Changing the World for the Better

Greeting by Countess Bettina Bernadotte and Jürgen Kluge

This summer, 39 Nobel Laureates and around 580 young scientists from 89 countries joined the 69th Lindau Nobel Laureate Meeting. Never before have so many countries been represented in this week of exchange. Although very diverse in their backgrounds, all these great scientists from around the world have one thing in common: their passion for physics.

In his opening lecture, Nobel Laureate Brian Schmidt discussed how the responsibility to improve society should shape every scientist’s motivation for their work. The aspiration to change the world for the better emerged as a key theme of this year’s meeting. Related issues were discussed during the opening lecture, in a multitude of sessions throughout the week and again during the closing panel discussion entitled ‘How Can Science Change the World for the Better?’ The ‘Lindau Spirit’ embraced in this way an attitude of challenging one another, in our actions, go further than what we have achieved thus far, recognising that every single person is an important protagonist of our world’s future. We should all stand shoulder to shoulder with our colleagues, friends and fellow citizens and look in the same direction: towards solutions for the challenges that we face as a global society – and take action accordingly.

The new Lindau Nobel Laureate Pier is an exciting new physical representation of the laureates that have attended the Lindau Meetings. Around 400 Nobel Laureates have participated in our meetings since 1951. The pier was built in their honour, and its representation of the laureates that have attended the Lindau Meetings. Around 400 Nobel Laureates have participated in our meetings since 1951. The pier was built in their honour, and its representation of the laureates that have attended the Lindau Nobel Laureate Meetings.

One of the guardrails of the pier also bears the name of Nobel Laureate Elizabeth Blackburn. In her opening lecture in 2018, she made a compelling appeal proposing to create a ‘Lindau Declaration’ for the 70th Lindau Meeting in 2020. She called for a new approach to global, sustainable, cooperative open science, since the problems currently facing humanity cannot be solved on a national basis anymore. Climate crisis, emerging infectious diseases and the need for alternative energy sources are only some of the pressing issues of our time that require global answers.

Since then, Elizabeth Blackburn and we at Lindau have written a first draft of the Lindau Declaration 2020. While it was formulated with basic research as its primary focus, its principles and goals can apply to all types of science. Now, it is open for debate, changes and amendments until the end of 2019. Everyone is invited to contribute to this project online at lindaudeclaration.org. It will be officially signed by Nobel Laureates and published during the interdisciplinary Lindau Meeting in 2020. This is the chance to spread the Lindau Spirit into the world and to make a change beyond our meeting in Lindau.

The core of the Lindau Meetings always was, and still is, to connect. In 1951, the idea of two doctors from Lindau became reality: They had the vision of connecting European scientists again, after years of separation during World War II. Together with Count Lennart Bernadotte from Mainau Island, Franz Karl Hein and Gustav Wilhelm Parade initiated the first ‘European Meeting of Nobel Laureates’. Seven Nobel Laureates. Only two years later, the first students were invited to join.

The founders wanted to establish a place of scientific as well as personal exchange between the Nobel Laureates and young scientists. They wanted people to be connected. Nearly 70 years later, this is still our aspiration. Not only to connect the right thoughts and concepts in order to foster new scientific discoveries. But above all to connect people, for the purpose of multiplying knowledge all over the globe.

Lindau should encourage everybody to debate, to exchange views, to discuss facts, scientific behaviour as well as personal beliefs and to learn from each other. We hope young scientists took the chance to chat with a Nobel Laureate during a breakfast, lunch, walk, dinner, or whenever there was the chance. We hope they experienced the special ‘Lindau Spirit’ as more than 35,000 Lindau Alumni have before them. And, ultimately, we hope that as well as feeling educated and inspired, they feel first and foremost connected.

“We should all look towards solutions for the challenges that we face as a global society – and take action accordingly.”

Countess Bettina Bernadotte and Jürgen Kluge

President of the Council for the Lindau Nobel Laureate Meetings

Chairman of the Board of Directors of the Foundation Lindau Nobel Laureate Meetings
“This is what we work for: we want to see the sparkle in the eyes of the young scientists and the Nobel Laureates.”

Countess Bettina Bernadotte, President of the Council for the Lindau Nobel Laureate Meetings

Rainer Weiss and young scientists taking a break during the Science Walk
Here in Lindau, it’s a good opportunity to think about the world around us as it presents itself in 2019. We certainly live in a time where every human on planet earth will find themselves less prosperous, less secure and ultimately, less happy. This second way has no winners.

Sobering words! But there is hope – and the hope is here in this room. There is nothing that lies before us that is not solvable. While the solutions involve ideas not yet had, and technologies not yet invented, the next generation of scientists spread around the world, rather than in just a few places – and that is all of you – will have the knowledge and tools to create the solutions. You have the ability to make sure they apply to everyone from all societies and backgrounds.

Now this isn’t something we can wait for permission to do from the political forces which are distorting our current world. It is the role of us scientists – young and old – to challenge orthodoxy and to think big. We can do things differently, and lead the way, continue to make progress so that when the political world clears its mind, and is ready to take action, we will have the answers.

Today I want to hopefully give each of you confidence about your part in this collective endeavour. But I also want to endow on you a sense of responsibility. An obligation to act for the good of all, and in a way that maximises the speed of progress, unhindered by short-term thinking. In the world today, it is so easy for the community and politicians who serve our community; to think that science is somehow not that important. The fruits of our endeavours are so ubiquitous, they are now part of the fabric of humanity – easily taken for granted. […]

Humans have been able to make progress because we are efficiently able to learn from each other, our breakthroughs and our mistakes are shared. Let’s just look at the accelerating Universe: if I look at all of the authors whom we cited in our 1998 paper announcing the evidence for an accelerating universe, it was about 10% of all practicing astronomers in the world. If we were to take the papers we cited, and the papers they cited – we would cover over half of all astronomers. A single discovery – and this is important because humanity is affecting our planet – we live in the Anthropocene epoch. We live in a time where our use of the Earth’s resources is not sustainable over the current human lifetime. I used to talk about my grandchildren, I now talk about me. We live in a time where the rapid rise of prosperity for all – especially amongst some of the haves in developed economies – has slowed for the first time since World War II, where democracies struggle against the rise of populism and the abundance of information, some true and some false; while authoritarians are able to double down with AI and data to increase their powers through the control of information. We live in a time where everyone finally has a voice, thanks to the internet – but it is hard to hear what is important amid the deafening collective noise.

So, in these times, humanity faces a choice. Either we choose to power through the Anthropocene with knowledge, technology and human organisation creating a more prosperous world for all, one that is able to thrive on earth in a sustainable prosperity.

Or we see ourselves fall into conflict, where the haves and have nots fight over the finite resources of earth. Where everyone finds themselves less prosperous, less secure and ultimately, less happy. This second way has no winners.

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So it is easy to feel isolated in research, that somehow your little piece doesn’t matter. But more often than not it does – or it will – but in ways that you simply cannot predict in advance. […] Science works because it is contestable and testable. And it works best when it is completely open and transparent. Have a thought about that Lindau Declaration document. Have it not be the Nobel Laureates’ document, have it be this community’s document. I routinely see scientists become highly secretive because they are paranoid that their ideas will be stolen. The basis of science is your ideas need to be shared. I hire people because of the number of ideas that they have that are taken up and used around the world. So yes – some prudence to make sure you get credit for your ideas, but then be open and share everything. Make sure people can use your ideas to further their work, don’t hinder them because you have a paper you might want to write sometime in the future. Ask yourself the following question. When I publish a result, when you lead a university as I do now, you get the opportunity to do our work. You as scientists, I hope, share the value to defend truth as a core value of our discipline. Yet, I continually see scientists around the world defending their own work or people who agree with them like a lawyer (who after all are required to defend in the face of all evidence), rather than with an open mind, receptive of possible short-comings. Indeed, as humans have done for our entire existence, we form tribes which we trust and defend. We use, as Nobel Prize Economist Daniel Kahneman wrote about in “Thinking, Fast and Slow,” our fast-thinking brain where we trust what is familiar with us, rather than engaging our rationality. And this fast way of thinking affects each of us all the time.

Last year, the Hubble Space Telescope for the first time allocated telescope time using a system where the people who allocated the time did not know the names of who was proposing. And for the first time ever, the success rate for women and men was more or less the same. […] The biases that caused women not to be allocated telescope time before at the same rate are indicative of biases that cut across all sorts of variables. It shows just how hard it is to be fully rational. We do better when we try to engage our slow-thinking, rational brain – but be aware of your own limitations to being perfect. But also be aware how the average person’s brain works, too. I find it beyond frustrating that the scientific evidence is so easily discarded for things like vaccination and climate change by so many, including the US president. Part of me realises this is because people now have access to counter information (largely based on the internet) that fits their own prior belief. But unfortunately, our brains are naturally wired to believe what we believe, and to double down on our beliefs when we are attacked. Shooting at President Trump is not going to make him or the voters who support him change their minds, in fact it is counterproductive. We need to somehow bring all of society into our tribe, where we, science and evidence are once again highly trusted. Each of us have a role to play. Get out, tell your stories of science, bring young and old into your world – don’t tell them they are idiots when they disagree with you. Listen to their questions with an open mind, be respectful. By the way, do the same thing when dealing with your scientific colleagues as well.

Research is a broad church. We need the curiosity-driven research to explore our Universe in all of its many facets. It is from this fountain of knowledge new solutions – revolutions – can emerge. I urge each of you to defend the importance of this aspect of science in your own country – no matter how rich or poor. It is the foundation of the research ecosystem. But we also need research to translate that knowledge, when appropriate, to real world solutions. Places where academic research and industry work hand-in-hand at first, eventually handing-off to industry to create the products and services that deliver prosperity to the world. All too often, I see people who work on fundamental research look down on the translational and industrial research. All research is important, it is all equally dignified, and none of us should be scared to bounce between fundamental and applied research, as opportunities emerge. And people like me, who run universities, will increasingly support these opportunities. […] So as I finish my talk, I ask each of you to embrace your privileged role as one of the world’s most educated citizens. Make sure your work, as much of it as possible, is available for fellow scientists to amplify. Always make sure you are working to push the boundaries of knowledge, rather than defending your view of the world. And bring the world with you. Know your own biases, be inclusive, show patience and respect to everyone around you – from young children you might meet visiting a kindergarten, to the leader of your country. If we all do this, we can make a difference. And in 2019, we MUST make a difference. The world is waiting.
Lindau Declaration 2020 – Guidelines Towards New Ways in Science

AT #LINO18 Nobel Laureate Elizabeth Blackburn suggested the initiative for a Lindau Declaration 2020, including guidelines for a new approach to global, sustainable, cooperative open science. These guidelines are now open for debate, changes and amendments and will be signed at the 70th Lindau Meeting.

Elizabeth Blackburn’s initiative for a Lindau Declaration on Sustainable Cooperative Open Science was a call to widely support new ways in science. While it was formulated with basic research as its primary focus, its principles and goals shall apply to all types of science. The initiative draws upon, refers to and supports various already existing projects and activities. The motivation and goals of this initiative have been described by Elizabeth Blackburn during the 68th Lindau Nobel Laureate Meeting:

“Over the past century, industrialised nations around the world have built robust government-funded national research enterprises. Each of these organisations has advanced science by infusing the universal human impulse for discovery with national or regional pride.

Despite the unarguable success of the nationally focused model of science that has dominated the past hundred years, the truly vexing problems now facing humanity – such as environmental degradation; the global climate crisis and its effects on health; emerging infectious diseases and pandemics; and the need for alternative energy sources – call for building something new: a global framework to support fundamental scientific research. This is an inspiring model of international commitment for the common benefit already exists in the Paris Agreement for climate change mitigation. The 2015 agreement, which recognises global climate change as one of the most daunting challenges faced by humankind, has the signatures of 194 nations plus the European Union, and lays out commitments to support the collective actions needed for long-term global benefit. Though the Paris Agreement has been subject to criticism that it is based on aspirations rather than mandates, it is nonetheless an unprecedented achievement in global cooperation toward a shared and urgent goal and a powerful example of what humanity can achieve through inclusive, careful negotiations conducted in good faith.

By implementing the equivalent of a Paris Agreement for long-term, cooperative, international support of scientific research – to complement the nation-based organisations that have served us so well – we can better embrace far-sighted, strategic scientific planning.

Arming the world with collectively acquired new scientific knowledge would allow us to anticipate crises that ultimately affect us all, freeing us from the reactive stances we so frequently must adopt in response to unexpected challenges.

A global model would also provide the means to build a sustainable source of funding and freely shared scientific tools. When fiscal resources for science are bound up in national politics, yearly-to-year funding proposals can be unpredictable and even capricious. The Paris Agreement crucially includes robust funding to achieve its objectives, via a Green Climate Fund that has so far attracted more than $10 billion in pledges. Notably, these pledging commitments have come not just from affluent, highly industrialised countries but also from a diverse range of nations, including Mexico, Indonesia and Vietnam.

The current concentration of scientific activity in a small number of rich nations excludes the perspectives and talents of millions who stand ready to contribute to science. By actively sharing technology and data through a global framework and by building on current momentum to open the scientific publishing process to all, we can greatly accelerate the pace of discovery and increase the diversity and richness of the research we pursue. We have presented preliminary ideas on a global science framework at several international forums and received an enthusiastic response. It is my hope that young scientists and future scientists just coming of age can imagine, and eventually realise, a global pact for science – a science based on shared goals and guidelines, transparency and strategic, long-range thinking. We would all stand to benefit.”

The guidelines currently consist of the following ten goals that shall be refined and complemented in discussion during the next months:

Goal 1
Cooperate Globally on Global Problems
The vast majority of the most pressing problems of today are of global nature: They affect large parts of the world’s population, they do not stop at borders and they cannot be solved alone.

Therefore, scientists, funders and politicians must cooperate globally to increase efficiency, speed and effectiveness. While the creative benefits of differing approaches and the stimulus of competition are to be acknowledged, inefficiency by unnecessary parallelism or obstruction must be avoided.

Goal 2
Share Knowledge
Knowledge becomes most powerful when it is shared with others. By sharing information, progress can be achieved faster and more efficiently. This includes sharing information about failures.

Thus, all scientific results and data shall be made openly available. Modern technologies (e.g. blockchain archives) allow for systems that can guarantee correct attribution of ideas to their inventors.

Goal 3
Publish Results Open Access
Scientific results shall be published in an open access mode. Many approaches such as open access journals or pre-print archives as well as new initiatives already exist. While it is not yet clear which modes and models will ultimately succeed, it remains a requirement that all relevant scientific findings must be published in an open access mode.

Goal 4
Publish Data to Repositories
Publishing is not limited to scientific findings. Any kind of data found, generated or used shall also be archived in appropriate data repositories. As this means storing vast amounts of data, the technological and administrative infrastructure must be continuously improved and adapted to guarantee safe and secure long-term storage. The publication of data, formulas, algorithms and other background used to generate findings will become a new requirement of scientific publishing. All scientific content shall be preserved, connected and versioned to foster discovery, accumulation of evidence but also respect for uncertainty.
Goal 5
Work Transparent and Truthful
Research must be transparent and truthful:

First, in methodology, data and findings, meaning that these have to be performed and documented in the most precise and comprehensible way.

Second, in communication and collaboration, meaning that relevant findings shall be communicated and provided to others in a precise, timely and constructive manner.

Third, in disclosure of funding, affiliations and political or ideological motivations, meaning that all motivations outside a pure scientific interest shall be communicated openly.

Goal 6
Change Reward Systems
Currently, working along the outlined standards and investing in transparency, openness, accessibility etc. is not appropriately rewarded, especially not when it takes capacity from traditional main goals. For the future, implementation and adherence to the aforementioned practices must be awarded, e.g. in reviewing and job employment selections. Evaluations of scientists shall be based on both the relevance of their discoveries and the process by which they were discovered, not on where those results are published. Credit will also be given for generating useful data, authoring code or creating resources that can be reused by others.

Goal 7
Support Talent Worldwide
Scientific talent exists in all parts of the world and all parts of society. All work and research environments as well as all structures related to that shall support scientific talent regardless of its background in a diverse and non-discriminatory manner. Equal access and opportunities shall be provided wherever possible.

Goal 8
Communicate to Society
Science has a distinct responsibility to communicate its procedures and results to society. Not only is most basic research funded by tax-payers money. Research and its application do also always influence people’s lives. Particularly in cases of world-wide relevance such as climate change, proper communication becomes an important duty.

