KAVLI NEWSLETTER

Kavli Institute of Nanoscience Delft

No.05

November 2012

IN THIS ISSUE:

Image: A hybrid superconductor - semiconductor nanowire structure hosting Majorana fermions at the ends of the superconducting contact.
Credit: Vincent Mourik, Kun Zuo, Sergey Frolov, Sebastien Plissard, Erik Bakkers, Leo Kouwenhoven. Artist impression made by Avalon designs.

THE UPCOMING KAVLI COLLOQUIUM WITH BONNIE BASSLER, OUR NEW IMAGING FACILITY, NEW COLUMNS, AND MORE

Perhaps the biggest scientific news from our institute in the past half year was the breakthrough that Leo Kouwenhoven and his team achieved in providing the first evidence for the existence of Majorana fermions, a new type of quasiparticles that may be used as building blocks for a future quantum computer since they couple only very weakly to the outside environment.
We congratulate Leo and his team and we are proud that our Institute is leading the way in this field. In the previous newsletter, this news was added as a last minute brief contribution since the news just broke when the newsletter was about to go on its way to the printer. Since then, Leo and his team members gave many tens of interviews in national and international media, and here – rather than yielding yet another interview with the same story – we highlight the Majorana device on the cover and provide a brief summary with newspaper headlines. Surely there is much more to come on this subject and we will keep you updated.

On November 22, we will feature Bonnie Bassler from Princeton as our Kavli Colloquium speaker. She is a molecular biologist who made key discoveries on the mechanism by which bacteria communicate to each other, known as quorum sensing. She is an outstanding speaker and this colloquium is going to be a special event so don't miss it. To get an impression of her outgoing and energetic personality, read the interview of her by PhD student Felix Hol – see page 4 and 5 of this newsletter.

Cutting-edge technology is key to virtually all of our research. Our most recent addition is the 'Bionanoscience Advanced Microscopy Center'. For this, Daniel Lam has a special invitation for you, see page 8 of this newsletter.

In the past two years we have enjoyed stimulating columns by Jan Lipfert and Yuli Nazarov. To widely span the entire breadth of our institute we have started a search for new columnists – while at the same time thanking Jan and Yuli very much for their great contributions. In this newsletter you can read Yuli's last column as well as enjoy the first one by a new columnist, graduate student Bojk Berghuis.

And there is yet more in this newsletter: The awarding of 2012 Kavli publication prize, photo's from the Kavli Day, self-introductions by faculty members Martin Depken and Erik Bakkers, an impression of the 2012 Kavli prizes in Oslo, and a variety of other new items. Enjoy!

• **Cees Dekker**

Cees Dekker

Column

AD ASTRA?

An immediate reason for this column is a piece of news worth noticing: Teun Klapwijk was awarded the 2012 Kamerlingh Onnes Prize for Experiments in Superconductivity for 'seminal experiments on the superconducting properties of superconductor-ferromagnet and superconductor-normal metal nanostructures.' I like the threefold coming of the "supercond" in this formulation that gives it a flavour of a liturgical prayer. I liked the wine Teun brought to celebrate. I very much like Teun in general and in person, that persistent emitter of friendliness and wisdom mounted on a seven-foot support.

Yet I do not want to get personal, but rather pose the question: how far should one dare to go beyond ones field of expertise that has perhaps already been designated and narrowed with a choice of your PhD supervisor. I address this because while outside our kingdom Teun is the star in fundamental superconductivity, he now actually cares more about real stars, distant galaxies and other immediate practical applications. His heart has gone to orbit with the Hershel Space Telescope.

Leonardo da Vinci is commonly regarded as one of the last universal scientists. Yet, was he universally successful? There's a couple of reasonable paintings left, while the heli he sketched has never flown and the glory went to another guy. Was the image of the universal scientist a product of some PR activities and influence gained by his serving the royalty? Can one be successful outside one's real expertise?

Teun's marriage of superconductivity to astronomy does not seem more likely than that of a British royalty and a South-African boer. Yet a peculiar dimensionless combination of fundamental constants guarantees that one field can give what another one is yearning so much. Many research groups of varying background and intentions are involved in the marriage, and it is hard to be the first: the competition is even harder than that in fundamental science.

Having read too much science fiction in my early teens, I made a telescope from the broken glasses of my granny and a broken camera of my dad: was that my first scientific achievement? The craft was prone to chromatic and achromatic aberrations, yet I was able to resolve the Great Andromeda Nebula. I've grown up since then. A friend of mine that works in adaptive optics keeps asking if I could invest my creativity to combat aberration in modern devices. My firm answer is no, I'm too busy with electron waves, students, grant applications, educations, trips abroad, and profiling my own research field. Would the kid that I was like my present answer? Would he like to become like me?

We are pursuing research careers within narrow fields, having (so much) success. But the distant stars are twinkling above, remaining far, passionate and unachievable, regardless of our efforts. Is our choice right? Is Teun right? Since this is my last column in the Kavli Newsletter, I pose the question to you: is your choice right? Would you please be so kind as to draw a conclusion yourself.

• **Yuli Nazarov** - QN Department

Interview

SEVEN ERC GRANTS AWARDED TO OUR INSTITUTE

Seven Kavli researchers have been awarded an ERC Grant (5 ERC Starting Grants, 1 ERC Advanced Grant and 1 ERC Proof of Concept Grant).

