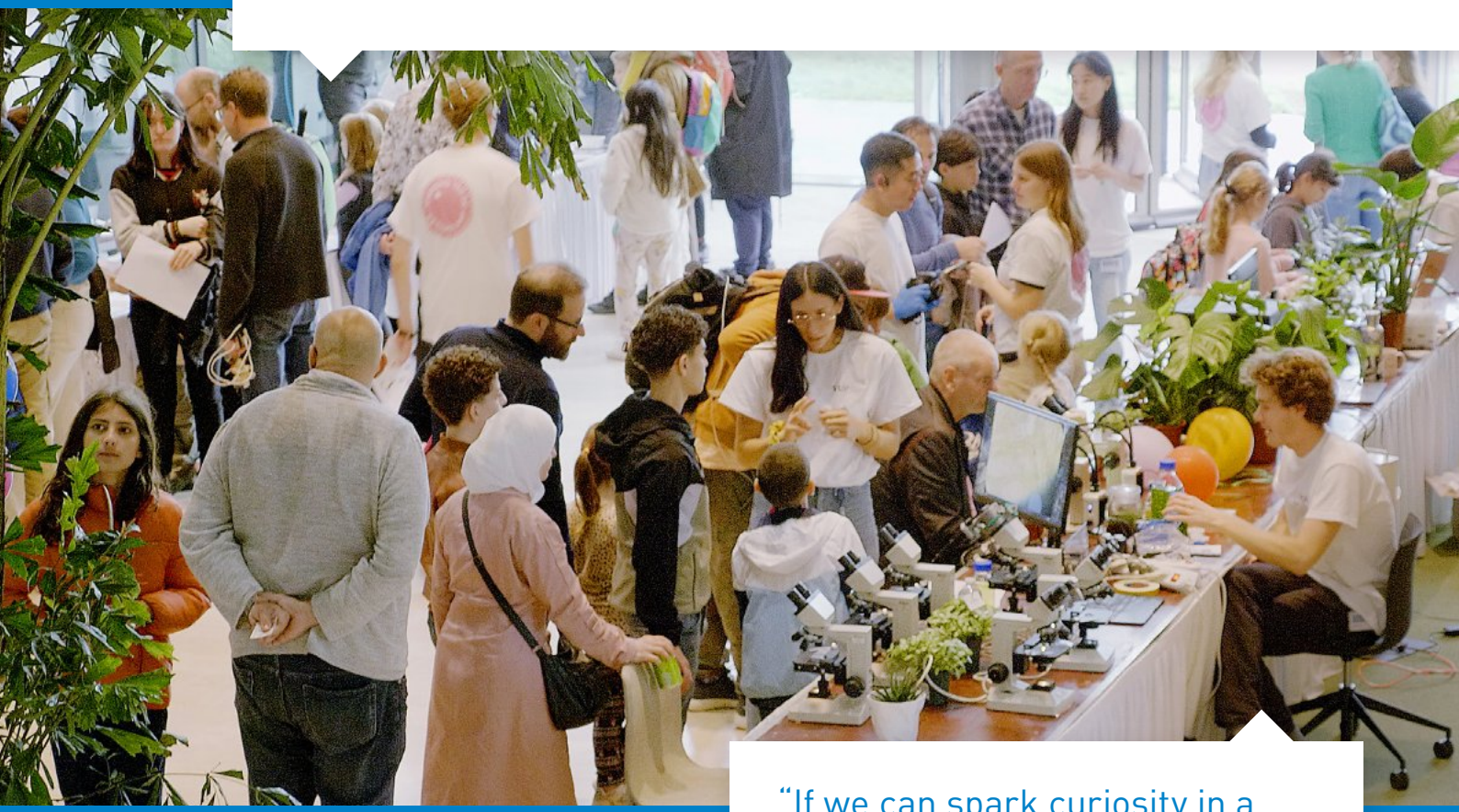
VU VRIJE UNIVERSITEIT AMSTERDAM

Physics & Astronomy Newsletter

The Faculty of Science
Physics and Astronomy Department
Issue 4 June 2026



"If we can spark curiosity in a ten-year-old at an event like this, that is **genuinely powerful**."

Volha Chukhutsina

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Colophon

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Secretariat

Vrije Universiteit Amsterdam

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Design
VU Amsterdam Designstudio

In Memoriam of Freek

In Memoriam - Dr. Freek Ariese (1961-2026)

On January 2, our department lost a cherished colleague, Dr. Freek Ariese. Freek built his career at the intersection of science and people. After obtaining his PhD at the VU in 1993 on low-temperature fluorescence spectroscopy and postdoctoral research at Iowa State University, he joined our department in 2012. His research on molecular spectroscopy and imaging, spanning biomedicine, environmental analysis, cultural heritage, and space research, resulted in nearly 200 peer-reviewed publications and a leading role in European laser research infrastructures.

But those who knew Freek will remember him just as much for the way he taught and mentored. He gave his time generously, guided students through the difficult moments with patience and quiet confidence and cared about the journey as much as the result. His warmth, calm presence, and genuine interest in people connected colleagues across sections and disciplines in ways that are not easily replaced.

Among Freek's many recent successes was a TKI grant awarded to him by Holland High Tech shortly before his passing. The project aims to advance circular plastic recycling through fundamental research on Deep-UV Raman spectroscopy for real-time characterization of plastic waste. As no spectral databases or classification models currently exist in the deep-UV range, the project aimed to establish the first such database, develop AI models, and design analytical pipelines to interpret this rich data stream. In honour of Freek's scientific vision, the department will carry this research forward.

We are grateful to have had him among us and extend our heartfelt condolences to his wife Anna, his family, friends, students, and all who had the privilege of working with him.

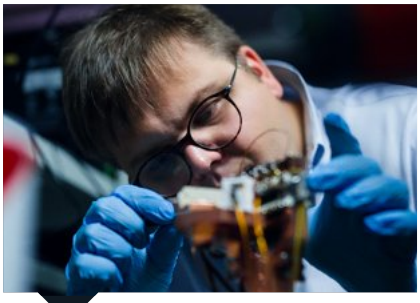
Grant & Awards

Imran Avci leads €6M EU Horizon Project on Microlaser-Based Mechanical Barcoding

Assoc. prof. Imran Avci from the Biophotonics and Medical Imaging Group will lead a major international consortium to develop a new method for analysing cells and microscopic particles, funded by Horizon Europe. The project, M-BARC, combines photonics, acoustics, and microfluidics in a single label-free, non-contact platform. At its core is an ultrasensitive microlaser-based acoustic sensor that generates characteristic "mechanical barcodes" from biological samples — enabling quantitative analysis without chemical modification. Seven partners from six countries are involved, with a total budget of €6 million, of which VU Amsterdam receives 27%.
Read more →

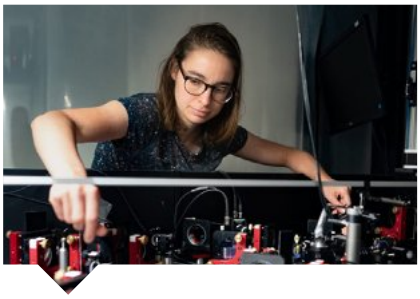
Vici Grant for Prof. Chase Broedersz

Prof. dr. Chase Broedersz of the Physics of Living Systems section has been awarded a prestigious NWO Vici grant for his research The secret social rules of cell collectives. Much like flocks of birds, cells move together as a collective — shaping us as embryos, keeping us healthy, and, in the case of cancer, enabling dangerous spread. Using advanced data-driven methods combined with physical models, Broedersz aims to uncover the hidden interaction rules that govern such collective motion, with broad implications for health and disease.
Read more →



