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PhD special

IN THIS ISSUE:

On research diversity: interview with Lieven Vandersypen and Nina Codreanu

By Violet van Houwelingen

Qu-Tech director Lieven Vandersypen and PhD student Nina Codreanu discuss their PhD's as well the potential of our research diversity. Nina Codreanu: "The diverse approach to research here at Kavli helps us tackle day to day challenges, such as the cutting edge nanofabrication procedures in the cleanroom."

Nina Codreanu works in the Hanson Lab at QuTech and in the Groeblacher Lab at the department of Quantum Nanoscience (QN), on the design, fabrication and characterization of photonic crystal cavities for novel quantum networks experiments. Prof.dr. Lieven Vandersypen is one of the founders and director of Qu-Tech: he works on quantum computation and simulation based on semiconductors.

Nina: "How was your time as a PhD student and postdoc back in the day?"

Lieven: "I'm originally from Belgium. I did my PhD at Stanford in the United States, worked quite hard with a lot of motivated people around me and came to Delft in 2001, first as a postdoc and then on a faculty position in Quantum Nanoscience. Here at the TU Delft I feel the same level of drive from people as I did at Stanford: the Kavli environment sets high scientific goals."

Continue to read on page 2 ›

FROM THE DIRECTORS

We enter the summer in excellent spirits; in the joyful expectation of an autumn less dominated by Covid-19, but also proud of the recognition that our colleagues received: Cees Dekker the 8th Nano Research Award, my co-director Chirlmin Joo with a prestigious Vici subsidy and last-but-not-least two super Mario's (M. Avellaneda Sarrio and M. Gely) who both receive a Rubicon to follow up on their PhD work in a new prestigious surrounding.
In this issue Viktorija Globyte critically reflects on the important question "Do we need more women in science?" and Giordano Scappucci wonders what Covid taught him about scientific meetings. We are pleased to welcome a new faculty member Mazhar Ali (or, see self-interview, "Dr. Maz"). We also learn how cutting-edge, fundamental research has led to a new company Qphox to develop a Quantum Modem. Moreover, three PhD students interview their Head of Department and vice versa. Preparations are underway for a great, off-line(!) Kavli Day (September 2, 2021) with great activities and thought-provoking speakers.

Kobus Kuipers

COLUMN

Do we need more women in science?

I guess this question already might have caused unpleasant goosebumps for some of my esteemed colleagues in KIND. Please bear with me while I ask a few other questions. Do we need more LGBT+ people in science? What about racial and religious minorities? You may already see what I am trying to get at. While many will disagree, I want to argue that we simply need more good, committed scientists, regardless of their gender, sexual preference or ethnicity. However, most programs aimed at increasing diversity simply focus on biological sex, based on the premise that we need more women in science. However, thinking that the problem is entirely in numbers is short-sighted. Trying to fix it by artificially creating more opportunities for women to get faculty positions or women-only grants will worsen the situation in the long term. Because the problem is not in the numbers, it is in the attitude.

Imagine a situation where a female gets hired as a faculty member with two years of postdoc over a much more experienced male candidate. What do you think the attitude will be towards that woman from her new colleagues when this information spreads (and it always spreads). What attitudes do you think the male, who lost an unfair race, will develop towards his competitor? After several of those situations repeat, what attitudes may develop towards young women in science overall? Instead of creating more equality, such schemes create an environment where people scrutinize and mistrust young female faculty members more because they are unsure if they really were the most qualified candidates. I have witnessed this happen in our own TU Delft, several other universities in the Netherlands, and abroad, where such schemes were applied.

You might wonder now what the solution to the underrepresentation of women in science (and other, usually better paid, professions) might be. In the international CRISPR conference in 2018, Alan Davidson, a famous professor from the University of Toronto, talked about a test he had done to identify his internal biases. He read many reference letters he wrote for his students and postdocs. The results really shocked him, as he never thought there was a difference, but there was a striking one, in fact. The males were "ambitious, intelligent leaders", whereas the females mainly were "diligent, hardworking, nice team members". This has caused him to re-evaluate how he views his laboratory members and colleagues and change how he writes reference letters or evaluates applicants.

I propose performing similar tests with the hiring board members: have them evaluate candidates in writing and then identify internal biases towards gender. If any of them present internal biases based on gender, they should either be removed from the hiring board or receive coaching on identifying and getting rid of their prejudices. Only then can men and women compete based on their merit, not what their mama gave them. Finally, aiming to have 50/50 or even 60/40 male/female ratios in faculties is often comic, when at the first year of bachelors, the ratio in many fields is around 80/20. Therefore, it is equally important to reach out to schools as early as possible, to get as many kids, male and female, interested in science. Just as important is teaching them to disregard traditional gender roles, which leave women in the kitchen and let men become the leaders of yesterday, today, and as it looks now – tomorrow.
So do we need women in science? Yes, but only when we get more girls in science. When each scientist is treated the same in the application and hiring process, and internal biases regarding gender are removed.

Viktorija Globyte

INTERVIEW

› **Continued from page 1**

Nina: "What advice would you give PhD's today?"
Lieven: "I would advise PhD's to see this period as a unique opportunity to develop great depth in the understanding of a topic. The PhD period is a unique time to really explore a subject, because afterwards you will need to do many other things as well if you start leading a group: supervision, teaching and administration too."
Nina: "Regardless of the impact of Corona, the ambiance of TU Delft as research environment in general is vibrant. People are now even more hungry to do research, especially because we all felt the restrictions here. I think the TU Delft is an amazing oasis where one can feed this hunger for research; I feel really lucky about this."

Lieven: "Before coming to Delft, have you heard of Kavli Institute before?"
Nina: "I have been aware of the mission of the Kavli Foundation and knew about the Kavli Institutes around the world before, so it was a happy surprise to realize that as it happens one has been initiated also here at TU Delft. Myself, I I have worked in a medium size cleanroom facility in Politecnico di Milano, Italy, during my Master Thesis. So coming to Delft was very exciting, since it gave me the opportunity to explore the possibilities and capacity offered by one of the largest nanotechnology research cleanrooms in Europe. I felt really lucky that I could apply for a PhD in Delft and now I enjoy this amazing research environment, with cordial people.

Lieven: "What surprised you the most about coming to here?"
Nina: "Kavli Institute is a unique environment where researchers with different backgrounds can express themselves in the most research-creative way. Everyone contributes to the state of the art fabrication techniques from which every member and laboratory benefits. The diverse approach to research here is crucial to building up robust scientific methods, and at the same time helps us to tackle day to day challenges, such as the cutting edge nanofabrication procedures in the cleanroom."

Kavli interviewer: "How would you propose that we stimulate the synergy between the research areas within Kavli more?"
Nina: "Since I spend a lot of time in the cleanroom, where departments share workspace, I know that the synergy is very much felt there. I would suggest organising some workshops that bring together people from different departments. We all have little time, so to get to know each other we need to have more interaction outside of the cleanroom as well."
Lieven: "Currently, we have opportunities for exciting outcomes at the interface of quantum and nano, for instance to understand the role of quantum physics in biological systems. Since we have top scientists with both of these background in nanoscience, it would be awesome if some of these breakthroughs come from our Kavli Institute. As you say, community building is strong, for example during Kavli days and colloquia. We need to continue to work on this and keep creating moments were we can all come together. We've got other initiatives as well at Kavli, with calls for seed funding to stimulate new collaborative ideas that can develop into full scale projects."

Lieven: "What achievement during your PhD would make you proud: do you have a specific achievement or grand goal?"
Nina: "I would be proud if any achievement by the research groups in our community would make a difference for the advancement of research, from which society can benefit. Currently I am working on design, fabrication and characterization of photonic crystal cavities for novel quantum network experiments in two projects: one is for hybrid spin-opto-mechanical quantum networks, the other one is diamond photonic crystal cavities for next generation quantum networks. Here we want to achieve robustness of our devices and obtain optimal performances– the best, even – for experiments. This relates to Qu-Tech's mission to build a quantum computer and quantum internet: milestones which will shift the paradigm of our society in a revolutionary way."

On life strategy: interview with Rachel Los and Martin Depken

By Violet van Houwelingen

At the department of Bionanoscience, PhD student Rachel Los and department chair Martin Depken consider how a good life strategy can help your scientific career. Martin Depken: "Think about your life in broader terms than science: decide what kind of person you want to be, and act from that."

Rachel Los is PhD student in theoretical biophysics at the Idema Lab in the department of Bionanoscience (BN), working on modelling the dynamics of early-stage biofilm formation. Dr. Martin Depken is associate professor and chair of BN. He uses statistical mechanics to understand how biological function arises and is maintained in the machines that work the genetic code.

Martin: "Already as a postdoc I noted that many of my Dutch friends had the discipline to get their work done by 5 o'clock. I have always struggled with work-life balance, so how do you do it? Is there maybe something in all that milk you drink?"

Rachel: "Part of that is culture in the Netherlands: it's normal not to work at home, or it used to be. I hear this often from foreign people, who notice that we Dutch people find work-life balance important."

Martin: "Discipline gives freedom, a lesson we would all benefit from taking to heart."

Rachel: "Do you have any advice for PhD students like me, who are choosing their topics and research questions?"

Martin: "A scientific career is an awesome thing to attempt, and it both gives and asks a lot from you. Like in any competitive undertaking, luck plays a definite role. It matters what project you land on and what people you work with, and much that matters is outside of your control. As a student, it's important to look the luck component straight in the eye from the start, and not get locked into the notion that science is all there is worth doing. My identity was really wrapped up in my science, and this often left me vulnerable to the feeling that setbacks at work were setbacks in life; they need not be. So, cultivate broad interests and be kind to yourself."

