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A sculpture installation by artist Ottmar Hörl commemorating the 250th anniversary of the birth of Ludwig van Beethoven: Figures of the smiling composer dot Bonn's Münsterplatz.



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Katja Becker

# Setting Course in a Crisis

*More than six months after the outbreak of the coronavirus pandemic, there are still two key tasks facing research funding: minimising the impacts on funding recipients and their projects, and providing impetus for research into the virus. The DFG has taken further significant measures in both areas.*

**A**s this edition of *german research* comes out, the impact of the coronavirus is still being felt in our everyday lives. More than six months after the first reports of the new virus emerged, we appear to have reached a kind of transitional stage in which optimism is mixed with pessimism, relief with anxiety, patience with impatience, and familiarisation with surprise, in numerous ways.

We now know much more about the virus than we did before, but the search for a vaccine is necessarily a lengthy and difficult process, often accompanied by setbacks. In Germany, we seem to have fared better than other countries in the first wave of infection, also due to government decisions based on scientific knowledge and recommendations. In other parts of the world, the pandemic is still raging and to a much worse extent, and even here at home, the end of summer vacation and the approaching lower temperatures in autumn and winter mean that the risk of a second wave cannot be ruled out. We've grown accustomed to some protective measures to prevent further spread of the virus, albeit with a measure of reluctance to make a regular habit of them; and still events and circumstances continually arise that are completely new and that no one could have previously imagined.

Who would have thought, for example, that the DFG's annual meeting would ever be held in a completely virtual format? Certainly not the member organisations of the DFG when they elected me as the future President at the 2019 annual meeting in Rostock, and certainly not I, when I took on this honoured and exciting role in January. And although since mid-March, all DFG reviews and committee meetings have been held as phone or video conferences and many decisions have been made using written procedures, becoming more professional and

routine with practice, a virtual annual meeting is a different matter altogether.

**I**t was very unfortunate that we were unable to meet as planned at the end of June and beginning of July in Berlin, in our committees and with a wider group of participants representing science and academia, politics and society. It was all the more regrettable as we had done a great deal of preparation for this meeting in connection with our anniversary campaign DFG2020 – Because Research Matters. Yet it was immensely important that the annual meeting should take place, at the very least in this adapted form.

Convening virtually, the DFG's various committees were able to discuss key issues and problems in research in view of the current situation and beyond, and make important decisions as to how to support the best research. New members were elected to the Executive Committee and the Senate, setting the course for the work ahead over the next few years. And importantly, the position of Secretary General was confirmed during the annual meeting, with Dr. Heide Ahrens scheduled to take up office on 1 October of this year, joining me on the DFG Executive Board.

So at this year's annual meeting, the self-governing body of the academic research community, for which the DFG so uniquely stands, once again proved to be both effective and forward looking. Especially in these times, this is a positive and important message for the research community, and indeed for everyone in our society who is interested in research and benefits from it in many ways.

As we deal with the ongoing coronavirus pandemic, research funding primarily calls for a two-pronged approach. First, we must minimise as far as possible the impacts of the pandemic, and the restrictions on public life necessary to contain it, on funded projects and the



researchers involved in them. Secondly, we must provide additional impetus for research into the virus. Since March, the DFG has introduced important measures and launched new initiatives in both areas. I can assure you that we will continue to adapt and intensify our response accordingly.

With regard to the support of funded projects, the most immediate impacts of the pandemic were initially absorbed by cost-neutral compensatory and bridge measures – including the extension of project durations, calls, fellowships and employment contracts. The DFG is also offering financial support to

*Regular updates on the impacts of the coronavirus pandemic on the work of the DFG and all current and future measures are posted on [www.dfg.de/en](http://www.dfg.de/en) and on our Twitter account @dfg\_public.*

research projects. A whole package of measures now allows additional staff and project funding to be requested in numerous funding programmes, allowing research work that cannot be carried out as originally planned to be continued and completed. This support, amounting to at least €175 million, closes an important gap in the system and gives our funding

recipients and their colleagues urgently needed additional security.

In terms of research into the coronavirus itself, our strategic call for pandemic research, launched back in March, also set the course. The aim is to better understand epidemic outbreaks and the full spectrum of their consequences, with a special focus on inter- and transdisciplinary research approaches and national and international cooperation. There is very strong interest in this call and in the first stage we have received several hundred letters of intent for future projects.

**I**t was with the same basic aim in mind that the DFG established a new interdisciplinary Commission for Pandemic Research in June. Composed of researchers from all disciplines, it is designed to strengthen the basic research that is so essential in coronavirus and pandemic research, support and coordinate projects funded through calls and other grants, and identify areas where more research is needed. In August, the Commission issued its first call under COVID-19 Focus Funding, a new funding opportunity enabling researchers to address especially urgent questions requiring rapid answers. This call focuses on immunity, host susceptibility and pathomechanisms of SARS-CoV-2 infection. The Commission will continue to identify research areas and issue corresponding calls through June 2021.

Through these additional measures, we are once again consciously focusing first and foremost on strengthening university-based research. Its importance, like the overall importance of our universities, cannot be emphasised strongly enough during these times. Right now, German universities are continuing not only to carry out the best research, but also to organise academic training, build our knowledge resources for the purposes of application-oriented research, and themselves contribute to this research. In this way, they are creating the framework for a research system that enables excellence across the board, in which cooperation takes priority over competition and synergies are possible, and thus makes a valuable contribution to societal challenges. This deserves recognition and support from all of us.

A handwritten signature in blue ink that reads 'K. Becker'.

**Professor Dr. Katja Becker**  
is the President of the DFG.



# Going Virtual

*A DFG annual meeting that was intended to be memorable unexpectedly became even more memorable*



Illustration: DFG/Unkel

The DFG has had plenty of memorable annual meetings over the decades, sometimes as a result of the venue, sometimes as a result of the discussions, and sometimes as a result of the people involved. The 2020 annual meeting would probably have been another such gathering – one that would have been remembered for a long time afterwards – even had everything gone according to the original plan. Timed exactly in the middle of the year, the traditional meetings of the statutory bodies and public events were to be combined with the highlight of the campaign “DFG2020 – Because Research Matters”. Coinciding with the 100th anniversary of the founding of the DFG’s predecessor organisation, the *Notgemeinschaft der Deutschen Wissenschaft*, the campaign was designed to show the public the importance of free and independent research to our society. The celebratory event at the Tempodrom in Berlin, organised in partnership with *Stifterverband*, with which the DFG has close links, was to have been attended by the Federal President and 1,500 guests. Performing artists “*Kompanie Kopfstand*” were also scheduled to be there, in the middle of a nationwide tour by expedition bus organised by the DFG to get people talking about science and research. When coronavirus hit, these plans suffered the same fate as all other plans in the face of the pandemic and what was intended to be a memorable annual meeting unexpectedly became an even more memorable occasion. The celebratory event had to be called off, as did the presentation of the Communicator Award and the first stops of the #researchmatters expedition, but the DFG’s committees were able to meet in the virtual format that has become the new norm for work and communication across the country. So on 30 June and 1 July, at her first annual meeting in office, President Katja Becker sat in the Norbert Elias Room at the DFG Head Office in Bonn, flanked – with appropriate social distancing – by members of the Executive Committee, the directors of Head Office and administrative and technical staff, and led the video conferences of the Executive Committee, the Senate, the Joint Committee and the General Assembly, in which members participated from their offices in universities and research institutes or from home. It was remarked upon many times over the two days that the physical attendance and in-person conversations were much missed. But since there was a high degree of unanimity in all the discussions and decisions, and the sophisticated conference technology functioned without a hitch, ultimately the verdict on the first virtual annual meeting was a positive one: “It’s a positive and important thing that, particularly in times like these, we have been able to demonstrate the capabilities of self-governance by the research community and make important decisions affecting the future of German research,” said Becker. Plans are already being made for the 2021 annual meeting, which – unless it becomes clear that this is impossible – will be entirely non-virtual. **fine**

# Heide Ahrens Appointed New DFG Secretary General

*Appointment of Bremen Senate Director by Joint Committee confirmed by General Assembly / “Highly experienced research manager with in-depth knowledge”*

The DFG has a new Secretary General. On Wednesday, 1 July 2020, at its session during the virtual annual meeting, the General Assembly confirmed the appointment of Dr. Heide Ahrens, who is currently Senate Director and head of the Higher Education and Research department in the office of the Senator for Science and Ports of Bremen. As Secretary General, Ahrens will be in charge of the DFG’s Head Office and serve as

a member of the Executive Board, on which her area of responsibility includes the implementation of the budget. She is due to take office on 1 October.

The confirmation of Ahrens’ appointment at the General Assembly was the final step in a multi-stage process to appoint a new Secretary General for the DFG as defined in the organisation’s statutes. Following the departure of Secretary General Professor Dorothee

Dzwonnek in November 2018, in July 2019 the DFG Executive Committee appointed a selection committee consisting of representatives of the Executive Committee, the Senate and DFG member organisations, as well as the federal and state governments as financial donors. After an intensive search, the Executive Committee proposed Heide Ahrens for the position of Secretary General, a recommendation which was adopted by the

*Laughter and looking forward to working together – even behind the mandatory face coverings: future Secretary General Heide Ahrens (right) with President Katja Becker after the virtual General Assembly.*



Illustration: DFG/Unkel



Executive Committee and presented to the DFG's Joint Committee. The Joint Committee decided in favour of Ahrens' appointment, a decision which has now been confirmed. The choice was unanimously approved by all statutory bodies.

