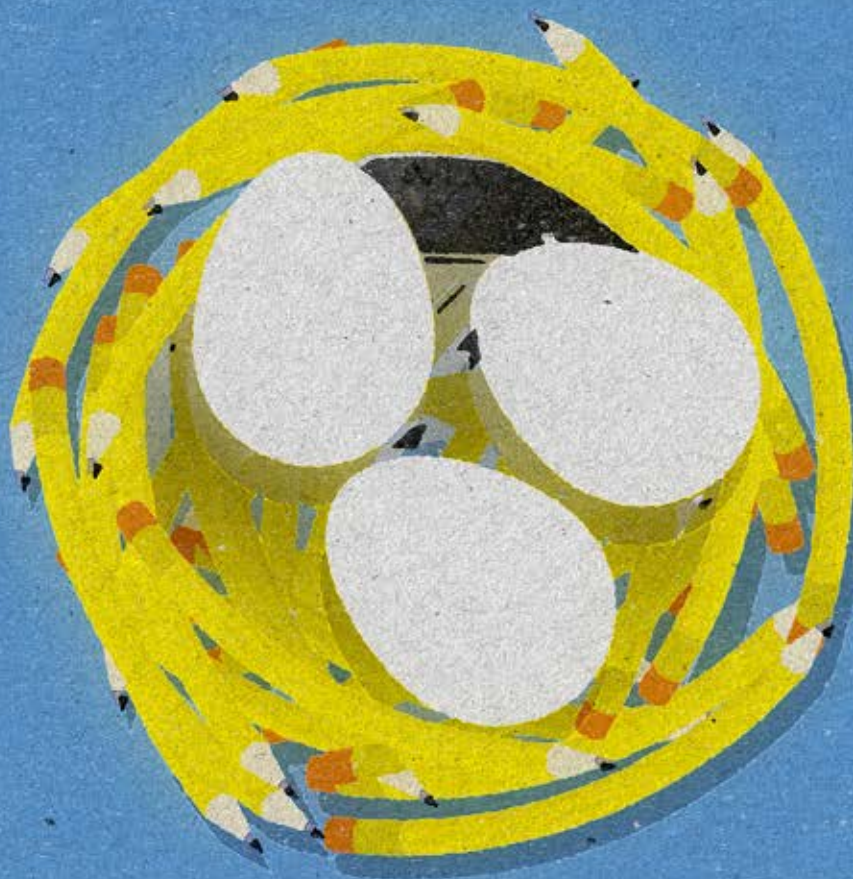


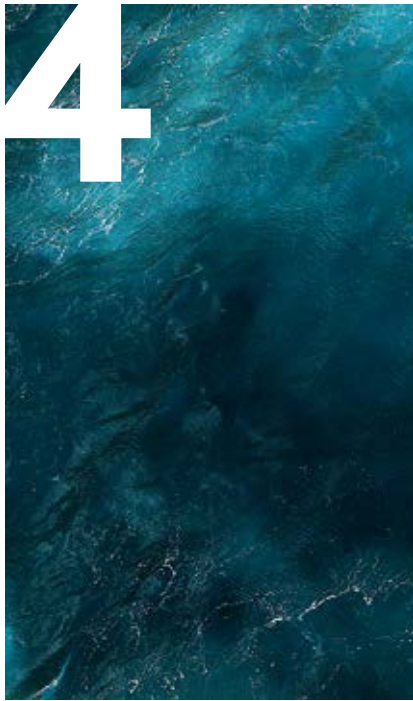
Portal Wissen

The Research Magazine of the University of Potsdam

Two 2021



DE PARTURE



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DEPARTURE

On October 20, 1911, the Norwegian Roald Amundsen left the safe base camp “Framheim” at the Bay of Whales together with four other explorers and 52 sledge dogs to be the first person to reach the South Pole. Ahead of them

lay the perpetual ice at temperatures of 20 to 30 degrees Celsius below zero and a distance of 1,400 kilometers. After eight weeks, the group reached its destination on December 13. The men planted the Norwegian flag in the lonely snow and shortly afterwards set off to make their way back – celebrated, honored as conquerors of the South Pole and laden with information and knowledge from the world of Antarctica. The voyage of Amundsen and his companions is undoubtedly so extraordinary because the five proved that it was possible and were the first to succeed. It is, however, also a symbol of what enables humans to push the

boundaries of their world: the urge to set out into the unknown, to discover what has not yet been found, explored, and described.

What distinguishes science – even before each discovery and new knowledge – is the element of departure. Questioning apparent certainties, taking a critical look at outdated knowledge, and breaking down encrusted thought patterns is the starting point of exploratory curiosity. And to set out from there for new knowledge is the essence of scientific activities – neither protected nor supported by the reliable and known. Probing, trying, courageously questioning, and sensing that the solid ground, which still lies hidden, can only be reached again in this way. “Research is always a departure for new shoreless waters,” said chemist Prof. Dr. Hans-Jürgen Quadbeck-Seeger.

Leaving behind the safe harbor, trusting that new shores are waiting and can be reached is the impetus

that makes science so important and valuable.

For the current issue of the University of Potsdam’s research magazine, we looked over the shoulders of some researchers as they set out on new research journeys – whether in the lab, in the library, in space, or in the mind. Astrophysicist Lidia Oskinova, for example, uses the Hubble telescope to search for particularly massive stars, while hydrologist Thorsten Wagener is trying to better understand the paths of water on Earth. Economists and social scientists such as Elmar Kriegler and Maik Heinemann are researching in different projects what politics can do to achieve a turnaround in climate policy and stop climate change.

Time and again, however, such departures are themselves the focus of research: And a group of biologists and environmental scientists is investigating

how nature revives forest fire areas and how the newly emerging forests can become more resilient to future fires.

Since – as has already been said – a departure is inherent in every research question, this time the entire issue of “Portal Wissen” is actually devoted to the cover topic. And so we invite you to set out with Romance linguist Annette Gerstenberg to research language in old age, with immunologist Katja Hanack to develop a quick and safe SARS-CoV-2 test, and with the team of the Potsdam Center for Industry 4.0 to the virtual factory of tomorrow. And we will show you how evidence-based economic research can inform and advise politicians, and how a warning system is intended to prevent future accidents involving cyclists.

So, what are you waiting for?!

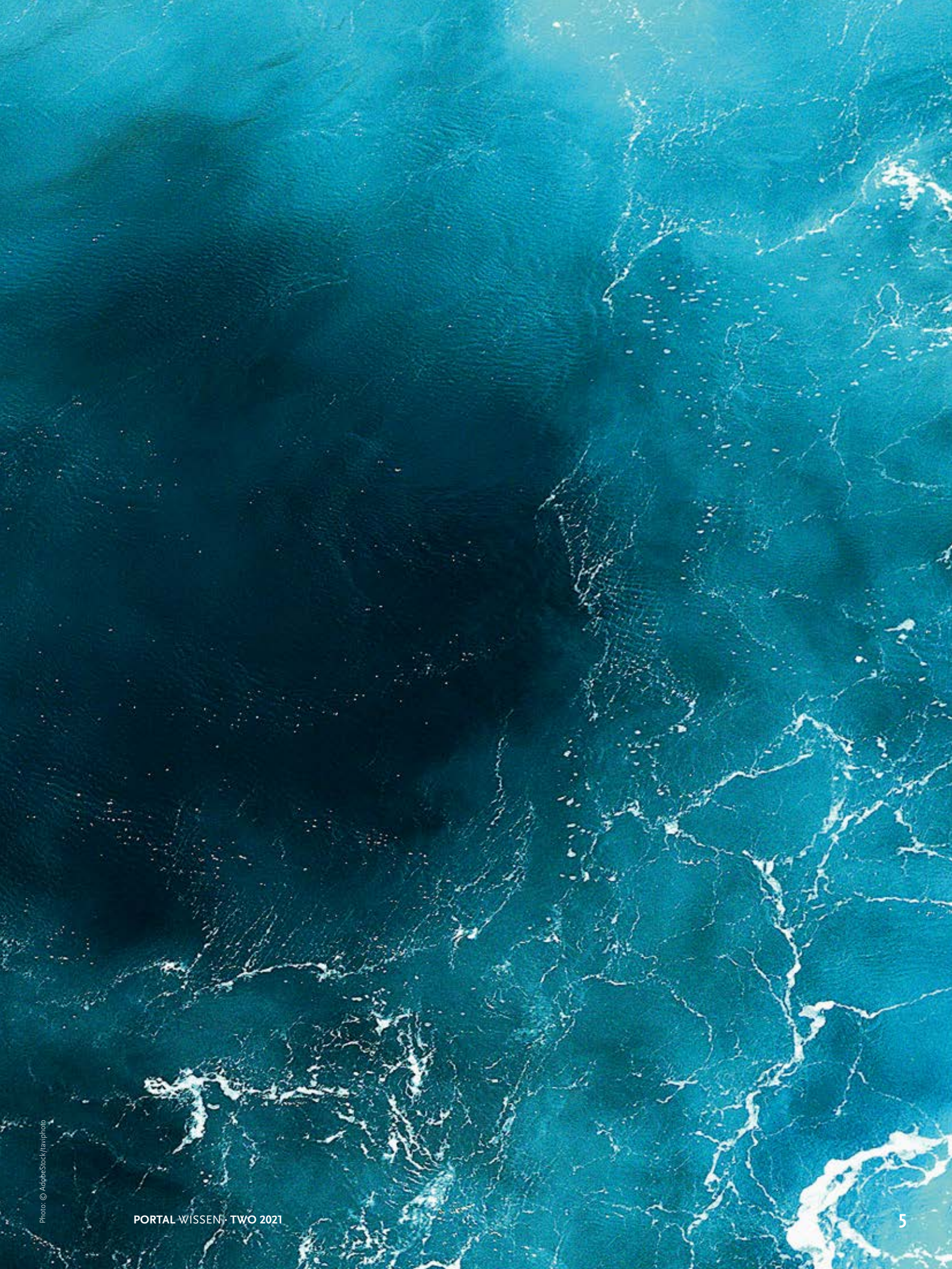
MATTHIAS ZIMMERMANN



water

IS HIS ELEMENT

Alexander von Humboldt Professor
Thorsten Wagener researches at the
University of Potsdam



“Back to familiar things after an absence of 25 years” – this is how he feels about returning to Germany after many years abroad, says Prof. Thorsten Wagener. On January 1, 2021, the researcher started the Alexander von Humboldt Professorship for the Analysis of Hydrological Systems at the Institute of Environmental Science and Geography. Since then, however, he has actually only been on Golm campus for a few days due to Corona. He describes his new start from his home office as follows, “It’s a bit weird to get to know your new colleagues online, and you don’t really learn the ropes at the university. That’s why I meet with staff members outside for a walk when the weather is good.”

Wagener came to the topic of water during a stay abroad in Ethiopia while studying civil engineering at the University of Siegen. After completing his master’s degree at Delft University of Technology (Netherlands), he was a PhD student at Imperial College in London before going to the University of Arizona as a postdoctoral fellow in 2002 on a DAAD research grant. In 2004, he accepted a position as Assistant Professor at Pennsylvania State University, where he specialized in hydrologic systems analysis and simulation, and became Associate Professor in 2009. From 2012 to 2020, Wagener was Professor of Water and Environmental Engineering and head of the research group

Water and Environmental Engineering at the University of Bristol (United Kingdom).

Last year, Wagener was appointed as a Humboldt Professor at the University of Potsdam. The professorship, endowed with 3.5 million euros, is awarded by the Alexander von Humboldt Foundation and funded by the German Federal Ministry of Education and Research. After Harald Clahsen in the cognitive sciences, he is the second Humboldt Professor at the University of Potsdam to receive Germany’s highest endowed science award.

An interdisciplinary water center

Wagener’s major goal at the University of Potsdam is to establish a research center for water, environment, and society. To be able to achieve this, he wants to enhance interdisciplinary research and work across institutes. “This water center will bring together people from different departments of the university and also involve the associated research institutes. We want to take Potsdam even further in water research, both nationally and internationally,” he says.

A new research complex, building 32, has been built on Golm campus, which will accommodate Wagener and his research group by the end of 2021. Among other things, high-performance computers





THE RESEARCHER

Prof. Thorsten Wagener, Ph.D. studied civil engineering at the University of Siegen and Delft University of Technology (Netherlands), and received his Ph.D. from Imperial College London. He has already held professorships at the Pennsylvania State University (USA) and the University of Bristol (UK). Since January 2021, he has been Alexander von Humboldt Professor for Hydrologic Systems at the University of Potsdam.

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will be installed there because Wagener's work focuses on mathematical models for predicting hydrological processes. "How sensitive are regions to weather extremes? How do changes in precipitation and temperature affect groundwater regeneration? How does the impact of dry periods differ across different regions? These are the kinds of questions we want to investigate with our research group," he says. "We then want to have an even more comprehensive and interdisciplinary look at these questions in the water center than what is possible for individual researchers."

With computer simulations, he and his team hope to understand how climate change – from local to global scales – affects hydrologic extremes such as droughts and flooding. "Here, our goal is also to better quantify how uncertain such simulations are, where and for what periods they are robust or need improvement," Wagener explains.

Committed to promoting junior researchers

During his stays in the UK and the US, Wagener became familiar with different approaches to scientific work as well as the training and mentoring of doctoral students and postdocs. "I want to change old behavior patterns and see how experiences from different countries can be combined," he says. "Through the water center, we want to communicate the state of scientific knowledge in order to identify and use interfaces between researchers inside and outside the University of Potsdam and the users of our research." A Twitter account has already been set up for this direct communication.

Wagener will teach a course on environmental modeling in the new master's degree program Climate, Earth, Water, Sustainability, which will start in the winter semester of 2021/22. He has a number of plans to raise the profile of junior researchers. "I usually prepare a multi-year career plan with my postdocs for the time until their next appointment. I have also started to compile online materials for doctoral train-



Building 32 where Wagener's working group, among others, will move.