"This is actually about developing strategies for living a good life. Think about your life in broader terms than science: decide what kind of person you want to be, and act from that. Reading about the Greek philosophy Stoicism has helped me a lot here, as it teaches you to focus on fulfilling your own values, and to depend less on the appreciation of others. With your values clear, your choices will be less dependent on contingencies, and your life and career will have fewer regrets."

Martin: "During your PhD, how has the work pressure been for you?"

Rachel: "As a scientist, you feel like you can never do enough. During my studies it came to a point where I was just too tired from all the different things I was doing. But I didn't want that to lead to a burnout so I made a rule that I still try to keep now: never do work in the weekends. I don't agree with the attitude that a lot of students have, that working more is always better. My philosophy now is that I need to do my PhD in a way that I'm also enjoying this time as a PhD. If I don't enjoy it and I do get the paper, it's not worth it."

Martin: "Wise words indeed!"

Martin: "How do you feel about diversity and equality in science?"

Rachel: "These things still have a long way to go, I think. Take parental leave, for example: because science is so competitive, the common view is that you can't take time off because it will jeopardize your career. But having children is something that falls on the shoulders of women, who simply have to take time off from work for this. And when are you going to do that in a traditional scientific career?"

Martin: "Yes I see the problem here, and I don't think it is made better by the government signalling that only five weeks off is needed from the father. I cannot help but feel that this implicitly says that early childcare should be left to the mother, further deepening the inequality in high pressure careers."

"I also think it's important that students get to hear about more diverse success stories during their study. The success stories I was told about were predominantly about white males doing nothing but science. I am a white male that used to do nothing but science, so this was never alienating to me. It must be alienating to other people though, and I now realize that this is a real problem."

Rachel: "What would you wish for students in the Kavli departments to get out of their time here?"

Martin: "An open environment where they feel free to ask questions, make suggestions, and take part in scientific excitement that is all around us. I would love for people to think back of their time in BN and Kavli as exciting, formative, and ultimately useful on their path through life. To get there, we need to listen to our members. When we can all meet again in persons without much restrictions, I will start having a birthday lunch with those in BN born in that month, every month. Not just students, but also technicians, admin, PhD's, postdocs; anyone in BN that is not a PI. By mixing the groups up, I hope to hear from a lot of different people."

Kavli interviewer: "How would you both like to get more involved in what other Kavli departments are doing?"

Rachel: "During the Kavli days we could have a poster session, or a session where everyone can give a short 5-minute pitch to show what they are doing. In my experience, the best way to form a collaboration is have someone talk to you about their research and you get excited and want to join in. We should foster mutual curiosity. And we should link it to free drinks, that also helps."

Martin: "I like the idea of poster sessions as well, with drinks. As quantum and bio are traditionally far apart, scientific talks might not be the best way to connect. If you go up to a person at a poster session, they are forced to explain their work to you in terms that you can understand. Let's hope Kobus and Chirlmin are listening in!"

On doctoral struggles: interview with Kobus Kuipers and Joris Carmiggelt

By Violet van Houwelingen

At the department of Quantum Nanoscience (QN), department chair Kobus Kuipers and PhD student Joris Carmiggelt discuss the challenges facing doctoral candidates. Kobus Kuipers: "When the research results were lousy, we would go on the flight simulator and shoot each other out of the sky to blow off some steam."

Joris Carmiggelt is PhD student at the Van der Sar Lab of Quantum Nanoscience and works on spin waves and two-dimensional materials. Prof. dr. Kobus Kuipers works in the field of nanophotonics. As well as chair of QN, he is also a director of the Kavli Institute of Nanoscience in Delft.

Joris: "Looking back on your time as a PhD, what is the thing you are most proud off?"

Kobus: "What I'm most proud of, is about a shared success as a team. When I started with my PhD, we only had a vacuum room to work with, while near the end of my promotion we managed to make a working high-temperature, high-speed scanning tunnelling microscope (STM). A lot of people worked on creating it: electronics experts, specialists in fine-mechanics, software designers, me and my supervisor. It was very cool to make furore with this machine."

Joris: "I'm told that for every PhD there comes a time when you run into a wall with your research and get disheartened: have you experienced such a period as well?"

Kobus: "Yes. Most PhD's when they get into their second year run into this wall: things are no longer new, and your "beginners luck" is confronted with reality. That's also about the time when the supervisor starts to point out the error margins, you get a critical comment from an editor… So you start to struggle. This is completely normal. Once in a while you will just have to get through that mush. However as a supervisor, it's hard to find the right response: you recognize the pattern and everyone has gotten through it, but good luck telling that to your doctoral candidate."

"I had a ritual with my supervisor for these moments that you run into a wall. I worked with the STM that I built at AMOLF. There was many a night that we were just looking at grey noise on the screen: quite frustrating for us both. We had a graphic work station which had a flight simulator on it – this was a top notch game at the time. And this was our ritual: when the research results were lousy, we would go on that simulator and shoot each other out of the sky a few times to blow off some steam. Only afterwards would we go home."

"This is why your PhD period is such a formative time of your life: to deal with setbacks in a secure environment. That's something people tend to forget: whatever you're working on, at some point something won't be a success, which feels awful, but this happens in a relatively safe environment with people around you who can help. While if you start out in the business world, the safety net is absent or at best unclear. So testing your boundaries, getting to know what you're good at and asking for advice makes your PhD time a valuable and fun training ground."

Joris: "Do you think that's the biggest challenge that PhD's face: perseverance?

Kobus: "It's an important quality. What's distinctive about the department and the Kavli Institute, is the fact that sometimes your best is not good enough, because nature is more complicated than what you can pull off. That's when you should ask for help. There are lots of characteristics that can lead to a fantastic promotion, lots of different talents that can lead to success: often we talk about someone being smart, but creativity is also important and perseverance, as well as social skills to work with all kinds of people."

Kobus: "I also have a question for you. If we want to do more outreach for graduate students in QN, how should we go about organizing this?"

Joris: "It works best to send a simple personal email, and keep the activity low key and voluntary: you want to have the option to go or not. We all tend to get very absorbed in our work, and a yes/no question is easily answered."

Kavli interviewer: "To encourage more synergy between the departments of Kavli Institute, some people suggested we could organize lunch sessions or podcasts together: what do you think of this?"

Joris: "As someone from QN, I am not well informed on the research done at Bionanoscience (BN). Therefore I'd prefer to hear the broader story behind the BN research areas – what are the frameworks and what are the open questions? – instead of a detailed lecture. I think outreach like that, with fellow PhD students in a lunch seminar or podcast, would be a great way to encourage synergy between the departments: this way we have regular moments to discuss our research and the things we run into."

Kobus: "A gap exists between the Bio and the Quantum side of the nanosciences. What do you think of making a podcast where for example you would interview a PI from BN, and the other way around?"

Joris: "I think that would work well. Mixing up the different departments will mean that the general level of the podcast becomes more accessible for people outside your own department, as well as for the broader TU Delft community."

A new spin on making minimal cells

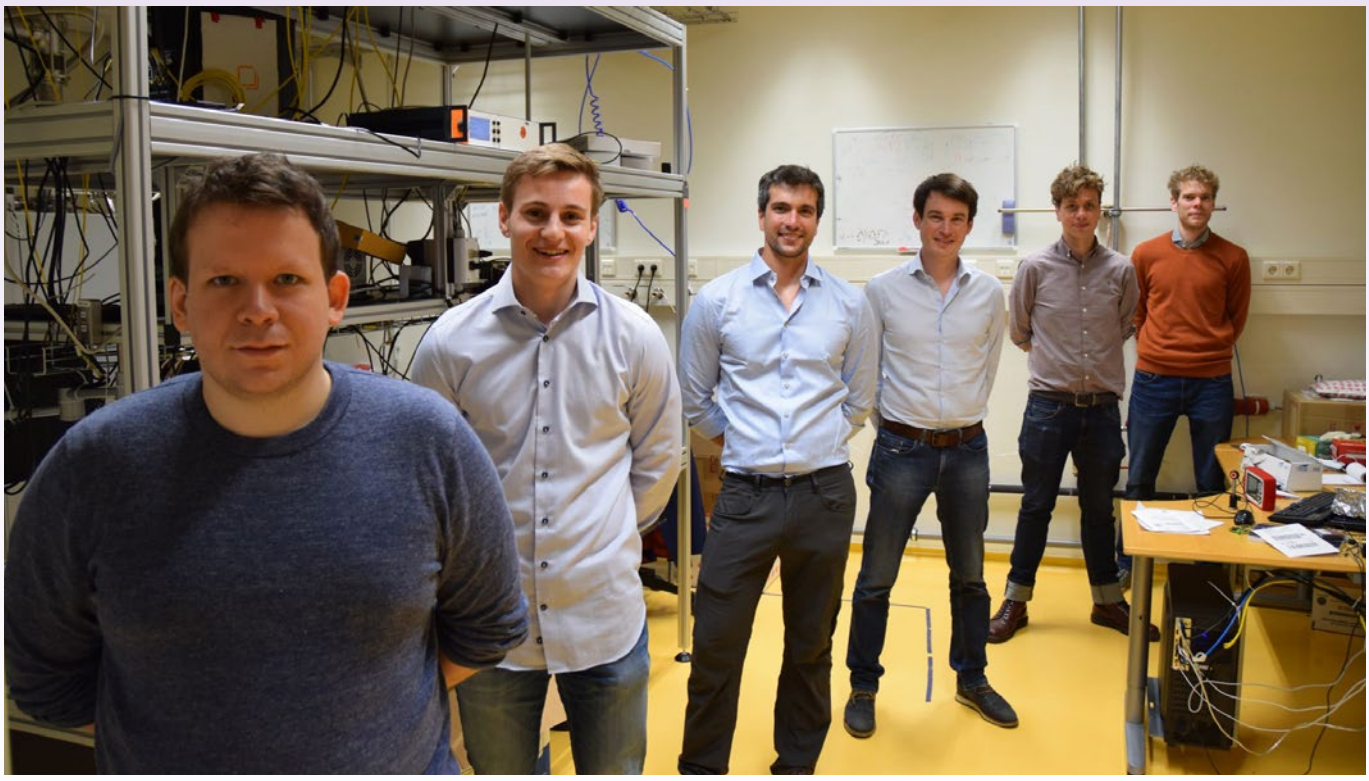
The ability of a cell to separate its own matter from its surroundings is a basic requirement for life. A team of researchers at AMOLF and Delft University of Technology have managed to create a synthetic container, or lipid vesicle, that is able to hold a range of different biological systems: from a cytoskeleton to entire E.coli bacteria. Their findings on this optimized cDICE method, which has the potential to reveal the inner workings of life, are published in ACS Synthetic Biology on DATE.