Vidi Grant for Max Beyer to explore the universe's simplest molecule

Dr. Max Beyer of the Quantum Metrology and Laser Applications section has been awarded an NWO Vidi grant of up to €850,000 for his project SAMURAI. His research focuses on the most fundamental chemical reactions: collisions between hydrogen atoms and ions, and how quantum effects influence molecule formation. Using a novel "half-collision" approach — bypassing the first phase of a collision to study the second in unprecedented detail — Beyer aims to isolate specific reaction pathways and probe quantum-mechanical tunnelling effects. Beyond their relevance to fusion reactors and industrial processes like those at ASML, these reactions were central to the cooling of the early universe after the Big Bang, and may one day help create the first antimatter molecules.
Read more →



Loreta Angela Muscarella, Ester Abram and Volha Chukhutsina awarded XS grant

Three researchers of our department have each been awarded a prestigious NWO ENW-XS grant.

Physicist Ester Abram has received the grant for her project *SHINE: Studying Biological Neurons at Single-Dendrite Precision with Photonic Microchips*. Understanding so-called dendritic computations is crucial for disorders such as epilepsy and autism. Current technologies, however, cannot measure or manipulate

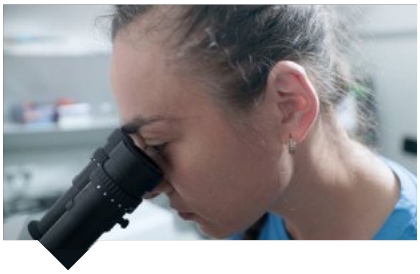
ERC Starting Grant for Laura Dreissen

Dr. Laura Dreissen has been awarded an ERC Starting Grant of approximately €2 million for her research on weak interactions in atoms. Using captured barium ions cooled to near absolute zero and a quantum entanglement technique, she aims to measure parity violation, a subtle asymmetry in the laws of nature, with unprecedented precision. The results will allow an independent test of the Standard Model of particle physics and may point to new, unknown physics, while also advancing quantum technology with future applications in secure communication and precision measurement.
Read more →

activity at single-dendrite resolution. SHINE addresses this gap with an all-optical physiology platform, enabling fully optical, non-invasive measurements of intracellular dynamics with unmatched spatial and temporal resolution.

Chemist Loreta Muscarella

has been awarded a grant for her project Metal-Free Perovskites for Autonomous Power in Medical Technologies. Muscarella explores a new class of safe, lead-free materials — metal-free perovskites — that can generate electricity from body movements. These materials could power medical devices such as pacemakers without conventional batteries, reducing health risks, electronic waste, and replacement costs.
Read more →



Biophysicist Dr. Volha Chukhutsina

has received an NWO Open Competition XS grant for her project SF-TA: Towards Scattering-Free Measurements in Transient Absorption Spectroscopy. Transient absorption spectroscopy is a powerful tool for studying ultrafast light-driven processes, but its use on complex biological samples such as plant leaves, intact algae, or protein crystals has long been hampered by light scattering. Chukhutsina's project develops a scatter-free setup that enables accurate in vivo measurements on exactly these challenging samples, opening new doors for research in photobiology and photosynthesis
Read more →

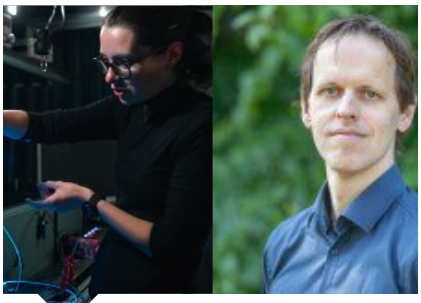
NWO allocation research project Imran Avci Open Technology Programme

Associate professor Imran Akca Avci (Biophotonics and Microscopy, VU Amsterdam) has received funding from the NWO Open Technology Programme (OTP) for her HERA project on next-generation microscopy for fertility treatments. HERA will develop a high-performance Stimulated Brillouin Microscopy (SBM) system to non-invasively measure the 3D mechanical properties of oocytes and embryos, providing an objective measure of their quality. By improving the selection of embryos, the project aims to increase IVF success rates in bovines, with results expected to translate to more efficient, accessible, and cost-effective human fertility treatments. Co-applicants are dr. ir. C.W. Visser (University of Twente) and dr. H. Aardema (Utrecht University).
Read more →

Funding for cutting-edge research on photonic chips

Two VU projects have received joint funding from NWO and the National Growth Fund programme PhotonDelta for advanced research on photonic chips. Associate professor Imran Akca Avci (Biophotonics and Microscopy) leads METAPIC, which develops ultra fast, low power photonic meta-circuits for precise, GHz-speed control of light, with applications in autonomous vehicles, medical imaging, metrology, and optical communication.**Physicist Andrea Baldi** heads BIND, creating inverse designed plasmonic metasurface sensors made of nanostructured gold that can detect biomolecules quickly and accurately using simple optics, paving the way for affordable diagnostics in labs, clinics,and homes.

Read more →

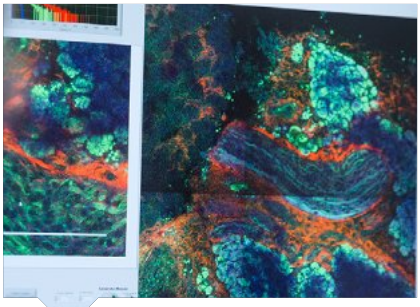


Grant awarded for algorithmic nanoscale imaging collaboration

The CHAIN (Coherent Algorithm-based Imaging of Nanostructures) collaboration is one of twelve new research projects funded by NWO's Perspectief programme. CHAIN brings together researchers from TU Delft, ARCNL, AMOLF, Leiden University and Utrecht University to develop new nanoscale imaging techniques that improve computer chip manufacturing. By combining advanced measurement methods using light, EUV radiation and electron beams with powerful data processing, the project aims to deliver faster, more accurate 3D imaging of the smallest chip structures and thus enable better process control.

The project is led by **Stefan Witte** (TU Delft). **Lyuba Amitonova**, head of the Nanoscale Imaging and Metrology group at ARCNL and associate professor at VU Amsterdam, leads the ARCNL/VU contribution, focusing on 3D imaging with visible light using computational algorithms, structured illumination and lensless detection. The project will also fund a new PhD position in her group and strengthen collaboration with Dutch partners in nanoscale imaging.

Read more →



NWO Take-off grant 1 for Imran Avci

Imran Avci has developed a new ultra sensitive microscope, known as Stimulated Brillouin Microscopy (SBM), which requires far less light than existing systems. As a result, it can perform measurements on materials that normally absorb too much light. Commercial application of this technology would be a major advancement for research on the properties of cells and tissues.

