

Universität  
Basel

Swiss Nanoscience Institute



10 years  
SNI

## SNI update July 2016



Dear Colleagues,

It's vacation time in Basel. From one day to the next, the trams empty and some of the university labs and offices are closed. At the end of June, however, the SNI was yet to enter the holiday spirit as its management team – particularly Olivia Diener, Michèle Wegmann, and Claudia Wirth – made

the final preparations for the Swiss NanoConvention 2016. And it was well worth it! The team organized an outstanding conference that once again showed all participants how exciting nano research can be. I myself learned quite a bit, enjoyed many inspiring discussions, and developed new ideas.

Before the SNC, a few other events took place that we will briefly touch on in this “SNI update”. On the initiative of Dr. Peter Reimann, the Department of Physics and the SNI travelled to Gelterkinden on May 21 to introduce the quantum and nano worlds to a wider public. An interactive exhibition provided visitors with insights into everyday laboratory life and research being conducted at the University of Basel was explained in talks and with display stands.

A rhetoric and communication workshop taught our doctoral students a few new things. For the second time now, Ralf Stutzki of the NCCR MSE ran this workshop, which was spe-

cially designed for the SNI PhD School. Participants completed various practical tasks and learned how to give better and clearer presentations.

In the last month, we were also delighted to hear that the SNI's Christoph Gerber will receive the Kavli Prize for Nanoscience together with Gerd Binnig und Carl Quate. 30 years ago, when these three men developed the atomic force microscope (AFM), they could not have foreseen the many fields in which AFM is used today and the new insights into the nano world it constantly delivers. SNI members find many uses for AFM as well – for example Ernst Meyer's group, which recently succeeded in measuring van der Waals forces for the first time with the aid of AFM, or Roderick Lim's team, who used a high-resolution AFM to film nuclear pore complexes at work. Over the past few months, these and other results have been published in prestigious journals such as Nature and shared with the public via media

releases.

I hope you enjoy our latest «SNI update». Most importantly, I wish you a wonderful relaxing vacation. I look forward to seeing many of you again at the Annual Event in September.

Kind regards,



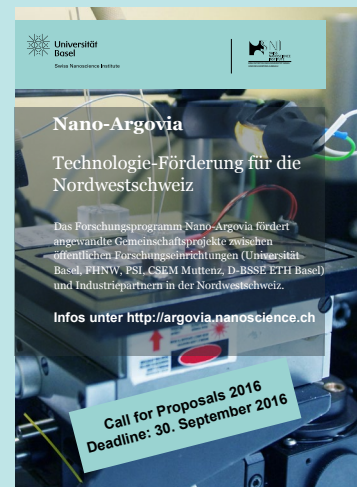
Director Swiss Nanoscience Institute, University of Basel

## Argovia Call 2016

Applications have once again opened for applied research projects in the Nano Argovia program. If you are interested, please visit our website:

<http://www.nanoscience.ch/nccr/argoviaProgram>

**The deadline for project proposals is September 30, 2016.**



## Swiss NanoConvention 2016

### Basel hosts Swiss NanoConvention for the second time

From June 30 to July 1, almost 650 nanoscientists from around the world came together in the Congress Center Basel for the sixth Swiss NanoConvention (SNC). Participants from both research and industry had the opportunity to see a diverse mix of excellent presentations on the latest research, an exhibition of over 160 posters and 30 exhibitors whose products prove that nano has arrived on the market.

This was the second time that the SNC had been hosted in Basel (after 2013). Once again, the program committee invited renowned nanoscientists from elite international universities to share insights into their pioneering research. The event was well received by the vast majority of visitors, who were very positive about the quality and variety of the SNC. The eight outstanding plenary sessions alone reflected the enormous diversity of topics and clearly indicated the influence that nano research can have on key issues affecting our society today.