https://www.tudelft.nl/en/2021/tnw/a-new-spin-on-making-minimal-cells

Collaborating groups:
Physics of Cellular Interaction Group (AMOLF), Koenderink Lab, Cees Dekker Lab and Danelon Lab (all TU Delft, department of Bionanoscience).

Converting quantum technology into business

By Simon Gröblacher



You may have heard of the newest spin-off company from the Department of Quantum Nanoscience, called QphoX. We are a quantum technology company working on a Quantum Modem: the equivalent of a standard modem that helps your computer connect to the internet, but for quantum computers. Here is a brief introduction and back story of how we managed to go from quantum technology to starting a business

Frederick Hijazi, Robert Stockill and myself (all from QN) publicly launched QphoX a few months ago. The Quantum Modem is a crucial component for building a quantum internet, because typically quantum processors don't operate at the optical telecom wavelengths required for non-cryogenic quantum communication.

Since I joined the Kavli Institute of Nanoscience as a faculty member almost 7 years ago, my group has been working at the forefront of quantum optomechanics – probing the foundations of quantum physics through the interaction of mechanical motion with light. In the quest for demonstrating ever bigger quantum states, one of our contributions was the first quantum state of an optomechanical device, as well as the creation of an entangled state between two of these devices over more than 70m and the violation of a Bell inequality, culminating in a teleportation experiment between light and mechanics.

Being able to control mechanical motion at the single phonon level further led us to experimentally demonstrate the first microwave-to-optics conversion in 2018 with no added classical noise. Fortunately, we realized its impact as a quantum technology early on and applied for a patent in order to make sure we could potentially commercialize this idea: this patent now forms the basis for the Quantum Modem.

Fast forward 2 years, after more experiments and testing, we co-founders sat together and started brainstorming what it would actually take to create a real technology out of the wavelength conversion. One of the big challenges was the amount of funding required to develop such a technology. Experimental physics is not cheap and building this new technology would require a lot of research and engineering, even with the head start we already had. To actually bring a quantum modem to market, the only realistic option was to spin-out the technology into a dedicated company backed by venture capital (VC).

This is of course much easier said than done, as even getting into the same room (or video chat these days) with VC firms isn't exactly easy. After several months of using our own network, talking to many people and gaining some traction we were introduced to Ton van 't Noordende. He is energetic and has an impressive network in the VC world. Together with Ton, we made a game plan and within a few months managed to attract a seed round of funding to get the company going.

While this financial backing was a crucial step, there are actually many other things that one needs to take care of when starting a company: lengthy discussions with lawyers about contracts, transferring the patent from the university to the company, filing trademarks, creating visual branding, as well as many other aspects we usually don't have to worry about at the university. Furthermore, having a good idea for a product is crucial – the funding certainly does not come without it. Throughout our endeavor of pitching our technology to investors, we learned how to sharpen our company vision and technical ideas for the business-focused world, where expectations are high and time scales are short. This is how the Quantum Modem was born and the path to create QphoX.

QphoX is now well on its way to realizing the Quantum Modem. We have assembled an exceptional initial team, and we are in the process of expanding further. I have grown a lot as a person, learning how to operate outside our usual academic environment. Thisis also what motivates me the most: learning about a completely different side of the research we've been working on for so many years, interacting with people in the business world and seeing their excitement when we talk about our vision. None of this would have been possible without the support from many people outside the company, such as the Department of Quantum Nanoscience, our investors, Freeke Heijman and Ton. Stay tuned for more news about QphoX!

QPHOX

Career lessons with Martin Depken, new Chair of the Bionanoscience Department

By Violet van Houwelingen

As Chair of the department of Bionanoscience since April 1st 2021, Martin Depken is working to solidify the department's position as an international hotspot for nanophysics and biology. To attract top talent at every level, he wants to focus on adding value to the lives and careers of all within BN, irrespective of their position or future career path. In light of this PhD newsletter special, what lessons can he share about his scientific journey up till now?

Q: What career advice do you want to share with current PhD's?

A: "PhD and postdoc years give you an enormous freedom to find your own path. Though wonderful, this freedom also comes with some challenging uncertainty. Drawing from my time as PhD and postdoc, I would advise you to simply focus your sense of achievement on the things you can control. You can control the quality of your work, not the journal it ends up in. Make sure to celebrate your good work, and try to worry less about how it is received. Accept that there is luck involved, and make sure you have good a plan B. Only then is it possible to relax in the face of uncertainty, and when relaxed, you will do your best work."

"The uncertainty of the job market was very stressful for me, and I want students to know that there is randomness in the system. This includes everything from the projects you happen to land on as a PhD student, to whether you get the right referees for a grant, or whether you get members on your hiring committee that know your field. A string of rejections might not be all down to you, as playing the job market is a bit like playing poker: even with a winning strategy at 70%, you will still lose 30% of the time!"

Q: How did you get past this stressful time?

A: "During my time as a PhD and postdoc, stress manifested physically as tension in my body. I only sought help for it when I became a PI, but would have benefited from better understanding my thought patterns much earlier. Therapy was very helpful for me, and so was reading about Stoicism and practicing meditation. Stoicism was what taught me to try value the things I can control, and to deliberately think about my own character and the person I want to be. Meditation allowed me to see how random and obstructive thoughts can be, as well as offering a way to calm things down when needed."

"Growing to accept that luck was involved in my career was also important. If you expect things to be fair, then your failures are squarely down to you. As soon as I accepted that things weren't always fair, I was also able to be kinder to myself, and roll with the punches"

Q: Did you have a mentor to guide you?

A: "I wouldn't have thought so at the time, but looking back it's clear that I had mentors during pivotal moments. One that pops to mind is when I was swapping to biophysics, my then supervisor gave me the advice to keep close to the experimenters instead of the theoreticians. Advice that has served me well!"

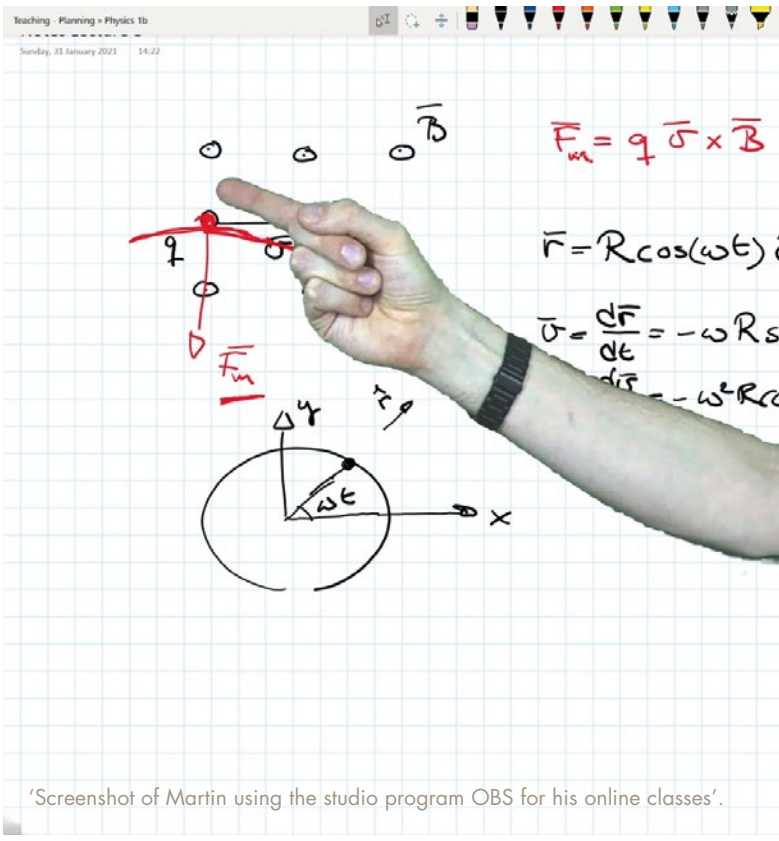
"One thing I have noted when offering mentoring advice myself, is that it is really quite nice to be asked. When younger, I often held back from asking for advice because I did not want to impose. Asking advice from people about strategic decisions, can be a good way of starting to think of and planning your next career move."

Q: Can you tell us about your group's current research in theoretical biophysics?