Introducing Heide Ahrens to the General Assembly, DFG President Professor Dr. Katja Becker emphasised her in-depth knowledge of all perspectives and interested parties in research management and science policy, her relevant leadership experience at

universities and her years of experience in ministerial cooperation between federal and state level, which she noted were decisive in Ahrens' selection.

Born in 1962 in Bergen, Lower Saxony, Heide Ahrens studied political science, communication research, phonetics and modern German literature at the University of Bonn, where she went on to earn her doctorate in 1994. In her first roles as head of section in the policy department at the Alexander von Humboldt Foundation and as pro-

gramme manager for Programmes and Funding at Stifterverband, Ahrens was already actively involved in research funding.

In 2004, she was appointed head of academic affairs at the University of Bremen. In 2007, she became Vice President for Administration and Finance at the University of Oldenburg, where she also served as Acting President between late 2008 and early 2010.

From 2011 to 2017, Ahrens was a head of section (Ministerialdirigent) and director of the science

department at the Schleswig-Holstein science ministry. She has been Senate Director in Bremen since February 2017, heading the Higher Education and Research department in the office of the Senator for Science and Ports.

"In Heide Ahrens, the DFG is delighted to have recruited a highly experienced research manager as its Secretary General. She satisfies all the requirements for her new role to an exceptionally high standard and will be a tremendous asset to all of us. I am very much look-

ing forward to working with her on the Executive Board," said DFG President Katja Becker, following the confirmation by the General Assembly.

Becker also thanked the four heads of department at the DFG – Jurij von Kreisler (Central Administration), Dr. Harald von Kalm (International Affairs and Integrative Activities), Dr. Annette Schmidtman (Scientific Affairs) and Dr. Ulrike Eickhoff (Coordinated Programmes and Infrastructure) – who had jointly covered

the responsibilities of the Head Office director on a temporary basis since the end of 2018. "With your high degree of professionalism and tremendous personal commitment, you have made a vital contribution to keeping the DFG's very complex administrative funding activities running smoothly during this time. The value of this is especially clear during the current coronavirus pandemic," added Becker.

[www.dfg.de/en/service/press/press\\_releases/2020/press\\_release\\_no\\_24](http://www.dfg.de/en/service/press/press_releases/2020/press_release_no_24)

The DFG has two new vice presidents. At its session during the 2020 virtual annual meeting on 1 July, the General Assembly elected molecular biologist Professor Dr. Axel A. Brakhage and engineer Professor Dr.-Ing. Hans Hasse to the Executive Committee of the DFG, Germany's largest research funding organisation and central self-governing body for the research community. Brakhage succeeds Professor Dr. Katja Becker, who became President of the DFG at the beginning of 2020, while Hasse takes over from engineer Professor Dr.-Ing. Frank Allgöwer.

Axel A. Brakhage (photo on the left) holds the Chair of Microbiology and Molecular Biology at the University of Jena and is Scientific Director of the Leibniz Institute for Natural Product Research and Infection Biology (Leibniz-HKI). His main research interests include the infection biology of human-pathogenic fungi, microbial communication, the search for microbial active compounds and the development of antibiotics. He is associated

with the DFG as the spokesperson of a graduate school, a Collaborative Research Centre (CRC)/Transregio and, since 2019, the Cluster of Excellence "Balance of the Microverse". He also served on a review board for eight years, including four years as its spokesperson.



Illustration: DFG

Hans Hasse (photo on the right) leads the Laboratory of Engineering Thermodynamics at TU Kaiserslautern. Between 2016 and 2020, he was a member of the DFG Senate and from 2008 to 2016, he was a member

## Two New Vice Presidents

Axel A. Brakhage succeeds Katja Becker; Hans Hasse replaces Frank Allgöwer / Julika Griem and Roland A. Fischer re-elected

of the review board for Process Engineering, Technical Chemistry, serving as its spokesperson from 2012 to 2016. He also serves or has served as spokesperson for numerous other coordinated DFG funding programmes, addressing topics such as the modelling and simulation of process engineering processes, and currently of the CRC "Microscale Morphology of Component Surfaces".

In addition to the two new members of the Executive Committee, English literature scholar Professor Dr. Julika Griem and chemist Professor Dr. Roland A. Fischer have been elected as vice presidents for a further term in office.

Griem has been director of the Institute for Advanced Study in the Humanities (KWI) in Essen since 2018. Since her election as vice president in 2016, she has been especially involved in issues relating to

the humanities and social sciences at the DFG, as well as German-Japanese and German-Israeli project cooperation. She has a special interest in science communication, serving as chair of the judging panel for the Communicator Award presented by the DFG and Stifterverband.

Fischer has held the Chair of Inorganic and Organometallic Chemistry at the Technical University of Munich since 2016. During his first term in office, he was particularly involved in the ongoing development and implementation of the DFG's Research-Oriented Standards on Gender Equality and represented the DFG on the Joint Committee with its Chinese partner organisation NSFC and on the Governing Board of Science Europe.

Together with DFG President Katja Becker and the new and re-elected vice presidents, the DFG's

Executive Committee also consists of mathematician Professor Dr. Marlis Hochbruck, computer scientist Professor Dr. Kerstin Schill, medical scientist Professor Dr. Britta Siegmund and legal scholar Professor Dr. Wolfgang Schön as vice presidents. The President of Stifterverband, Professor



Illustration: DFG

Dr. Dr. Andreas Barner, has an advisory role on the Executive Committee by virtue of his office.

"I am delighted to be able to work with this Executive Committee to advance the DFG's strategic and concep-

tual orientation and energetically promote the further strengthening of research, particularly basic research, at German universities and the interests of the researchers we support," said President Katja Becker.

Becker also bid farewell to departing vice president Frank Allgöwer and thanked him for his dedicated and wide-ranging work over the past eight years. She noted that Allgöwer had emphasised interdisciplinary perspectives and had led the Joint Committee on the Handling of Security-Relevant Research of the DFG and the German National Academy of Sciences Leopoldina as well as the expert committee for the development of the national research data infrastructure (NFDI). He chaired the judging panel for the Communicator Award and was a member of the expert commission on the digital turn in the sciences and humanities, and is also participating in the DFG's new interdisciplinary Commission for Pandemic Research.

[www.dfg.de/en/service/press/press\\_releases/2020/press\\_release\\_no\\_26](http://www.dfg.de/en/service/press/press_releases/2020/press_release_no_26)





The group photo of the Executive Committee has become almost the traditional ending to the General Assembly and, since this concludes the round of committee meetings and other events, to the DFG annual meeting too. Last year, on the afternoon of 3 July, the Executive Committee was able to stand on the steps in front of the historic main building of the University of Rostock. Katja Becker (centre) had just been chosen as the future President after an exciting election, and together with the then President Peter Strohschneider and the full group of vice presidents, was looking forward to the time ahead – as can be easily seen in the faces of everyone present. At noon on 1 July 2020, things looked rather different. This time the group photo was taken inside, in the Norbert Elias Room of the Head Office in Bonn, in front of the background with the DFG emblem that featured throughout the virtual meetings of the week, and with everyone wearing a protective face mask – not showing quite as clearly the satisfaction, or perhaps relief, that the meetings all passed off so well. With the DFG President in our photo are the members of the Executive Committee who physically attended this year's annual meeting: from left, re-elected vice president Roland A. Fischer and vice president Britta Siegmund, and from the right, newly elected vice president Axel A. Brakhage and vice president Marlis Hochbruck. In view of the occasion, newly appointed Secretary General Heide Ahrens also attended (3rd from right).

As well as the confirmation of the future Secretary General and the election and re-election

## Senate Election

of members to the Executive Committee, on 1 July 2020 the agenda for the virtual General Assembly included elections to the DFG Senate. Nine new members were elected to the central statutory body responsible for scientific affairs, which advises and decides on all important affairs of the DFG.

Of the nine seats in the Senate, two are occupied by representatives of the engineering sciences, two by the life sciences, three by the humanities and social sciences and two by the

natural sciences. Five of the new members are women, bringing the total number of women in the 39-strong Senate to 19.

The following nine members were newly elected to the Senate: Professor Dr. Charlotte Krawczyk (Earth geosciences), GFZ Helmholtz Centre Potsdam; Professor Dr. Annette Haug (historical-hermeneutic studies), Kiel University; Professor Dr.-Ing. Gisela Lanza (engineering sciences – cross-disciplinary methods and cross-cutting issues), Karlsruhe Institute of

Technology; Professor Dr. Christiane J. Bruns (clinical medicine II), University of Cologne; Professor

Dr.-Ing. Georg N. Duda (clinical-theoretical medicine), Charité Berlin – FU Berlin and HU Berlin; Professor Dr. Andreas Speer (history of art/philosophy), University of Cologne; Professor Dr. Ralf Ludwig (physical chemistry), University of Rostock; Professor Dr. Laura Kallmeyer (linguistics), University of Düsseldorf; Professor Dr.-Ing. Wolfgang Peukert (process engineering/flow mechanics), University of Erlangen-Nuremberg.

