KAVLI NEWSLETTER

Kavli Institute of Nanoscience Delft

No.08

October 2013

IN THIS ISSUE:

Major new center 'QuTech' announced

In his yearly innovation speech, on October 2, Minister Kamp from the Ministry of Economic Affairs of the Netherlands announced the formation of a new center for Quantum Computing and Quantum Networks: QuTech

Quantum science is on the verge of a transformational phase from university-based physics research to engineering-driven technologies. Seemingly fundamental limitations of quantum systems have recently been overcome. Although significant challenges remain, quantum science is at a point where engineering development is both feasible and desirable. QuTech will be based in Delft, centering around the existing scientific research. At TU Delft, this new center will join quantum computing and networking research from the Applied Physics department with electrical engineering and possibly quantum software development at the department of Electrical Engineering, Mathematics and Computer Science. Several connections have been made to research institutes such as TNO and to the (inter)national high tech industry. The quantum network approach will focus on building optical quantum repeaters for security, encryption and data connections while the quantum computing approach will target building scalable circuits that will be a precursor for actual quantum computers in the future. While this is a long term effort, spin-off companies and useful knowledge for existing industry can be derived from the new insights that will be developed from the start. The interested audience in the Ridderzaal on October 2 was very pleased that Kamp announced QuTech as one of the measures to incorporate long term research in the Dutch topsector policy.

QuTech will be based in Delft, centering around the existing scientific research

FROM THE DIRECTOR

This Kavli Newsletter continues to be a successful forum for exchange of news related to our institute. Often, our small editorial board is wondering what items to publish, as not too many news items were sent in. And then invariably, lots of news comes in, characteristically right after all deadlines have passed... And we accommodate these happily. Examples in this newsletter are the great news about the large initiative named 'Qutech' and the announcement of a new Kavli Institute of Nanoscience at Berkeley. Interestingly, the new director of the new Berkeley Institute is Paul Alivisatos, who will present a Kavli Colloquium at Delft on October 31 – don't miss that exciting talk. I hope you will enjoy this latest newsletter, which also has undergone a slight restyling as you may notice.

• **Cees Dekker**

COLUMN

Why engineers enjoy quantum

A dimly lit pub. A TV screen mounted in an upper corner is showing soccer World Cup quarter finals. Seated at the bar are a few onlookers, some of them watching the match, others looking at another, much larger, screen in the opposite corner. 'An evening about quantum mechanics,' it says on that screen. Below, in smaller font, 'how to live with uncertainties.'

In front of the large screen, three physicists are perched on high stools. One of them is gesticulating wildly, and snippets of sentences can be heard at the bar: "…being here and there at the same time…, superposition…, undecided until you measure…."

The small crowd that has gathered in front of the scientists consists of a few students, but mostly of older men and, to a lesser extent, women: 65+, glasses, many grey-haired heads.

I have a hypothesis that the vast majority of that audience, the visitors of today's Science Café on quantum mechanics, are retired engineers. Retired mechanical engineers, electrical engineers, aerospace engineers and the odd retired civil engineer, all of them deeply curious about quantum mechanics.

Why should that be so? My theory is that quantum mechanics as a subject is sufficiently close to the average engineer's academic background to be really interesting and has this fascinating strangeness to it; yet it is not a part of the mechanical — or electrical, aerospace, etc. — engineering degree curriculum. (It certainly wasn't 40-50 years ago, which is about when the current generation of retired engineers got their degrees, and elective programs such as minors did not yet exist).

I imagine a young, broadly interested engineering student in the seventies who has learned all about classical mechanics and electrodynamics. Occasionally he hears something about quantum mechanics, and he starts to wonder what is so different about mechanics and electrical conduction when objects become really small. His degree curriculum, however, does not provide any room for studying this in depth. Then, after graduation, many years pass by — filled with a career in engineering which again leaves him little time for learning more about quantum phenomena. But all the way through, his interest to understand this part of the physical world remains.

And finally, roughly 40 years later, it is time for action. The engineer, comfortably retired, enrolls in university courses for senior adults on quantum mechanics, attends Science Café sessions on quantum phenomena and sends in quantum-related questions to the "Ask us why" column of popular physics journals.

Over time I have met many engineers, retired but also younger, with real curiosity about quantum mechanics. My feeling is that, as researchers in quantum nanoscience, we should cherish their interest in the quantum world and the way they genuinely enjoy understanding more about it. Through their enthusiasm, network and background these engineers make great ambassadors for fundamental quantum-related research. And, last but not least — at the point where our capabilities come to a halt, they are able to actually engineer smart and useful quantum applications.

