KAVLI NEWSLETTER
Kavli Institute of Nanoscience Delft
No.24
March 2019

IN THIS ISSUE:

Announcing the Kavli Chairs 2019 and 2020

We are very excited to announce that Prof. Dr. Erwin Frey and Prof. Dr. Michel Devoret will be our Kavli Chair of 2019 and 2020, respectively.

Erwin Frey is an eminent theoretical physicist working at the intersection of biological, soft condensed matter, and statistical physics. With his group, he attempts to develop a better understanding of what differentiates living and non-living systems. Since 2004, he is the Chair for Statistical and Biological Physics at the Ludwig-Maximilians-Universität München. Erwin will visit our institute two times in 2019, the first time from March 23 to April 30.

Michel Devoret is a pioneer in mesoscopic physics, in which collective degrees of freedom like currents and voltages show quantum mechanical behavior. He currently aims to push our fundamental understanding of quantum non-equilibrium physics of superconducting circuits for quantum computation and quantum sensing. He is the F. W. Beinecke Professor of Applied Physics at Yale University. Michel will visit our Kavli Institute in May and June of 2020.

We very much look forward to stimulating discussions and collaborations with our upcoming Kavli Chairs!

FROM THE DIRECTORS

Another newsletter with many exciting developments. including the announcement (on this page) of the Kavli Chairs for 2019 and 2020. Erwin will give the Kavli Colloquium on April 4, 2019, speaking about Emergence and Self-Organisation in Biological Systems. To learn more about Erwin, please read the interview on page 2. Furthermore, we feature Kobus Kuipers who received the Physica 2019 prize and Anton Akhmerov who was selected a member of The Young Academy.
We also have an interview with the chair of the Quantum Nanoscience department (Kobus Kuipers), the chair of the Bionanoscience department (Marileen Dogterom) and the scientific director of QuTech (Ronald Hanson), on what our Kavli Institute has meant and means for them, and what their vision is for the future of our institute.
Furthermore in this newsletter, there is a column by Timon Idema, as well as a large number of publication highlights and news items.

Lieven Vandersypen

COLUMN

How to get a better team

A few years ago, I met a professor whose view on hiring was IgNobel-worthy (i.e., making you first laugh and then think): "I only want to hire new PIs who are better than me". That way, the quality of the department would rise over time, and by the time this professor would retire, that mere action would let the department would be better off, as the average would then surely go up.

Professors aren't known for their humility, so even admitting that there are people who are better than you is commendable. Still, the comment made me uncomfortable. If everyone applied this rule, any new hire would immediately be the best in any department – so you should never take the job!

On the other hand, the viewpoint has an aspect that is worth copying: the professor in question wanted to make the *department* better. The means I disagree with, but the motive is perfectly sound.

When hiring, nobody is aiming to make their department (or whatever you're hiring for) worse. However, what we're often actually doing may have that effect. The criteria we apply are all about the individual – we're looking for excellent scientists, communicators, teachers, and managers, preferably all in one person, and preferably doing work that could be useful for our own projects.

To see what effects that policy may have, you only have to consider the results of the Dutch national soccer team in recent years. They did great, and won the European championship last year, because they were a team. The men's team however didn't even qualify for competing in either the last European or the last world championship, despite the individual players somehow being regarded among the best in the world.

Science isn't sports, and all claims that this and that is `topsport' are, frankly, silly. What they do share is that both require dedicated work, and the willingness to work as a team.

So, how do we get the best team, given that we can't (nor want to) fire all the people we already have? Simple: we look at studies for what makes the strongest team, and find consistently that this requires two things: diversity and an encouraging environment in which people are not afraid to make mistakes. Unsurprisingly, these two usually come together and reinforce each other. The hiring rule then becomes either "I only want to hire people who are different than I am" or "I only want to hire people that I feel safe around", and these will surprisingly often overlap. They may or may not have the highest h-index of all applicants, but they will help the department get better.

Timon Idema

INTERVIEW

Interview with Erwin Frey

Q: Dear Prof. Frey, in your research group you apply theoretical physics to biological systems and other soft matters. What got you interested in this field in the first place?

A: The story is kind of interwoven. I did my Postdoc in Harvard, working on a problem in condensed matter theory, namely flux lines of superconductors. I found it quite fascinating to do statistical physics of lines and surfaces. In a very abstract way I wanted to understand what happens if you have lines and surfaces instead of point particles. So I was looking around for various problems. The first thing I studied was what's called flickering in red blood cells - the bending modes and bending fluctuations of red blood cells. When I came back to Munich after my Postdoc in Harvard I met Erich Sackmann, who studied biopolymers like actin at that time. I thought this is great, because these are lines, these are polymers, polymer solutions, and polymer networks. So I started working on such problems, which is essentially polymer physics in biology. That was the starting point. From there on, it just broadened out to other topics, including molecular motors, transport along cytoskeletal filaments, population dynamics, evolutionary questions, and most recently also to pattern formation in cells.

Q: Your field of interest has broadened out quite a bit. How do you choose systems you are investigating? When does a system become interesting?

A: I become interested if you have some kind of emergence happening in these systems. I'm not so much interested in the behaviour of a single particle, I get excited when I see collective phenomena! In biology, when you look at all these different questions, they all have in common that I'm asking: what is the behaviour of a system at the scale of the whole system? And how is this different, how is this novel in comparison to the behaviour that you have at a single individual scale? For example in pattern formation, there are proteins that interact and form a reaction network. There is no way to connect that ad hoc with all these beautiful patterns. For me it is interesting to know how you get from a reaction network to patterns and what determines them. If you look into population dynamics - the same thing: You have individuals interacting, they share some common goods or they fight each other by some poison. I am interested in how these interactions lead to the emergence of biodiversity and collective behaviour in these systems. It's always the emergence phenomenon at a large scale that gets me interested.

Q: In a lot of your research you are collaborating with experimental groups. What motivates you to do such collaborations?

A: From a theorists point of view, for me, collaborating with experimentalists is a reality check. I mean, we don't do theory just because we do theory, we do theory for real systems. For me it's really key that any kind of science is connected to experimental science. Once you start deviating from that, you leave the path of science - I would say. That's why I put a very strong focus on these collaborations. Another side aspect is that if you are a theoretician collaborating with experimentalists, you also have the chance of communicating to them what you think the important questions are. That often leads to a change in plan, also on the experimental side. So it's a beautiful way of influencing each other: the experimentalists give us the reality check and theoreticians - then from a conceptual point of view - can point to certain directions which are worthwhile to study experimentally.

Q: What is important in such collaborations?