A: "We are focusing on the machines that work on our genetic code. With the advent of next-generation sequencing technology, troves of high-resolution quantitative data are rapidly becoming available. This offers great opportunities for predictive modelling processes that are important for health and biology from the bottom up. Our mechanistic modelling capitalizes on 200 years of progress in statistical physics to constrain the model space, and can offer solutions to problems that have proven hard to address with traditional bioinformatics approaches. One prime example is CRISPR-Cas gene editing technology, where we have recently shown that bottom-up modelling beats all present-day top-down approaches, including throwing a massive neural net at the problem!"

Q: How has the pandemic changed your way of working?

A: "For me personally, the corona measures meant an opportunity to do things that I hadn't taken time to do before. Since in-class lectures were not possible anymore, I got the opportunity to move more of my in-class materials to video's that people can consume beforehand.



'Screenshot of Martin using the studio program OBS for his online classes'.

Like many others, I started using a studio program called OBS, which Youtubers and gamers use. With OBS I can place myself down in a corner of the screen, with my calculations put up behind me. This worked well."

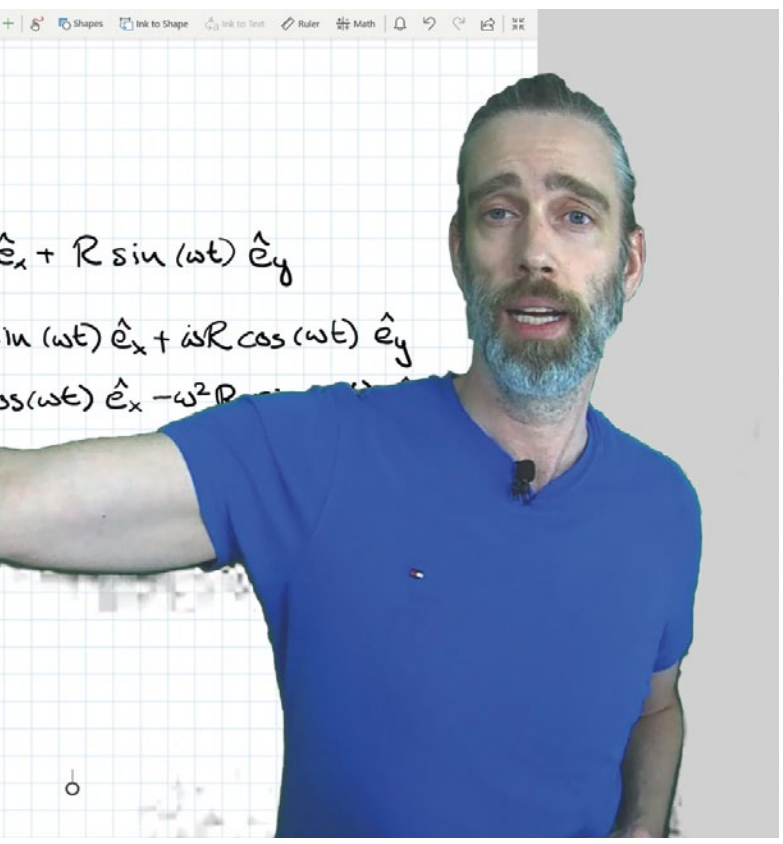
"I have been missing my whiteboard discussions with my students, but also here zoom has worked surprisingly well. I hope that when the corona measures disappear, I can still keep some of the good stuff. To not always have to be present in person. To move between meetings in one second. To travel less. There have been some definite upsides!"

Q: Congratulations on becoming chair of the Department of Bionanoscience! What will be your focus in this position?

A: "What we do is highly knowledge intensive, and all our output relies on the intellectual input of our members. So, it is also important that everyone feels free to voice their suggestions and ideas openly. People need to feel psychologically safe. I suspect asking questions in seminars is a litmus test for psychological safety: a high pressure situation with all of your peers are listening in. I want to see if I we can make the BN fora and seminars more lively, with more people comfortable asking questions. In a sense, I would like the brand of BN be that of an interactive and stimulating interdisciplinary environment where people come do their best work."

I myself for long found it hard to ask questions in seminars, but also here a little reframing has helped me. I now tell myself that there is nothing wrong with saying or even believing something wrong, what matters is that you are ready to think differently the second you have evidence you are wrong. When aiming for this, you cannot fail: asking the question is simply a way of becoming better, not an opportunity to make yourself look silly."

"I also want to give a lot of responsibility to people in the department who want to organise things, be they scientific or support staff. I work with the assumptions that people want to take responsibility, and can and will do things independently. Only if things go wrong do I intend to meddle. Bionanoscience now has something close to 200 full time employers. A massive operation for a guy who ran a 3 people group! But I worry not, with the help of all our top-notch members, I am sure we will keep the BN ship on course for many more great discoveries in the years to come."



COLUMN

Reflection on scientific meetings today and to come.

My first column for this newsletter was at the end of the first wave of corona. And here comes my second, at the end of the second wave. Let's see what happens in the next few months. Today I want to reflect with you on scientific meetings. Yes, that's right, scientific meetings! Remember when we used to go to conferences or workshops, give talks, listen to talks, look at posters while having a drink, connect with each other, find that bright PhD to hire, discuss with that inspiring researcher about the next crazy idea for an experiment, and why not, take that overseas trip as an occasion for some sightseeing out of Delft?

Though much these memories come back with a touch of nostalgia, this is only one side of the coin. Personally, I confess, I do not miss the majority of the scientific meetings I use to attend in person. People, who know me, know I am a person that likes to connect, network, and put a lot of value into scientific communication. So, am I kidding? No. Specifically, I do not miss those days of flying in and out of that one conference to give an invited talk only because I have one more invited talk on my CV (with age I've learned how to be more selective) and I do not miss rushing back jetlagged to my family with little children. I do not miss getting lost around the corridors at the March Meeting just to attend that one session, to find out it is held at the other side of the building. Finally, I really do not miss the idea that so much money is required to exchange knowledge, considering conference fees, transportation, meals and hotels.

So, in the end, what have I really been missing? After much thought, I came to the conclusion that I have only missed those small and targeted scientific meetings representing cohesive scientific communities. Those meetings where you catch up with colleagues and in friendly competition (sometimes less friendly) you can advance the field.

Over the past year, traditional in-person scientific meetings have been halted and replaced by virtual conferences. Virtual meetings did exist in the past, however the pandemic crisis has skyrocketed their visibility and popularity. According to recent surveys, scientists want virtual meetings to stay after the COVID pandemic (https://www.nature.com/articles/d41586-021-00513-1). At the same time, 'hybrid' scientific conferences aim to offer the best of in-person and virtual meetings (https://www.sciencemag.org/careers/2021/05/hybrid-scientific-conferences-aim-offer-best-person-and-virtual-meetings).

I know this is the most likely future for scientific meetings, but here are my two cents: let's keep the small meetings in person as much as possible and let's keep the large meetings live online. Hybrid models can well turn into a fiasco if the worst of the two worlds are combined. In any case, please let's not do "flipped conferences" where talks are prerecorded. Recordings are a great addition, but nothing can replace a live performance, even if it is streamed. And what about you? What is your ideal scientific meeting of the future?

Giordano Scappucci, QuTech

SELF-INTERVIEW MAZHAR ALI

Like most people who end up becoming professors and group leaders, I have been interested in science since I was a child. While my mother likes to tell the story that I declared myself "Dr. Maz" when I was in 3rd grade, it of course took me a little longer to actually earn that distinction. And the truth is, "Dr. Maz" was supposed to be a pediatrician, not a research scientist! But I always found science and research to be compelling in a way that nothing else compared to. For me, the big draw is the exploration; the enticement of doing, observing and discovering things no one ever has before. Being a researcher is rather like being captain of a ship in ages past: armed with your wits, experience, and intuition you set out to find new and exotic places where unexpected and unknown possibilities await.

While I wanted to broadly "do science", that isn't exactly available as a major in any college that I knew of and I had trouble choosing just one path. In the end, I narrowed to the hard sciences and got bachelor's degrees in both chemistry and physics from UC Berkeley. But at the same time I did research at Bayer Pharmaceuticals on extending the lifetime of the Factor VIII protein in hemophilia-A patients (they can't produce it properly and when they infuse it, their bodies filter it out over time). I also joined the nuclear chemistry group at LBNL and invented an instrument for creating nuclear targets for heavy ion beam irradiation. I wanted to keep exploring as many islands of knowledge and wisdom as I could!
This habit continued through my graduate school at Princeton, where I worked on discovering new superconductors but ended up also dabbling (quite successfully) in two-dimensional and topological materials. These were relatively young fields at the time; new theories were being developed and novel physical properties were being predicted, but there were precious few material examples to actually probe. So it was an incredibly exciting opportunity, combining materials science with condensed matter physics, coming up with ideas, going into lab, making, and measuring them. Every experiment carried the thrill of possible discovery with it, and we managed to strike gold more than once!