Read more →

Amsterdam Science & Innovation Awards 2025 for Anouk Post

Two VU researchers were honoured at the Amsterdam Science & Innovation Awards 2025, held at NEMO Science Museum on 17 June. Econometrician Quint Wiersma and physicist Anouk Post won the Innovation Award 2025 with Readler and LightUp, respectively. Anouk Post's LightUp project is a swallowable, pill-sized camera that combines imaging with a

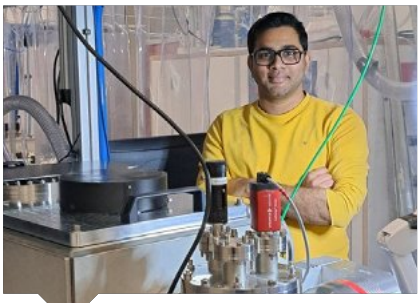
technique that makes cancer cells glow, enabling a simple and patient-friendly procedure that detects significantly more early-stage oesophageal cancer cases than current endoscopy-based screening. She received €10,000 to further develop the innovation. Together with fellow physicists Tyla Danskin and Johannes de Boer, Anouk plans to launch a spin-off to bring this breakthrough technology to market. Read more →

Thesis Award for Janni Harju on Chromosome Organisation

Physicists Dr. Janni Harju has received the Thesis Award from the Society for Bio Physics and Biomedical Engineering (BIOPM) for her doctoral thesis "Top-down and back up: Modelling chromosome organisation". The award was presented at the 2025 Biophysics Conference of the Dutch Research Council (NWO). Using theoretical models and simulations, Harju investigated how bacteria use loop-extruding motor proteins to organise their chromosomes prior to cell division. This process is critical to ensure DNA is correctly separated. Her findings have potential implications for the development of new antibiotics and for research into artificial cells. Read more →

Marie Curie & EMBO Fellowship for Eleonora Traverso

Researcher Eleonora Traverso from the Biophysics of Photosynthesis section has been awarded both a Marie Curie Fellowship and an European Molecular Biology Organization (EMBO) fellowship for her research on how plants evolved their light-protection strategies during the transition from water to land. Using the moss Physcomitrium patens — evolutionarily positioned between green algae and land plants — she will combine genetic and spectroscopic approaches to investigate how the protective mechanism that dissipates damaging excess sunlight as heat evolved over time. Her findings may ultimately help guide efforts to improve crop resilience in a changing climate.



Marie Sklodowska-Curie Fellowship for Optical Metrology Research

Anchit Srivastava, postdoctoral researcher at the ARCNL group of Peter Kraus (Associate Professor at the VU Physics department), has been awarded an ERC Marie Sklodowska-Curie Actions postdoctoral fellowship for his project LOTUS – Lightwave-driven spatio-temporal metrology of transition-metal oxides. LOTUS aims to push the frontiers of optical metrology by resolving ultrafast insulator-to-metal transitions in transition-metal oxides in both time and space, opening pathways toward next-generation memory technologies such as ReRAM, neuromorphic computing, and ultrafast electronics. Srivastava emphasises how crucial this support is for early-career researchers to "explore bold ideas and tackle complex challenges with confidence," and credits Peter Kraus as an essential partner in developing the successful proposal.
Read more →

€4.5M Marie Sklodowska-Curie Grant for CAFE-BIO PhD Network Curie Grant for CAFE-BIO PhD Network

Prof. Chase Broedersz of the Physics of Living Systems section will represent VU Amsterdam in CAFE-BIO, a new European doctoral training network awarded €4.5 million through the Marie Sklodowska-Curie Actions programme. The network brings together 12 universities and research institutes across Europe to train 15 PhD candidates at the interface of statistical physics, systems biology, and machine learning — investigating how complex collective behaviours emerge in living systems. VU Amsterdam contributes theoretical tools rooted in non-equilibrium statistical physics. Recruitment for the doctoral positions opens in February 2026, with research starting in autumn 2026.

Read more →

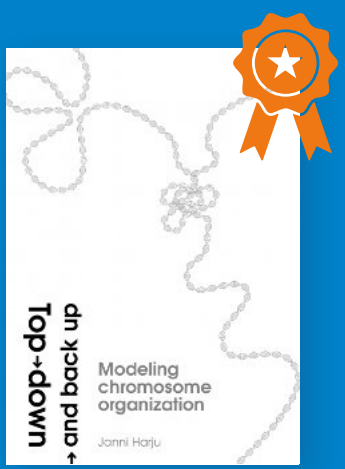
NWO ENW M Open Competition grant for Gijs Wuite

Together with biophysicist Remus Dame (Leiden University), Gijs Wuite has received an NWO ENW M Open Competition grant to explore a newly identified class of non-canonical histones in archaea, which may organise genomes in a completely different way. The genomes of all forms of life are structurally and functionally organised to orchestrate the DNA-encoded key functions in the cells of these organisms, such as transcription of genes. Histones and histone-like proteins are central players in genome organisation. Canonical histones organise genomic DNA by wrapping DNA around a protein core. Here, we investigate the possibility that a class of non-canonical histones that we identified bioinformatically functions in an unconventional manner. The knowledge generated in this project is key to advancing our understanding of the structural principles that underlie genome organisation and of genome evolution.

Read more →

Recent **PhD Theses**

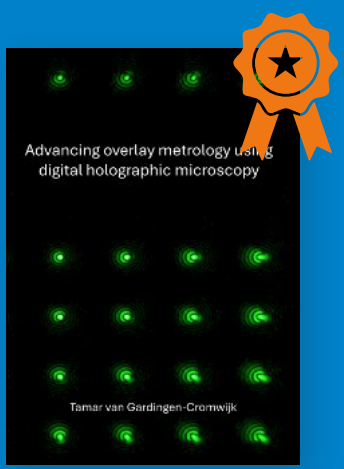
Cum Laude



Janni Kaisa Harju
Top-down and back up: Modeling chromosome organization

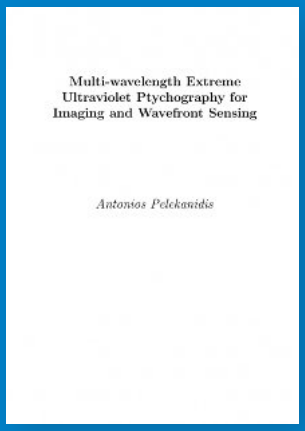
Promotor: dr. C.P. Broedersz
Copromotor: prof. dr. G.J.L. Wuite
Defence: 13 June 2025
Section: Physics of Living Systems
More information on the thesis

Cum Laude



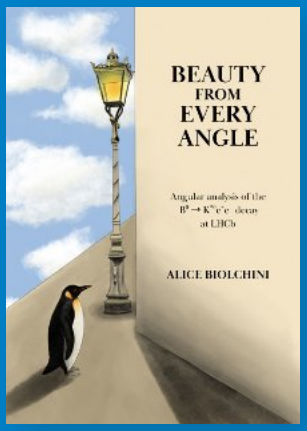
Tamar Christina Cromwijk
Advancing overlay metrology using digital holographic microscopy

Promotor: prof. dr. A. den Boef
Copromotor: prof. dr. J.F. de Boer, dr. S.M. Witte
Defence: 3 July 2025
Section: Biophotonics & Medical Imaging
More information on the thesis



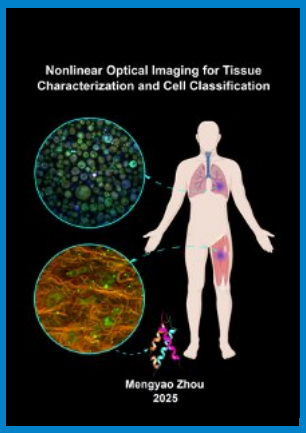
Antonios Pelekanidis
Multi-wavelength extreme ultraviolet ptychography for imaging and wavefront sensing