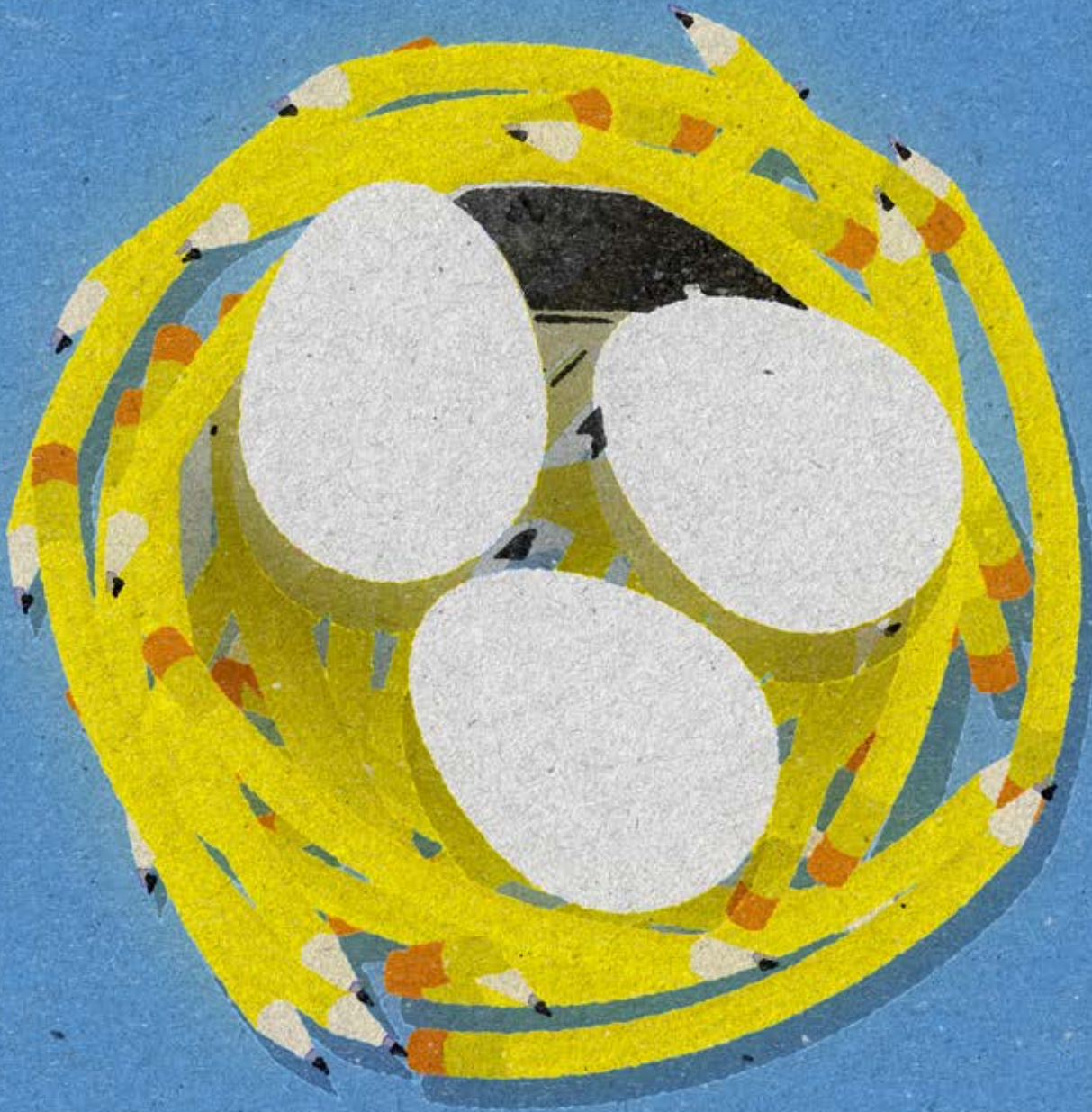
ing. This includes, for example, tools and methods for scholarly work and writing. In my time at Bristol, I taught this content in a workshop every year."

Much room for cooperation

Wagener sees connecting factors of water research, for example, in the life sciences and medicine but also methodologically in computer science, mathematics, and physics. He already contributed to the establishment of environmental institutes and led large multidisciplinary research projects at the University of Bristol and the Pennsylvania State University. Numerous collaborations, for example through joint research proposals, are planned with extramural research institutions such as the Potsdam Institute for Climate Impact Research, the Helmholtz Center for Environmental Research Leipzig, and the German Research Center for Geosciences Potsdam. Even establishing a collaborative research center is being discussed – in any case, there is certainly great potential for cooperation in water research.

DR. STEFANIE MIKULLA

TRANSLATION: SUSANNE VOIGT



THE PERFECT COMMUNITY

VERENA ADAMIK ANALYZES UTOPIAN COMMUNITIES
IN US AMERICAN LITERATURE



THE RESEARCHER

Dr. Verena Adamik studied English Literature, American Studies, and Psychology at the Julius-Maximilians University of Würzburg. Since 2013, she has been a research and teaching assistant at the University of Potsdam, where she earned her doctoral degree in 2018.

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In the realm of utopia, everything is supposedly better: There is no injustice or oppression but fair work, sufficient food, education, and life satisfaction for all. US American literature of the 18th and 19th century describes utopian communities based on real-life models. American studies expert Verena Adamik has analyzed five select novels and bridges the gap between fiction and reality.

When Verena Adamik talks about the topic of her doctoral thesis, it usually piques her interlocutor's curiosity. "It is a topic on which virtually everyone has some opinion," she says. "People then talk about how they envision it all and why it wouldn't work out in the end anyway," Adamik says, laughing. In her dissertation project, she examined what an ideal community might look like and what makes it fail or succeed, and the role played by the US American self-image as the "land of opportunity". Adamik examined these research questions using five novels from US history. She called her work, which she also published as an English non-fiction book in 2020, "In Search of the Utopian States of America".

Communities existed long before the hippies

The hippie movement of the 1960s provides probably the most prominent example of a community that rebelled against the then common perceptions of life and morality – quintessentially US American, and at the same time dismissive of firmly held American values such as prosperity, capitalism, and consumerism. "Long before the hippies, however, there were people in the US who had very radical reform ideas and also tried to implement them," Adamik explains, who through literary research delved deeper into the world of the Amish, Mennonites, Quakers, Owenites, and Shakers.

Especially in the middle of the 19th century, numerous communes with alternative views on life flourished in the US. Ending the oppression

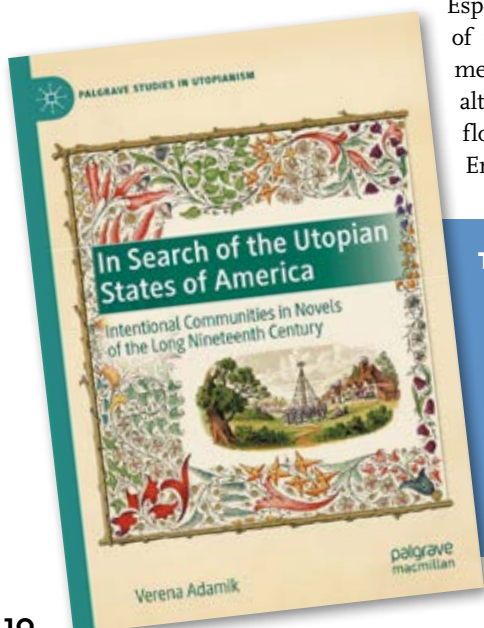
of the working class, abolishing slavery, living in harmony with nature, being a farmer and at the same time an intellectual, being self-sufficient or sharing everything communally, simply living in a better society – these were often the goals of such communities.

Author Marie Howland writes about this in her 1874 novel "Papa's Own Girl". "The novel is almost forgotten today, but at the time it persuaded over a thousand people to join a community," Adamik says. Howland herself came from a very poor family, started working in a factory at an early age, benefited from the first workers' education programs, and ultimately moved in New York's intellectual circles as a writer, feminist, and reformer. She joined the Fourierists – a community that dates back to the French philosopher and early socialist thinker Charles Fourier. Its members wanted to live and work together in a kind of agricultural production and housing cooperative. Free love was an important concept of this community.

Adamik summarizes the content of the novel in one sentence, "Woman must get divorced, meets rich European count, founds community, happy ending." Howland's own life was apparently not quite as simple. She co-founded a community in Mexico, which quickly failed because it lacked an economic foundation. For Americanist Adamik, Howland is not only a fascinating personality but also a typical representative of her time – including some highly problematic ideas and convictions. Neither the liberation of enslaved people, for example, was particularly important to her nor the equal treatment of Black people. "The novel also has passages that really hurt," Adamik says. For example its discussions of whether a civil war had really been necessary to abolish slavery. "But that also shows what was typical of those communities: They tried to solve one or two problems but didn't want to deal with others."

Reality and illusion

In addition to "Papa's Own Girl", Adamik examined and analyzed four other books. Of course, the researcher's work is not finished after reading the books and taking a few notes on them. On the contrary: After that, her work is just getting started. The American-



THE BOOK

Based on five historical novels of US American literature of the 18th and 19th century, "In Search of the Utopian States of America" analyzes the connection between the self-image of the US as a "land of opportunity" and the founding of utopian communities. The English non-fiction book was published by Palgrave Macmillan in December 2020.

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A way out of oppression

ist searches for secondary literature on the historical background and questions raised by the novels, reads specialist literature on the texts, the authors, and the era. Then she goes through the books a second time. And a third time. And many more times. “Every book I write about I have touched at least ten times,” she says. She has invested about half a year’s work into each book to really get a complete picture of it.

At the end of this process, known among experts as “close reading”, the book contains numerous notes and underlines, with sticky notes in different colors on every third page. “Orange is for landscape descriptions, green is for everything on the utopian community, pink is for love, and yellow is for everything else that matters,” Adamik says, explaining the color choices in her working copy of “The Emigrants” by author Gilbert Imlay. The novel was published in 1793 and was once considered the first US American novel ever written. “Here, everything comes together,” Adamik describes the book, “the perfect hero, the perfect heroine, the perfect landscape, and the perfect country.” Against this backdrop, the protagonists establish a community where everything is perfect, too, and everyone is happy. However, the author drew the picture of this ideal community not entirely altruistically. “He wanted to sell land with it,” Adamik explains, “and nourished the cliché of the land of opportunity with his story.”

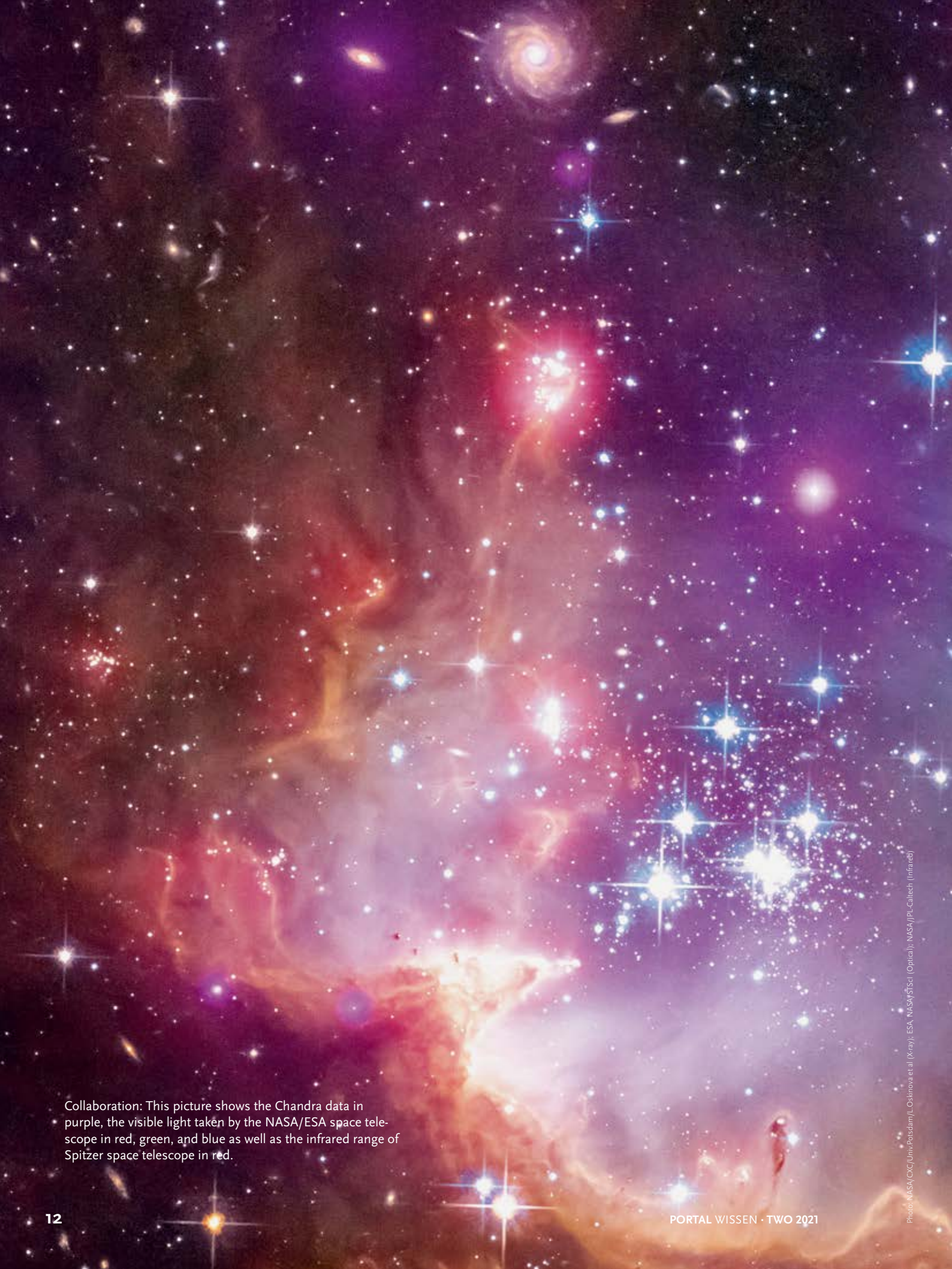
The analysis of the novels shows what is reality and what merely illusion regarding this promise, which also reveals much about what the people of the time considered advantages and disadvantages of the United States. Literary studies here mix with historical and cultural studies. Both the books and history show, “the better and more elaborately the structures were planned, the more successful the communities were.” A solid economic basis, craftsmanship, fair distribution of goods, and common, binding values were – and are – good guarantors of successful coexistence. “Religious communities are often more successful in this respect because they share a similar view of the world,” Adamik says.

Through the motif of the community the examined books negotiate over and over again whether people can improve the US and the world. After all, it is also every community’s aspiration to lead a better life immediately and in the here and now. “The idea of utopia was particularly attractive to African Americans,” Adamik explains. After the Civil War, they had a short window of opportunity to improve their living conditions. Black people had the right to vote, for example, and were able to hold important political offices. “When that window of opportunity closed again,” she says, “an incredibly terrible time began for Black people in the United States.” Lynching was commonplace, Black people received the lowest wages, were discriminated wherever possible. “During that time, many Black intellectuals wondered where the way out might be.” As a result, utopian communities also boomed among the Black population. “To this day, this idea still lives in urban gardening projects, for example, which are predominantly run by African Americans in the US to provide the neighborhood with fresh vegetables,” she says.

