KAVLI NEWSLETTER
Kavli Institute of Nanoscience Delft
No.21
March 2018

IN THIS ISSUE:

The Kavli-Intel collaboration

Since the summer of 2015 the spin qubit team lead by Lieven Vandersypen (as well as the groups of Leo DiCarlo, Koen Bertels, and Edoardo Charbon) is actively collaborating with Intel Corporation. Since then both Giordano Scappucci and Menno Veldhorst started their own groups in QuTech's Fault Tolerant Quantum Computing road map and joined the efforts towards a spin qubit based quantum processor. Next to Intel, QuTech also has a collaboration with Microsoft, which to some extent even goes further than the collaboration with Intel, since an entire Microsoft lab is being built in our university building, called Microsoft Station Q at Delft.

The collaboration with Intel is more than regular research funding, which makes it unique in its kind. Intel has never before worked together with academia so closely, while QuTech now has access to knowledge, expertise, and facilities to which virtually no other university had access before. It's this what makes the collaboration a real win-win by fulfilling both Intel's desire to learn about quantum and QuTech's wish for more uniform and reproducible qubits. Intel and QuTech joined forces and agreed on a strong collaboration for a long term, 10 years. It is an active collaboration with material and samples going in both directions, regular knowledge transfer via weekly Skype meetings and more importantly, physical transfer of people. Dave Michalak is an Intel engineer in the Quantum Computing group who has been worked in Delft for the last two years, mainly with the superconducting team. Another Intel engineer, Kanwal Singh, is in Delft for one and a half year now and works together with us on the fabrication of spin qubits in purified silicon. In the other direction, I was given the opportunity to work at Intel last summer. I lived in Oregon for three months and mainly worked on low-temperature characterization of transistors to help improve Intel-made spin qubit devices. I was able to act as a translator between the quantum people in Delft and the transistor people at Intel.

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FROM THE DIRECTORS

We are thrilled to soon host Hagan Bayley from Oxford University, who will visit our Institute March-May as the 2018 Kavli Chair. Hagan is one of the leading scientists in chemical biology who has done pioneering work on using nanopores for sensing and sequencing (which yielded the leading nanopore-based DNA sequencing company worldwide). On top of that he is now exploring the 3D printing of artificial tissues. On March 29, he will present his Kavli Colloquium on these subjects. In the preprogram before the colloquium, three new faculty members from our institute will introduce themselves.

Furthermore, this newsletter contains an impression by Jelmer Boter on how a collaboration between an academic and major industrial partner (Intel) works out in practice. And Stefania Usai describes the recent big BaSyC project aimed at making a synthetic cell. Finally, as usual, you are welcome to ponder the thoughts of our columnists Anton Akhmerov and Martin Depken, and read lots of other news. Enjoy!

Cees Dekker

COLUMN

Questions of purpose

The goal of biophysics is to understand biological systems from a physics perspective. To me, such understanding implies the ability to model biological function in terms of basic physical and chemical processes. Biology is complex though, and even describing the most basic of biological processes one has to connect many disparate parts of physics and chemistry. Take for example the study of RNA polymerase, a molecule that runs along DNA while synthesizing a RNA copy, using its DNA track as a template. This process is essential to all life of earth, as it forms the fountain head of information flowing from genome to actions in the physical world. Though basic and fundamental to biology, even a narrow physical description of a single RNA polymerase interacting with a gene can benefit from a wide variety of concepts, including random walks, first passage times, exclusion processes, persistence lengths, polymer dynamics, Stoke's drag, RNA folding kinetics, Michaelis-Menten kinetics, catalysis, nucleolysis, to name but a few.

The fact that the biological processes I teach and study happen inside me, and are ultimately the very source of my ability to teach and study them, always seemed wonderfully strange to me. This fact, together with the opportunity to tie so many elegant descriptions of the physical world together into a whole, was for a long time what I thought drew me to the study of biological systems. Now I think the source of the attraction runs much deeper, itself a direct result of natural selection.

Let me explain. In standard physics, you can determine the state of your system by experimentally measuring its characteristic properties, or you could seek to understand what caused them to be what they are by considering ever more fine-grained models of lower level details. Maybe this sort of reduction could go on indefinitely (turtles all the way down!), or maybe—just maybe—the final destination is that last one-parameter theory, with the dial set to 42!

Whichever the case, evolution by natural selection changes the rules of the game, and offers a second path to understanding how a systems characteristic properties are set. For evolved systems, it makes sense to seek causes, not only by looking down to the previous level of causation, but also by looking up to the next level. You have hard bones to allow you to stand tall in a gravitational field, and the CRISPR-Cas prokaryotic immune system cuts DNA to protect against viral infections. With causation so strangely reversed, the lower level properties are seemingly set by the effect they have on higher levels. Of course, causation is not actually reversed, but the repeated application of natural selection has eliminated replicators that did not make the cut, leaving the rest to look like they were destined for success.