The science community must also constructively work on providing usable information to the decision-making process in politics, society, industry and other areas.

Goal 9
Engage in Education
While research is at the core of the scientific discovery process, engaging in the education of the next generation is equally crucial.

Enabling and supporting aspiring young pupils, students and scientists ensures a sustainable process of mutual learning and empowers the subsequent cohort of researchers.

Goal 10
Ensure Global Funding
Basic research requires reliable funding, even more so than other forms of science, such as industry research. In almost all cases, insights from basic research, or even blue-sky research, lay the ground for inventions and products that directly benefit people.

This goal specifically calls upon governments, funding agencies, science-promoting foundations, supranational organisations and other institutions to collaborate and actively engage in ensuring reliable long-term funding, with a focus on global, imminent problems rather than national agendas.

“"It is my hope that young scientists can imagine, and eventually realise, a global pact for science – a science based on shared goals and resources, transparency and strategic, long-range thinking.””

Elizabeth Blackburn

Everyone is invited to join the discussion and contribute ideas and suggestions for the declaration’s guidelines at www.lindaudeclaration.org by the end of 2019.
Facing the Challenges of Our Time

In her speech held during the opening ceremony of the 69th Lindau Nobel Laureate Meeting, German Federal Minister of Education and Research Anja Karliczek stressed the relevance of the Lindau Meetings as a platform for international scientific exchange and issued a call for more academic freedom.

I was thrilled when I saw the numbers for the 2019 Lindau Nobel Laureate Meeting: Well over 500 young scientists have come to Lindau this year from 84 countries! So basically, almost the entire global community is represented here at Lake Constance. That’s fantastic!

It also shows that the annual Lindau Meeting is a very special format. It is an international forum of encounter, a forum that is unique in the world. Here at Lindau, we are not only building bridges between nations, but also forming networks across generations. Where else could young scientists and students enjoy such close exchanges with Nobel Laureates? Where else is it so easy to make such contacts? [...] It is the opportunity to make people-to-people contacts and discuss challenging topics for the world today face-to-face that makes the Lindau Nobel Laureate Meetings such a unique and successful event.

As the Federal Government, we attach great importance to sending out a strong signal from time to time. This is why we keep supporting these meetings year upon year – and are happy to do so. The Lindau Meetings are a beacon of excellence and showcase the German science and research landscape. Our support emphasises just how much importance we attach to our way of life and work. They are also mutually reinforcing.

Globalisation and digital technology are revolutionising the perspectives and research results of scientists from various countries. [...] The 2019 Lindau Nobel Laureate Meeting is dedicated to physics. Basic physical research helps us to gain a better understanding of our world and the universe. There are several prize-winning researchers gathered here in Lindau whose discoveries in cosmology, laser physics and research on gravitational waves have provided humankind with game-changing new insights. We very much hope that they will continue to make further discoveries in the future.

At the same time, basic physical research is also one of the key motors of innovation today. Let’s take laser physics as an example: Laser tweezers revolutionised medical care. They made it possible to use microscopic fingers to trap and examine objects such as bacteria or viruses. Already now, laser tweezers help us to broaden our knowledge base in the fight against cancer – and thus to save lives.

Laser tweezers and other innovations directly benefit the people. They show that science and research improve the lives of all of us. It is especially in today’s times where nationalism and populism are on the rise around the world, that we need strong and independent science. This means in particular exchange and cooperation, curiosity and open-mindedness – always with the aim of generating new findings to achieve progress.

In this context, it is essential that we create an environment characterised by academic freedom. The freedom of science and research is a precondition for producing research results that benefit all of humankind as well as the entire planet. It is this freedom alone that enables researchers and academics to let themselves be guided not by their own interests, but by the challenges that concern all of us. [...] The Lindau Meetings are an expression of a spirit that we need now more than ever: the meeting brings together researchers, who are aware of their social responsibility and get actively engaged in debates and discussions. To give you just one example: in the 2015 Mainau Declaration, you called upon us policy-makers to strengthen our commitment to climate change mitigation. I quote: “If left unchecked, our ever-increasing demand for food, water, and energy will eventually overwhelm the Earth’s ability to satisfy humanity’s needs, and will lead to wholesale human tragedy.” This quote embodies the Lindau Spirit. And it is precisely this spirit that we admire about the Lindau Nobel Laureate Meetings. They provide an important impetus for the whole of society. On this note, I wish all of you a good start to the 2019 meeting, inspiring discussions and a successful conference!
The scientific chairpersons of the 69th Lindau Nobel Laureate Meeting, Rainer Blatt and Lars Bergström, reflect on the diverse programme of this year’s meeting and share some of their personal highlights.

Rainer Blatt

The 69th Lindau Nobel Laureate Meeting 2019, devoted to physics, was graced with the presence of 19 Nobel Laureates in physics and other disciplines, who, together with 580 enthusiastic young scientists from a record 89 countries contributed to a vibrant atmosphere. A defining characteristic of the meeting was the frequent highlighting of the importance of physics to society and its interface with other disciplines.

The tone of #LINO19 was set in a keynote address by Brian Schmidt, who was awarded the physics prize in 2011 for his fundamental research into supernova cosmology and the rate, the so-called Hubble constant, which is considerably higher than what is measured using the microwave background radiation. It is fascinating to speculate that this may tell us something new about the workings of the universe.

For the first time, the Nobel Laureates in Physics 2017, Michael Kosterlitz and F. Duncan M. Haldane, attended a Lindau Meeting and presented their award-winning research in a compelling and clear way to the appreciative audience of young scientists.

Also for the first time in Lindau, laureates Konstantin Novoselov (Nobel Prize 2010) and Wolfgang Ketterle (2001) presented the important role of basic science and that occasionally there is a long time between basic discoveries and applications. He described his smartphone as a very good example of something that incorporates many discoveries in basic physics that have now, after in some cases decades, reached a level of sophistication where they can be combined together in an important application for society. In this vein, the final panel discussion on Mainau Island was devoted to the question ‘How can Science Change the World for the Better?’, Brian Schmidt was joined by, among others, 1997 physics laureate Steven Chu. Again, the tone was hopeful about the role of science in solving the many issues currently facing society. However, profound problems like overpopulation and unequal distribution of wealth necessitate sustainable solutions that will require politics and science to collaborate.

The interactions between laureates and young scientists in this year’s Lindau Meeting took a variety of different forms, from traditional lectures to more open-format Agora Talks, Science Walks, Laureate Lunches, Master Classes, and of course the important face-to-face Open Exchange meetings between young scientists and Nobel Laureates in the afternoons. Together with other interactive sessions, these formats promote one of the most important aims of the meeting, namely, to foster inspiring connections between people.

For the lectures, priority was given to recently honoured Nobel Laureates and first-time visitors of the Lindau Meetings. The first lecture was given by 2018 laureate Donna Strickland, who gave an inspirational account of how she made her discovery on fast-pulsed and powerful lasers already as a graduate student something that certainly caught the attention of the young scientists. Her collaborator and Nobel Laureate Gérard Mourou followed her and gave a more general review of some of their current research. The final talk of the meeting was given by Claude Cohen-Tannoudji (1997), who talked about his life-long research at the École Normale Supérieure, which laid the many of the foundations in quantum mechanics and quantum optics.

With its varied programme, ranging from the work of the most recent laureates over new developments and current topics in physics to reviews covering the history and the development of physics, the meeting was a fascinating showcase for the young scientists and will surely remain long in the memory of all participants.
“The Lindau Nobel Laureate Pier is a tribute to the unique bond between Nobel Laureates from around the world and the city of Lindau. We hope that it will motivate young people to discover the beauty of science.”

Fredy Raas, Chairman of the Board, Boehringer Ingelheim
The inauguration of the new Lindau Nobel Laureate Pier was one of the highlights of the 69th Lindau Meeting. In the presence of laureates, young scientists and guests, the pier was handed over to the City of Lindau and officially opened to the public.

The Lindau Nobel Laureate Pier honours the more than 400 Nobel Laureates who have participated in the Lindau Meetings since 1951. Its guardrails bear the names and disciplines of the laureates as well as the year of the award and the year of their first meeting participation. In total, the pier has more than 1,000 individual metal bars – sufficient for the names of future Nobel Laureates who will participate in the Lindau Meetings to come.

During the official inauguration of the pier, the final metal bar with the name of Donna Strickland, 2018 Nobel Laureate in Physics, was inserted into the guardrail. Thus, the pier was symbolically completed and handed over to the public.

“In the future,” said Countess Bettina Bernadotte during the ceremony, “people will remember the laureates’ names and their outstanding achievements for science and humankind while strolling along the Nobel Pier.”

The Lindau Nobel Laureate Pier could be realised thanks to the support of the Beisheim Stiftung and the City of Lindau. The pier now constitutes the central station of the Lindau Science Trail. A knowledge pylon at the entrance to the pier portrays the history of the Nobel Prize.
Opening Day

Opening Ceremony

Welcome & Interview
Countess Bettina Bernadotte, President, Council for the Lindau Nobel Laureate Meetings

Greetings from Stockholm
Lars Bergström, Member of the Board of the Nobel Foundation (2001–17), Secretary of the Nobel Committee for Physics (2004–15), Sweden

Address
Anja Kaslitzek, Federal Minister of Education and Research, Germany

Opening Speech
BIG QUESTIONS FOR SOCIETY, BIG QUESTIONS FOR RESEARCH
Brian P. Schmidt, Nobel Laureate in Physics 2011, Vice-Chancellor, The Australian National University, Australia

Interview
– Lars Bergström, Scientific Chairperson, 69th Lindau Nobel Laureate Meeting
– Rainer Blatt, Scientific Chairperson, 69th Lindau Nobel Laureate Meeting

Master of Ceremonies
Adriana Marais, Director, Foundation for Space Development, Lindau Alumna 2016, South Africa

>> Reception and Concert

hosted by the Federal Ministry of Education, Science and Research, Austria

Welcome Address
Barbara Weitgruber, Director General for Scientific Research and International Relations, Federal Ministry of Education, Science and Research, Austria

Ensemble of the Vienna Philharmonic Orchestra

>> Foundation Dinner

hosted by the Foundation Lindau Nobel Laureate Meetings

Welcome Address
Jürgen Kluge, Chairman of the Board of Directors, Foundation Lindau Nobel Laureate Meetings

Jürgen Kluge addressing the guests at the Foundation Dinner

Group photo of the attending Nobel Laureates

Barbara Weitgruber

Ensemble of the Vienna Philharmonic Orchestra

Countess Bettina Bernadotte

Presentation of the opening film

Scientific Chairpersons Lars Bergström and Rainer Blatt with Adriana Marais

The Nobel Laureates waving to the audience
Nobel Laureates

Laureates at #LINO19

41 LAUREATES

- 28 Physics
- 9 Chemistry
- 1 Peace
- 1 Physiology/Medicine
- 2 ACM A.M. Turing Award

NATIONALITIES

12

Most Participations
1. Robert Huber (23)
2. Hartmut Michel (22)
3. Klaus von Klitzing (16)

First Participations
F. Duncan M. Haldane
Tawakkol Karman
Wolfgang Ketterle
J. Michael Kosterlitz
Gérard A. Mourou
Sir Konstantin S. Novoselov
Adam G. Riess
Donna Strickland
Joseph H. Taylor
Rainer Weiss

Earliest Award
Brian D. Josephson (1973)

AGE

Youngest: Tawakkol Karman (40)
Oldest: Martinus J. G. Veltman (88)
Robert Huber
Nationality: Germany
Nobel Prize: Chemistry
Year: 1988
Prize Motivation: “for the determination of the three-dimensional structure of a photosynthetic reaction centre”

Hartmut Michel
Nationality: Germany
Nobel Prize: Chemistry
Year: 1988
Prize Motivation: “for the discovery of neutrino oscillations, which shows that neutrinos have mass”

Wolfgang Ketterle
Nationality: Germany
Nobel Prize: Physics
Year: 1997
Prize Motivation: “for the achievement of Bose-Einstein condensation in dilute gases of alkali atoms, and for early fundamental studies of the properties of the condensate”

J. Michael Kosterlitz
Nationality: United Kingdom/USA
Nobel Prize: Physics
Year: 2020
Prize Motivation: “for the discovery of the quantised Hall effect”

Takaaki Kajita
Nationality: Japan
Nobel Prize: Physics
Year: 2015
Prize Motivation: “for the discovery of neutrino oscillations, which shows that neutrinos have mass”

Tawakkol Karman
Nationality: Yemen
Nobel Prize: Peace
Year: 2011
Prize Motivation: “for their non-violent struggle for the safety of women and for women’s rights to full participation in peace-building work”

Tawakkol Karman
Nationality: Yemen
Nobel Prize: Peace
Year: 2011
Prize Motivation: “for their method of generating high-intensity, ultra-short optical pulses”

Adam G. Riess
Nationality: USA
Nobel Prize: Physics
Year: 2018
Prize Motivation: “for the discovery of the accelerating expansion of the Universe through observations of distant supernovae”

Rainer Weiss
Nationality: United States
Nobel Prize: Physics
Year: 2017
Prize Motivation: “for decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction”

Nobel Laureates at #LINO19

Takahiro Kobayashi
Nationality: Japan
Nobel Prize: Physics
Year: 2015
Prize Motivation: “for the discovery of neutrino oscillations, which shows that neutrinos have mass”

Georgy A. Mourou
Nationality: France
Nobel Prize: Physics
Year: 2018
Prize Motivation: “for their development of methods to cool and trap atoms with laser light”

Joseph H. Taylor
Nationality: USA
Nobel Prize: Physics
Year: 1993
Prize Motivation: “for development of techniques for observation of gravitational waves”

Dan Shechtman
Nationality: Israel
Nobel Prize: Chemistry
Year: 2011
Prize Motivation: “for the discovery of quasicrystals”

J. Michael Kosterlitz
Nationality: United Kingdom/USA
Nobel Prize: Physics
Year: 2020
Prize Motivation: “for the discovery of the accelerating expansion of the Universe through observations of distant supernovae”

Donna Strickland
Nationality: Canada
Nobel Prize: Physics
Year: 2018
Prize Motivation: “for decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction”

Nobel Laureates at #LINO19

William E. Moerner
Nationality: USA
Nobel Prize: Chemistry
Year: 2016
Prize Motivation: “for groundbreaking inventions in super-resolved fluorescence microscopy”

Martinus J. G. Veltman
Nationality: Netherlands
Nobel Prize: Physics
Year: 1979
Prize Motivation: “for elucidating the quantum structure of electroweak interactions in physics”

Jan C. Mather
Nationality: USA
Nobel Prize: Physics
Year: 2011
Prize Motivation: “for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation”

Rainer Weiss
Nationality: United States
Nobel Prize: Physics
Year: 2017
Prize Motivation: “for decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction”

Nobel Laureates at #LINO19

Brian D. Josephson
Nationality: United Kingdom
Nobel Prize: Physics
Year: 1973
Prize Motivation: “for theoretical predictions of the properties of a supercurrent through a tunnel barrier, in particular those phenomena which are generally known as the Josephson effects”

J. Michael Kosterlitz
Nationality: United Kingdom/USA
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Year: 2020
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Young Scientists at #LINO19

580
from
89 countries

GENDER BALANCE

♂ 65%
♀ 35%

AGE

Oldest
35 years
Youngest
19 years
Average
28 years

Most Represented Nations

Academic Degrees

12%
Undergraduate
38%
Master/Diploma
50%
PhD

All portraits taken from the photo series ‘Nobel Laureates photographed by Peter Badge’. For more information see p. 99.

The mediathèque contains profiles of almost 500 Nobel Laureates.
To ensure the scientific excellence of participants, the Lindau Nobel Laureate Meetings maintain a strong global network of more than 200 academic partner institutions. World-renowned science and research bodies both from the public and private sector are entitled to nominate young scientists for participation in the Lindau Meetings.

Nominating partners include academies of sciences, leading universities, research institutions, foundations and innovative enterprises throughout the world.

For the 69th Lindau Nobel Laureate Meeting, 180 academic partners received the call for nomination of young scientists, and 161 of them participated in nominations.

Generally, young scientists are nominated by official academic partner institutions and apply through them. In exceptional cases, applications can be submitted directly to the Council via Open Application, for example, when an applicant studies or works in a country where the Lindau Meetings do not yet have an academic partner.