• **Miriam Blaauboer**

INTERVIEW

Interview with Paul Alivisatos

On October 31st, the Kavli Colloquium will be given by professor Paul Alivisatos, director of the Lawrence Berkeley National Laboratory. He received his Bachelor's degree in Chemistry at the University of Chicago. He continued his graduate studies at the University of California, Berkeley. After his postdoc at AT&T Bell Labs, he joined the faculty of the University of California, Berkeley. His talk will focus on climate change, and he will show us how nanoscience can help to improve the carbon cycle.

You have walked an impressive path from Ph.D. researcher up to director of the Lawrence Berkeley National Laboratory. I always wonder whether the best researchers will be good managers and if they enjoy this transformation. How did this change from doing research by yourself to managing at such high level work for you? Do you have any tips for the ones at the start of this path?

"I am a scientist. I still meet with my students to talk about science, which I enjoy very much. With my job I can make a difference for a larger science community; it is part of the career and I find it very interesting. I work with thousands of scientists, and every day I learn a new piece of science! As a Ph.D. student you are learning to create knowledge; it is very specific. As a postdoc, you work with a system of interlocking research projects. This system grows and keeps going. If you are comfortable in it, you can take the next step.

Tip: find something you really enjoy doing. It is very important to help others around you and be interested in what they are doing. There is always more to do!"

During your post-doc you became affiliated with nanoscience, and nowadays nanofabrication is of huge importance for science. What is one of the most important skills that we have nowadays in nanofabrication?

"Fabrication has advanced enormously. This is interesting, fascinating and sometimes even scary. Procedures that are routine nowadays are invented by very creative people. It is fun to see and participate in these processes. But there is a lot to do; it is important to balance. Nanofabrication is not just a service, it is a science. Spend time in understanding what is happening in the materials and make a contribution. As a grad student I used to stand in front of a machine and understand its physics and limitations: make it a learning experience."

While the Lawrence Berkeley National Laboratory has a broad range of research topics, you are specialized in solar energy. Do you think it is an option to make solar the only energy resource, or will it always be only one source among several?

"In the near future, solar could be more dominant. It will still be a part, but an important part. Now is an exciting moment; the prices have gone down, and there is a huge growth in industry. In the future I see a heterogeneous energy system including solar but also hydrocarbons and more natural gas. At least for the coming 50 years, the energy mix will be complicated."

One of the problems of solar energy is energy storage. I heard in a talk by you on YouTube that artificial photosynthesis is an option. This sounds very cool to me. Could you explain this?

"This is a challenge! Artificial photosynthesis can solve the solar fuel problem, but it will take time. The first solar cell is over 60 years old, and still solar contributes only a few percent to the energy system. It takes time to become widespread. We need to create a balanced carbon cycle before artificial photosynthesis will be greatly available. We could find a different solution before that is achieved."

One of the big student projects in Delft is the Nuon Solar Team, which competes in the World Solar Challenge with a race car fuelled only by solar energy. Do you see cars with solar cell roofs in the future?

This will be hard. We like to move around, and a roof solar panel will only be sufficient for a superlight car. I do not think this could be the right idea. I am more excited by the electric cars. Any electric input could work in the end; we could bring the solar energy to the car.

• **Julia Cramer**

KAVLI COLLOQUIUM

'Nanoscience and the Future of the Global Carbon Cycle'

Paul Alivisatos

University of California, Berkeley

On October 31, 2013 Paul Alivisatos will give a Kavli colloquium on Nanoscience and the Future of the Global Carbon Cycle"

Paul Alivisatos

The global carbon cycle is out of balance. Byproducts and side effects of human energy use are changing the planet. This talk will briefly illustrate how core subjects of physics and chemistry like thermodynamics, quantum mechanics, and spectroscopy form the basis from which we understand how human activity is altering the global carbon cycle. As we look towards re-balancing the carbon cycle, nanoscience and nanotechnology will play a key role. A future balanced carbon cycle will rely on combinations of carbon capture and management, solar and renewable energies, and energy storage on a vast scale. This talk will illustrate that all of these will be greatly enhanced by nanoscience and nanotechnology.

15.00 h	Pre-programme:
	The 2013 Nobel prize in medicine The 2013 Nobel prize in physics The 2013 Nobel prize in chemistry
15.45 h	Break
16.00 h	Kavli colloquium by Paul Alivisatos: 'Nanoscience and the Future of the Global Carbon Cycle'
17.15 h	Drinks & time to meet

EXTRA SEMINAR

'Design and synthesis of multi-component colloidal nanocrystals for catalysis and sensing'

On October 31 there will be an additionaly lecture on: "Design and synthesis of multi-component colloidal nanocrystals for catalysis and sensing". The abstract for this lecture reads as follows:
Today it is possible to make nanocrystals with complex shapes, interconnections and topologies. This talk will first briefly describe new methods for imaging the growth and assembly of nanocrystals in the graphene liquid cell, providing new insights into how these materials form. Secondly, I will show examples of nanocrystal synthesis for a designed purpose: the formation of a nested system of nanoparticles for use in catalysis, and the synthesis of branched nanocrystals as a luminescent stress sensor.