Promotor: dr. S.M. Witte, prof. dr. K.S.E. Eikema
Defence: 17 September 2025
Section: Quantum Metrology and Laser Applications
More information on the thesis



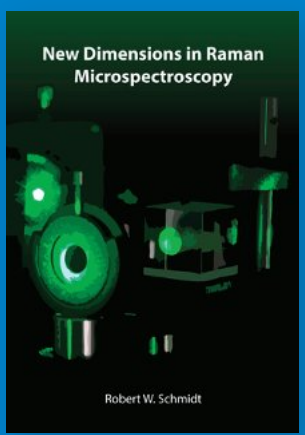
Alice Biolchini
Beauty from every angle: Angular analysis of the $B^0 \rightarrow K^{*0}e^+e^-$ decay channel using Run 1 and Run 2 LHCb datasets

Promotor: prof. dr. H.G. Raven
Copromotor: dr. M. Senghi Soares
Defence: 18 September 2025
Section: (Astro-) Particle Physics
More information on the thesis



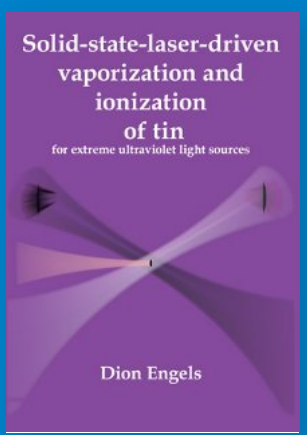
Mengyao Zhou
Nonlinear Optical Imaging for Tissue Characterization and Cell Classification

Promotor: prof. dr. M.L. Groot
Copromotor: dr. L.V. Amitonova
Defence: 9 October 2025
Section: Biophotonics & Medical Imaging
More information on the thesis



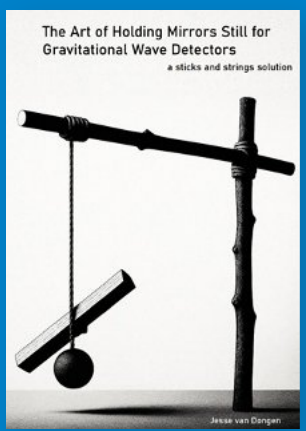
Robert W. Schmidt
New Dimensions in Raman Microspectroscopy

Promotor: dr. F. Ariese, prof. dr. S. Woutersen
Defence: 23 October 2025
Section: Biophotonics & Medical Imaging
More information on the thesis



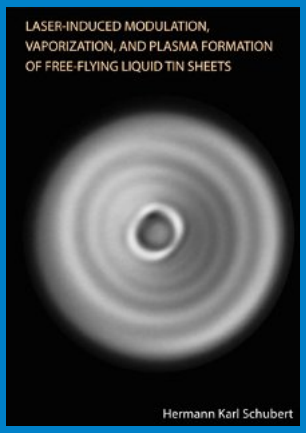
Dion J. Engels
Solid-state-laser-driven vaporization and ionization of tin

Promotor: prof. dr. O.O. Versolato
Copromotor: dr. J. Sheil, prof. dr. W.M.G. Ubachs
Defence: 26 November 2025
Section: Physics of Nanolithography
More information on the thesis



Jesse van Dongen
The art of holding mirrors still for gravitational wave detectors: a sticks and strings solution

Promotor: dr. C.M. Mow-Lowry, prof. dr. A. Freise
Defence: 28 November 2025
Section: (Astro-) Particle Physics
More information on the thesis

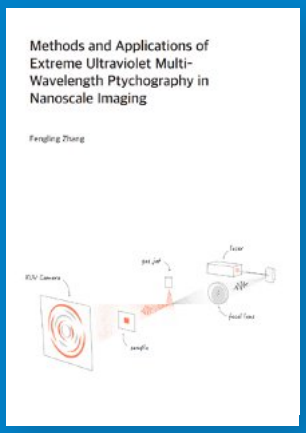


Karl Schubert
Laser-Induced Modulation, Vaporization and Plasma Formation of Free-Flying Liquid Tin Sheets

Promotor: prof. dr. O.O. Versolato
Copromotor: prof. dr. W.M.G. Ubachs
Defence: 9 December 2025
Section: Physics of Nanolithography
More information on the thesis

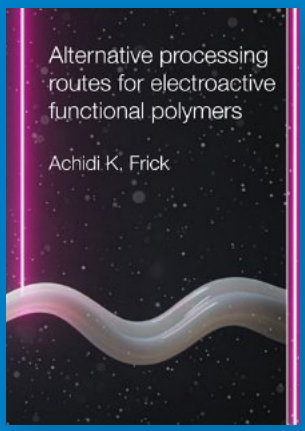
Bram J.A. Mooij
A versatile Raman setup: with time-gating and fast widefield imaging capabilities

Promotor: dr. F. Ariese, prof. dr. G.R. Davies
Defence: 9 December 2025
Section: Biophotonics & Medical Imaging
More information on the thesis



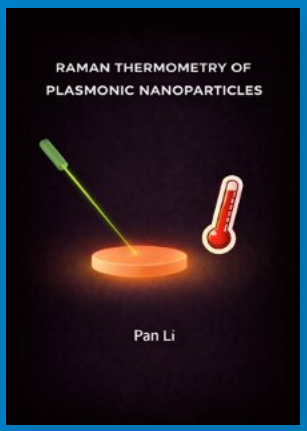
Fengling Zhang
Methods and Applications of Extreme Ultraviolet Multi-Wavelength Ptychography in Nanoscale Imaging

Promotor: dr. S.M. Witte, prof. dr. K.S.E. Eikema
Defence: 11 December 2025
Section: Quantum Metrology and Laser Applications
More information on the thesis



Achidi K. Frick
Alternative processing routes for electroactive functional polymers

Promotor: dr. E.L. von Hauff, dr. A. Baldi
Defence: 26 January 2026
More information on the thesis



Pan Li
Raman thermometry of plasmonic nanoparticles

Promotor: dr. A. Baldi
Co-promotor: dr. E.L. von Hauff, dr. S.H.C. Askes
Defence: 23 March 2026
More information on the thesis

Science, Business & Innovation:
A unique programme

Interview
Professor:
dr. ir. Iddo Heller
Programme directorship SBI

The Science, Business & Innovation (SBI) programme is entering a new chapter. After six years of dedicated leadership, dr. Marie-Louise Blankesteijn hands over the role of Programme Director to dr. ir. Iddo Heller. We talked to Iddo about what SBI has been, and what it is becoming.

You are a physicist known for hands-on research and spin-off experience. How did you end up as Programme Director of SBI?

For me, that journey is about a broad interest and pursuing impact. I am a physicist with a drive to not only explore new physical principles, but also develop them into applications and technologies that can make a difference beyond the lab. Now, for example, I am leading a new NWO-XL consortium in which we pioneer artificial molecular machines — just think about the potential for innovative self-healing materials or adaptive systems with life-like properties.

That spark for impact has grown ever since I was part of the founding team of VU spin-off Lumicks B.V., which commercialised the nanomanipulation and visualisation instruments developed in our Physics of Living Systems labs together with Prof. dr. Gijs Wuite and Prof. dr. Erwin Peterman. I see such valorisation as an ultimate form of dissemination — it brought our research tools into the hands of hundreds of biology and pharmaceutical labs worldwide, something that publishing alone could never have achieved.

The SBI programme focuses on exactly this kind of question: how can scientific discoveries be translated into real-world impact?

