KAVLI NEWSLETTER
Kavli Institute of Nanoscience Delft
No.25
May 2019

IN THIS ISSUE:

Opening of the Microsoft Quantum Lab

The Microsoft Quantum Lab (MQL) on the TU Delft campus was officially opened on 21 February. The lab is led by Leo Kouwenhoven and will be cooperating closely with QuTech. The festive opening was attended by King Willem-Alexander and his brother Prince Constantijn, which ensured plenty of attention for the event. Simone Berkouwer is Executive Business Administrator at Microsoft and assistant to Microsoft Quantum Lab director Leo Kouwenhoven and she played a key role in organising the opening and planning the King's visit. We asked her what it was like to organise such a special event.

How did the idea arise to invite the king to the MQL opening?
'It started with a round table meeting in The Hague with Satya Nadella, the CEO of Microsoft. Microsoft had initiated the meeting to discuss how the scientific and business communities and the government could combine their strengths to help safeguard the Netherlands' leading role in the field of quantum technology. Prince Constantijn attended the meeting in his role as Special Envoy for StartupDelta, as did State Secretary for Economic Affairs and Climate Policy Mona Keijzer.

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FROM THE DIRECTORS

A series of new exciting activities in Kavli Institute of Nanoscience Delft! Microsoft Quantum Lab opened in the presence of His Majesty, the King. See page 6 to learn about the opening ceremony. Simon(e) van Saarloos was selected the first Artist-of-Residence. The Parents-in-KIND program will help young parents in Kavli. Joanna Aizenberg from the Kavli Institute of Nanoscience Harvard is visiting for the Kavli Colloquium on 24th May. Read the interview on page 3. We celebrate 3 major grants and 2 prizes awarded to Kavli researchers: Stan Brouns (NWO Vici), Sander Otte (NWO Vici), Chirlmin Joo (HFSP), Jorine Eeftens (DEWIS), and Stephanie Wehner (Ammodo Science Award) and a large number of publications.

Chirlmin Joo

COLUMN

A matter of trust

Some people living in the US, including the current inhabitant of the White House, adhere to something called prosperity belief: the idea that God wants his followers to (economically) prosper. Doing well is then seen as a sign of being in high divine standing (while still taking personal credit for the success of course), while doing badly is seen as a shortage of faith. To see how influential this idea is, look at a dollar banknote, which reads "In God we trust".

We may (and probably should) laugh or scoff at such notions, but unfortunately, in scientific research we tend to do much the same, except that we put our trust in NWO. Getting a (big) grant is a reason for celebration and very good for your CV. It also helps you a lot in getting ahead in science, not in the least because it helps you get your next grant.

The way NWO distributes the grants is based on competition. The market-thinking based idea is that competition makes everything better, and selects for the best ideas and the best scientists. The logical conclusion is that eventually all money will go to Ben Feringa (our only currently active Nobel Prize winner). Clearly that'd be an excellent idea, just like it's an excellent idea to allow companies like Google and Facebook to dominate the internet.

The alternative is to not put our trust in NWO (an organization), but in the people actually doing the science. Surprisingly, when I teach I get very few (if any) questions on how I do that and why I make the choices I make. Clearly the university trusts me to do my teaching work to the best of my ability (thank you). For research money however, I have to fight my colleagues to the scientific death, as my success is their loss and vice versa.

The economic analog of trusting the scientist with the money is the guaranteed base income. Of course there are potential problems with "free money", but experiments largely show very positive results. In a recent large-scale one in Kenya, people use the money to send their children to school or to start a company, both benefiting the community. The only necessary step was to trust these people to spend the money wisely.

A base income won't make you rich, but it does allow you to spend time on things you think matter. That may be striving for a big group, and competing for the (extra) money to build it. Or it may be working on a long-term goal that bears fruit in ten or fifteen years. Some ideas will fail (as they sometimes do now), but in the long run, putting your trust in people is the best strategy for success.

Timon Idema

INTERVIEW

Interview with Prof. Joanna Aizenberg

Q: Dear Professor Joanna Aizenberg, you are an established scientist in the field of biomineralization and biomimetics. What would you say is your primary motivation to work in these fields?

A: There are plenty: from pure interest in how nature works to figuring out how to use the principles and solutions that have evolved in natural systems for designing materials having interesting and useful properties. And, of course, because it is real fun!

Q: Given your ample contributions to deciphering biological systems and materials design, in a span of 10 years what is the dream that you would like to achieve in this field?

A: This one is hard. The dreams that come to my mind typically involve something that is exceedingly complex and highly unlikely to be achieved any time soon. But the overarching goal and inspiration is to continue building a toolbox in dynamic, responsive, and adaptive materials that would allow us to mix and match various response modalities in a single hybrid materials platform. It may sound too general, but this is exactly how I try to approach the big goals: reduce the complexity and combine different effects in one system.

Q: How far can we envision the translation of biomineralization and biomimetics research to daily life applications?

A: Nature is very rich. Who knew twenty-thirty years ago that exceptional self-cleaning properties of lotus leaf will be mimicked and replicated - not only by expensive and impractical lithography, but also by using readily scalable spraying technique? Who knew that we can learn from brittle stars and sponges how to make high-quality lenses and optical fibers? Who knew that a carnivorous pitcher plant will give us ideas how to build multi-repellent materials allowing to prevent ice formation, marine fouling, adhesion of biological complex fluids? Biomineralization keeps surprising us: from selective concentration of micro impurities to building exceptionally mechanically performing materials from limited building blocks through spatial control and self-assembly. One can only imagine what materials we will be able to build using these principles.

Q: Your research on unmasking the resistance of bacterial biofilms to liquid wetting is attractive! How do you think that this could be tackled? What are important factors to be considered in designing of anti-biofilm surfaces and biofilm control strategies in your perspective?

A: As everything in nature, bacteria and other organisms, that lay biofilms, have evolved over millions of years to overcome many obstacles to their existence. I am surprised on a daily basis with the tricks they find to help them adhere and then resist removal once the biofilms are formed. So, I think a more promising approach is trying to intercept the very first steps of adhesion by making surfaces that the adhering organisms won't like. This is the direction we and others are working hard to advance. And we have made quite significant strides in this area. This approach, as opposed to using all kinds of biocides, has another important advantage in that it does not trigger evolution of resistant species and does not disrupt biochemical and ecological balance. At least not nearly as much as biocides and antibiotics do.