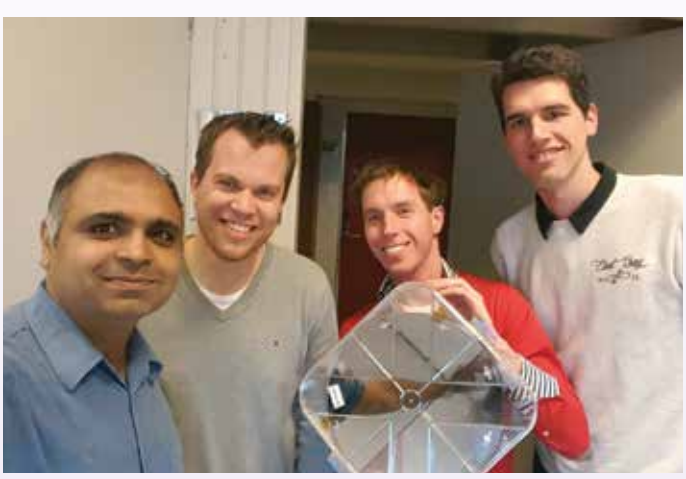
So, tough often confusingly complex, biological systems can still show simplicity in the purpose they have evolved to fulfill, and therein lies the beauty of it all. We are all social animals, primed to look for intent and purpose behind unexplained events. In light of this, the joy I find in studying and lecturing about biological systems seems natural: I can finally follow the yellow-brick road, and take a peek behind the screen at the wizard that was not!

Martin Depken

The Kavli-Intel collaboration

› **Continued from page 1**

So far, Intel supplied us with purified silicon substrates that were made using a growth process that was completely new for Intel at the start of the collaboration. Giordano Scappucci's team set up fabrication and measurement capabilities that allow for fast turn around and quick feedback in order to improve material quality. This means that for our quantum dot device fabrication effort in Delft, we now have an essentially unlimited supply of high-quality material, in the form of 300 mm wafers. In addition, we have access to a set of metrology tools we could not have dreamt of a few years ago and Intel's processing experience is invaluable in solving the various issues that we run into in the cleanroom. The Intel philosophy of 'copy exactly' facilitates well-thought decisions, but on the other hand doesn't lend itself well for quick tries. This is a delicate balance: to be able to draw firm conclusions you need to work systematically and take incremental steps, but sometimes it pays off to be bold and make more radical changes in an attempt to solve a problem. The first experimental result on quantum dots fabricated on Intel substrates is about to be published. It is a promising result showing only a weak temperature dependence of spin relaxation and charge noise. Naturally both sides of the collaboration are happy to see all the hard work pay off.



From left to right: Kanwal Singh (Intel), Menno Veldhorst, Jelmer Boter and Gabriel Droulers (Kavli and QuTech) showing the first ^{28}Si-MOS wafer that arrived in Delft.

University-industry collaborations come with their own challenges. In the long term, I strongly believe our goals are aligned, but on the short term, the interests of academia and industry can be misaligned. What's interesting scientifically, isn't necessarily what an industry partner is after. PhD students and postdocs want to write a thesis and publish their results. That is not a priority for industry and sometimes even the opposite of what industry would like, as they would like to keep the results for themselves out of strategic reasons. With quantum computing's potential for commercialization, industry and academia will have to find the middle ground on these topics. And we did. QuTech's researchers can publish their work, but whenever relevant, a patent application will be filed prior to publication. Furthermore, not all technical details of work done at Intel can be shared, since findings in Oregon can relate to Intel's core business and affect more than just the quantum program. Therefore, since PhD students and postdocs in Delft must be able to talk freely about their work with colleagues from all over the world, they themselves are not provided with all details.

To be able to make fast progress towards the grand goal of realizing a quantum computer, a multidisciplinary approach and strong collaboration between academia and industry are crucial. This is exactly the path we pursue at QuTech together with Intel and Microsoft. Working with industry is an interesting process, which comes with challenges, but also huge opportunities that make it extremely motivating to work in this environment.