KAVLI COLLOQUIUM

'Nanoscience and the Future of the Global Carbon Cycle'

Date : October 31, 2013 at 15.00 hours
Location : Aula Conference Centre, Lecture room A

EXTRA SEMINAR

'Design and synthesis of multi-component colloidal nanocrystals for catalysis and sensing'

Date : October 31, 2013 at 10.00 hours
Location : Faculty of Applied Physics, Lorentzweg 1, Lecture room E

NEWS

Kavli Student Exchange Program

Last June, members from all 4 Kavli Institutes of Nanoscience at Caltech, Cornell, Harvard, and Delft met for a joint scientific meeting. The workshop featured talks by all participants and open discussions about future areas in nanoscience.
One of the concrete outcomes was the start of a new student exchange program where PhD students will have the opportunity to do some research at one of the other Kavli Institutes. The idea is that students can be sent from one of our Kavli Delft groups to a group at a Kavli Institute at Harvard, Cornell or Caltech for a short period for some joint research project. Or vice versa, that we can host students from those institutes to our groups at Delft. Travel and lodging costs for these visits will be supported from this exchange program, which has been funded by the Kavli Foundation for 1 pilot year, i.e., the upcoming academic year. A first student from Delft has already made his way to Harvard now.

New proposals can be sent in before December 15

ERC GRANTS

Two ERC grants for the Kavli Institute

A 'chemical' and 'biological' eye on graphene
Grégory Schneider, until recently postdoc in Cees Dekkers group at BN studies graphene from a chemical perspective. He will use his ERC grant to harvest the unique edge and surface chemistry of graphene for developing a general method for functionalizing graphene through a fundamental understanding of graphene chemistry at a single molecule level.

Astronomy technology for research into quantum materials
The aim of the ERC project of **Teun Klapwijk** is to enhance understanding of quantum materials in which different ground states compete with each other, a situation that results in electronic inhomogeneity in the material. The challenge is therefore to measure the electrodynamic properties of these materials on the local scale (i.e. the nanoscale).

VENI'S

Three NWO-VENI grants awarded to our institute

Marie-Eve Aubin-Tam

Realtime tracking of toxin invasion
Several pernicious bacteria can inject lethal protein toxins into our cells. The penetration of the protein toxins into cells requires membrane transporters, which thread the protein toxins through narrow pores across the cell membrane. To elucidate this process, toxin molecules will be followed with biophysical tools, one at a time, while they cross the membrane.

Enrique Burzuri

Graphene and molecules for quantum computation
Individual magnetic molecules could be used to process information in computers. The magnetic state could be read and written injecting magnetically polarized currents. This research aims at using magnetically functionalised graphene, two-dimensional carbon structures, as electrodes to bring applications closer.

Tim Taminiau

Correcting quantum errors
The natural laws of quantum mechanics make it possible to process information in a new and more powerful way, but unfortunately this makes it extremely sensitive to errors in calculation. The researcher intends to demonstrate that even quantum errors can be traced and rectified.

Andreas Engel

An invitation at the right time

A decade ago Cees Dekker visited my lab in Basel with his entire team to see how we got our wonderful results. I did not hear from him since then, and his invitation to join the Department of BioNanoscience recently thus came as a surprise. For 25 years I did lead a successful group at the Maurice E. Müller Institute of the University of Basel. We combined the strength of electron microscopy and atomic force microscopy to study membrane proteins. Just before my retirement, Kris Palczewski offered me a position at the Case Western Reserve University. After four years in Cleveland I had to figure out how to continue – finally become a ski bum or write new grants? The latter would be a 5-year engagement to stay in the US, which is not compatible with my family in Switzerland. My wife Barbara has provided a fantastic infrastructure throughout my scientific career. But now she is the happiest grandmother I have ever known, and while she still has understanding for my perpetual curiosity and my fascination for instruments that can decipher the secrets of life, this is no longer true for me working so far away. The invitation to join BioNanosicence came thus at the right time. I am member of the Department of BioNanoscience since January 2013 and started my little team in July.

'After four years in Cleveland I had to figure out how to continue – finally become a ski bum or write new grants?'