Herre van der Zant plans to use his ERC Advanced Grant to study Controlling Molecular Spin at the Molecular Scale. Magnetic molecules in principle enable radically new approaches in using the spin degree of freedom for storing and reading information, but their incorporation in solid-state devices is a daunting task. In this ERC project, the fields of molecular magnetism, molecular electronics and nanotechnology will be merged. Nanodevices will be built, containing individual magnetic molecules or magnetic nanoparticles, so called spin transistors, in which the electric current through the individual molecule or nanoparticle is sensitive to its spin properties.

Nynke Dekker uses her ERC Starting Grant to study the question: What stops DNA replication? With the powerful instruments recently developed by her research group, Dekker can visualise individual proteins and at the same time control and monitor the state of the DNA. The proteins and protein complexes she will study are essential for the survival of the cell.

Chirlmin Joo plans to use his ERC Starting Grant to get more insight into RNA. MicroRNA is a small piece of regulatory RNA that controls so-called messenger RNA. This microRNA has smart applications in gene therapy. A key role in this process is reserved for the RISC protein complex. Joo plans to shed more light on this complex. He will tackle this using the technique of single molecule fluorescent microscopy. This will enable him to observe all processes in real time.

Ronald Hanson will use his ERC Starting Grant to study the quantum properties of spins. It is already possible to manipulate and read out individual spins in solid matter, but none of these experiments have succeeded in correcting interference and errors and, moreover, they only work at short distances. This is the issue Hanson wants to tackle. He believes that quantum feedback and quantum entanglement between isolated spins should make more robust control of spins and true quantum networks possible.

Val Zwiller plans to use his ERC Starting Grant to study the possibility of communication with individual photons. This research includes generating identical individual photons, interfaces to link the polarisation of individual photons to the spins of individual electrons, and designing highly efficient detectors. He plans to design a 'nanodevice toolbox' for quantum optics, based on individual photons.

Francesco Pedaci, postdoc in the Nynke Dekker Lab, received an ERC Starting Grant titled Probing the angular dynamics of biological systems with the optical torque wrench. Based on this he will establish his own research group at CNRS in Montpelier, France.

Henny Zandbergen received an ERC Proof of Concept Grant to bring developments on in-situ transmission electron microscopy at low temperatures within his existing ERC project to a commercial product. The product will be a very versitale sample holder allowing experiments with double tilt of the sample and temperatures in the range from 90 K to room temperature with a resolution of 0.1 nm. •

Kavli prizes 2012

The Kavli Prize Ceremony artistic finale. (Credit: Scanpix)

TIM VAN DER HAGEN VISITED THE KAVLI PRIZE CEREMONY 2012 IN OSLO

PHD STUDENT SAL J. BOSMAN INTERVIEWED HIM ON THIS

Some people at our Kavli Institute might not be familiar with our Dean of Applied Sciences: Tim van der Hagen. Can you briefly introduce yourself, and your views on the Kavli Institute of Nanoscience in Delft?

In 1985 I started with my PhD in Delft. Now, about 20 years later, I combine my job as Dean of the Faculty of Applied Sciences together with my position as professor of nuclear reactor physics. We, myself as well as the board of the university, are very proud that the Kavli institute of nanoscience Delft is part of our faculty and university. Not everybody is aware that 'Kavli' is not merely some name, but a mark of great excellence.

As Dean, how do you view the fact that our institute is part of a global network of science institutions?

In fact, this should be the case for all our institutions. Modern science is a global enterprise - your colleagues are all over the world - and the Kavli network where Delft teams up with Harvard, Cornell, and Caltech, is an excellent example of how science should be globally organized.

Together with previous Kavli director Hans Mooij, current Kavli director Cees Dekker, Leo Kouwenhoven who spoke at a Kavli Symposium, and our University President Dirk Jan van den Berg, you visited in Norway the Kavli ceremony in Oslo where the Kavli 2012 prizes were awarded this September. What was your impression of this ceremony and visit?

The ceremony was extremely well organized and a fantastic event. There were lectures by the best scientists in the three fields where the Kavli foundation focuses on. For example, the lectures on astrophysics gave a layman, such as I am in this field, a clear impression of what progress has been achieved. I also enjoyed the forum discussion on global health. The days in Oslo gave us much opportunity to get in contact with the key players of the top institutes worldwide. It was interesting to sit next to the president of MIT for example, and to discuss with him.

Can you give us an impression of Fred Kavli, the founder of the Kavli foundation?

I was pleased and honored to meet Fred Kavli. He has a very clear vision on how to initiate progress in these three very important fields in science. Of course it would be great if we could host another visit of Fred Kavli here in Delft.

The Kavli prize winner for nanoscience in 2012 was Mildred Dresselhaus "for her pioneering contributions to the study of phonons, electron-phonon interactions, and thermal transport in nanostructures." What is, in your view, her most outstanding achievement?

What struck me most was that in many fields of nanoscience she truly is a pioneer. She was active on topics and subjects before they even had a name. Her career spanned more than 50 years! Also remarkable is that she is the first person that solely won a Kavli prize, and one of the first female winners.

Do you have any words of advise for (our) potential future Kavli prize winners?

Follow your heart. Put quality first in everything you do. And most importantly, enjoy what you do. This joy and enthusiasm in your work is what I saw clearly reflected in all the Kavli prize winners of this year. For some it took years of work before it bore fruit. In these processes it is essential to enjoy what you are doing.