The partner network is continuously being expanded by means of memoranda of understanding (MoU). In these, both the Lindau Meetings and their partners commit themselves to the interconnection and promotion of aspiring young scientists and thus to spreading Lindau’s ‘Mission Education’ worldwide.

Partnerships 2019

In 2019, official partnerships with the following international institutions have been established or renewed:

- Australian Academy of Science
- Austrian Federal Ministry of Education, Science and Research
- University of Nicosia, Cyprus
- University of Iceland and The Icelandic Centre for Research
- Ministry of Research, Technology and Higher Education of the Republic of Indonesia
- Irish Research Council
- American University of Beirut, Lebanon
- Lithuanian Academy of Sciences and Arts
- Ministry of Education of the Republic of the Union of Myanmar
- Cabirute Gulbenkian Foundation
- National Research Foundation, Singapore
- Slovenian Academy of Sciences and Arts
- Ragnar Söderberg Foundation
- Honoris United Universities
- University of California, USA
- European Organization for Nuclear Research

New memorandum of understanding with Honoris United Universities

MoU with the Ministry of Research, Technology and Higher Education of the Republic of Indonesia (MoRTHE): Nikolaus Turner, Anif Havas Degrosen, Ambassador of Indonesia to Germany, Aiman Na’im, Secretary General MoRTHE

Academic Partners

Partnerships 2019

In 2019, official partnerships with the following international institutions have been established or renewed:

- Australian Academy of Science
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- University of Nicosia, Cyprus
- University of Iceland and The Icelandic Centre for Research
- Ministry of Research, Technology and Higher Education of the Republic of Indonesia
- Irish Research Council
- American University of Beirut, Lebanon
- Lithuanian Academy of Sciences and Arts
- Ministry of Education of the Republic of the Union of Myanmar
- Cabirute Gulbenkian Foundation
- National Research Foundation, Singapore
- Slovenian Academy of Sciences and Arts
- Ragnar Söderberg Foundation
- Honoris United Universities
- University of California, USA
- European Organization for Nuclear Research

Application Process

REQUIREMENTS

Undergraduates, Master or PhD Students, or Post-Docs <35 Years of Age

Top 5% of Class Recommendations

APPLICATION

Web-Based Two Procedures

Regular:
- Nomination by Academic Partners (Internal Selection)

Exception:
- Open Application (If No Academic Partner Is Responsible)

EVALUATION & SELECTION

Review Panel of the Council
- 400–600 Participants (Depending on Meeting Type)

PARTICIPATION

Lindau Island

One-Time Only

LINDAU ALUMNI COMMUNITY

33,000 FORMER PARTICIPANTS
SINCE 1951
Nominating Institutions

With Accepted Candidates at #LINO19

Académie Sinica
Académie Nationale des Sciences et Techniques du Sénégal
Academy of Science of South Africa (ASSAf)
Academy of Sciences Malaysia
Acatech – National Academy of Science and Engineering, Germany
Australian Academy of Science
American University of Beirut, Lebanon
Alexander von Humboldt Foundation
Alexander S. Onassis Public Benefit Foundation
African Academy of Sciences
Academy of Sciences Malaysia
Academy of Science of South Africa (ASSAf)
Académie Nationale des Sciences et Techniques du Sénégal
Academia Sinica
Fund for Scientific Research, Belgium
Fraunhofer-Gesellschaft zur Förderung
einer angewandten Forschung e.V.
Foundation for Polish Science
European Molecular Biology Organization (EMBO)
European Council for Nuclear Research
CERN
Chemnitz University of Technology, Germany
Columbus Association
Croucher Foundation
CSIR
Danish Council for Independent Research
Danish Academy of Sciences
Department of Science & Technology, Government of India
Elite Network of Bavaria
Elke Kröner-Fresenius-Stiftung
Estonian Academy of Sciences
European Commission
European Molecular Biology Organization (EMBO)
Foundation for Polish Science
Fraunhofer-Gesellschaft zur Förderung
der angewandten Forschung e.V.
French National Centre for Scientific Research
Fund for Scientific Research, Belgium
Georg-August-Universität Göttingen, Germany
German Academic Exchange Service (DAAD)
German Academy of Sciences Leopoldina
Global Young Academy
Goethe University Frankfurt, Germany
Göttingen Graduate School for Neurosciences, Biophysics, and Molecular Biosciences, Germany
Graphene Flagship
Heidelberg University, Germany
Heinrich-Oppermann-Preis
Heinrich-Hertz-Institut für Elektronenphysik, Germany
Human Frontier Science Program
ICRBA – Catalan Institution for Research and Advanced Studies, Spain
Internationale Bodensee-Hochschule
Irish Research Council
Jacobs University Bremen cGmbH, Germany
Japan Society for the Promotion of Science
Johannes Gutenberg University Mainz, Germany
Julius-Maximilians-Universität Würzburg, Germany
Karlsruhe Institute of Technology, Germany
King Abdullah University of Science and Technology, Saudi Arabia
Kiefer Foundation
Leibniz Association
Leipzig University, Germany
Ludwig-Maximilians-Universität München, Germany
Luxembourg National Research Fund
Max Planck Institute for Biophysical Chemistry, Germany
Max Planck Society
Mexican Academy of Sciences
Ministry of Education and Human Resources, Tonga
Ministry of Education and Research, Mauritius
Ministry of Education of the Republic of the Union of Myanmar
Mongolian Academy of Sciences
National Academy of Sciences of the Republic of Armenia
National Academy of Sciences of Uruguay
National Research Foundation, Singapore
National Science and Technology Development Agency, Thailand
Oak Ridge Associated Universities (ORAU), USA
OCIC Standing Committee on Scientific and Technological Cooperation (COMSTEC)
Otto von Guericke University Magdeburg, Germany
Paderborn University, Germany
Pakistan Institute of Engineering and Applied Sciences
Ragnar Söderberg Foundation
Research Foundation – Flanders (FWO)
Royal Netherlands Academy of Arts and Sciences
Sharif University of Technology, Iran
Siemens Foundation for Research, Promotion, China
St Petersburger Universität, Russia
Swiss Academy of Sciences (SCNAT)
Technische Universität München, Germany
Technische Universität Berlin, Germany
Technische Universität Braunschweig, Germany
The Council of Finnish Academies
The Korean Academy of Science and Technology
The Lithuanian Academy of Sciences
The Norwegian Academy of Science and Letters
The Research Council, Oman
The Royal Society
The Russian Rectors’ Union
The Slovenian Academy of Sciences and Arts
TU Dortmund University, Germany
TUBITAK, Turkey
TWAS – The World Academy of Sciences
Universidad de los Andes, Colombia
Universität Hamburg, Germany
Universität Regensburg, Germany
Universität zu Lübeck, Germany
University of Augsburg, Germany
University of Bayreuth, Germany
University of Bonn, Germany
University of Duisburg-Essen, Germany
University of Kassel, Germany
University of Konstanz – Zukunftskolleg, Germany
University of Lichtenstein
University of Malta
University of Minster, Germany
University of Rostock, Germany
University of Siegen, Germany
University of Tübingen, Germany
Volkswagen Foundation
Weizmann Institute of Science, Israel

The nomination process in Germany was conducted in cooperation with the Mathematisch-Naturwissenschaftlicher Fakultätentag (MNFT) and the German Physical Society (DPG).
Fostering Intergenerational Dialogue

Saverio Francesconi from the Université Paris Diderot, France, presenting his poster to Astrid Weidt, Leibniz Institute of Surface Engineering, Germany, and a future young scientist.
Scientific Programme

Lectures (in Alphabetical Order)

Joachim Frank: Visualising Short-Lived States of Biological Molecules by Cryo-Electron Microscopy
David J. Gross: The Future of Fundamental Physics
F. Duncan M. Haldane: Entanglement and Topological Quantum Matter
Theodor W. Hänsch: Laser Spectroscopy of Hydrogen and the Proton Radius Puzzle
Takaaki Kajita: Oscillation of Atmospheric Neutrinos
Wolfgang Ketterle: New Forms of Matter Near Absolute Zero Temperature
Klaus von Klitzing: Quantum Hall Effect and the New SI System
J. Michael Kosterlitz: Creating New Scientific Knowledge
Arthur B. McDonald: Direct Detection of Dark Matter With Liquid Argon
Gérard Mourou: Passion for Extreme Light
Sir Konstantin S. Novoselov: Materials of the Future
Adam G. Riess: The Expansion of the Universe, Faster Than We Thought
Carlo Rubbia: Further Searches of the Higgs Scalar Sector
Dan Shechtman: Scientific Blunder
Donna Strickland: From Nonlinear Optics to High-Intensity Laser Physics
Joseph H. Taylor: The Long Tortuous Path to Gravitational Waves
Rainer Weiss: Gravitational Wave Astronomy
Kurt Wüthrich: NMR – From Physics to Biology and Medical Diagnosis
Ada E. Yonath: The Ribosome – A Connection Between the Prebiotic Origin of Life and Next Generation Antibiotics

Along with approximately 900 videos, lectures from #LION19 can be watched in the mediatheque.
The Heidelberg Laureate Forum (HLF) was founded in 2013 by Klaus Tschira after the model of the Lindau Nobel Laureate Meetings. Tschira, who died in 2021, was one of the most committed supporters of the Lindau Meetings and member of the Honorary Senate of the Foundation. His experience of the Lindau Meetings spawned the idea of creating something similar for mathematics and computer science; thus, the HLF dedicates its meetings to prize-winning and aspiring young scientists from these disciplines. To emphasise these close links and the outstanding partnership, Lindau hosts Heidelberg Lectures every year, and Lindau Lectures are part of the programme of every HLF.

Already for the fourth time at #LINO19, a laureate from computer science or mathematics was invited to give a lecture on a topic of their current or past research. In this year’s Heidelberg Lecture, Martin E. Hellman, known for his contribution to public key cryptography, shared eight lessons he learned in his scientific life.

THE TECHNOLOGICAL IMPERATIVE FOR ETHICAL EVOLUTION

Martin E. Hellman, ACM A.M. Turing Award 2015, Stanford University, USA

At past Lindau Meetings, several Nobel Laureates have given inspiring lectures with considerable insights into their own scientific paths, including helpful and practical hints for academic careers. Particular highlights – to be watched in the mediathèque – are among others the lectures by Christian de Duve, Oliver Smithies and Sir Harold Kroto.

To officially implement this session type, the ‘Life Lecture’ became part of the meeting programme in 2018. The format allows a laureate to reflect on his or her life inside and outside of academia and provides rare and personal insights. The Life Lecture is designed to motivate and inspire the young audience and numbers among the emotional highlights of the Lindau Meetings’ lecture programme.

In this year’s Life Lecture, Nobel Laureate Claude Cohen-Tannoudji provided a Brief Description of My Personal and Scientific Itinerary. The audience was introduced to several companions of Claude Cohen-Tannoudji (family, professors, students) who shaped him as a person and as a scientist. He also emphasised that (school) education is a pillar of society and that his main aim in life is to share the values taught by his companions with the next generation.

A BRIEF DESCRIPTION OF MY PERSONAL AND SCIENTIFIC ITINERARY

Claude Cohen-Tannoudji, Laboratoire Kastler Brossel, France
### Agora Talks (in Alphabetical Order)

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<th>Moderator</th>
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<td>Non-Thermal Equilibrium Transport by Dynein Molecular Motors in Live Neurons, and Breakthroughs in Linear and Non-Linear Ultrasound Imaging</td>
<td>Adam Smith, Chief Scientific Officer, Nobel Media, Sweden</td>
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<td>Johann Deisenhofer</td>
<td>Photosynthesis – Structural Biology and Evolution</td>
<td>Paul Kennedy, Academy of Science of South Africa</td>
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<td>Serge Haroche &amp; David J. Wineland</td>
<td>Future Quantum Technologies</td>
<td>Gunter Werth, Johannes Gutenberg University Mainz, Germany</td>
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<td>Bovine Origin of Infections Linked to Colon and Breast Cancers</td>
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<td>Stefan W. Hell</td>
<td>Reaching Molecular Star Resolution in Lens-Based Microscopy: the Diffraction Limit Blown Away</td>
<td>Anna Sjöström-Douagi, Vice President Science &amp; Programs, Nobel Prize Museum, Sweden</td>
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<td>Robert Huber</td>
<td>Proteases for Drug Design and Development, My Experience</td>
<td>Tobias Maier, Deputy Director, National Institute for Science Communication (NWWk), Germany</td>
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<td>Brian D. Josephson</td>
<td>W22 Twenty-First Century Physics Need Biology?</td>
<td>Burkhard Fricke, former Vice-President, Council for the Lindau Nobel Laureate Meetings, Germany</td>
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<td>John C. Mohler &amp; George F. Smoot</td>
<td>From the Big Bang to Intelligent Life</td>
<td>Lars Bergtizion, Scientific Chairperson, 69th Lindau Nobel Laureate Meeting</td>
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<td>Hartmut Michel</td>
<td>Structures of Terminal Oxidases: A Compassion of Structure Determinations by X-ray Crystallography and Electron Microscopy</td>
<td>Tobias Maier, Deputy Director, National Institute for Science Communication (NWWk), Germany</td>
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<tr>
<td>William E. Moerner</td>
<td>What Can You Learn From Single Molecules, Even When Trapped Without Optical Forces?</td>
<td>Gunter Werth, Johannes Gutenberg University Mainz, Germany</td>
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<tr>
<td>Martinus J.G. Veltman</td>
<td>The Future of Particle Physics</td>
<td>Rolf-Dieter Heuer, President, SESAME Council, Germany</td>
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| Carl E. Wieman              | Taking a Scientific Approach to Physics Teaching and Learning        | Laura Sprechmann, Acting CEO, Nobel Media, Sweden                                          

Agora Talk with Serge Haroche and David Wineland, moderated by Günter Werth

Audience at Stefan Hell’s Agora Talk

William E. Moerner

Martinus Veltman and moderator Rolf-Dieter Heuer

George Smoot and John Mather

Johannes Gutenberg University Mainz, Germany
Panel Discussions

THE DARK SIDE OF THE UNIVERSE

Panellists
- David J. Gross, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, USA
- Kirsten Hall, Department of Physics and Astronomy, Johns Hopkins University, USA
- Adam G. Riess, Department of Physics and Astronomy, Johns Hopkins University, USA
- Brian P. Schmidt, The Australian National University, Australia
- George F. Smoot, Lawrence Berkeley National Laboratory, University of California, USA

Moderator
Jan-Martin Wiarda, Journalist for Education and Research, Germany

HOW CAN SCIENCE CHANGE THE WORLD FOR THE BETTER?

Panellists
- Vinton Cerf, VP and Chief Internet Evangelist, Google, Inc., USA
- Steven Chu, Physics Department, Stanford University, USA
- Tim Luce, Head of the Science & Operations Department, ITER, France
- Adriana Marais, Director, Foundation for Space Development, South Africa
- Brian P. Schmidt, The Australian National University, Australia

Moderator
Karen Kahaner, Director in Global Education Companies and Institutions, Singapore & United Kingdom

STUDENT, POSTDOC, AND THEN? – AIMING FOR A CAREER IN SCIENCE

Panellists
- Niamh Kavanagh, University College Cork, Ireland
- Wolfgang Ketterle, Research Laboratory for Electronics, MIT Massachusetts Institute of Technology, USA
- William D. Phillips, Laser Cooling and Trapping Group, National Institute of Standards and Technology (NIST), USA
- Donna Strickland, Department of Physics and Astronomy, University of Waterloo, Canada
- Maria Zurek, Lawrence Berkeley National Laboratory, USA

Moderator
Alaina Levine, President, Quantum Success Solutions, USA
Poster Presentations allow young scientists to present their research to fellow young scientists and Nobel Laureates. Three hundred young scientists applied for this opportunity – 30 have been chosen by Lindau Alumni peer reviewers. These 30 were also invited to pitch their posters during the two-minute Poster Flashes before they were then exhibited in the Inselhalle to stimulate discussions between participants.

For the first time, a further 70 young scientists had the chance to show their posters in a digital format during the meeting week. In total, this enabled 100 young scientists to present their highly diverse research posters at #LINO19. Among others, the following topics have been covered:

- Quantum Physics
- Astrophysics
- Material Sciences
- Solid-State Physics

The 30 posters selected for the traditional poster session were also eligible for the poster prize. In a public vote, the participating Nobel Laureates and young scientists voted for five posters which took the top three places.