Q: At the moment, how satisfied are you with conducting science in academia and what are the rooms for improvement you see in academic science?

KAVLI COLLOQUIUM

"EVERYTHING SLIPS: Design of Novel Omniphobic Materials"

Joanna Aizenberg

Harvard University

May 24, 2019 will feature a Kavli colloquium by Joanna Aizenberg:

Liquids entrapped within a nanostructured solid begin to exhibit unique behaviors often providing the surrounding material with unprecedented properties. Recently we have introduced a new technology to create self-healing, anti-fouling materials (so-called Slippery, Lubricant-Infused Porous Surfaces, or SLIPS). These bioinspired coatings, which mimic slippery surfaces of a pitcher plant, outperform state-of-the-art materials in their ability to resist ice and microbial adhesion, repel various simple and complex liquids, prevent marine fouling, or reduce drag. Generalized chemical design principles to create stable, shear-tolerant SLIPS on metals, ceramics, glass, fabrics and polymers will be discussed. We anticipate that slippery surfaces can find important applications as antifouling materials in medicine, construction, naval and aircraft industries, fluid handling and transportation, optical sensing, and as antifouling surfaces against highly contaminating media operating in extreme environments.

15.00 hr	Pre-programme: presentation by Martin Caldarola and Stef Smeets (KIND fellows)
15.45 hr	Break
16.00 hr	Kavli colloquium by Joanna Aizenberg: "EVERYTHING SLIPS: Design of Novel Omniphobic Materials"
17.00 hr	Drinks & time to meet

KAVLI COLLOQUIUM

Date: May 24, 2019
Location: Aula, lectureroom B

Joanna Aizenberg received the M.S. degree in Chemistry from Moscow State University, and the Ph.D. degree in Structural Biology from the Weizmann Institute of Science. After spending nearly a decade at Bell Labs, Joanna joined Harvard University, where she is the Amy Smith Berylson Professor of Materials Science, Professor of Chemistry and Chemical Biology, Director of the Kavli Institute for Bionano Science and Technology and Platform Leader in the Wyss Institute for Biologically Inspired Engineering.

The Aizenberg lab's research is aimed at understanding some of the basic principles of biological architecture and the economy with which nature solves complex problems in the design of multifunctional, adaptive materials. These biological principles are then used as guidance in developing new, bio-inspired synthetic routes and nanofabrication strategies that would lead to advanced materials and devices, with broad implications in fields ranging from architecture to energy efficiency to medicine. Research topics of interest include biomimetics, smart materials, wetting phenomena, bio-nano interfaces, self-assembly, crystal engineering, surface chemistry, structural color and biomineralization.

Aizenberg is elected to the National Academy of Engineering, American Academy of Arts and Sciences, American Philosophical Society, American Association for the Advancement of Science; and she is a Fellow of the American Physical Society, Materials Research Society and External Member of the Max Planck Society. Dr. Aizenberg received numerous awards from the American Chemical Society and Materials Research Society, including MRS Medal; Kavli Innovations in Chemistry Leader Award, ACS; Fred Kavli Distinguished Lectureship in Nanoscience, MRS; Ronald Breslow Award for the Achievement in Biomimetic Chemistry, ACS; Arthur K. Doolittle Award in Polymeric Materials, ACS; Industrial Innovation Award, ACS, as well as ~50 Named and Distinguished Lectureships, two R&D100 Awards for best innovation, and was recognized with Harvard's most prestigious Ledlie Prize that is awarded for the most valuable contribution to science made by a Harvard scientist. She has >230 publications, ~50 issued patents, and is a Founder of four start-up companies.

A: This is a topic for a big separate conversation, though what I will think on this subject and will say now is nothing new. Academia is the oasis of free thinking. It is critical to continue to allow it to be exactly that. Fundamental research is key to technological advances. Some of them won't come in the nearest 20-30 or even more years. It is absolutely necessary, in my view, to continue enabling academia to do fundamental research with a longer time horizon than a very short-term outlook for immediate applications. Industry is much better suited for solving immediate challenges, but it is the long-term fundamental research that lays the groundwork for effective technological advances and solutions.

Q: What are the success tips you would like to give the upcoming researchers and students in the field of biomaterials?

A: Love what you do. Be curious. Always remember to look for unexpected results and "artifacts". They often bring most interesting discoveries. I think this applies to research in biomaterials as much as to many other fields

Kui Yu & Srikkanth Balasubramanian

Simon(e) van Saarloos First Artist in Residence at our Kavli Institute

We recently initiated an 'Artist in Residence' program, where annually we offer one internationally acclaimed artist working in the fields of conceptual art, visual art, photography, music, design, dance, film, theatre, or poetry, an opportunity to work on a project at our institute for a few months. We started this to promote the relationship between the arts and sciences and thus find new ways to interact and communicate concerning discoveries about matter on the nanoscale. Interaction between the Artist in Residence and us scientists is essential. Our hope is that the cross-fertilization between creative approaches and scientific disciplines will evoke disruptive new insights, strengthen ties, and trigger novel approaches.

Last fall, we issued an open call for applications for this Artist in Residence fellowship, and many tens of excellent candidates applied. A broad jury consisting of Kavli Faculty members and external art experts made a selection, conducted some interviews, and selected an outstanding Artist in Residence for our institute.

Hence it is our pleasure to announce that Dutch writer and philosopher Simon(e) van Saarloos (1990) will be the first Artist in Residence at Delft for the year 2019. With the jury, we feel that Van Saarloos possesses the right mix of personal traits and intellectual and artistic skills that Kavli is looking for. In a sparkling and disruptive manner, she questions all that she sees. Her curiosity and genuine interest in the scientific research and the people at the Kavli Institute is expected to trigger debate and cross-fertilization for both herself and the researchers.

Some background on Simon(e) van Saarloos: she writes the "e" in her name between parentheses because she questions gender norms and doubts anything that appears 'as given' or self-evident. Also, what's between parentheses might be more meaningful than what is said to be meaningful. She is the author of 4 books, she writes theatre and poetry and performs on stage as a lecturer and interviewer. One of her most recent speaking engagements was at the United Nations Commission on the Status of Women. Simon(e) van Saarloos is living in Brooklyn, New York, and Amsterdam.