After building lasers and producing holograms to earn a PhD in physics in the early seventies I continued my scientific career in biology. I first developed instruments and then acquired a deeper understanding of biology to apply my expertise is in high-resolution electron and atomic force microscopy (AFM). Edward Kellenberger introduced me to molecular and structural biology, and my interest for membrane proteins came through a productive collaboration with Jürg Rosenbusch, who studied bacterial outer membrane porins. Together with Ueli Aebi I built the Maurice E. Müller Institute that educated around 50 PhD students and 50 postdocs, and produced 660 papers within its 25 years of existence. I also developed the first BSc/MSc curricula for nanoscale sciences. Attracted by the inspiring interdisciplinary scientific environment, many talented, creative and ambitious students and postdocs joined my group. This group engaged in numerous collaborations with colleagues and friends, among them Wolfgang Baumeister, Peter Agre, Yoshi Fujiyoshi and Kris Palczewski. Peter Agre, who discovered the water channel protein of the red cell (aquaporin-1), was awarded the Nobel Prize in 2003 – the structure aquaporin-1 that we solved together with Yoshi Fujiyoshi was important in this. The honorary doctorate in medicine of the University of Aarhus that was awarded to me by the Queen of Denmark was an impressive recognition of this work.

Barbara took great care to maintain a balance between real life and the fascination of basic science. We developed many outdoors activities together with our two children, Hansres (theoretical physicist) and Eveline (neurobiologist). Both are fantastic skiers. Thus skiing remains our major winter sport. Hiking was and lately climbing is the main summer activity. The latter is reactivating talents discovered during my military training. Besides sports I enjoy playing Happy Jazz with my friends, sketching, doing water colors but mainly being a family man. After seven years working in the US, my son returned to Basel and we have extended our house to accommodate three generations.

But many times I still ponder about science: How can we unveil the secrets related to maintenance of water homeostasis in our body or our capacity to detect a single photon? In both cases the native structural framework has to be established to the highest resolution, and to be combined with functional analyses. Both processes involve dynamic interaction of proteins. The quest is to identify those proteins if still unknown, to solve their structure, to assess their native assemblies, and to extract from such data new hypotheses on the molecular mechanisms involved. This general approach can successfully be applied to all physiological processes that are to be unraveled, but it requires availability of modern cryo-electron microscopy including sample preparation tools and powerful image processing facilities. My mission is to bring this method to the TU Delft, where it not only would be applied but most importantly also be further developed.

• **Andreas Engel**

KAVLI DAY - EXCURSIONS IN DELFT

Several groups exploring Delft

An acrobat in our middle!

Bullet holes from the murder of Willem van Oranje

De Oude Jan

Antonie van Leeuwenhoek

Hans Mooij

Lunch Prinsenhof

Photo's: Angela de Ceuninck van Capelle

KAVLI DELFT THESIS PRIZE 2013

His most decisive contribution, chapter 3 of his thesis, led to a first-author article in Science last yeat.

NEWS

Kavli Delft Thesis Prize 2013 for Martijn van Loenhout

The Kavli Delft thesis prize is a prize for the best PhD thesis written by a graduate student at our Kavli Institute of Nanoscience at Delft in the previous two years. It consists of an award and an amount of € 3000 that can be freely spent by the laureate. On the Kavli Day, the 2013 Kavli Delft thesis prize was awarded to Marijn van Loenhout for his thesis "Single-molecule studies of the twisted, knotted, and broken genome". Marijn van Loenhout's thesis, which he defended cum laude in November 2012, was of exceptional quality, both in terms of productivity and quality. His single-molecule biophysics experiments, aimed at resolving DNA supercoiling and DNA-protein interactions, led to 7 publications. His most decisive contribution, chapter 3 of his thesis, led to a first-author article in Science last year. In this paper, he showed for the first time ever, the dynamics of DNA plectonemes, coiled up DNA knots, and he discovered a new mode by which such DNA objects move and rearrange.

SYMPOSIUM

Teun Klapwijk 65 year symposium: 'From nano to cosmo'

On **Friday November 1, 2013**, a special symposium 'From nano to cosmo' will be held on the occasion of 65th birthday of prof. Teun Klapwijk. Lectures will be given by Ewine van Dishoeck (Leiden University), Xander Tielens (Leiden University), Mike Norman (Argonne University), Seamus Davis (Cornell University), Leo DiCarlo (Delft University of Technology), and Jochem Baselmans (Delft University of Technology/SRON). The symposium is followed in the afternoon by the farewell lecture of Teun Klapwijk.
For further information see:
casimir.researchschool.nl/from-nano-to-cosmo-2005.html.