[www.dfg.de/pm/2020\\_30](http://www.dfg.de/pm/2020_30)  
(in German only)

# 31,150 Projects, €3.3 Billion Budget

2019 Annual Report documents facts and figures on research funding

The annual report for 2019 was also presented at the DFG's General Assembly. Even in a virtual meeting format the report still fulfilled a legally important function, since the reported revenues and expenditures and the annual financial statement are required in order for the member organisations to formally approve the actions of the Executive Board.

This year, however, it was not possible to present the 328-page publication in public, the DFG's annual press conference – at which the report is traditionally presented – having been cancelled due to COVID-19.

As usual, the latest report presents the most significant topics and developments of the past year in relation to research and funding policy, as well as selected funded projects and key facts and figures on funding activities.

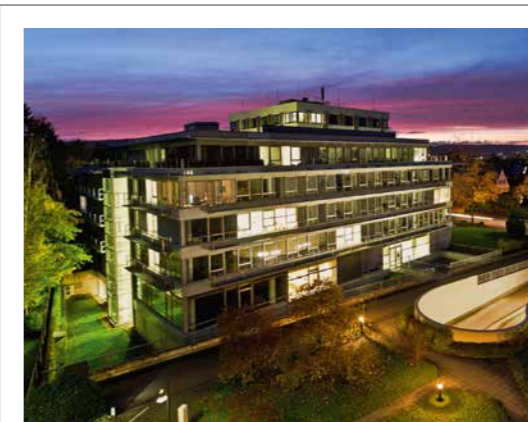
In 2019, the topic of freedom of research played an important role. The DFG and its President Peter Strohschneider, in the last year of his term in office, played a large part in making the public aware of this issue.

Against this background, the annual report looks back at a whole series of initiatives with

which the DFG honed its profile and flexibly responded to changes in the research system in 2019, establishing a clear framework for freedom of research. These ranged from artificial

approximately 31,150 projects in all scientific disciplines with a total of almost €3.3 billion. Of these, 7,330 projects were newly approved. As in previous years, more than half of all awards – amounting to 17,128 projects or 55 percent of all projects – were individual grants; around €1.2 billion was awarded in this type of funding. In Research Training Groups, Collaborative Research Centres and other coordinated programmes, funding was awarded to 850 groups with precisely 11,806 projects and a total approved sum of approximately €1.4 billion.

In terms of the major research categories, life sciences received the most funding with around €1.2 billion (35.5 percent of the total sum awarded), followed by natural sciences with around €735 million (22.4 percent),



Deutsche Forschungsgemeinschaft  
Jahresbericht 2019  
Aufgaben und Ergebnisse

DFG

intelligence and the first steps towards building a national research data infrastructure to the systematic restructuring of the DFG funding portfolio.

The selected research projects presented in the latest report focus on digitalisation and demonstrate the extent to which this phenomenon is changing all areas of research and the way it is funded.

In terms of research funding itself, in 2019 the DFG funded ap-

engineering sciences with around €639 million (19.5 percent) and humanities and social sciences with around €493 million (15.0 percent); interdisciplinary projects received approximately €252 million (7.7 percent) in funding.

The DFG Annual Report 2019 is available online at [www.dfg.de/en/dfg\\_profile/annual\\_report](http://www.dfg.de/en/dfg_profile/annual_report) (in German only) and printed copies can be requested by e-mailing [presse@dfg.de](mailto:presse@dfg.de).



## Eugen and Ilse Seibold Prize Awarded

Four dedicated people building bridges between Japan and Germany

This year, the DFG is to honour four researchers – two women and two men – with the Eugen and Ilse Seibold Prize (photos from left to right): Chemist Professor Dr. Shigeyoshi Inoue from TUM, Japanologist Professor Dr. Regine Mathias from Ruhr-Universität Bochum, materials physicist Professor Dr. Hidenori Takagi from the Max Planck Institute for Solid State Research in Stuttgart and jurist Professor Dr. Kanako Takayama from the University of Kyoto are each to receive the €15,000



Illustration: TU Munich



Illustration: private



Illustration: private



Illustration: private

award. Through years of dedication, they have successfully contributed to both academic and cultural exchange between Germany and Japan. The Seibold Prize will be awarded for the final time in 2020, since the fund established by Eugen and Ilse Seibold in 1997 will be exhausted following this round of awards. The presentation of the Seibold Prize has been postponed to next year due to the coronavirus pandemic.

[www.dfg.de/en/funded\\_projects/prizewinners/seibold\\_prize/2020](http://www.dfg.de/en/funded_projects/prizewinners/seibold_prize/2020)

## Forging German-Polish Collaboration

Copernicus Award goes to Sebastian Faust and Stefan Dziembowski

Professor Dr. Sebastian Faust (photo on the left), TU Darmstadt, and Professor Dr. Stefan Dziembowski, University of Warsaw, have been chosen to receive the 2020 Copernicus Award from the DFG and the Foundation for Polish Science (FNP, Fundacja na rzecz Nauki Polskiej) for their services to German-Polish research collaboration. The jury appointed by the DFG and FNP chose the two



Illustration: TU Darmstadt/Binner



Illustration: private

researchers for their outstanding collaboration in theoretical cryptography and IT security. Their joint research on the mathematical

foundations of encryption techniques has significantly contributed towards making the use of information technologies and the associated data transfer process more secure and at the same time more efficient. The vital contribution of their work, in the jury's view, lies in the way they bring different security models together.

[www.dfg.de/en/funded\\_projects/prizewinners/copernicus\\_award/2020](http://www.dfg.de/en/funded_projects/prizewinners/copernicus_award/2020)

Rembert Unterstell

## Ode to an Oeuvre

The 250th birthday of Ludwig van Beethoven is being celebrated all over the world with concerts, exhibitions and events of all kinds. Out of the public eye, scholars are making their own contribution by shedding new light on the composer's legacy. An interview with musicologist Christine Siegert in Bonn on the current German-British DFG project "Beethoven in the House".



© Wikimedia Commons

*german research:* Our interview is taking place at the Beethoven Haus in Bonn, or to be more precise the Beethoven Archive, which for many years has been dedicated to documentation and research – for example, through critical historical editions of the composer's works. Is Beethoven research today the domain of specialists outside universities?

**Siegert:** I would say it's both – there is research going on outside universities, on an institutional basis like

in our archive, and there is university-based research; both need to work together. For example, we're involved in a collaborative project with the University of Vienna and of course we also work with the musicology / sound studies department at the University of Bonn. Since February, we've also been an affiliated institute of the university here in Bonn, which illustrates the links between university-based re-

search and research taking place in other contexts.

*But the dominant perspective is different in each case?*

Yes, absolutely. We focus on indexing and studying sources. Obviously, this is partly due to the fact that at the Beethoven-Haus we have extensive collections of written, visual and audio sources and part of our job is to study them. One primary task is the



creation of a complete Beethoven edition. Beethoven research at universities tends to take an approach based on cultural studies, aesthetics or music analysis. Each needs the other to form a complete picture.

*What do you regard as the value and benefit of a complete Beethoven edition of 56 volumes in the digital age?*

Firstly, it's a task that has been ongoing for a long time. I believe such major projects should be brought to a successful conclusion. As far as editions are concerned, the desired insights and access options must match. The Bonn Beethoven edi-

tion, which was begun in the 1960s, uses an access model that exploits the possibilities of a printed edition. A digital edition would have to be designed quite differently. Once the printed edition is complete, the obvious next step would be to start work on an edition of Beethoven's works designed specifically for a digital format.

*The Beethoven-Haus has already completed a number of projects to index and digitise its collections with the help of DFG funding. What does the Digital Beethoven Archive, which is open to music lovers and scholars alike, offer today?*

Looking back, the Digital Beethoven Archive was one of the pilot projects in digitisation for musicology. It has evolved – as well as digitised sources, such as scores and autographs, it contains plenty of additional and contextual information. You can also listen to pieces of music and hear recordings of Beethoven's letters. In future, more use needs to be made of the great potential for deeper digital indexing.

*The DFG project "Beethoven in the House", approved in November 2019, is still in its initial phase. What are the starting points for this project?*

*Enchanting music in the home – Beethoven at the piano in elegant company. Wood engraving by Richard Brend'amour, pioneer of modern wood engraving technique, after a painting or drawing by Borchmann, Aachen, circa 1890.*



For me, there is first of all a very non-digital starting point – the fact that in Beethoven's time, before any kind of recording technology, you couldn't reproduce music at the touch of a button; you had to play it yourself. The project is concerned with musical transcriptions: Hausmusik – the kind of music that was played in a private or semi-public setting. There's another digital starting point which links in to the question of how surviving sources can be digitally indexed in large numbers, and with differing degrees of depth. What is it that constitutes a particular transcription – and how can we describe it using digital methods?

*What does this mean in concrete terms?* The "Beethoven in the House" project has both a qualitative and a quantitative focus. Here at the Beethoven-Haus, we want to examine the transcriptions and describe them using analogue and digital tools. In Oxford and at the Bodleian Library there, the digitisation experts will examine whether and how the semi-automated indexing of Beethoveniana could be achieved.

*Is that what makes this project so unique?*

The international cooperation between the e-Research Centre at Oxford University, the Bodleian Library, a digital musicology team at the University of Paderborn and editors at the Beethoven-Haus is certainly remarkable. It's a very happy set of circumstances because the institutions complement each other wonderfully well.