A: What's important? Well, it's respect I would say. I mean, every branch of science has its own methods and its own strengths and weaknesses, and for me it's very important that in any of those collaborations is a lot of respect for the other side and for the methods the other side is using. So there is no looking down on anybody from any side. I've seen instances where those collaborations failed because there was some kind of hubris on either side. My advice, for anybody, is just to be respectful and humble in those kinds of collaborations.

Q: Thank you for the interview!

- Sophie Tschripke

KAVLI COLLOQUIUM

"Emergence and Self-Organisation in Biological Systems"

Erwin Frey

Ludwig-Maximilians-University of Munich

April 4, 2019 will feature a Kavli colloquium by Erwin Frey:

Isolated systems tend to evolve towards thermal equilibrium, a special state that has been a research focus in physics for more than a century. By contrast, most processes studied in biological systems are far from equilibrium. A fundamental overarching hallmark of all these processes is the emergence of structure, order, and information, and we are facing the major challenge to identify the underlying physical principles. Two particular exciting problems are the self-organised formation of spatio-temporal patterns and the robust self-assembly of complex structures. In both fields there are recent advances in understanding the underlying physics that will be reviewed in this talk. In reaction–diffusion systems, it has been shown that the essential dynamics is the spatial redistribution of the conserved quantities which leads to moving equilibria. Efficient self-assembly of macromolecules and protein clusters is a vital challenge for living organisms: Not only are resources limited but also are malfunctioning aggregates a substantial threat to the organism itself.

15.00 hr	Pre-programme: Introducing 2 new faculty members • Dimphna Meijer • Wolfgang Tittel
15.45 hr	Break
16.00 hr	Kavli colloquium by Erwin Frey: "Emergence and Self-Organisation in Biological Systems"
17.00 hr	Drinks & time to meet

KAVLI COLLOQUIUM

Date: April 4, 2019
Location: Faculty of Industrial Design, Joost van der Grinten room

The Physics Prize 2019 has been awarded to Kobus Kuipers, who is not only a pioneering physicist but also someone who is strongly committed to outreach.

Kobus Kuipers is one of the founders of 'nanophotonics', the science that controls light at length scales much smaller than the wavelength. Nanophotonics is exciting, alive and kicking because light behaves so surprisingly differently in cleverly structured materials than we are used to from a conventional transverse non-dispersive flat wave. Microscopes place experimenters in the middle of the wonderful nanoworld, and provide their research groups with glasses to see electric and magnetic fields evolve in space and time. This provides unprecedented insight into the physics of light at the nanoscale, in photonic crystals for example.

Kobus Kuipers (1967) studied physics at the University of Amsterdam and started his impressive academic career as a PhD student at the AMOLF; at a young age he became a professor. In 2005 Kobus Kuipers was admitted to 'De Jonge Akademie'. Kobus Kuipers played a key part in the establishment of the Center for Nanophotonics at AMOLF and was its head for many years. Under his leadership, the programme developed into one of the world leaders in the field of nanophotonics. Since 2016, Kuipers has been Professor of Nanophotonics and Chairman of the Quantum Nanoscience Department at the Kavli Institute of Nanoscience and the Faculty of Applied Sciences at Delft University of Technology.

As mentioned above, Kobus Kuipers is not only a top researcher. He is also active in the promotion of science. For example, he has participated eight times in the National Science Quiz, in which he explained scientific questions and experiments, among other things. He was also chairman of the International Year of Light 2015 NL foundation, which initiated many public activities to do with light in the Netherlands in 2015.

His creativity and motivation to be amazed by physical phenomena not only characterize his scientific publications. He is widely known for his sharp questions and his contagious enthusiasm for physics and for the process of doing science in all of its facets. This makes him an extraordinary, inspiring mentor for his students, PhD students and postdocs, whom he guides with love for the profession and continuous commitment to their personal development.

The Physics Prize is awarded annually to an eminent physicist working in the Netherlands. After consultation with various representatives of the physics community in the Netherlands, the prize is awarded by a jury consisting of the chairman of the Dutch Physics Association (www.nnv.nl), the chairman of the Physics Foundation (www.physica.nl) and an earlier Physica Prize winner. Kuipers will receive the prize at the FYSICA 2019 congress on Friday 5 April at Amsterdam Sciencepark (www.fysica.nl). That day, he will also give the accompanying Physica Lecture.

The March and May 2019 editions of the Dutch Journal of Physics (www.ntvn.nl) will focus on the work of Kobus Kuipers.

What is "The Young Academy"?

I was recently selected as one of the 10 new members of The Young Academy (De Jonge Akademie), a branch of the Dutch academy of sciences. Preparing to this selection and later attending the first meeting, I learned a few interesting things that I would like to share.

I have a very vague idea of what the "real" academy of sciences is about. On the one hand I know that several of our prominent colleagues are its members.
On the other, I also know that these colleagues count free time in imaginary numbers, so I cannot imagine them being actively involved in a yet another activity.
From this I have guessed that the academy of sciences is a club of senior researchers that gather a few times a year in the old academy building and have a nice chat about the future of science.

Then by extrapolation I have assumed that the young academy is the same, but the researchers are younger and less elite while the membership is temporary.
I still don't know much about the old academy, but at least about the young one I was wrong.

I had to update my mental model already from looking at the application: in addition to the usual "tell us how awesome you are" part, it also asked to which of the four activities of the academy do I want to contribute, and what this contribution might be.
I have then chatted with several former members, checked the academy's website, and through that learned that every member have worked on an unusual project within the academy.
The young academy actively lobbied for the change in the law allowing more than just full professors to be official supervisors ("promotors").
It published the "A beginner's guide to Dutch academia" to help newcomers to the country to orient themselves.
So rather than a discussion club, I then thought, it looks more like a "hobby club" where professors relatively early in their career get to meet in their spare time and work on what they like in their spare time.

What is something that I am not already doing and that I would really like to improve, I then asked myself.
The answer was clear. Many of you have probably heard me complain about how the university does not just allow to publish open source software.
Or maybe I was rambling about how researchers still do not publish their code, data, lecture notes, or many other useful things.
This is actually my biggest hobby horse: I am a fan of open science and open source movements.
Outside of my research this is an activity I am most passionate about.
I then decided I will try and use this opportunity to look around, see what is happening with open science and try to push it further.

On the one hand, academy gives me a chance to discuss these questions from people from other communities.
For example, during my first visit of a young academy meeting, an econometrics researcher was surprised to learn that publishing the source code was not commonplace already.
Likewise the traditions and customs of other fields of research vary greatly, and my personal opinions might not even make sense in a broader context.
In order to make useful steps in the direction of open science, I really want to know what even makes sense, and the young academy will provide such a chance.