During her stay at our institute, this upcoming fall, Simon(e) van Saarloos intends to pursue several artistic interventions. A theme that she is interested in is for example the role of metaphors in translating science to common language and images, and the way that metaphors cloude or clarify our understanding. Through meetings with us, she is interested to explore our beliefs in objectivity, our common language, our diverse international backgrounds, our experience of the everyday world, and our ambitions. She plans to present her observations through a 'performative lecture' for the Kavli community which, she promises, will not a boring accumulation of observations but will include some surprises. Furthermore, she may set up a theatrical setting of a nanoscience-driven future scene in which several Kavli members may participate with sensorial, dramatic language.

We'll see how all of this will work out. As we know, it is fun to do experiments. For sure, it is going to be different and interesting.

Cees Dekker

NEW EMPLOYEES

Name	Date of employment	Title	Lab
Chengyu Huang	01-02-19	Process Engineer	Zandbergen Lab
Sara Marzban	01-03-19	Postdoc	Tittel Lab
Shazia Farooq	01-03-19	PostDoc	Liedewij Laan Lab
Artem Pulkin	01-04-19	Postdoc	Wimmer Lab
Michael Borst	01-04-19	PhD	Van der Sarlab
Samyuktha Jagarlamudi	01-04-19	Process Engineer	Zandbergen Lab
Bas Hensen	01-04-19	PD	Groeblacher Lab
Lukas Veldman	01-04-19	PhD	Otte Lab
Wouter Liefting	01-04-19	PhD	Bertus Beaumont Lab
Marloes Arts	01-04-19	Technician	Hyun Youk Lab
Miranda Blansjaar	15-04-19	Technician	Liedewij Laan Lab
Gandhika Wardhana	16-04-19	Process Engineer	Zandbergen Lab
Alberto Tosato	01-05-19	PhD	Scappucci Lab
Adrián Sanz Mora	01-05-19	PostDoc	Steele Lab
Nicole Scherer	02-05-19	Technician	Greg Bokinsky Lab
Tzu-Kan Hsiao	16-05-19	Postdoc	Vandersypen Lab
Marta Pita Vidal	01-06-19	PhD	Kouwenhoven Lab
Miguel Serrão Morato Moreira	01-06-19	Software engineer	DiCarlo Lab
Floor van Riggelen	01-07-19	PhD	Veldhorst Lab
Max Russ	01-08-19	PhD	Vandersypen Lab
Carolien Bastiaanssen	01-09-19	PhD	Chirlmin Joo Lab

New Kavli Initiative for Parents

KIND has created a new initiative "Parents in KIND" to help group leaders run their research while attending to their parental duties. This will be a way of promoting career opportunities for the faculty members of the KIND-associated departments who are parents. In order to promote equality and encourage also fathers to take an active part in childcare, the funding is available to both female and male principle investigators.

The financial support is up to 10k EUR for a group leader on maternity leave and 7k EUR for a group leader on paternity leave. In addition, matching funding may be provided from the associated department (maximum 10k or 7k EUR) if granted by the head of the department and from a Spinoza Award (maximum 10k or 7k EUR) if granted by Spinoza laureate Marileen Dogterom.

A group leader can apply for this funding if they are working in our Kavli Institute with an appointment of 0.5 fte or higher during the funding period. The funding can be used e.g. to hire a laboratory manager or guest lecturer while the principal investigator is away on maternity/paternity leave.

At the moment, KIND does not have a similar scheme for postdocs or PhD students. If you wish to propose ideas of how Kavli Institute of Nanoscience in Delft can aid postdocs and PhD students who become parents during their time in one of the associated departments, please send a letter detailing your proposal to the KIND Directors.

Artist in Residence Call for 2020

We will continue the 'Artist in Residence' program at our Kavli Institute. This will annually offer a talented international artist working in the fields of conceptual art, visual art, photography, music, design, dance, film, theatre, or poetry an opportunity to work on a project within our institute. He/she will be invited to come visit us for a period of about 3 months, in which he/she will have the opportunity to closely interact with the scientists at the institute, join in work discussions, experience lab work, and the like. The expectation is that the Artist-in-Residence fellowship will result in a piece of art that relates to our nanoscience. We hope that the cross-fertilization between the creative approaches and our scientific discipline will evoke disruptive new insights, strengthen ties, and trigger novel approaches. We have now opened a call that is open for artists to apply. For 2020, we aim to attract an international artist with a profile that differs from that of the 2019 Artist in Residence, Simone van Saarloos. Notably the **deadline for applications is 30 September 2019**. Further information is given at http://kavli.tudelft.nl/kavli-artist-residence.

COLUMN

How I spend my time

I recently found a couple of interesting blog posts describing how their authors found a tenure track position.
In summary: it was hard, and it required producing systematic evidence of being a promising researcher.

Comparing to my personal experience, I realized that the whole process—the procedure of finding an academic job—was already mostly clear to me and my peers halfway through the PhD.
What it would be like when I actually started working as a tenure tracker in Delft, on the other hand, caught me entirely by surprise, and this is what I want to share.
I expected that a professorship is going to be essentially "postdoc+": predominantly supervising research projects, with some side activities like writing grants, organizing the group (how hard can that be?), taking part in some mysterious committees (what is there to do anyway?), and teaching (that hopefully takes not too much time).
While this was not completely wrong, I realize that I was missing the big picture.

The main reason I like research is because it is all about selecting one single problem, isolating it, understanding it really well, and solving it in the most satisfying way.
In other words, to me research is all about going down the rabbit holes as deep as they get.
I completely overlooked that most of the side activities that I mentioned are really hard because people are much more complex than any research topic.
It is also impossible to isolate each of these topics: in order to teach my own course (solid state physics) reasonably, I need to do much more than learn its contents really well.
I also need to learn how quantum mechanics, statistical physics, and math are covered in the prior courses, what are the questions that students will find hard, how to plan joint work of the course team, or how to best communicate with the students.
Education is indeed an exciting, rich, and hard topic.
Most of the side activities that pop up on my radar are equally captivating—even the ones that are as mundane as maintaining a server.