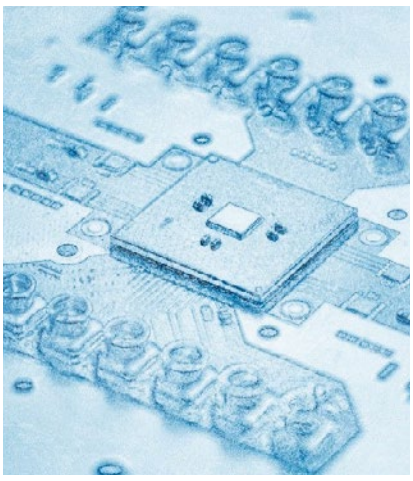
Later on, as a postdoc at IBM in Silicon Valley, I continued working on novel materials and properties, but with more of a focus on technological applications. Around the same time though, a disaster occurred in the US where tainted drinking water, particularly in Flint Michigan, exposed thousands of children and adults to lead toxins. I couldn't believe this had been allowed to happen! When an opportunity to try to prevent something like that from happening in the future arose, I jumped on it. I joined a fledgling start-up as the Chief Scientist, invented an electrochemistry based autonomous, continuous, and cheap water quality analyzer, and built-up a product development team that made it into a commercial reality. That company, Ketos Inc., has grown dramatically and today my analyzers are used throughout municipalities and private companies across the US.

Finally as a group leader at the Max Planck Institute for Microstructure Physics, my group maintained this exploratory and interdisciplinary approach as we synthesized novel materials, fabricated electronic devices, measured physical properties, and theoretically modeled new phenomenon. We worked on a variety of topics ranging from designing a novel Dark Matter detector to pioneering the field of Quantum Material Josephson Junctions. And now at TU Delft, and as part of the Kavli Institute, we will continue that spirit of boldly venturing into the unknown together; trying, testing, and experimenting as we navigate the seas of possibility and imagination.

Nano Research Award for Cees Dekker

Cees Dekker has been awarded the 8th Nano Research Award 'for significant contributions to nanoscience ranging from carbon nanotubes to nanobiology.'

The Nano Research Award, established by the journal Nano Research and sponsored by Tsinghua University Press (TUP) and Springer Nature is awarded for outstanding contributions to nano research by an individual scientist. Professor Cees Dekker was selected for the award in recognition of his significant contributions to nanoscience ranging from carbon nanotubes to nanobiology.



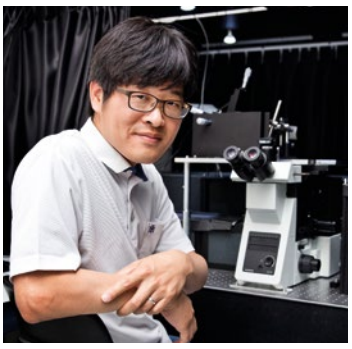
http://www.thenanoresearch.com/work_news_content.asp?id=30

Researchers discover how a cell's armour can be both flexible and strong

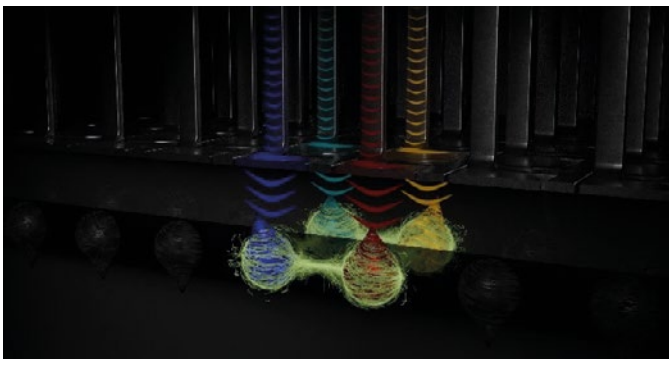
Medieval knights either had thick, cumbersome armour, or they could wear less protective armour and be flexible in combat – they couldn't have both. Cells, on the other hand, do have it all. An international team of researchers led by Gijsje Koenderink (Bionanoscience) discovered that proteins called 'septins' reinforce the fragile membrane of a cell, while still being flexible enough to allow the cell to change shape.
https://www.tudelft.nl/en/2021/tnw/researchers-discover-how-a-cells-armour-can-be-both-flexible-and-strong

Chirlmin Joo receives VICI grant for identifying proteins one at a time

Researcher Chirlmin Joo of TU Delft will receive a VICI grant for developing a method to sequence proteins one at a time. He will receive 1.5 million euros from the Netherlands Organisation for Scientific Research (NWO).



Joo proposes a novel sequencing technique that probes the protein profile to retrieve the sequence. This proposed new method (FRET X) will allow for sequencing at the single-molecule level. The new technique can probe a single protein many times, which will make it more accurate and readily applicable for life sciences and medicine. Joo expects it could lead to a revolution in biophysics, biotechnology, and healthcare.



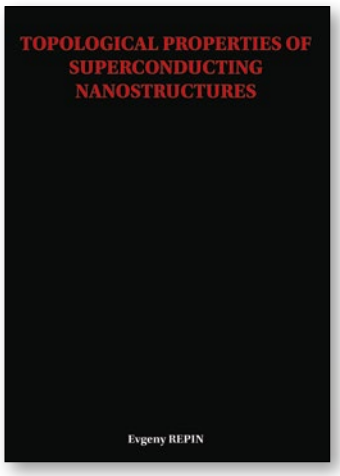
https://www.tudelft.nl/en/2021/tu-delft/chirlmin-joo-receives-vici-grant-for-identifying-proteins-one-at-a-time

ERC grantees Anna Akhmanova and Marileen Dogterom improved our understanding of how cells self-organise

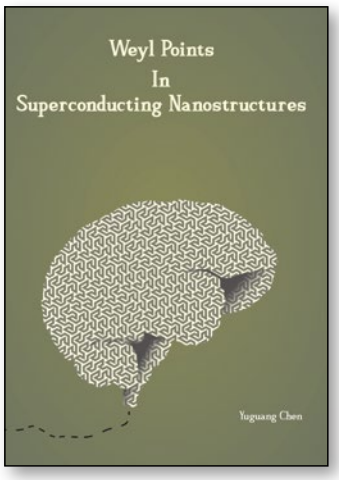
Prize-winning ERC grantees Anna Akhmanova and Marileen Dogterom combined cutting-edge research in the fields of biophysics and biology to achieve a better understanding of how cells self-organise.
In the ERC-funded MODELCELL project, the grantees pooled their expertise to look at the physical and chemical properties of cell structure and how cell biology translates into functionality. Their findings could have far-reaching implications for our ability to manipulate cells and treat diseases such as cancer.
https://erc.europa.eu/how-ERC-transformed-science/stories.html#modelcell