Anton Akhmerov

Funding for two NWO Physics vrije programma proposals in QN

Quantum Acoustics

Main applicant: Dr Simon Gröblacher,
Delft University of Technology
Collaborating institutions: Delft University of Technology, University of Twente, Leiden University, Eindhoven University of Technology, AMOLF

While quantum mechanics governs the physics of atoms, the macroscopic world is usually described classically. This programme will investigate the quantum properties of sound waves in solids, involving billions of atoms and propagating over macroscopic distances. Besides its fundamental character, the research will open up new avenues for quantum information processing.

Chirality-induced Spin Selectivity in Electron Transport

Main applicant: Prof. Herre van der Zant,
Delft University of Technology
Collaborating institutions: Delft University of Technology, Leiden University

This programme will explore a fundamentally new approach to electronics based on the transport of electron spins rather than charges. By means of a fundamental study of spin transport in molecules with a helical structure, the researchers will derive design rules for the construction of more efficient spin-based electronic devices.

HyperSpy Workshop 2018

On the 10th and 11th of December 2018, the Conesa-Boj group at the Quantum Nanoscience department organised a workshop about the HyperSpy multi-dimensional data analysis toolbox. This workshop, supported by the Kavli Institute of Nanoscience Delft, was open to researchers interested in using the HyperSpy software suite for the analysis of multi-dimensional data for Electron Microscopy analysis and related techniques. HyperSpy is a fully open source, community-supported, Python library which provides tools to facilitate the interactive data analysis of multi-dimensional datasets, as well as easy access to analytical tools suitable to exploit this multi-dimensional character.

During the two-day workshop, the basics of data handling in HyperSpy were covered by a combination of theory talks and of practical hands-on sessions, delivered by international experts on HyperSpy including some of their lead developers. The topics covered included the analysis of spectroscopy datasets in electron microscopy as well as the use of Machine Learning tools available within HyperSpy and their application to various types of problems.

This successful workshop was attended by around 30 participants from various national (Delft, Eindhoven, Leiden and Groningen) and international universities such as EPFL Lausanne, Grenoble, Darmstadt, Manchester, Lille, Antwerp and Julich. There was also representation from commercial companies such as NanoMEGAS and TESCAN. The participants were enthusiastic and positive about the outcome of the workshop, and enjoyed also in many cases the opportunity for a first visit to Delft, including the excellent social dinner at the recently renovated restaurant “de centrale”.

Sonia Conesa Boj

NEW EMPLOYEES

Name	Date of employment	Title	Lab
Brecht Simon	01-10-18	PhD	Van der SarLab
Vivien Thiney	01-10-18	Postdoc	Otte Lab
Stefan Dröge	01-10-18	Technician	Kouwenhoven Lab
Elvedin Memisevic	01-11-18	Technician	Kouwenhoven Lab
Guus Avis	01-11-18	PhD	Wehner group
Edouard Lesne	01-11-18	Postdoc	CavigliaLab
Kongyi Liu	01-12-18	Technician	Kouwenhoven Lab
Joris Carmiggelt	15-11-18	PhD	Van der SarLab
Javier Hernandez Rueda	15-11-18	Postdoc	Kuipers Lab
Catia Frias	15-11-18	Technician	Dimphna Meijer Lab
Spiridon van Veldhoven	01-12-18	Technician	Kouwenhoven Lab
Matthijs de Jong	01-12-18	PhD	Groeblacher Lab
Marc Noordam	01-12-18	PhD	Kuipers Lab
Carlo Delle Donne	10-12-18	PhD	Wehner group
Job van Staveren	01-01-19	PhD	Charbon Lab
Alessandro Ciani	07-01-19	Postdoc	Terhal group
Léo Bourdet	15-01-19	Technician	Kouwenhoven Lab
Stef Smeets	15-01-19	Postdoc	Arjen Jakobi Lab
Reza Choubeh Ranjbar	15-01-19	Postdoc	Liedewij Laan Lab
Wojciech Kozlowski	01-02-19	Postdoc	Wehner group
Jasper van Heusden	01-02-19	Project officer	Department Bionanoscience
Srikkanth Balasubramanian	01-02-19	Postdoc	Marie-Eve Aubin Lab
Rajkiran Tholapi	01-02-19	Technician	Kouwenhoven Lab
Sara Marzban	01-02-19	Postdoc	Tittel Lab
Chris Zachariadis	01-02-19	Fabrication engineer	Di Carlo Lab
Anuj Kumar	18-02-19	PhD	Nynke Dekker Lab
Nicola de Franceschi	01-03-19	Postdoc	Cees Dekker Lab
Svetlana Korneychuk	01-03-19	Postdoc	Kouwenhoven Lab
Kostas Tsoukalas	01-03-19	PhD	Vandersypen Lab
Hans Bartling	01-03-19	PhD	Taminiau Lab
Magdalena Chichocka	01-03-19	postdoc	Conesa Boj Lab
Maarten Bolhuis	01-03-19	PhD	Conesa Boj Lab
Adam Pomorski	01-04-19	Postdoc	Chirlmin Joo Lab
Oscar Franch	01-04-19	Postdoc	Cees Dekker Lab

Interview with BN/QN/QuTech Chairs

The first Kavli Newsletter of the New Year is an opportunity for reflection. How has the Kavli Institute of Nanoscience Delft (KIND) helped the three departments up until now? What is its added value at the moment? And how is the future of the institute looking? We spoke to three Department Directors: Marileen Dogterom (Bionanoscience. BN), Kobus Kuipers (Quantum Nanoscience, QN) and Ronald Hanson (QuTech).

Ronald Hanson

Marileen Dogterom

Can you tell us what the Kavli Institute of Nanoscience Delft meant to your department when it first started?

RH: "QuTech has its origins in KIND. It was launched in 2014 following breakthroughs in fundamental quantum nanoscience. It focused on controlling and manipulating individual quantum particles. Even further back, KIND had its roots for a large part in early research in the quantum field by professors Hans Mooij and Leo Kouwenhoven. In that sense, the quantum people helped to get KIND here and, in turn, KIND was the right environment to allow quantum research to grow into the basis for a whole new institute on quantum technologies."

MD: "When I arrived at Delft in 2014, Bionanoscience was already a major part of KIND. Bionanoscience benefited from Kavli 'seal of excellence', as the biological part developed in a very organic way. In other words, our department wasn't an independent unit waiting to become part of KIND. The department was founded with help from Kavli. Kavli always was, and still is, very interested in new developments, new young people, new ideas and new interconnections. They are open-minded and always happy to join in considerations. I can imagine just how important this support from Kavli was at the start of the up-and-coming department of Bionanoscience."

The funding that you received as a Kavli Institute must have helped?

MD: "That's definitely true. Operating as a Kavli Institute certainly gives you more financial freedom. It's not a large amount of money, but you can use it as you see fit and try all kinds of new things."