NEWS

Marileen Dogterom new chair BN

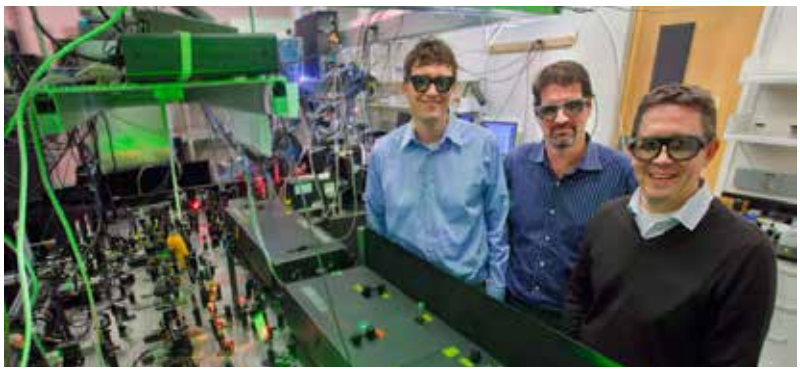
Prof. Marileen Dogterom has been appointed as chair of the department of Bionanoscience, starting from January 1, 2014. Marileen currently is head of the department Systems Biophysics at the FOM Institute AMOLF and will continue her research as a professor within BN. She is a world leader in the biophysics of the cytoskeleton, the microtubules that give biological cells their distinctive and functional shapes. She is at the forefront of biomimetics and is a recognized expert in cell biophysics.

Marileen Dogterom will succeed Prof. Ted Young, who has been the interim head of the department in 2013. We would like to express our heartfelt thanks for his enthusiasm and hard work in the past year and wish his successor Marileen every success.

NEWS

New Kavli Institute of Nanoscience at Berkeley

On October 3, the University of California, Berkeley, the Lawrence Berkeley National Laboratory, and the Kavli Foundation announced the establishment of a new Kavli Institute: the Kavli Energy NanoScience Institute. The Institute will study how nature manages energy at the nanoscale and develop entirely new ways to capture, store, and harness energy for the world's growing population. The new Kavli Institute at Berkeley will be led by its director Paul Alivisatos and co-directors Omar Yaghi and Peidong Yang.



NEW EMPLOYEES

New employees Kavli Institute of Nanoscience

Name	Date of employment	Position	Lab
Shun Yanai	4/1/2013	PhD student	QN/MED
Meike van der Meer-Verschuur	6/1/2013	Management Assistant	QN/QT
Vanessa Carvalho	6/15/2013	PhD student	BN/Andreas Engel lab
Rocco Gaudenzi	6/15/2013	PhD student	QN/MED
Theo van Laar	6/24/2013	Technician	BN/Nynke Dekker lab
Mingyun Yuan	7/1/2013	Postdoc	QN/MED
Jochem Pronk	7/15/2013	PhD student	BN/Andreas Engel lab
Sergiy Dobrovolskiy	8/1/2013	Postdoc	QN/QT
Pawel Tulinski	8/15/2013	Technician	BN/Nynke Dekker lab/ BN/Chirlmin Joo lab
Anestasia Holovchenko	9/1/2013	PhD student	QN/MED
Toivo Hensgens	9/1/2013	PhD student	QN/QT
Mark Ammerlaan	9/1/2013	Technician	QN/QT
Anton Akhmerov	9/1/2013	Assistant Professor	QN/TN
Raymond Vermeulen	9/15/2013	Tecnnician	QN/QT
Carsten Blom	9/30/2013	PhD student	BN/Bertus Beaumont lab
Fabrizio Anella	10/1/2013	Postdoc	BN/Christophe Danelon lab
Michael Wimmer	10/1/2013	Scientific project leader	QN/QT
Daniel Verschueren	10/1/2013	PhD student	BN/Cees Dekker
Alicia Soler Canton	10/15/2013	PhD student	BN/Christophe Danelon lab
Jorine Eeftens	11/1/2013	PhD student	BN/Cees Dekker
Sung Hyun Kim	11/1/2013	Postdoc	BN/Cees Dekker, BN/Chirlmin Joo lab
Afshin Belarghou Vahid	1/1/2014	PhD student	BN/Timon Idema lab
Siddarth Rajendra Deshpande	1/15/2014	PhD student	BN/Cees Dekker

NEWS

The first equipment is now being installed. Ultimately, there will be 2 wet and 12 dry state-of-the-art dilution refrigerators.

Quantum Computer lab on its way

Construction in the B Wing of the Applied Physics Department in Delft is nearing completion: the first equipment is rolling into the brand new QC-lab.

Andrea Caviglia

QC-lab is the new research facility for the ERC Synergy team led by Leo Kouwenhoven, Carlo Beenakker (Leiden University) and Lieven Vandersypen. The team was one of the winners in the first round of ERC Synergy Grants in 2012, receiving 15 million Euro for 6 years of highly challenging research. The Delft-Leiden team will use a highly integrated approach to enable the next big step in quantum computing: realizing a full-scale quantum circuit.