### Learning to understand cell division

In the Güntherodt Lecture, for example, Professor Daniel Müller (D-BSSE ETHZ in Basel, Switzerland) explained how he and his team are investigating the division of animal cells. Before the complex division process begins, the cells very clearly change in form. If this necessary morphological change does not take place, cancers may develop. The scientists are now using atomic force microscopy combined with cell-biological and genetic tools to analyze the rounding process in detail and deciphering the proteins and genes involved. In the future, this information might be able to help suppress the division of cancerous cells.

### Efficient analysis

The nanotechnology method presented by Dr. Steven Henck (Genia Technologies, Santa Clara, California, USA) to quickly and reliably decipher genetic make-up might also influence the treatment of diseases. His team uses a biological nanomachine that synthesizes a DNA strand complementary to the DNA to be analyzed. The individual components are marked differently. These markings are detected during passage through a nanopore, indicating the sequence of the components and therefore the genetic code of the material in question. The scientists

aim to develop and market a device that quickly analyzes a patient's DNA with minimal sample quantities to predict the efficacy of medicines.

### Self-organization of complex systems

The talk given by Professor Vinothan Manoharan (Harvard University, Cambridge, USA) revolved around viruses which partially are involved in the development of diseases. The simplest viruses are made up of RNA and a protein shell. If you mix the components in a test tube, complete viruses quickly form as if by magic. Vinothan Manoharan uses various optical techniques to explore the dynamics of this self-organization in viruses. Understanding these processes will deliver decisive insights to inspire developments in both medicine and nanotechnology and enhance our understanding of the basic physical principles of complex systems.

"The SNC in 2016 in Basel was a fantastic event bringing together nanotechnologists from all over the world and from all kind of interdisciplinary fields. The atmosphere of the conference was warm, friendly, collegial and inspired to establish new research and collaborations. I wish conferences of this kind and quality could be established on a routinely basis to highlight and support the outstanding nanotech hub Switzerland."

#### Daniel Müller

Professor at D-BSSE ETH Zurich in Basel

### Artificial photosynthesis

Another topic concerning our society – and the subject of a plenary lecture – is energy supply and fixation of the greenhouse gas carbon dioxide. Professor Peidong Yang (University of California, Berkeley, USA) is currently investigating possible methods of artificial photosynthesis. With green plants as his model, his goal is to produce energy-rich carbohydrates and oxygen from carbon dioxide and water. Since his aim is to optimize light yield, Yang does not use plants, instead combining semiconducting nanowires with acetogenic bacteria. In this system, the nanowires act as tiny solar cells. Far more effective than natural photosynthesis, the nanowires "catch" the light and act as charge carriers. The bacteria, which cannot conduct photosynthesis in nature, use these charge carriers to reduce carbon dioxide to carbon compounds and therefore to store chemical energy. Yang's work could help to bind more carbon dioxide and use this to produce fuel.

### Fixation of greenhouse gases

Professor Omar Yaghi from Berkeley (California) also presented possible ways to bind carbon dioxide. His work focuses on metal-organic frameworks (MOF), porous crystalline materials made from metallic components and organic molecules that form one-, two-, or three-dimensional networks. The pores of MOFs can be functionalized in different ways, allowing carbon or water to be temporarily "caught", for example. One application in which MOFs are used to bind (and therefore compress) methane as an energy supply is already being commercialized.

"The meeting was one of the best I've attended this year. It was well organized, the talks were very interesting and varied among many fields of nano, and the discussions with scientists in the break time were excellent."

#### Omar M. Yaghi

Professor at the University of California, Berkeley and Co-Director of the Kavli Energy NanoSciences Institute

### Liquid prevents adhesion

The research methods employed by Professor Joanna Aizenberg (Harvard University, Cambridge, USA) are also closely aligned with practical applications. She develops surfaces to which microorganisms, ice, and liquids cannot adhere, even under extreme conditions.

"I have received feedback from various sides regarding the impeccable organisation of the convention. This is particularly true for international attendees, many of whom told me how they have rarely experienced a conference as well and smoothly organised as this one. For them, this really left an excellent and lasting impression of the SNI, the Physics Department in Basel and the general research-environment in Switzerland.