What is the vision of SBI, and what kind of students does it attract?

The core mission of SBI is to educate science-based innovators and entrepreneurs that can translate scientific discoveries into innovations that create economic and societal value. What makes SBI distinctive is that we do this from a strong foundation in the exact sciences — students follow physics, chemistry, and mathematics courses while also engaging deeply with business and innovation sciences.

The programme attracts broad-minded students who love science and technology and are eager to understand how that knowledge can create value. They typically thrive in interdisciplinary contexts, enjoy working in teams, and are motivated by themes such as the energy transition, sustainability, health innovation, or emerging AI-driven technologies.

What skills do SBI graduates leave with, and how is the curriculum structured to deliver that?

Our graduates are trained to bridge science with business and society. The curriculum is organised around six learning lines, recently refined through the Visible Learning Lines trajectory: Science Basics, Energy & Sustainability, Life & Health, Innovation & Entrepreneurship, Methodology & Ethics, and Professional Skills. Through this balanced, interdisciplinary curriculum, our students become experts in the science-to-business process.

A standout feature is the project-based experiential learning approach: students work on real-world innovation challenges in the domains of Life & Health and Energy & Sustainability, and complete their final thesis as an external research internship at a company, startup, hospital, or R&D organisation. The student association Subliem also organises career days and study trips — including visits to CERN — giving students genuine hands-on experience in science-based entrepreneurship.

"The core mission of SBI is to educate science-based innovators and entrepreneurs that can **translate scientific discoveries into innovations** that create economic and societal value."

How do you see the future of SBI within the Physics & Astronomy department?

As a department, we excel at generating new knowledge — but society increasingly expects us to also ensure that knowledge leads to meaningful innovations. Valorisation and societal impact have become central in the VU's mission, in research evalutions and national advisory reports, and in grant applications. With SBI, our department takes a leading role in this translation from discovery to value.

SBI staff and students are trained to analyse technology, adoption barriers and identify market opportunities. A great example is the course Innovation Project Diagnostics & Healthcare, in which teams of SBI students assess the market potential of inventions from our own physics labs. Over the years, ideas from student reports have even found their way into impact paragraphs of research grants.

With the upcoming Matrix Innovation Centre opening next to our Research Building in 2027, SBI will connect excellently to new neighbours — including the Demonstrator Lab VU and start-ups and scale-ups in Life Sciences, Medtech and AI. As technological change accelerates, the need for professionals who can connect scientific discovery with societal and market needs will only increase.

Weekend of Science: **Science is for everyone**

Assistant Professor: Volha Chukhutsina

Last October, the doors of VU Amsterdam's Faculty of Science swung wide open for 1,000 curious visitors. Robots, lasers, and live experiments filled the building - all thanks to the Weekend of Science. We spoke with dr. Volha Chukhutsina, one of the people who made it happen.

What exactly is the Weekend of Science?
It is a national event where universities and research institutes across the Netherlands open their doors to the public — families, kids, curious neighbours, anyone really. Researchers come out of their labs to show what they do all day. It is science but make it fun.

And VU Amsterdam joined in for the first time in years?
Yes! For the first time in over a decade. Together with my colleagues of the Physics and Astronomy department Jordi Dahlberg and Melike Hocaoglu, I helped organise VU's contribution. We put together a full programme of 21 demonstrations and public talks in our brand-new VO building. Almost 1,000 people showed up — many of them children and families — and the atmosphere was just electric.

What kind of things could visitors see and do?
All sorts of things! Live science demonstrations, hands-on experiments, talks about everything from the origins of the universe to how plants deal with too much sunlight. The idea was to make real research feel accessible and exciting — not something that only happens behind closed doors. It clearly worked, because we ended up being featured in New Scientist, on the radio, and we even opened the national Weekend of Science after movie!

Why is this kind of outreach important to you personally?
I really believe that inspiring young people early makes a huge difference — not just for science, but for society. Big changes in how we think about the world, about equality, about the environment — those changes start with curiosity and open minds. If we can spark that in a ten-year-old at an event like this, that is genuinely powerful.
I had been pushing for VU to take part in the Weekend of Science ever since I arrived here. So when it finally happened, and it turned out to be such a success — I was over the moon.

Your own research is also about something that affects everyone: climate change.
Exactly. I study photosynthesis — how plants and algae capture sunlight and turn it into energy. It sounds very fundamental, and it is, but it is also directly connected to climate change. When temperatures rise, photosynthesis is affected, and that has consequences all the way up to ecosystems and food production. Understanding those connections, from the molecular level all the way up, is what drives my research.

Any other good news to share?
Actually, yes! Earlier this year, our team won the Valorisation Award at the faculty afternoon — which recognises research that makes a real impact beyond the university. That meant a lot to us. Science is most powerful when it reaches the world outside the lab.

"If we can spark curiosity in a ten-year-old at an event like this, that is **genuinely powerful**."

Volha Chukhutsina

Want to join next year? The Weekend of Science returns soon. Keep an eye on the department's website and social media for updates! Get in touch if you want to join.

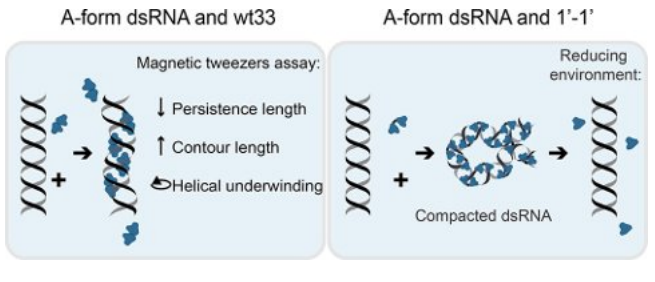
Scan the QR-code for the video

Highlighted Papers

TAV2b Peptide Derivatives Underwind and Stabilize Double-Stranded RNA upon Binding

A new study from the Physics of Living Systems section, published in the Journal of the American Chemical Society, reveals how peptides derived from the viral protein TAV2b interact with and alter the mechanical properties of double-stranded RNA (dsRNA). Using high-throughput magnetic tweezers, researchers showed that these peptides underwind and stabilize dsRNA upon binding — with one variant compacting the RNA strand at low forces and releasing it only under reducing conditions, mimicking the cellular environment. The findings provide a quantitative framework for characterising dsRNA binders and have direct implications for the design of more effective RNA therapeutics, including improved delivery and controlled release of RNA in cells. Read more

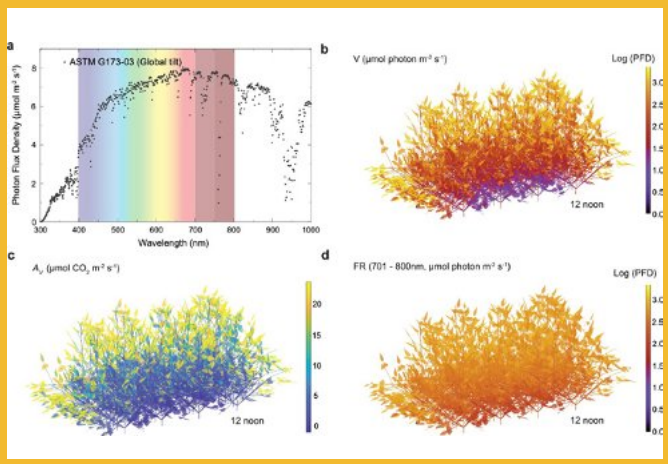
Dulin et al., J. Am. Chem. Soc. 2026, 148, 8298–8309.
DOI: 10.1021/jacs.5c18586



Adding Far-Red Chlorophylls to Crops Could Boost Photosynthetic Productivity by 26%

A new modelling study by researchers from the Biophysics of Photosynthesis section, published in Nature Communications, shows that introducing far-red-absorbing chlorophylls into crop plants could increase photosynthetic productivity by up to 26% — a potentially transformative step for global food security.