The flip side of the coin should be obvious: there is no way in the world I can do everything as well as I would like to.
Even worse, some of my tasks I do mediocre because of biting way more than I can chew.
Ultimately I realized that the hardest part of my job now is choosing what to focus on, and what to try my best to avoid.
I enjoy this work even despite the need to miss on most of the exciting opportunities and the need to perform some tasks at a minimal satisfactory level.
This is because the activities that I choose to focus on leave me no time to get bored.
Still the more I think about it, the clearer it becomes: I had no idea what being a professor would be like, even despite knowing rather well how research works.

Anton Akhmerov

Interview with Simone Berkouwer about the opening of the Microsoft Quantum Lab

› **Continued from page 1**

We asked Prince Constantijn if he would like to attend the opening of the Microsoft Quantum Lab, and the prince himself suggested we should invite his brother too. The king is very interested in technology, and more specifically in quantum applications, so it was a good fit. Moreover, Leo had already joined the king on several other trips, including to the Niels Bohr Institute in Denmark, so the two already knew each other. TU Delft, QuTech and Microsoft jointly sent an invitation to the king, which he accepted. This was in mid-January and the plan was to hold a fairly intimate opening with only some 100 guests.'

There were quite a few more than that, weren't there?

'You can say that again! It is, of course, not every day that Microsoft opens a new public-private lab here on campus, so after some preliminary talks we decided to scale up the opening and include a programme of quantum-related activities. There was such a lot of demand to attend the event that we eventually had to close registrations. We managed to organise this event for 900 participants in only four weeks. Of course, I did not do this alone; a whole team of people worked together, including employees from Microsoft in the Netherlands, Microsoft's head office in Redmond in the US and TU Delft. The people at Protocol Offices were among those who did a lot to help make the event happen.'

How did you coordinate the visit with the Royal Family?

'A team of representatives came to visit, including the King's aide-de-camp and of course security staff, because security was obviously priority number one. We discussed matters of protocol, such as the correct way to address the king, who should be the first to stand up and receive him and who should walk where when the king would be moving from place to place. Of course the king's representatives did not make any decisions about the content of the programme, but they have a lot of experience with events like this, so they suggested which parts were likely to run smoothly and which could be more problematic. Another thing to take into account was that the programme had to go ahead even if the king was unable to attend for some reason.'

How did the opening go?

'Everything went flawlessly, so I was really pleased. We held a practice run in advance so we could be sure everything would go according to plan and avoid unpleasant surprises. Thanks to this practice run, as organisers we were all able to enjoy the day itself and really take in everything that happened.'

The king briefly visited the auditorium and was then given a guided tour?

'That's right. After the king had officially opened the lab in the auditorium, he had a meeting behind the scenes with his brother, prince Constantijn. That was really special, of course. After that, we gave the king, state secretary Mona Keijzer and mayor Marja van Bijsterveldt a tour of the lab. It was a short tour and the security was extremely efficiently organised. You aren't aware of it at first, but then you notice that suddenly all the doors have been closed and a security staff member is standing next to each one. The king himself is a very friendly man and he was immensely interested in what we had to tell. He actually ended up staying for more than two hours, while we had originally planned for one and a half. That helped to ensure an unhurried atmosphere.'

Quantum technology is a difficult subject. Did the king understand your explanations of the research?

'We have a very intelligent king…'

That's a very diplomatic answer.

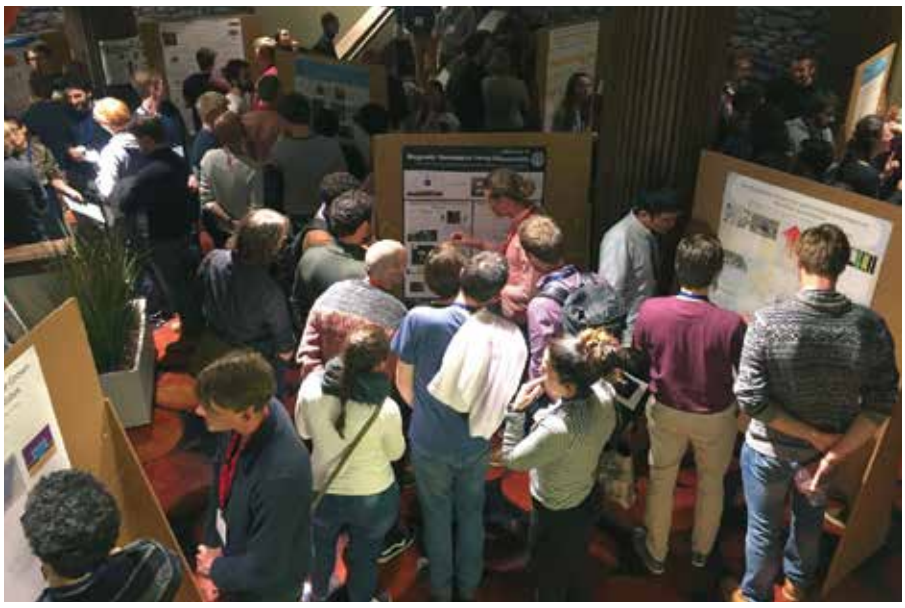
[laughs] 'Well, it is obviously inappropriate to ask the king "Did you understand that?", so we didn't. But I can say that the king asked a lot of questions himself. I didn't hear everything he asked, because I also had to watch the time we had for each part of the tour and give Leo a subtle signal when it was time to move on, but I have been given to understand that he asked pertinent questions. After the opening ceremony, the king asked if the keynote speeches that he had missed had been recorded so that he could watch them. Happily that was not a problem, because Collegerama recorded everything.'

Jerwin de Graaf

An amazing week of nanoscience in the snow

Successful third edition of the NanoFront Winter Retreat

On Monday 18 March 140 Leiden and Delft nanoscientists travelled to Courchevel in the French Alps. Here, in a conference centre 1850 metres above sea level, we gathered for four exciting days of science, fun and outdoor activities. Our program committee, consisting of Liedewij Laan, Sonia Conesa-Boj and Stefan Semrau, had composed a nicely balanced program of PI-interviews, challenging workshops and keynotes, and PhD student and postdoc presentations and poster sessions that were tailored to the needs of our diverse audience.



Right at the beginning of the retreat, in his opening lecture, Steering Committee member Carlo Beenakker stressed the importance of taking time for reflection. "Being away from the lab is not a burden, but a chance to see things from another perspective," he said. And he was right, many of us experienced during and after the retreat that it led to new insights.