To maximize collaboration between researchers, we decided to rethink the lab space from the ground up. As Carlo Beenakker states, 'There is no substitute for physical proximity to promote synergy'. This wish was shared by all involved and taken very seriously. Synergy between scientists, techs and management has swiftly resulted in an open-door facility that is functional, inspiring, comfortable and fun; so much so that even theorists will want to be near the experiments. QC-lab spans two floors. On the ground floor you will find all the cryogenic equipment housing the quantum circuits and the required infrastructure. The central staircase takes you into a different world upstairs. There are two meeting rooms, and fatboys and glassy whiteboards all around to promote discussion, thinking, and relaxing. Around them you find inviting data acquisition stations laid out in a beautifully open arrangement. Having the experiments directly underneath will allow the PhD students and postdocs to remain very close to their experiment without the usual rumble and heat from pumps and rack equipment. Leo Kouwenhoven: 'From the carpet on the floor to the complete absence of doors, the QC-lab facility is a daring experiment in itself. We are excited to see it improve the way we work and collaborate'.

• **Anouschka Versleijen and Leo DiCarlo**

In order to provide easy access to the measurements downstairs, 80 cm holes were drilled through ground floor's ceiling.

Roomy and lit office space for the QC-lab team to work in: postdocs and PhDs working on different types of qubits can share expertise. (Photo credit: Alessandro Bruno)

INTRODUCTION NEW FACULTY

Anton Akhmerov

Witnessing phenomena that are puzzling and beautiful

Yes, this is me.

Of course I do not mean the crazy schematic man dancing between the closing doors of a train in Italy. I am rather the focused person taking the photo, whose reflection can be seen in the background.

You see me occupied with my favorite hobby: witnessing aspects of society that are puzzling and, in a certain sense, beautiful at the same time. I try to imagine the person who made this image as a warning to the passengers; did they think that people caught by the train doors would be doing this kind of weird dance? Was this mere lack of attention, or maybe even a subtle call to rebel against the closing doors? Like most other questions about society, this one is rather hard to answer with definiteness.

'However the best part about physics is that we can mostly try to understand what is happening, or even think about how to make something happen'

In quantum nanophysics I like just the same kind of thing: witnessing phenomena that are puzzling and beautiful. Due to that reason, much of my recent work has been about Majorana fermions. These are particles that are the same as their own antiparticles (most have heard this part). More fascinating facts about them is that they are also fermions that are not actually fermions, and particles with no internal degrees of freedom whose state changes after they are shuffled. However the best part about physics (as opposed to the study of society) is that we can mostly try to understand what is happening, or even think about how to make something happen. These possibilities motivate me in my work as a theorist.

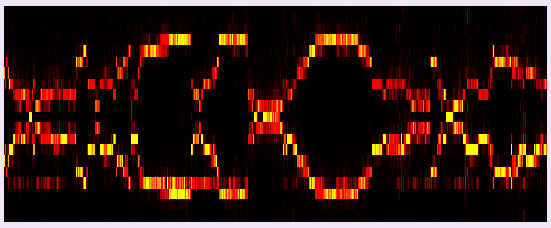
My scientific trajectory is rather simple: I moved to Leiden in 2006 after five years of undergraduate study at the Moscow Institute of Physics and Technology. In Leiden, I worked in the group of Carlo Beenakker for six years, first as a master student, then a Ph.D. student, and finally briefly as a postdoc. During this time I enjoyed frequent visits to Delft, learning about the cool experiments that happen here. Eventually I even joined regular discussions of a couple of ongoing projects. So as you see, my transition to the Kavli Institute was gradual, and after a year spent as a postdoc at Harvard, I am finally very happy to begin here full time.

I enjoy learning about open problems, running experiments, and unexpected results. To feel the pulse of research at the Kavli Institute I would like to meet with many people in the coming days. I am looking forward to learning about what is happening now, and what is going to happen soon. If I were to select just one thing that I want my coworkers to know about me, it is my attitude towards discussion. I always like to hear about new things, and I am always willing to help solve a puzzle. I hope that you will keep this in mind, and I wish everyone a great academic year.

• **Anton Akhmerov**

HIGHLIGHT PAPERS

Millisecond charge-parity fluctuations and induced decoherence in a superconducting transmon qubit



Superconducting circuits are promising for quantum computing, but quasiparticle tunneling across Josephson junctions induces qubit decoherence. Ristè et al. converted a transmon qubit into its own real-time quasiparticle-tunneling detector and directly measured induced decoherence in the millisecond range. The measured timescale demonstrates that quasiparticle tunneling does not presently bottleneck transmon qubit coherence, leaving room for at least an order of magnitude increase.