While Adamik is breaking new ground in Germany with her topic, there is already a completely distinct discipline, “Communal Studies”, in the US, which researches the history and present of communities. The association “Society of Utopian Studies” brings together researchers of various disciplines who research the utopian aspect. Adamik, who has launched her own podcast, “Talking American Studies”, where she presents current research from American Studies, also engages in a close exchange with colleagues of this network for her follow-up project. This time, it’s about the 20th century and novels dealing with grand conspiracies masterminded to improve the world. “The topic is shadow states and other forms of large-scale organized resistance to racism, which has not yet been dealt with in literary studies,” Adamik explains, who – “if everything works out” – will make this her habilitation project.

HEIKE KAMPE

TRANSLATION: SUSANNE VOIGT



Collaboration: This picture shows the Chandra data in purple, the visible light taken by the NASA/ESA space telescope in red, green, and blue as well as the infrared range of Spitzer space telescope in red.



BIG BUDDIES IN SPACE

**Lidia Oskinova observes
massive stars through
space telescopes**

Potsdam astrophysicist Lidia Oskinova uses the largest astronomical telescopes on Earth and in space to study massive stars. In addition to the Hubble Space Telescope, which has been bringing us closer to cosmic objects such as stars, galaxies, and planets for over 30 years, these include the X-ray telescopes XMM-Newton of the European Space Agency ESA and Chandra of the U.S. space agency NASA. Other data come from the world's most sophisticated optical instrument, the Very Large Telescope in Chile. For all these instruments, Oskinova regularly applies for observing times – successfully. From the collected data she gains new insights into the evolution of the universe and fantastic images of our cosmos.



THE RESEARCHER

Apl. Prof. Dr. Lidia Oskinova studied astronomy at St. Petersburg University where she also earned a doctorate. Then she worked as a researcher at the University of Glasgow (Scotland). In 2002, she came to the University of Potsdam, where she was habilitated in 2013. Since 2020, Lidia Oskinova has been Professor of Astrophysics.

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During our interview, an important message from the Hubble Space Telescope comes in. “I’m looking at the star SST2011-J081929.00+704219.3 with Cosmic Origins Spectrograph for Dr. Lidia Oskinova.” Exactly at this moment, Hubble is looking at one of Oskinova’s research objects. Only two hours later, the telescope is already pointed at another area of space. On spacetelescopelive.org, everyone can watch the current observations of the world’s most famous telescope orbiting Earth.

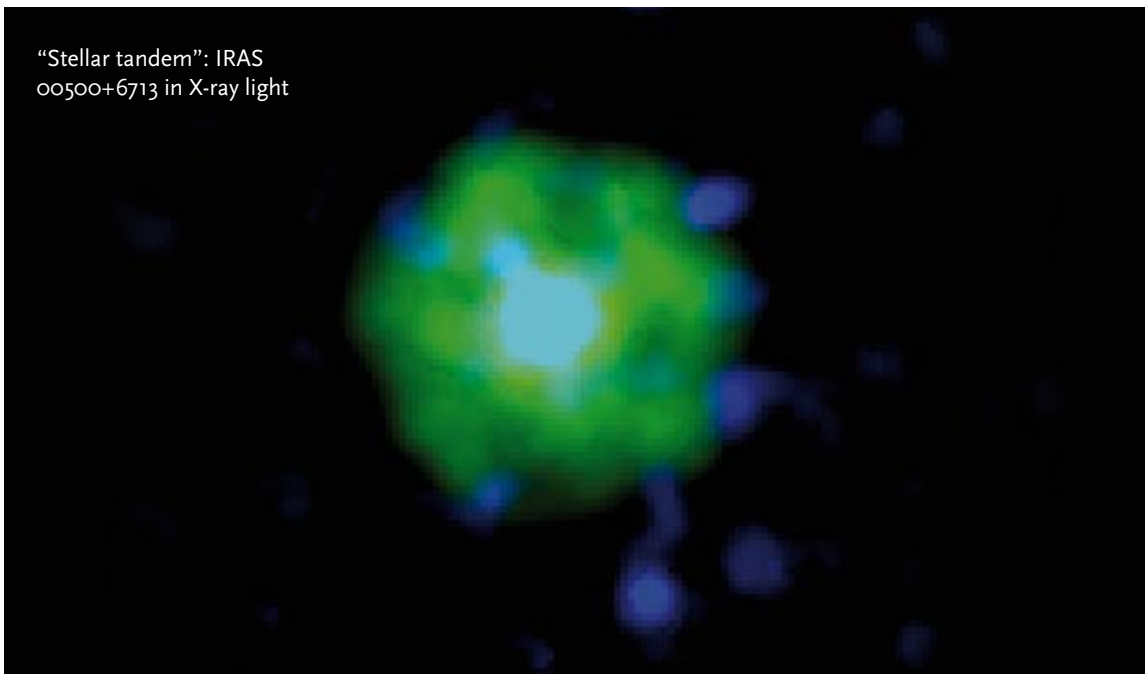
Computer models and gender bias in astronomy

Oskinova’s research projects all concentrate on a particular type of star that emits X-rays and has more than ten times the mass of our Sun. “These so-called massive stars are rather rare in our galaxy. However, since

they have more energy and are brighter than other stars, they dominate our night sky,” Oskinova says. At the end of their lives, their cores collapse due to their large mass and form very high-density neutron stars or even black holes. “We only measure the light, but we want to understand what the stars are made of and what they do to their surrounding area. To this end, we use the PoWRCode.” Wolf-Rainer Hamann, at the time professor of astronomy, developed the Potsdam Wolf-Rayet Models (PoWR) in the 1990s. They have since become an internationally acclaimed and efficient computer code “made in Potsdam”.

But before any investigation, it is necessary to obtain observing time for the space telescopes. And this is not as easy as it seems: For a few hours of observing time, you must submit a comprehensive, scientifically sound observing proposal, which is reviewed by an independent committee of experts. The proposal must convincingly explain what is to be observed and

“Stellar tandem”: IRAS 00500+6713 in X-ray light



why. Only 10% - 20% of all proposals are approved. "Evaluations of all proposals of the last few years have shown that it is much more difficult for women and also for early-career researchers to obtain observing time. For established researchers, on the other hand, the probability of approval is higher," Oskanova says. "Since double-blind reviews have been introduced, the review process has become fairer." The "gender bias" for the Hubble Space Telescope, for example, has been corrected and other telescope teams now want to follow suit.

Cosmic neon lights

Using the XMM-Newton X-ray telescope, Oskanova recently detected a very unusual type of star. The object with the exotic name IRAS 00500+6713 consists of a central star embedded in a circular nebula of gas with a temperature of a few million degrees and cooler dust. The nebula shines brightly in the X-ray range, specifically in neon light. Oskanova's team is convinced that these are the remnants of two white dwarf stars that have collided. The neon-rich nebula is the material ejected in the course of this event. It has also been known for a few years that a record-breaking stellar wind emanates from the central star – with a speed of 16,000 kilometers per second! "In addition to radiation, massive stars give off streams of particles at incredibly high speeds. This causes the stars to lose a lot of mass over time," Oskanova describes her observations. For many years, she has been working on the theory and spectroscopic analysis of stellar winds using the PoWR computer code.

X-ray vision into the future

With ESA's XMM-Newton X-ray telescope in orbit for over 20 years, there are plans for two new astronomical instruments: ATHENA, a telescope for high-energy astrophysics, and the LISA laser interferometer, a space-based gravitational wave observatory. Gravitational waves are produced when space objects with extremely high density, such as neutron stars or black holes, merge with each other. Oskanova studies massive stars that form the precursors of these exotic objects. "Thus, there is a connection between what we observe with the naked eye in the night sky every day and the invisible gravitational waves, whose existence we can hardly imagine," she says. Although it will take at least ten years before the missions will start, she is already looking forward to new, exciting data from the depths of space.

Prof. Lidia Oskanova



Discourse on genome surgery:
Prof. Ranisch at an event of
"Wissenschaft im Dialog"



“Science Needs Values”

Junior Professor of Medical Ethics Robert Ranisch is among the first newly appointed professors of the Faculty of Health Sciences Brandenburg.

When COVID-19 infections, and with them the severe COVID cases, skyrocketed in the spring of 2020, medical laypersons, i.e. most people, learned a term that originated in the military and doesn't sound half as ominous in French as it does in German: triage. People were hesitant to imagine what it would mean to sort patients according to the severity of their illness and their chances of survival in order to be able to select those who would receive intensive treatment in case of limited capacities. Suddenly, questions of medical ethics were on everyone's lips.

During his winter vacation in early 2020, Robert Ranisch still thought that COVID-19 would be over in a month or two. But after returning to Tübingen, where he worked theoretically at the university and practically at the hospital as an expert on medical ethics, he soon realized the extent of the catastrophe. “In our professional association, we discussed medical ethical challenges of the pandemic early on, including triage,” he reports. The dramatic images from Bergamo did the rest. “We began to prepare: What would respon-

sible triage look like? How could future vaccines be fairly distributed? What privileges should vaccinated people get?” There was little praise for the answers. “Nobody wanted to hear anything like that,” Ranisch says, who, like his colleagues, had to put up with accusations of pessimism. But they knew what they were talking about. Ranisch had already dealt with similar issues in connection with the Ebola epidemic in Central Africa. “The question was how to properly deploy the few local resources to save as many people as possible. In addition, medical staff had to be trained on the ethical conflicts of such decisions,” Ranisch reports.

Even though the feared overload of intensive care units did not happen in Germany, it was still important to be prepared. This experience brought him, together with his colleagues in medical ethics networks, to address foreseeable problems associated with the COVID-19 pandemic in time. When the second wave hit in the fall, they were already able to present a few results, such as ethics guidelines for vaccine distribution and digital contact tracing while respecting data privacy. However, months passed before these were being used. “That's frustrating because several developments didn't come as a complete surprise,” Ranisch says, who doesn't deny his particular affinity for questions arising from digitization.

THE RESEARCHER

Prof. Dr. Robert Ranisch studied philosophy in Warwick, Jena, and Oxford. He earned his doctorate in biomedical ethics in Düsseldorf and Tübingen. Since 2021, he has been Junior Professor of Medical Ethics (tenure track) with a focus on Digitization.

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From philosophy to medical ethics

Ranisch had initially wanted to study computer science. Since his sister had already chosen this subject, Ranisch, who was born in Thuringia, went to Weimar to train in the arts. First, however, he completed a

general studies program at the university in Jena and, in order to earn money, developed a new logo for the ethics institute there. “I found the things they were doing really exciting, and enrolled in the minor,” says Ranisch, who immediately caught the bug for the subject and ended up studying philosophy. After stints at the universities of Warwick and Oxford, he returned to Germany to work on ethical issues of new technologies, like genetics and digitization, while completing his doctorate. Two fields of knowledge with a similar mentality, as Ranisch says. “Whether genetic engineer or programmer – both enter into a code to change its information,” Ranisch says, who has been head of the research unit “Ethics of Genome Editing” at the Institute for Ethics and History of Medicine in Tübingen since 2017.

One of the key questions that has been on his mind ever since are the long-term consequences of so-called germline interventions – when humans intervene in the process of procreation and thus evolution to prevent hereditary diseases. “After all, the genetic changes are passed on to the children and grandchildren of the yet unborn child, and not only the desired but also potential adverse effects. This is an overall question for humankind that we need to discuss on a broad basis,” he urges. When the first genetically modified babies, the twins Lulu and Nana, were born in China in 2018, this was a great shock and opened Pandora’s box. Can it be closed again? “Without wanting to limit the freedom of research, we must always consider the consequences of our inventions,” Ranisch warns. In other areas, such as nuclear energy or the combustion en-

gine, it was possible to backpedal. On the other hand, no one can or wants to stop scientific progress. In the ethical discussion of new technologies, he therefore advocates a change in the fundamental question, from “Are we allowed to do this at all?” to “How can we do this well?,” because this is where the responsibility of those acting is needed.

Teaching across disciplines and supporting the practical field

This spring, in the midst of the third lockdown, Ranisch was appointed Junior Professor of Medical Ethics of the University of Potsdam. He is thus the first newly appointed professor of the Faculty of Health Sciences, which is currently being established and is a joint project of the University of Potsdam, the Brandenburg Medical School Theodor Fontane and the Brandenburg University of Technology Cottbus-Senftenberg. In Potsdam, he will particularly focus on ethical aspects of digitized health care, “an area in which opportunities and risks are interconnected, where an unreflective euphoria about technology is just as out of the question as a fear-driven attack on new computer-based possibilities,” says the faculty’s founding dean, Prof. Dr. med. Cornelius Frömmel. Because “digital medicine” will also have to be medicine devoted to people.

“We can already collect valuable health data via mobile phone or smartwatch, and that carries great potential,” Ranisch says. “However, permanent health





The **Faculty of Health Sciences Brandenburg** was established in 2018 as a joint faculty of the University of Potsdam, the Brandenburg Medical School Theodor Fontane and the Brandenburg University of Technology Cottbus-Senftenberg. It is the core of the Brandenburg Health Campus. The aim is to develop new types of medical, nursing, and medical-technical care services as well as innovative degree programs. In cooperation with other universities and research institutions, the faculty will contribute to improving medical care in the Brandenburg region.

<https://www.fgw-brandenburg.de/>

tracking can change our self-image or our relationship to the healing professions,” he points out. In the future, he wants to explore such issues in research and teaching, but also in ethics consultation, to contribute to a responsible development of new care concepts and structures. Brandenburg could become a future-oriented model location for good and fair health care, says the medical ethicist, who would also like to offer courses of subjects other than health sciences to be able to discuss values with students of other disciplines.

Ranisch also wants to continue his work in ethics consultation in Brandenburg. As managing director of the Clinical Ethics Committee at the University Hospital of Tübingen, he had assisted in overcoming ethical challenges at the hospital. “The medical profession comes with great responsibility and outstanding dedication, with the duty to help, to heal, and to maintain confidentiality. All this means that physicians are often confronted with ethical conflicts,” Ranisch knows. In the case of patients who are incapable of giving consent, for example, there might be the question which treatment would be in their best interest. This is where clinical ethics consultation comes in. Together with the medical staff and relatives, the counselors try to give recommendations. “Such a service may also be expanded in the state of Brandenburg, at hospitals but especially at outpatient departments,” Ranisch suggests, who is advocating for establishing a corresponding network for Brandenburg.