• **Sal Bosman**

Kavli prizes 2012

The Kavli prizes recognize scientists for their seminal advances in three research areas: astrophysics, nanoscience and neuroscience. Consisting of a scroll, medal and cash award of one million dollars, a prize in each of these areas has been awarded biennially since 2008.

The 2012 Kavli prize for astrophysics was awarded to David C. Jewitt, Jane X. Luu, and Michael E. Brown, who are recognized for discovering and characterizing the Kuiper Belt and its largest members, work that led to a major advance in the understanding of the history of our planetary system.

The 2012 Kavli prize in nanoscience awarded to Mildred S. Dresselhaus, who is recognized for her pioneering contributions to the study of phonons, electron-phonon interactions, and thermal transport in nanostructures.

The 2012 Kavli prize in neuroscience was awarded to Cornelia Isabella Bargmann, Winfried Denk, and Ann M. Graybiel, who are recognized for elucidating basic neuronal mechanisms underlying perception and decision.•

HOW BACTERIA TALK

Interview

A CONVERSATION WITH KAVLI COLLOQUIUM SPEAKER BONNIE BASSLER

After obtaining a PhD in biochemistry from Johns Hopkins University, Bonnie Bassler started working on obscure bioluminescent bacteria that live in the gut of fish. This work sparked interest in a whole new area of microbiology currently known as quorum sensing. Now - 20 years, a MacArthur fellowship, a National Academy of Sciences membership, and many other prizes later - Bonnie is a professor of molecular biology at Princeton. She leads a lab, dubbed an 'intellectual-super-organism' by National Public Radio, that works on all aspects of bacterial collective behavior. I had the privilege to chat with this energetic and outgoing biologist about her work, lab, and the way she likes to do science.

Could you give a one-sentence definition of quorum sensing?
Bonnie Bassler (BB): It is how bacteria talk, how bacteria execute group behavior and act like multi-cellular organisms. Bacteria are incidental, they're too small to do anything by themselves, but if they work together they can do all these miraculous things that we know about. The bottom line of quorum sensing is that by doing things together, bacteria can get more bang for their buck.

Much of the initial work regarding collective behavior of bacteria was done at the Agouron Institute where Bonnie spent four years as a post-doc working with a little known bioluminescent bacterium called Vibrio harveyi that lives inside the gut of fish.

Why did you ever start working with Vibrio harveyi?
BB: This was all before GFP and all other fun tricks you guys work with now. At that time we didn't have microarrays or the sequence of the V. harveyi genome. So it was fantastic that V. harveyi's bioluminescence made the invisible world of collective behavior visible to us. I could make strains that were making light when they shouldn't be, or were not making light when they should. Without bioluminescence we could not have found what is so obvious to us now - that bacteria were doing these things in unison.
In the popular press quorum sensing has been proposed as the solution to many microbe-related problems like multi-drug resistant bacteria. On the other hand quorum sensing also may provide an opportunity to enhance the beneficial functions of bacteria. I asked Bonnie her vision on the future of quorum sensing.

What problems will quorum sensing solve?
BB: It's all about food, health, energy and the environment! Now that we know that bacterial communication is chemical, we can influence their communication. We know what the molecules are, we know what the receptors are; we're smart, we can disrupt it! Either you can make good bacteria communicate better, or you try to stop bacteria from talking because they do harmful things. The applications of quorum sensing are about a lot more than virulence and pathogenicity; there is no life on earth without bacteria. No plants, no animals, no insects, nothing. So most bacteria are doing good things and keeping us and plants and everything else alive. One idea is, could you grow crops reliably if you understand quorum sensing? Could you really mine the interactions of these chemical vocabularies to get food for the world? By doing so we may be able to use microbes to make biofuels that are politically and environmentally neutral. So, to me, it's food, health, energy and the environment.

Finally she adds with a smile "but of course I'm completely brainwashed and I believe that if you solve quorum sensing you can solve everything".

Is one of the main difficulties of utilizing quorum sensing making it specific? In other words, how do you disrupt the right bacteria, and not enhance the wrong ones?
BB: No, the main difficulty is that the bacteria have a 4 billion year head start! They have optimized this over 4 billion years, and we've only been working on these applications for 4 years. Bacteria have a complicated lexicon. Some molecules with which they talk are very specific, others are very general. If you want to make a narrow spectrum antibiotic, that doesn't goof up all the other bacteria, you go for the specific system. If you want to go for the general quorum sensing enhancer, you go for the generic system, so there are different strategies. I shouldn't over-talk this, none of this works very well yet, but this is the strategy for the future.

Are bacteria multi-cellular organisms?
BB: Yeah, I think they are. But I want to be careful, I don't want to say 'yes' to that, I want to say 'sort of'. A single species biofilm is close to multi-cellularity, as every bacterium has the same genome. I think requirements for multi-cellularity, like: how to get collective behavior, how to get noise reduction, I think those the bacteria figured out.
Felix Hol (FH): The basic rules that underlie multi-cellularity were set by bacteria?
BB: Exactly. Questions like how to get noise reduction, synchrony, feedback loops, molecular police such that you don't get cheaters? We don't know all those things yet, but the answers are going to be in bacteria.

