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FINLAND
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NANONEWS in

2023

Editorial

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Lotta-Riina Sundberg

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University of Jyväskylä

PREFACE

2023 is coming to an end, and it is clear we have reached a “back to normal” status after the pandemic. Looking back to what changed, this year the campus renovation brought us a cleanroom expansion, and in line with the University webpage renewal, we now present research in NSC from a different angle. In October, we had the International Advisory Board meeting, which gave us feedback and ideas how to develop the research and community further in NSC. Funding calls resulted into many new projects, from EU, Business Finland, and ERC, for example. In addition, from next year on we are members in the Finnish Quantum Flagship, which opens again new branches and networks for research. So, this has been a productive year!

The year 2024 is the 20-year anniversary of NSC, and 20th Nansocience Days. To celebrate, we have planned some special events, which will help people to realize what happens in NSC. Our research is genuinely interesting for the public, which can be seen in the increasing numbers of people visiting NSC in the Researchers’ Night event or on the guided tours for schools. At the times when it is easy to use social media to question the relevance of scientific research, it is important we maintain an open and active communication to the public to show that the fundamental research is important.

Have a relaxing Christmas time, and all the best for 2024!

Prof. Lotta-Riina Sundberg
Scientific Director of NSC 2022-2025

Announcements

The 32nd Jyväskylä Summer School
5.–16.8.2024

Nanoscience Days 2024
8.–9.10.2024

NSC Paper of the Year Award
December 2024

Seminars and events:
- **Light and Matter seminar**, Every second Tuesday at 14:00, YNC330 and Zoom
- **Nanophysics Theory seminar**
- **Microbiology seminar**, Every second Tuesday at 10:00, YNC122
- **NSC Explain this!** at 14:00, The first Wednesday of each month, NSC coffee room
- **Nanoseminar**, usually on Fridays at 13:00
- **Computational Chemistry Methods,** Thursdays at 15:00

More information:
www.jyu.fi/en/science/nsc/current-at-the-nanoscience-center

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Major EU Funding for Researchers at NSC

European Research Council Consolidator Grant for Fabien Cougnon

Associate Professor Fabien Cougnon received 2 000 000 € funding from highly competitive ERC Consolidator Grant funding program. Fabien Cougnon's research concentrates on developing a method to control the formation of entanglements at the molecular scale. The grant allows the group to push the boundaries of understanding entangled molecules and to produce large knotted molecules with practical properties in catalysis in the future.

Read more: https://www.jyu.fi/en/current/archive/2023/01/major-eu-funding-for-three-jyu-researchers

European Research Council Starting Grant for Elina Laanto

Dr. Elina Laanto received 1 500 000 € funding from the ERC Starting Grant funding program to study the biology and ecology of giant phages. The project utilizes the first known giant phages isolated from Finnish lakes and rivers. The giant phages carry many unsolved mysteries such as their appearance, infection mechanisms and other interactions with the infected bacteria and with this research, Elina Laanto aims to answer questions on phage diversity.

Read more: https://www.jyu.fi/en/news/significant-erc-funding-for-two-projects-at-the-university-of-jyvaskyla-new-innovations-expected-in

Research and Innovation Action funding for Tero Heikkilä

Prof. Tero Heikkilä is one of the principal investigators in JOGATE project under the digital, industry and space program of the Research and Innovation Action funding scheme. He received 630 000 € for studying superconducting transistors. The project aims to advance the fabrication processes to be compatible with the methods of large-scale integration, making it possible for Europe to lead the industrial production of superconducting transistors.

Read more: https://cordis.europa.eu/project/id/101135240

EIC Pathfinder Open funding for Karoliina Honkala

Prof. Karoliina Honkala is one of the principal investigators in MetCat project under the EIC Pathfinder Open funding program. She received 560 000 € for delivering a proof-of-concept for the direct conversion of CO_2 to ethylene. The MemCat consortium will utilize synthesis, catalysis, and theory to obtain novel nanostructured tandem catalysts and develop nanocomposite membranes for a prototype catalytic membrane reactor. If successful, the science to technology breakthrough will replace current multi-step conversion pathways with existing catalysts.