Although we had a full program, there was some spare time in the afternoons, which offered us the chance to discover the beautiful surroundings of Courchevel, either on ski, snowboard or on foot. In evenings, there were plenty of opportunities to meet new people over dinner, and challenge each other in the quiz for example. Gary Steele's after dinner lecture on Wednesday gave us a new perspective on the future of publishing in general, and about open science in particular. His quest for openness was underlined by the fact that he had immediately published his lecture slides on Zenodo.

Throughout the program, the two invited workshop hosts from Know Innovation, Tim Dunne and David Lomas, guided the group through various activities to look for overlap in the different research projects. This led to numerous new creative ideas, accumulating in four synergetic research proposals that were presented on the Friday afternoon. After some deliberation, the jury decided to award the mash-up proposal prize to Alexander Lau, Daniel Varjas, Kim Poyhonen and Ivo Severins – they will receive support to submit their idea in the NWA Idea Generator competition. Apart from this prize, the jury, consisting of all the session chairs and the workshop hosts from Know Innovation awarded PhD student Esmée Adegeest for her original presentation, and the best poster prize was won by Benjamin Lehner, who received the most dots at one of the poster sessions.

After four stimulating days of science and snow we returned home in the early morning of Saturday 23 March.
We would like to thank everyone for their contribution to the success of this event!

Marije Boonstra

The role of science in politics – from science advisors to fake news

What role does science play in decision making for public policy? Where do politicians find reliable scientific information, in a world filled with pseudo-science and misinformation? How can (!) bring in your expertise for the public good in the political debate?

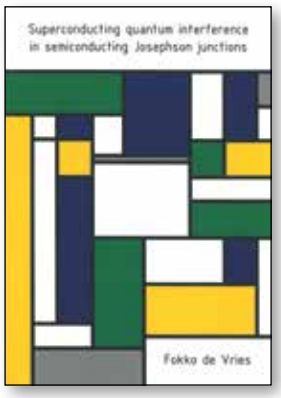
The event will be followed by an afternoon of fun activities, the awarding of the Kavli Delf thesis prize and a dinner.

With:
Eppo Bruins – Member of the Dutch House of Representatives, former director of STW, PhD in Physics

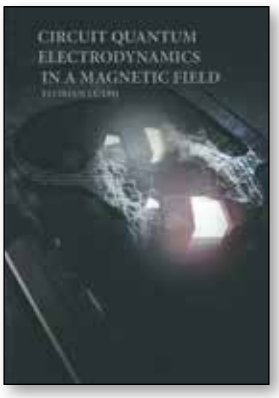
Wim van Saarloos – President of the Dutch Royal Academy of Arts and Sciences, Professor of Theoretical Physics at the Lorentz Institute of Leiden University

RECENT PHD THESES

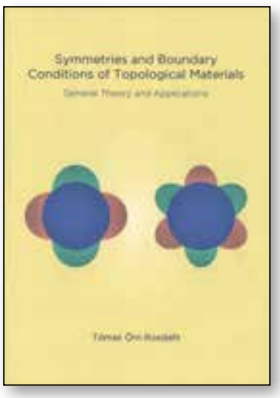
João Machado
27 February 2019



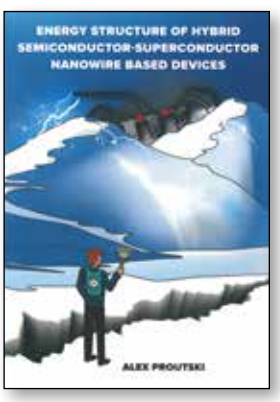
Fokko de Vries
13 March 2019



Florian Lüthi
25 March 2019

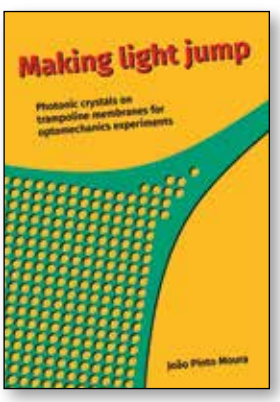


Tómas Orn Rosdahl
25 March 2019

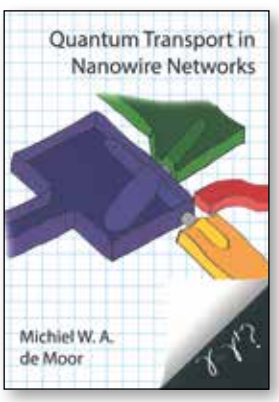


Alex Proutski
28 March 2019

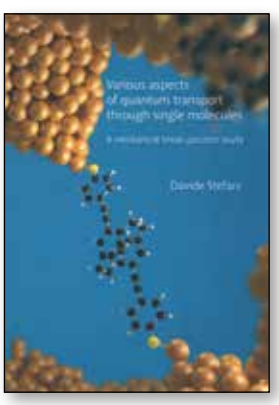
Helena Shomar Monges
28 March 2019



João Pinto Moura
03 April 2019

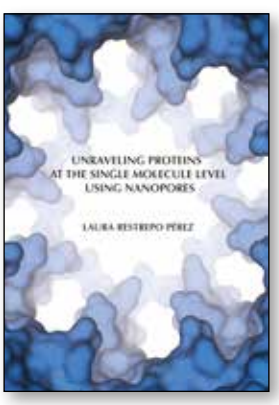


Michiel de Moor
16 April 2019



Davide Stefani
23 April 2019

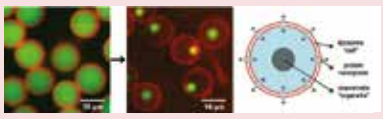
Maurits Kok
24 April 2019



Laura Restrepo
10 May 2019

HIGHLIGHT PAPERS

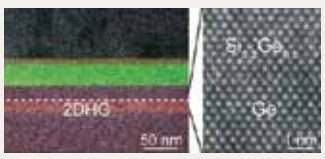
Spatiotemporal control of coacervate formation within liposomes



The understanding of liquid-liquid phase separation is crucial to cell biology and benefits from cell-mimicking in vitro assays. In this paper, we developed a microfluidic platform to study coacervate formation inside liposomes and showed the potential of these hybrid systems to create synthetic cells.