PHD IN KIND

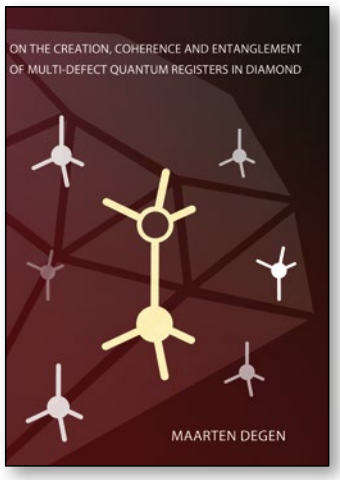
RECENT PHD THESES



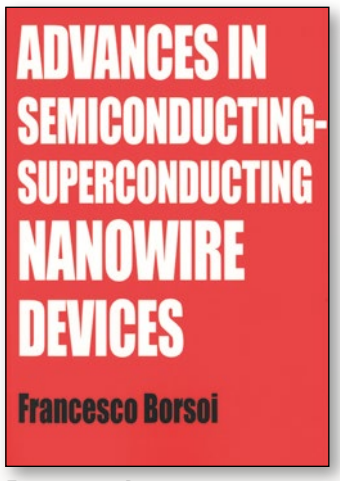
Evgeny Repin
6 April 2020



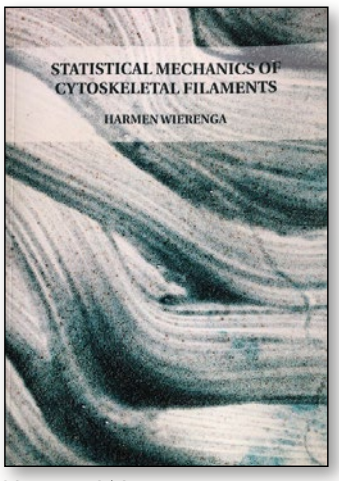
Yuguang Chen
20 May 2020



Maarten Degen
12 april 2021



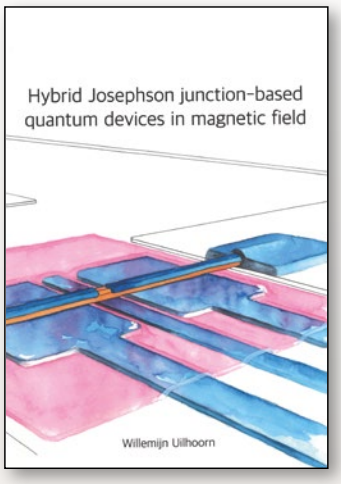
Francesco Borsoi
14 april 2021



Harmen Wierenga
17 May 2021

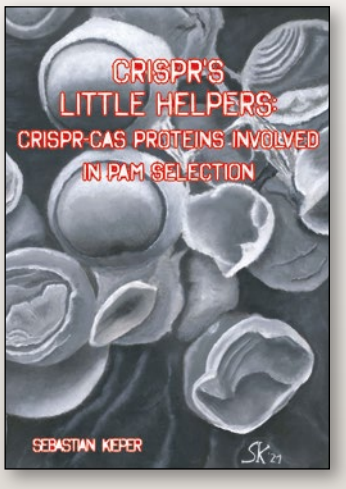
Duco Blanken
18 May 2021

Ines C. Rodrigues
25 May 2021

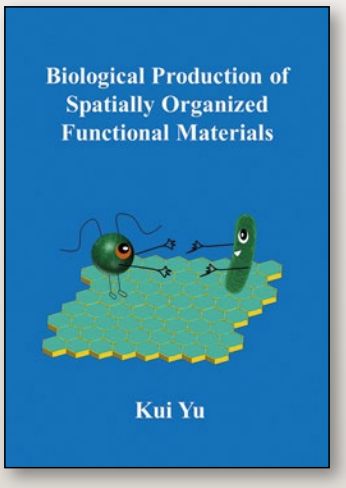


Willemijn Uilhoorn
28 May 2021

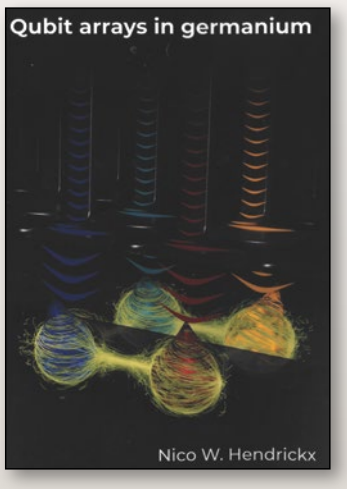
Lisa Dreesens
14 June 2021



Sebastian Kieper
16 June 2021



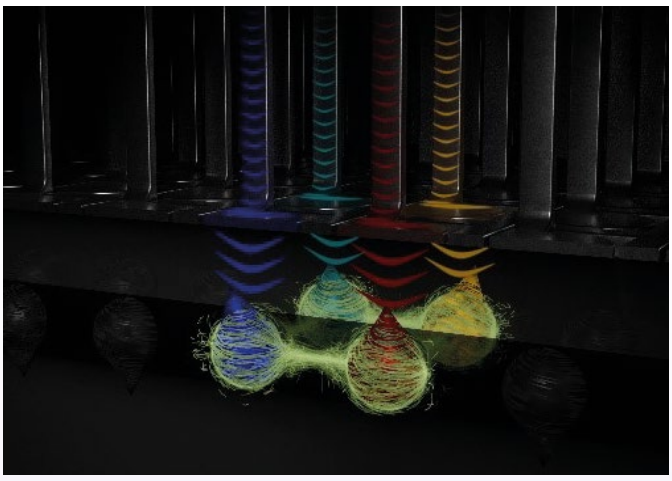
Kui Yu
18 June 2021



Nico Hendrickx
12 July 2021

Chirlmin Joo appointed Full Professor

The Executive Board of TU Delft has decided to appoint Chirlmin Joo (Department of Bionanoscience) as Full Professor of Single Molecule Biophysics.
Joo focuses on developing and applying single-molecule techniques to the mechanistic studies of biological systems. He has been advancing these techniques while studying small RNA biology (microRNA and CRISPR), which has led to numerous high impact works. To get further insights on the biological systems, Joo's group is developing a first-ever high-throughput single-molecule fluorescence method that integrates next-generation DNA sequencing with single-molecule fluorescence.



In addition, understanding the need for a platform for highly sensitive protein analysis tools, Joo is developing high-resolution techniques that can determine protein sequences at the molecular level. Joo envisions that this tool will revolutionize the fields of biology and medicine when its commercial form is achieved.
https://www.tudelft.nl/en/2021/tnw/chirlmin-joo-appointed-full-professor

Two former Applied Sciences researchers, Mario Avellaneda Sarrio (Bionanoscience) and Mario Gely (Quantum Nanoscience) have been awarded a coveted Rubicon grant by NWO.

Immune cells need to navigate through the human body in search of pathogens. Mario Avellaneda Sarrio is doing research to elucidate how local electric potential changes in cell membrane assist steering of immune cells during migration.

Mario Gely is researching how to make quantum computers small (fit on a chip).

The Rubicon grant enables young, promising researchers to do research at a top institution abroad. For many scientists, experience in a foreign country is an important step in their career.

NEW EMPLOYEES

Name	Date of employment	Title	Lab
Roald van der Kolk	04-01-2021	Procestechnoloog	Kavli Nanolab
Céline Cleij	01-02-2021	PhD	Danelon lab
Arash Ahmadi	01-02-2021	PhD	Greplová lab
Ulderico Filoppozzi	01-02-2021	PhD	Caviglia lab
Francesca Moretto	01-02-2021	Project officer	Bionanoscience
Arjen Vaartjes	15-02-2021	Data Engineer	Kouwenhoven lab
Oriol Pietx I Casas	01-03-2021	Phd	Vandersypen lab
Frank van Opstal	01-04-2021	Technician	Laan lab
Louis Reese	15-05-2021	Postdoc	Dogterom lab
Julia Brevoord	15-05-2021	PhD	Hanson lab
Michael Chan	15-05-2021	PhD	Kouwenhoven lab
Yaojia Wang	01-06-2021	Postdoc	Ali lab
Josep Ingla	01-06-2021	Postdoc	Van der Zant lab
Katinka Ligthart	01-07-2021	Technician	Nynke Dekker lab
Wu Heng	01-08-2021	Postdoc	Ali lab
Mazhar Ali	01-08-2021	PI	Ali lab
Juan Hurtado	01-08-2021	Guest	Van der Zant lab
Xin Zhang	01-08-2021	PhD	Vandersypen lab
Lucia Malone	01-08-2021	Postdoc	Brouns lab
Serge Vincent	01-09-2021	Postdoc	Nynke Dekker lab
Talieh Ghiasi	01-09-2021	Postdoc	Van der Zant lab
Liu Zhaowei	01-09-2021	Postdoc	Nynke Dekker lab
Alex Joesaar	01-09-2021	Postdoc	Cees Dekker lab
Koushik Sreenivasa	01-09-2021	PhD	Joo lab
Kijun Kim	01-09-2021	Postdoc	Joo lab
Maxim de Smet	15-09-2021	PhD	Vandersypen lab
Marie-Christine Röhsner	01-10-2021	Postdoc	Hanson lab
Marcos Arribas	01-11-2021	Postdoc	Koenderink lab
Liu Chen	15-05-2021	PhD	Groeblacher lab
Luigi Maduro	15-06-2021	Postdoc	Kavli Nanolab

Kavli Day 2021 Delft

2 September 2021

Program
12.00 - 13.00 Lunch at Knus, Delftse Hout, Delft
13.30 - 15.00 Outdoor activities

Online Scientific Program
Join Zoom Meeting
https://tudelft.zoom.us/j/98977620976?pwd=SVNEcTYxcXJ5blZVQU9NT1d3V3ZVZz09

Meeting ID: 989 7762 0976
Passcode: 960184

Theme: Quantum Biology

15.30 - 15.35	Welcome by Kavli directors
15.35 - 15.45	Introduction Andrija Pavlovic; the new Artist in Residence
15.45 - 15.50	Award ceremony Kavli Delft Thesis Prize
15.50 - 16.00	Dimphna Meijer and Eliška Greplová: Kavli Synergy Program proposal
16.00 - 16.40	Talk of Professor Matthew Fisher from UC Santa Barbara and Kavli Institute for Theoretical Physics entitled "Are we quantum computers, or merely clever robots?"
16.40 - 17.00	Panel discussion with: Lieven Vandersypen, Miriam Blaauboer, Bertus Beaumont, Dimphna Meijer


Matthew Fisher


Andrija Pavlovic

Lorentz Center Workshop: Cancer in a physical context

Gijsje Koenderink, PI at Bionanoscience Department, is co-organizing a workshop this fall from November 29th to December 3d. 2021 at the Lorentz Center: 'Cancer in a physical context: from Understanding to Therapeutics'. The aim of this workshop is to initiate a roadmapping effort for future cancer mechanobiology research.

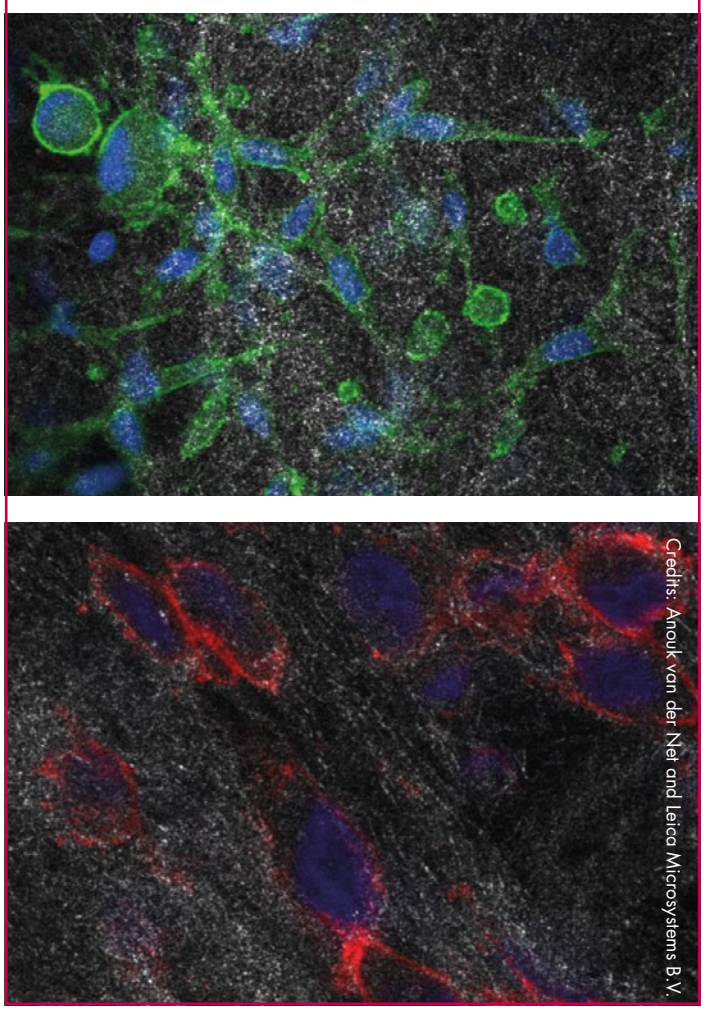
The other organizers of the workshop are Roeland Merks and Erik Danen from Leiden University, Kees Storm from Eindhoven University of Technology, and Erik van der Giessen from Groningen University. The workshop is motivated by the fact that researchers from a diverse range of fields, from biology, to oncology, to biophysics, now agree that hallmarks of cancer such as genetic instability, tumor growth and metastasis are all intimately coupled to physical properties of the cell and its environment.