If you were to start over as a post-doc tomorrow, what would you do?
Well, it definitely would be in microbiology. I'm brainwashed, I think microbes are going to save the world. For the last 150 years microbes have been studied in the context of the terrible things they do. That is because people didn't realize that microbes also do good. Its not like you get up every morning and thank your bacteria for digesting your breakfast, for keeping you alive. People only notice microbes when they do something terrible. So, if I would do it again, I think the horizon in biology is microbiology. I would work on beneficial bacteria. I think that if we learn enough about these invisible partners who are keeping this planet going, we could solve some of the worlds biggest problems.

Would you like to know more about Bonnie's research on quorum sensing but can't wait for the colloquium? Check out Bonnie's talk on TED.com:
www.ted.com/talks/bonnie_bassler_on_how_bacteria_communicate.html

• **Felix Hol**

Kavli Colloquium


Bonnie Bassler

TINY CONSPIRACIES: CELL-TO-CELL COMMUNICATION IN BACTERIA

BONNIE BASSLER, PRINCETON

November 22, 2012 will feature a Kavli colloquium by Bonnie Bassler. Tiny Conspiracies:
Cell-cell communication in bacteria involves the production, release, and subsequent detection of chemical signaling molecules called autoinducers. This process, called quorum sensing, allows bacteria to regulate gene expression on a population-wide scale. Processes controlled by quorum sensing are usually ones that are unproductive when undertaken by an individual bacterium but become effective when undertaken by the group. For example, quorum sensing controls bioluminescence, secretion of virulence factors, biofilm formation, sporulation, and the exchange of DNA. Thus, quorum sensing allows bacteria to function as multi-cellular organisms. Bacteria make, detect, and integrate information from multiple autoinducers, some of which are used exclusively for intra-species communication while others enable inter-species communication. New studies show that interfering with quorum sensing can be used to control bacterial virulence in globally important pathogens. These findings suggest an alternative to traditional antibiotics. •

15.00 hr	Pre-programme: 'Science and background of the Noble Prize'
	Christine Mummery (Leiden) : The 2012 Nobel prize in medicine Miriam Blaauboer (Delft) : The 2012 Nobel prize in physics Marie-Eve Aubin (Delft) : The 2012 Nobel prize in chemistry
15.45 hr	Break
16.00 hr	Kavli colloquium by Bonnie Bassler: " Tiny Conspiracies: Cell-to-Cell Communication in Bacteria "
17.15 hr	Drinks & time to meet

Extra seminar

MANIPULATING QUORUM SENSING TO CONTROL BACTERIAL PATHOGENICITY

On November 22 , Bonnie Bassler will additionally present a lecture: "Manipulating Quorum Sensing to Control Bacterial Pathogenicity". The abstract for this lecture reads as follows:

Quorum sensing is a bacterial cell-cell communication process that relies on the production and detection of extracellular signal molecules called autoinducers. Quorum sensing allows bacteria to perform collective activities. Vibrio cholerae, a pathogen that causes an acute disease, uses quorum sensing to repress virulence factor production and biofilm formation. Thus, molecules that activate quorum sensing in V. cholerae have the potential to control pathogenicity in this globally important bacterium. Using a whole-cell high-throughput screen, we identified eleven molecules that activate V. cholerae quorum sensing: eight molecules are receptor agonists and three molecules are antagonists of LuxO, the central NtrC-type response regulator that controls the global V. cholerae quorum-sensing cascade. The LuxO inhibitors act by an uncompetitive mechanism by binding to the preformed LuxO-ATP complex to inhibit ATP hydrolysis. Genetic analyses suggest that the inhibitors bind in close proximity to the Walker B motif. The inhibitors display broad-spectrum capability in activation of quorum sensing in Vibrio species that employ LuxO. To the best of our knowledge, these are the first molecules identified that inhibit the ATPase activity of a NtrC-type response regulator. This discovery supports the idea that exploiting pro-quorum sensing molecules is a promising strategy for the development of novel anti-infectives. •

Kavli Colloquium

'TINY CONSPIRACIES: CELL-TO-CELL COMMUNICATION IN BACTERIA '

Date : November 22, 2012 at 15.00 hours
Location : Faculty EWI, Mekelweg 4, Lecture room A

Extra seminar

'MANIPULATING QUORUM SENSING TO CONTROL BACTERIAL PATHOGENICITY'

Date : November 23, 2012 at 10.00 hours
Location : Faculty of Applied Sciences, Lorentzweg 1, Lecture room G

AVOIDING ERRORS

Introduction new faculty

Martin Depken

A SELF-INTERVIEW BY MARTIN DEPKEN

Humans make errors, and a lot of them. Professional typists get about 1% of their keystrokes wrong, which drops to around 0.1% if they are allowed to correct them. Given that I am not a professional typist, you should expect an erorr or two within the few hundred words printed on this page—even after I have proofread it extensively. While ancient scribes had problems keeping the copies true to their originals, the scribes inside our cells, DNA and RNA polymerases, face the same problem but continuously do a much better job. They can transfer genetic information from one medium to another at speeds of hundreds of letters a second, sometimes only making a single error in a million. Even though these scribes are nano-scale machines and strongly influenced by thermal noise, they are able to perform a highly complex task with precision. They do not always get it right though, but they can also proofread their writings. Getting it right, and getting it right on time, is vital for the cells survival. My new group in the Bionanoscience department focuses on understanding the physics behind the molecular scribes and other genomic processes.