D. Ristè, C.C. Bultink, M.J. Tiggelman, R.N. Schouten, K.W. Lehnert, L. DiCarlo
Nature Communications, 2013, 1913,
doi:10.1038/ncomms2936

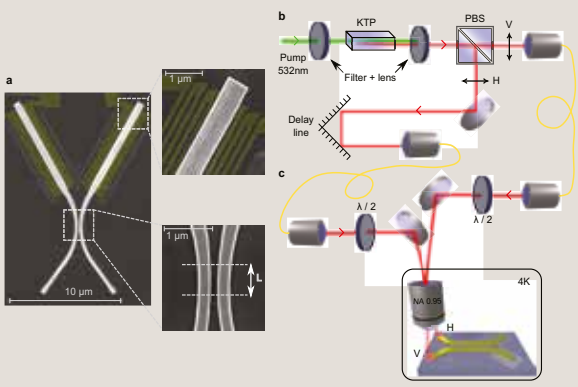
A valley–spin qubit in a carbon nanotube

The low abundance of magnetic nuclei in carbon nanotubes makes them potentially attractive host materials for electron spin qubits. Such a qubit has now been realised with the help of spin-orbit interaction in a bent nanotube.

E.A. Laird, F. Pei, L.P. Kouwenhoven
Nature Nanotechnology, 2013, 565–568,
doi:10.1038/nnano.2013.140

Quantum interference in plasmonic circuits

We have demonstrated a fundamental optical experiment at an unprecedented small scale. By propagating single photons in a plasmonic interferometer where light is confined to nanometer scale metal waveguides, we have observed the coalescence of indistinguishable photons, a crucial building block for quantum processors.



R.W. Heeres, L.P. Kouwenhoven, V. Zwiller
Nature Nanotechnology, 2013, doi:10.1038/nnano.2013.150

COLUMN

Go Go Go!

The start of the new academic year always has something special to it. After the calm of summer, the air is suddenly bustling with the buzz of new students on campus grounds. A fresh batch of slightly disoriented, ever younger-looking students once more roam the hallways of our Applied Physics building. The weather - after the short, reasonably-dry-and-not-too-cold period the Dutch call summer - characteristically turns sour as deluges become a daily recurring event (somehow always peaking when I am on my way to or from work, irrespective of the time of day). Then there is the yearly Kavli Day; always a friendly reminder that we are all part of something bigger. The day that the exchange of awkward or wary glances between BN and QN grad students along the corridors actually becomes a careful exchange of words, or even experiences…

This year, the start of the academic season also marks the kick-off of the second half of my Ph.D. A perfect time to look back and reflect, then look forward and move on. Well into my Ph.D., I suddenly realize that I have become a more senior member of the lab; people actually come and ask me for advice (!). By the time you read this, I will just have premiered my work at a conference, which hopefully matched the fantastic prospects I sketched in my abstract months ago… Students have already come and gone, graduated under my supervision. Around Christmas time, my first BN paper might even have sprung into existence.