Creating greater awareness for this topic and communicating medical ethics to the general public are particularly important to him. He and his colleague Julia Diekämper have just been awarded the Tübingen Early-Career Prize for Science Communication. Together with the Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science, they had addressed ethical questions arising from the increasing possibilities of germline interventions in the research project “ZukunftMensch”. They used the birth of the genetically modified twins Lulu and Nana as an opportunity to discuss with a broad public the potential consequences of intervening into the human genome. “We went to cinemas and pubs, asked people to write greeting cards to the two children and also to the responsible researcher,” Ranisch says. The newly appointed professor wants to pursue such effective public formats in Potsdam, for example on issues of “planetary health”, issues that are particularly pressing during the pandemic: Where does the COVID-19 virus come from? Meat consumption, urbanization, deforestation, climate change, and the pandemic – how are these things connected? “We researchers must reach out, take people seriously and explain complicated things in a generally understandable way,” says Ranisch and adds, “also when we communicate with the media and politicians.” Today, within just one legislative period, he says, things have to be decided that have an impact far into the future. “Parliaments probably need ombudspersons who always keep an eye on the long-term nature of today’s decisions,” he says. To convey the uncertainty of science is a difficult task, he adds. Why is there so much seemingly contradictory information coming from the field of research, as is the case right now during the pandemic? How can we handle permanent uncertainty? “We need to make people aware that there are always various hypotheses, that it takes a long time for something new to emerge, that there are failures and errors, but that science still deserves trust,” Ranisch says, deeply convinced that problems can only be solved if we all act jointly and assume responsibility. “Science needs values!”

ANTJE HORN-CONRAD

TRANSLATION: SUSANNE VOIGT

THE FOREST OF TOMORROW

On former burnt areas, researchers are studying how forests can become more resilient

Area in Treuenbrietzen hit
by forest fires



The forest in Germany is doing badly. Since 1984, the health of trees has been published in the annual forest condition report. In 2020, only 21% of trees had an intact crown– the worst condition since the survey began. Particularly the past years of drought, which led to devastating major fires in Brandenburg, have taken their toll on the forest. How the forest can become more resistant to drought, heat, and fire is being investigated by the joint research project PYROPHOB.

“Initially, there was nothing,” Dr. Thilo Heinken recalls his first visit to the forest fire area near Treuenbrietzen in November 2018. “Just dead pine trees and a black ground covered with ash.” A few months earlier, a typical Brandenburg Scots pine forest had been growing where the botanist now stood with the town’s forest ranger. In August, however, several hundred hectares of this forest had gone up in flames – after a summer of record-breaking temperatures and far too little rain. A year later, after great heat and drought, there was another large fire in a pine forest – this time near Jüterbog.

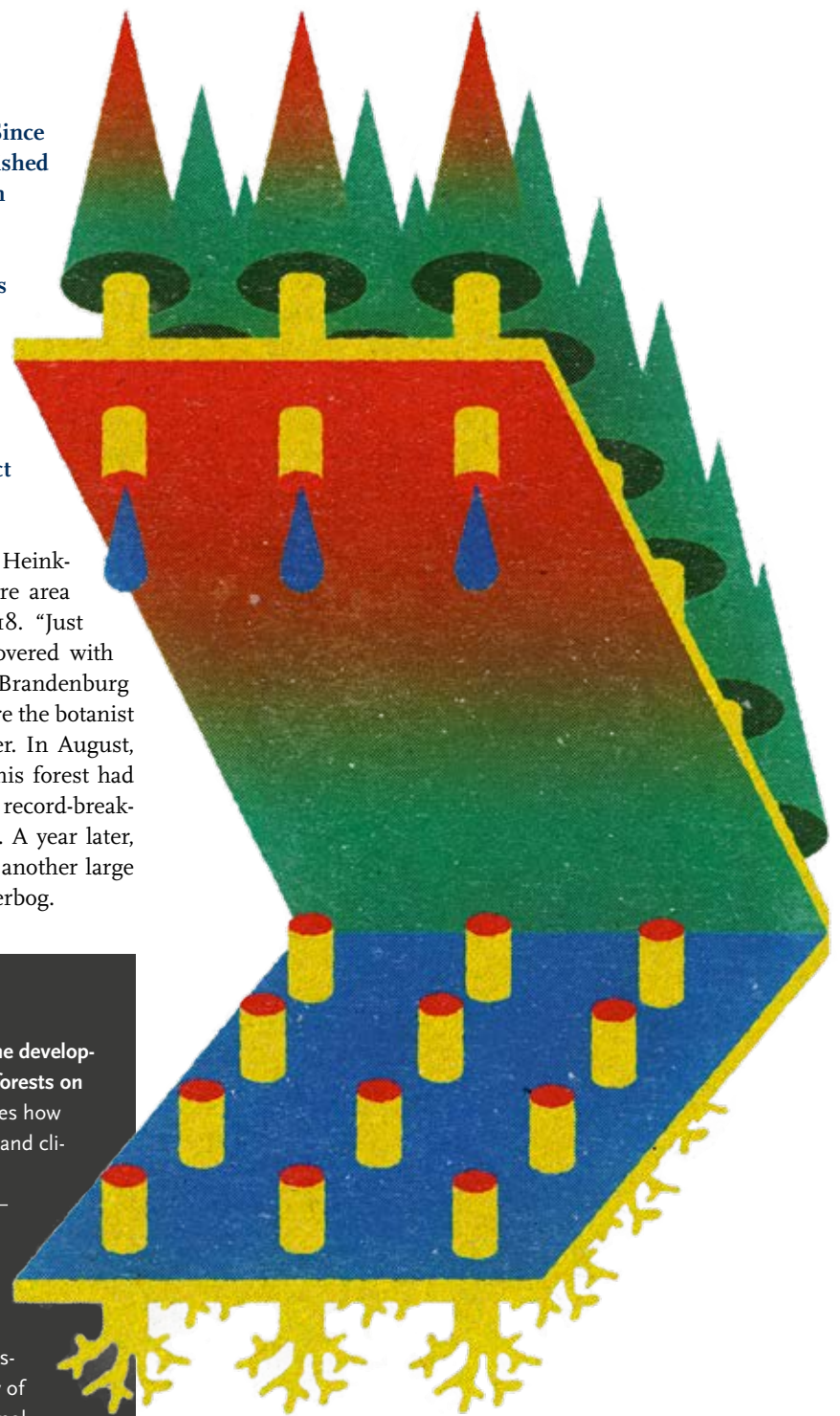
THE PROJECT

The collaborative project “Strategies for the development of pyrophobic and climate-resilient forests on forest fire areas” (PYROPHOB) investigates how forests can become more resistant to fire and climate change.

Project coordinator: Eberswalde University for Sustainable Development / Center for Econs and Ecosystem Management

Participants: Eberswalde University for Sustainable Development (HNEE), University of Potsdam, Brandenburg University of Technology Cottbus- Senftenberg (BTU), Eberswalde Forestry Research Institute of the State of Brandenburg (LFE), Institute of Forest Genetics (TI-FG), Senckenberg German Entomological Institute (SDEI), Natural Forest Academy, Brandenburg Wilderness Foundation
Funding: Federal Ministry for Food and Agriculture (BMEL), Agency for Renewable Resources (FNR), and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) within the framework program Forest Climate Funds
Project period: 2020–2025

 <https://www.pyrophob.de>



Burnt areas – an open-air laboratory

Both large fires were a disaster but created the unique opportunity to scientifically study such fire events. Today, the burnt areas are a kind of open-air laboratory where researchers from different disciplines and eight institutions investigate how vegetation, wildlife, microclimate, water balance, and soil are developing and what influence various silvicultural measures have on these developments.

“All components of the ecosystem ‘burnt pine forest’ are being investigated,” Heinken says, explaining

the goal of the PYROPHOB collaborative research project, which was initiated by the Eberswalde University for Sustainable Development. Its aim is to generate knowledge about what the resilient, healthy forest of tomorrow might look like. “This is also an economic question,” emphasizes Heinken, who is involved in the “Soil Vegetation and Soil Moisture” subproject at PYROPHOB. After all, “it’s getting hotter, not really wetter, and extreme weather conditions like this will become more frequent,” which means that the danger of large fires will increase in the future.

Tracking down fire with satellites and sensors

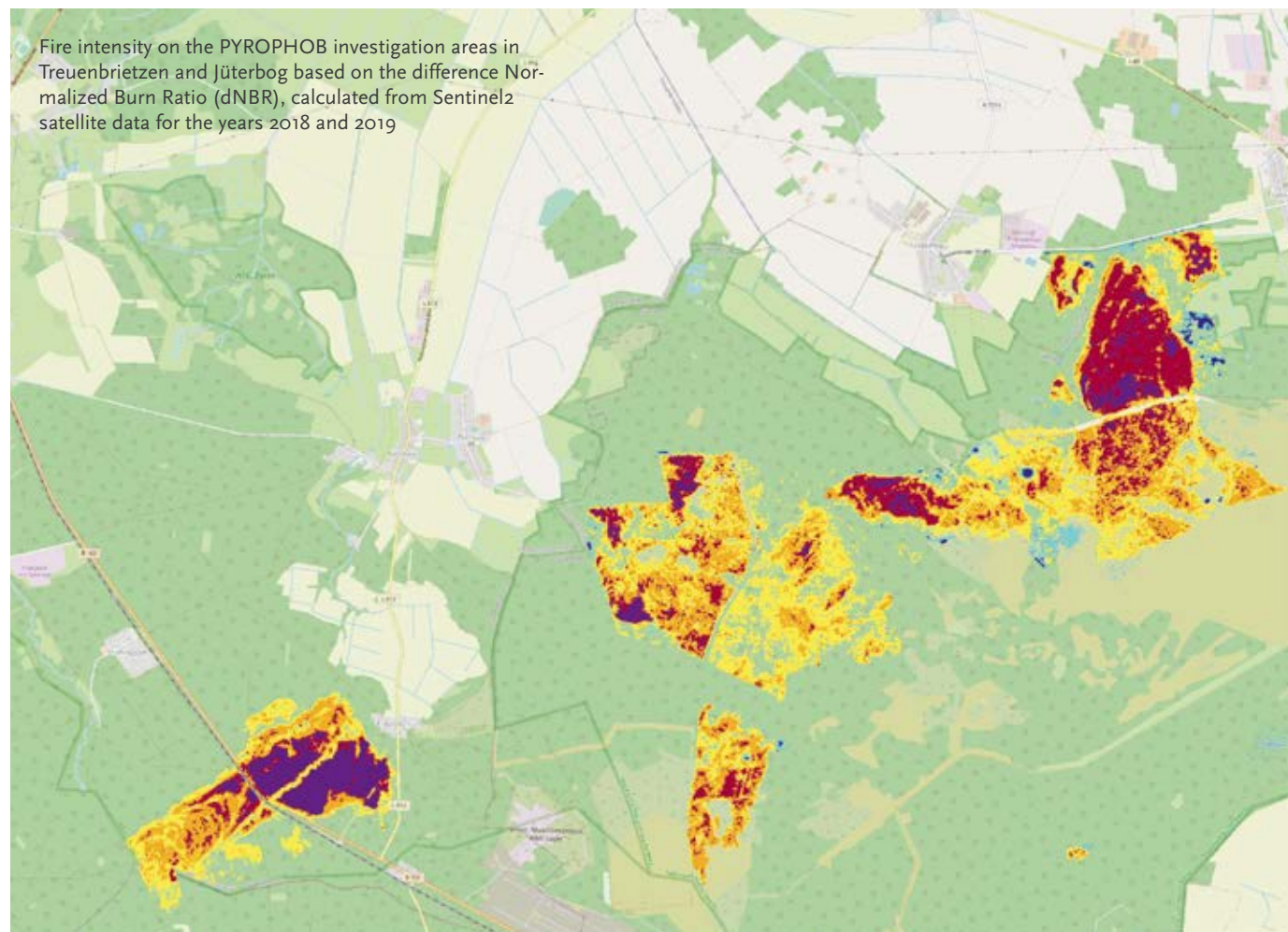
The hydrology and climatology group at the University of Potsdam is also using the opportunity to analyze these forest fire areas. By means of remote sensing, the team is investigating the fire intensity, the condition of the tree populations, and the vegetation after the fires. The fires raged with different intensities in different locations, Dr. Arlena Brosinsky explains. Together with her team, she wants to analyze how

and why individual areas are affected to such different degrees and how they are developing in the first few years after the fire.

Among other things, the researchers are using satellite data from the European Space Agency’s (ESA) “Copernicus” Earth observation program, which was recorded before and after the fire. From the reflectance in the near and short-wave infrared range, they are able to calculate how badly the areas were damaged by the fire and where the vegetation has remained intact. “This gives us a good spatial overview from the air and information that would be difficult to collect on the ground for such a vast area,” Brosinsky explains

Patterns of recolonization

On the map, which Brosinsky has created based on the satellite data, the fire intensity is represented by colors ranging from yellow to orange and red to purple. “The fire started here,” she explains, pointing to the yellow areas to the southwest of the fire site. “Then it spread northeast with the wind direction and turned





Areas of forest fires in 2018, ...



in 2020 with understorey vegetation and aspens.



in 2019 with eastern groundsel and moss and ...

New life on burnt soil

While Brosinsky keeps track of her study areas primarily from a bird's eye view and will also use the remote sensing data to analyze future plant growth, Maren Schüle examines the forest from the ground. The ecologist visited the forest areas near Treuenbrietzen for the first time two years after the major fire. She already saw a very different picture than in 2018. "The Canadian horseweed (*Erigeron canadensis*) had already spread enormously and covered the areas," she recalls. "In other places, a sea of aspen was growing – some already over two meters high. It was all surprisingly green." Together with Heinken, she studies how the understorey vegetation on the burnt areas is developing and compares it with unburnt control areas as well as with each other.

After the fire, the landowners, including the municipalities, the Brandenburg Wilderness Foundation and some private owners, dealt very differently with what the flames had left behind. On large areas, the dead wood was removed and the ground was plowed immediately after the fire. In some areas new trees were planted there. Others remained untouched and left to natural succession. Yet others were fenced off and tree seeds were spread. "We can observe what is happening on all these areas over a long period of time. You rarely get such a chance," Schüle says happily.

into a treetop fire up here," she explains the change in tones to dark purple. A yellow stripe runs through the most affected area on the map. "We can't explain yet why the fire was apparently weaker here," she says.

The researchers are trying to clarify the different shades, ripples, and lines on the map on site. Topography, soil type, vegetation, tree species, age of plants, and management – all these aspects can influence the fire intensity. "In addition to the fire intensity, we want to analyze the reasons for these patterns and understand recolonization." The team also uses a hydrological measurement network to monitor precipitation and soil moisture as well as hydrological models to reconstruct soil water balance. The results will show which silvicultural measures are most beneficial to the emerging forest and are able to retain water and nutrients in the ecosystem.

There is a good reason why she is particularly interested in herbs, grasses, and mosses as well as the young trees. After all, the understorey vegetation has important functions for the areas' further development. For example, it binds nutrients that are excessively present right after the fire but are then quickly washed out and disappear, covers the areas and thus prevents erosion. A humus layer can gradually form again as dead plant parts are decomposed by microorganisms. This prepares the way for other, more nutrient-demanding plants.