The Winners

1st Place
Vanessa Graber – McGill Space Institute, McGill University, Canada
for her poster

PROBING NEUTRON STAR ASTROPHYSICS WITH LABORATORY EXPERIMENTS

2nd Place
Aonan Zhang – College of Engineering and Applied Sciences, Nanjing University, China
for his poster

QUANTUM AND CLASSICAL BEHAVIOURS IN CONTEXTUALITY TESTS

3rd Place
Gavin Macauley – School of Physics and Astronomy, University of Glasgow, United Kingdom
for his poster

ICE-RULE MADE MANIFOLD: PHASE TRANSITIONS AND TOPOLOGICAL DEFECTS IN 2-D ARTIFICIAL SPIN SYSTEMS

3rd Place
Fabian Mooshammer – University of Regensburg, Germany
for his poster

QUANTUM MATERIALS ON THE FEMTOSECOND AND NANOMETER SCALE

Two young scientists use the new e-poster format for discussion.

Vanessa Graber presenting her prize-winning poster.

Markus Parzefall from the ETH Zurich in front of his poster.

Scientific chairpersons Rainer Blatt and Lars Bergström framing the poster prize winners Fabian Mooshammer, Gavin Macauley, An Pan, Aonan Zhang and Vanessa Graber.
Master Classes

TOPOLOGY & PHYSICS: TOPOLOGICAL MATERIALS, SKYRMIONS chaired by Albert Fert
Speakers
– Edoardo Albisetti, Politecnico di Milano, Italy
– Kai Litzius, Massachusetts Institute of Technology (MIT), USA
– Helena Reichlová, Technische Universität Dresden, Germany

TEACHING PHYSICS chaired by Carl E. Wieman
Speakers
– Sarah Guerin, Bernal Institute, University of Limerick, Ireland
– Sébastien Philippe, Harvard University, USA
– Philine van Vliet, University of Amsterdam, Netherlands

MANIPULATION OF INDIVIDUAL QUANTUM SYSTEMS chaired by Serge Haroche and David J. Wineland
Speakers
– Jan Goetz, Aalto University, Finland
– Elena Jordan, National Institute of Standards and Technology (NIST), USA
– Ashwarya Kumar, The Pennsylvania State University, USA
– Guoji Zheng, Delft University of Technology, Netherlands

THE TRANSIENT UNIVERSE chaired by Brian P. Schmidt
Speakers
– Vivien Bonvin, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
– Marilyn Cruces, Max Planck Institute for Radio Astronomy, Germany
– Hester Schutte, Northwest University, USA
– Sebastian Völkel, University of Tübingen, Germany

Scientific Programme of #LINO19
The Science Breakfast hosted by the Lindau Nobel Laureate Meetings offered the chance to start the meeting day with a stimulating discussion. The scientific input by a panel at the beginning of the breakfast and ice-breaker questions led to diverse discussions on material sciences, new technologies, science policy and society. Hence, the Science Breakfast topic at #LINO19 – Graphene – illustrated how complex the relation between academia, technology and society can be.

**GRAPHENE**
hosted by the Lindau Nobel Laureate Meetings

Panelists:
- Jari Kinaret, Director, Graphene Flagship, Chalmers University of Technology, Sweden
- Klaus von Klitzing, Max Planck Institute for Solid State Research, Germany
- Sir Konstantin S. Novoselov, University of Manchester, United Kingdom/National University of Singapore

Moderator:
Adam Smith, Chief Scientific Officer, Nobel Media AB, Sweden

GLOBAL SCIENCE IN REACHING FOR THE STARS
hosted by South Africa

Panelists:
- Frank Bradley, Senior Developer – Project Lead, South African Radio Astronomical Observatory, South Africa
- Thebe Medupe, Deputy Dean, Community Engagement and Stakeholder Relations, North West University, South Africa
- Brian P. Schmidt, The Australian National University, Australia
- Buyisiwe Sondezi, Lecturer in Physics, University of Johannesburg, South Africa

Moderator:
Beverley Damonse, Group Executive, Science Engagement and Corporate Relations, National Research Foundation, South Africa

EXCELLENCE IN SCIENCE AND EXPLORATION
hosted by Rolex SA

Panelists:
- John C. Mather, Goddard Space Flight Center, NASA, USA
- Andrew McGonigle, Department of Geography, The University of Sheffield, United Kingdom

Moderator:
Francesco Raeli, Rolex SA
Sessions of the Scientific Programme of #LINO19

**Panel Discussions**
- Topical and Relevant Issues
- Discussions involving the Audience

**Breakfast Sessions**
- Early Morning Discussions
- 4 Partner & 1 Science Breakfast
- Presented by Partners and the Lindau Meetings

**Panelists**
- Levke Caesar, Potsdam Institute of Climate Impact Research, Germany
- Sylvia Earle, Marine Biologist, Explorer, Author and Lecturer, USA
- Donna Strickland, Department of Physics and Astronomy, University of Waterloo, Canada

**Moderator**
- Meeri Kim, science journalist, USA

**Panelists**
- Rebecca Meißner, Institute for Ion Physics and Applied Physics, University of Innsbruck, Austria
- Rainer Weiss, LIGO MIT, USA

**Moderator**
- Olaf Reimer, Institute for Astro- and Particle Physics, University of Innsbruck, Austria

**Partner Breakfasts**

**BIG SCIENCE: IS THERE STILL ROOM FOR THE ONE BRIGHT IDEA?**
- Hosted by the Austrian Federal Ministry of Education, Science and Research

**Panelists**
- Rebecca Meißner, Institute for Ion Physics and Applied Physics, University of Innsbruck, Austria
- Rainer Weiss, LIGO MIT, USA

**Moderator**
- Olaf Reimer, Institute for Astro- and Particle Physics, University of Innsbruck, Austria

**Panelists**
- Levke Caesar, Potsdam Institute of Climate Impact Research, Germany
- Sylvia Earle, Marine Biologist, Explorer, Author and Lecturer, USA
- Donna Strickland, Department of Physics and Astronomy, University of Waterloo, Canada

**Moderator**
- Meeri Kim, science journalist, USA
The Innovation Forums were established in 2010 upon the initiative of Nobel Laureate Martin Chalfie. Their aim is to bring together top-level scientists and business executives for an informal exchange on current problems and solutions for tomorrow.

The Innovation Forum of the 69th Lindau Nobel Laureate Meeting featured some innovations in its own format: a new venue, a new programme structure and an increased exchange between the participants.

Thematically, the Innovation Forum explored the second quantum revolution, and shed some light on the question of whether it is hype or reality.

In the early 20th century, Albert Einstein, Werner Heisenberg, Erwin Schrödinger, Niels Bohr, John von Neumann and many others developed the theoretical framework of quantum mechanics, which turned out to be an extremely useful description for the outcome of experiments, though based on axioms to account for the observed quantum phenomena. Subsequent applications based on and making deliberate use of quantum properties, such as wave-particle duality, the uncertainty principle and the probabilistic description of measurements allowed for the development of modern devices, such as lasers, transistors, magnetic resonance imaging and many more – a development often termed the first quantum revolution.

In the last decades of the 20th century, creating and mastering the manipulation of superpositions and entanglement became routinely feasible. An enhanced understanding of these phenomena enabled scientists to develop new technologies facilitating nonlocal operations useful for communication purposes and enhanced metrology tasks. Quantum protocols, such as teleportation, quantum key distribution and entanglement swapping have enabled the development of completely new communication tools. The creation and manipulation of highly non-classical entangled states allow for enhanced precision measurements and even new computational methods. This development is often referred to as the second quantum revolution, since the newly available quantum control holds the potential to revolutionize a number of different technology fields. Quantum technologies promise secure communication via quantum cryptography as well as quantum simulators and quantum computers, which have the potential to help solve problems that are currently intractable, possibly leading to revolutionary materials and chemical processes.

Over the last years, this has led to worldwide research efforts to further understand these quantum phenomena for technical applications. Big technology leaders currently make huge investments in the quest for quantum technologies. More than a hundred start-up companies have been established globally during the last few years, striving for innovative quantum protocols and quantum devices. Governments worldwide recognize the emerging fields as future strategic key technologies and invest huge amounts of money.

The race for new quantum technologies is on. However, what can we actually expect as an outcome of this? Which promises are merely hype, and which envisioned goals will lead to real innovations? Which quantum technologies will become relevant for industry and consumers, and when will they become available? These were some of the questions discussed at the 12th Lindau Innovation Forum.

Session I: Quantum Communication
Quantum Communication: Past, Present and Future
Jianwei Pan, University of Science and Technology of China
Quantum Communications in the Real World
Gregoire Ribordy, ID Quantique SA, Switzerland
Discussion Moderator
Martin Hellman, Jianwei Pan, Gregoire Ribordy
Moderator
Jan-Martin Wiarda, Journalist for Education and Research, Germany

Session II: Quantum Metrology and Sensing
Quantum Sensing: New Paradigms for Precision Measurements
Jörg Wrachtrup, University of Stuttgart, Germany
Quantum Sensors at Bosch
Thomas Strohm, Robert Bosch GmbH, Germany
Discussion
David Wineland, Jörg Wrachtrup, Thomas Strohm
Moderator
Jan-Martin Wiarda

Session III: Quantum Computation & Simulation
Quantum Computing with Superconducting Circuits
Andreas Wallraff, ETH Zurich, Switzerland
Quantum Computing with Atoms: From Research to Engineering
Chris Monroe, Joint Quantum Institute & IonQ, USA
Quantum Computing – Towards Applications
Heike Riel, IBM Research – Zurich, Switzerland
Discussion
Serge Haroche, Andreas Wallraff, Chris Monroe, Heike Riel
Moderator
Jan-Martin Wiarda

Serge Haroche, Heike Riel, Andreas Wallraff, Chris Monroe
Jan-Martin Wiarda, Martin Hellman, Jianwei Pan, Gregoire Ribordy
David Wineland, Jörg Wrachtrup, Thomas Strohm

Innovation Forum of LINO19
Impressions

Young scientist Noelia Fernández giving a presentation during the Poster Flashes

Johann Deisenhofer in discussion with young scientists

Hartmut Michel during his Agora Talk

Agora Talk with Brian Josephson

Carlo Rubbia
Social Programme

Summer Festival of Science

Hosted by the German Federal Minister of Education and Research Anja Karliczek

Reception at Eilguthalle, Lindau

Welcome Addresses
– Anja Karliczek, Federal Minister of Education and Research
– Countess Bettina Bernadotte

Dinner at Eilguthalle, Lindau

International Day

Hosted by South Africa

Partner Breakfast: Global Science in Reaching for the Stars
hosted by South Africa (see pp. 72/73 for more details)

International Get-Together
hosted by South Africa

Musical Greeting
Marimboz

Welcome
Countess Bettina Bernadotte

Welcome Address
Bheki Hadebe, Director, High End Skills, Department of Science and Technology, South Africa

Moderator
Himla Soodyall, Chief Executive Officer, Academy of Science of South Africa (ASSAf)

Cultural Performance
Nomfusi

Bheki Hadebe

Himla Soodyall
**Bavarian Evening**

hosted by the Free State of Bavaria

Welcome Address
Countess Bettina Bernadotte

Words of Welcome
Bernd Sibler, Bavarian State Minister of Science and the Arts, Germany

Traditional Bavarian Music & Folk Dance
– Alphorngruppe Ebratshofen
– Die 4 Hinterberger Musikanten, Bavarian folk musicians, and performers in traditional attire

**Baden-Württemberg Boat Trip**

hosted by the State of Baden-Württemberg

Welcome Address
Ulrich Steinbach, Deputy Minister of Science, Research and the Arts, Baden-Württemberg, Germany

Exhibition
Presentations by selected research institutions and projects of Baden-Württemberg

Poster Awards Ceremony
Winners of the #LINO19 Poster Sessions (see pp. 46/47 for details)

Science Picnic
hosted by the Ministry of Science, Research and the Arts, Baden-Württemberg
During a Science Walk, Nobel Laureates spend their time exploring picturesque spots in Lindau and its surroundings together with ten young scientists. It is yet another opportunity for informal discussions. A total of 17 walks were organised, taking place on two different days.

Joachim Frank  
David J. Gross  
F. Duncan M. Haldane  
Stefano W. Hell  
Brian D. Josephson  
Takaaki Kajita  
Wolfgang Ketterle  
Klaus von Klitzing  
J. Michael Kosterlitz  
John C. Mather  
Arthur B. McDonald  
William E. Moerner  
William D. Phillips  
Adam G. Rossi  
Donna Strickland  
Joseph H. Taylor  
Rainer Weiss

During a Laureate Lunch, one Nobel Laureate sits together with up to ten young scientists at a local restaurant in Lindau to talk informally over lunch. Almost all participating laureates took part in this format.

Ada E. Yonath with young scientists during a Laureate Lunch  
Science Walk with J. Michael Kosterlitz  
Science Walk with Wolfgang Ketterle  
Laureate Lunch with J. Georg Bednorz

upon invitation of the Lindau Nobel Laureate Meetings in cooperation with the City of Lindau

Welcome Addresses  
– Gerhard Ecker, Lord Mayor of Lindau  
– Countess Bettina Bernadotte

Donations  
The proceeds and donations were divided among two institutions for projects in the Lindau region: Mentor Stiftung Deutschland and the Degermoos marshland renaturation project.

Support  
– Continental AG  
– Stadtwerke Lindau

Thomas Görlies, Stadtwerke Lindau, Countess Bettina Bernadotte, Lord Mayor Gerhard Ecker and Norbert Hammerschmidt, Continental AG

Joachim Treusch, Lindau Alumni and CEO of the Wilhelm und Else Heraeus-Stiftung, welcoming the fellows of the foundation

Hosts  
Academy of Science of South Africa (ASSAf)  
Alexander von Humboldt Foundation  
Australian Academy of Science  
Austrian Federal Ministry of Education, Science and Research  
Bayer AG  
Continental AG  
Dieter Schwarz Stiftung gGmbH  
Elite Network of Bavaria  
German Academic Exchange Service (DAAD)  
Helmholtz Association of German Research Centres  
Max, Incorporated  
Max Planck Society  
Oak Ridge Associated Universities (ORAU), USA  
Wilhelm und Else Heraeus-Stiftung

Social Programme of LINOS19
Marshland Renaturation

Since 2018, the Lindau Nobel Laureate Meetings have supported the local Degermoos marshland renaturation project to help offset the carbon emissions generated by the meetings and the participants’ travel. But how does marshland renaturation work, and why is it the method of choice?

In intact ecosystems, CO₂ is captured and carbon is stored in vegetation and soil. When plants lose their leaves or die and are decomposed, CO₂ is released back into the atmosphere. Planting new trees or regrowing forests captures CO₂ which is used by plants for their growth. Carbon can be stored for decades or centuries in the tree’s biomass. The presence of and release of CO₂ into the atmosphere is actually important – it helps regulate the temperature by absorbing and trapping heat radiation. However, our industries, transportation and agriculture produce too much CO₂ too quickly. Our planet is heating up, with many negative and unpredictable consequences.

In marshes, water blocks oxygen from the layers below, creating an oxygen-poor environment. Under these conditions, dead biomass is turned into peat, which can store carbon for a long time. However, marshes also produce potent greenhouse gases like methane (CH₄). This, in combination with the carbon storage, makes marshes in a natural, balanced state more or less climate-neutral. Turning marshes into farmland is detrimental for the climate, as it releases large amounts of carbon previously stored as CO₂. Rewetting and renaturing marshlands stops and slowly reverses this process.

Marshes store vast amounts of carbon for a very long time, but the growth process is slow. Renaturating marshes is comparably fast and effective. Planting trees is fastest, but the capacity (per hectare) is lower.
“One of the things that I love so much about Lindau is that I’m constantly having conversations with young people and learning new stuff at the same time that I’m telling them things that I do.”

A Week on Mount Olympus

Gérard Mourou, Nobel Laureate in Physics 2018, visited Lindau for the first time this summer. In a personal review, he reflects on his experiences at the 69th Lindau Nobel Laureate Meeting and shares his impressions on being at the summit of science.