*Everything has its dark side. Where does the challenge lie?*

One challenge for me is the political uncertainty after Brexit; but for me

## Prof. Dr. Christine Siegert

... is head of the Beethoven Archive, the musicological research and documentation department at the Beethoven-Haus. Before moving to Bonn in autumn 2015 she was a junior professor at the Berlin University of the Arts. Siegert studied musicology, Romance studies and philosophy in Hannover and Amiens; in 2003, she earned her doctorate with a thesis on Italian composer Luigi Cherubini, a contemporary of Beethoven. She was subsequently involved in a variety of musicological edition projects, including one on Joseph Haydn. Her main research interests are in edition philology/digital editions and music from the period around 1800.



Illustration: Unterstell

## The Beethoven-Haus in Bonn

... is supported by an association founded in 1889 as the result of a civic initiative. The cultural institution includes an important Beethoven collection, a museum in the house where the composer was born (with a redesigned permanent exhibition for the anniversary year) and a musicology department with an archive, library and publishing house. Concerts are held in its own chamber music hall. "By bringing together collection and conservation, research and access, presentation, publishing, education and interpretation ... the Beethoven-Haus offers a modern centre of musical and cultural life."

[www.beethoven.de/en](http://www.beethoven.de/en)



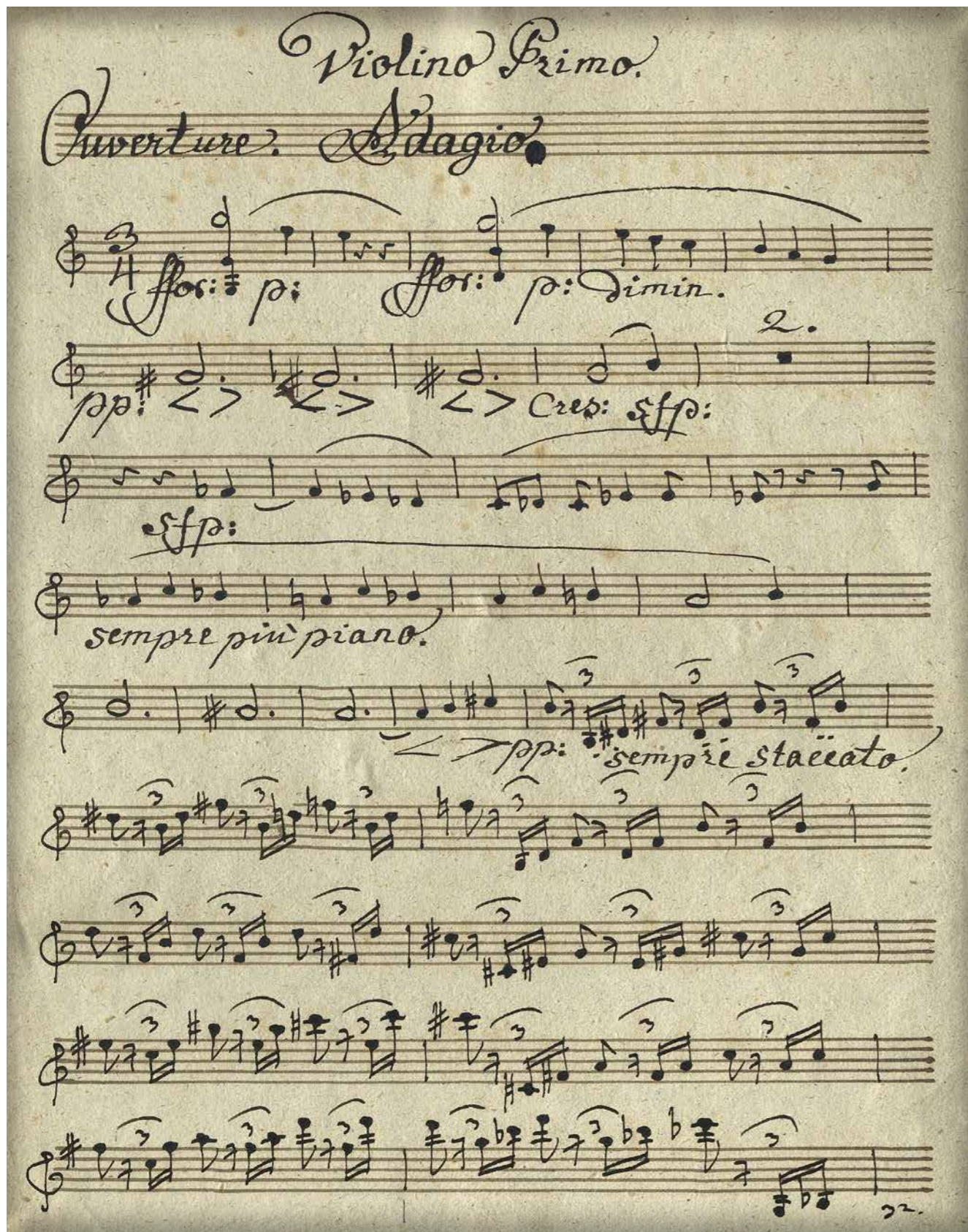
Illustration: David Ertl

that's also an important reason to carry out the project now. We will need to engage with the question of how a collaboration can work now and with what modalities. I have great confidence in scholarly cooperation, even in politically stormy times.

*Thinking ahead to the conclusion of the project, in an ideal scenario, what could musicologists and edition philologists learn from it?*

In an ideal scenario, the project could develop standards for musicological edition projects with an enlarged concept of an oeuvre. By that I mean that transcriptions are understood as part of the whole complex of a composer's output. Remember that it was primarily through these arrangements for music played at home that Beethoven's contemporaries received his work. This demands a change in thinking for edition scholarship. Here we are





Left: Ludwig van Beethoven, *Fidelio* op. 72, 2nd version 1806, *Leonore Overture No. 2* with ending from *Leonore Overture No. 3*, copy. Top: Around 1800, Beethoven was presented with four valuable string instruments by his friend and patron Prince Karl Lichnowsky. Today, they form part of the permanent exhibition at the Beethoven-Haus in Bonn.

dealing with a plural concept of an oeuvre, which includes the various manifestations of a work in versions or transcriptions. In printed editions it's scarcely possible to apply an open concept of an oeuvre. This is where the possibilities of digital indexing and presentation come into their own.

*Would it be wrong to say that musicological research in a narrower sense is being replaced by cultural studies research in a broader sense?*

In my opinion, Beethoven research still has a long way to go in that respect! However, cultural studies-based research needs source documents as its basis, and vice versa, source research needs a cultural studies background. Only with the cultural studies approach that we've chosen for "Beethoven in the House" does it become clear

how important these transcriptions were. This doesn't play a role in traditional edition philology, because here you are looking for what is assumed to be the final version of a score approved by the composer.

*What expectations do you have of the Beethoven anniversary year in 2020?*

I expect important fresh impetus and a long-lasting boost to research. In February 2020, we had a major week-long Beethoven conference with colleagues from all over the world, both established and early career researchers, who presented their research topics and projects and discussed them with each other – which was one reason why the motto we chose for the conference was "Beethoven Perspectives".

*Finally, let's talk about Bonn perspectives: Beethoven lived in Bonn between*

*1770 and 1792 and spent his childhood and youth there, before departing for Vienna, where he remained for the rest of his life. Is the Bonn element over- or underestimated with regard to Beethoven?*

In the marketing for the anniversary year, he is sometimes referred to as the Bonner Weltbürger, the citizen of the world from Bonn. This alludes to both his local roots and his global impact. However, in traditional Beethoven research at least, the Bonn Beethoven tends to be underestimated. But there is little point in playing off the Bonn Beethoven against the Viennese one. I think we need to try to understand Beethoven, in his work and impact, as one entity. The anniversary year can remind us of that.

**Interview: Dr. Rembert Unterstell,**

Publishing Executive Editor of *german research*.



Jochen Liske



# The Universe in Real Time

In Chile's Atacama Desert, the world's largest telescope is under construction. Astronomers and astrophysicists hope that its extremely high measurement accuracy will enable them to directly measure the dynamics of the universe's expansion.

The universe is expanding. When we allow this astonishing statement to sink in, it certainly makes us pause and ponder. For astrophysicists and astronomers, it's a fact that has lost none of its fascination even 88 years after it was first discovered. As an insight, it has wide-ranging implications: rather than being unchanging, the universe appears to be a dynamic, continually evolving system. This realisation has changed our view of the cosmos perhaps more lastingly and profoundly than anything since the Copernican Revolution 400 years ago.