Read more: https://cordis.europa.eu/project/id/101130047

Nearly 370 000 € to combat antibiotic resistance

Prof. Varpu Marjomäki and Prof. Lotta-Riina Sundberg are one of the principal investigators in IN-ARMOR project with 17 participants under the health program of the Research and Innovation Action funding scheme. Antibiotic resistance is one of the leading global health concerns as there are no new drugs in the clinical pipeline to combat the 13 most dangerous infections of the world. In this project, the goal is to harness the body's first line of defense, the innate immunity, to generate antimicrobial molecules that have exhibited effective antimicrobial activity against bacteria, viruses, fungi, and protozoa.

Read more: https://www.jyu.fi/en/news/new-in-armor-project-aims-to-fight-antimicrobial-resistance

The Finnish Cultural Foundation awards 450 000 € for projects at NSC

Two working groups from NSC received funding from the 2022 round of applications to Additional Million-euro funding to Science call by the Finnish Cultural Foundation. Working group led by Professor Karoliina Honkala received 200 000 € for using new computational methods to study electrocatalytic materials in green transition. Professor Pekka Koskinen's group is also part of this working group. In addition, working group led by Professor Jussi Toppari received 250 000 € for novel and more effective solar panels based on strong interactions between light and matter.
Read more *(in Finnish)*: https://www.jyu.fi/fi/uutinen/suomen-kulttuurirahastolta-liki-14-miljooonaa-euroa-jyvaskylan-yliopistoon

Nearly 500 000 € for building a shared infrastructure environment to develop quantum technologies

Professor Juha Muhonen leads the building of a shared infrastructure environment for the development of quantum technologies with significant funding from the Sustainable Growth Program for Finland related to the EU Recovery and Resilience Facility (RRF). The infrastructure will be located in Jyväskylä and it is going to be open both for public and private research. Accordingly, the target audience will include university researchers and start-up companies. This type of shared facilities are rare even internationally and the facility will be the only one in Finland openly available and focusing specifically on semiconductor-based quantum technologies.

BUSINESS FINLAND

Read more: https://www.jyu.fi/en/news/shared-infrastructure-environment-for-the-development-of-quantum-technologies-to-be-built-in

Physicists from NSC to take part in the Finnish Quantum Flagship

Professor Tero Heikkilä is the principal investigator in the consortium, led by Aalto University, which also includes the University of Helsinki, the University of Oulu, VTT Technical Research Centre of Finland Ltd and CSC – IT Center for Science ltd. Accordingly, the Finnish Quantum Flagship connects leading quantum experts in physics, computational science, mathematics, nanoscience and -technology, and economics, to advance the national ecosystem and promote cutting-edge research. Subsequently, the flagship aspires to boost the emergence of new businesses, and secure a position as a leading quantum-enabled society.
Read more: https://www.jyu.fi/en/news/jyu-hits-the-jackpot-the-university-of-jyvaskyla-is-included-in-three-new-flagships-of-the-academy

Academy Projects (01.09.2023 - 31.08.2027):

509 556 € for a new mathematical foundation of density-functional theory

Professor Robert van Leeuwen received 509 556 € funding for establishing new mathematical foundation of density-functional theory. Finding sound approximations has been a long-standing challenge and it is thus of utmost importance to gain new insight in the exact properties of the functional. Density functions are a key method for studying the behavior of multi-electron systems by replacing the complicated many-particle interactions with an exact non-interacting system with same electron density.

ACADEMY OF FINLAND

More information:
Robert van Leeuwen, robertus.vanleeuwen@jyu.fi

543 900 € for super-resolution laser writing of two-dimensional materials

Professor Mika Pettersson received 543 900 € developing ultrahigh-resolution modification of materials with laser radiation. In nanotechnology, laser-fabrication is used for example in modification of two-dimensional, one atom thick materials. In contrast, laser writing can be used to fabricate circuits and devices in micrometer

scale which is too large for many applications in modern electronics. In this project, the aim is to bridge the gap by utilizing optical near-field techniques, that will yield 10 nm spatial resolution in laser writing.