Crop leaves absorb 90% of visible light (400–700 nm) but transmit or reflect most far-red photons (700–800 nm), leaving a substantial portion of the solar spectrum untapped. Some cyanobacteria have evolved the ability to use this far-red light by incorporating alternative chlorophylls — chlorophyll d and chlorophyll f — into their photosystems. Using a detailed 3D canopy model of soybean, Wang, Oliver, Croce and Long simulated what would happen if these pigments were introduced into crop plants.



The results are striking. When far-red absorption is regulated in response to light conditions at different depths in the canopy — mimicking a natural shade-sensing mechanism — simulated daily CO_2 assimilation increases by up to 26%, with only a modest rise in water use. The benefit is greatest in the middle and lower canopy, where visible light is already depleted but far-red light remains abundant.

The study also outlines a realistic bioengineering path: the synthesis of chlorophyll f requires only a single additional gene, and experimental work has already shown that plant light-harvesting proteins can bind these alternative chlorophylls. Combined with other ongoing efforts to improve photosynthetic efficiency, incorporating far-red chlorophylls could offer a synergistic and much-needed boost to crop yield potential in the face of growing global food demand.
Read more

Wang et al., Nature Communications (2025) 16:7933. DOI: 10.1038/s41467-025-62885-6

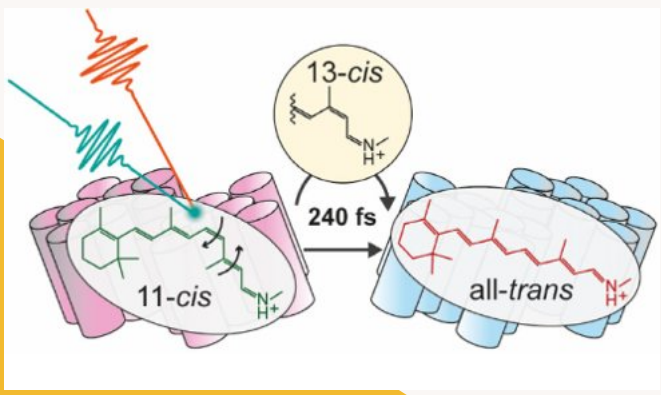
Multistep 11-cis to All-trans Retinal Photoisomerization in Bestrhodopsin, an Unusual Microbial Rhodopsin

A new study from the Biophotonics section, published in the Journal of the American Chemical Society, reveals an unexpectedly complex photoisomerization mechanism in bestrhodopsin, a recently discovered and unusual class of microbial rhodopsin found in the Antarctic alga Phaeocystis antarctica. Rhodopsins are light-sensitive proteins found across all domains of life, from microbes to humans. They are activated when a retinal chromophore — a small light-absorbing molecule — changes shape upon absorbing a photon. In most microbial rhodopsins this involves a well-defined all-trans to 13-cis isomerization, while animal rhodopsins such as those in the human eye use an 11-cis to all-trans reaction. Bestrhodopsin is peculiar in that it can be photoswitched back and forth between two stable states, and uniquely among microbial rhodopsins, it employs an 11-cis to all-trans photoreaction — more reminiscent of animal vision than of its microbial relatives.

Using femtosecond transient absorption and femtosecond stimulated Raman spectroscopy, the researchers tracked the photoreaction of bestrhodopsin with extraordinary temporal precision. They found that the primary photoreaction does not proceed cleanly to a single product. Instead, within just 240 femtoseconds of light absorption, the retinal chromophore branches into a mixture of two distorted isomers: an all-trans and a 13-cis form. The 13-cis fraction then thermally converts to all-trans in 120 picoseconds, followed by further structural relaxation on the microsecond-to-millisecond timescale. The researchers propose that this branching arises from a "bicycle pedal" isomerization mechanism, in which two double bonds rotate simultaneously upon photoexcitation — with the outcome depending on whether one of the rotations is aborted or completed.

The findings shed new light on the fundamental mechanisms of biological light sensing and suggest that the clean, single-product photoreactions seen in most rhodopsins may represent a special case of a more general, branched isomerization process.
Read more

Broser, Kaziannis et al., J. Am. Chem. Soc. 2025, 147, 25571–25583. DOI: 10.1021/jacs.5c06216



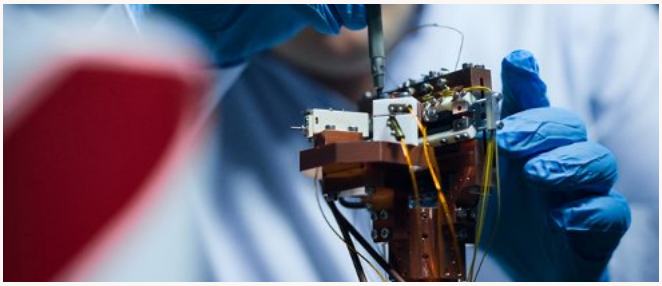
Letokhov-Chebotayev Intracavity Trapping Spectroscopy of H_2

A new study from the Quantum Metrology and Laser Applications section, published as an Editors' Suggestion in Physical Review Letters, reports the first experimental demonstration of a spectroscopic trapping scheme originally proposed by Soviet physicists Letokhov and Chebotayev more than fifty years ago — and does so using hydrogen, the universe's simplest molecule.
In precision spectroscopy, one of the fundamental challenges is that molecules are constantly moving, causing their spectral lines to blur due to the Doppler effect. Various techniques have been developed to overcome this, from molecular beams to laser cooling. Letokhov and Chebotayev theoretically proposed that molecules could be trapped in the intensity maxima of a standing-wave light field inside an optical cavity, effectively freezing their motion along the laser propagation direction and allowing spectral lines to be measured at the zero-recoil position — free from Doppler broadening.

Prof. Wim Ubachs and colleagues at VU Amsterdam, together with international partners, have now realised this scheme experimentally. Using a high-sensitivity intracavity laser technique (NICE-OHMS), they measured an extremely weak quadrupole overtone transition in molecular hydrogen (H_2) at 1189 nm. The trapping manifests as a strikingly narrow absorption feature — shifted by just 70 kHz from the Lamb-dip position — exactly as predicted by Letokhov and Chebotayev. A quantitative analysis of the saturation and trapping conditions fully supports the interpretation.

The result represents a milestone in precision molecular spectroscopy and opens new avenues for ultra-high-resolution measurements of hydrogen and other light molecules, with implications for testing fundamental physics and probing the quantum structure of matter.
Read more

Ubachs et al., Phys. Rev. Lett. 135, 223201 (2025). DOI: 10.1103/rxcj-6dw6



Control and Scaling of Nonlinear Emission for Super-Resolution Microscopy

This paper from researchers in Peter Kraus's group at ARCNL in collaboration with LaserLaB (VU Physics & Astronomy) shows how to turn label-free third-harmonic generation (THG) microscopy into a true super resolution method. The authors first analyse how the THG point-spread function behaves in a standard, single color microscope and show that operating at low driving intensity keeps the nonlinear response high and the THG focus spot as small as possible.