Jelmer Boter

KAVLI COLLOQUIUM

Nanopore engineering

Hagan Bayley

Oxford University

March 29, 2018 will feature a Kavli colloquium by our 2018 Kavli Chair Hagan Bayley

The properties of protein nanopores have been expanded by using a wide variety of "engineering" techniques that range beyond simple mutagenesis and include the introduction of unnatural amino acids, the fitting of molecular adapters and modification with reagents including polymer chains. These nanopores have various applications in biotechnology. In stochastic sensing, individual molecular binding events or bond-making and bond-breaking steps occurring within a pore are monitored with sub-millisecond time-resolution, allowing the detection of diverse molecules and a variety of covalent chemistry. Stochastic sensing has been elaborated, first in academia and then at Oxford Nanopore, to perform nucleic acid sequencing. The MinION developed at Oxford Nanopore is a low-cost, portable device that permits rapid long-read sequencing. In a second area, networks of aqueous droplets joined by lipid bilayers have been assembled. The droplets in the networks communicate with each other and with the environment through protein nanopores. Synthetic tissues comprising many thousands of droplets have been fabricated by 3D printing. These droplet networks can display emergent properties including the ability to store and use energy and to move and change shape. Means are being devised to interface synthetic tissues with living tissues and control them with external signals.

15.00 h	Pre-programme
	Introducing 3 new faculty members: - Srijit Goswami - Arjen Jakobi - Toeno van der Sar
15.45 h	Break
16.00 h	Kavli colloquium by Hagan Bayley: "Nanopore engineering"
17.15 h	Drinks & time to meet

Hagan Bayley is Professor of Chemical Biology at the University of Oxford. He received his B.A. in chemistry from Oxford in 1974, while at Balliol College, and his Ph.D. in chemistry from Harvard University in 1979 in the laboratory of Jeremy Knowles. After postdoctoral work with Gobind Khorana at the Massachusetts Institute of Technology, he was on the faculty at Columbia University and the University of Oxford. From 1988 to 1996, he was at the Worcester Foundation for Experimental Biology in Shrewsbury, Massachusetts, and from 1997 to 2003 at Texas A&M University in College Station.

Major interests of his laboratory are the development of engineered pores for stochastic sensing, the study of covalent chemistry at the single molecule level, ultrarapid DNA sequencing and the fabrication of synthetic tissues. In 2005, Professor Bayley founded Oxford Nanopore to exploit the potential of stochastic sensing technology. The company has developed the MinION portable DNA sequencer. In 2014, he founded OxSyBio to build synthetic tissues for regenerative medicine.

Both his research and entrepreneurial skills have been recognized several times. He has been a recipient of the Royal Society's Wolfson Research Merit Award and was the 2009 Chemistry World Entrepreneur of the Year. In 2011, Professor Bayley was elected a Fellow of the Royal Society. In 2012, he was awarded the Royal Society of Chemistry's Interdisciplinary Prize and in 2017, the Menelaus Medal of the Learned Society of Wales.

KAVLI COLLOQUIUM

Date: March 29, 2018 at 15.00 hours
Location: Aula, lectureroom C

Publication prize 2018

This year 2018, we will again award the bi-annual prize for the best publication resulting from our Kavli Institute of Nanoscience Delft that appeared in print in the previous two years. This prize, which consists of an award and an amount of € 3000, is given out every two years and will be announced at our annual Kavli day on August 30.

A publication is eligible for the 2018 prize when it is published from our Kavli Institute (as must be clear from the address) and when the publication date was between 1-4-2016 and 1-4-2018.

Anyone can nominate. Please send your nomination(s) by email to c.dekker@tudelft.nl. Concretely, please send a pdf of the publication and a motivation letter why you consider this the most outstanding paper from our institute in the past 2 years that is worthy of this prize.

Deadline for submission of nominations is May 1, 2018.

So please send your nomination for an outstanding article that merits the Kavli Delft publication prize 2018 before May 1.

Can we build a living cell from lifeless components?

An update on a major new research initiative

'Building a synthetic biological cell starting from its basic molecular components' - this is exactly what the Dutch BaSyC consortium aims at.
The BaSyC project - led by Marileen Dogterom from our Kavli Institute - is a joint effort of 17 team leaders from all across the Netherlands with backgrounds in physics, chemistry and biology. They work at 6 Dutch research institutions: Delft University of Technology, Groningen University, Radboud University Nijmegen, Vrije Universiteit Amsterdam, Wageningen University, and the AMOLF Institute. BaSyC recently received major funding (19M€) by a "Gravitation" grant from the Dutch Ministry of Education, Culture and Science.

Bottom-up vs top-down approach to understanding life

The so-called bottom-up approach of BaSyC works in the opposite direction from the top-down approach used by the Craig Venter institute in the United States, in which a minimal cell is created by selectively removing components from the genome of an existing bacterium. While very successful in demonstrating that synthesized genomes containing only several hundreds of genes can still lead to viable cells, this top-down approach does not reveal how the remaining gene products act together to create life. Consider for example that the most recent minimal cell obtained by Venter's group, in 2016, contained 473 genes, but for 149 of these (30% of the total number), the biological function was still unknown.
In recent years, tremendous progress has been made in the in *vitro* reconstitution and quantitative understanding of complex biological systems and processes. In parallel, the possibilities for genome engineering have exploded with the development of tools such as CRISPR technology. All these rapid advances in biophysics, biochemistry and genome engineering, together, make it possible to take on the challenge of integrating basic individual systems into biologically functional entities, ultimately aiming to lead to the bottom-up construction of synthetic cells.