The first trees are poplars and birches

On a total of 150 circular sample areas, each 314 square meters, Schüle examines which plant species are present and how much of the area they cover. It takes her about half an hour to document all the plant species within the sample circle and estimate their number. She also records the biomass and its element and nutrient contents, measures shoot lengths and root collar diameters to get a comprehensive picture of the soil vegetation.

"The first plants here are often undemanding, have flying seeds that can travel long distances, or very long-lived seeds that survive for decades in the soil," Heinken explains. They provide information about environmental conditions, whether it is dry or wet, rich or poor in nutrients. "Very different species grow on the burnt areas compared to the unburnt reference areas," explains Schüle, who already found more than twice as many species on the burnt areas than on the unburnt areas in the first and second year after the fire. "There are many pioneer species among them, which always establish first on cleared areas, such as poplars and birches."

Maren Schüle recorded more than 140 plant species in total. On average, the researcher found eleven species per sample circle on those forest areas that had been spared from the fire. More than twice as many, 26 on average, she found on the burnt areas. Some species occur now that depend on fire. "In the first year, the mycologists found over 40 species of fungi that only occur on burn places," Heinken explains. "Among them are some that were recorded for the first time in Brandenburg."

From pine forest to mixed forest

"The pine is a tree species that burns relatively quickly," says Schüle. Pine monocultures are widespread, especially in Brandenburg because they grow quickly, are competitive on the nutrient-poor and sandy soils and have low water requirements. But for a more resilient forest, a good mix of deciduous and coniferous



THE RESEARCHERS

PD Dr. Thilo Heinken studied biology in Göttingen. Since 2002, he has been researching at the Institute of Biochemistry and Biology of the University of Potsdam. The vegetation ecologist is an expert for pine forests.

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Maren Schüle studied ecology, evolution, and nature conservation at the University of Potsdam. Since 2020, she has been a PhD student in the research project PYROPHOB.

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Dr. Arlena Brosinsky studied landscape ecology in Münster. Since 2016, she has been research assistant at the Chair of Hydrology and climatology of the University of Potsdam and is the expert for remote sensing in the PYROPHOB project.

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trees is needed. "We are not yet certain about which tree species will cope best with the new climate conditions," Heinken knows. "Probably a mix of many different species is most advantageous, but a lot of testing and trying will be necessary."

Over the next four years, the researchers will continue to document in detail which species are colonizing the burnt areas, how long it takes for trees to grow back to size, whether it makes sense to clear the areas of dead wood or whether it is better for new growth to leave the burnt tree remnants standing and lying. Ultimately, the question is: How can we create a resilient forest that can withstand fires and better recover from them? "We want to capture the overall picture, bring together the multitude of data, and ultimately provide a meaningful handout for an economically and ecologically sound management of Brandenburg's pine forests," says Heinken. He is convinced that, "The Scots pine will always have its place in Brandenburg – at extreme locations, but also as a pioneer tree species."

HEIKE KAMPE

TRANSLATION: SUSANNE VOIGT

THE TIME OF OPEN EARS

New in Potsdam: As Professor of Music Education and Music Didactics, Isolde Malmberg is committed to strengthening her subject



Born in Linz, she moved to Vienna for her studies. There was no getting around music here: the Opera, the concert halls, the clubs and salons. Music from every alley, every little church. Both classical music like Mozart or Haydn, and contemporary music at the festival “Wien Modern”. How could one ever leave this city? Especially as someone who teaches music and is a member of the renowned Arnold Schoenberg Choir. But it may well be that wherever you go in life, the sounds you have heard, the songs you have sung, and the pieces you have played stay with you. A sounding memory, always present.

Isolde Malmberg sits in her Golm office and feels that this is just the right place to be. Here she can do what is so dear to her heart: Train future music teachers. In Vienna, she had worked at a school for eight years before returning to university to combine her skills in music pedagogy with her ample experience in order to develop new teaching methods. She wrote her doctoral thesis on the project method in music teaching and described the huge potential of student-led artistic and creative learning processes for the musical and aesthetic education of children and young people. Especially for the youngest children it is important to expand their period of “open ears” as much as possible. Malmberg uses the expression to describe the early years when musical preferences have not yet developed and children absorb every rhythm and melody naturally. This period lasts until they are about ten. Later, they develop musical preferences which may restrict their view – much like blinders. So how can this be prevented?

“Making music is the best way to keep one’s ears open – whether it is playing an instrument or using one’s voice,” Malmberg says. Following her time in Vienna, she trained future elementary school and special needs teachers at the Rostock University of Music for some time. Studies in string and wind classes revealed that children who practice music remain more open to musical genres and styles. Malmberg knows that it is important to open all doors to the acoustic world so that, later on, children can make conscious decisions and enjoy the whole world of music. As a trained mezzo-soprano, Malmberg is particularly happy to find that there is more singing in German schools these days. Especially in West Germany, singing had been frowned upon since the 1960s. “Your voice is always with you. Everyone can use their voice – and (learn to) sing.”

Malmberg doesn't believe that there is such a thing as an untalented child. Often enough in project lessons she saw children excel when their interests were touched and new paths to their emotional world opened. As an educationalist, Malmberg knows that this is not coincidence, but a matter of methodology. But there is a huge gap here. Music didactics is “more



THE RESEARCHER

Prof. Dr. Isolde Malmberg studied music education and Romanistic languages (French teaching) as well as instrumental music education (voice and piano) at the University of Music and Performing Arts and the University in Vienna, where she also earned her doctorate. At the University of Potsdam, she has been Professor of Music Education and Music Didactics since 2020.

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of a patchwork” and the subject as such “chronically under-researched,” she says. As one might expect, she is going to change that.

Turning points of criticism into visions

Even though the pandemic weighed heavily on her first year in Potsdam, she has got a lot off the ground in terms of teacher training: for example, a future workshop on music instruction in the planned university school. “Once we had agreed that everything needs to be changed, the students were asked to criticize their own subject,” Malmberg reports. “In the next step, they were encouraged to develop visions based on their points of criticism. The final step – and this is important in a future workshop – was the realization of these visions,” Malmberg explains. “In our case, this meant presenting the innovations developed by the concept group for the university school.” For the students this was an important experience. Many of them see the weak points in music teaching – which often does not correspond to the interests of children and young people – very clearly. As classrooms are becoming more heterogeneous, diagnostic tools are needed to establish what the pupils already know and are capable of. Only then can the teachers build on that using the right tools, Malmberg finds.

Meanwhile, the first students have developed their own didactic tools. They will test them during their



practical semester and write their master's theses about them. "Developing and testing, evaluating and refining – it's a spiral process," Malmberg explains, tracing a spiral with her hands.

Don't tiptoe around digitization

For instance, digital instruments can be used for playing, or virtual and augmented reality for music reception. "There is no use in tiptoeing around it," says Malmberg, who is a classically trained pianist and singer. "Rather, we have to see not only what new technologies can do, but also what our artistic aspirations are." That's why the University's music department is now cooperating more closely with Kammerakademie Potsdam, which has been able to gain important experience with virtual concerts during the pandemic. Besides, Malmberg is hoping for a lot of inspiration in the less-familiar genre of new music from this orchestra.

Recently, students gained their first practical experience with digital sound experiments during a project week on water and sustainability hosted by the University of Potsdam in cooperation with Leibniz



Gymnasium Potsdam, a secondary school. The interdisciplinary program for eighth-graders was organized jointly by the Center for Teacher Training and Educational Research and future teachers of chemistry and biology.

Above all, it was this interdisciplinary exchange with the didactics of other subjects which prompted Malmberg to transfer from the Rostock University of Music to the University of Potsdam a year ago. Here, she can work with many like-minded people to bolster the teaching profession, both within the University and in cooperation with other teacher training colleges. A round table has been established with Berlin's University of the Arts. "We don't see each other as competitors, we support each other," says Malmberg, who is active in the international arena as well. Earlier this year, she was elected President of the European Association for Music in Schools (EAS). Even in Vienna she coordinated the establishment of the "music education network", a European network of communication and knowledge management in music education. "It is so important to support each other and learn from each other, as music education has come under pressure, suffered cutbacks and is being pushed back across Europe," Malmberg warns.



Except for the Baltic countries, that is, which have been known for assigning high – even political – importance to music and singing since well before their “Singing Revolution”.

Every child should have the opportunity to play an instrument

In her education policy demands, Malmberg does not mince her words: The teaching profession needs to be upgraded in general. “Teachers teach too many hours and spend too much time on other tasks,” she criticizes. As far as music is concerned, lessons must be firmly integrated into the curriculum and taught as one double lesson per week, not merely a period of 45 minutes. Structurally, schools should be connected with music schools so that every child has the opportunity to play an instrument. All schools, especially elementary schools, must be equipped with specialist music teachers because “for younger children, music should be both an integrative part of a range of subjects and an independent subject,” Malmberg underlines. And, of course, every school needs a choir. Not as a means to an end, for transfer



FUTURE WORKSHOP: MUSIC AT THE UNIVERSITY SCHOOL POTSDAM

A seminar offered teacher trainees the opportunity to rethink the music lessons of the future with Isolde Malmberg, Professor of Music Education and Music Didactics. It took the form of a future workshop and dealt with the question of what music instruction could and should look like at the future university school. Which didactic concepts should definitely be accommodated? What rooms need to be built? How can one cooperate with outside partners? Based on these and similar questions, the students developed didactic and pedagogical approaches to music lessons at the future university school in Potsdam. They presented their ideas to the university school concept team, together with a strong position paper.

<https://www.uni-potsdam.de/de/innovative-hochschule/education-campus/university-school/participation/scientific-accompaniment>

effects, to promote social interaction, but to gain artistic experience. “Art is a value in itself. It is about experiencing your own aesthetic creation of the world.” Malmberg says this with passionate conviction and a tone in her voice as if there was broad agreement on this point. Of course, she knows that it is not as easy as it sounds, but: “Impossibilities are the most beautiful possibilities.” She learned this from Nikolaus Harnoncourt, the exceptional conductor. She had the good fortune of working with him during her time as a member of the Arnold Schoenberg Choir, his preferred choir. The Viennese memories echo indelibly in her. She brought them with her to Potsdam. A sounding memory, always present.

ANTJE HORN-CONRAD
TRANSLATION: MONIKA WILKE



THE RESEARCHER

Prof. Dr. Elmar Kriegler studied physics at the University of Freiburg and received a PhD from the University of Potsdam. He is Head of the Research Department “Transformation Pathways” at the Potsdam Institute for Climate Impact Research (PIK). Since 2021, he has been Professor for Integrated Assessment of Climate Change at the University of Potsdam.

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QUESTIONS

to “interface researcher”
Professor Elmar Kriegler

What can we do to stop climate change? Why has so little of it been implemented so far? And why does science not always get through to politics? Elmar Kriegler is Head of the Research Department “Transformation Pathways” at the Potsdam Institute for Climate Impact Research, where he puts his focus on the Research Area “Mitigation and Sustainable Development Pathways”, and Professor for Integrated Assessment of Climate Change at the University of Potsdam. His research focuses on the integrated assessment of climate change, scenario and decision analysis. For “Portal Wissen” he answered “33 Questions”.

Can the world still be saved?

Our planet has already been through a lot. It will also survive the intervention of humans. The question is rather how we humans can still be saved on this planet. If we are smart, we will put our knowledge of how to stop human-made climate change into practice. Then we can still save “our world”.

Is the glass half-full or half-empty for you?

In the heat of the moment, it's often half-empty, but after a bit of reflection, usually half-full. The assumption that the glass is half-full usually takes me further.

Car or bike?

The bike for daily errands, except for grocery shopping with the family.

How would you respond if someone said that we can still address climate change “tomorrow”?

The nations of the world already agreed at the Earth Summit in Rio in 1992 to avoid dangerous human intervention in the climate system. Since then, greenhouse gas emissions have risen year after year, with only a few exceptions. “Tomorrow” was yesterday, now it's the day after tomorrow.

You said last year that “around the middle of the century, we would have to be at zero net Co2 emissions globally” to reach the 1.5°C target. Is it still possible to achieve that?

We have just published a study on 1.5 degree scenarios, which shows how difficult this has become. Only if we are able to get all the options for climate protection ready and running worldwide without delay can we hope to limit warming to 1.5°C in the long term. Time is not on our side. Since the Earth Summit in Rio, we have spent 30 years with rising emissions. Now we must bring the increased emissions to zero in another 30 years. We can't waste any more years.

What has to be done to achieve this?

We must transform our energy and land use completely to emissions neutrality within 30 years. To achieve this we must take seven steps: rapid decarbonization of electricity production, electrification of energy use, reducing the demand for non-electric energy sources, conversion to low-carbon fuels, reduction of



Prof. Elmar Kriegler

emissions from agriculture, sustainable land use, and CO₂ sequestration from the atmosphere. For all this to happen in a coordinated way and to provide sufficient incentives for climate-friendly innovations, we need to fix a high price on greenhouse gas emissions that covers as many areas as possible. Our model calculations determine 100-200€/ tCO₂ in 2030. To ensure that this does not exacerbate social and international inequalities, the revenues from greenhouse gas pricing would have to be redistributed in favor of low-income households and to support developing countries in the process of implementing the transition.

Why does politics not listen to science?

That's a good question. Politicians have privileged access to scientific advice, and they make use of it. However, the fact that politicians listen to science does not mean that they do what is advisable from a scientific point of view. This was also evident during the Corona pandemic. Politicians must react to high pressures from various sides. It is a matter of winning and retaining majorities. And, in this regard, the path of least resistance is often the most tempting. That's a key reason why little has happened in climate protection over the past 30 years, even though our understanding of the dramatic consequences of unchecked climate change continues to improve.

Has the Corona pandemic changed anything in this respect?

We will probably have to wait a few more years to be able to answer that conclusively. During the first wave, I was still enthusiastic about the rationality and science-based character of the political and public discourse. That turned into the opposite after the second and third wave. It didn't take long before there was a vociferous movement of Corona deniers. Some

politicians and media tried to disparage science or to play its representatives off against each other. Climate researchers know these patterns all too well. What disillusioned me was the fact that even the immediate presence of the pandemic did not seem to make a real difference. Although the consequences were not globally distributed and would not occur years into the future but in close proximity at the intensive care units of neighboring hospitals, policymakers did not effectively respond to the second and third wave, even though they could have known and probably did know better. That makes me think. Democracies depend on decision-making in a broad social discourse. If these are rational at their core, the democratic process is unbeatable. We have a problem if we increasingly lose our collective mind in such discourses.

Have you ever said, "I told you so!"?

Nobody wants to hear that, and I can understand why. Even if I think it, I try to keep it to myself.

Do you prefer setting yourself long-term or short-term goals?