They then introduce HADES (Harmonic Deactivation Microscopy): a second laser pulse with a donut-shaped profile, carrying orbital angular momentum, is used to "switch off" the harmonic signal everywhere except in a tiny central region. In experiments on NbO_2 thin films, this spatial deactivation shrinks the THG emission spot to about four times below the usual diffraction-limited size, in excellent agreement with their theoretical model. Because the scheme is label free, compatible with solid samples, and based on tabletop ultrafast lasers, the work opens a path to applying super resolution microscopy in condensed matter physics, semiconductor wafer metrology, and other areas where fluorescent markers are impractical.
Read more

Kevin Murzyn, Tanya W. P. van Horen & Peter M. Kraus, Optica 13, 164–171 (2026). DOI:10.1364/OPTICA.57638

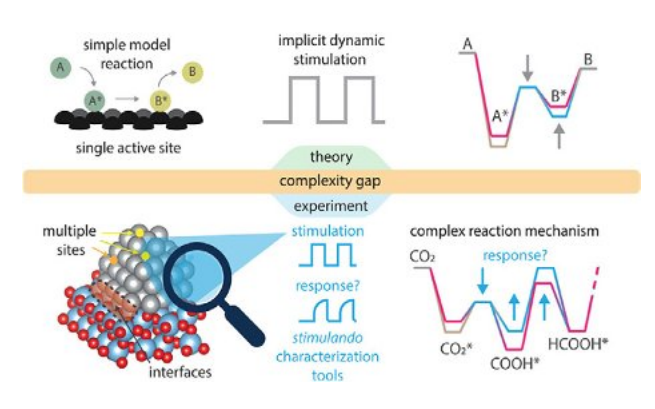
(ARCNL researchers Kevin Murzyn and Tanya van Horen in the lab)

Grand Challenges and Opportunities in Stimulated Dynamic and Resonant Catalysis

Traditional heterogeneous catalysis is fundamentally constrained by kinetic and thermodynamic limits — static active sites can only push reactions up to a fixed maximum rate. A new perspective paper in ACS Catalysis, co-authored by five members of our Photoconversion Materials section — Andrea Baldi, Sven Askes, Sarah Lander, Guobin Miao, and Johannes Zeininger — surveys the emerging field of dynamic and resonant catalysis, in which external stimuli such as light, mechanical strain, electric charge, and heat are used to actively oscillate a catalyst's physical or electronic structure on the timescale of the catalytic cycle itself.

The paper, which arose directly from a Lorentz workshop on Dynamic Stimulated and Resonant Catalysis held in Leiden, introduces the concept of stimulando characterisation — a new operando-inspired approach for studying catalysts under simultaneous stimulation and reaction conditions. It maps out the key challenges and opportunities across modelling, experimental methods, and benchmarking, and proposes a set of model "fruit fly" reaction systems to allow meaningful comparison across laboratories and stimuli.
Read more

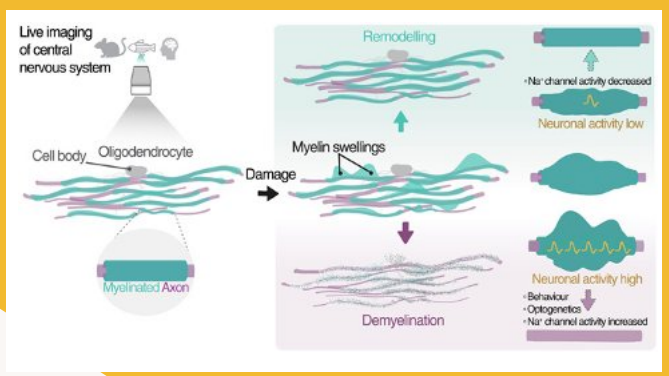
Monai, M. et al. ACS Catal. 2026, 16, 4077–4112. DOI: 10.1021/acscatal.5c07014



Dynamic myelin swelling visualised: new insight into development and recovery MS

Marloes Groot and her team participated in an international research effort that gained new insights into the dynamics of myelin swellings in the brain. Myelin is essential for normal central nervous system (CNS) function. The loss of myelin (demyelination) in the central nervous system is a hallmark of several neurological disorders. In conditions such as multiple sclerosis (MS) and in animal models of demyelination, the loss of myelin can trigger the regenerative process of remyelination, which is primarily mediated by the generation of new oligodendrocytes.
However, it remains unclear how the demyelination process occurs. Using zebrafish models and human tissue, Arafa et al. showed that myelin sheets swell drastically after the induction of damage and before being lost. Live imaging data in zebrafish indicated that myelin sheaths can in some cases withstand extensive damage (swelling) and even recover through morphological remodelling. Pharmacological manipulation of neuronal activity can affect this recovery capacity, suggesting a potential therapeutic opportunity to prevent myelin loss in disease and aging.
Read more

Arafa, D. et al. Science, 2026, Vol 391, No. 6786. DOI: 10.1126/science.adr4661

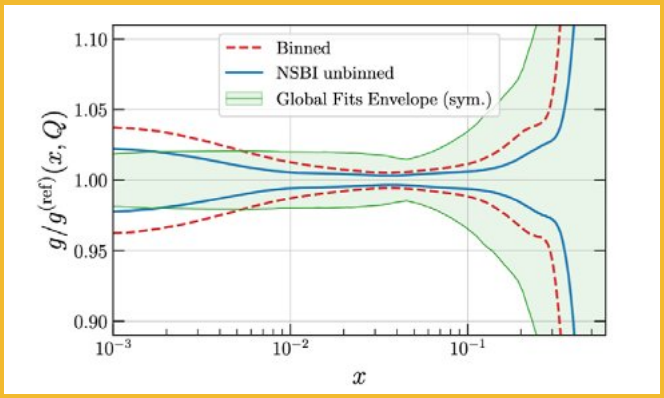


Proton Structure from Simulation-Based Inference at the LHC

The proton, one of the building blocks of all matter, contains a swarm of fundamental particles (quarks and gluons) each carrying a different fraction of its energy. Knowing precisely how that energy is shared is crucial for interpreting experiments at CERN's LHC, but extracting this information has traditionally required compressing rich experimental data into coarse summaries, throwing away valuable information in the process. In this work, researchers from Nikhef and our Particle Physics department show that a modern machine learning technique can instead work directly with the full experimental data. They demonstrate, using simulated collisions producing pairs of top quarks, that this approach achieves significantly higher precision in the determination of the gluon content of the proton than traditional methods.

This points toward a new way of doing measurements at the LHC that loses less information and extracts more physics from every recorded collision.
Read more

R. Barrue et al, arXiv: 2604.13157 , https://inspirehep.net/literature/3145457



Book Spotlight

Fixing Academia

Together with fellow members of the Amsterdam Young Academy, Laura Dreissen co-authored *Fixing Academia*, a timely and thought-provoking book that explores some of the most pressing challenges facing the academic world today. The book was officially published on April 2 and is available both as a limited-edition print copy and as Open Access online. Featuring contributions from a diverse group of early-career scholars, *Fixing Academia* reflects on the realities of working in academia today, from structural pressures and funding systems to questions of fairness, career development, and the changing nature of research and writing in an era shaped by generative AI. As Prof. Caspar van den Berg (Universiteit van Nederland) notes, the book offers "a thoughtful and engaged reflection on Dutch academia" and contributes meaningfully to ongoing conversations about improving the academic climate.
Read more

News & Announcements

Stevin Prize for **Ilse Aben's** Pioneering Methane Research

Ilse Aben was endowed professor at the Physics department of the Vrije Universiteit from 2001 until 2021 and was closely connected with the LaserLab institute. Currently, she is a professor by special appointment at VU Amsterdam in the Department of Earth Sciences and senior scientist at SRON. She has received the prestigious Stevin Prize for her pioneering work on satellite-based detection of methane, a powerful greenhouse gas responsible for about one-third of global warming. As a key figure behind the Dutch TROPOMI instrument, she developed methods to identify major methane leaks worldwide with city-scale precision, providing crucial input for UN programmes and international agreements such as the Global Methane Pledge.