Coming to TU Delft has closed a circle for me: I started out as an engineer for my MSc in Sweden, became a theoretical physicist during my PhD in Oxford, and through postdocs here in the Netherlands and in Germany I have recast myself as a theoretical biophysicist. I am now back at a technical university where I will get the opportunity to educate the next generation of engineers and scientists—or whatever else they choose to recast themselves as.

Somewhere in the building I now work in, experiments are being performed on biological systems, data are being collected, and techniques are being developed and pushed to new limits. For me this is especially exciting, since I believe Mr. S. Holmes got it right when he said:

"It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."

The theory part of our department is small, but growing. I would like to see it develop into a cluster of theoretical groups joining forces with experimentalists to forward our understanding of life from a physical perspective.

Being a scientist is much more than a way of making a living for me: it is how we know the world around us, from the mundane to the extraordinary. I therefore spend much of my spare time reading popular science, with a recent focus on the scientific study of the mind. As in our daily lives, staying objective is hard when considering consciousness; we must take extra care to scale our convictions with the evidence.

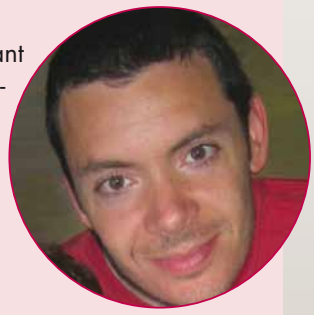
• **Martin Depken**

News

KAMERLINGH ONNES PRIZE TEUN KLAPWIJK

The 2012 Heike Kamerlingh Onnes Prize has been awarded to Teun Klapwijk for seminal experiments on the superconducting properties of superconductor-ferromagnet and superconductor-normal metal nano structures. We congratulate Teun for this honorable award.•

VIDI FOR CHRISTOPHE DANELON



NWO has awarded a VIDI Grant to Christophe Danelon for his research on the question of whether it is possible to create 'life' with far fewer components and less complexity than is encountered in nature.•

VIDI FOR SANDER OTTE

Sander Otte has received an NWO VIDI Grant. He will use the funding to study the collective magnetic properties of small one- and two-dimensional lattices of quantum spins.•

KAVLI DELFT PUBLICATION PRIZE

Kavli Delft publication prize 2012

From left to right: D. Riste, V.V. Dobrovitski, R. Hanson, G. de Lange, C. Dekker.

At the annual Kavli Day on September 13, 2012, we awarded the first "Kavli Delft publication prize". This is a prize for the best publication that resulted from our Kavli Institute of Nanoscience at Delft that appeared in print in the previous two years. This prize, consisting of an award and an amount of € 3000 that can be freely spent by the laureates [half of which goes to the first author], will be given out every two years (alternating with the best thesis prize in the intermediate years).

The 2012 Kavli Delft publication prize was awarded to Gijs de Lange and co-authors Z.H. Wang, D. Ristè, V.V. Dobrovitski, R. Hanson for their paper 'Universal Dynamical Decoupling of a Single Solid-State Spin from a Spin Bath' that appeared in Science in 2010. Gijs de Lange is a graduate student in the group of Ronald Hanson, who received his PhD degree cum laude in the beginning of September. Gijs and Ronald have done the work described in the paper in collaboration with three scientists at Ames Laboratory and Iowa State University in the US.. •

Majorana in the news

READ THE FULL ARTICLES ONLINE

1 www.dutchdailynews.com/dutch-scientists-find-long-sought-majorana-particle/
2 www.rnw.nl/english/bulletin/dutch-physicists-rock-scientific-world
3 news.nost.org.cn/2012/04/dutch-scientists-have-succeeded-for-the-first-time-in-detecting-a-majorana-particle/
4 www.bbc.co.uk/news/science-environment-17695944
5 www.reuters.com/video/2012/04/27/scientists-hail-majorana-miracle?videoId=234068687

INTRODUCING BNAMC

Invitation

INVITATION

Dear Invitee,

We are happy to invite you to our Bionanoscience Advanced Microscopy Center (BNAMC). This is the central place to address all your questions regarding microscopy and to use our common equipment.

Think big about life at the smallest scale
Let me first introduce myself. When I started my studies in Molecular Life Sciences in Nijmegen ten years ago, the Human Genome Project was almost completed. In all my naivety, I thought this could be a decisive step towards the understanding of life itself. Soon after, however, I discovered that the living cell – the smallest unit of life – is far more complex than I could imagine, and that many follow up question need to be addressed – which is a lot of fun. I ended up doing my PhD research on the delicately balanced and complex signalling involved in cell migration, with Rac1 as a 'hub'-protein.

Imaging is everything
To investigate that complexity of the living cell, it is not enough to just know the components, but also their interactions in space and time. During my studies I became interested in quantitative fluorescence microscopy as the tool to provide insight in these processes. This is a highly interdisciplinary and expanding field of research, which makes it exciting and a perfect fit into the department of Bionanoscience.

A new center for advanced microscopy: BNAMC
Indeed the BN department, with generous support from NanolabNL (a grant for research facilities in nanoscience), recently built an entire new center for advanced microscopy, named BNAMC (BioNanoscience Advanced Microscopy Center). The BNAMC is located in the K-wing of the TNW-building. It serves our own researchers for their needs in advanced microscopy and also is the portal for the outside world to the advanced research of the department of Bionanoscience. People from within the Kavli Institute are free to use the equipment of the BNAMC. We also link to NL-Bioimaging-AM to provide expert knowledge on microscopy from all of the Netherlands and Europe.
In our center we now have six commercial setups, including two FACS machines.