A European Synthetic Cell FET Flagship?

Internationally, there are different communities engaged in the effort of building life from the bottom-up. The United States and Europe are the major players in this effort, but while in the US the traditional top-down approaches to minimal life are stronger, Japan and Europe present a stronger presence of bottom-up approaches to biology in the physics and chemistry research communities.
As the prospect of creating synthetic living systems slowly seems to come within reach, European scientists are organizing themselves in a number of initiatives, at the national as well as at European level. Indeed, main participants of the BaSyC consortium are also playing a major role in its European extension, the **European Synthetic Cell Initiative**. This is a dedicated European platform with a common ambition to engineer synthetic life using the bottom-up approach. Initiated by Marileen Dogterom and Cees Dekker from our Institute, together with Petra Schwille (Max Planck Institute of Biochemistry) and Hagan Bayley (Oxford University), the initiative is strongly supported by a large and still growing number of researchers from many European countries, such as the UK, Germany, Netherlands, Scandinavian countries, France, Italy, Spain, Greece, Croatia, and Switzerland. Last July, the initiators organized a Future symposium on Building a Synthetic Cell in Schloss Ringberg (Germany), bringing together top researchers in the synthetic cell field, as well as politicians, ethicists, representatives of the European Union, funding bodies, science academies, and industry. During the symposium, three Nobel Laureates stated their enthusiasm and support for the collaborative project, Jean-Marie Lehn, Jack Szostak (in picture), and Ada Yonath.
Based on consultations and discussions in the European Commission, in 2016 the Synthetic Cell initiative has now been shortlisted as a possible candidate topic for a H2020 FET Flagship. We are in the process or submitting a formal proposal for a FET Flagship Preparatory Phase. For an update of the progress please have a look at our website www.syntheticcell.eu, and join this exciting effort!

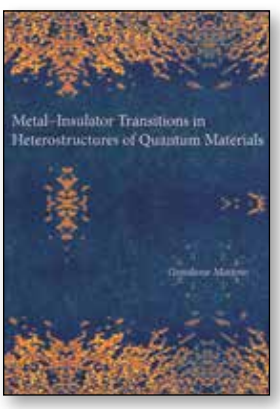
Stefania Usai

RECENT PHD THESES

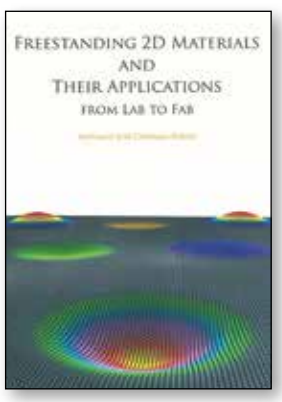
Önder Gül
18 October 2017

José Artureo Celis Gil
02 November 2017

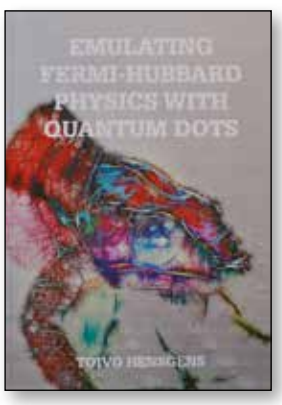
Stefan Bogdanović
03 November 2017



Giordano Mattoni
18 December 2017



Santiago Cartamil-Bueno
18 December 2017



Toivo Hensgens
10 January 2018

Victor Marrin Lizarraga
23 February 2018

Stephanie Heerema
04 April 2018

HIGHLIGHT PAPERS

Real-time imaging of DNA loop extrusion by condensin

Single-molecule imaging showed the formation of large DNA loops by single condensin complexes, providing direct evidence for a loop-extrusion mechanism for the spatial organization of chromosomes.

M. Ganji, I.A. Shaltiel, S. Bisht, E. Kim, A. Kalichava, C. H. Haering, C. Dekker
Science, online 22/2/2018, DOI: 10.1126/science.aar7831

"Viral suppressors of RNAi employ a rapid screening mode to discriminate viral RNA from cellular small RNA"

RNA interference is an indispensable antiviral defense mechanism in insects, including mosquitoes that transmit human diseases. Viruses employ variety of protein suppressors of RNAi (VSR) that protect viral RNAs from being recognized by RNA interference. Fareh et al revealed bimodal physical interactions between viral RNA molecules and VSR proteins.