KK: "Take the *Artist in Residence* who is shortly to be appointed. I think it's a great idea, and a typical example of something that the department would find difficult to explain and justify to the dean. But now we can decide that we think this is a good and fun way to interest the general public in our science. It's a real luxury. In this respect, Kavli money is worth more than the funding you acquire for research, for example, as the Institute itself is free to decide how to spend it."

What do you think is the added value of the Kavli Institute at the moment?

KK: "We do a lot of team building, reinforcing our 'family' vibes. This is very worthwhile as we have two fantastic nano areas in Delft, but synergy is sometimes difficult to achieve. So last year, we appointed the first KIND fellow, and the second was appointed at the start of this year. These fellows are there to strengthen the ties. One

of the two is in my group and spends one day a week in the group of Marie-Eve Aubin-Tam from Bionanoscience to carry out nanophotonic measurements on individual proteins. The main aim of appointing these fellows is to identify common ground. This is still quite a tough task for the Institute. Although it is not always evident, common ground certainly does exist."

MD: "That's right. Arjen Jakobi from our department and Sonia Conesa-Boj from QN also share a KIND fellow. I think it would be safe to say that without KIND, these more recent collaboration projects would not have come about."

RH: "KIND is also a way for QuTech to organise things better in concert with colleagues from BN and QN. The cleanroom is an example of this. More importantly, KIND also provides a connection to top-quality research and researchers at BN and QN. We share ideas and thoughts, and help each other with work wherever we can."

And what else?

RH: "I believe KIND also serves as a role model. We see that the modern standards we aim to set at KIND influence the rest of the university. KIND is a PI-based organisation. Its criteria for the promotion of researchers, its joint meetings with top-level speakers and its diversity measures are all examples of this. One really needs a critical mass of like-minded people to perform such a role and KIND provides that."

KK: "I suppose you could say that being a Kavli Institute is a kind of permanent aspiration. You don't want anyone to say that we're no longer worth the seal of excellence. Although our people don't really need it, it does give a sort of *noblesse oblige* - the feeling that we must keep doing our best.

MD: "To me, the most important part of being a Kavli Institute is the freedom to develop new initiatives. At the moment, we're working on the 'Parents in KIND' programme, designed to compensate young parents for the time they cannot work. An initiative like this stimulates diversity, and if the KIND directors decide that this is important to our institute, they can spend money on it. In this particular case, it's a joint initiative. Not only is KIND investing in it, but also the departments, and I'm contributing with my Spinoza prize."

Does the fact that you are a Kavli Institute attract more talent to Delft?

KK: "I think that the 'Kavli Institute' predicate has a positive effect. It also helps that as a PI at Kavli, you are part of something bigger than a department but smaller than the Faculty, which is hardly on a human scale any more.

MD: "I'm not sure if everyone is familiar with the name, it probably depends on where they come from. I think that people from the American system are perhaps more aware of it than people who have worked elsewhere. For example, there's a Kavli Institute for Theoretical Physics in Santa Barbara, which has been a high-profile organisation for quite some time. As I was already familiar with that one, I knew what Kavli was before I came to Delft. Some researchers may know the name but not be quite sure what it involves in Delft."

Kobus Kuipers

What kind of future do you envisage for KIND?

RH: "I hope that KIND on the one hand will keep its role in connecting the different nanoscience branches at Delft into a top-quality institute. On the other hand, I hope that KIND will strongly evolve further because of new breakthroughs in the various branches of nanoscience. Ten years is a long time in research. I personally also hope that one or more KIND researchers that have made this institute to what it is today will be honoured with a Kavli Prize in the next decade, as well as a Nobel Prize!"

KK: "I hope that we can establish more links on the interface of quantum nanoscience and bionanoscience. When Bionanoscience was developing, the tendency was to show how different the department was. But I think that QN, QuTech and BN have proved how good they are at what they do and it is now time to see where and how they can reinforce each other."

MD: "I think it's particularly important to continue stimulating the joint fellows. There aren't many places where top bionanoscience and quantum nanoscience can be found side-by-side. This is a unique strength and we need to encourage it. Not by forcing it, but by capitalising on opportunities as they emerge. KIND can play a crucial role in this respect. And if we find ourselves in a better financial position, KIND might have a role to play in modernising the Faculty. Kavli can help if we want to keep attracting new top talent, not only through its reputation, but also by providing financial assistance. This should be our top joint priority: becoming an even more attractive environment for top scientists at every level."

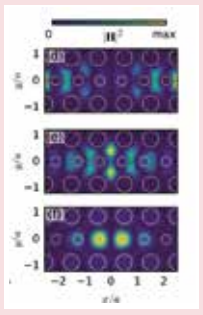
Jerwin de Graaf

NWO grant collaborative cryo-microscopy development by Arjen Jakobi (BN)

Within this collaborative project CRYO3BEAMS, the research team will develop a novel cryogenic microscope in which a high-resolution light microscope is integrated with focused electron and ion beam systems to allow targeted extraction of specific proteins for high-resolution structural determination.

HIGHLIGHT PAPERS

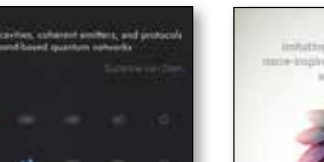
Topological edge states in bichromatic photonic crystals



We show that photonic crystals based on the idea of a "bichromatic potential", i.e., photonic crystals characterized by a spatial distribution of the refractive index containing two periodicities, exhibit nontrivial topological properties. They provide the photonic analogon of the integer quantum Hall effect. The nontrivial topology of the bandstructure is illustrated by the formation of strongly localized, topologically protected boundary modes.

F. Alpeggiani and L. Kuipers
Optica 6, 96-103 (2019)

Superconducting quantum point contact with split gates in the two dimensional LaAlO3/SrTiO3 superfluid



The highly unusual electron system at the LaAlO3/SrTiO3 interface becomes a unique superconductor at low temperature. Researchers at TU Delft have used two nano scale gate electrodes to confine this superconductor into the quantum transport regime and in this fashion probe the superconducting state at the mesoscopic scale.

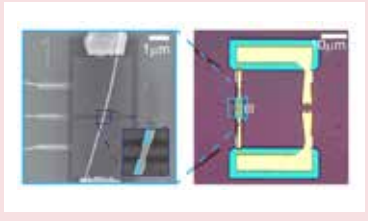
H. Thierschmann, E. Mulazimoglu, N. Manca, S. Goswami, T.M. Klapwijk, A.D. Caviglia
Nature Communications 9, 2276 (2018)

Electromagnetic helicity in complex media

Helicity, i.e., the projection of spin onto the direction of momentum, is a well understood property of fundamental particles, such as electrons and free-space photons. Yet, when it comes to photons in inhomogeneous and dispersive optical media, such as nanophotonic and plasmonic systems, its definition becomes an intriguing puzzle. In the paper, which is a theoretical collaboration with RIKEN (Tokyo, Japan), we put forward a rigorous definition of the helicity for such systems and investigate its implications for the interaction between light and chiral molecules.