A Week on Mount Olympus

My week in the little town of Lindau on the shores of Lake Constance in Bavaria, Germany, was an unforgettable scientific experience. I will cherish my memories of this wonderful place and of the inspiring encounters with other laureates and young scientists.

Together with 39 Nobel Laureates, I met with 580 young scientists from around the world. All who I had the pleasure of encountering personally were passionate about knowledge and wanted to know more about the physical sciences as well as a career in academia. I felt like I had reached the Mount Olympus of science. What an immense privilege it was to bathe in this environment, where every scientist had contributed in a major way to advancing society through seminal discoveries or inventions. What a pleasure to take part and observe the intense, fruitful interactions between the Nobel Laureates themselves and of course between the laureates and the future generation of scientists, who were eager to learn from the laureates and hear their advice.

A relaxed atmosphere was vital for encouraging effective communication between young scientists and laureates. We broke the ice with scientific round table discussions, Master Classes and even a bit of a bop on the dance floor at the International Get-Together on the evening of the second meeting day. The array of various activities ranged from formal lectures delivered by some of the attending laureates to casual lunch breaks and Science Walks with one laureate accompanied by ten young scientists through the picturesque scenery in and around Lindau. In general, there were so many possibilities for intense personal and scientific exchange. My own highlights are discussions about the creation of the Universe and of particles: this switch from the simple to the complex in an attempt to answer the big question of whether life is unique or inevitable was a definite high point of the conference.

In such a relaxed atmosphere, the discussions were not unlike those you might have encountered if you happened upon Aristotle walking with his Peripatetic disciples or Goethe holding forth on nature. The high point of the week was when the conference decamped to the amazingly beautiful Mainau Island, where we heard the Yemeni Nobel Peace Laureate Tawakkol Karman speak movingly about the fight for democracy and human rights in her homeland. This was followed by a discussion entitled “How Can Science Change the World for the Better?” and a grand Science Picnic in the park of the small island – another opportunity to talk about scientific careers and research ethics with the meeting participants.

Although my Lindau experience is already now several months in the past, I have indelible memories of the week on this ‘Mount Olympus’, where every morning began with a long swim in the wonderfully calm lake before breakfast, with only the wild ducks and moorhens for company. Then came breakfast with a view over the lake, before I hurried back to join my colleagues and continue sorting out the world!

A video of Gérard Mourou’s first Lindau lecture ‘Passion for Extreme Light’ can be watched in the mediatheque.

Gérard Mourou with young scientist Tareem Afify

“What an immense privilege to bathe in this environment, where every scientist had contributed in a major way to advancing society.”

Gérard Mourou

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Eight Lessons from the 69th Lindau Meeting

#LINO19 young scientist Samer Kurdi is an experimental physicist and material scientist currently working on his PhD at the University of Cambridge. In his reflections on the 69th Lindau Meeting, he highlights eight key lessons that he has learnt in Lindau.

Samer Kurdi

July 2019 was the 100th anniversary of the total solar eclipse and the 50th anniversary of the moon landing and the coming together of 580 young scientists from 89 countries, joining 39 Nobel Laureates during the 69th Lindau Nobel Laureate Meeting. Each of these numbers represents something significant, and the people who make up the numbers even more so.

July 2019 was the 100th anniversary of the total solar eclipse that proved Albert Einstein’s general theory of relativity, the 50th anniversary of the moon landing and the coming together of 580 young scientists from 89 countries, joining 39 Nobel Laureates during the 69th Lindau Nobel Laureate Meeting. Each of these numbers represents something significant, and the people who make up the numbers even more so.

For the 580 young scientists at #LINO19, myself included, this came as a welcome reassurance. There are many times on a regular basis in this field where you wonder if your work is good enough and if you are doing the right thing – it was positive encouragement to hear that you CAN fail. That you CAN struggle. And you can ultimately succeed.

Career Paths Are Not Linear

On the panel discussion ‘Student, Post-Doc, and then? Aiming for a Career in Science’, three Nobel Laureates and two young scientists shared their stories, and it was clear that they had all taken different paths to achieve their goal. For example, Wolfgang Ketterle shared his experience as a “zig zag” – going from PhD to three different post-docs in three different fields, before ending up at the Massachusetts Institute of Technology (MIT).

Bill Phillips always wanted to be a scientist. He described the two main chapters of his thesis as completely different – one on precision and one on lasers. Based on the chapter on precision, he ended up at the National Bureau of Standards but his lasers knowledge was important for that role – showing how no knowledge is wasted, and that the coming together of opportunity and learnings can open new doors in your career.

Learn Something New and Have Fun Doing It

Every Nobel Laureate I encountered – whether it was on a panel, giving a presentation, over breakfast or during a Science Walk – was passionate about his or her work, field of research and science as a whole. To me, this means that to be curious and open-minded, and to work where your passion lies, is ultimately where your strength and success will come from.

Challenging the Status Quo

Throughout the week, many of the founders of the quantum revolution said there are a number of theories that were proven to be wrong, and statements that have subsequently been challenged; Einstein doubted his prediction of gravitational waves, which was subsequently detected by LIGO. Schrödinger even stated in 1952 that “We never experiment with just one electron or atom or small molecule”, which is now very common.

Challenging the status quo evolves scientific theories and practices, and these evolutions require an individual team or research group to stand firm in their beliefs and work, regardless of existing understanding.

Science Can Change the World for the Better!

The opening lecture by Brian Schmidt was entitled ‘Big Questions for Society, Big Questions for Research’, and it stayed with me throughout the week.

Schmidt spoke of political instability and uncertainties, technological advancement at an unprecedented scale and unsustainable use of the Earth’s resources. He emphasised that the 580 young scientists from 89 different countries can work together, participate in areas outside of our existing fields, and use the scientific framework to make a positive impact on the world.

Everybody Loves a Quote

During the 69th Lindau Meeting, many quotes have been shared formally and informally, so it seemed apt that I end this article with just one more that was told by John C. Mather: “Nature is complex and our imagination doesn’t take us that far, so we need to keep dreaming and be curious.”

John C. Mather
The Lindau Experience

Intersection of Science and Society – The Lindau Experience

South Africa hosted the International Day at the 69th Lindau Nobel Laureate Meeting. Himla Soodyall, Executive Officer of the Academy of Science of South Africa, gives a personal account of her week in Lindau and explains why it was a ‘Wow!’ moment in her life.

After months of preparations, the time had come for South Africa to host the International Get-Together on 1 July 2019. Soon after midnight, the bright colours of the South Africa table settings and decorations, affirming the richness of South Africa’s cultural heritage, drew the spirit of celebration. After all, we had a lot to celebrate. It was our moment to bring South African hospitality to the world-stage – and we were ready to do this, than in Lindau, among Nobel Laureates, the world’s most accomplished academic achievers, and to have an opportunity to showcase South African science.

After welcoming all the guests to the evening, I shared with the audience that exactly four years ago today, the Academy of Science of South Africa (ASSAf) signed a memorandum of understanding (MoU) to be part of the Lindau Meetings family. Hosting the International Get-Together was a momentous occasion for South Africa. The house was entertained by Nomumzi – a young female artist who brought the sounds of South Africa to the stage and it was difficult to get people off the dance floor to follow the programme. For the first time in the history of the Lindau Meetings, dancing preceded the dinner.

Bhekisile Hadebe, who represented the Department of Science and Innovation (DSI) at the meeting, reminded us in his address at the dinner that “physics research in South Africa dates back to 1820, when the astronomical observations of Sir John Herschel at the Royal Observatory in Cape Town in the 1820s. On the international scene, South Africa was a founding member of the International Union of Pure and Applied Physics (IUPAP) in 1935. The South African Institute of Physics (SAIP) was established in 1955. Even during the apartheid era, SAIP membership was open to all races and genders and its constitution never differentiated on these attributes.”

Between 2012 and 2018, 50 young South African scholars had participated in the Lindau Meetings. I had the privilege of meeting some of the Lindau Alumni, together with the 20 young scientists who were selected to attend #LINO19. From the alumni I heard stories of how the Lindau experience had empowered them to advance their own careers. ASSAf, in partnership with the DSI, is going to produce a publication capturing these stories in the next year.

Promptly at 19.00 hrs the vibrant sounds of the marimba drums, singing and clapping filled the entrance hall. The Marimboz band and Xhosa dancers performed energetically and drew the attention of the spectators, including me, to the dance floor. I have a love for marimba-style music and allowed myself to be drawn into the spirit of celebration. After all, we had a lot to celebrate. It was our moment to bring South African hospitality to the world-stage – and where better to do this, than in Lindau, among Nobel Laureates, the world’s most accomplished academic achievers, and to have an opportunity to showcase South African science.

Damonse captured the essence of what the International Day meant to South Africa, commenting that hosting “was a really important opportunity for us to show the global community how seriously we take science, technology, and innovation. We need to continue to make our voice heard in these global conversations.”

Over the rest of the week, the South African delegation was treated to all that the meeting could offer – excellent presentations, engagement with Nobel Laureates, discussing their research and interests with fellow young scientists from all over the world and networking. We had an opportunity to dine with Nobel Laureate Donna Strickland one evening and participated at the various events with the best of the best with mutual respect.

Personally, the Lindau experience was a ‘WO.W’ moment in my own journey:

‘W’: wonderful showcase for science and the way science is integrated into our daily lives without us truly appreciating the work that goes on behind the scenes.

‘O’: opportunity – to meet ordinary people who have made extraordinary contributions to science in the world of physics, chemistry and biology and who unstintingly work to improve the world for future generations. More importantly – the opportunity to be the first country from Africa to host such an occasion.

‘W’: willingness to share experiences, tell stories and to inspire.

A quote from the late former President Nelson Mandela aptly summarises what the Lindau Nobel Laureate Meetings epitomise: “Young people must take it upon themselves to ensure that they receive the highest education possible so that they can represent us well in the future as future leaders.”

“To be in a room with Nobel Laureates and other scientists from the same discipline really is what I call that ‘Wow!’ moment.”

Himla Soodyall
Impressions

Dan Shechtman in discussion with young scientists

Get-together outdoors

Joseph Taylor and young scientists exploring the Lindau Science Trail

Morning workout at LINDO19
The results are available as a video and as an article in Nature Outlook.

Don’t Lecture Me!

Nobel Laureate Carl Wiemann and several education practitioners and educators discussed the educational technique of active learning during the 69th Lindau Nobel Laureate Meeting. The results are available as a video and as an article in Nature Outlook.

Rather, the technique is used by people across the world and it has been described in a large number of studies and publications. Simply put, the idea behind active learning is that the brain needs to exercise continuously to form new neural connections, which strengthen decision-making and in doing so rewires the brain. Passively listening to lectures does not help the brain to exercise, actively thinking about right or wrong explanations and paths to follow does.

In science and engineering fields, decisions to be exercised and made are usually: What concepts and models are relevant? What information is relevant, irrelevant or needed? What approximations are appropriate? What method(s) can be used to pursue potential solutions? What criteria can be used to test results? Wieman also claims that active learning works equally well in non-STEM disciplines.

Active learning methods have been implemented in various departments and courses, including the Science Education Initiative headed by Wieman at the University of British Columbia, Canada. The vast majority of active learning cases have involved implementation at the undergraduate university level in the United States — so the obvious questions are a) is the approach applicable to other levels, and b) is it transferable to other countries and cultures?

Wieman tells the anecdote of how he once explained his method at the University of Tokyo, and all faculty members told him that this would never work in Japan because of cultural differences. However, when he was talking directly to and with the students they very actively engaged in the discussion and did not hesitate at all to engage in active learning. It seems that even though teaching practices may vary widely around the world, learning may be more universal. “It is all about changing the norms of the classroom,” concludes Wieman.

As for earlier stages of education, such as kindergarten or elementary school, he admits that not a lot of research data are available and that active learning definitely becomes more difficult to measure because there are many more factors in play and environments are not as controllable as those in a university setting. The cognitive and neural mechanisms of active learning should, however, apply equally to all ages in principle.

John Rogers, dean of studies at Phillips Academy Andover, USA, notes that some version of active learning is absolutely the norm at institutions that have a teaching at and teachers no longer just practice lecture-style instruction and set tests. But is that also the norm at public schools and regular universities? In any case, Carl Wieman claims that it is not a question of money. Active learning requires some extra training for the teachers, but does not cost more money or require more time than traditional teaching. It also works with large class sizes up to several hundred students. Further, all educators who have been trained in active learning prefer the method to their previous approach.

Leslie Medema, head of the Green School in Bali, has a lot of practical experience with active learning. At her institution, teachers and students jointly decide what and how they are learning. But she reminds us that not all students are the same, and that some are more introvert than others and need other ways of being taught. “For a majority of students, active learning is probably most powerful, but we can’t forget about those of us who sit in that back row,” says Medema.

Additionally, Wieman points to the issue of measuring the quality of teaching overall: “Right now, the evaluation of teaching is extremely hard to put it diplomatically, terrible.” “Without a good assessment, we can’t really measure if we are doing what we are trying to do,” adds John Rogers. But Michael Schratz, professor of education at Innsbruck University, Austria, emphasizes another point: “If you only use evaluation sheets, what evidence is that? It is an immediate impression, but it is not about the sustainability of knowledge, and this is what matters.” Carl Wieman agrees because he has done some research spanning a two-year period (where students taught with active learning methods still perform better). However, studying the long-term effects of teaching methods is very complicated.

What we need to learn has dramatically changed over the past couple of hundred years, from algebra and writing to very complex and extensive topics that are currently taught at universities. The question remains: Why have teaching methods not changed accordingly to adapt to this new complexity?
Nobel Laureate Adam Riess had a busy third day at the 69th Lindau Nobel Laureate Meeting, presenting a lecture, debating in a panel session and meeting for an open exchange with young scientists. He was in demand not only because he was visiting the Lindau Meetings for the first time, but also because his work tackles cosmological questions we have all asked at some point in our lives. When was the universe created? How will it end? And what is it made of?

Riess’ Nobel-winning research, shared with Saul Perlmutter and Brian Schmidt, provided strong evidence for an answer to the second question. To get there, the researchers focused on measurements of one of the most important parameters in cosmology – the Hubble constant. The Hubble constant gives the rate at which the universe is expanding today from the Big Bang. Scientists already knew the Hubble constant was not constant (in time at least, it is however the same and therefore constant throughout space). In the distant past, the universe’s expansion rate was much larger, and then it shrank as the universe expanded.

It was therefore a complete surprise when Riess and Schmidt, and colleagues from the SHOES (Supernovae H0 for the Equation of State) collaboration measured the Hubble constant to be 74 km/s/Mpc, with a precision of 1.9%.

To get to such a level of accuracy, Riess explained that his team had to build a strong ‘cosmic distance ladder’. This entailed measuring accurate distances to nearby galaxies and then moving to galaxies farther and farther away. For relatively nearby galaxies, the team used standard candles called Cepheid variables, common stars that pulse at predictable rates that indicate their intrinsic brightness. For those farther away, they could also use much brighter but rarer cosmic yardsticks: exploding stars called Type Ia supernovae. By comparing these distances to measurements of an entire galaxy’s light, they could then calculate how fast the cosmos is expanding: the Hubble constant.

Yet despite its accuracy, this value surprisingly doesn’t match with the one derived from another key technique for calculating the universe’s expansion rate. ESA’s Planck satellite, which maps the cosmic microwave background – the relic afterglow from the Big Bang – was used by researchers including Nobel Laureate George Smoot to calculate how fast the universe was expanding when it was just 380,000 years old. They extrapolated this value forward to today and came to a Hubble constant value of 67 km/s/Mpc.

This mismatch presents a big problem for the current model of the universe, known as ΛCDM. “If we have reached a point of confirmation of this discrepancy, then we have to imagine new physics in ΛCDM,” Riess said.

Riess only hinted at what this new physics could be during his lecture, making the subsequent panel discussion (ominously titled ‘The Dark Side of the Universe’) in which some of these possibilities were explored all the more eagerly anticipated. The discussion focused exclusively on dark matter and dark energy are very phenomenological… that’s not a complete description of their physics.”

Adding a cosmological constant essentially has an anti-gravity effect on the universe, allowing it to push itself apart when it should be slowing down. What this anti-gravity effect is, however, remains a complete mystery. At least, a mystery to most: “I really don’t like the term dark energy”, said Nobel Laureate David Gross. “It isn’t dark, it isn’t mysterious – it’s the only form of energy and pressure that looks the same to all observers.”