It really depends; I don't have a system for that. Long-term goals are important for giving direction but also tempt you to lapse into comfortable idleness. The analogy to climate protection also applies here. There is a lot of talk about long-term targets. In the Paris Agreement, the targets were even raised from the 2-degree limit to well below 2°C and 1.5°C, even though emissions had been rising for 25 years. So we need both: short-term and long-term goals. Right now, for example, it's important to talk about how – and not whether – Germany and the EU will achieve greenhouse gas neutrality by 2045 and 2050 respectively.

Has your research already had an impact on your lifestyle?

Yes, I have significantly reduced my meat consumption over the past three years.

What would be hard for you to give up?

Right now, I miss the direct exchange with international colleagues at conferences and workshops. The pandemic has shown that more exchange than we thought is also possible virtually, but it can't replace every physical meeting. Sitting together in a room and discussing scientific issues can, if things go well, develop a specific quality that is difficult to reproduce virtually.

“The Day After Tomorrow” (Roland Emmerich) or “An Inconvenient Truth” (Davis Guggenheim/Al Gore)?

“An Inconvenient Truth”. The way Al Gore climbed up on the scissor lift to illustrate the current rise of CO₂ concentration in the atmosphere was impressive. The speed of human-made climate change is unparalleled in the Earth’s history. Within 60 years, CO₂ concentration has risen to levels that have not existed for millions of years. Al Gore was able to get the threat of climate change and ways to address it into the minds of many people. Emmerich’s Hollywood blockbuster did what such blockbusters usually do: show much action with a background story that has little to do with real climate change.

Why did you study physics?

As a student, I was very fascinated by how the material world could be traced back to basic equations and fundamental forces. I wanted to study physics to understand what held the world together at its core. It turned out that this wasn’t on offer. Physics is not metaphysics, and rightly so. You find, of course, little in physics about the things that concern societies at their core. Nevertheless, studying physics was very important for me. It honed my analytical skills and gave me the quantitative tools for my current research.

How did you “become” a climate researcher?

I am not a classical climate researcher but would describe myself as a researcher at the interface of various disciplines, which transdisciplinary topics such as climate change can create. We use coupled energy-land-economy-climate models, so-called integrated assessment models, to achieve an integrated assessment of climate change mitigation strategies. In my diploma thesis, I analyzed data from a particle physics experiment at CERN. I enjoyed that very much but it was far away from social issues. After graduation, I took a few months and toured Germany to check out different topics for a possible PhD thesis. Climate protection was still a marginal topic at the end of the 1990s, but it immediately fascinated me because of its connection between society and nature. That’s how I came to the then still young Potsdam Institute for Climate Impact Research (PIK) and my current research topic.

Who is your role model?

I don’t have one specific role model, but fortunately I have met a few people who are role models in different areas.

What has been a key moment in your work as a researcher?

The thematic reorientation for my doctoral thesis was certainly the most important key to my career as a scientist. This already started with my first working group meeting at PIK. There, physicists and economists were dueling over whose concepts should dominate the research. It was immediately clear to me that this was not the first time they were doing this. Eventually, this friction led to new ideas that pushed the research. Some other key moments were my work as an author for the Fifth Assessment Report and the special report on the impacts of global warming of 1.5 °C of the Intergovernmental Panel on Climate Change (IPCC). The summary reports for decision makers must be confirmed verbatim by the countries in week-long meetings. Those were exhausting days and sleepless nights. And at the end, we came to realize that it could work. The reports’ scientific integrity was preserved, and countries found the reference points they wanted. The IPCC is a success story of scientific political consulting.

What does success mean to you?

Success feels good and is important for your academic career. But it is not everything. Failure is a part of it too, and you can often learn more from failure than from success. And sometimes you achieve success in a non-linear way. My experience is that an exceedingly linear focus on success, the constant question of “What’s in it for me?”, does not necessarily lead to success. Passion, intuition, and cooperation are the better companions.

How do you measure success?

Success is when your own work is received and discussed by specialist colleagues – and even more so when it also reaches decision-makers and the broader public. Ultimately, success is any substantive discussion that generates new thoughts and allows me to learn.

What was your biggest failure?

Failure is part of an academic career. A submitted article is rejected, a third-party funding application fails. This is disappointing, but these are also important experiences that teach you how to deal with them and to improve things. My biggest failure perhaps was the failure of a comprehensive EU application that I had coordinated and of which we were very convinced as

a consortium. We had just successfully completed a research cycle, including several EU-funded projects, and many of our findings had been included in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. We then thought we could start the next research cycle with this project. The rejection brought us rudely back down to earth. Building the new research cycle then turned out to be much more strenuous than we had hoped.

Why did you come to Potsdam?

To write my PhD thesis at PIK.

Why did you stay?

For a while, I was on a research stay at Carnegie Mellon University in Pittsburgh together with my family. But the PIK is a unique place to conduct research on the natural scientific, economic, and social aspects of climate change and to provide science-based policy advice. That and the fact that we feel very comfortable in Potsdam made us return and stay.

Early bird or night owl?

Night owl. I have always been one.

What do you want to achieve as a scholar?

With our research, we want to help find pathways toward a sustainable future. For example, we have just developed a number of climate scenarios to assess financial market risks for a network of central banks.

The integrated assessment of climate change strategies uses scenarios of possible futures (“What could happen?”), as well as goal-oriented futures (“What would have to happen to achieve a particular goal?”). They are designed in such a way that they can be used to analyze the implications of different possible actions and assumptions. In this way, we try to bridge the gap between aspects of the natural and social sciences, between short-term measures and long-term considerations, between national and international debates, and between achieving climate targets and other social goals. To be able to achieve that with the necessary concreteness is an ongoing challenge.

What topic are you currently researching?

As head of the Research Department “Transformation Pathways” at PIK – together with my colleague Katja Frieler – I am fortunate to be able to work with a large team of excellent researchers on a variety of issues. Our department covers a range of topics, from the assessment of future climate-related damages, the analysis of energy and land use transformation at the German, European, and global level to questions of policy instruments to design and implement these transformation processes. I am leading an EU project on the development of a new generation of integrated assessment models, I research the embedding of climate change mitigation pathways in a broader sustainability context, and I am involved in the 6th Assessment Report of the IPCC Working Group on Emissions Reductions.

Who would you like to do research with?

We are already well connected internationally, conducting research in various projects with researchers from Europe, Australia, Asia, North and Latin America. I would like to do more research on political economy and institutional issues of social transformation path-

ways, with colleagues from the social sciences who are also interested in modeling and scenario building. I also find research on digitization, the future of work, inequality, and energy use very interesting.

Which discovery would you like to have made yourself?

This question doesn't mean much to me. I think that many discoveries are great, but why would I want to have made them myself? It's good that they were made, completely irrespective of me. I'm rather motivated by the question, what would I like to find out? A number of things come to mind, all requiring to link process understanding and modeling: Where does climate change interfere most with the growth process, and what does that mean for future climate-related damage? What strategy best combines social justice, innovation, and climate protection? And which new ideas on reducing emissions exist that could make global CO₂ neutrality more achievable by 2050?

What do you like most about your profession?

To be able to look at the whole picture, the privilege of being able to think about the future of the world for a living, and the richness and transdisciplinarity of the climate issue. There are few topics of our time without a reference point to climate change. And it is the daily work in an inspiring team that is dedicated to the integrated assessment of climate change and climate protection.

And what not at all?

The race for third-party funding becomes a treadmill when more than half of employees are financed through it. Third-party funding enables us to cover a broad and socially relevant range of topics in line with the potential we have. But it also leads to a constant cycle of applications, project meetings, and reports, which can wear you down. The most difficult part is the fact that we are unable to offer long-term career prospects for many young and outstanding researchers even if we would like to keep them.

What advice would you give to young researchers?

I would advise them to listen to themselves and follow their own intuition and passion, even if their future prospects are still unclear. Good science starts with a

good question. For those who can ask such questions, want to get to the bottom of things, and seek knowledge for the sake of knowledge or social progress, science might be the right path. But science inevitably also means competition, because a new discovery can only be published once. You have to be ready to face that; it's not stress-free. What makes the situation more difficult for future researchers in Germany is the lack of a clear career path. It therefore remains an adventure to set out on this path. Whether you want to do this is an individual decision and of course also depends on factors other than scientific aptitude.

Which book that you have recently read has remained in your memory?

"Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark. In fact, the phrase that AI is neither artificial nor intelligent is on many people's lips. But Tegmark has convinced me that the ingredients for a new age of autonomous, self-learning machines with cognitive skills have already been prepared when you think beyond the next few years. What makes Tegmark's book so interesting to me is that he looks at the question of what it will mean to be human and organize the economy and society in the face of such machines. We are facing a drastic upheaval that is taking place simultaneously and closely interwoven with the fundamental changes caused by climate change, the struggle for social justice and equal economic access, and the struggle between democracy and autocracy. And as such upheavals demand, Tegmark asks the pressing question of how we want to shape the new machine age.

How do you create a balance to research?

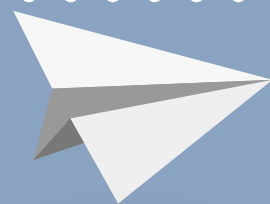
Activities with the family, going out into nature, immersing myself in exciting stories, and just doing nothing for a change. Admittedly, I do that far too rarely at the moment.

In which situation in your life were you lucky?

I would say that I have been very lucky overall. To be able to grow up in peace and prosperity in a free society and in an intact home, to start a family with my wife, and to see the children grow and become independent, that is happiness.

THE QUESTIONS WERE ASKED
BY MATTHIAS ZIMMERMANN.
TRANSLATION: SUSANNE VOIGT

IN THE NAME OF





EVIDENCE

The Center for Economic Policy Analysis (CEPA) pools empirical economic research and communicates findings to policy makers

What are the most effective ways for policy makers to regulate the labor market? Does government aid during the Corona pandemic reach those who really need it? Does this aid actually help? How can you combine efficient climate and economic policies? How high is the gender pay gap and how can it be reduced? The Center for Economic Policy Analysis (CEPA) stands at the intersection of economic research and political practice. CEPA was founded in 2018 and is a think tank that pools socially relevant research and communicates it to the political arena. CEPA provides a network for researchers of the Faculty of Economics and Social Sciences at the University of Potsdam and external partners in Potsdam and Berlin. Above all, it introduces students to research early on and teaches them what scientific expertise can achieve.

“The Corona crisis has made us realize that continuing education and lifelong learning will become increasingly important due to the ever-changing demands on the labor market,” says Marco Caliendo. “At the same time, we know that some people systematically participate less in continuing education than others – even though

they would benefit from it. Why is that?” Caliendo is an economist who researches questions like these – questions also addressed by CEPA. Caliendo, who is Professor of Empirical Economics at the University of Potsdam, founded the center together with colleagues to combine research and teaching with transfer to the political and social field. The fellows include researchers from the faculty but also from other institutes in Potsdam and Berlin, such as the Potsdam Institute for Climate Impact Research (PIK), the German Institute for Economic Research (DIW), the Mercator Institute for Economic Research (Mercator), and the Berlin School of Economics (BSE). Some of them are jointly appointed professors at the University of Potsdam – such as Matthias Kalkuhl from the MCC, Katharina Wrohlich and Alexander Kritikos from the DIW, and Elmar Kriegler from PIK. “We pool our research qualities in an excellent but also competitive research environment of the metropolitan region,” Caliendo explains. “This also makes us more visible and attractive to students and doctoral candidates.” After all, they are just as important a part of CEPA as the senior members, who primarily include postdocs and professors.

Prof. Marco Caliendo





The “Center for Economic Policy Analysis” was founded at the Faculty of Economics

and Social Sciences of the University of Potsdam in 2018. It offers an attractive study and research environment. Its evidence-based research is embedded in the economic policy of the Potsdam-Berlin region. The center focuses its work on policy-relevant economic research, which includes labor markets, inequality, human behavior, economic growth, and sustainability. CEPA offers an ambitious economics curriculum to bachelor, master and PhD students (in cooperation with the Berlin School of Economics). In addition to academic training, students of the University of Potsdam can acquire skills in economic policy analysis through CEPA's Internship Program at partner institutions.

<https://www.uni-potsdam.de/en/cepa>

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Providing empirical evidence for economic science hypotheses

They all share an interest in empirical research and socio-politically relevant issues. Like Marco Caliendo, most of the members have backgrounds in economics or related disciplines. For many years, Caliendo has been investigating the instruments that can support and steer the labor market. For example, he analyzed the impact of introducing minimum wages. Back in 2017, he and colleagues from the DIW were able to show that the minimum wage significantly raised low wages but that not all those who were entitled to it actually received it. In concrete terms, the introduction of a minimum wage in 2015 led to a 15% increase in wages between 2014 and 2016 for the 10% of employees with the lowest incomes. The researchers also calculated, however, that two years after the introduction of the minimum wage, up to 1.8 million workers were still earning below 8.50 euros per hour. “So the instrument works to the effect that it has given a boost to low wages,” Caliendo sums up. “At the same time, however, policy makers must ensure that the minimum wage actually reaches everyone who is entitled to it.”

Such an empirical project, which provides information about more than 44 million working people in Germany, becomes possible thanks to comprehensive surveys such as the Socio-Economic Panel (SOEP), the largest and longest-running multidisciplinary survey in Germany. “The fact that more and more data are being collected and made available in economic and

social sciences has led to a small empirical revolution in economics in recent decades,” Caliendo explains. “Our goal is to provide empirical evidence for the scientific hypotheses that we develop.” Making science comprehensible, taking it from the spheres of theory into practice, is a goal shared by the researchers at CEPA, the economist says. And here, a direct path leads to the sphere of politics. After all, science can contribute to evidence-based policy making, i.e. using empirical data to prove which political measures are effective and which are not. This goal has been met with strong interest from the other side: The minimum wage project was developed in cooperation with the Institute for Employment Research of the Federal Employment Agency in Nuremberg and the SOEP at the DIW in Berlin.

Evidence-based advice for policy-making

CEPA takes this exchange to the university, for example with the “CEPA Policy Lecture Series”. Political and scientific experts are regular guests at lectures and discussions, such as most recently Stefanie Hiesinger from the Climate Cabinet of the EU Commission, Prof. Dr. Claudia M. Buch, Vice President of the Bundesbank, and Prof. Dr. Andreas Peichl, who is Director of the Center for Macroeconomics and Surveys at the Ifo Institute in Munich. “We want to give our junior members and students the opportunity to interact with political decision-makers and policy advisors. And to let them know how important such exchanges are – for both sides,” says Caliendo. After all, CEPA's mission is not only to analyze and evaluate (economic) policy retrospectively. The center also wants to position itself as a scientific institution able to provide advice on the design of leading-edge polit-

The **Socio-Economic Panel (SOEP)** is the largest and longest-running multidisciplinary household survey in Germany. The SOEP is part of the German research infrastructure at DIW Berlin and is funded by the Federal Ministry of Education and Research (BMBF) and the federal German states under the umbrella of the Leibniz Association (WGL).