More information:
Mika Pettersson, mika.j.pettersson@jyu.fi

558 923 € for dynamical response of correlated quantum materials

Professor Tero Heikkilä received 558 923 € for studying the functionality of new quantum materials in microwave fields. Recent technological progress has enabled the creation of two-dimensional layered materials. At low temperatures, different types of correlated electronic states such as magnets or superconductors are formed depending on the elemental structure. This allows creating new types of functionalities for applications in electronics, and studying the hybrid materials creates new knowledge about phases of matter. This project focuses on the use of such hybrid quantum materials in high-speed electronics by studying their response to microwave regime electromagnetic signals.

More information:
Tero Heikkilä, tero.t.heikkila@jyu.fi

489 345 € for multi-component assembly of protein-like molecular knots

Associate Professor Fabien Cougnon received 489 345 € for investigating whether the shape of large molecules can be controlled by tying them into knots. The spatial conformation of large molecules alters their function but is difficult to control and this project proposes to build large, knotted molecules that mimic the conformations of biological molecules like proteins. It is foreseen that these synthetic architectures can be used to develop new systems for water desalination, and new gene delivery technologies for cancer treatment and Covid-19 vaccines.

More information:
Fabien Cougnon, fabien.b.l.cougnon@jyu.fi

550 134 € for new methods for computational design of metal nanoclusters for bio-imaging and photodynamic therapy

Professor Hannu Häkkinen received 550 134 € for developing new computational methods for holistic understanding of the functionality of metal nanoclusters as fluorescent labels and photosensitisers in bioimaging and photodynamic therapy. The new methods will combine quantum physics - informed machine learning and molecular dynamics simulations. The research is done in collaboration with groups in USA (UC Irvine and Stanford University Medical Center) and Canada (Queen's University).

More information:
Hannu Häkkinen, hannu.j.hakkinen@jyu.fi

Read more on the projects *(in Finnish)*: https://www.jyu.fi/fi/uutinen/suomen-akatemia-myonsi-jyvaskylan-yliopistoon-10-hankerahoitusta-luonnontieteiden-ja-tekniikan-alan

Other Academy of Finland Funding

Academy Research Fellow (01.09.2023-31.08.2027)

Reetta Penttinen, Department of Biological and Environmental Science, 707 671 €: *"Ecology and Evolution of Plasmid-Mediated Antibiotic Resistance in Human Gut Microbiota"*
Read more on the project *(in Finnish)*: https://www.jyu.fi/fi/uutinen/suomen-akatemialta-rahoitusta-neljalle-jyvaskylan-yliopiston-tutkijalle-0

Daniel Martín Yerga, Department of Chemistry, 727 999 €: *"CELL2H2: Green Hydrogen and High-Value Chemicals by Electrocatalytic Valorisation of Cellulose"*
Stefan Ilić, Department of Physics, 549 753 €: *"Supercurrent diodes in disordered quantum materials"*
Read more on the project *(in Finnish)*: https://www.jyu.fi/fi/uutinen/suomen-akatemian-rahoitus-seitsemalle-jyvaskylan-yliopiston-tutkijalle

Three new professors at the NSC

The new professors share their main research interests and talk about their ideas for the future as NSC professors.

Professor Jussi Toppari

For me, nanoscience means first of all interdisciplinarity, in addition to tiny structures at the molecular scale. My research is already involving multiple disciplines, like physics, chemistry, biology, and material science, with organic molecules always playing an active role.

Big part of my experimental work has concentrated on using DNA molecules to build self-assembled optical, i.e. plasmonic, constructions. I'm utilizing the well-developed DNA-origami structures and combining them with metallic nanoparticles to obtain optical activity. For more versatile nanofabrication of plasmonic surfaces, I have developed together with my colleagues from Aalto and other universities a DNA-assisted lithography. This method we are harnessing further and aiming all the way to self-assembled metamaterials.