While dark energy is expanding space everywhere, dark matter – the second mystery – has an opposite binding effect on matter in the universe. It is an invisible substance forming a universal cosmic web. This cosmic web is thought to help form galaxies and prevent them from spinning apart.

Like Gross on dark energy, Riess was keen to downplay dark matter’s dark credentials. “One of my favourite observations is of the Bullet Cluster where you see two clusters of galaxies pass through each other in a collision”, he said. “Luminous matter is shocked and heated and left behind a little bit, and the dark matter separates and moves on, and you can actually see it.” But he added: “Our current descriptions of dark matter and dark energy are very phenomenological… that’s not a complete description of their physics.”

So, although these two dark constituents of the universe may not be as dark as we thought, there is still an awful lot to learn about them – a good reason for young scientists attending the 2019 Lindau Meeting to illuminate the dark side of the universe.
Fighting for Democracy and Human Rights in Yemen

Yemeni Nobel Peace Laureate Tawakkol Karman inspired the #LINO19 participants with her attendance at the conclusion of the Lindau Nobel Laureate Meeting on Mainau Island. Science writer Meeri Kim on Karman’s life and her struggles for peace and democracy.

She garnered international attention after playing a key role in the 2011 pro-democracy youth uprising in her home country of Yemen, which was under the dictatorial regime of President Ali Abdullah Saleh at the time. Later that year, Karman became the first Arab woman and second Muslim woman – as well as the youngest recipient at the time, at 32 – to receive the Nobel Peace Prize.

In conversation with Adam Smith, Chief Scientific Officer of Nobel Media, Karman discussed her ongoing promotion of democracy and human rights in Yemen, the country’s current humanitarian crisis, and what might be done about it.

“I am really so proud to be with you here, along with these huge scientists who changed the world, and my great colleagues – and I am so proud to say they are my colleagues –, and also you as the young people who will be the next Nobel Laureates and the next leaders of the world,” said Karman to the audience.

From a young age, Karman recognised the power of speaking out against political oppression. She organised several student rallies in Sana’a, the largest city in Yemen, while earning her degree in political science from Sana’a University. Later, she used journalism as a gateway to activism, writing candidly about the regime’s injustices and civil rights violations, despite Yemen’s severe restrictions on press freedom. In 2005, she co-founded the group Women Journalists Without Chains to promote freedom of expression and democratic rights.

Karman credits her father, a lawyer and politician, as an early influence on her strong character and boundless courage: “Since I was a child, the first question I was asking my father was ‘What can I do for my country?’ I was never asking, what can you do or what can the government do,” she said. “Always, he told me to be responsible, to carry the initiative, to do something and also to be in the front line.”

From 2005 to 2010, she regularly led demonstrations and sit-ins in Tahiri Square. Many thought she would get bored and eventually give up, but the situation suddenly swung in her favour in late 2010, when the Arab Spring began to sweep across the Middle East from Tunisia. She gained prominence in her country as a leadership figure, becoming known as the ‘Mother of the Revolution’ and paving the way for the participation of women in peace-building work.

However, with her struggle for democracy has come an arrest, threats on her three children’s lives, and even an attempted assassination. Her opponents have tried everything to scare her into compliance, but without as much as an inch of success. “When they arrested me, they made me stronger than before. When I was weak, I was a little afraid because they can reach me and my kids,” she said. “But when they arrested me – and they were so stupid when they did that – they made my voice stronger, and they gave me more power inside Yemen and outside Yemen.”

Although President Saleh finally resigned in 2012 after the Yemeni revolution, Karman’s mission is far from over. Her country is currently suffering through what the United Nations has called “the world’s worst man-made humanitarian disaster.” Yemen is in the midst of a civil war; now in its fourth year, that has left 24 million people – an estimated 80 percent of the entire population – in desperate need of aid or protection. Civilians are being injured or killed at an alarming rate, and millions more are malnourished, homeless, or sick with cholera.

But Karman and the Yemeni people haven’t lost hope. “I speak about the Yemen of my childhood, it is the same Yemen that I am living in now because I never left. The Yemen in my mind is the great Yemen,” said Karman. “The most important thing that we have is a great people, a very strong people who want to change their situation and who made the greatest peaceful revolution against the dictator Ali Abdullah Saleh.”

A video of the interview with Tawakkol Karman is available in the mediatheque.
Quazi Rushnan Islam is a young scientist from the University of Dhaka, Bangladesh. Her research aims to increase the efficiency of conventional silicon-based solar cells. Science writer Ulrike Böhm interviewed her about her career, her advice for other women in research and her experience at #LINO19.

““To me, every coffee table was hosting a unique mini-international conference on interdisciplinary research.””

Quazi Rushnan Islam

Ulrike Böhm: What inspired you to pursue a career in science?
Quazi Rushnan Islam: When discussing the applications of electromagnetism, my high school teacher told me to investigate the physics behind a credit card swipe. On a mission, I went home and started researching the topic. I was awestruck by the fact that the technology behind the black magnetic stripe on a credit card was derived from basic principles I learned in class! I was amazed by this intricate fusion of physics and engineering has had on the way we transact money. From then on, whenever my dad paid the restaurant bill, rather than fighting over the last piece of pizza, I would stare at the card reader slot and visualise all the imaginary flux lines around the black stripe. From that moment on, I knew science was for me.

UB: What is the coolest project you have worked on and why?
QRI: In my junior year, I had the opportunity to take part in the Student Small Satellite (SSS) project directed by the Asia Pacific Space Organization (APSCO). The three-year-long project is a collaboration between eight countries aimed to give students hands-on experience in satellite engineering. The project aspires to launch one microsatellite and two cubesats in 2020. During the summer camps hosted in Beihang University, China, and Middle Eastern Technical University, Turkey, I worked on activities with students of different academic backgrounds. Such an experience helped me appreciate the advantages of working in an interdisciplinary environment; every individual can add a different perspective when problem-solving. For example, when designing a solar panel for a particular satellite mission, I would have to ask a variety of questions: How much solar radiation would the satellite receive at the particular orbit height? How long will it be in the shadow? How much power will be consumed by the different subsystems? What kind of radiation hardness will be required of the solar cell material? How will I protect the panels from the debris in space? This kind of questioning helped me see that an informed decision can only be made if interdisciplinary participation is fostered. The successful launch of the three satellites next year would mean that every scientist and engineer correctly applied their knowledge in this cool scientific concert!

UB: What advice do you have for other women interested in science?
QRI: I absolutely loved the Open Exchanges with the Nobel Laureates. When a Nobel Prize is awarded, we are mainly informed about the science behind the discovery. However, at the Open Exchanges, I got the opportunity to know the minute details of the countless struggles behind the journey to that discovery. I especially enjoyed asking endless questions at the Open Exchange with Nobel Laureate Donna Strickland—

To hear about her struggles during her PhD and later in her work life was both heartening and eye-opening. Every person in the room, including me, could relate to the difficulties she had faced.

Furthermore, the random conversations with other young scientists over coffee at the Inselhalle were most enjoyable. In just a few minutes, I learned about the different research cultures in various countries alongside learning about ongoing research projects in biology, chemistry and astrophysics conducted by the young scientists. To me, every coffee table was hosting a unique mini-international conference on interdisciplinary research. I believe you can only get such a rich and diversified environment at Lindau!

UB: What should be done to increase the number of female scientists and female professors?
QRI: I am excited to see how the concepts of nanophotonics will revolutionise the solar cell industry. I cannot wait to see the day when solar cell efficiencies skyrocket to the point that non-renewables do not stand a chance when it comes to costs. Hence, all you need is will power. Also, as a consequence of being offered a rare chance to conduct research at a prestigious institution, many will question whether or not you are deserving of the offer—many will attribute it to being given special treatment for being a woman in the STEM field. However, such questions will become irrelevant when the results of your research are made apparent. Therefore, focus on doing excellent work that advances the field instead of giving weight to peripheral concerns.

UB: In your opinion, what will be the next great breakthrough in physics?
QRI: I am particularly curious about the possibilities in nanophotonics. Every new experiment I read about makes me think that nanophotonics will revolutionise our daily lives. For instance, when you insert a card into a card reader slot, it is the application of nanotechnology which allows the electron to be captured. If nanophotonics continues to develop, it could lead to a breakthrough that makes all our life transactions more secure. I would love to be a part of that revolution.

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A Bit(e) of Science: The Grill & Chill at #LINO19

At the Grill & Chill at #LINO19, Nobel Laureates, young scientists and citizens of Lindau gathered in an informal, inclusive and culturally diverse atmosphere. Science communicator Andrei Mihai shares his impressions of this get-together.

Few things are constant in life, and food is most certainly one of them. At the 2019 Lindau Nobel Laureate Meeting citizens of Lindau and meeting participants – including Nobel Laureates as well as young scientists – gathered in lovely Toskanapark for one of the simplest pleasures of life: a barbecue.

The symbolism is remarkable. You usually have a barbecue with your friends and family – and at the Grill & Chill, the crowd felt just like one big group of friends. You could talk to anyone about anything, everything was informal, casual and fun.

This atmosphere of internationality and tolerance is also supported by the host families programme in Lindau. For eleven years already, volunteer host families from Lindau and the surrounding areas have welcomed young scientists from all over the world. This programme allows young scientists to experience Lindau, its people and its culture first-hand, often creating long-lasting friendships. Brigitte Trojan and Hans Schweickert, who have been hosting young scientists for eight years, say they love this opportunity. They are also happy to stay in touch with their guests after the meeting (take note, young scientists).

"You never know who you will get, it’s like a Christmas gift,” Brigitte says. "I am so happy when they write a letter to us, but I understand they are very busy doing science," she adds in a heartwarming manner.

Across the table, a couple of Afghan refugees don’t speak English, but they converse in perfect German. They’ve been in Lindau for a few years and they love it. Their three-year-old daughter speaks German as a native language. She’d rather play than eat, spreading contagious energy as she runs around.

Meanwhile, other people were more interested in the food. Barbecuing for a thousand people is no easy feat, and the queues snaked around the wooden benches. Some went straight for the Bratwurst, others preferred to have a drink and wait until the queue was smaller. Although it’s safe to say that most people in Lindau are aware of the Lindau Nobel Laureate Meetings, many guests were participating in the Grill & Chill for the first time. It was a great opportunity to spread the word about the meeting and further propagate its message. This was not without effect, and it wasn’t long before children at the event were asking questions about what it’s like to be a scientist and what they need to do in order to become one. Who knew a barbecue can be so good at getting children interested in science?

Close by, Nobel Laureates such as F. Duncan Haldane, Bill Phillips, Serge Haroche and their families were also enjoying the atmosphere. It’s not every day that you get to crack jokes and discuss with Nobel Laureates in an informal way, but this is exactly what makes it so special: everyone is engaging with everyone, and this is what we need more of in the world – particularly in today’s context. In the age of rising nationalism, where research and expertise are sometimes cast aside by populism, showing the world that scientists are just as good-natured and human as everyone else is an important matter.

At #LINO19, that’s exactly what’s happening: the human side of science shows up.

All around the park, conversations flowed like water. The interesting part is that the more people talked, the more they came back to common themes like science, culture, society as a whole – a great reminder that our similarities are much larger than our differences. People were acutely aware of rising populism and disinformation and wanted to combat these trends, something which was uplifting. Again, food was a great unifier: what better way to bring people together?

In true Lindau spirit, sustainability was an important topic, and that was clearly visible at this social gathering. There was no plastic in sight, and waste was kept to a minimum. The food options also reflected this: aside from the traditional Bratwurst and Steak, there were also delicious vegetarian options and salads. The money raised from tickets at the event was rounded up by the organisers and donated to the Mentor Foundation Germany for workshops with students at local schools in Lindau as well as the Degermoos marshland renaturation project – which is a great way to offset the CO₂ emissions produced by meeting participants traveling to Lindau (see pp. 64/65).

All in all, it was a delightful and very useful evening. As they say: a small grill for scientists, but a giant grill for science.
“I have never interacted with so many international scientists in one space; that’s the best thing that has ever happened in my scientific career and it’s a memory I will keep for my whole life.”

Katekani Shingange, ILIND19 participant, Council for Scientific and Industrial Research, South Africa
It has become a tradition at the beginning of a new year that the Lindau Nobel Laureate Meetings invite citizens of Lindau to a lecture programme and subsequent reception to celebrate the awarding of the latest Nobel Prizes. In January 2019, two scientific chairmen and two Lindau Alumni gave accessible and entertaining presentations to explain the research findings of the laureates awarded with the Nobel Prize in 2018.

Presentations

THE NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE: JAMES P. ALLISON AND TASUKU HONJO
Henriette Uhlenhaut, Lindau Alumna of the 64th Lindau Nobel Laureate Meeting in 2014, professor at the Technical University of Munich, Germany

For this year’s Lindau Meeting, 1997 Nobel Laureate in Physics William D. Phillips relocated his laboratory from Maryland (USA) to the Lindau City Theatre for one day. During his live experiment ‘Time, Einstein, and the Coolest Stuff in the Universe’, Phillips explained basic phenomena in physics as well as his own scientific research in an entertaining and understandable way. What is time? How to explain Einstein’s theory of relativity? How does laser cooling work? These and other questions were the focus of a lively presentation.

The event took place on Friday evening before the official opening of the 69th Lindau Nobel Laureate Meeting and was especially aimed at interested citizens of Lindau. More than 500 people attended the live experiment and greatly enjoyed the laureate’s engaging presentation and his personable manner. At the end of the performance, Phillips answered questions from the audience.

A video of the life experiment with Bill Phillips can be watched in the mediatheque.

THE NOBEL PRIZE IN CHEMISTRY: FRANCES H. ARNOLD, GEORGE P. SMITH AND SIR GREGORY P. WINTER
Wolfgang Lubitz, Vice President of the Council and scientific co-chair of the Lindau Meetings dedicated to chemistry, Director emeritus of the Max Planck Institute for Chemical Energy Conversion, Germany

THE SVERIGES RIKSBANK PRIZE IN ECONOMIC SCIENCES IN MEMORY OF ALFRED NOBEL: WILLIAM D. NORDHAUS AND PAUL M. ROMER
Andreas Brunhart, Lindau Alumnus of the 5th Lindau Nobel Laureate Meeting in 2014, Head of Research Economics, Liechtenstein Institute

THE NOBEL PRIZE IN PHYSICS: ARTHUR ASHKIN, GÉRARD MOUROU AND DONNA STRICKLAND
Rainer Blatt, Member of the Council and scientific co-chair of the Lindau Meetings dedicated to physics, Professor of Experimental Physics at the University of Innsbruck and Scientific Director of the Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Science

Moderator

Hendrik Groth, Editor-in-Chief, Schwäbische Zeitung

Partners

City of Lindau
Schwäbische Zeitung/Lindauer Zeitung
Sparkasse Memmingen-Lindau-Mindelheim
The Lindau Nobel Laureate Meetings were honoured to welcome Her Majesty Queen Silvia of Sweden to their premises in Lindau in September 2019. During her visit, the Queen received an introduction to the mission of the annual Lindau Meetings, the unique ‘Lindau Spirit’ and signed the guest book of the meetings. Queen Silvia was accompanied by Countess Bettina Bernadotte whose roots are in the Swedish Royal Family – her late father Count Lennart Bernadotte, Co-founder of the Lindau Meetings in 1951 and Honorary President of the Council for the Lindau Nobel Laureate Meetings, was the grandson of the later King Gustav V of Sweden who presented the first Nobel Prizes in 1901.

The visit of Queen Silvia took place as part of the 25th anniversary of Mentor International. The foundation, which was established by Queen Silvia in 1994, organises workshops and mentoring projects to promote and inspire students. Countess Bettina Bernadotte is the chair of Mentor Foundation Germany. The Lindau Meetings support the foundation through the donations of the annual Grill & Chill event that takes place during the meeting (see pp. 84/85). The donations will be used for projects at schools in Lindau.

In 1977, NASA sent two identical phonograph records into the Universe on board of the interstellar spacecrafts Voyager 1 and Voyager 2. The ‘Voyager Golden Records’ contain the compressed knowledge of humankind in the form of images and sounds from the Earth as well as multilingual greetings and musical pieces. The records are meant to reflect the diversity of life and were intended to function as messages for any intelligent extra-terrestrial beings that may find them in the vastness of the Universe.