Our first microscope is a wide-field fluorescence microscope. It is enclosed with an incubator to keep the temperature constant for long-term imaging.
A second system is a TIRF-microscope (Total Internal Reflection Fluorescence Microscope). With this system it is possible to excite only the fluorochromes that are close to the glass surface, thereby increasing the resolution in the Z-direction.
Another option to increase the axial resolution is our third microscope, a spinning disk system. By filtering out the out-of-focus fluorescence light, it is possible to make optical slices of your specimen. This system is expanded with a FRAP-unit, for fast bleaching of a precisely defined region in your field of view.
The fourth microscope is a dedicated photon counting setup for time-resolved fluorescence applications such as Fluorescence Lifetime Imaging Microscopy (FLIM) and Fluorescence Correlation Spectroscopy (FCS).

Our flow cytometry options consist of a cell analyzer and a cell sorter. With the analyzer (FACS Scan) it is possible to count cells and their fluorescence intensity. With the sorter (FACS Vantage SE) it is also possible to sort a sub-population of cells into a new tube to culture them further.

In the future we will expand our equipment according to the needs of Bionanoscience.

You're invited
You are welcome to the BNAMC to discuss your applications. With a background in cell biology and experience in microscopy, I will be able to help you design your experiment. The standard setups can be tweaked according to your purpose. You - and your students - are also more than welcome to come to me for training on all the equipment and teaching the fundamentals of light microscopy and image analysis.

Hope to see you soon!
Regards,

Daniël Lam
Managing Director, Bionanoscience
Advanced Microscopy Center

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KAVLI DAY IN ROTTERDAM

September 22, 2012

Workshop photography

Rotterdam City Tour

Abseiling from the Euromast

Futereland Express tour through Maasvlakte 2

Water taxi

Spacer stadium 'De Kuip'

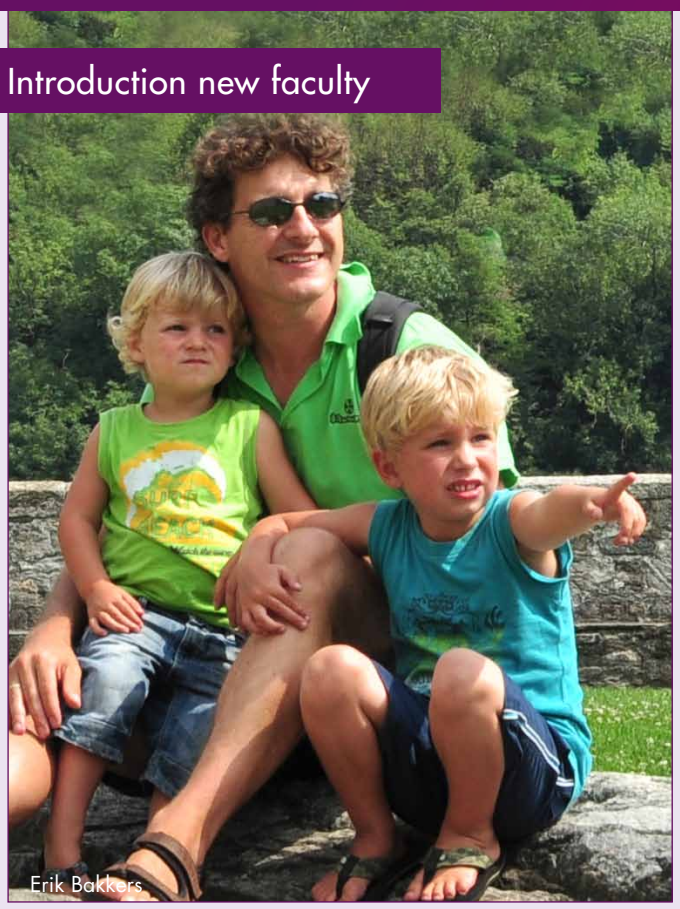
MUSEUM BOIJMANS VAN BEUNINGEN

HAL 41

ANGELA BELCHER

STRAWBERRIES AND NANOWIRES

Introduction new faculty


Erik Bakkers

A SELF-INTERVIEW BY ERIK BAKKERS

What is your background?

The Kavli Institute is not entirely new to me. I have a long-standing collaboration with Leo Kouwenhoven, since the last year of my PhD. During my PhD I studied photoinduced electron transfer of colloidal quantum dots. In this period I got increasingly enthusiastic about academic research, but didn't want to spend all my future life within universities. My plan was to be in a company for 3-4 years and then go back to academia. Directly after my PhD I started at Philips Research and was lucky to be within one of the few long-term academic projects on nanoelectronics. Although the topic had changed from quantum dots to nanowires the collaboration with Leo continued. The four years planned, became 9 years, without any regret. Since 2010 I'm affiliated to the Kavli institute and also to the Eindhoven University. The research at these locations is complementary: materials science in Eindhoven and collaborations on quantum transport and optics in Delft.

What do you think of the Kavli institute and what could be done (more)?