S. Deshpande, F. Brandenburg, A. Lau, M. G. F. Last, W.K. Spoelstra, L. Reese, S. Wunnava, M. Dogterom, C. Dekker
Nature Communications (2019)

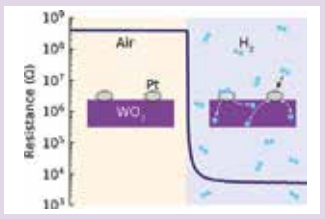
Shallow and Undoped Germanium Quantum Wells: A Playground for Spin and Hybrid Quantum Technology



A two-dimensional hole gas is created by top-gating of an undoped, strained, and shallow germanium quantum well. The high mobility of half a million, light effective mass of 0.09, and high effective *g*-factor of 9.2 highlight the potential of germanium for spin and hybrid quantum technologies.

A Sammak, D. Sabbagh, N. W. Hendrickx, M Lodari, B Paquelet Wuetz, A Tosato, L Yeoh, M Bollani, M Virgilio, M A Schubert, P Zaumseil, G Capellini, M Veldhorst, and G Scappucci,
Advance Functional Materials 29, 1807613 (2019)

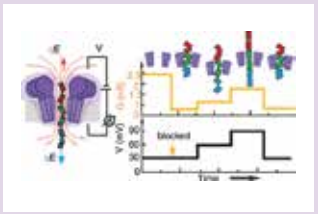
Single-Crystal Pt-Decorated WO3 Ultrathin Films: A Platform for Sub-ppm Hydrogen Sensing at Room Temperature



Hydrogen has the potential to replace fossil fuels as the most important energy carrier in the near future. It has the highest energy per mass of any fuel and can be produced sustainably. However, it is also flammable, making sensors that can detect it an absolute necessity for the transition to a hydrogen economy. Various types of hydrogen sensors already exist, but most of these sensors require high temperatures in order to function. Researchers at TU Delft have now developed a sensor that works at room temperature.

G. Mattoni, B. de Jong, N. Manca, M. Tomellini, A.D. Caviglia
ACS Applied Nano Materials 1, 3446 (2018)

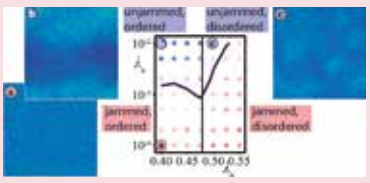
Electro-Mechanical Conductance Modulation of a Nanopore Using a Removable Gate



In this paper we show, experimentally and using molecular dynamic simulations, that the conductance of a nanopore channel can be modulated using a bipolar peptide gate. The bipolar peptide contains a stretch of positive and negative amino acids in its ends. The peptide is stretched to different degrees at different applied voltages, modulating the current through the nanopore.

S. Zhao, L. Restrepo-Pérez, M. Soskine, G. Maglia, C. Joo, C. Dekker, and A. Aksimentiev
ACS *Nano* 2019 13 (2), 2398-2409, 10.1021/acsnano.8b09266

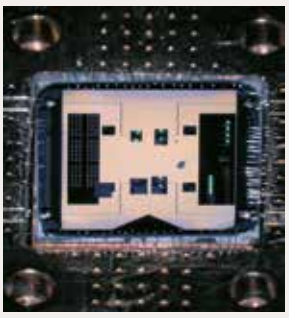
Active particle dynamics beyond the jamming density



Active particles can easily get jammed (think cars on the highway), but, given some degree of freedom, can unjam at surprisingly high densities (think people in a crowd). We've studied this system as a function of self-propulsion strength and neighbour alignment, and found that unjamming occurs most easily when the alignment is a little noisy. In addition to the jammed/unjammed phase transition, that leads to an ordered/disordered transition as well, and the emergence of four distinct phases.

D.R. McCusker, R. van Drongelen and T. Idema
EPL 125, 36001 (2019)

Observation and stabilization of photonic Fock states in a hot radio-frequency resonator



Circuits which behave in a quantum way are the building blocks of a future quantum computer. Pushing these circuits to one hundred times lower frequencies, we have used the same technology to observe and manipulate radio-wave photons. This enables applications in quantum thermodynamics or detection, and furthers our group's goal to put macroscopic objects in a superposition.

M.F. Gely, M. Kounalakis, C. Dickel, J. Dalle, R. Vatré, B. Baker, M.D. Jenkins, G.A. Steele
Science, 7 March 2019

DEWIS award for Jorine Eeftens

DEWIS is the women's network of Delft University of Technology. DEWIS believes in the benefits of difference and the success of teams made up of diverse players.

Jorine Eeftens received on 4 March 2019 the DEWIS Award by Rob Mudde, Vice Rector Magnificus/Vice President Education of TU Delft. Jorine Eeftens received her PhD cum laude (Cees Dekker lab) in November 2018 for her study on the Structural Maintenance of Chromosomes proteins which are essential for DNA organisation. Jorine is currently working as a post-doc researcher at Princeton University, in the US.

Targeting the Genetic Code

How CRISPR-Cas9 searches for the gene to edit

By Viktorija Globyte – PhD candidate

The revolutionary gene editing technology CRISPR-Cas9 has recently been used to create the world's first genetically engineered babies, igniting a heated debate about the ethics of gene editing among scientists and the general public. Despite the controversy, the molecular mechanism of Cas9 is fascinating. How did Cas9 find the gene it was programmed to edit? Are there any rules governing its molecular mechanism that will help researchers to make this technology safer and more efficient?

The advent of DNA sequencing in the 1970s allowed us to read our genetic code and revealed that some diseases are caused by a fault in our DNA. Until recently, correcting these faults seemed next to impossible. Since 2012, however, this has become a reality. The discovery of the CRISPR-Cas9 system has shaken the scientific world with a promise of making genetic engineering easier than it has ever been. But editing the DNA, unlike treating the symptoms of a disease, will introduce permanent changes to the genetic code. If done incorrectly, such changes damage vital genes. While knowing what the genes do is crucial, understanding how the gene editing process works is even more important.

Needle in the haystack

The CRISPR-Cas9 technology is so revolutionary because it is very easy to use. Anyone can now purchase a DIY CRISPR-Cas9 kit and see how it works. Easy? Not so fast. While we know that Cas9 (a protein) assembles with RNA (DNA's more flexible cousin) which then guides it to a selected sequence, finding its target is a complicated process. Knowing how this mechanism works can make gene editing more efficient and help avoid targeting the wrong genes.