Which content could be sent today into space on an updated version of the Golden Record, nearly 40 years after the Voyager programme? This question was in the centre of attention during the musical soiree ‘Voyager 3’ on the final day of the 69th Lindau Nobel Laureate Meeting. John C. Mather, 2006 Nobel Laureate in Physics, and German songwriter Gisbert zu Knyphausen nominated, discussed and played their personal favourites for a Golden Record Update 2020 together with Swiss musicians Michael Flury and Hank Shizzoe. The evening was open to the public and organised by the Zeughaus Lindau e.V. in cooperation with the Lindau Nobel Laureate Meetings.

A recording of the Voyager 3 event with John C. Mather is available in the mediatheque.

Queen Silvia in Lindau

Queen Silvia signing the guest book of the Lindau Meetings

Queen Silvia on a guided tour through the Lennart-Bernadotte-Haus

Voyager 3

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Impressions

Wolfgang Ketterle and Steven Chu

Stefan Hell

Konstantin Novoselov in exchange with young scientists

Harald zur Hausen during his Laureate Lunch

Coffee break with F. Duncan M. Haldane
Attending a Lindau Nobel Laureate Meeting is a once-in-a-lifetime experience for young scientists and young economists that hopefully has a lifelong impact. Lindau Alumni share memories and motivation created by the unique ‘Lindau Spirit’. The alumni initiative of the Lindau Meetings aims to strengthen this community by identifying existing connections and retying loose ends. The connecting centrepiece of this effort is an online social platform: the Lindau Alumni Network.

Launched in 2017 and extensively updated in 2018, the Lindau Alumni Network aims to create a digital space for Lindau Alumni. In addition to a growing database, this online community includes tools that enable users worldwide to share their work, swap stories and find Lindau Alumni events. The Lindau Alumni Network is a further way to educate, inspire and connect.

The Lindau Meetings express their sincere gratitude to the German Federal Ministry of Education and Research for supporting the project. All former and future participants are invited to join this community and to enrich it with their own ideas and perspectives.

Log in to the Lindau Alumni Network at lindau-alumni-network.org

The Lindau Alumni initiative aims to extend the ‘Lindau Spirit’ beyond the boundaries of a weeklong conference. In addition to events organised by the Executive Secretariat in Lindau, meetups and workshops organised on the initiative of Lindau Alumni are an exciting addition to the Lindau Alumni community.

The highlight of the year for the Lindau Alumni initiative was the tour of NASA’s Goddard Space Flight Center (see p. 96). The series of webinars for Lindau Alumni produced by the Lindau Meetings with Alaina Levine has been continued. In April, Lindau Alumni in all career stages received advice on how to establish and leverage a mentoring relationship.

In September 2019, a Lindau Alumni Retreat took place in Heidelberg, Germany, with 13 alumni from the USA, Australia, Germany, Brazil, Romania and Norway. The group discussed research as well as equality in science, open science and mental health in academia. Moreover, Nobel Laureate Harald zur Hausen gave a lecture about his research on nutritional infections as risk factors for human cancers. The retreat was initiated and organised by 2018 Lindau Alumna Tanja Bhuiyan and colleagues.

The Lindau Nobel Laureate Meetings encourage alumni to engage in science outreach projects and in the future will continue to offer member-exclusive opportunities and events as well as seek to support Lindau Alumni in local initiatives.

In 2019, young scientists again had the opportunity to present their research to the Nobel Laureates and the Lindau community in the form of Master Classes and Poster Sessions. As part of their application for these additional formats, young scientists handed in about 430 abstracts in 2019. Continuing a collaboration that started last year, former participants got involved and acted as peer reviewers in the review process for the poster sessions and master classes. Lindau Alumni are closely connected to current, cutting-edge research, have already experienced the Lindau Meetings and are in a unique position to review the work of the new young scientists.

More than 40 Lindau Alumni volunteered to become peer reviewers and as such were actively involved in the meeting this year. We would like to thank all Lindau Alumni reviewers for volunteering their time and expertise and thereby giving back to the Lindau Meetings community. We are looking forward to continuing this successful cooperative effort for the upcoming interdisciplinary 70th Lindau Nobel Laureate Meeting and the 7th Lindau Meeting on Economic Sciences.

To find out more about volunteering as a reviewer or to suggest other Lindau Alumni projects, write to alumni@lindau-nobel.org.
On 15 February 2019, a group of Lindau Alumni visited NASA Goddard Space Flight Center. The NASA facility in Greenbelt, Maryland, on the outskirts of Washington, D.C., is the place where the COBE (Cosmic Background Explorer) satellite mission was developed and is the home of the Hubble Space Telescope, the James Webb Space Telescope, and the future Wide Field Infrared Survey Telescope (WFIRST) missions. Guide for this exceptional event was Nobel Laureate John C. Mather, who received the 2006 Nobel Prize in Physics for his measurements of cosmic microwave background radiation – work he conducted at the Goddard Center with the COBE satellite data.

John Mather and colleagues showed the group part of the campus, including the Space Environment Simulator, a huge vacuum chamber that can be heated and cooled to test whether equipment can withstand the extreme conditions of space, and a large clean room where components are assembled under sterile conditions. Many Lindau Alumni were particularly impressed by the Hubble Space Telescope’s mission control center. NASA’s longest and most successful mission, the telescope is the size of a school bus, is in orbit close to 600 kilometers above the Earth and can be navigated to image objects with such accuracy that it deviates less than a hair’s width at a mile’s distance. The navigation takes place in a small room that our alumni were allowed to see and explore.

The diverse group of Lindau Alumni from different disciplines, some of whom had travelled from as far away as Germany, Norway and the United Kingdom, also had lunch with John Mather. The visit to NASA Goddard Space Flight Center certainly was the highlight of the year for the Lindau Alumni initiative, whose goal is to extend the ‘Lindau Spirit’ beyond the boundaries of a weeklong conference.

Find a full recap of the visit to the NASA Goddard Space Flight Center by Lindau Alumna Orsolya Symmons in the Lindau Alumni Network: www.lindau-alumni-network.org.

AAAS 2019 Annual Meeting

The Lindau Nobel Laureate Meetings participated in the American Association for the Advancement of Science (AAAS) 2019 Annual Meeting, which took place 4–17 February 2019 in Washington, D.C.

At a joint booth of the Lindau Meetings and the Heidelberg Laureate Forum Foundation, young scientists received information about participating in the two meetings. Representatives of research institutions and universities could learn more about the global academic partner network, and media representatives were provided with information on covering the meetings.

The theme of the AAAS Annual Meeting was ‘Science Transcending Boundaries’. Attendees vigorously debated science’s role in society, the importance of fundamental research and international collaboration, especially in the face of global challenges.

Lunch at the German Embassy

On Wednesday, 13 February 2019, the German Embassy in Washington, D.C., invited a select group to a business lunch at the residence of German ambassador Emily Haber on behalf of the Lindau Nobel Laureate Meetings. Guests had the opportunity to meet Nobel Laureates John C. Mather and William D. Phillips and learn more about the Lindau Meetings. The two laureates as well as Lindau Alumni Martine Abboud, Yeka Aponte and Valerie Darcey acted as perfect advocates for our mission.

During the small gathering for potential partners and supporters on the eve of the AAAS Annual Meeting, Nobel Laureate Bill Phillips appealed for the transcending of boundaries: “The fantastic thing about science is that it has no borders, and anybody who wants to build walls definitely goes in the wrong direction!”
Why not ask Nobel Laureates to make a sketch of the discovery for which they received the Nobel Prize – and then ask them to present their artwork to the camera? This is exactly what German photographer Volker Steger did to create the exhibition ‘Sketches of Science’ which is an ongoing project of the Foundation Lindau Nobel Laureate Meetings.

In his photo series, Volker Steger shows a different angle on the people behind the Nobel Prizes. He captures the spontaneity and creativity of Nobel Laureates; the pictures express the enthusiasm of scientists and researchers for their work.

An exhibition of 50 photos of the series was launched at the Nobel Museum in Stockholm in June 2012 and has been on tour around the globe ever since. The following countries have hosted ‘Sketches of Science’ so far: Germany, Japan, Malaysia, the Russian Federation, Singapore, South Korea, Sweden and the United States.

Project Partner
Nobel Prize Museum, Stockholm

Principal Funder
Klaus Tschira Foundation

Since 2000, German photographer Peter Badge has been traveling around the globe on an ambitious mission: to take a picture of every living Nobel Laureate. As part of this long-term project, more than 400 laureates have already been photographed, plenty of them during the Lindau Meetings. Each portrait in this remarkable array of black-and-white photographs reveals a haunting, authentic and fascinating impression of the laureate’s unique personality and serves to highlight their scientific, literary or humanitarian achievements.

In 2019, an exhibition of Nobel Laureates photographed by Peter Badge took place at the residence of the Swedish Ambassador, Håkan Juholt, in Reykjavik, Iceland. As welcomed guest of honour, HRH Victoria, Crown Princess of Sweden, was one of the first visitors of the exhibition. Only a few weeks after Her Majesty Queen Silvia of Sweden took a closer look at the permanent exhibition of Badge’s photos in the Lennart-Bernadotte-Haus in Lindau (p. 93), her daughter Crown Princess Victoria also had the chance to enjoy a selected number of portraits, including all Swedish laureates, in Reykjavik.

Beyond that, a selection of portraits as well as the coffee table book ‘Nobel Heroes’ were presented in various locations worldwide, e.g. at the annual meeting of the American Association for the Advancement of Science (AAAS) in Washington, USA.

Exhibitions 2019
Reykjavik, Iceland
Residence of the Swedish Ambassador
12 October 2019–12 December 2019

Project Partner
Klaus Tschira Foundation

An arthook with a wide selection of sketches is available for download in the mediatheque.

William E. Moerner drew the function of super-resolved fluorescence microscopy at #LINO19.

Gérard Mourou and his Sketch of Science at #LINO19.

Jörgen Deisenhofer photographed by Peter Badge during #LINO19.

HRH Victoria, Crown Princess of Sweden, guided through the exhibition in the Swedish Embassy in Reykjavik by Peter Badge.

Johann Deisenhofer photographed by Peter Badge during #LINO19.
“Sometimes science can be quite a lonely space. But it’s not lonely in Lindau.”

Niamh Kavanagh, #LINO19 participant, Tyndall National Institute, Ireland

#LINO19 participants celebrating diversity in STEM on Mainau Island
The Mediatheque

The mediatheque is a unique treasure trove packed with lectures dating back to 1952. Talks from the likes of Nils Bohr, Werner Heisenberg and Dorothy Crowfoot Hodgkin are available as well as the latest lectures from Gérard Mourou, Sir Konstantin Novoselov and Adam G. Riess from #LINO19. Also, all panel discussions and many Agora Talks have been added. This year, new Mini Lectures and Topic Clusters were created based on the growing collection of video material from the meetings.

MINI LECTURE: SI SYSTEM
The discoveries of Klaus von Klitzing and Brian D. Josephson that led to their respective Nobel Prizes are also the basis for the redefinition of the International System of Units. This Mini Lecture shows how and explains why the unit system was redefined.

MINI LECTURE: LIGHT AND OPTICS
The nature of light is as diverse as its uses. This five-part Mini Lecture explains the dualism of wave and particle and discusses how the different spectral ranges of light have found their applications in science, medical treatments and everyday life.

TOPIC CLUSTER ON VIRUSES
The ongoing debate on vaccinations makes the topic cluster on viruses and their nature timely and topical. Utilising historical and more recent lectures by Nobel Laureates like Françoise Barré-Sinoussi, this cluster gives further insights in this topic and research field.

TOPIC CLUSTER ON NOBEL FAMILIES
The question whether Nobel Prizes run in families does not just encompass the Curies but also laboratories and experiments which have led to several Nobel Prizes. True to the proverb ‘standing on the shoulders of giants’, we trace the history of Nobel Prizes, their recipients and their advisors.

Our Nobel Lab 360° series is particularly interesting for those curious about what the working group and the lab of a Nobel Laureate looks like. The constantly updated mediatheque aims to serve people fascinated by science as well as (young) scientists as a platform for learning and as a space to discover new topics of different disciplines.

NOBEL LAB 360°: MAY-BRITT AND EDVARD MOSER
Edvard I. Moser and May-Britt Moser received the 2014 Nobel Prize in Physiology or Medicine together with John O’Keefe “for their discoveries of cells that constitute a positioning system in the brain.” Here, they give us a glimpse into their lab at the Kavli Institute for Systems Neuroscience.

NOBEL LAB 360°: Joachim Frank
Joachim Frank received the 2017 Nobel Prize in Chemistry “for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution”. Visit his Nobel Lab to discover more about Frank’s research focus, lab workspace and experimental procedures.

WEBINARS
The Lindau Meetings host webinars for Lindau Alumni in periodical intervals. These webinars address questions many scientists encounter: how to find your career path, communicating with the media, networking at conferences etc. Recordings of past webinars are available in the mediatheque.

mediatheque.lindau-nobel.org

Recently added to the collection of virtual lab tours: the Nobel Lab 360° of May-Britt and Edvard I. Moser
The mediatheque aims to serve as a unique learning infrastructure and research resource for scientists, teachers, students and audiences generally interested in science. Much of the material in the mediatheque is well-suited for use in schools. To meet the rising demand for teaching and didactic material, the Lindau Nobel Laureate Meetings keep expanding this educational section based on the discoveries of Nobel Laureates.

Teaching Guides
So far, 18 teaching guides have been published covering socio-economic topics as well as various topics in chemistry, physics and medicine. This year, the teaching guide library gained six new lessons. These have been developed in collaboration with Lehrer-Online, one of the leading and most renowned providers of learning materials in German-speaking countries. Each unit consists of a precise lesson design proposal, worksheets and other training materials.

The teaching guides are based on and include mediatheque content: Mini Lectures, Topic Clusters, Nobel Labs 360° and Nobel Posters. This allows for a multimedia approach in schools and lets students and their teachers explore the various topics.

Didactic Filter
As an additional feature particularly for German and Austrian educators, the didactic filter aligns the contents of the Mini Lectures, the Nobel Labs 360° and the Topic Clusters to curricula of the federal states of Germany and Austria. The content can be filtered according to country, state, subject and level.

Nobel Posters
Every year, the Swedish Royal Academy of Science and the Karolinska Institute publish posters explaining the discoveries of the Nobel Laureates in Swedish and English. These posters are presented during the Nobel Week in December. The Lindau Nobel Laureate Meetings with the support of the Christa and Hermann Laur-Stiftung translated the posters for the 2018 Nobel Prizes into German and distributed them among secondary schools in Germany, Austria and Switzerland.

Teaching guides and Nobel Posters are available for download in the educational section of the mediatheque.

Educational Outreach

Cooperations

The Lindau Nobel Laureate Meetings aim to share the fascination with science and the archived knowledge that is represented by the mediatheque with a larger community, including schools, universities and the general public. This goal can only be achieved by cooperating with other educational content providers. In 2019, the Lindau Meetings extended their cooperation with new partners to reach an even wider audience within the educational sector.

Cooperation With the German National Library of Science and Technology (TIB)
As part of the Leibniz Association, the German National Library of Science and Technology (TIB) is the leading centre for the digitalisation of scientific and technological content in Germany. Thanks to a cooperation with the TIB, the Lindau Meetings will make historical lectures by Nobel Laureates from 1952 up to today available to a broader audience. The ability of the TIB to catalogue film material and generate transcripts of the respective lectures will help to make the lecture content more easily searchable and accessible to scientists, students and the general public.

A full list of partners can be found in the educational section of the mediatheque.

Cooperation With Educational Content Providers

With the aim of imparting and further disseminating scientific information by and about Nobel Laureates, the Lindau Meetings embarked on a strategy to collaborate with non-profit providers of digital educational content, mainly public providers of didactic material for teachers. A selection of videos from the mediatheque that are particularly suitable for use in classrooms can be accessed from the partner’s media portal.

A full list of partners can be found in the educational section of the mediatheque.

One of the most viewed educational materials on the partners’ websites was the Mini Lecture on immunisation.
The Lindau Science Trail opened in 2017 and consists of a total of 20 knowledge pylons. Fifteen of them are located on the island of Lindau, two pylons are on the mainland of Lindau and three on Mainau Island. At the pylons, visitors can learn more about the everyday applications of scientific phenomena that have been honoured with the Nobel Prize.