For me, Kavli is a very inspiring environment and what I appreciate is the open-minded atmosphere and the high-level ambition. At this moment physics and biology are well covered within the institute, but chemistry or materials science, which is one of the pillars of nanoscience is not represented at a similar level. Related to this, a theme like 'energy' would nicely fit in the institute.

What is your research plan?

One of my goals is to make new materials with new functionalities. One unique possibility of nanowires is that we can make well-known materials like silicon and germanium with another crystal structure. According to theory, the wurtzite versions of these materials should have dramatically different optical properties compared to their normal cubic structures, like a direct optical bandgap. It may address one of the holy grails in the semiconductor industry: to integrate photonic structures on-chip. With wurtzite gallium phosphide, which is also optically inactive in the bulk structure, we seem to be successful and have indications for a direct bandgap and even lasing from these nanowires. It fascinates me that we can change the materials properties so much just by slightly changing the way the atoms are stacked.

Do you have unexpected hobbies?

I used to play a lot of sports (squash, cycling, indoor hockey, hiking), but having a sizeable research group and a family means that there is not so much time left for hobbies. For two years now there is a new hobby with my oldest son who likes gardening. We used to have a few strawberry plants and he wondered what the runners are good for. I explained that they are for the reproduction of the plant. He wanted to see that and we got more and more strawberry plants. So, last year we removed a big, old walnut tree, which took a lot of sunlight from our garden and now we have hundreds of plants with at least ten different species. We are now becoming specialists in growing strawberries, optimizing soil, fertilizer, and light, which is a bit similar to growing nanowires.

• **Erik Bakkers**

New employees

NEW EMPLOYEES DEPARTMENT BIONANOSCIENCE

Name	Date of employment	Title	Lab
Marie-Eve Aubin-Tam	07/01/2012	Faculty	Marie-Eve Aubin Lab
Aafke van den Berg	07/15/2012	PhD	Martin Depken Lab
Tessa Jager	08/13/2012	PhD	Cees Dekker Lab
Seungkyu Ha	08/15/2012	PhD	Nynke Dekker Lab
Pauline van Nies	08/15/2012	PhD	Elio Abbondanzieri Lab
Laura Dickinson	08/23/2012	Post doc	Nynke Dekker Lab
Timon Idema	09/01/2012	Faculty	Timon Idema Lab
Aditya Ananth	09/15/2012	PhD	Cees Dekker Lab
Jakub Wiktor	09/15/2012	PhD	Cees Dekker Lab
Vlad Karas	10/01/2012	Research assistant	Anne Meyer Lab
Victor Marin Lizaragga	11/15/2012	PhD	Marie-Eve Aubin Lab

NEW EMPLOYEES DEPARTMENT QUANTUM NANOSCIENCE

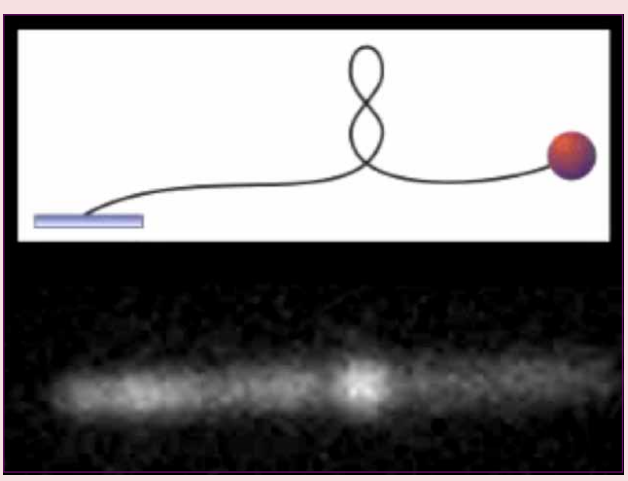
Name	Date of employment	Title	Section
Jakob Kammhuber	04/01/2012	PhD	QT
Anastasia Holovchenco	09/01/2012	PhD	KN
Leonardo Vicarelli	09/01/2012	PhD	TN
Joshua Island	09/15/2012	PhD	MED
Erika Verseveld	09/17/2012	Management assistant	TN
Dorine Verhoeven	09/10/2012	Management assistant	MED/NF
Frank Dirne	05/01/2012	Managing Director	KN

NEW CHAIR QN

Prof. Leo Kouwenhoven has been appointed Chair of the Quantum Nanoscience department, starting from October 1, 2012. Leo Kouwenhoven is a professor in the Quantum Transport research group and will henceforth combine his professorship with his tasks as Departmental Chair.

Departing Departmental Chair Prof. Herre van der Zant will be turning his full attention to his research and teaching activities in the again. Starting in 2008, he has fulfilled the position of Departmental Director with great enthusiasm. We would like to express our heartfelt thanks for his active efforts and cooperation and wish his successor Leo every success. •

DYNAMICS OF DNA SUPERCOILS



Researchers from Cees Dekker's group at our Kavli have published some exciting new findings on the dynamics of DNA supercoils in the 5 October issue of Science. What is it about? If you take hold of a DNA molecule and twist it, this creates 'supercoils', which are a bit like those annoying loops and twists you get in earphone cables. Static images of the DNA supercoils have been studied in detail in the past, but their dynamics remained unknown up till now. PhD student Marijn van Loenhout developed a new technique that enabled him to observe how the coils travel along a DNA molecule for the first time. Magnetic tweezers were used to stretch out a DNA molecule and with fluorescence microscopy it was possible to observe the movement of the DNA coils (see the movies at the website, http://ceesdekkerlab.tudelft.nl/downloads/). In the DNA molecule, these coils can make their way surprisingly quickly along the length of the DNA. This newly discovered 'hopping' mechanism - which takes places in a matter of milliseconds - could have important biological implications, because cells use the coils to bring specific pieces of DNA into contact with one another. •