We owe this seminal insight mainly to the work of astronomer Edwin P. Hubble (1889–1953). In the 1920s, Hubble was using the 100-inch telescope at the Mt. Wilson Observatory to study what were known at the time as “spi-

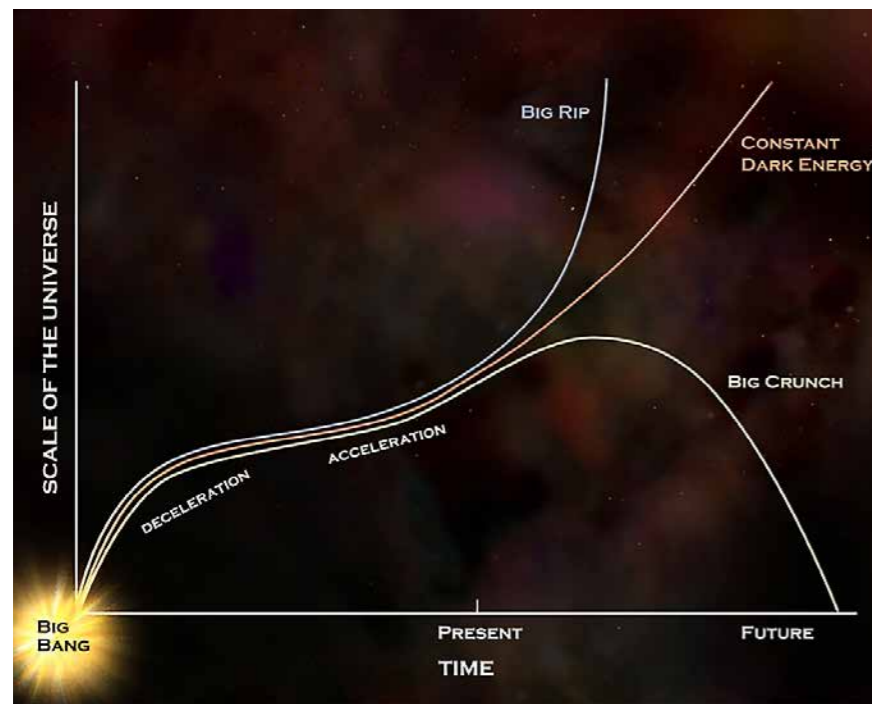
ral nebulae”. He was the first to demonstrate that these were located far outside our own galaxy, the Milky Way, making them independent “island universes” in their own right, comparable to the Milky Way. Soon afterwards, he recognised a linear relationship between the recession velocity of these objects, already discovered in 1912, and their distance: the further away a galaxy is from us, the faster it is moving away.

This relationship – now known as Hubble's Law – received its physical context through Albert Einstein's general theory of relativity, published in 1915, which is still the accepted understanding of gravity held by scientists today. In his theory, Einstein departed from the conventional understanding of space and time as a kind of passive, static stage on which the laws of physics are played out, and replaced this with the concept of a dynamic space-time which itself obeys physical laws.

When applied to the universe, Einstein's theory predicts that, over cosmological distances, space should either expand or contract. At that time, however (before

*Building the world's largest telescope: The peak of Cerro Armazones in Chile's Atacama Desert, once 3,064 m high, has already been removed. By 2024 the plateau will be home to the Extremely Large Telescope (ELT), a model of which can be seen top left.*





Graphic: NASA/CXC/M. Weiss

Schematic representation of the expansion of the universe over billions of years.

Hubble's observations), there was no experimental evidence to suggest that the universe might not be static, so Einstein initially rejected this extraordinary prediction and questioned the validity of his new theory on cosmological scales. Ultimately, however, it was to be spectacularly confirmed by Hubble's discovery – heralding the dawn of modern physical cosmology.

As might be expected for such a dramatic paradigm shift, a whole array of new questions soon arose. Among these was the question of how the expansion of the universe changed over time. It was obvious from the outset that the gravity produced by all of the matter in the universe had to slow down the expansion, just as the Earth's gravity slows down a tennis ball thrown vertically upwards. But what was uncertain was whether the density of matter in the universe (not yet

accurately measured at the time) would be enough to one day cause the expansion to grind to a halt, at which point the universe would collapse in on itself again. Or would the universe continue expanding forever?

While attempting to answer this question, in 1998, two research groups led by US astrophysicists Brian Schmidt and Adam Riess and physicist Saul Perlmutter discovered something very surprising. Contrary to the hitherto undisputed expectation that the expansion should be slowing down, they discovered that around 6 billion years ago it actually began to accelerate.

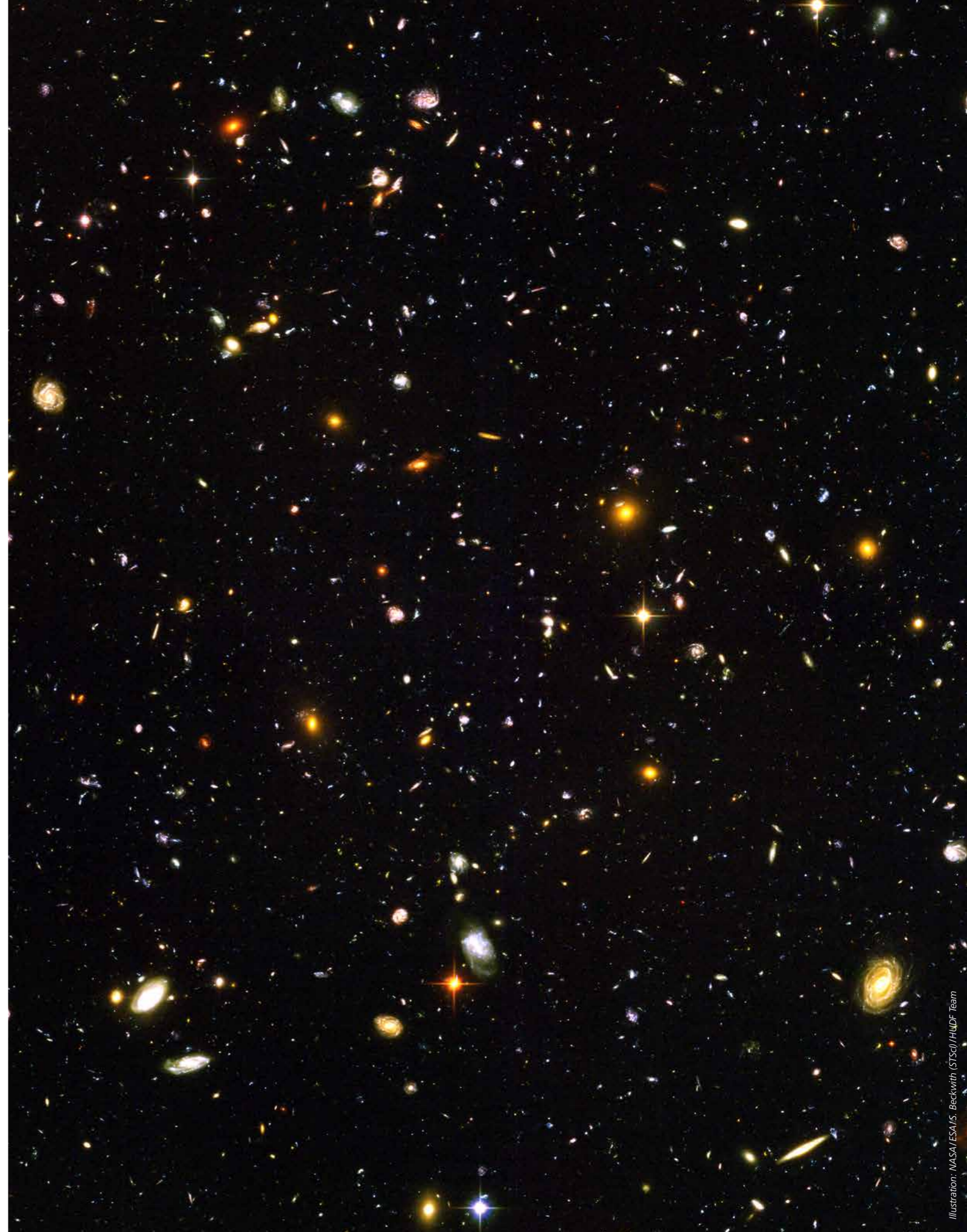
It's hard to overstate the astonishment this caused, not only among astrophysicists, but in the broader physics community as well. After all, the expectation that the expansion should be slowing

down was based on two indisputable facts: first, that the universe is not empty, and second, that gravity only ever attracts, never repels. An increasing rate of expansion of the universe would be tantamount to a tennis ball tossed vertically into the air which then raced away from the Earth's surface at an ever-increasing speed as if powered by a rocket.

This result allows just two conclusions: either the general theory of relativity loses its validity over cosmological distances after all, or there is some form of energy in the universe with the extraordinary property of exerting a negative pressure and thus generating a kind of "anti-gravity" that drives the acceleration (as in our "rocket" example). In keeping with the time-honoured astronomical tradition of giving newly discovered phenomena cryptic names, this hypothetical form of energy was dubbed "dark energy". The problem is that in the Standard Model of physics, such a form of energy does not occur with the energy density required by the observations.

Scientists were inescapably drawn to the conclusion that the acceleration of the universe's expansion pointed to new physics beyond the Standard Model (either a new theory of gravity or dark energy), and this evidence came from a completely unexpected direction. This is why physicists were so as-

*The vastness of space: The Hubble Ultra Deep Field is one of the deepest glimpses of the universe ever achieved by humankind. The Hubble Space Telescope needed approximately 270 hours' exposure time to capture this single image.*





tonished and also why Schmidt, Riess and Perlmutter were awarded the Nobel Prize in Physics in 2011 for their discovery.

Given this background, it's hardly surprising that, over the last 20 years, cosmologists have been especially interested in the history of the universe's expansion and how to measure it. Since 2015, the DFG has been funding a Heisenberg professorship at the University of Hamburg,

*By observing spiral "nebulae", Edwin P. Hubble (1889–1953) discovered that the universe is expanding, laying the foundations for modern cosmology.*



Illustration: Observatories of the Carnegie Institution of Washington

which aims, inter alia, to develop a particularly elegant and effective method to measure the history of the expanding universe. Although the method was first proposed in 1962, until recently it was far beyond what was technically feasible.