First of all, Cas9 needs to find a twenty nucleotide sequence among millions of nucleotides. This is like trying to find a twenty-character phrase in a book of a thousand pages. In addition, cells, the building blocks that make up our bodies, are crowded environments. Imagine trying to get to your destination while you are walking through water and constantly bumping into various objects - not an easy task! Nonetheless, Cas9 finds its target very efficiently.

Looking at molecules one by one

Living in the twenty first century means we have fantastic technology, which can help answer the most difficult questions. In my research at the C.Joo lab I use cutting-edge single-molecule fluorescence microscopy to investigate how CRISPR-Cas9 finds its target gene. This technique allows me to look at the behavior of a single Cas9 molecule at a time. By looking at single molecules it is possible to uncover all the information about the molecular mechanism of Cas9, which would otherwise get lost as conventional techniques only give us an average of all properties.

Sliding or bumping? Why not both!

If you try to find a twenty-character phrase between a thousand pages of text, how will you go about it? You might open a random page and check at a random place if your phrase is there and repeat until you find it. Or you might read the text from start to finish until you stumble upon your phrase. In case of Cas9, so far we knew that it does the former – uses three-dimensional diffusion (bumps into DNA randomly) until it finds what it is looking for. What we have found is that the protein actually uses a combination of both – three-dimensional (random bumps) and lateral diffusion (sliding along the DNA) to speed up its target search.

But why is that important? After all, CRISPR-Cas9 finds its target and that's all that matters. Not quite. There are specific sequences that cause the protein to stick to DNA for long times, meaning it could deter it from finding its real target. However, if you have very few Cas9 molecules, such sequences, if close to the target, could help. Imagine yourself lost in a city – if you spend more time close to your destination, there is a higher chance that you will find it!

In addition, Cas9 can slide between similar sequences nearby. What this means is that the sequence close to the target can help Cas9 find the gene it has been programmed to cut. Think about the text analogy: if you open your book at a random page and start at a random sentence, if the page contains your phrase you are more likely to find it by continuing to read on rather than going to another page and then coming back to read a different sentence later.

Target search for better gene editing

The fundamental knowledge of target search can help make genetic engineering more accurate and efficient. Knowing which sequences cause the protein to stall and which can promote target binding can help scientists choose the optimal sequence for Cas9 to cut.

Genetic engineering holds a lot of promises, from curing genetic disease to helping solve world hunger. Before we take advantage of the technique, however, it is worth to a look at the smallest aspects of its mechanism. Until the world agrees on the rules and ethics of gene editing, the least we can do is to make sure the technology safe.

Are you a PhD student in KIND and do you want to contribute your story to PhD in Kavli? Please send an inquiry letter to the KIND Directors

HFSP grant for Chirlmin Joo

Chirlmin Joo is awarded with the HFSP Research Grant for collaboration with Sang Wook Lee in Ewha Womans University.

The Human Frontier Science Program (HFSP) is a prestigious international research fund for interdisciplinary and intercontinental biology research projects which are both unpredictable in outcome and promising in outlook.
The project's aim is to identify proteins from single cells. Proteins are a cell's workhorses. Almost every cell action is done happens through proteins. Small errors in protein synthesis can have disastrous results like metabolic diseases, muscular disorders, cystic fibrosis, and Alzheimer's disease. Joo and Lee will identify single proteins using a graphene nano-mass sensor.

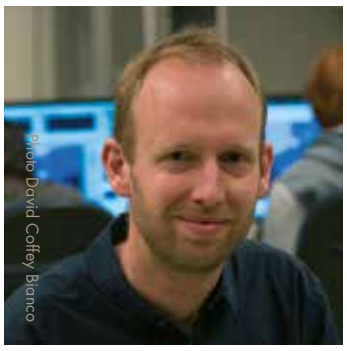
VICI Grants for two Kavli researchers: congratulations to Stan Brouns and Sander Otte

March 2019 2 Vici grants from Netherlands Organisation for Scientific Research (NWO) were rewarded to Sander Otte and Stan Brouns to enable them to develop an innovative line of research in the coming five years.

Stan Brouns

Uncovering CRISPR memory formation in bacteria

Dr Stan Brouns' group has recently uncovered a new Cas protein involved in the CRISPR memorization process. The protein Cas4 is one of the most widely distributed Cas proteins, and present in the majority of CRISPR-Cas systems. It was found that this protein is involved in capturing fragments of virus DNA for integration into the CRISPR memory locus, and observed that only in the presence of Cas4 newly captured memories could drive functional CRISPR immunity by allowing enzymes such as Cas9 to cleave their target DNA. In the proposed research, Brouns aims to elucidate the molecular mechanism of the Cas4-mediated CRISPR-adaptation process, by uncovering how Cas4 is able to provide functionally competent CRISPR memories. He aims to use this knowledge to potentiate bacteriophage therapy strategies against antibiotic resistant bacteria where CRISPR resistance formation may be a limiting factor.



Sander Otte

Atomic-scale magnetic waves

Spin waves are collective magnetic excitations propagating through a material. Gaining control over spin waves is of great importance for further miniaturization of data storage devices and for the development of spintronics, the promising energy-efficient alternative to electronics. Professor Sander Otte proposes to design and construct chains of magnetic atoms in order to study spin waves with atomic precision. Otte will combine scanning tunneling microscopy (STM) with a very recently developed technique that allows electron spin resonance (ESR) to be performed on individual atoms. This will allow him to prepare specific quantum states on demand, providing unprecedented control of collective spin dynamics. Thus, he will investigate how spin waves propagate, disperse and decay, depending on the atomic geometry. The outcomes of this project will greatly enhance our abilities to engineer and control quantum magnetism.