F. Alpeggiani, K.Y. Bliokh, F. Nori and L. Kuipers
Phys. Rev. Lett. 120, 243605-1/6 (2018)

Observation of the 4π-periodic Josephson effect in indium arsenide nanowires

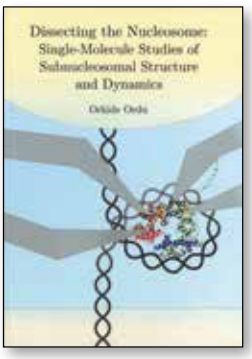


A long sought signature of Majorana bound states is the doubling of the supercurrent phase periodicity in topological Josephson junctions. The researchers demonstrated this effect for the first time by carefully measuring the microwave radiation emitted by an indium arsenide nanowire Josephson junction.

Nature Communications 10, 245 (2019)
D. Laroche, D. Bouman, D. van Woerkom, A. Proutski, C. Murthy, D. Pikulin, C. Nayak, R. van Gulik, J. Nygård, P. Krogstrup, L. Kouwenhoven, A. Geresdi

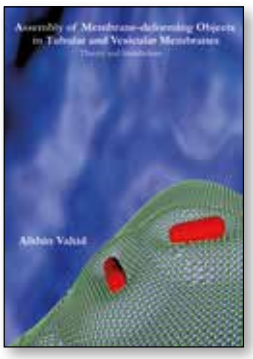
RECENT PHD THESES

Christian Dickel
25 September 2018

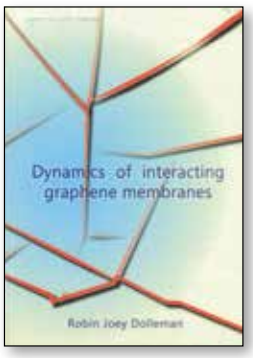


Orkide Ordu
27 September 2018

Seungkyu Ha
16 October 2018



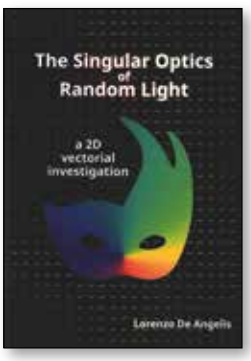
Afshin Vahid
17 October 2018



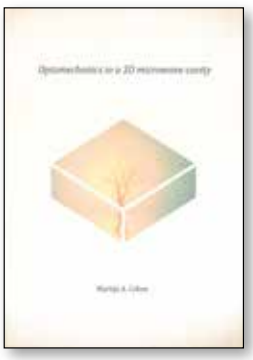
Robin Dolleman
20 November 2018

Shun Yanai
28 November2018

Xiang Fu
11 December 2018

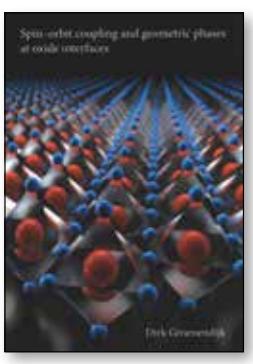


Lorenzo de Angelis
20 December 2018



Martijn Cohen
16 January 2019

Mafalda Monteiro
21 January 2019

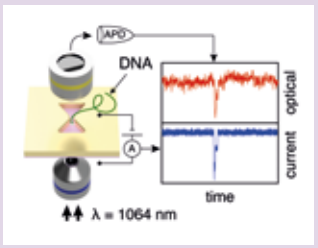


Dirk Groenendijk
28 January 2019

Suzanne van Dam
1 February 2019

Dominik Schmieden
20 March 2019

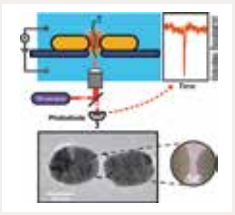
Label-free optical detection of DNA translocations through plasmonic nanopores



Nanopore sensors rely on an ionic current to detect biomolecules, but this couples signal strength to driving voltage and requires the use of high concentration electrolytes. To decouple the detection scheme from the driving force and buffer conditions, we integrated a nanopore with a plasmonic nanoantenna, where changes in the transmission of the optical intensity through the nano antenna can be used to detect DNA molecules.

D.V. Verschueren, S. Pud, X. Shi, L. de Angelis, L. Kuipers, C. Dekker
ACS Nano, 2018

Active delivery of single DNA molecules into a plasmonic nanopore for label-free optical sensing



In this paper, we combine a plasmonic nanoantenna with a solid-state nanopore and demonstrate that single DNA molecules can be efficiently delivered to the plasmonic hotspots and detected in a label-free manner at submillisecond acquisition rates by monitoring the backscattered light intensity from the plasmonic nanoantennas. Our method realizes orders of magnitude better temporal-resolution and significantly improved reusability comparing to the traditional single-molecule plasmonic resonance sensing methods. We believe our plasmonic nanopore sensor provides great opportunities for high-throughput optical single-molecule-sensing assays.

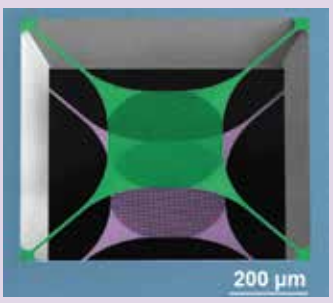
X. Shi, D.V. Verschueren, C. Dekker.
Nano Lett. 18 , 8003, Vol. 13, 1, p. 61-70 (2018)

Near-field coupling of a levitated nanoparticle to a photonic crystal cavity

We have developed a new device that can measure and control a nanoparticle trapped in a laser beam with unprecedented sensitivity. The technology could help study movement on the scale of atoms and subatomic particles, which are governed by the rules of quantum mechanics rather than classical physics.