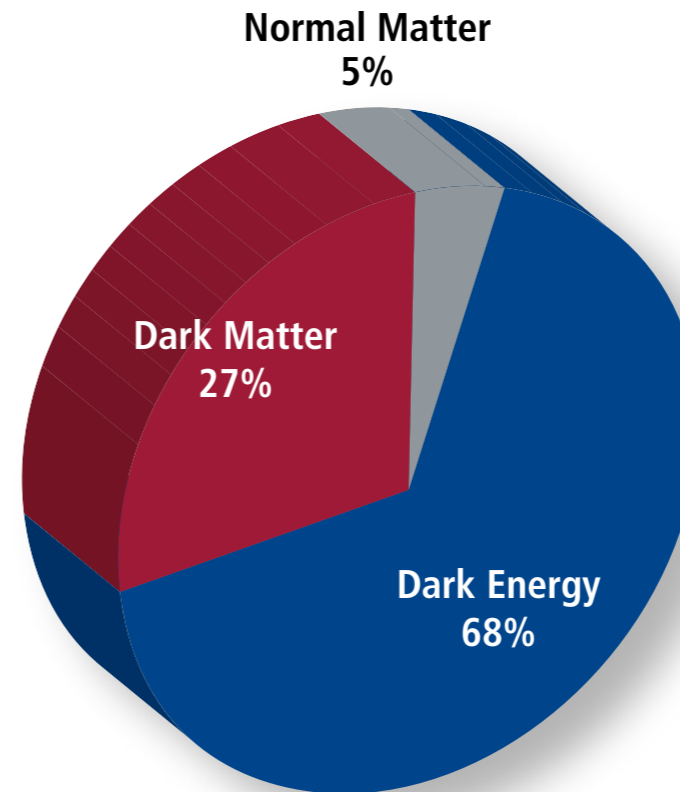
The basic idea is simply to make the movement of the universe directly visible for the first time. This "real-time observation" would be fundamentally different from all other cosmological observations. To understand the difference, let's

imagine a photo of a galloping horse. By examining various features, like the position of the legs and the mane fluttering in the wind, we can easily deduce that the horse must be moving. But ultimately, our conclusion that the horse is moving is based on the model we have in our minds of what a horse is and how it moves. It's an indirect conclusion.

Once you realise that the model you are using is incorrect, obviously you want to reduce your dependence on it as much as possible. A second photo, taken shortly after the first, would provide much more direct evidence of the horse's movement. By comparing the two photos, you could measure the changes and directly conclude that the horse was moving without having to draw on our model of a horse – in fact without even knowing what a horse is.

Researchers are now planning to apply a similar approach to the expansion of the universe. The idea is to measure the properties of cosmologically distant objects repeatedly over a number of years to deduce the history of the expanding universe directly from the changes observed over time. The reason it has taken so long to put this apparently simple idea into practice is that the expected changes are extremely small. Compared with the 13.8 billion years of the universe's lifetime so far, an observation period of just a few years is a tiny window of time in which the universe's expansion will produce only minute changes. To measure these, we need extremely high precision, which until recently simply wasn't possible.

One important phenomenon we want to measure is what's known



*A model with astounding implications: To explain the acceleration of the universe's expansion, dark energy – assuming that it actually exists – would need to make up nearly 70 percent of the total energy density in the universe.*

as "redshift". Over the billions of years that it takes light to reach us from a faraway object, the expansion of the universe causes the wavelength of the light to be "stretched". The light that reaches us has shifted into the red part of the spectrum compared with the light that was emitted, and by the same factor by which the universe has expanded during that time.

A closer examination of the redshift shows that its change over time is directly related to the history of the universe's expansion. This relationship doesn't require us to make any assumptions about any particular cosmological, astrophysical or other kind of model;

it is simply based on the global dynamics of the universe. Just as the phenomenon of redshift occurs only because the universe is expanding, the change in redshift over time occurs only because the rate of the expansion is changing. This means that, in principle at least, we can observe the universe in real time, as it were, measuring how its expansion has progressed over its history.

In practice, measuring this effect comes with a whole range of challenges. One of the main difficulties is the fact that current telescopes don't have sufficient light-gathering power to achieve

the required measurement precision. However, all this is about to change. In Chile's Atacama Desert, the European Southern Observatory is leading the construction of the world's largest telescope, which is due to be completed in 2024. With a primary mirror measuring 39.3 metres in diameter, the Extremely Large Telescope (ELT) is set to revolutionise many fields of astrophysics – and become the workhorse of optical-infrared astronomy in the decades ahead. But above all, this huge telescope will enable us for the first time ever to perform real-time cosmology.

Astrophysics still has a long way to go before it can achieve this ambitious goal. Actually achieving the precision which the ELT makes theoretically possible demands a high-resolution spectrograph with some very specific properties. Developing such an instrument, along with the associated observation methods, is currently the focus of our work within an international collaboration. In the long term, the aim of this project is to usher in an era of real-time cosmology and thus contribute to solving one of the biggest enigmas in modern physics.



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is the Heisenberg Professor of Observational Astronomy at the Hamburger Sternwarte (Hamburg Observatory), University of Hamburg.

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## Christoph Koch



Illustration: Silke Umbach

**Christoph Koch**, born in 1967, is senior editor of the science desk of stern magazine in Hamburg. He studied human biology, social sciences and also health economics, in which he holds an MBA. His journalistic interests include medicine, philosophy of science, science communication and the social economics of health. Christoph Koch is an alumnus of the German Academic Scholarship Foundation and a regular participant in various forums on science communication.

*The DFG and Stifterverband have been presenting the Communicator Award for 20 years – a good opportunity to congratulate the winners and take a look back, particularly as the planned celebrations have had to be postponed to next year due to the coronavirus pandemic. The editorial team of german research asked stern editor Christoph Koch to contribute an article to mark the anniversary – an external perspective on the winners and the framework required for successful, sustainable science communication.* **RU**



# A Real Dream of Communication

*The Communicator Award is celebrating its 20th anniversary. What if all the previous winners were to get together for a discussion forum? And what might we learn about science communication from such a gathering?*

Two decades, 21 awards for the very best voices in science. Through each individual recipient of the award, and all of them collectively, the organisations which present the award – the DFG and Stifterverband – have sent out an important signal to the public and the media. It is a recurring acknowledgement of the importance of giving scientific thinking a public voice. Successful science communication gets people talking – and earns itself a place in the spotlight.

What this means during a crisis is clearly shown by the Special Award for Outstanding Science Communication in the COVID-19 Pandemic, presented earlier this year to Berlin virologist Christian Drosten by the DFG and Stifterverband in a separate process from the Communicator Award. By the end of June, Drosten had already posted 50 coronavirus updates – a remarkable achievement in public communication on science. It certainly could not have come about in any conventional design process for strategic communication. In a radio interview, the researcher confirmed that there was no risk assessment, no committee meetings, no discussions of the “Yes, but...” variety. Despite its comparatively short duration, Drosten’s communication pro-



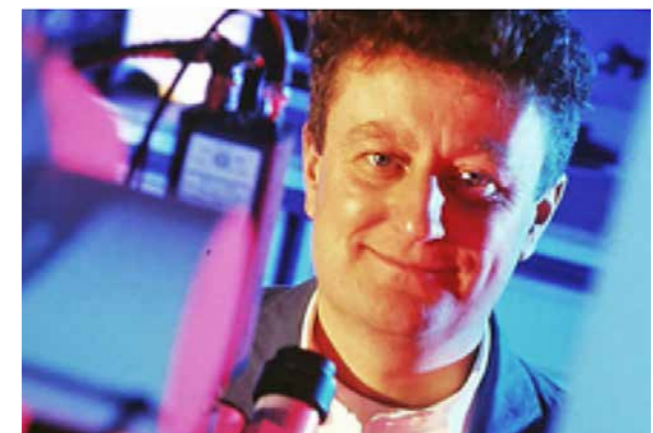
Albrecht Beutelspacher

2000



Gerold Wefer

2001



Wolfgang Heckl

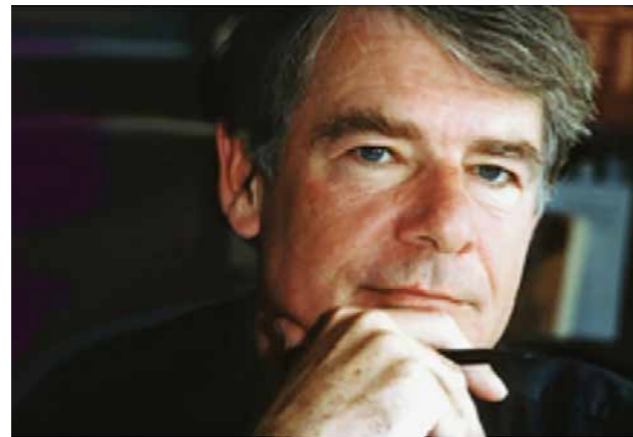
2002



ject deserves to stand by the side of the 21 winners of the Communicator Award. This is easily demonstrated by a thought experiment.

Let's imagine that the pandemic is finally over. Before we can hand its history over to the historians, we need a moment of reflection. What would be the ideal forum for this? How about a group of learned individuals, unique in their diversity and united by excellence, speaking publicly about what has happened? Personally, I couldn't think of a better group than a gathering of all past winners of the Communicator Award.