Read more →

VU Amsterdam Joins €53M **FASTTRACK Project at CERN**

VU Amsterdam is contributing to a major new initiative at CERN: the FASTTRACK project, led by Mara Soares and Wouter Hulsbergen, with Gerhard Raven heading the (Astro-) Particle Physics section. The project develops next-generation sensor technologies that will allow experiments such as LHCb, ATLAS, and ALICE to record particle collisions up to 50 times faster than currently possible. This enables more precise measurements and opening the door to entirely new physical phenomena. As a partner of Nikhef, VU Amsterdam plays a key role in the LHCb experiment, which investigates the subtle differences between matter and antimatter. Supported by the NWO National Roadmap for Large-Scale Research Facilities with a total budget of €53 million, FASTTRACK keeps the Netherlands at the forefront of global particle physics research into the fundamental building blocks of nature.

Read more →

Matz Liebel joins Advisory Board of the Dutch Physics Council (DPC)

As of 1 January 2026, Dr. Matz Liebel (DPhil) will join the Advisory Board of the Dutch Physics Council (DPC) as the new representative of Vrije Universiteit Amsterdam, succeeding Prof. Roberta Croce The Department of Physics and Astronomy warmly thanks Prof. Croce for her valuable contributions during her time on the board.

Read more →

Volha Chukhutsina organised Lorentz workshop on Photosynthesis and temperature

Volha Chukhutsina was the lead organizer of the Lorentz Centre workshop "Photosynthesis and temperature extremes in a changing world" (16–20 June 2025), which brought together 30 leading researchers to examine how photosynthetic organisms respond to increasing heat and cold stress under climate change. The meeting focused on identifying key knowledge gaps in photosynthesis and its regulation across scales—from molecular mechanisms to ecosystem dynamics—and across diverse phototrophs. By fostering interdisciplinary exchange, the workshop integrated insights from physiology, ecology, and modelling to better understand and predict how temperature extremes will shape primary productivity and ecosystem resilience in a warming world. These efforts are now being consolidated into a white paper.

Read more →

25 years of Physics of Living Systems

Gijs Wuite and Erwin Peterman marked the 25th anniversary of their laboratory with a reunion held in November. The event brought together around 70 alumni from across the globe, reflecting the lab's broad international impact and strong community. Former members gathered to reconnect, share memories, and celebrate a quarter-century of science together.

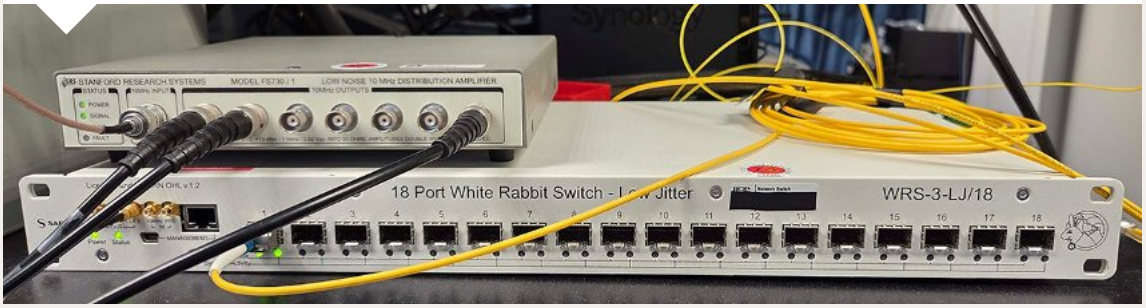
Ivo van Stokkum: Celebrating 40 Years of Excellence at VU

The Physics & Astronomy department wishes to celebrate dr. Ivo van Stokkum's 40-year scientific career. He has a background in experimental physics and did a PhD on measuring and modelling of auditory brainstem neurons in the grass frog. Ivo joined the (in those days) Faculty of Physics and Astronomy in December 1989, as a member of the section Physics Applied Computer Science. Over the decades, he found his home in the Biophysics of Photosynthesis section, where he has been a central figure since 2005. He is internationally recognised for pioneering global and target analysis methods for time-resolved spectroscopy, developing software tools that are now widely used to unravel the ultrafast dynamics of photosynthetic systems. His work has earned over 24,000 citations, a remarkable mark of lasting scientific impact. Equally valued is his longstanding dedication to teaching across bachelor, master, and interdisciplinary programmes. His care for students and his enthusiasm for modelling and data analysis have left a mark on many who have passed through our department. In March, Ivo has been elected as a member of the VU central Works Council, that discusses VU policy matters with the university board.
Here is to 40 wonderful years — and many more to come!

VU and VSL join forces for a future-proof national time infrastructure

Vrije Universiteit Amsterdam and VSL, the National Metrology Institute of the Netherlands, have signed a Memorandum of Understanding to collaborate on high-precision time networks. Building on advanced fibre-optic technology that links atomic clocks across locations, the partnership aims to develop a robust national time system that can serve as a backup for satellite navigation signals from GPS and Galileo — signals on which critical infrastructure such as mobile networks and power supplies heavily depends. Beyond resilience, the collaboration opens the door to innovations in radio astronomy, geodesy, quantum communication, and fibre-optic seismic sensing.
Read more →

As of 29 January 2026, the results of this long-term collaboration are now available to the wider research community. Through a new network service developed by SURF, in partnership with VSL and the international White Rabbit Collaboration, the most accurate time and frequency signal ever available in the Netherlands can now be accessed via the SURF research network — currently at eleven locations, with further expansion planned.
Read more →



Excellent Research Assessment for Physics & Astronomy

The Physics & Astronomy department has received an excellent evaluation in the 2017–2024 research assessment. The external committee praises our internationally competitive research quality, strong record in attracting prestigious grants (including many ERCs), and our impressive track record in valorisation, patents, and spin offs such as Optics11, LUMICKS, and Rapid Photonics. The report also highlights our modern research infrastructure, the vital role of LaserLaB Amsterdam, and a collaborative, supportive academic culture. Special thanks go to Erwin Peterman and Karin Colvin for coordinating the assessment process and documentation. Their efforts were instrumental in achieving this outstanding evaluation.

SAVE the DATE!
Upcoming PhD defences

Two PhD candidates from our department will defend their theses in May 2026:

Anne Julia Maria Bakx, with Erwin Peterman and Gijs Wuite as promotors, will defend her PhD project called *Untangle DNA* on the 29th of May, 2026.

Charlaine Florence Roth, with Kjeld Eikema as promotor and Wim Ubachs as copromotor, will defend the thesis on *High-precision spectroscopy on molecular hydrogen and molecular deuterium* on the 26th of May 2026. More information about both theses will be available on the VU website.

More information

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