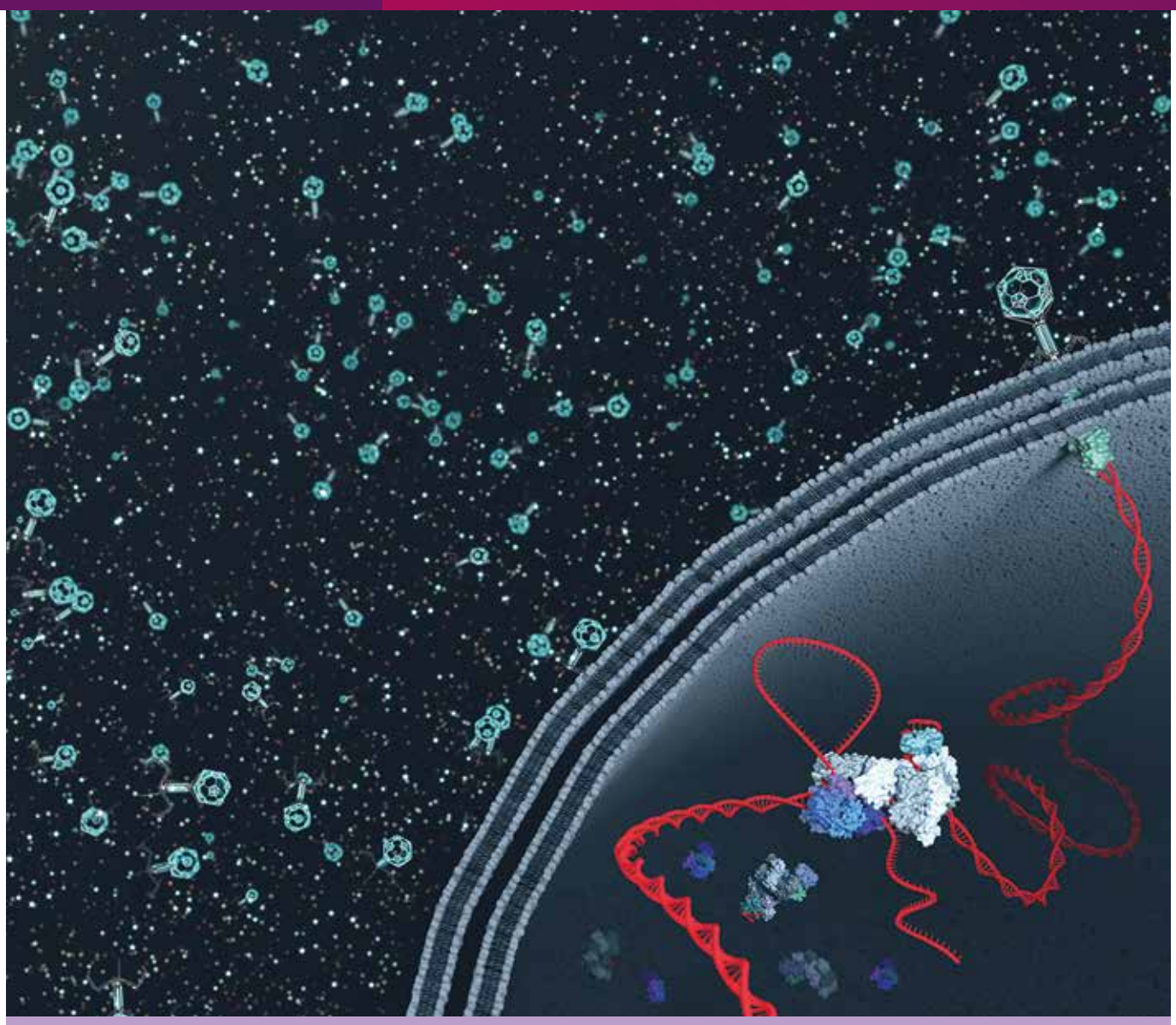
Stephanie Wehner wins Ammodo Science Award 2019

Stephanie Wehner, Antoni van Leeuwenhoek Professor in quantum information at QuTech, wins prestigious Ammodo Science Award 2019. The Ammodo Science Award is intended for excellent, internationally recognised mid-career scientists who work in the Netherlands and obtained their PhD no longer than fifteen years ago. The eight laureates each receive a sum of 300,000 euros. They can use this money in the coming years to explore new avenues in fundamental scientific research.

Excellent evaluation report for QuTech

An international review committee, chaired by professor Robbert Dijkgraaf, is 'unreservedly positive about the success of QuTech in the past, and fully endorses the institute in the years to follow'. Dijkgraaf presented the evaluation report to TU Delft and TNO on Wednesday March 27, 2019. Tim van der Hagen, President of TU Delft: "This excellent report is the result of the commitment and very hard work of many people in QuTech. I am proud that the review committee confirms QuTech is firmly on the right track." The ultimate goal of QuTech, a collaboration between TU Delft and TNO, is to develop a quantum computer and quantum internet.
The committee is impressed by the 'enormous progress the relatively young institute QuTech has made and by the professional organization it has established'. The committee sees an institute with world-class-quality research, with influential breakthrough experiments and theory published in leading journals. At the same time, QuTech has been successful in attracting many academic, industrial and societal partners to its endeavours, both in terms of funding and in the set-up of a quantum community and quantum campus surrounding its activities. "We are delighted that the committee fully endorsed the quality, viability and relevance to society of QuTech", said Paul de Krom, CEO of TNO.

SCIENCE ART



Artist impression of CRISPR-Cas immunity: Bacteria are constantly threatened by a large array of viruses.
To fight these viruses, bacteria harbour CRISPR-Cas immune systems that eradicate the viral genetic information.
Inspired by single-molecule experiments obtained by Luuk Loeff et al. Molecular Cell, 2018.

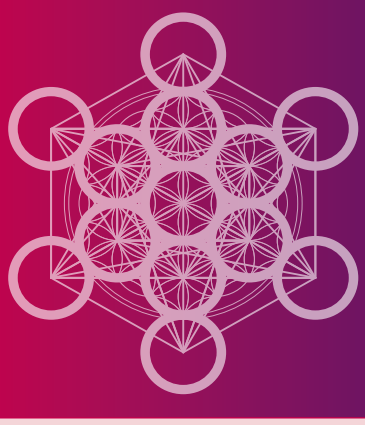
UPCOMING KAVLI COLLOQUIUM

Joanna Aizenberg

May 24, 2019

Harvard University

KAVLI DAY 2019



September 5, 2019

The Hague

UPCOMING KAVLI COLLOQUIUM

Harold Y. Hwang

November 14, 2019

Stanford University

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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