Through psychologist Gerd Gigerenzer (Communicator Award 2011), we could talk about the public evaluation of collective risks, and distortions in decision-making processes. Through sociologists Jutta Allmendinger (2009) and Andreas Zick (2016), we could discuss social change amid the pressure of a crisis, the reconfiguration of gender roles, and polarisation and ideologisation in our democracy. Socioinformatics researcher Katharina Anna Zweig (2019) could enlighten us on the capabilities, opportunities and risks of using artificial intelligence in areas such as epidemiology, but especially on the public debate surrounding the power of algorithms.



Wolf Singer

2003



Hubert Wolf

2004



Harald Lesch

2005

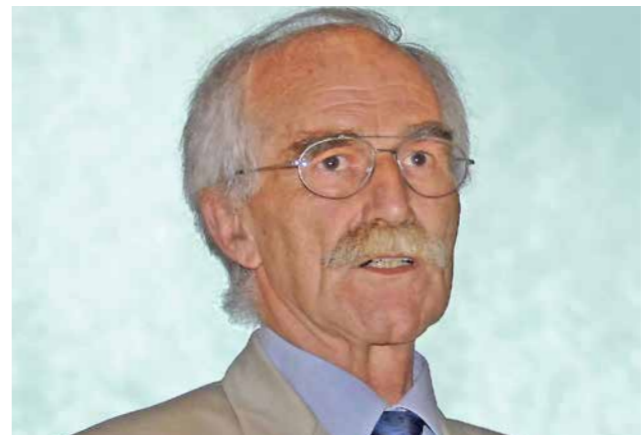
We would welcome physicists like Metin Tolan (2013). We would be able to understand the kinetics of flying droplets and suspended aerosols (who would have imagined that Germany would become caught up in a nationwide argument over masks?). And while we're on that subject, Harald Lesch (2005) and Antje Boetius (2018), both actively involved in the climate debate, could explain that public discourse can take trajectories no less ballistic than the flight of a football so brilliantly explained by Tolan. Each and every recipient is highly skilled in explaining the results of research and how we push back the boundaries of knowledge – the kind of ability the award is designed to recognise. But they also demonstrate confidence at all levels of the science dialogue. From losing one's sense of orientation in the pitch-black Saharan night (Stefan Kröpelin, 2017) to digging deep in the secret archives of the Vatican (Hubert Wolf, 2004), there is certainly no lack of material for the storytelling that has become so popular in science communication today.

But there is far more to science communication than just that, and in recent years this has become increasingly clear. In the desert, there is more waiting for us than just adventure: there is a geological archive going



Friedemann Schrenk

2006



Heinrich Miller, on behalf of the Glaciology Working Group

2007



Günter M. Ziegler

2008



back innumerable years. There are also surprising implications for the Anthropocene (we could argue about terminology here, but let's keep things concise). For example, what would happen if the oceans we have warmed were to alter monsoon dynamics, transforming the deserts into green oases at the "wrong" time in earth history? In the archives in Rome, there are treasures that cast doubt on generally accepted elements of the German postwar narrative. These have been uncovered by Hubert Wolf's research on Pius XII. But just as in a Dan Brown thriller, it doesn't end there.

Christian Lindner, leader of Germany's Free Democratic Party, recently used an image from the Vatican when he suggested a discursive backward innovation in the dispute about the appropriate degree of protection against infection – "I wish virologists and epidemiologists would meet like cardinals do to choose a new pope, in a conclave. And once they've reached a decision, white smoke rises," he said in late April. It was a suggestion intended to demand of science a unanimity with which to legitimate political decisions in the midst of a global pandemic crisis.

As absurd as this demand might seem to the scientifically literate, its implication is equally



Jutta Allmendinger

2009



Hanns Hatt

2010



Gerd Gigerenzer

2011

radical. Even after 20 years of intensified science communication, the PUSH initiative to promote dialogue with the public on science, the presentation of major awards, the founding of Wissenschaft im Dialog (Science in Dialogue) and many other initiatives, we still have a long way to go. The fact is that consensus papers, syntheses of evidence and statements from all leading research organisations and the National Academy had been available for a long time. What is more to be lamented, however, is the widespread lack of understanding of research processes and the discourse structures of the scientific community.

My dream of a reflective forum made up of our prizewinners certainly wouldn't resemble a conclave that reaches a final decision, after which unlimited power is handed over to a leader through the global community of scholars. Instead, the diversity of viewpoints, the plurality of approaches, the need to interpret the evidence would all be respected throughout the discussion and afterwards.

The way I see it, the primary goal of good science communication as we enter the third decade of the 21st century should not be to demand more and more self-promotion on the part of institutionalised research. Nor should it be simply



Jürgen Tautz

2012



Metin Tolan

2013



Onur Güntürkün

2014



about inspiring storytelling as a means of boosting recruitment. And it goes without saying (and everyone has agreed on this for at least 15 years) that it should not be public instruction on the basis of a deficit model. My ideal aim would be the effective dissemination of the scientific style of thinking, of public discussion of the way in which research is done. Our epistemic power deserves what in Rome has long been known as the *propaganda fide*, albeit no religious faith is involved.

The first few months of 2020 have dramatically demonstrated that a sound grasp and understanding of this way of thinking is thinly sown. Think of the fate of the Heinsberg study [the COVID-19 Case Cluster Study on Germany's first large outbreak], whose less than admirable political instrumentalisation probably caused less damage than the blurring of what science is, what it can achieve and what it does. Or think of the tabloid-style attack on special award winner Christian Drosten, which was intended not only to defame but also to achieve a kind of inverse instrumentalisation. The aim was to show the scientist as being wrong so as to bring about politically that which he was allegedly attempting to prevent. Yet as communicators, we could



Boris Zernikow

2015



Andreas Zick

2016



Stefan Kröpelin

2017

have foreseen manufactured scandals and pseudocriticism of science.

Years ago, Marc-Denis Weitze and Wolfgang Heckl (Communicator Award in 2002) wrote: "Controversies are widespread in science and essential to the advancement of knowledge. But so far, they have played only a marginal role in the dialogue between science and the public." We only have to look at the climate debate, the March for Science and the continual attacks on scientific knowledge capital to see that this is true.

However, to date, we have not succeeded in awakening a broad understanding of the constructive dispute over insights and interpretations or in qualitatively distinguishing it from events in the political arena. It has been all too easy to keep evoking the cliché of the scholarly argument. So all of us – science and its communicators, journalists, and those who use science communication to inform political decisions – still have plenty of work to do.

Each and every one of the 21 winners of the Communicator Award deserves our thanks – as do the 21 judging panels. Much has been achieved. Much remains to be done.

[www.dfg.de/en/funded\\_projects/prizewinners/communicator\\_award](http://www.dfg.de/en/funded_projects/prizewinners/communicator_award)



Antje Boetius

2018



Katharina Anna Zweig

2019



Robert Arlinghaus

2020

Alle Fotos: DFG



Jonathan Jeschke

# Marbled Crayfish and Other Novel Organisms

Ecology in the Anthropocene: Biologists aim to understand the dynamic, complex interactions between organisms and their environment – where the term “environment” includes humans and their activities. The example of invasive species and their communities illustrates what this means.

*Invasive animal species are also on the advance in Germany – and besides an interesting study object: here a Louisiana crawfish photographed in the Berlin Tiergarten.*



The marbled crayfish (*Procambarus virginalis*) is a species that would not exist without humans, or to be more precise, without the interest and ambition of aquarium enthusiasts. It was first discovered in the 1990s in the pet trade and probably originated in the laboratory of a breeder or dealer from the slough crayfish (*Procambarus fallax*) native to North America. The exact circumstances of the species' origins are unknown.

Aquarium keepers are fond of the strikingly marbled shell, which quickly made the marbled crayfish so popular that it is now found in aquariums all over the world. In addition to its unusual origins, the species has another intriguing fea-

ture: only female individuals have ever been found, and they reproduce by parthenogenesis. Marbled crayfish are therefore genetically identical, and a single individual is enough to establish a population.

Since many marbled crayfish are kept in aquariums and the species reproduces quickly, the inevitable happened: some aquarium keepers got tired of their crayfish and released them into the wild, where their offspring can be found today. The first wild specimen was found in Baden-Württemberg in southwest Germany in 2003, and since then wild marbled crayfish have been found in around 25 inland waters throughout the country, with a rising trend. In 2016, our

team found the species in the lake Krumme Lanke in Berlin.

So the existence of this species is inseparable from humans, their hobbies and activities. But it's only one example of the kinds of species known as "novel organisms": organisms that, like the marbled crayfish, have been created by humans or are, due to human activities, now found in areas where they did not previously occur. Examples include species whose distribution has shifted due to climate change, such as the scarlet dragonfly, and invasive non-native species that humans transported either intentionally or accidentally beyond their native range, such as the nutria, the raccoon or the Canada goose.

The marbled crayfish (*Procambarus virginalis*) is an invasive species first recognised in the 1990s, which did not originally exist in the wild. Below is a wild specimen from southern Germany.



Illustration: Creative Commons/Chueholl

But what counts as a species' native range? The cut-off date used by many scientists working in the field of invasion biology is the year 1492. Species that occurred in an area prior to this year are described as being "native" to the area, whereas species that only arrived thereafter are referred to as "non-native". The year 1492 was chosen because global species transport increased significantly after Christopher Columbus' voyage to the Americas.