M. Fareh, J. van Lopik, I. Katechis, A. W. Bronkhorst, A. C. Haagsma, R. P. van Rij, C. Joo
Nucleic Acids Research, 2017

Quantum Race accelerates development op Sillicon Quantum Chip

Strong spin-photon coupling in silicon

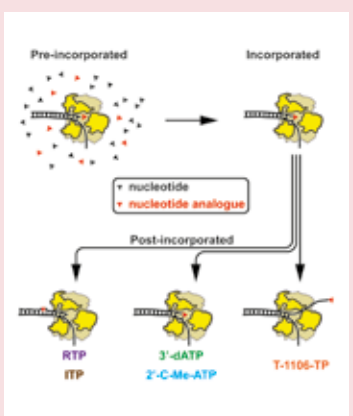
N. Samkharadze, G. Zheng, N. Kalhor, D. Brousse, A. Sammak, U. C. Mendes, A. Blais, G. Scappucci, L. M. K. Vandersypen
Science 10.1126/science.aar4054 2018

A programmable two-qubit quantum processor in silicon

In this paper we demonstrate a programmable two-qubit quantum processor is silicon which can run simple quantum algorithms. The quantum bits (qubits) are made from single electron spins confined in quantum dots in silicon and are controlled using electrical signals. These qubits are an attractive platform for large-scale quantum computers due to their excellent coherence properties, small size, and compatibility with industrial fabrication processes.

F. Watson, S. G. J. Philips, E. Kawakami, D. R. Ward, P. Scarlino, M. Veldhorst, D. E. Savage, M. G. Lagally, Mark Friesen, S. N. Coppersmith, M. A. Eriksson, L. M. K. Vandersypen
Nature doi:10.1038/nature25766

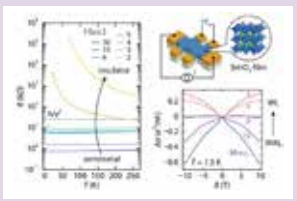
Signatures of nucleotide analogue incorporation by an RNA-dependent RNA polymerase revealed by using high-throughput magnetic tweezers



TU Delft researchers have, in collaboration with their colleagues at the University of Erlangen, the University of Minnesota, and Penn State University, revealed that poliovirus RNA-dependent RNA polymerase, a key protein found in this and other RNA viruses, pauses in distinct ways when incorporating different nucleotide analogue inhibitors. These findings are important because such inhibitors are used to target viral activity. In particular, the researchers were able to show that T-1106 antivirals (orange in associated figure) – a new class that alters the base of the RNA building block, rather than the sugar – work in a new way. Unlike other known antivirals that either incorporate mutations into the replication process or stop it completely, this new class works by causing the RNA polymerase enzyme to pause and backtrack.

D. Dulin, J.J. Arnold, T. van Laar, H.S Oh, C. Lee, D.A. Harki, M. Depken, C.E. Cameron, and N.H. Dekker
Cell Reports 21, 1063–1076, 2017

Spin-orbit semimetal SrIrO3 in the two-dimensional limit



"Due to strong spin-orbit coupling, *5d* transition metal oxides with heavy atoms like Iridium feature correlated states that are inaccessible in conventional materials.
A notable example is $SrIrO_3$, an exotic semimetallic material that has been considered as a promising candidate for the realization of topological states. In this work, we study the effect of dimensionality on its electronic properties by creating artificial layers with atomically controlled thickness."

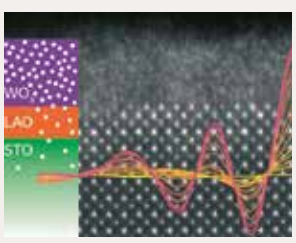
D.J. Groenendijk, C. Autieri, J. Girovsky, M. Carmen Martinez-Velarte, N. Manca, G. Mattoni, A.M.R.V.L. Monteiro, N. Gauquelin, J. Verbeeck, A.F. Otte, M. Gabay, S. Picozzi, A.D. Caviglia
Physical Review Letters (2017)

Nonlinear dynamic characterization of two-dimensional materials

The mechanical resonances of atomically thin membranes show nonlinear responses at driving forces in the pico-Newton range. Here, the authors develop a contactless method to extract the Young's modulus of 2D materials from the nonlinear dynamic response of these nano-mechanical resonators.