My other main interest has been a strong light-matter coupling, in which the coupling is so strong that new hybrid light-matter-states, called polaritons, are formed. My main subject has been photoactive organic molecules strongly coupled to confined light modes of optical cavities or plasmons. The formation of the polariton can alter the molecule's behavior and chemistry, as well as enable a long-range molecular energy transfer, which can be further utilized for example in light harvesting.

Working at Nanoscience Center has already given me a huge advantage in my research, via possibility to collaborate with chemists and biologists. For example, I have enjoyed the long and successful collaboration with Gerrit Groenhof who can predict the effects of the polaritons by quantum level chemistry simulations. In future, I wish I have even more possibilities to widen the collaborations with other disciplines, especially within the field of experimental physical chemistry. Recently I have been active also in developing new independent bachelor program for the nanoscience. I hope opening of this own bachelor program will encourage new generation of brilliant minds to start studying this interesting field of science.

Professor Lotta-Riina Sundberg

I am interested in mechanisms by which bacteria cause diseases and how the interactions with phages (viruses that cause infection in bacteria) influence different aspects of the bacterial lifestyle. Nanoscience perspective plays a role here because phages are nanosized particles and all interactions with the hosts and environment happens in nanoscale, for example with phages binding to the mucosa, or bacteria resisting phages infections.

As a new NSC professor, I especially want to expand the toolkit in studying microbes. NSC has excellent opportunities for collaboration and learning new aspects using different methods, e.g. in imaging. I also try to encourage others to use

these opportunities and to help bringing the biology closer to the center of nanoscience.

In 2024, I am excited about all the scientific discussions with colleagues and wrapping up some exciting datasets. Hopefully there will be some new findings as well! I also look forward to all the happenings planned for the 20th anniversary of the NSC.

Professor Juha Muhonen

My group's name is "Hybrid quantum technologies in silicon", and we are interested in studying the interfaces between different quantum systems such as spins, photons and phonons in silicon. The motivation is to realize components for a quantum computer using silicon, the same material used in "classical" computers. In addition, we are motivated by the idea of using quantum coherent mechanical resonators to create semi-macroscopic quantum states.

The main research direction is focused on coupling spins in silicon into nanomechanical structures. The mechanical structures can then in turn be coupled to light and hence we would induce an effective coupling between light and the spins via the mechanical mode. In other words, we want to use the mechanical mode as a "quantum transducer", that can transduce the quantum state from the spins to optical light.

Compared to my previous position as an Associate Professor, I do not expect a lot to change. We are already collaborating extensively with many groups at NSC, especially with the LaserLab-NSC and in cleanroom fabrication. I of course want to be involved in developing the whole center forward, for example, I think we have a good change to be an important part of the Finnish quantum ecosystem.

There are many exciting things happening in 2024: We are building a new joint private-public infrastructure for the development of quantum technologies with Business Finland funding that will take shape in 2024. The Finnish Quantum Flagship – which we are a part of – will start. And research wise I hope we will demonstrate the world's first spin-optomechanical device next year!

More information:

https://www.jyu.fi/en/news/new-professor-jussi-toppari-is-a-cross-disciplinary-expert

https://www.jyu.fi/en/news/recently-appointed-professor-lotta-riina-sundberg-develops-virus-based-treatments-for-bacterial

https://www.jyu.fi/en/news/new-professor-juha-muhonen-has-a-passion-for-quantum-technologies

The Scientific Director wishes happy 20th Anniversary to NSC

Year 2024 marks the official 20-year anniversary of the Nanoscience Center, as our building was taken into use in 2004. Next year is actually a double anniversary, as also the Nanoscience days will be organized for the 20th time. To celebrate these milestones, we have planned a few science -themed public events, and we are inviting special guests to give talks at the NSDays.