#### Patrick Maletinsky

Professor at the Department of Physics,  
University of Basel

Using the pitcher plant as inspiration, she has developed surfaces covered by a liquid film that prevents the adhesion of particles. In shipbuilding, for example, this technology (known as SLIPS) could be used to stop the growth of algae and barnacles, saving enormous amounts of fuel. A surface that prevents bacteria growth and the adhesion of viscous fluids and is resistant to damage would also be a welcome development for catheters and other medical products.

optics, and functional surfaces – saw 32 invited speakers present their latest research findings. The Commission for Technology and Innovation (CTI) also invited attendees to a satellite symposium on applied topics. The breaks were generally spent discussing the 160 posters and talking to the 30 exhibitors. With very good service from the Congress Center, the SNC was a relaxed and casual affair that encouraged attendees to share their ideas and establish contacts.

For a report from the perspective of the main sponsor, BaselArea.swiss, which also discusses the CLINAM conference before the SNC, visit:

[www.i-net.ch/blog/brief-review-extraordinary-nano-week-basel/](http://www.i-net.ch/blog/brief-review-extraordinary-nano-week-basel/)

Interviews with some participants can be found at:

[www.sciencerradio.ch](http://www.sciencerradio.ch)

### Creating a quantum computer with silicon

The first and last keynote speeches at the SNC transported the audience to completely different worlds. Professor Michelle Simmons, who travelled all the way from Sydney (Australia) specially for the occasion, began the conference by presenting her practical approach to creating a quantum computer with silicon. She began this work ten years ago and is now able, with the aid of a special scanning tunneling microscope, to embed individual phosphor atoms in silicon crystals with great precision and then use the spin of the electrons to store information. The processing power of such quantum computers would far exceed today's computers and would allow unsorted data volumes to be searched quickly and efficiently, for example.

### New approaches in chemistry

The last keynote speaker, Professor Thomas Ebbesen (University of Strasbourg, France), also concentrated on questions from the quantum world. His work attempts to harness special properties of vacuums resulting from quantum physics. According to these, the vacuum is not empty as particles and antiparticles can spontaneously develop and disappear. These vacuum fluctuations influence the electromagnetic interaction with matter. They can especially emerge in small, specially formed cavities, influence the electron transfer and herewith accelerate chemical reactions of molecules. The recipient of the 2014 Kavli Prize, Thomas Ebbesen, explained how, in this way, he and his team would like to create products with modified properties such as improved electrical conductivity.

### A range of information

A total of 11 sessions took place between the keynote speeches over the two days of the conference, sometimes running in parallel. The overarching topics – 30 years of atomic force microscopy, nanobiology, nano for energy, production processes, materials, sensors, quantum technology, quantum

"I very much enjoyed the conference, and also the social after the meeting. It covered a good collection of important topics. In fact, I was so much into the discussion with the students that day, and apparently missed the speaker banquet."

#### Peidong Yang

Professor University of California, Berkeley







## Events

### Quantum and nano worlds attract plenty of visitors

On May 21, 2016, the Department of Physics and the SNI held an interactive exhibition entitled “Quantum and Nano Worlds” in Gelterkinden’s multi-purpose hall (Basel Landschaft). Initiated and organized by Dr. Peter Reimann, the event drew in around 800 visitors. With 16 display stands, there was plenty to discover, explore, and experience. Meanwhile, 12 speakers informed the visitors about the latest research. And, naturally, there were plenty of fun activities as well. The ice cream made with liquid nitrogen and raspberries was a real hit and long queues formed in front of the laser labyrinth too. An experiment workshop gave children the opportunity to become young researchers, a jazz band provided entertainment, and the restaurant ensured that nobody went hungry.



“Quantum and Nano Worlds” was a great success and bridged the gap between the scientific world and the public. It would not have been possible without the sheer dedication of Peter Reimann and the 75 staff members from the Department of Physics and the SNI.