Since 1984, every year several thousand people have been interviewed for the SOEP by the polling agency Kantar Public. Currently, this includes approximately 30,000 people in 15,000 households. The SOEP data provide information about personality traits, education, health, income, employment, and life satisfaction. Since the same people are interviewed every year, one can analyze not only long-term social trends but also the group-specific development of life courses.



THE RESEARCHER

Prof. Dr. Marco Caliendo studied economics at the Goethe University in Frankfurt am Main and the University of Manchester. Since 2011, he has been Professor of Empirical Economics at the University of Potsdam and Program Director for the research area “Evaluation of Labor Market Programs” at the Institute of Labor Economics (IZA) in Bonn.

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ical frameworks and programs. “With this approach, we want to help establish evidence-based policy-making as a tradition in Germany,” says Caliendo, who is CEPA’s spokesperson. In disseminating science, CEPA also aims to reach a wider public. “We know a lot about research and teaching, but when it comes to outreach, we leave our comfort zone,” Caliendo admits. “In fact, economics, which often involves quantitative work, can be visualized and communicated very

well. In any case, we still see room for improvement, and there is a lot to do!”

The starting point and core objective of CEPA’s work, however, is to enter into a dialogue about research or even to initiate joint projects, for example at the weekly “Potsdam Research Seminar in Economics (PRSE)”, where all members regularly put their current projects up for discussion. It does not matter whether it is a doctoral thesis or a large third-party funded project. The “CEPA Flash Talk” is actually explicitly about presenting early-stage projects or initial ideas and collecting suggestions. “Of course, such formats are particularly useful for our junior members, who can practice giving presentations and are thereby able to decisively improve their projects,” says Caliendo. But the knowledge transfer does not only go in one direction. “Feedback is also extremely important for senior researchers.” To publish exciting results beyond CEPA at an early stage and make them accessible to a larger research community, a “Discussion Paper Series” was initiated, which is published by Universitätsverlag Potsdam. In this series, all CEPA members can publish working papers, which sometimes take two to three years to be published in economic journals due to the lengthy review process. “This particularly helps junior





researchers' visibility at an early stage. Sometimes this can be decisive for their further career path," Caliendo says. In order to promote early-career researchers, CEPA is constantly developing new formats. In September 2021, already the seventh "PhD Workshop in Empirical Economics" will take place. In April 2021, a "Coding Bootcamp" was held, where practical examples demonstrated how to obtain big data through the computer-assisted reading of web pages.

Who invests in continuing education?

For some time now, Caliendo has been particularly interested in the motivation behind people's decision to invest time and resources in continuing education. "In several projects, I am investigating so-called human capital investments, particularly the question of how people's personalities influence their decision to participate in continuing education." Skills demanded on the labor market are changing fast, and lifelong learning is now considered essential. And yet Caliendo and his team were able to show that not all people are equally willing to take part in continuing education. This is due to specific personality traits, for example the so-called locus of control. People with an

internal locus of control believe that their own actions have an impact on their lives, i.e. that they have control over it. People who tend toward an external locus of control are convinced that external factors primarily determine their success or failure. Since the locus of control can be determined relatively well with the help of standardized questionnaires, the researchers were able to show that people with an internal locus of control are more likely to undergo further training. The reason for this is that they simply expect the benefits to exceed the costs. "Findings like these are, of course, just as important for HR managers as they are for job placement officers at the employment agency," Caliendo explains. "Because these findings clearly show that personality types should be approached and supported differently when it comes to arranging continuing education."

In a follow-up project, Caliendo is now investigating how the personality of managers responsible for the continuing education of their employees affects decisions about who is sent to training courses. As soon as the first results are available, he also intends to present them for discussion at CEPA.

MATTHIAS ZIMMERMANN
TRANSLATION: SUSANNE VOIGT



LIGHTING UP THE BLIND SPOT



**Benno Stabernack develops
an assistance system to prevent
accidents between cars
and cyclists**

Prof. Dr. Benno Stabernack wants to increase road safety – including in vehicle blind spots. As a graduated electrical engineer, Stabernack therefore launched the “SySiKo” project in which he tests, in cooperation with industrial partners, a variety of sensors to unite them in one system. Using artificial intelligence, “SySiKo” is designed to reliably detect what may slip the attention of drivers and cyclists – and even to warn all road users, if necessary.

Bus drivers who overlook an approaching racing bike while making a turn, cyclists who fail to notice a truck overtaking them: Every year, accidents involving cyclists and especially large vehicles make the headlines. Time and again, serious injuries and even fatalities are reported. “I am an ardent driver and cyclist myself,” Stabernack says. “And for me, every cyclist injured in a traffic accident is one too many.” Stabernack is Professor of Embedded Systems Architectures for Signal Processing, a joint appointment with the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute (HHI) and the University of Potsdam. He has launched a research project to help


prevent such accidents. “I can't understand why, year after year, new technologies are being developed for multimedia home entertainment – but not for road safety, where they could make a real difference. So I asked myself, ‘Can I do something about it?’ The answer was yes. So we launched the project, if only to demonstrate what's possible.”

THE PROJECT

“SySiKo” – Vehicle-based system for the detection and signaling of a collision risk with weak road users in the blind spot area

Participants: University of Potsdam (Prof. Dr.-Ing. Benno Stabernack, Michal Stec); Solectrix GmbH, Fürth; DResearch Fahrzeugelektronik GmbH, Berlin
Funding: German Federal Ministry of Education and Research (BMBF)

Duration: 08/2019 – 07/2022

 <https://www.elektronikforschung.de/projekte/SySiKo>

Artificial intelligence to link sensors

In cooperation with two industrial partners – Solectrix GmbH in Fürth and DResearch Fahrzeugelektronik GmbH in Berlin – Stabernack is developing a predictive sensor system to reliably detect the risk of a collision between a large commercial vehicle, such as a bus, and a cyclist traveling in the same direction. In case of an imminent danger, the system will warn both road users in good time. In fact, as Stabernack points out, simple warning systems are already being used. Many public buses have cameras installed that trigger an alarm in critical situations. However, these systems are not precise enough yet and often trigger false alarms. So for lack of trust, they are ignored or even switched off. “SySiKo” wants to do better. “We want nothing less than absolute safety,” Stabernack says. For that purpose, he and his team are combining various sensors in one system. The collected data are then analyzed using artificial intelligence to reliably detect potential collision risks.

For the prototype of their project, the researchers have installed an RGB camera, a lidar radar and a heat sensor in a small white box mounted to the outside of the test vehicle at about the level of the side mirror. In addition, three time-of-flight (TOF) cameras were attached with magnets on the outside of the vehicle. “We are testing the technology,” Stabernack explains. “How to integrate the system into vehicles, perhaps in mirrors or other body parts, will be dealt with later.” The researchers are using the test system to collect various data sets: RGB video images, radar and thermal data, and information provided by the TOF cameras. These cameras emit infrared light and measure how long it takes for the light to return. When a cyclist passes the vehicle and possibly overtakes it in its blind spot, these values will change – and make the cyclist “visible”. Even supporting sensors for or on cyclists are conceivable, such as real-time location systems using GPS, Bluetooth, wireless LAN or other radio signals, which are able to locate themselves spatially, Stabernack says. In the future, these sensors, which are not even expensive, could be mounted in bicycle helmets and communicate with the safety systems of vehicles – and

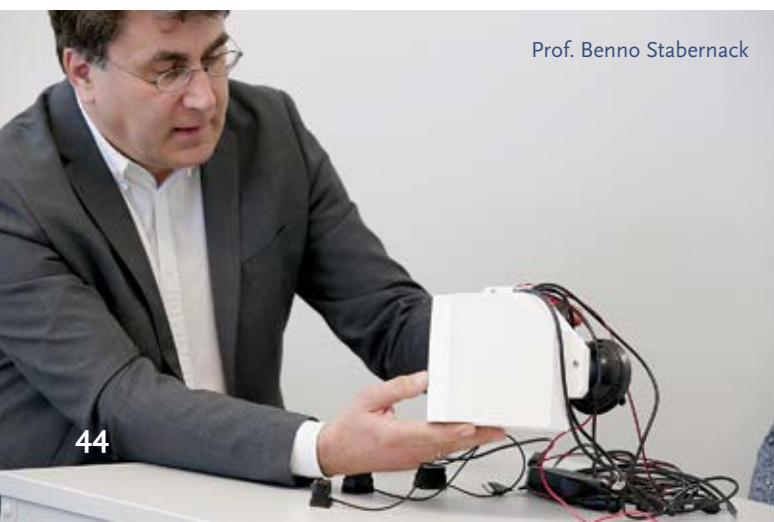
thus save lives. If a bus and a bicycle get dangerously close to each other, the bus driver's alarm would go off and warn the cyclist, too, for instance through warning lights on the outside of the bus. “Light signals would indicate that the bus driver may not have noticed the cyclist and therefore not react properly.”

Driving the streets of Berlin in the test vehicle

Currently, Stabernack and his team are testing what data the sensors can deliver, and how well they can be analyzed. As yet, it is not clear which of them will be best suited for combined use. “We intend to evaluate the whole range of sensors – individually and in combination,” Stabernack says. “Therefore, we want to establish what additional detection reliability the various systems offer.”

To this end, the researchers spent many hours driving the streets of Berlin in their prepared test vehicle. But first of all they had to define what exactly they wanted the sensors to record. “Specifically, we asked bus drivers what they considered the most dangerous situations in road traffic,” explains Michal Stec, a member of the “SySiKo” team. “And we asked what they expected of a turn-off assisting system. How could it really help them?” Based on this prior research, a storyboard was created with all situations in urban traffic to be covered. Two sources of danger stood out by far: turning right at low speed with large steering wheel deflection, and changing lanes at higher speed with low steering wheel deflection. Besides, data had to be collected at as many times of the day, and year, as possible to find out whether the sensors provide reliable data at different temperatures and under different lighting conditions as well. Almost eighteen months of the project went into collecting data alone. Today, more than 100 hours of data are available.

Photos: Scholz, Sandra (2)



Prof. Benno Stabernack



Michal Stec



THE RESEARCHERS

Prof. Dr.-Ing. Benno Stabernack studied electrical engineering at Technische Universität Berlin. He is the head of the Embedded Systems Group at Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute (HHI), and has been Professor of Embedded Systems Architectures for Signal Processing at the University of Potsdam since 2016.

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Michal Stec studied electrical engineering at Technische Universität Berlin. Since 2019, he has been a research associate at the Chair of Embedded Systems Architectures for Signal Processing.

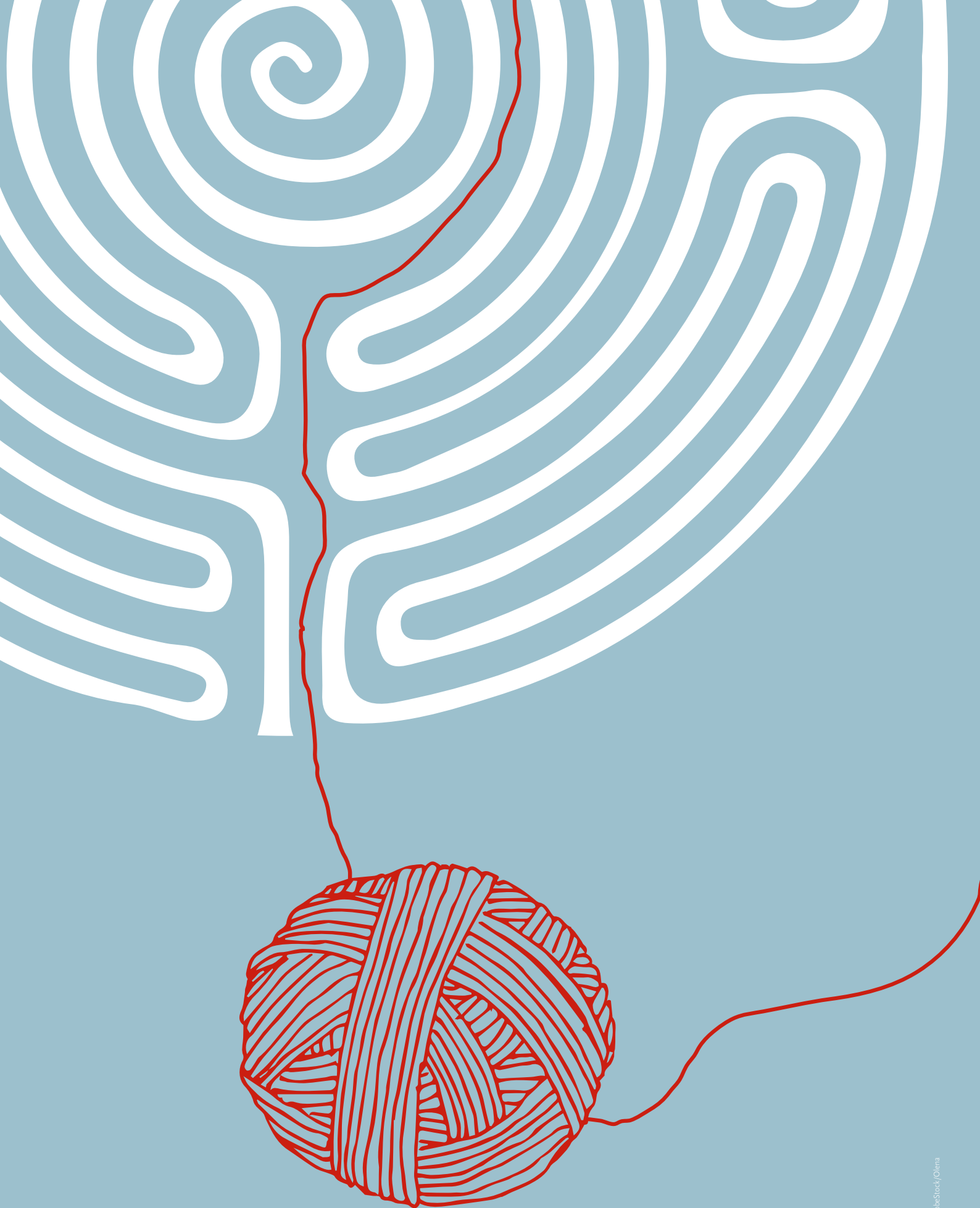
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“In the meantime, we have entered the training stage,” Stabernack explains. After all, the processing of the sensor data is performed with the help of artificial intelligence. “Although the term doesn't really fit,” Stabernack remarks. “Strictly speaking, these are artificial neural networks.” That is to say, they only detect what they were trained to. For this reason, all data need to be analyzed and labeled “manually” first. Cars, cyclists and other road users are marked on all data series. Then the AI starts practicing – “and it cannot be smarter than the person who taught it.”