The pylons cover the three natural science disciplines – physics, chemistry and physiology or medicine – as well as economic sciences, peace and literature. One pylon at the Lennart-Bernadotte-Haus in Lindau gives insights into the longstanding history of the Lindau Nobel Laureate Meetings. Since 2019, a pylon at the new Lindau Nobel Laureate Pier provides interesting facts about the Nobel Prize. All information is available in English as well as in German.

Guided Tours
With a special children’s section on every pylon, the trail invites students and schools to discover the exciting world of science. Guided tours around the trail can be booked as part of school trips to Lindau.

Mobile App
A mobile app expands the Lindau Science Trail on site: by means of augmented reality functions, one can meet virtual Nobel Laureates at various places in Lindau. They describe why they received the Nobel Prize and explain more about their research. With numerous quiz questions, the app also allows users to test their freshly acquired knowledge on a Science Rallye.

Virtual Science Trail
The web-based Virtual Science Trail takes users on a virtual walk through the existing science trail – irrespective of space and time. The pylons can be easily located through a vivid online map containing site pins to access any chosen pylon. Interactive panoramic images enriched with multimedia elements ensure a truly immersive navigation experience. The Virtual Science Trail, available in both German and English, reaches out to an even wider audience as the trail can be explored from afar.

The Lindau Science Trail could be realised thanks to the support of the Beisheim Stiftung and the City of Lindau. The Virtual Science Trail can be accessed at www.wissenspfad.de.

Engaging Future Generations

School Visit
To inspire the younger generation and to actively involve local students in the Lindau Nobel Laureate Meetings, the Council organises a visit of a local school for one of the participating Nobel Laureates every year. The school visit is part of the Lindau Meetings’ “Mission Education”.

During #LINO19, Klaus von Klitzing, 1985 Nobel Laureate in Physics, visited the Valentin-Heider Gymnasium in Lindau to give a captivating talk about science and research. Von Klitzing explained the definition of the kilogramme that was revised in May 2019 together with the other six base units – the second, the meter, the ampere, the kelvin, the mole and the candela. He also introduced metrology, the science of measurement, by emphasising the importance of natural constants in the past as well as in the present.

The detailed lecture was followed by a lively exchange with the students, in which von Klitzing provided insights into his personal background, his research and career path. Spending nearly two hours with Klaus von Klitzing, the high school students grasped a little of the Lindau Spirit and the world of science.

Teaching Spirit
Scientific curiosity and a passion for research can be instilled at a young age in children, especially when teachers go above and beyond in shaping that passion with their students. Therefore, every year the Lindau Nobel Laureate Meetings invite a select number of excellent teachers to honour their educational performance and dedication and to provide them with new impulses for their work.

Twenty dedicated physics teachers from Germany, Austria and Switzerland were invited to take part in two days of the 69th Lindau Nobel Laureate Meeting. Their programme included lectures, panel discussions and a workshop organised jointly with the Ludwig Maximilians-Universität München (LMU). During a lunch with several Nobel Laureates, the Bavarian Evening and the Baden-Württemberg Boat Trip to Mainau Island they also had the opportunity to mingle with the participants of #LINO19.

Participants of ‘Teaching Spirit’ exploring the Lindau Science Trail during #LINO19

Klaus von Klitzing explaining his research to high school students

Teaching Spirit participants during physics experiments at #LINO19
Baden-Württemberg Boat Trip to Mainau Island

Young scientists and Nobel Laureates partying at the International Get-Together

Robert Huber and his wife on their way to the opening concert

Young scientists in the Lindau city centre

Young scientists and Nobel Laureates partying at the International Get-Together

Impressions
The Lindau Meetings nurture long-term relationships with a number of premier media partners. The following partners played a key role in covering the Lindau Meetings:

- Bayerischer Rundfunk & ARD-alpha
- Deutsche Welle
- Nature Publishing Group
- Schwäbische Zeitung with Lindauer Zeitung

Representatives of several German public broadcasting stations taped segments showcasing the special interactions during the meeting week. For the Bavarian news format Rundschau, Nobel Laureate Klaus von Klitzing and young scientist Jana Lasser met and talked about their work. Germany’s national public educational TV station ARD-alpha met young scientist Nelson Darkwah Oppong in his lab at the Ludwig-Maximilians-Universität München and accompanied him on his Science Walk with Nobel Laureate Bill Phillips.

Communications

Media Representatives

Media representatives from outlets such as Times Higher Education, Scientific American, La Nación, FAZ, YTN Science Korea, Focus, Nature, Physics World and many others from all around the world were present at #LiNO19.

About 100 journalists and communications professionals from 20 countries used the unique opportunity of a Lindau Meeting to engage with Nobel Laureates and young scientists and to gather material on interesting topics from science and research. Members of the media were able to attend the various lectures, Agora Talks, panel discussions, special press events as well as highlights of the social programme. As usual, the Lindau Meetings assisted with organising interviews with the participants.

Continuing the efforts of the last few years, the Lindau Meetings provided travel grants to outstanding science journalists from more remote countries.

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Two of Germany’s most renowned dailies, Frankfurter Allgemeine Zeitung (left) and Süddeutsche Zeitung, covered #LINO19 in editorial supplements.

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Press Talk

THE END OF INTERNATIONAL COLLABORATIONS IN SCIENCE? HOW NATIONALISM THREATENS AN OPEN SCIENTIFIC WORLD

Today, international collaborations are common and foster advances in fundamental research. Large multinational projects such as CERN, ITER, ESO, SKA etc. are good examples of an open society, where partnerships without barriers are normal and not something extraordinary. At the 69th Lindau Meeting, accredited journalists were invited to join a panel discussion on the pressing question of whether the recent rise in nationalist movements globally has an impact on this kind of international scientific cooperation. Nobel Laureate Konstantin Novoselov debated with Rolf-Dieter Heuer and young scientists Lakshmi Balasubramaniam and Henry Enninful on the degree to which developments like Brexit will have an impact on large-scale international scientific collaboration.

Panellists
- Lakshmi Balasubramaniam, Institut Jacques Monod, Université Paris Diderot, France
- Henry Enninful, Felix Bloch Institute for Solid State Physics, Leibniz University, Germany
- Rolf-Dieter Heuer, President of the SESAME Council and former Director-General of the European Organization for Nuclear Research (CERN), Germany
- Konstantin Novoselov, Nobel Laureate in Physics (2010), University of Manchester, United Kingdom, and National University of Singapore

Moderator
Lea Albrecht, science journalist, Deutsche Welle, Germany

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The blog of the Lindau Nobel Laureate Meetings features background stories on the Lindau Meetings, interviews with participants as well as research news and science history targeted at a broad audience. Over the years, science writers, young scientists, Lindau Alumni and Nobel Laureates have contributed and helped turn the blog into the central online platform and content hub of the Lindau Meetings. This is just a small selection of the topics covered in 2019. For more please visit lindau-nobel.org/blog

Connecting people to share ideas has always been part of the Lindau Meetings’ mission. In 2019, the ‘Lindau Spirit’ was once again present on social media.

Facebook
The official Facebook page of the Lindau Nobel Laureate Meetings reaches more than 15,000 followers. We update our community on news from Lindau, share our own and our partners’ content and engage in vivid discussions on science-related topics. During the meeting week, science comedian Brian Malow posted interviews with young scientists as popular Facebook Live videos.

Twitter
During the meeting, participants, Lindau Alumni and users at home engaged on Twitter using the hashtag #LINO19 and created a digital space for discussion, insightful comments and observations on the social programme. The hashtag #LINO19 trended in Germany on the first day of the meeting. Throughout the year, we share news, videos and other related content with our engaged followers.

YouTube
Like last year, a number of short interviews with Nobel Laureates and young scientists were produced by UK-based Econ Films and have been added to the Lindau Meetings’ YouTube channel, including a discussion between Nobel Laureate Brian Schmidt and members of Fridays for Future Lindau. The Mini Lectures we released this year are also available on YouTube, a medium widely used by a younger audience.

LinkedIn
The Lindau Meetings are also present on LinkedIn. Since last year, we’ve been using the networking community for professionals to create and nurture relationships with partners and friends of Lindau. LinkedIn is a particularly ideal platform to reconnect with Lindau Alumni and to refer them to the Lindau Alumni Network.

Instagram
A growing audience engages with us on Instagram, sharing photographic highlights from the Lindau Meetings as posts and interactive Instagram stories, especially during the meeting week. Throughout the year, we share visual highlights of the meeting as well as news on our outreach activities and other digital content.

Flickr
Hundreds of pictures from past Lindau Meetings are accessible to everyone on our Flickr page, be it to relive memories of their meeting participation or to find high-quality pictures for reports on the Lindau Meetings. Editorial use is free, but the copyrights must be acknowledged accordingly.

Meeting App
The official meeting app has become an established digital extension of the meeting programme. All participants could download the app onto their iOS and Android devices, create their own personal timetables, submit questions for the panel discussions and stay in the loop on all relevant, up-to-date information on the programme sessions.

The official hashtag #LINO19 was prominently featured onstage.
For the 69th Lindau Nobel Laureate Meeting, we continued our collaboration with London-based Econ Films to produce a series of short interviews during the meeting week. The videos feature Nobel Laureates, young scientists and guests alike. The topics of the interviews vary, from intergenerational advice and nationalism’s effect on science to 3D printing on a nanoscale and confidence in your scientific work. The interviews were distributed through social media.

All interviews are available on the Lindau Meetings’ YouTube channel.

Two new short films, produced during the 69th Lindau Nobel Laureate Meeting, showcase the unique Lindau Spirit. ‘The Spirit of Connection’ highlights the connections made during the meeting week, using statements by Nobel Laureates, young scientists, Lindau Alumni and representatives of our supporters and partners. In ‘A Young Scientist’s Journey’, the viewer accompanies Margareth Córdova Castro as she travels from London to Lindau, meets fellow young scientists and Nobel Laureates and experiences the meeting week.

Both films are available on our YouTube page and our social media profiles.

The Lindau Meetings continued the collaboration with a production team from the Filmakademie Baden-Württemberg to create a new opening video for the 69th Lindau Nobel Laureate Meeting, taking a humorous, fictional interstellar view on the Lindau Meetings’ community in three chapters. The film was shot at Haus der Astronomie in Heidelberg, Germany.

You can find all #LINO19 Facebook Live videos on the Lindau Meetings’ Facebook page.

Find the opening videos in our mediatheque.
“Lindau connects scientists with diverse experiences and an immense passion for science. I left with a spirit full of energy and renewed curiosity.”

Latifah Al-Maghrabi, #LINO19 participant, King Abdullah University of Science and Technology, Saudi Arabia

Baden-Württemberg Boat Trip to Mainau Island
The Council and the Foundation

**The Council**

The Council for the Lindau Nobel Laureate Meetings was founded in 1954, three years after the first Lindau Meeting, to secure their existence and shape their future development. Count Lennart Bernadotte, one of the three founders of the meetings, became the first president of the Council. He was followed by his wife Countess Sonja in 2004 and then by his daughter Countess Bettina in 2008, who still chairs the Council.

The purpose of the non-profit Council is to organise the annual meetings. This includes the establishment and maintenance of close relations with scientific partners worldwide. The Council maintains an executive secretariat at Lindau.

Honorary Presidents

Count Lennart Bernadotte af Wisborg †

Roman Herzog †

Honorary Chairman

Wolfgang Schürer

Board of Directors

Jürgen Kluge

Chairman

Nikolaus Turner

Managing Director

Countess Bettina Bernadotte af Wisborg

Reinhard Pöllath

Members

Rainer Blatt

Thomas Ellerbeck

Stefan H. E. Kaufmann

Jürgen Kluge

Heiner Lenke

Hartmut Michel

Ture Ising

Reinhard Pöllath

Klaus Schmidt

Lars Bergström

Astrid Gräslund

Hans Jörnvall

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Hans Jörnvall

Sten Örenäs

Gerhard Ecker

Urs Schwager

**The Foundation**

The Foundation Lindau Nobel Laureate Meetings was established in the year 2000 by 50 Nobel Laureates. To date, 343 Nobel Laureates are members of its Founders Assembly (pp. 120/121).

The Foundation’s general objective is to promote science, research and related societal activities. In particular, its main purpose is to ensure the continuance and further development of the Lindau Meetings. This includes the support of outreach projects and initiatives.

The Foundation is registered on Mainau Island. In the interest of a close collaboration with the Council, the office of the Foundation is also based in Lindau.

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Countess Bettina Bernadotte af Wisborg

Reinhard Pöllath

Reinhard Pöllath

Thomas Ellerbeck

Reinhard Pöllath
The Foundation Lindau Nobel Laureate Meetings was established in 2000 by 50 Nobel Laureates, the Bernadotte family and Council members. Through their membership in the Founders Assembly, Nobel Laureates demonstrate their strong support of the Lindau Meetings. As of September 2019, 345 Nobel Laureates constitute the assembly.
The members of the most prestigious committee of the Foundation Lindau Nobel Laureate Meetings, the Honorary Senate, function as advisors to the board and distinguished ambassadors for the cause of the Lindau Meetings. With their considerable experience and expertise, they are dedicated to advance the values and aims of Lindau’s ‘Mission Education’.

Honorary Senate

Members
Josef Ackermann
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In Memoriam

Klaus Kleinfeld, member of the Honorary Senate of the Foundation, at the 69th Lindau Nobel Laureate Meeting

Zhores Alferov
1930–2019
Nobel Laureate in Physics 2000
Lindau Meeting: 2001

Manfred Eigen
1927–2019
Nobel Laureate in Chemistry 1967

Murray Gell-Mann
1929–2019
Nobel Laureate in Physics 1969
Lindau Meeting: 1994

Riccardo Giacconi
1931–2018
Nobel Laureate in Physics 2002

Roy Glauber
1925–2018
Nobel Laureate in Physics 2005

Sir Aaron Klug
1926–2018
Nobel Laureate in Chemistry 1982
Lindau Meetings: 2002, 2005

Kary B. Mullis
1944–2019
Nobel Laureate in Chemistry 1993
Lindau Meetings: 2000, 2005

John R. Schrieffer
1930–2019
Nobel Laureate in Physics 1972
Impressions

Memorandum of understanding with the National Research Foundation (NRF), Singapore: Wei Yang Cheong, Deputy CEO NRF, Tock Seng Low, CEO NRF and Jürgen Kluge

HRH Princess Maha Chakri Sirindhorn of Thailand and Countess Bettina Bernadotte

Nicolaus Turner and Jón Áli Benediktsson, Rector of the University of Iceland, signing a new memorandum of understanding

Participants of the academic dinner hosted by Bayer AG

Participants of a Zeppelin flight supported by the Helmholtz Association

Christiane Haupt and Ilia Schleßer-Gäbler from the Max Planck Society talking to young scientists
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Executive Secretariat Staff
Office Operating Costs
Office Supplies & Equipment
Expected Total Expenditures

Offices of the Foundation

» Preliminary Account 2019: Expenditures

Travel
Nobel Laureates
177,969.23
Young Scientists
3,251.72
Media
6,388.82
Others
28,490.50

Lodging
Nobel Laureates
73,046.00
Young Scientists
296,096.40
Media
9,779.00
Others
62,892.30

Boarding
Nobel Laureates
19,235.94
Young Scientists
225,542.63
Media
7,533.20
Others
37,121.61

Meeting Organisation
Scientific Programme & Selection of Young Scientists
12,068.27
Rental Fees Locations
104,372.64
Technical Equipment
215,312.12
Utilities & Services
48,601.27
On-Site Staff
116,632.18
Transfers
24,332.75
Supporting Programme
37,393.62
Printed Matters
48,059.00
Expendable Items
11,434.96
Audio, Video & Web Productions
81,211.58
Science & Media Services
87,989.92
Website
6,251.77
Telecommunications, Postage
27,067.21
IT Services, Hardware, Software
79,583.16
Accounting, Legal Advice, Insurances
41,420.70
Other Costs
16,438.18

Executive Secretariat
Staff
836,451.62
Office Operating Costs
117,729.54
Office Supplies & Equipment
8,042.62

Expected Total Expenditures
2,847,420.56

Please note:
The total expected costs include € 340,907.17 of expected costs for October–December 2019. The budget does not include costs of the meeting covered directly by the Foundation.
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Total Revenues* 

€ 2,847,420.56

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25 – 29 August 2020
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Chemistry
27 June – 2 July 2021
#LINO21
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