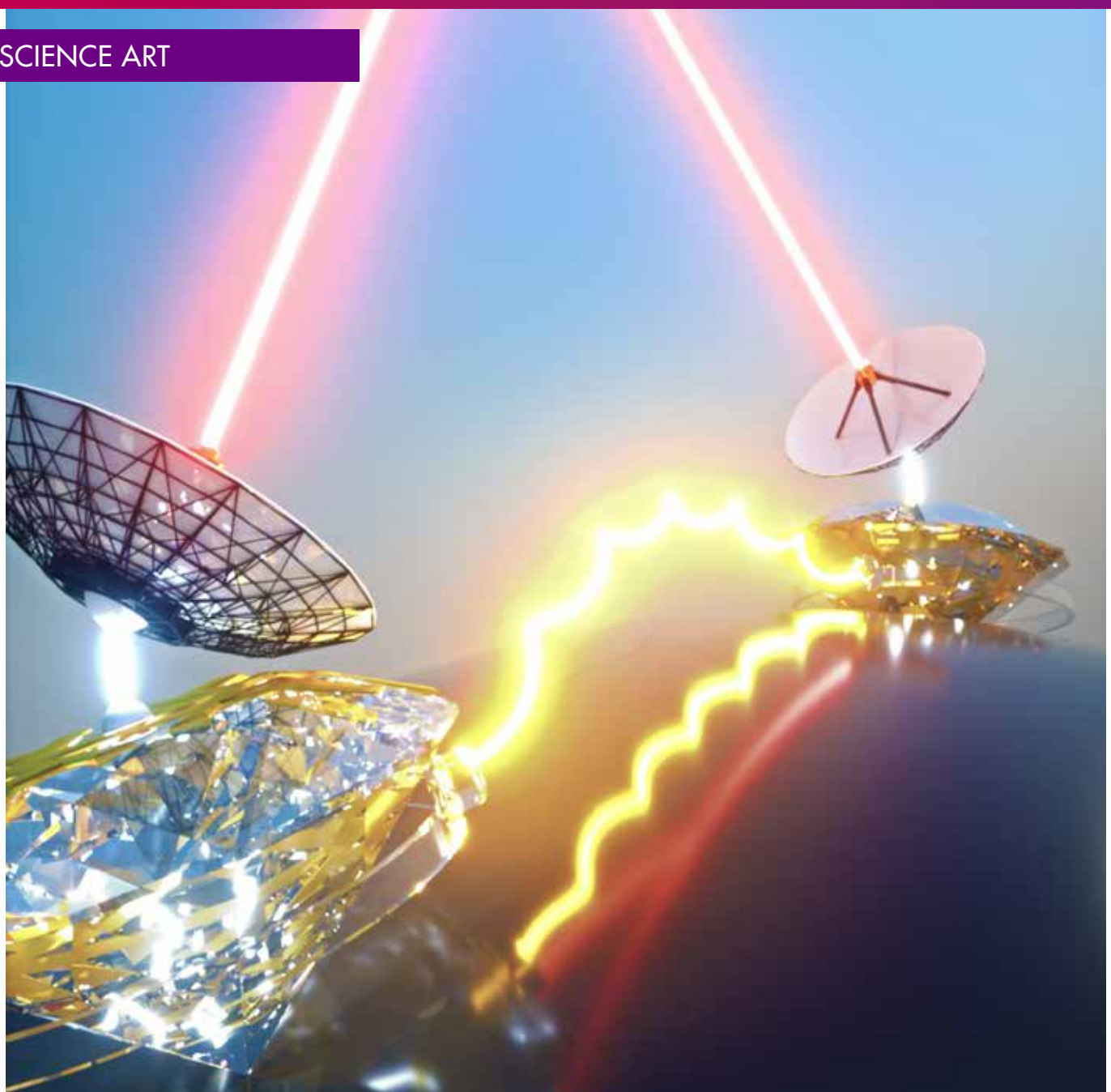
I also realize now more than ever - as many of my fellow grad students will immediately recognize - that there actually is an end to this seemingly endless stretch of experiment-time called a Ph.D. "Oh no!" I hear myself thinking, "So many projects left to pick up, so little time left! I have to start focusing; what will be my main storyline? Which projects are worth putting in time and effort? What about life after Ph.D.? Is there life after Ph.D.?!"

Calm down Bojk, things are still going according to plan: You love the work you are doing, have learned tons, projects are definitely going somewhere and - in the long run most important - chances are there will be life after your Ph.D. I mean, the (academic) job market is tight, and all of us will have to put up a fight to secure the job we want, but things could be worse. Take the countless number of freshly minted Ph.D.s the LHC project has churned out over the last years, where will they go? The vast majority is obviously hoping to stay in the field, but with particle physics budgets in the US and Europe stagnating, there aren't nearly enough academic positions to accommodate them all. Two words: embrace alternatives. That's the only option for these guys. I have read that single post-doc positions can draw more than 100 applications. Then even the best and brightest can come up empty-handed in their hunt for an academic position.

Though people here aren't in such a predicament, I also observe the (life-long) struggle for grants, post-docs and tenure-tracks from up close. I then often can't help thinking: 'Guys don't you realize there's a whole world out there?' The time for me to make a career choice still lies ahead of me; I for one do realize there are many exciting opportunities both within and outside academia. For now, half time is over: go go go!

•Bojk Berghuis

SCIENCE ART



Visualisation of quantum entanglement of spins in diamond - connected to the paper 'Heralded entanglement between solid-state qubits separated by three metres' by H. Bernien, B. Hensen, W. Pfaff, G. Koolstra, M. S. Blok, L. Robledo, T. H. Taminiau, M. Markham, D. J. Twitchen, L. Childress, R. Hanson | Nature 497, 86 (2013)

Artist impression made by Avalon Designs

Please send suggestions for 'Science Art' to Amanda van der Vlist, A.vanderVlist@tudelft.nl

KAVLI COLLOQUIUM

Paul Alivisatos

31 October 2013

University of California, Berkeley

UPCOMING KAVLI COLLOQUIUM

George Whitesides

Date to be announced

Harvard University

CONTRIBUTE TO THIS NEWSLETTER

Input to forthcoming newsletters is very welcome. Please send any relevant material to Amanda van de Vlist (A.vanderVlist@tudelft.nl).
If you like to contribute to this newsletter as an editor, please contact Cees Dekker. •

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