At the start of the next 20-year period, the focus areas of NSC have been changed along with the webpage renewal of the JYU. In contrast to previous division of 5 focus areas based on scientific disciplines, we now present our research through the following themes: Health and wellbeing, Sustainable society and Second quantum revolution. These themes reflect the interdisciplinary research done at the NSC, which, although being often fundamental science, also contributes to solving societal challenges. This presentation may also be helpful in future funding calls. The themes have been divided into more specific sub-themes, allowing everyone to find their niche(s).

In respect to our new focus areas and 20-year anniversary, NSC will organize three events that are aimed at the general public. The idea is that the public will hear about scientific topics that have societal relevance in the long run. The celebrations will start on January 30th 2024 with a public event on hydrogen economy (sustainability theme), when Karoliina Honkala from NSC, Mikko Lappalainen from VTT and Timo Harju from Business Jyväskylä will talk about production of green hydrogen, and what hydrogen economy means for Central Finland. Similar types of events for the health- and quantum -themes will happen later in the year, and more info will follow.

The main scientific celebration event will be the 20th Nanoscience Days, organized from 8th to 9th of October 2024. This time the NSDays are organised by the NSC board, and the aim is to put together an event with invited top tier speakers, including familiar faces from the history of NSC and NSDays. Maybe you will even have chance to meet a Nobel prize winner.

Events

Sustainable society
30.1.2024 Hydrogen economy

Health and wellbeing
TBA, summer 2024

Quantum revolution
TBA, autumn 2024

Nanoscience Days 2024
8.-9.10.2024

WeNSC – Workshop for Enhancing NSC

After a three year long pause, the NSC community building event, WeNSC was organized in September 2022. It was a big success and shortly after the next event was scheduled for spring 2023. The hope was that in the spring there is less overlap with other responsibilities and thus more people are able to participate. Half of the team of six from autumn 2022 continued in the organizing committee and three new members were recruited to help with organizing the event.

Dedicated program to enhance the community

As in the previous events, WeNSC took the NSC staff to the Konnevesi Research Station which is about one-hour-drive away from central Jyväskylä. Since the purpose of the event is to enrich the NSC, its staff and functionalities, the program typically include both networking opportunities and inspiration for researchers on all levels. This year, the program focused on the various aspects of turning research to business. In addition, the participants were divided into two groups to provide a peer support session for the junior researchers and to hold a PI meeting discussing the upcoming IAB meeting and reporting.

After the bus ride to the venue, the event kicked off with scientific speed dating between junior and senior participants which has become a WeNSC tradition. Participants were challenged to whisper yet failed miserably as loud and keen discussions ensued and the participants got to know each other through series of preprepared questions. This concluded the morning program, and the discussions were continued throughout lunch.

In the afternoon the first set of new NSC PI presentations by Heikki Takala and Kezilebieke Shawulienu provided the audience with interesting details regarding their new groups at NSC. Following a coffee break, the business service managers Suvi Harsunen and Anni Taponen held a workshop. Afterwards, the participants were divided in two groups and the juniors continued to a peer support session while the PIs discussed the IAB meeting and reporting due in autumn. The first day was concluded with instructions to Murderous Nano Master Mystery (MNMM), a group activity where the participants performed tasks, earned clues, and solved a mystery. The program continued into the evening with dinner, the group activity, sauna, and BBQ.

The next morning begun with creative writing and problem solving as the groups prepared to explain their solution to the murder mystery. Once the presentations were honed to perfection, the participants gathered to hear the rest of the new NSC PIs, Fabien Cougnon, Marko Melander, and Arttu Miettinen, introduce their research groups. Unfortunately, the Professor of Practice, Sauli Vuoti, had to cancel his on-site participation at the last minute. However, he joined the event by giving an online talk about his position and view for the future. Following the talk, the participants enjoyed lunch at the cafeteria.