D Davidovikj, F Alijani, SJ Cartamil-Bueno, HSJ Zant, M Amabili, PG Steeneken
Nature Communications ,Vol 8, 2017

Insulator-to-Metal Transition at Oxide Interfaces Induced by WO3 Overlayers



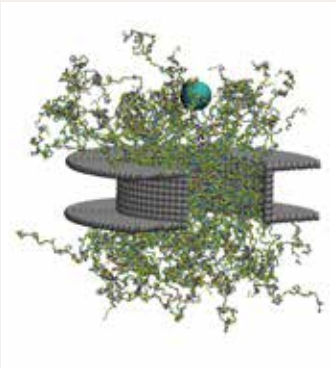
The paper details an interesting method for turning a highly insulating material into a highly conducting system. The process involves combining three different metal oxides in a sharp interface. The findings are a strong proof of the rising importance of complex oxides, which could be used in the electronics of the future.

G. Mattoni, D.J. Baek, N. Manca, N. Verhagen, L. F. Kourkoutis, A. Filippetti, A.D. Caviglia
ACS Appl. Mater. Interfaces, 2017, 9 *(48), pp 42336–42343*

HIGHLIGHT PAPERS

Spatial structure of disordered proteins dictates conductance and selectivity in Nuclear Pore Complex mimics

This paper reports the transport of ions and transport receptors through engineered mimics of the nuclear pore complex. Experiments on nanoporesare combined with coarse-grained molecular dynamics simulations that reveal that pores exhibit a high-density, nonuniform protein distribution, in contrast to a uniform and significantly less-dense protein distribution for a mutant without the core hydrophobic proteins.



We conclude that the sequence-dependent density distribution of disordered proteins plays a key role for its conductivity and selective permeability.

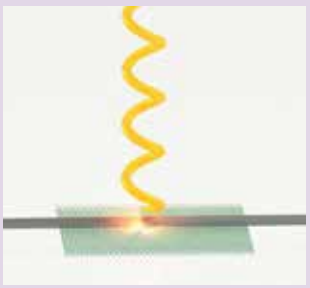
A.N. Ananth, A. Mishra, S. Frey, A. Dwarakasing, R. Versloot, E. Van der Giessen, D. Gorlich, P. Onck, C. Dekker
eLife 2018;7:e31510 DOI: 10.7554/eLife.31510

Testing Quantum Repeaters and Quantum Memories

Capacity estimation and verification of quantum channels with arbitrarily correlated errors.

C. Pfister, M. A. Rol, A. Mantri, M. Tomamichel, S. Wehner
Nature Communications 9, 27 (2018)

Nanoscale chiral valley-photon interface through optical spin-orbit coupling



The emergence of two-dimensional transition metal dichalcogenide materials has sparked intense activity in valleytronics, as their valley information can be encoded and detected with the spin angular momentum of light. We demonstrate the valley-dependent directional coupling of light using a plasmonic nanowire-tungsten disulfide (WS2) layers system. We show that the valley pseudospin in WS2 couples to transverse optical spin of the same handedness with a directional coupling efficiency of 90 ± 1%. Our results provide a platform for controlling, detecting, and processing valley and spin information with precise optical control at the nanoscale.

S. H Gong, F. Alpeggiani, B. Sciacca, E. C. Garnett and L. Kuipers
Science 359 (6374), 443-447

NEW EMPLOYEES

Name	Date of employment	Title	Lab
Jingkun Guo	01-11-17	PhD	Groeblacher lab
T.C. van Thiel	01-11-17	PhD	Caviglia lab
I. Bertelli	01-11-17	PhD	Van der Sar lab
William Lawrie	01-11-17	PhD	Veldhorst lab
Els Sweep	01-12-17	PhD	Liedewij Laan lab
Enzo Kingma	15-12-17	PhD	Liedewij Laan lab
Mohammad Mehmandoost	01-01-18	PhD	Dobrovitski group
Luca Binci	01-01-18	PhD	Kouwenhoven lab
Sophie Hermans	01-01-18	PhD	Hanson Lab
Ramon van der Valk	01-01-18	Technician	Liedewij Laan lab/Marie-Eve Aubin lab
Elisa Godina	01-01-18	PhD	Christope Danelon lab
Filip Asscher	01-01-18	Technician	Nynke Dekker lab
Walter Hahn	16-01-18	Postdoc	Dobrovitski group
Vanessa Schaller	15-01-18	PhD	Kouwenhoven lab
Chaline van Aartrijk	15-01-18	PhD	Marie-Eve Aubin lab
Robbie Elbertse	01-02-18	PhD	Otte lab
Roy Schoonenboom	01-02-18	Allround Technicus	QuTech
Nick van Loo	01-02-18	PhD	Kouwenhoven lab
Csilla Buiting	01-02-18	Program manager	Roadmap TOPO
Dominique Laroche	01-02-18	PD	Kouwenhoven lab
Ana Rita Martins Costa	01-02-18	PostDoc	Stan Brouns lab
Fatemeh Moayed	01-02-18	PostDoc	Nynke Dekker lab
Teunke van Rossum	04-02-18	Science manager	Stan Brouns lab
Tao Yu	15-02-18	PostDoc	BauerGroup/Blanter Group
Sathish Kumar Rangaswamy Kuppuswamy	15-02-18	PhD	Akhmerov Group
J. Hortensius	15-02-18	PhD	Caviglia lab
Fatemeh Fani Sani	16-02-18	PhD	Otte lab
Jian Li	01-03-18	Researcher	Zandbergen lab
Brian Pasquelet Wuetz	01-03-18	PhD	Scappucci Lab
Arian Stolk	12-03-18	PhD	Hanson Lab
Reza Amini	01-03-18	PhD	Marileen Dogterom lab
George Dadunashvili	15-04-18	PhD	Timon Idema lab
Paola de Magistris	01-05-18	PostDoc	Cees Dekker lab
Lars-Eric Fielmich	01-07-18	PostDoc	Hyun Youk lab
Milan Lacassin	01-08-18	PhD	Hyun Youk lab

