forests and how they respond to changing environmental conditions. In particular, to extreme events such as heatwaves and drought spells. My main focus is on the underlying physiological responses and how we can implement experimentally-derived process understanding into vegetation models. The goal is to project how a rapidly changing climate might affect ecosystem services by forests and how we can make forests more resilient.

The Plant Ecophysiology research team of Nadine Rühr during their retreat in November 2022.

If you could change one thing in your academic environment, what would it be?
Have a more diverse professorate at KIT, particularly with more female colleagues. This would improve the overall work environment to become more inclusive, inspiring, productive, and ready for future challenges.

What do you want to achieve in the future?
Contribute towards a better understanding of how trees and forests help us in mitigating climate change; provide some possible solutions on how we should manage forests to increase stress resilience. In addition, to raise public awareness of the Earth System and forests in particular, I want to get more engaged with citizen science projects and science education in general.

Your word of advice to rather early career researchers?
First, invest in building a scientific network which is great to exchange ideas and receive support. Second, trust into your own research ideas. And third, be bold and just do it.

WORDS OF ADVICE
Trust in your ideas!
Be bold and just do it!

Imprint

Circulation
400

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

Editorial board
Dr. Susanne Benz, Dr. Dominic Bresser, Dr. Simon Fleischmann, Dr. Somidh Saha, Dr. Benjamin Schäfer, TT-Prof. Philip Willke, YIN Office

Further proof of pictures
cover (Road Sign) Karen Roach – stock.adobe.com, (Mortarboard) BillionPhotos.com – stock.adobe.com; arrangment by Lilith C. Paul
p. 5 (Langer) Patrick Langer, KIT
p. 6 (Niessner), p. 16 (Käfer) Daniel Kuntze, die Fotofabrik Daniel Kuntze
p. 11 (Quinting), p. 12 (Friederich), p. 13+35 (Anzt), p. 20 (Biedermann), p. 29+39 (Thimme) Amadeus Bramsiepe, KIT
p. 14+15 (Periodic Table) Humdan – stock.adobe.com
p. 17, 33 (Schäfer) Fotodesign Julia Wisswesser
p. 20 (Paetzold), 30 (Teaching Award), 35 (all) Markus Breig, KIT
p. 31 (Wagner) Lydia Albrecht, KIT
p. 33 (Strauss) Marco Striebinger
p. 34 (Kahlhöfer) Kira Held, KIT
p. 34 (Zillinger) Tanja Meißner, KIT
p. 39 (Färber) Andreas Friedrich, Andreas Friedrich Fotografie
all other unmarked images: YIN or private sources

Layout
Lilith C. Paul

Statistics
Janine Pallasch, Dr. Gunnar Seemann

Interviews lead by
Lilith C. Paul (p. 6f; 14f), Dr. Dominic Bresser and Dr. Simon Fleischmann (p. 36f)

Print
Systemedia GmbH // Dachsteinstraße 3 // 75449 Wurmberg

Karlsruhe, February 2023

What We Stand For

JProf. Christian Grams
Representative and Finance

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 tenured 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 KIT's Excellence Strategy *Living the Change*. The continued existence of YIN is a testament to the role it plays within the academical hierarchy and to the services it provides for members. Our mission, comprised of the following three statements, has and will continue to guide YIN.

TT-Prof. Katharina Scherf
Representative

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

Dr. Zbigniew Pianowski
Event

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

TT-Prof. Julian Thimme
Board member

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

Dr. Michael Färber
Board member

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

Dr. Dominic Bresser
Public Relations

Dr. Somidh Saha
Public Relations

>> Contents <<

Contact

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

76131 Karlsruhe

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

Issued by

Karlsruhe Institute of Technology (KIT)

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