L. Magrini, R. A. Norte, R. Riedinger, I. Marinković, D. Grass, U. Delić, S. Gröblacher, S. Hong, and M. Aspelmeyer
Optica 5, 1597 – 1602 (2018)

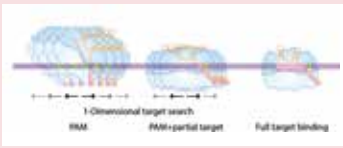
Integrated optomechanical arrays of two high reflectivity SiN membranes



We have designed, fabricated and tested an integrated array of two high reflectivity mechanical oscillators, that form a Fabry-Perot cavity. In this experiment we characterize their optical, mechanical and optomechanical properties, and show a clear enhancement of the coupling rate of the center-of-mass mode of the array over the single device case, demonstrating the potential of our method for novel multi-element experiments in optomechanics

C. Gärtner, J. P. Moura, W. Haaxman, R. A. Norte, and S. Gröblacher
Nano Lett. 18, 7171 (2018)

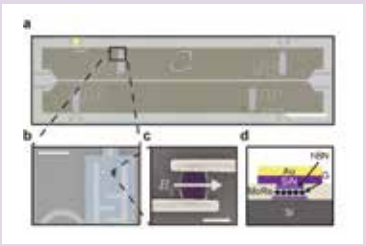
CRISPR/ Cas9 searches for a protospacer adjacent motif by lateral diffusion



Since its discovery, the CRISPR/Cas9 system has been at the focus of fundamental researchers, genome engineers, and the general public alike. Despite being in the spotlight for several years, aspects of the precise molecular mechanism of Cas9 activity remain ambiguous. Single-molecule studies illustrate that lateral diffusion contributes to target site search by the Cas9, emphasizing the importance of neighboring sequences for genetic engineering approaches.

V. Globyte, S. H. Lee, T. Bae, J.-S. Kim, C. Joo,
EMBO Journal (2018)

Magnetic field compatible circuit quantum electrodynamics with graphene Josephson junctions



A transmon qubit insensitive to magnetic field is a crucial element in topological quantum computing. Here we create graphene transmons by integrating monolayer graphene Josephson junctions into microwave frequency superconducting circuits, allowing it to operate in a parallel magnetic field of 1T.

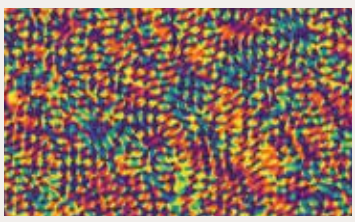
J. G. Kroll, W. Uilhoorn, K. L. van der Enden, D. de Jong, K. Watanabe, T. Taniguchi, S. Goswami, M. C. Cassidy & L. P. Kouwenhoven.
Nature Communications 9, 4615 (2018)

An optomechanical Bell test

Why does quantum mechanics work so well for microscopic objects, yet macroscopic objects are described by 'classical physics'? This question has bothered physicists since the development of quantum theory more than a 100 years ago. Researchers in the group of Simon Groeblacher at Delft University of Technology and the University of Vienna have now devised a macroscopic system that exhibits entanglement between mechanical phonons and optical photons. They tested the entanglement using a Bell test, one of the most convincing and important tests to show that a system behaves non-classically

I. Marinković, A. Wallucks, R. Riedinger, S. Hong, M. Aspelmeyer, and S. Gröblacher
Phys. Rev. Lett. 121, 220404 (2018)

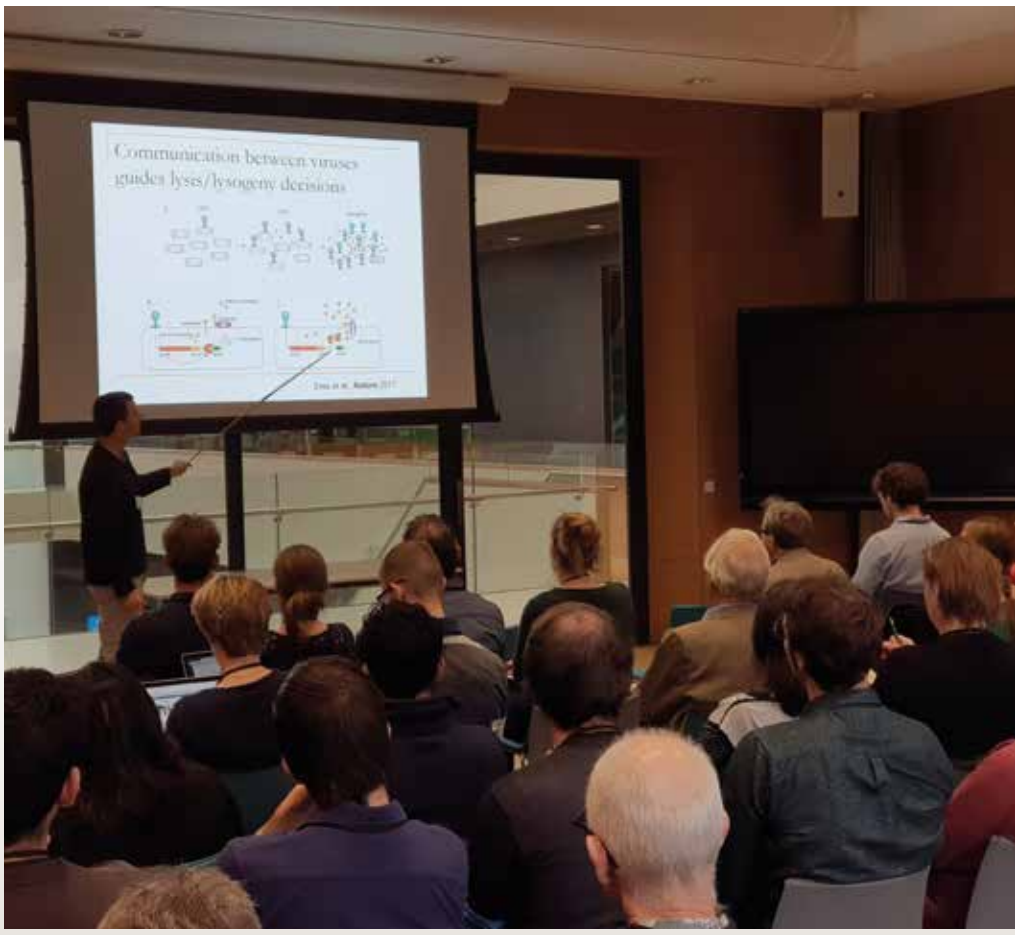
Polarization singularities in two-dimensional random vector waves



Random light fields are riddled with infinitely small features where an aspect of the field becomes undefined. These optical singularities have a topological index. In the past we have experimentally shown that phase (scalar) singularities are roughly distributed in space like the ions in an ionic liquid, with opposite topological indices repelling each other. Surprisingly and unlike their 3D cousins, we find, in experiment and theory, that polarization singularities in 2D exhibit a bunching of same index singularities, caused by polarization correlations resulting from the reduced dimensionality.