(Photos: Stefan Messmer and Michael Steinacher)

### Improving presentation skills in an abbey

In May, the two-day rhetoric and communication workshop for the SNI PhD School was held for the second time in Mariastein Abbey. Ralf Stutzki of the NCCR MSE joined actress Sasha Manzotti in putting together another varied program that differed slightly from the previous year. This time, for example, the 11 young participants had to explain their research in the form of a children’s story – and with only 20 minutes to prepare. As you can hear at <http://www.sciencerradio.ch/sni-phd-school-audio-2016/>, this was no problem for the SNI’s creative doctoral students.

In the abbey’s relaxed atmosphere, the SNI doctoral students familiarized themselves with and learned to use tools that will help them to remain calm and confident while giving clearly understandable presentations.



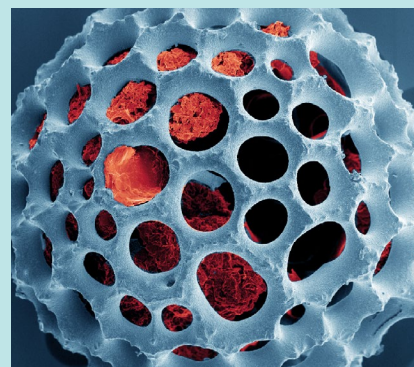
“Dive into science with rhetoric to experience the wonders of research,” said Deepika Sharma, a doctoral student with Yasin Ekinci, summarizing the workshop.

# Nano Image Award

## We want the best nano photos

We are always looking for interesting and appealing photos for our publications, so we look forward to receiving plenty of entries for the next Nano Image Award. The SNI management team will choose the three best photos, which will each be awarded CHF 300. We will announce the winners in the next “SNI update” and on our website.

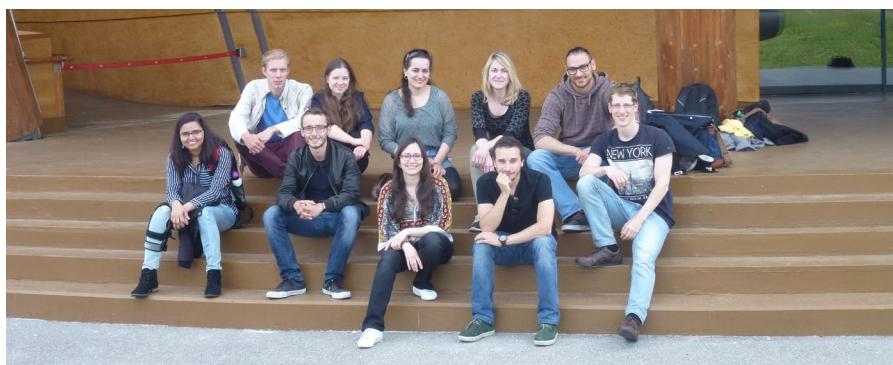
Please send your photos with a title, short description, and scale of the image to [c.moeller@unibas.ch](mailto:c.moeller@unibas.ch) by September 18, 2016.



## SNI PhD students visit CERN

In May 2016, 13 students from the SNI PhD School visited CERN in Geneva. The excursion, which was organized by Tomaž Einfeldt, offered participants an opportunity not just to learn about the groundbreaking science conducted at CERN, but also to meet a potential employer.

The young nanoscientists were initially greeted by a retired physicist who had spent almost his entire working life at CERN. He related the history of CERN from personal experience and explained how the multinational collaboration began and where it stands today. A brief, accessible introduction to the complex world of particle physics made it easier for the students from Basel to process the wide range of information gleaned from the visit. They learned how the huge quantities of data from the LHC (large hadron collider) and ATLAS detectors are processed by the server farm and made available for analysis. Everyone was thrilled to hear how the various components of the particle accelerator were put together and how temperatures approaching absolute freezing are generated on a large scale. The considerable technical outlay is reflected in the fact that the number of engineers and technicians at CERN outnumber the research physicists by ten to one.