Cells actively sense, and respond to, the material properties of their surroundings but also, in turn, alter the structure and mechanical properties of the extra- and pericellular matrix. Understanding cancer and finding novel therapies will therefore require the convergence of oncology, biology, biochemistry, biophysics and materials science.

The workshop will bring together an international group of scientists who study the physics of cancer from different angles. The program comprises discussions with national and international experts and key opinion leaders in the relevant fields, to identify a consensus understanding of cancer mechanobiology and, importantly, the main open questions. The organizers anticipate that the workshop may be held in hybrid form with some participants on-site and some online.

The Lorentz Center is a workshop center in Leiden that hosts international scientific meetings of typically one week. The workshops are characterized by an open and interactive atmosphere and ususally explore frontier scientific topics from a multidisciplinary perspective.

More information: Cancer in a physical context: from Understanding to Therapeutics.



MV3 cells in 'collagen matrix'

HIGHLIGHT PAPERS

A variational toolbox for quantum multi-parameter estimation

Entangled quantum states can be use to enhance sensing capabilities beyond what is possible with classical means. Designing such states are however difficult due to the complexity of describing a large quantum system classically. We provide a variational quantum algorithm that allows to use a near-term quantum computer to circumvent this bottleneck.

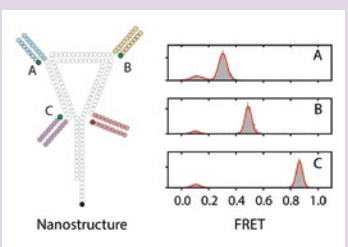
J.J. Meyer, J. Borregaard, J. Eisert
npj Quantum Information 7, 89 (2021)

The germanium quantum information route

Germanium is a promising material to build quantum components for scalable quantum information processing. This Review examines progress in materials science and devices that has enabled key building blocks for germanium quantum technology, such as hole-spin qubits and superconductor–semiconductor hybrids.

G. Scappucci, C. Kloeffel, F.A. Zwanenburg, D. Loss, M. Myronov, J.J. Zhang, S. De Franceschi, G. Katsaros, M. Veldhorst
Nature Reviews Materials 2020

High-Resolution Single-Molecule FRET via DNA eXchange (FRET X)



Single-molecule FRET is a versatile tool to study structures at the nanometer scale. The authors used programmable binding between DNA strands to resolve the FRET efficiency of multiple pairs of fluorophores. The new FRET technology will be a tool for the high-resolution structural analysis.

M. Filius, S.H. Kim, I. Severins, C. Joo
Nano Letters. 2021, 21, 7, 3295–3301

A four-qubit germanium quantum processor

Their compatibility with semiconductor manufacturing make quantum dots an appealing platform for quantum computation. However, despite over two decades of active research, scaling beyond two qubit logic has remained a challenge. This work shows that larger systems can be built by using germanium as host material and four-qubit quantum processor is shown with qubits position in a two-dimensional grid.

N.W. Hendrickx, W.I.L. Lawrie, M. Russ, F. van Riggelen, S.L. de Snoo, R.N. Schouten, A. Sammak, G. Scappucci, M. Veldhorst
Nature volume 591, pages 580–585 (2021)

Bioprinting of regenerative photosynthetic living materials

This paper reports a 3D bioprinting approach for fabrication of photosynthetic living materials composed of microalgae deposited onto bacterial cellulose. The bioprinted living materials developed with this technique exhibit regenerative nature, display mechanical robustness, and can be employed in a range of innovative environmental applications including artificial leaves, photosynthetic biogarments, and adhesive labels.

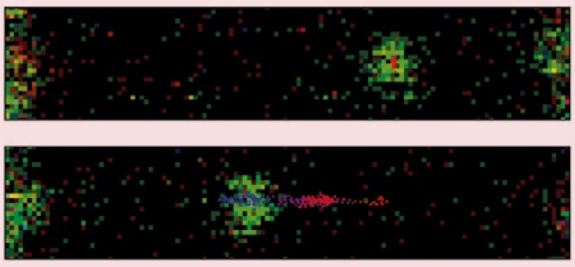
S. Balasubramanian, K. Yu, A.S. Meyer, E. Karana, M.E. Aubin-Tam
Advanced Functional Materials, 2011162, 2021

Photon-Pressure Strong-Coupling between two Superconducting Circuits

When light bounces off a mirror, Maxwell's equations predict that the mirror experiences a force from the momentum of the photon. In this work, we use a Superconducting Quantum Interference Device (SQUID) embedded in a microwave resonator to allow two superconducting circuits, one at GHz and one at MHz frequencies, to "push" on each other using an analogous "photon pressure" force, with exciting applications in quantum sensing of radio-frequency fields.

D.Bothner, I.C.Rodrigues, G.A.Steele
Nature Physics 17, 85 (2021)

DNA replication origins retain mobile licensing proteins



Before cell division, cells need to replicate their DNA. Researchers from the TU Delft, collaborating with investigators from the Francis Crick Institute in London, has shown that the proteins involved in initial steps of DNA replication are mobile but reduce their speed at specific DNA sequences on the genome. Combining biochemical and biophysical methodologies, the first part of the replication machinery was built up from its individual components on a single molecule of DNA held by optical tweezers. By attaching fluorescent labels to the proteins of interest, the researchers could then reveal their movement on the DNA. These findings hold novel implications for the roles of DNA replication machinery components inside of cells.

H. Sánchez, K. McCluskey, T. van Laar, E. van Veen, F. M. Asscher, B. Solano, J.F.X. Diffley, N.H. Dekker
Nature Communications volume 12, Article number: 1908 (2021)

Noise-robust exploration of many-body quantum states on near-term quantum devices

Near-term quantum computers are noisy which limits the scope of the operations that can reliably be performed on them. We show that a sequential way of operating allows to study local properties of many-body quantum states on such devices despite the device not being able to create the entire many-body state at once.

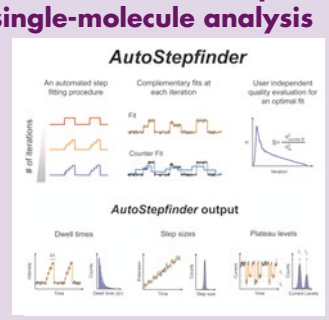
J. Borregaard, M. Christandl, D. Stilck França
npj Quantum Information 7, 45 (2021)

CMOS-based cryogenic control of silicon quantum circuits

A specially designed chip to control qubits can operate at extremely low temperatures, and opens the door to solving the 'wiring bottleneck'. Researchers and engineers from QuTech and Intel jointly designed and tested the cryogenic chip and made an important step towards a scalable quantum computer.

X. Xue, B. Patra, J.P.G. van Dijk, N. Samkharadze, S. Subramanian, A. Corna, B. Paquelet Wuetz, C. Jeon, F. Sheikh, E. Juarez-Hernandez, B. Perez Esparza, H. Rampurawala, B. Carlton, S. Ravikumar, C. Nieva, S. Kim, H.J. Lee, A. Sammak, G. Scappucci, M. Veldhorst, F. Sebastiano, M. Babaie, S. Pellerano, E. Charbon, L.M.K. Vandersypen
Nature, 593, 205–210 (2021)

AutoStepfinder: A fast and automated step detection method for single-molecule analysis



Single-molecule techniques have made it possible to track individual protein complexes in real time with a nanometer spatial resolution and a millisecond timescale. Accurate determination of the dynamic states within single-molecule time traces provides valuable kinetic information, which underlies the function of biological macromolecules. Here, we present a new automated step detection method called AutoStepfinder: a versatile, robust, and easy-to-use algorithm that allows researchers to determine the kinetic states within single-molecule time trajectories without any bias.

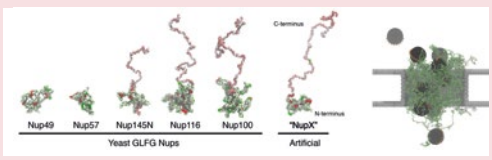
L. Loeff, J.W.J. Kerssemakers, C. Joo, C. Dekker
Patterns, Volume 2, Issue 5, 100256, May 14, 2021

Hydrodynamic shear dissipation and transmission in lipid bilayers

The response of lipid bilayers to shear stresses induced by surrounding fluid flows can trigger biophysical processes in cells and influence the efficacy of drug delivery by synthetic vesicles. Here, we use optical tweezers to apply and measure local hydrodynamic shear stresses on both sides of a freestanding lipid bilayer. With this method, we determine the rheological properties of bilayers and capture a previously unreported phenomenon, in which the intermonolayer friction is so low that the monolayers slip past each other and hydrodynamic shear is not transmitted through the bilayer.