COLUMN

Why researchers need programming

Three years ago, together with several like-minded colleagues I organized the Casimir programming course. It takes five full days: a rather short period where we aim to give PhDs and postdocs just the absolute minimum of information required to make efficient use of programming in their research. We teach the skills that are not covered by the rather minimal amount of programming the students encounter in a typical science curriculum. For example we show where to find an existing solution to the programming task you need solved. We discuss how to preserve the code, share it with your collaborators or how to publish it. Related to that we also teach how to write the code such that you are not mortally ashamed to show it to other people and don't hate your past self when you undig this code a year later.

There are many strong arguments why learning to program should be a low priority for a researcher whose main focus is something other than making numerical simulations. Firstly, everyone has a lot on their plate: we need to be experts in our own extremely hard research topic (already a task that was only accomplished by a handful of people around the globe). If that isn't enough, in order to succeed in academic environment we need to excel also in communicating our research to our peers. That is we need to learn how to make as many people interested in something that only very few can understand. With these hard tasks, should a researcher also learn to use some extra techniques that are likely to expire in a year or two due to rapidly evolving information technology?

I think the main reason to learn programming is because it teaches us to identify parts of our work that can be improved not incrementally, but by orders of magnitude. The output of our work is always data, and computers are much better in analyzing data than humans. Thinking about research as a process of generating and transforming data makes you notice bottlenecks that you can avoid, or allows you to create new insight that you would miss otherwise. The same perspective also applies beyond the scope of a single project, but also to how the complete research fields advance. In a way, our community is slow in adjusting to the change, and we are lagging behind for example the astronomers: they cannot wait for another similar supernova to adjust the measurement resolution, and therefore they cannot do their work with less than perfect data processing.

The idea to teach active researchers to code is much older than the Casimir programming course; my main inspiration was Software Carpentry, a grassroots volunteer organization that organizes training workshops (a lot of our materials and techniques are adopted from the Software Carpentry lessons). Our community gradually learns the new skills, however I also realize that we need more than a crash course to learn to use the new opportunities to the fullest. What do you think?

Anton Akhmerov

The John Stewart Bell Prize 2017 for Ronald Hanson

Congratulations to Roland Hanson who was awarded with this John Stewart Bell Prize 2017 for Research on Fundamental Issues in Quantum Mechanics and Their Applications'.

Marie Curie grants

Congratulations to several Postdocs that received a Marie Curie grant; Kaley McKluskey (Nynke Dekkers lab); Eugene Kim (Cees Dekker lab); Hamza Balci (shared Chirlmin Joo/Stan Brouns lab) and Sabina Caneva (shared Herre van der Zant / Cees Dekker).

NWO Grant

Congratulations to Nynke Dekker who was awarded with a NWO TOP grant and NWO ALW.