## First KidsCamp at the University of Basel

This summer, the University of Basel offered its first UniKidsCamp for the children of its employees and students. The eight- to twelve-year-olds spent the first week of their vacation gaining insights into natural sciences and technology. The SNI was also involved in the program, which left plenty of room for play and fun as well as experiments. Under the guidance of Michèle Wegmann and some helpers, the girls and boys learned that sunlight is made up of different colors and that these rainbow colors can be made visible with a hand-made spectrometer.





## Honors and awards

### Christoph Gerber receives the Kavli Prize and an honorary doctorate from the University of Twente



The SNI management team congratulates Christoph Gerber and watches the official announcement of the Kavli Prize winners together with Christoph Gerber.

microscopy and his work on biochemical sensors. The press release from the University of Twente also emphasizes the inspiration his activities have given to many young scientists.

To read the full press release from the University of Basel, the Kavli Foundation, and the University of Twente, please visit:

[www.nanoscience.ch/nccr/media/recent\\_press\\_releases](http://www.nanoscience.ch/nccr/media/recent_press_releases)

Professor Christoph Gerber of the Swiss Nanoscience Institute and the Department of Physics at the University of Basel has been awarded the 2016 Kavli Prize in Nanoscience together with Professor Gerd Binnig (formerly of IBM Zurich Research Laboratory) and Professor Calvin Quate (Stanford University). The award honors their invention and creation of the first atomic force microscope 30 years ago.

Since 2008, the Kavli Prize has been presented every two years to honor outstanding research in astrophysics, nanoscience, and neuroscience. It comes with prize money of one million dollars for each field of research and recipients are selected based on the recommendations of internationally renowned scientists via the Kavli Foundation, the Norwegian Academy of Science and Letters, and the Norwegian Ministry of Education and Research. The winners were notified on June 2 and the ceremony will be held on September 6, 2016, in Oslo, Norway.

In November 2016, the University of Twente will present Christoph Gerber with an honorary doctorate in recognition of his role in the development of scanning probe

## Annual Meeting



This year's SNI Annual Meeting will take place on September 15–16 in the Hotel Schweizerhof, Lenzerheide (<https://www.schweizerhof-lenzerheide.ch/en/home/>).

Questions regarding the meeting should please be addressed to [michele.wegmann@unibas.ch](mailto:michele.wegmann@unibas.ch).



On October 28, the SNI celebrates its 10<sup>th</sup> anniversary together with all its members at the Halle 8 in the Gundeldinger Feld in Basel

Please reserve this date!



# Media releases and uni news from SNI members

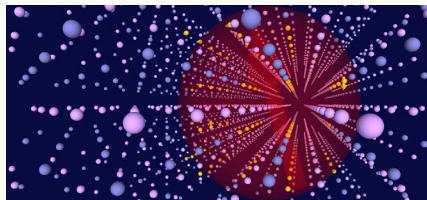
## University of Basel, 18.07.2016. A Playful Approach to Quantum Computing

One day, quantum computers will perform rapid calculations and solve complex tasks for us. However, there are a few hurdles to overcome along the way. Basel-based physicist Dr James Wootton is searching for methods that allow information to be encoded and then decoded again using quantum mechanics. And a game for smartphones is going to help him do so.

## University of Basel, 14.07.2016. Cell Death: How a Protein Drives Immune Cells to Suicide

For some pathogens, attack is the best form of defense – they enter immune cells of the human body. However, if they are detected in their hidden niche, the infected cell kills itself to re-expose the pathogens. In the “EMBO Journal” a research group at the University of Basel’s Biozentrum has reported that a protein called gasdermin forms permeable pores in the cell membrane and thus triggers the suicide of the immune cell.

## University of Basel, 11.07.2016. Physicists Couple Distant Nuclear Spins Using a Single Electron



For the first time, researchers at the University of Basel have coupled the nuclear spins of distant atoms using just a single electron. Three research groups from the Department of Physics took part in this complex experiment, the results of which have now been published in the journal Nature Nanotechnology.