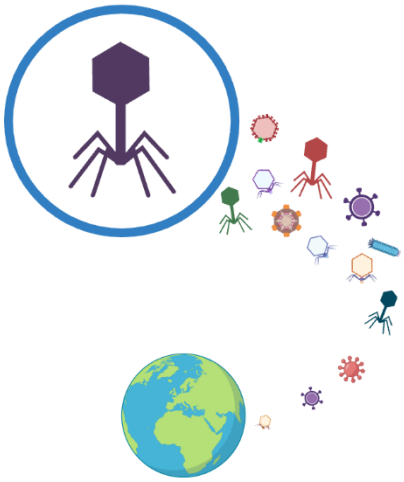
The afternoon offered three talks regarding different stages of turning research to business. Varpu Marjomäki discussed her experiences with Business Finland funding aiming at commercialization of research outputs, Matti Jalasvuori talked about his experiences with setting up a startup and Mikko Laitinen introduced an alternative concept of offering research-based knowhow and products within the JYU setting.

The day concluded with the MNMM presentations. As we saw also in autumn 2022, the NSC staff is brilliantly innovative. The groups came up with very creative, even humorous solutions and used everything from acting to audio and video to make their case. In the end, Noora Aho, Pavel Buslaev, Henri Lyyra, Antti Kanniainen, and Noora Hyttinen provided the victorious solutions and were marked in history as the first MNMM winners.

Introducing new NSC group leader

I am Elina Laanto and I work as a senior researcher at the Department of Biological and Environmental Sciences and NSC. I gained my PhD at the University of Jyväskylä and after my latest postdoctoral project at the University of Helsinki, I applied to gain funding to start a research group here in Jyväskylä. This became true after ERC funded my Starting Grant proposal called Life of Giant Phages.

In the project we will study the biology and ecology of the “bigger than normal” -sized bacteriophages. We have a unique opportunity to get our hands into the biological details of the so far unknown megaphages, a group of phages that have been roughly classified to have a genome size of over 600 kbp. We were lucky to isolate the first-ever megaphages, in addition to other interesting larger phages, from Finnish fresh waters. These discoveries were made together with Hanna Oksanen at the University of Helsinki and separately in another project here at Jyväskylä, together with Lotta-Riina Sundberg and PhD researcher Kati Mäkelä in Lotta-Riina’s Eemil Aaltonen project.



Life of Giant Phages

Funded by the European Union

European Research Council
Established by the European Commission

Currently I am co-supervising Kati and two master’s students, and the future research group is under construction. During the spring 2024, I hope to include a PhD researcher, and a postdoc to the team.

Ever since I began studying phages at the University of Jyväskylä there has always been a close connection to NSC and starting as NCS group leader was a natural continuum, especially as the topic of my research involves nanoscale phenomena. Even though the word giant might suggest otherwise, giant phages are still very nanoscale creatures. For the following year, I look forward to learning from the interdisciplinary science done at the NSC and fruitful collaborations, research paths and new discoveries.

More information:
https://www.jyu.fi/en/news/significant-erc-funding-for-two-projects-at-the-university-of-jyvaskyla-new-innovations-expected-in

https://erc.europa.eu/news-events/news/erc-2023-starting-grants-results

1. What is your name, your group leader, and your core field at NSC?
2. What is your project and how often do you visit at the NSC building?
3. Why do you want to be part of NSC?
4. What is your major scientific finding in year 2023?
5. What should researchers at NSC do together in year 2024?