De Angelis, F. Alpeggiani and L. Kuipers
Phys. Rev. X 8, 041012-1/10 (2018)

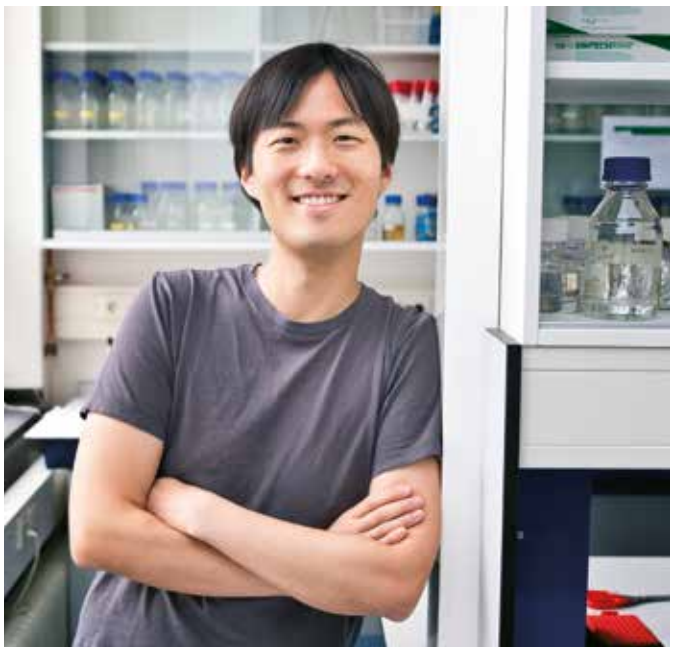
Microbiology meeting at the faculty of Applied Sciences



The KNVM (Dutch Royal Microbiology Society) aims to promote the knowledge dissemination of Microbiology in The Netherlands and Flanders, and organizes several scientific meetings such the annual Fall Meeting of its division General and Molecular Microbiology (GMM). On November 9 last year the GMM Fall Meeting was hosted at TU Delft. The one-day symposium brought together 82 professionals and students from the Netherlands and Belgium with an interest in diverse aspects of Microbiology. Thanks to kind sponsoring by the Kavli foundation and NWO, we were able to invite two international keynote speakers, Prof. Rotem Sorek (Weizmann Institute, Israel) and Dr. David Bikard (Institute Pasteur, Paris). Prof. Sorek talked about newly discovered bacteriophage defense systems, and presented bacteriophage-encoded communication systems. Dr. Bikard presented what we learn from genome wide screens using CRISPR-Cas9 Nanotechnologies. Speakers from diverse Dutch institutes and Universities also presented their research, ranging in topics from the archaeal origin of the eukaryote, to the ecology of the Black Sea subsurface floor and metabolic engineering of membrane synthesis pathways of bacteria, and single cell studies using microfluidic flow cells. Medically relevant topics were also covered including how pathogenic bacteria such as *Mycobacterium tuberculosis* covers its outer surface and the importance of our gut microbiome for human health. The speakers were not only representing diverse institutes, but also people in various phases of their careers (PhD, Postdoc and PI and included: Rebecca McKenzie (TU Delft), Dr. Daphne Stapels (UMCU), Dr. Melvin Siliakus (NIOZ), Bastiaan von Meijenfeldt (UU), Dr. Coen Kuijl (VUmc), Dr. Laura van Niftrik (Radboud UMC), Dr. Anja Spang (NIOZ), Prof. Joost Wiersinga (AMC/UvA), Dr. Nina van Sorge (UMCU). All in all it was a very diverse meeting and an excellent opportunity to network with researchers from interdisciplinary research fields.

Stan Brouns (TU Delft)
Reindert Nijland (Wageningen University)

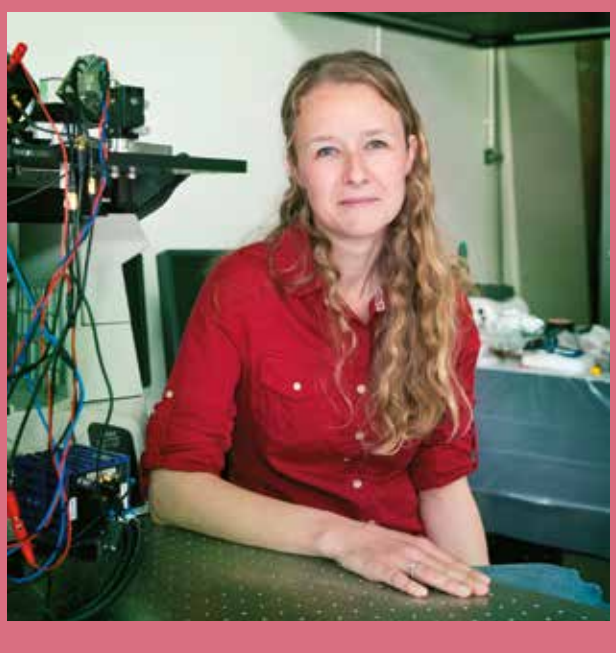
Hyun Youk selected as EMBO Young Investigator



The European Molecular Biology Organization (EMBO) has selected Hyun Youk and 25 other life science researchers within their first four years as group leaders to become EMBO Young Investigators. Youk will join an active network of 102 current and 314 past Young Investigators and will receive support from EMBO during the foundation of his first independent laboratory.

Marie-Eve Aubin-Tam awarded NWO Athena Prize 2018

Dr Marie-Eve Aubin-Tam have received the NWO Athena Prize 2018 at the CHAINS chemistry conference on 4 December. The prize is awarded in recognition of women chemists who serve as role models for other researchers.



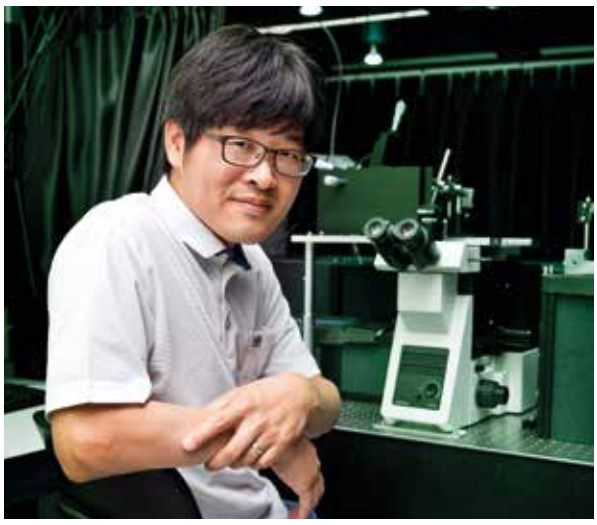
Kavli Postdoc Retreat "Mapping Your Road as a Science Professional"

At several stages in the academic life, in particular when we are about to finish our PhD or one of many temporary postdoc contracts, we find ourselves at a familiar crossroads: what next? For many of us, this essential question is a troubling matter to confront, and thus particularly challenging to answer. Most difficult proves to be our lack of awareness of the ample skills we have built up, almost unperceived, over many years. We mainly ride the 'academic train' through all the degrees we can achieve without reflecting much on what we can do and what we really want to do.