## University of Twente, 30.06.2016. Honorary Doctorate for Christoph Gerber

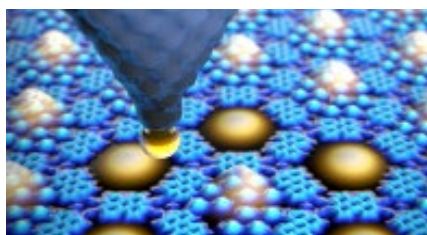
The University of Twente in The Netherlands will award four honorary doctorates later this year. Biomechanics expert Hugh Herr, former politician Neelie Kroes, nano technologist Christoph Gerber and statistician Edward Tufte will receive an honorary doctorate on the occasion of the 55th Dies Natalis of the university, November 25. Ed Brinksma, UT’s Rector Magnificus, announced this today.

## University of Basel, 29.06.2016. Basel – For Two Days International Center for Nanoscience



In the next two days, more than 600 nanoscientists from around the world meet in the Congress Center in Basel for the sixth Swiss NanoConvention. They use the chance to exchange their latest findings, develop new approaches and to establish news contacts among each other and with representatives from industry.

## University of Basel, 09.06.2016. Controlling Quantum States Atom by Atom



An international consortium led by researchers at the University of Basel has developed a method to precisely alter the quantum mechanical states of electrons within an array of quantum boxes. The method can be used to investigate the interactions between various types of atoms and electrons, which is essential for future quantum technologies, as the group reports in the journal Small.

### University of Basel, 02.06.2016. Christoph Gerber to Receive the Kavli Prize



Professor Christoph Gerber of the Swiss Nanoscience Institute and the Department of Physics at the University of Basel has been awarded the 2016 Kavli Prize in Nanoscience together with Professor Gerd Binnig (formerly of IBM Zurich Research Laboratory) and Professor Calvin Quate (Stanford University). The award honors their invention and creation of the first atomic force microscope 30 years ago.

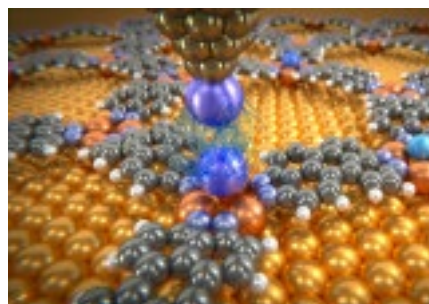
### Kavli Foundation, 02.06.2016. 9 Scientific Pioneers to Receive the 2016 Kavli Prizes

NINE PIONEERING SCIENTISTS from Germany, Switzerland, the UK and the USA have been named this year's recipients of the Kavli Prizes – prizes that recognize scientists for their seminal advances in astrophysics, nanoscience and neuroscience.

### University of Basel, 23.05.2016. A Negative Enzyme Yields Positive Results

Chemistry has provided many key tools and techniques to the biological community in the last twenty years. We can now make proteins that Mother Nature never thought of, image unique parts of live cells and even see cells in live animals. This week in ACS Central Science, two research groups from the University of Geneva and the University of Basel, both members of the NCCR Molecular Systems Engineering, show how to design an unnatural protein with new-to-nature capabilities.

### University of Basel, 13.05.2016. Physicists Measure van der Waals Forces of Individual Atoms for the First Time



Physicists at the Swiss Nanoscience Institute and the University of Basel have succeeded in measuring the very weak van der Waals forces between individual atoms for the first time. To do this, they fixed individual noble gas atoms within a molecular network and determined the interactions with a single xenon atom that they had positioned at the tip of an atomic force microscope. As expected, the forces varied according to the distance between the two atoms; but, in some cases, the forces were several times larger than theoretically calculated. These findings are reported by the international team of researchers in "Nature Communications".

All media releases can be found at: [www.nanoscience.ch/nccr/media/recent\\_press\\_releases](http://www.nanoscience.ch/nccr/media/recent_press_releases).

For media coverage based on the media releases please visit: [www.nanoscience.ch/nccr/media/in\\_the\\_media](http://www.nanoscience.ch/nccr/media/in_the_media).

## Please provide feedback

Please provide feedback and information for SNI update to [c.moeller@unibas.ch](mailto:c.moeller@unibas.ch).