KAVLI STUDENT RECEIVES THE HENDRIK CASIMIR PRIZE

QN student Christopher Watson was awarded the yearly prize from the Casimir Research School, which is awarded to the best MSc students. This Hendrik Casimir prize 2012 comes in the form of a certificate and a sum of €750. The prize is based on the revenues from a donation by the late Josina Casimir-Jonker, widow of the famous Hendrik Casimir. •

Column

SWEAT MATTERS

Success is 1 percent inspiration, and 99 percent perspiration – almost a Thomas Edison quote, were it not that this American Idol avant la lettre was referring to (his own) geniality rather than success. But it is success most of us are aiming for in science. And everyone - students to professors alike - has experienced first-hand that the better part of being successful is just plain hard work. So far nothing new.

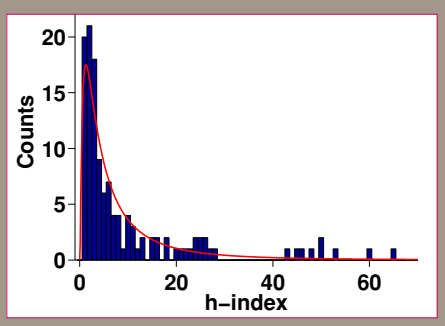
But how to assess success? A recent report [1] shows the future is not that unpredictable after all. Using the h-index as a measure of success, a large database of predominantly neuroscientists and employing machine-learning techniques, the authors came up with an equation that predicts the future to a reasonable extent. The Hirsch or h-index is – as most readers of this purple periodical undoubtedly know – a scientist's h number of papers with at least h citations each. As Hirsch reasoned in 2005, the main advantage over other single-number measures is that h combines both the productivity (# of papers) as well as the impact of this productivity (# of citations) into a single number. In 2007 this California-based-physicist-gone-sociologist empirically demonstrated the potential predictive power his index could have. The new-and-improved formula also takes into account other factors such as the total number of papers, the number of distinct journals, the number of active years in research and the number of publications in top-journals.

Acting as modern scientists proper, the authors launched an app that will look into the crystal ball for you (as refraining from digital media use these days is – some might argue – a sure predictor for extinction…). A noteworthy feature of this methodology is that the weight of the various parameters changes as the years progress. At first, the researcher's current h value for instance has a relatively large impact, while in later years the number of high-level publications becomes increasingly important. Seems pretty reasonable. Following the same line of reasoning (though not something this study accounts for) one could argue that for the most accomplished amongst scientists not even the latter retains its impact-level. For these happy few, the success of their (former) PhDs and post-docs is what will increasingly contribute to the mentor's overall achievement.

Remaining on-topic, another feature worth noting is that for any given research group, the distribution of h-indices is said to be log-normal. Log-normal distributions – a probability distribution of a variable whose logarithm is normally distributed – are found in areas ranging from nature to economics and tend to show up wherever multiple independent barriers need to be crossed. A main goal with many different sub-tasks so to say. A quick assessment among the scientists at the Kavli institute – from PhD students to professors – lead me to conclude two things: First, people with a unique (middle) name are real timesavers, second, as expected the Kavli h-indices are not normally distributed; indeed a log-normal fit does the job pretty well.

As for me; I conclude that there are many barriers still awaiting me in this global rat race, many years of fruitful perspiration. A recent attempt to perspire more fruitfully lead me to join the Kavli soccer team, though something tells me there need not be a direct correlation between this form of perspiration and academic success…

• Bojk Berghuis



Guess who is who, the distribution of h-indices of researchers within the Kavli institute.

[1] Acuna, D.E. et al. Nature 489, 201-202 (2012)

Science art

Artistic impression of the dynamics of DNA supercoils. A person manipulates a long DNA molecule. Loops in the DNA molecule are created by winding up the DNA. For the first time ever, the research by Van Loenhout, Grunt and Dekker in Science 338, 94 (2012] revealed how these DNA loops dynamically move along the DNA strand. (Image: [reported in Cees Dekker Lab TU Delft / Tremani)

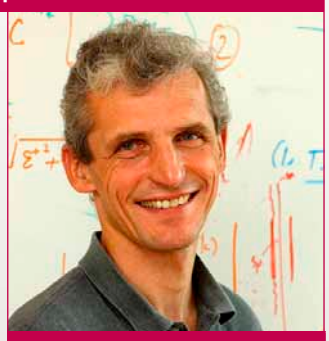
Please send suggestions for 'Science Art' to Amanda van der Vlist, A.vanderVlist@tudelft.nl

Upcoming Kavli Colloquia

BONNIE BASSLER

November 22, 2012

Princeton University



WOLFGANG KETTERLE

March 7, 2013

MIT

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. •

Colofon

The Kavli Newsletter is published three times a year and is intended for members of the Kavli Institute of Nanoscience Delft and those interested. PDF versions of all Kavli Newsletters can be found at www.kavli.tudelft.nl

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