With an eye to helping us engage in this process, the Kavli Institute organized a postdoc career retreat together with the Qia Consultancy & Training and Ralph Rousseau. When, where, and how long should be indicated. The retreat turned a science professional's typical 'job search' thought process upside down: instead of looking for jobs that one just 'fits into' at the next step of one's career, we learned to search for the jobs that actually match our skills, expectations, and personal goals in other areas of life. During the retreat, we became aware of how incredibly large the skill set acquired in the academic environment actually is, and how highly qualified it actually makes us for careers outside the academic world. This retreat gave us the tools to reflect on ourselves, identify the intrinsic motivation in things we do, and decide on the activities we like doing most. A prominent 'dream job' may not actually be the best fit for us in the more personal sense, and this event both helped us identify our individual best fits and develop techniques for getting there through the power of self-awareness and networking.

Sergii Pud

ERC Consolidator grant for Chirlmin Joo



Dr. Chirlmin Joo has been awarded with an ERC Consolidator grant to develop a new gene editing tool based on a system found in a single-celled organism. Genome editing is an essential tool for life sciences. Recently, a potent genome editing system was discovered in bacteria. This system, called CRISPR/Cas9, has paved the way of editing the genome of many different organisms. But, despite its wide use, CRISPR/Cas9 has its limitations, especially in medical applications. A new genome editing tool is therefore highly anticipated.

Luuk Loeff receiving the Rubicon fellowship

NWO Rubicon fellowship supports about 60 PhD students for their post-doctoral study abroad. Luuk Loeff formerly from the Chirlmin Joo group received this fellowship in January 2019. He started his post-doc study on bacterial immunity systems in Martin Jinek's group in University of Zurich in December 2018.

Thijs Cui receiving a Best Presentation Award from the NWO-CHAINS conference 2018

In the NWO CHAINS conference, where chemistry communities meet every year, Thijs Cui from the Chirlmin Joo group presented his single-molecule study on a new bacterial defense system. He was awarded a Best Presentations Prize.

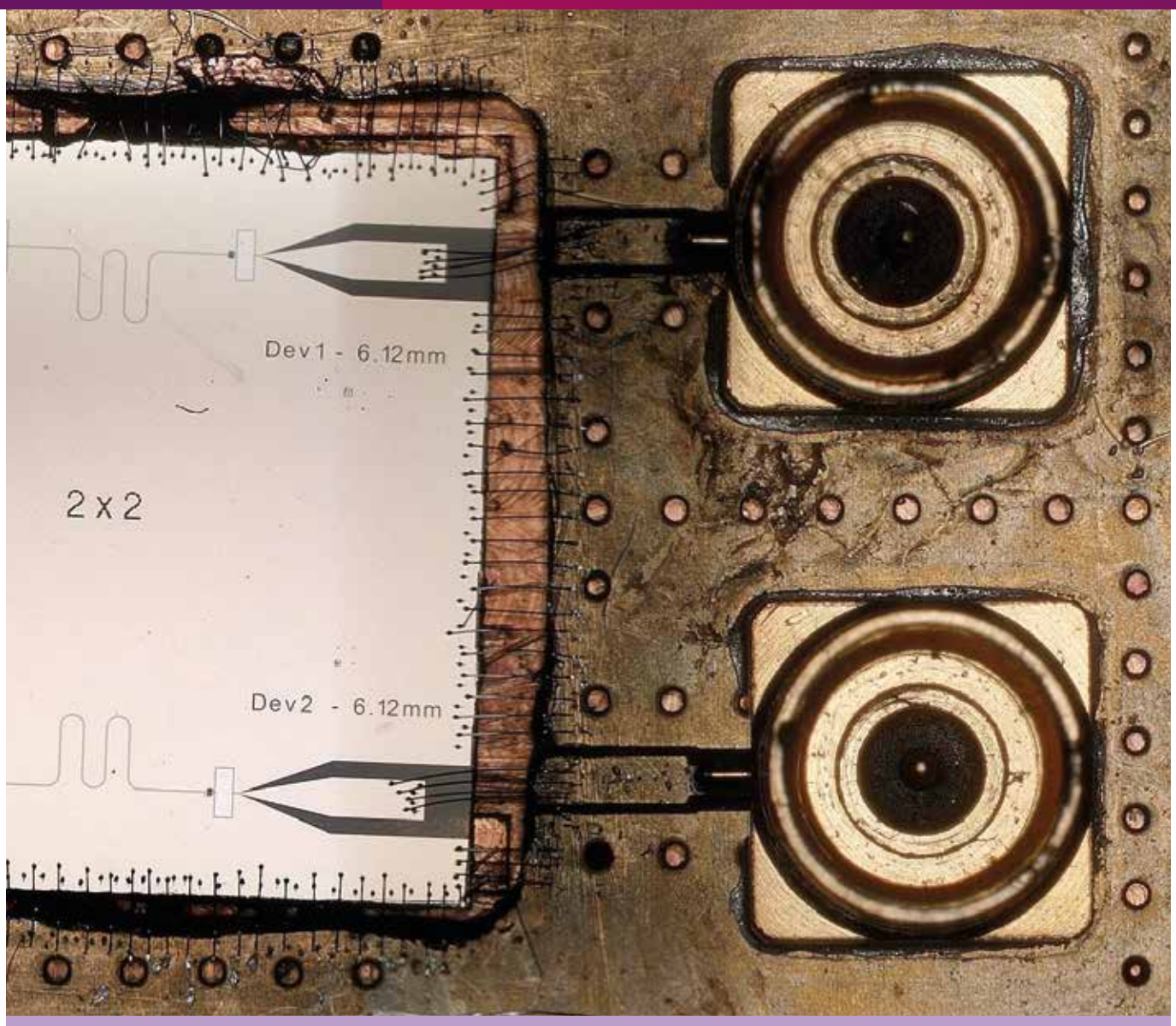


Image of a superconducting quantum chip based on graphene
Image credit: F. E. Schmidt

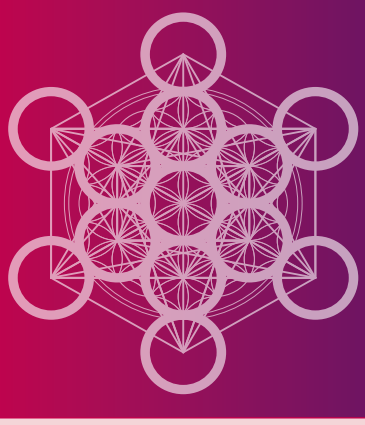
UPCOMING KAVLI COLLOQUIUM

Joanna Aizenberg

May 24, 2019

Harvard University

KAVLI DAY 2019



September 5, 2019

The Hague (TBC)

COLOFON

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Lay out
Haagsblauw

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