Stabernack reckons that it could take years before “SySiKo” will assist drivers and cyclists on the road. Once the time-consuming AI training has been completed, the researchers will have to analyze which sensors contribute the most to detection reliability. It may well be that not all sensors are needed in the end. Quite obviously, the AI required to process the sensor data in real time has a huge hunger for energy. Not everything that can be done is suited for everyday use. Moreover, only what is affordable will find its way into mass-pro-

duced vehicles, and the market will “regulate” that. “Our industrial partners have already indicated that the price of the system must not exceed 200 euros,” Stabernack says. “But even a new cell phone may be 500 euros or more these days!” Stabernack is annoyed by the fact that many people seem to be willing to spend more on consumer electronics than on road safety. At the same time, this inspires him. “Our aim is to prevent these serious accidents one hundred percent of the time, and nothing will stop us!”

MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE



THE RED THREAD TO ENERGY TRANSITION

The joint research project “Ariadne” is looking for the best ways to achieve a climate neutral society

THE PROJECT

“Ariadne” is funded by the German Federal Ministry of Education and Research (BMBF) with a total of 30 million euros over three years and is part of the Copernicus research initiative. As its fourth pillar, “Ariadne” complements the ENSURE, P2X and SynErgie projects. Together, the Copernicus projects represent one of the largest German research initiatives on energy transition.

Duration: 2020–2023

Participants: 26 research institutes under the direction of the Potsdam Institute for Climate Impact Research (PIK)

<https://ariadneprojekt.de>

The coming years will determine whether humanity can tame climate change. Important steps need to be taken right now to advance economic transformation. Research findings will help make the right decisions.

The Paris Climate Agreement sets the target: Global warming is to be kept to 1.5 degrees Celsius – this is what the 195 parties to the United Nations Framework Convention on Climate Change, after tough negotiation, adopted by consensus on December 12, 2015. In this way, the global community rises up against the risks and dangers of man-made climate change. The target can only be achieved if greenhouse gas emissions are massively reduced. In this process, energy transition plays a major role: Fossil fuels such as coal, oil or natural gas are to be replaced by energy from renewable sources such as wind, water, solar power or biomass.

The effects of carbon pricing on the national economy

“We must take concrete action, and above all quickly,” says Maik Heinemann, Professor of Growth, Integration and Sustainable Development at the University of Potsdam with reference to the 1.5 degree target. In the joint project “Ariadne”, he and his colleagues from 26 research institutions are studying what the path to the post-fossil age could look like. Under the direction of the Potsdam Institute for Climate Impact Research (PIK), the researchers are developing so-

cially viable strategies for the energy transition. Their work packages cover a variety of fields: transportation, heat, electricity grids, taxes, hydrogen or the industry. “Reconciling all these aspects and finding a common course can be pretty difficult at times,” Heinemann says. In his subproject, which he is realizing with researcher Ulrich Eydam, he is studying how taxes and government spending can be designed in such a way as to meet climate targets and at the same time ensure that the measures are accepted by large sections of the population and economy.

“We are exploring the distributional impact of climate policy measures and their consequences,” Eydam explains. “Let’s take carbon pricing, which was introduced in Germany earlier this year.” With the help of computer models, Eydam is analyzing various scenarios: What are the consequences of different carbon prices for the economy at large and for the individual? How do product prices or inflation rates develop under various carbon prices, and what are the repercussions on household incomes? Are wealthy households affected as much as those with lower incomes? And is carbon pricing a way to effectively finance climate protection measures?

Research findings as decision support for policymakers

“For the moment, we are calibrating our models to replicate basic macroeconomic features of the Ger-





man economy,” Eydam explains his approach. This “kit” can then be used to simulate different scenarios in tax policy and carbon pricing, and compare their effects. “Businesses react to changes in taxation: As a result, market prices change and households, for instance, respond by adapting their demand decisions. This has feedback effects on prices. On the other hand, not all households react in exactly the same way, as their decisions depend on income and wealth. Thus, poorer households – who spend a larger share of their income on energy-related goods – are more affected by a carbon tax or carbon pricing than wealthier

households,” Heinemann describes the interactions between political measures and economic developments. “We need to design models that are suitable for tracking feedback occurrences and distributional effects well and to capturing the most relevant interrelations.” In this way, the researchers will be able to look ahead and forecast which policy instruments are best suited to making progress on the road towards climate neutrality.

Ultimately, the findings of the Potsdam researchers will support policymakers in their decision-making, and promote dialog with citizens on the energy transition. The research results of the Ariadne project have been widely publicized and discussed in citizens’ forums. “With the analyses of our work package we can help forecast, and prevent, undesirable effects of measures,” Eydam states. “In the long run, this will enhance their acceptance.”

“The energy transition requires massive investments,” Heinemann underlines. Grids and infrastructures need to be expanded, and businesses completely restructured. The transition to a climate neutral economy and society is like navigating a labyrinth – for which the researchers can provide some guidance. After all, it is with good reason that the joint project was named “Ariadne”: The central theme of the energy transition project relates to Greek mythology. Ariadne, daughter of the Greek King Minos, helped King Theseus conquer the Minotaur, a monster with the body of a man and the head of a bull. It was only with the help of Ariadne’s thread, which Theseus attached to the entrance of the Minotaur’s cave and unwound on his way through the labyrinth, that he was able to retrace his way out of the labyrinth. Navigating the labyrinth of energy transition is to be made just as safe – by following the red thread provided by researchers.

HEIKE KAMPE

TRANSLATION: MONIKA WILKE



THE RESEARCHERS

Prof. Dr. Maik Heinemann studied economics at the University of Hanover. Since 2011, he has been Professor of Growth, Integration and Sustainable Development at the University of Potsdam.

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Ulrich Eydam studied economics at the Viadrina University Frankfurt/Oder and at the University of Potsdam. Since 2014, he has been a research associate at the Chair of Growth, Integration and Sustainable Development at the University of Potsdam. In 2021, he completed his doctorate in economics at the University of Potsdam.

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THE PROJECT

“CORONA – development of a certified in vitro diagnostic medical device (IVD) for the reliable detection of COVID-19 specific immune responses in human sera” is a research project for the development of a detection system for novel COVID-19 viruses.

Duration: 11/2020–12/2021

Funding: Federal Ministry of Education and Research (BMBF)

Participating: University of Potsdam, Charité – Universitätsmedizin Berlin, WIMEDKO GmbH, CellTrend GmbH, sifin diagnostics GmbH

A background image showing a gloved hand using a pipette in a laboratory setting, with various lab equipment visible.

Cells with Special Demands

A new detection system for
SARS-CoV-2 is being developed
at the University of Potsdam

COVID-19 tests are an important tool in pandemic response. Antigen rapid tests provide a result in just a few minutes but are relatively inaccurate. PCR tests guarantee a reliable result but take much longer. Endowed Professor Dr. Katja Hanack and her research team are working on a detection system using human immune cells and an artificially constructed viral envelope that will combine the strengths of both methods – speed and accuracy.

“This is my personal treasure,” says Anja Hönow. The researcher carefully carries the laboratory dishes from the culture cabinet to the safety workbench, where she can work under sterile conditions. The cells growing

in these dishes with a yellowish liquid must get fresh nutrient medium. These cells come from blood donations. The special thing about them is that their donors have overcome a Corona infection. The donors’ immune systems are familiar with the virus and have developed cells that, when they come into contact with the virus again, produce large quantities of antibodies that rapidly eliminate the pathogens. In a highly complex biotechnological process, Hönow has created a so-called hybridoma cell line from precisely such cells – so-called B lymphocytes. The cells can survive outside the body, continue to divide indefinitely, and produce lots of antibodies. Twice a week, the culture needs fresh nutrients to be able to grow.



Detecting the whole virus

The precious cells are part of an ongoing research project on the novel SARS-CoV-2 virus. “We want to develop a certified test system, which can detect the virus directly,” Hanack, who is the head of the project and Endowed Professor of Immunotechnology, describes the goal of her research. Thus, the intended detection system differs from existing well-established tests: The usual rapid antigen tests detect specific proteins on the surface of the virus. “Our system is not only designed to detect a fragment but really the whole virus,” Hanack explains. This test is intended to be “extremely accurate, safe, and nevertheless fast.”

To develop such a test, the researchers need human antibodies that can bind the virus particle. Millions of different B lymphocytes exist in human blood, each producing specific antibodies for different pathogens. Hanack and her team have developed their own pat-



ented technology to rapidly isolate and activate exactly those B lymphocytes that produce antibodies against SARS-CoV-2. This procedure, which has become very well established by now, takes two to three weeks.

The real challenge, however, is to design a stable system in which the cell cultures that develop from a single cell are comfortable over a long period of time. The goal is to create cell lines that can be cultivated under laboratory conditions and, as small antibody factories, permanently produce antibodies. Unlimited quantities of a reference antibody with consistent quality can be produced with such cell cultures. “Ultimately, we don’t only want to publish the results once but have a reliable, marketable technology,” Hanack emphasizes.



THE RESEARCHERS

Prof. Dr. Katja Hanack studied biology in Rostock and Berlin. Since 2015, she has been an Endowed Professor of Immunotechnology at the University of Potsdam. The endowed chair

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Age, genetics, and lifestyle influence immune cells

The human immune cells do not make this task easy for her research team. “Sometimes I have sleepless nights because of this,” Hönow admits. “You have to learn to understand the cells.” While the technology is already well established for cells from mice, human hybridoma cell lines are relatively new in the lab – and not as easy to satisfy. “Human cells are more demanding than mice cells,” Hönow says. To grow well, they need structures or an environment that is similar to what the cells find in the body - a “home,” as Hanack calls it. “They also like to live in groups,” adds Hönow. “You might also say they need some cuddling.” Through trial and error and observation, she is slowly getting to know the specific needs of her cell cultures.



Hanack's working group has developed a novel testing system for the SARS-CoV-2 virus.

The donors' blood samples pose further challenges in the laboratory because the cells differ considerably in quality, number, composition, and genetics. Lifestyle, genetic background, medications, and age – all these factors influence the cells of the immune system. "We can also see when someone who was sick donated blood," explains Hanack. These cells are less vital than in people who are in good health.

To eventually work out an improved detection system for SARS-CoV-2, Hanack's team is cooperating closely with the Charité in Berlin and the three biotech companies Wimedko, sifin and CellTrend. Coronaviruses are replicated in the laboratory there, but they do not contain any genetic information. "It's just the outer viral envelope," Hanack explains. Experts refer to these building blocks as virus-like particles. Such a particle cannot infect a human but has all the necessary information to be recognized by detection systems. The Potsdam researchers need these particles to build and validate their test system. "Everything has to be compatible – the pairs of antibodies and the virus particles," Hanack explains.

Basis for potential Covid-19 medication

The researchers already know that the antibodies they have produced in the laboratory can attach themselves to the surface structures of the viruses. Now they are testing whether they can also neutralize the viruses. If this is the case, these biomolecules would not only be candidates for an effective test system but also for an active ingredient that could be used to approach pharmaceutical companies to develop drugs. Since the antibodies produced in Hanack's lab are of human origin, they would also be particularly well suited for therapeutic use in humans.

But first they focus on the detection system. "This should be launched as soon as possible," Hanack says. A first prototype was already completed in May 2021. By the end of the project period in October, the certification process is to be completed so that the new test can already be used this year. "That was also the condition of the Federal Ministry of Education and Research for their funding," Hanack explains. "After all, the system should be ready and running during the pandemic." She also sees numerous other uses for the cell cultures developed in her lab that produce human antibodies. "It's a large market in which we want to establish and develop ourselves."

HEIKE KAMPE

TRANSLATION: SUSANNE VOIGT

Prof. Katja Hanack



Anja Hönow



Designing the Factory of Tomorrow

Dr.-Ing. Sander Lass, Technical Director of the Potsdam Center for Industry 4.0

Everyone is talking about digitization, Industry 4.0, the smart factory.... But what exactly is behind these buzzwords? And how can these general terms be implemented on the shop floor to deliver the promised benefits? These questions are part of my daily work at the Potsdam Center for Industry 4.0 (ZIP4.0), which is located on the premises of the "Digitalvilla" on Karl Marx Strasse in Potsdam-Babelsberg. With the hybrid model factory, a simulator for manufacturing processes, we are investigating the integration of new systems and how to operate them most efficiently, how these systems can interact with established technologies expediently, and which stumbling blocks come up on the path to modern production systems. For this purpose, there is a toolkit in the model factory with the

help of which we can simulate and test production scenarios. There are different machine simulators, intelligent workpiece carriers that steer themselves through production, industrial robots and roller conveyors, mobile devices, and many more. All this, the actors can operate, maintain, and test, e.g. in the role of a machine operator within a production scenario.

At the moment, we are working on integrating another module for the factory of the future: smart glasses. A typical example of how novel things find their way onto the shop floor. These glasses are meant as a tool enabling the actors in the plant to master complex tasks. At the same time, the new module will expand the toolkit for research activities. Colleagues can then use them, for example, in their experiments to design assistance systems or to conduct usability studies.

After gathering possible application scenarios, we decide on the type of support for the machine operator in the maintenance process.

Then it is time to design the storyboard and select the devices. One possible candidate is Microsoft's HoloLens. Is this device really a suitable solution? Is it functional and safe, even under the rough conditions at a factory? After an initial round of testing with partners from the industry, we choose another device, the HMT-1. As so-called assisted reality glasses, they fit the requirements best. After the storyboard, the next step is implementing the corresponding functions in the simulator and on the glasses themselves. After all, the device needs data from the process and at the same time returns information from its application to the simulation system. For this purpose, the system must be configured and additionally programmed with the help of web services. Only a short time later, the system and the glasses are ready for use...

However, the model factory is constantly changing, growing, and being rebuilt.

It has become apparent, for example, that the central control principle of our roller conveyor system has reached its limits. Using just one control computer to regulate all activities creates an extremely high level of complexity and does not seem sustainable due to an increasing need for adaptability. It was imperative to find a remedy here. Researchers were therefore called upon to find a suitable concept and engineers to develop a solution from this concept that would be useful in practice. Fortunately, ZIP4.0 offers both. Within a few weeks, the alternative control system for the transport system is "up and running" – with an interplay of cyber-physical systems, each responsible for a segment of the roller conveyor and drawing on a number of centrally provided services.

It is a simple principle at first glance but has required a considerable amount of research and development to be implemented. The future of the factory has already taken shape in ZIP4.0.

Dr. Sander Lass with AR glasses at the ZIP

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