This division into native and non-native species seems to be reasonable, but it has the drawback of not taking into account the temporal dynamics of processes taking place in the human era, which is also known as the "Anthropocene". More and more species are being translocated worldwide, as studies by many ecologists have shown. Today, communities of organisms are characterised by a wide range of new interactions between species that did not previously come into contact with each other – and these interactions are highly dynamic.

Back to the crayfish in Germany. Native species like the noble crayfish (*Astacus astacus*) are now only rarely seen and are threatened by a disease spread by North American crayfish species – the crayfish plague. Interestingly, North American crayfish share an evolutionary history with this pathogen and exhibit reduced symptoms when being infected. For individuals of European species, on the other hand, the disease is often lethal. Stocks of European crayfish were also heavily fished in earlier times, resulting in a sharp decline in their numbers in Germany and other parts of Europe.



Illustration: Bernd Wolfram

This animal was caught in the lake Krumme Lanke in Berlin.

Consequently, in the 19th and 20th centuries, North American crayfish such as the spiny-cheek crayfish (*Faxonius limosus*) were introduced for human consumption – bringing with them the pathogen that causes crayfish plague.

Following this first wave of invasions by North American crayfish, a second wave has been taking place since the late 20th century – primarily of visually attractive

species for aquariums. In Germany and elsewhere in Europe, the large majority of crayfish in our inland waters are now non-native; in other words, they have arrived since 1492. But they didn't all arrive at the same time, or for the same reasons.

Together with collaborators, our working group is investigating what happens in communities and ecosystems when novel organisms





Other invasive species found in Germany: the American mink (*Neovison vison*), a member of the mustelid family, here living in the wild in northern Germany ...



... the now widespread Canada goose (*Branta canadensis*), here a flock on the partially frozen river Spree in Berlin ...

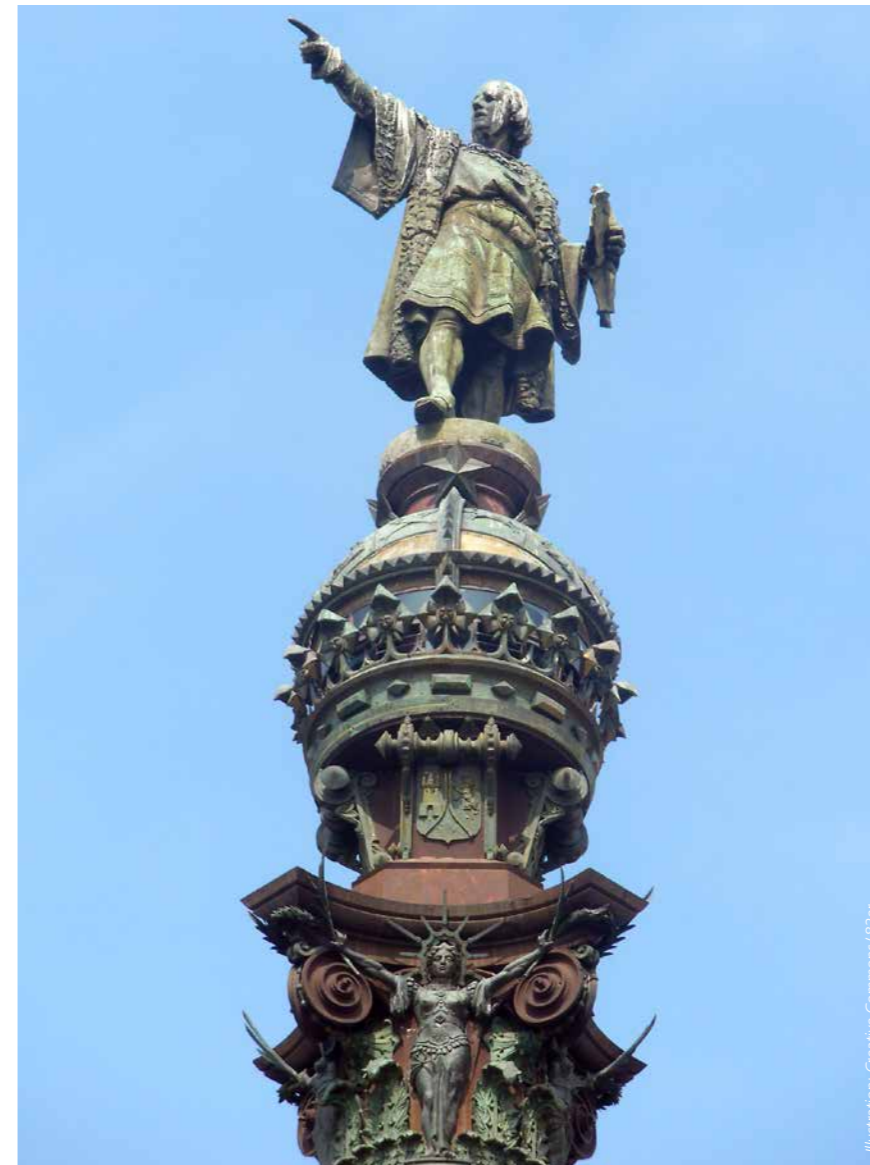


... and the photogenic, explosively spreading Louisiana crawfish (*Procambarus clarkii*) on a path in Berlin's Tiergarten.

have been introduced. How do interactions in food webs change? How do the structures of communities and ecosystems change? As part of a dissertation project by Stefan Linzmaier, spiny-cheek crayfish from the Müggelsee, a lake in the southeast of Berlin, were compared with marbled crayfish from the laboratory and wild marbled crayfish from Berlin and Baden-Württemberg. The experiments showed that the more recently introduced marbled crayfish are more aggressive than spiny-cheek crayfish, even when the marbled individuals were brought into contact with larger spiny-cheeks. Conversely, we observed that male spiny-cheeks in particular consume more prey than marbled crayfish, who are all female.

Our research also showed that the impacts of new organisms depend on their degree of novelty. To assess novelty, Wolf-Christian Saul developed the concept of eco-evolutionary experience in his dissertation: eco-evolutionary experience is low if an organism is suddenly confronted with a species that differs markedly from other species in its community. Dramatic examples of the impacts of such novel interactions can be found in New Zealand, where kiwis and other flightless birds developed over evolutionary time frames, as there were no land-dwelling predators that they needed to fly away from.

This situation changed dramatically with the introduction of weasels and cats, which caused drastic declines in kiwis and other birds. In the dissertation project by Florian Ruland, analyses of global data produced similar results. In summary,



Columbus and biodiversity – the voyage to the Americas in 1492 is still considered an important cut-off date. Species that existed in an area prior to this year are described as “native”, other species as “non-native”. Left: The 60 metre high Columbus monument in Barcelona.

in partnership with initiatives focusing on similar topics.

The results so far suggest that boom-bust dynamics are not as common as previously assumed. In other words, a “do nothing” management strategy in relation to invasive species does not seem to be useful. Future studies will track dynamic population trends and the impacts of novel organisms with greater accuracy. Working with collaborators in a range of disciplines, we are also increasingly investigating various aspects of global change in a joint approach, for example the impacts and consequences of artificial light, the “loss of night” not just in urban but also in non-urban areas. Jointly examining global and local changes can contribute to a deeper understanding of ecological relationships in the Anthropocene.

the lower the eco-evolutionary experience of native species, the more severely they are affected by newly introduced enemies.

Over a long period of time, such effects may decrease: populations of initially successful non-native species may collapse again, although this does not necessarily happen. Currently, it is unclear how often and under what conditions such “boom-bust” dynamics occur.

As part of the Invasion Dynamics Network (InDyNet), funded by

the DFG between 2015 and 2018, global datasets in this research field are being examined and analysed from an interdisciplinary perspective, fostering international joint work and dialogue. Through this approach, we are addressing unanswered questions relating to zebra and quagga mussels (*Dreissena spp.*), the American mink (*Neovison vison*) and various species of fish and ants. Now that the initial DFG funding has ended, we are continuing this international network



Prof. Dr. Jonathan Jeschke

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## The Deutsche Forschungsgemeinschaft

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**Rendezvous in the Arctic:** It was a long-awaited day for everyone involved. The ships' crews and polar scientists had been preparing for weeks, in some cases undergoing strict quarantine, to enable the *Polarstern* (front right) to rendezvous with the *Maria S. Merian* (left) and the *Sonne*. In the spring, the German research vessel, secured to an ice floe in the Arctic as part of the international research expedition MOSAiC, found itself impacted by the coronavirus pandemic. The usual supply visits by Russian, Swedish and Chinese icebreakers were cancelled and personnel had to wait longer than usual to be relieved. Relief came in the form of rapidly organised assistance supported by the Federal Ministry of Education and Research, the German Research Fleet Coordination Centre and the DFG, which in mid-May dispatched the two supply ships to the *Polarstern*, which had left its position to meet them. At the beginning of June, in the open sea off Spitzbergen, crew and research personnel changed over and fuel and provisions were loaded. “Through this joint action, we were able to prevent the premature termination of the MOSAiC project and therefore protect research from the loss of extremely valuable data,” said DFG President Katja Becker. The *Polarstern* is to remain in the Arctic, a region that serves as a key climate indicator, until October as part of the largest Arctic research expedition to date, enabling 300 scientists from 20 nations to gain new insights into global climate change. [www.mosaic-expedition.org](http://www.mosaic-expedition.org)