ERC Consolidator

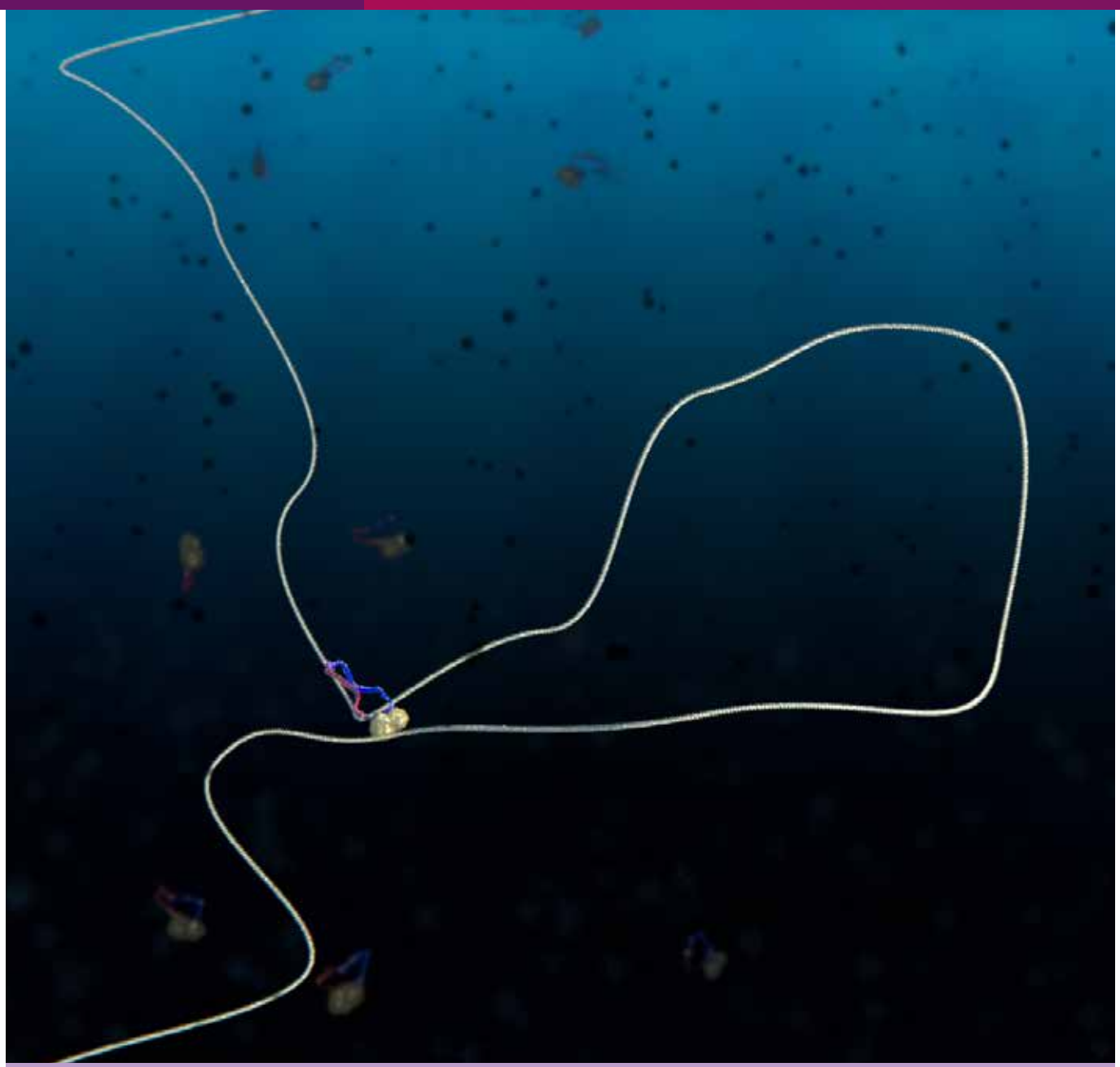
Congratulations to Ronald Hanson who was awarded with a ERC Consolidator Grant.

NWO Minerva Prize for 2017 awarded to Julia Cramer

She will receive the prize for her research in the field of quantum science and technology. The committee was very impressed by the quality of an article that appeared in Nature Communications in 2016, of which Cramer was the lead author. In that article, she and her co-authors showed that it is possible to protect certain quantum states against errors.

Bas Hensen won the NWO award for best physics thesis

He wrote last year's best physics dissertation and wins the 2017 award. Hensen was awarded his PhD *cum laude* on 29 April 2016 at TU Delft by Professor Ronald Hanson.



Artist impression of a loop of DNA that is extruded by the SMC protein complex condensin.
Inspired by single-molecule visualisation experiments by Mahipal Ganji et al, Science online Febr.22, 2018
Image credit: Scixel and Cees Dekker lab TU Delft

UPCOMING KAVLI COLLOQUIUM

Hagan Bayley

March 29, 2018

University of Oxford

UPCOMING KAVLI COLLOQUIUM

Tim Mitchison

June 14, 2018

Harvard University

UPCOMING KAVLI COLLOQUIUM

David Awschalom

To be announced

University of Chicago

COLOFON

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Editorial staff
Cees Dekker, Esther Reinders, Etty van der Leij and Amanda van der Vlist

Lay out
Haagsblauw

Contact address

Kavli Institute of NanoScience Delft
Delft University of Technology
Department of Bionanoscience

Van der Maasweg 9
2629 HZ Delft
The Netherlands

Phone: +31(0)15 - 27 89 352

E-mail: A.vanderVlist@tudelft.nl