G. Amador, D. van Dijk, R. Kieffer, M.E. Aubin-Tam, D. Tam
Proc. Natl. Acad. Sci., 118, 21, e2100156118, 2021

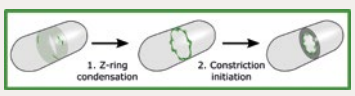
A designer FG-Nup that reconstitutes the selective transport barrier of the nuclear pore complex



Intrinsically disordered FG-Nups line the Nuclear Pore Complex (NPC) lumen and form a selective barrier where transport of most proteins is inhibited, whereas specific transporter proteins are able to pass. Here, we reconstitute the selective behaviour of the NPC by introducing a rationally designed artificial FG-Nup that demonstrates that neither specific spacer sequence nor a spatial segregation of different FG-motif types is needed to create selective NPCs.

A. Fragasso, H.W. de Vries, J. Andersson, E.O. van der Sluis, E. van der Giessen, A. Dahlin, P.R. Onck, C. Dekker
Nature Communication 12, 2010 (2021)

FtsZ treadmilling is essential for Z-ring condensation and septal constriction initiation in Bacillus subtilis cell division



Bacterial cells divide using a collection of proteins that work together as a nanoscale machine to build the cell wall inward, centred around the essential cytoskeleton protein FtsZ. We used nanofabricated 'microholes' to confine bacteria vertically so that we could image filaments of FtsZ moving with high resolution. We found that FtsZ filament motion has two essential roles: to assemble the division ring at mid-cell, and to start division by guiding the path of enzymes that synthesize the cell wall inward.

K.D. Whitley, C. Jukes, N. Tregidgo, E. Karinou, P. Almada, Y. Cesbron, R. Henriques, C. Dekker, S. Holden
Nature Communications 12, 2448 (2021)

Spin Relaxation Benchmarks and Individual Qubit Addressability for Holes in Quantum Dots

Holes in germanium are emerging as a leading platform for quantum computation with quantum dots. However, a key question has been whether holes can have a sufficiently long spin-life time due to the presence of strong spin-orbit coupling. This works that strong spin-orbit coupling can be used for fast qubit operations, while still enabling long spin-life times.

W.I.L. Lawrie, N. W. Hendrickx, F. van Riggelen, M. Russ, L. Petit, A. Sammak, G. Scappucci, M. Veldhorst
Nano Lett. 2020, 20, 10, 7237–7242 (2020)

Realization of a multinode quantum network of remote solid-state qubits

We have built and demonstrated the world's first entanglement-based network connecting multiple quantum processors. Our quantum network is composed of three independent nodes, called Alice, Bob and Charlie, based on diamond nitrogen-vacancy centres. We realize two canonical quantum network protocols: genuine multipartite entanglement distribution across all the nodes and any-to-any connectivity via entanglement swapping.

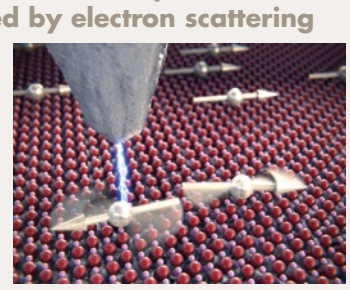
M. Pompili, S. L. N. Hermans, S. Baier, H. K. C. Beukers, P. C. Humphreys, R. N. Schouten, R.F. L. Vermeulen, M. J. Tiggelman, L. dos Santos Martins, B. Dirkse, S. Wehner, and R. Hanson
Science Vol. 372, Issue 6539, pp. 259-264

Membrane binding controls ordered self-assembly of animal septins

We show by cell-free reconstitution that binding to flat lipid membranes requires electrostatic interactions of septins with anionic lipids. This promotes the ordered self-assembly of fly septins into filamentous meshworks. Transmission electron microscopy reveals that both fly and mammalian septin hexamers form arrays of single and paired filaments. Our work shows that membrane binding is required for fly septins to form ordered arrays of single and paired filaments, providing new insights into the mechanisms by which septins may regulate cell surface mechanics.

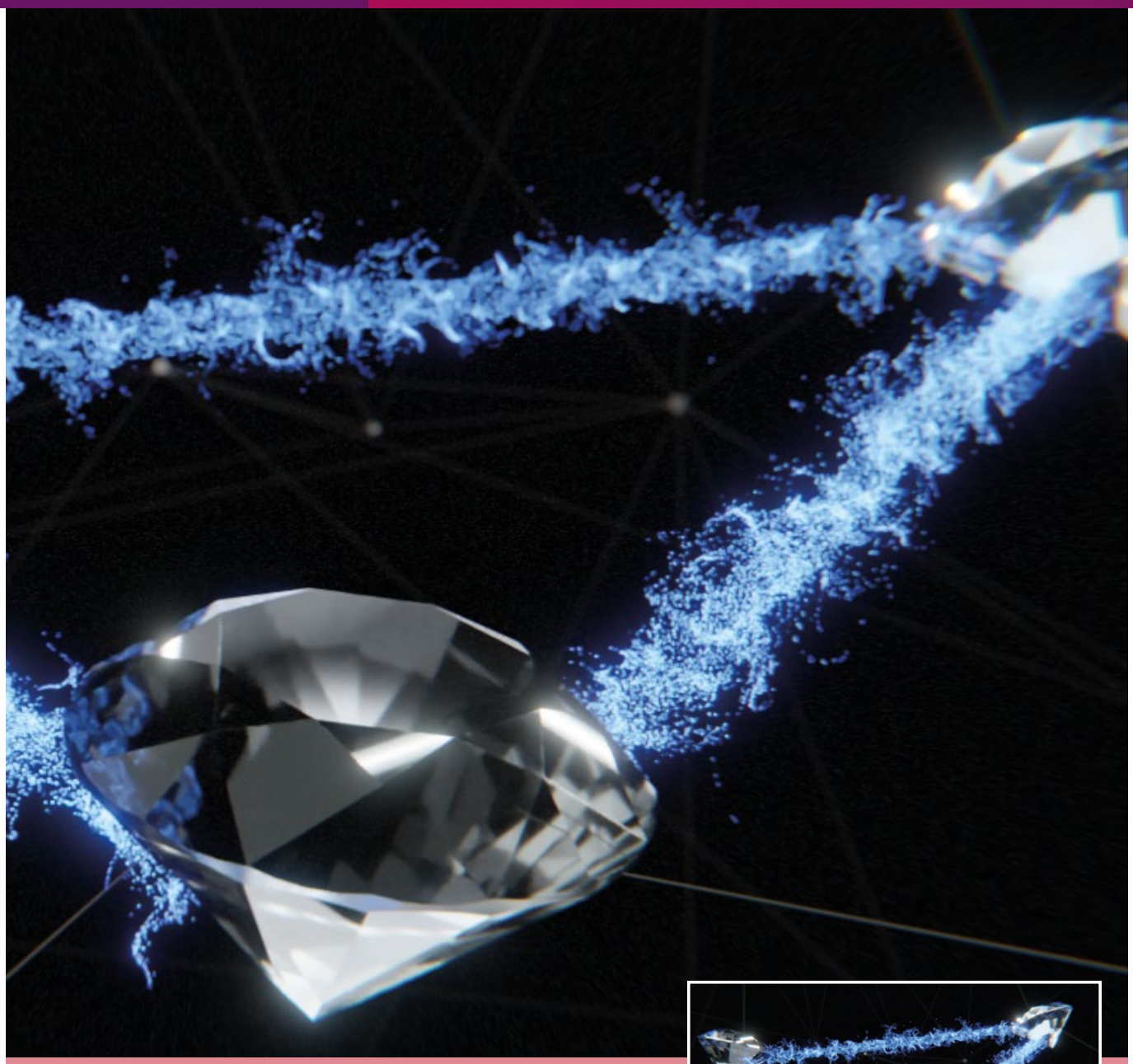
A. Szuba, F. Bano, G. Castro-Linares, F. Iv, M. Mavrakis, R.P. Richter, A. Bertin, G.H. Koenderink
eLife 2021, 10 e63349

Free coherent evolution of a coupled atomic spin system initialized by electron scattering



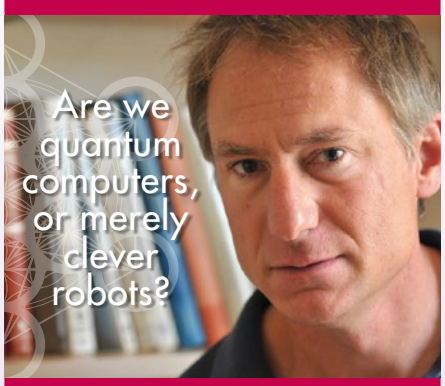
Magnetic atoms interact with each other at very short timescales. We have been able to trace the interaction between two atomic spins over a period of 100 ns using a detection scheme of DC voltage pulses in a scanning tunnelling microscope. Surprisingly, the DC pulses were able to initialise the spins without breaking their quantum coherence, opening avenues for exciting experiments on extended spin arrays.

Lukas M. Veldman, Laetitia Farinacci, Rasa Rejali, Rik Broekhoven, Jéremi Gobeil, David Coffey Blanco, Markus Ternes, Alexander F. Otte
Science, 28 May 2021, vol. 372, 6545, 964-968



Artist impression of the three-node quantum network. The diamonds host our quantum bits, which can be entangled over long distances using photons.
Credit: Matteo Pompili for QuTech

KAVLI DAY



Matthew Fisher

September 2, 2021

UC Santa Barbara

UPCOMING KAVLI COLLOQUIUM

Alexander van Oudenaarden

November 25, 2021

Hubrecht Institute

COLOFON

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