1. I am Arun Kumar Kanakati, a Grant Researcher, working in Prof. Gerrit Groenhof and Prof. Jussi Toppari groups, Polaritonic Chemistry.
2. The current project is focused on synthesizing novel carbon quantum dots as a nanoprobe to be utilized for the detection of enterovirus capsids and RNA, also to be integrated with opto-electronic set up. Furthermore, I intend to develop carbon quantum dots based electrochemical sensors and upscale them to the tailor-made laboratory prototype in collaboration with IIT laboratory, India. Since my office is located at NSC, I am available throughout the weekdays.
3. The NSC is an interdisciplinary research center equipped with state-of-the-art facilities for research in chemistry, physics, and biology. It was established by groups from the chemistry, physics, and biology departments at JYU who chose to work and collaborate voluntarily. In this spirit, my interest extends not only to the research groups of Prof. Gerrit Groenhof and Prof. Jussi Toppari but also to becoming a member of the NSC community. This engagement will contribute to enhancing my knowledge and research skills, creating opportunities for new collaborations, and advancing my independent research career.
4 I was involved and examined the spectroscopy and time-dependent dynamics of several polyatomic molecules, where electronic excited states make significant contributions. In particular, my research addressed one of the fundamental and contemporary problems concerning the ubiquitous nonadiabatic processes occurring through the break-down of the well-known Born-Oppenheimer approximation, resulting from the mixing of electronic and nuclear motions (vibronic couplings), namely Jahn-Teller (JT) and Renner-Teller (RT) effects.
5. I am yet to explore the various activities going around here. The researchers at NSC should do some get-together activity, and we should also have common seminars so each researcher will get to know each other and know about their research.

1. My name is Dr. Sukhbir Singh and I work in Prof. Pekka Koskinen's group as a post-doctoral researcher.
2. The project I'm working with concerns modeling of low-dimensional nanostructures.
3. I am enthusiastically engaged in exploring the fundamentals of computational material science and conducting cutting-edge research at the Nanoscience Center. The center provides an exceptional working environment that fosters equal growth opportunities for its staff members. The remarkable computational facilities, coupled with the invaluable guidance from professors and staff, have created a conducive atmosphere for scientific growth. My decision to be a part of NSC is driven by a deep-seated commitment to enhancing my research skills and dedicating my life to the pursuit of scientific knowledge.
4. My current focus revolves around investigating the stability of novel two-dimensional materials. In this pursuit, we are systematically analyzing the existence of 2D metals under various lattice parameters using a range of density functional theory codes. Our goal is to unveil the material's stability across all dimensions of the lattice, providing a comprehensive understanding of its electronic structure.
5. Within our team, we share a collaborative goal centered on exploring the stability of 2D metals derived from elements in the periodic table. Our group supervisor and fellow members are diligently working in a similar direction. Specifically, my role involves using various DFT codes to elucidate the stability of 2D metals. The coordinated effort within our group signifies a collective commitment to advancing our understanding of this intriguing area of research.

1. I'm Pradip Kumar Mondal from Prof. Petri Pihko's group and my core field of Research at NSC is synthetic organic chemistry.
2. I work in the COCOA project, Control of Catalyst Operation with Anions. I visit the NSC building at least twice a week.
3. Pihko's group has been part of NSC for last 15 years.
4. My major scientific finding in 2023 has been enzymatic beta hydroxylation of enone using water as a source of hydroxy group.
5. In 2024, the researchers at NSC should create an even higher team spirit.

1. Hi, I'm Sophie Gholadze, from Georgia - one of the homelands of phages. It's where I first got familiar with phage research, and in February 2023, I started a new chapter of my life - doctoral studies in Lotta-Riina Sundberg's group.
2. The field of my research project is Microbiology. We aim at understanding phage-host interactions and bacterial defense systems in the mucosal environment, which is important for efficient phage therapy and prophylaxis. Although NSC building is not my working environment, I'm its frequent guest.
3. And to me, being part of NSC means equitable, creative learning and research opportunities, as well as potential for multidisciplinary collaboration.
4. The most important finding of my first-year PhD work was how mucin treatment induces bacterial fitness trade-offs during phage infection.
5. As for the next year NSC activities, I think, interdisciplinary workshops, or nanoscience hackathon along with research retreats would make it inspiring.

1. I am Maya Khatun, and my journey as a postdoctoral researcher at NSC began in November 2023. I am a member of a research group led by Prof. Hannu Häkkinen in the Department of Physics.
2. Our research focuses on unraveling the complexity of biocompatible nanosystems, with a keen emphasis on their physical, chemical, and catalytic activities. By investigating the physical and chemical characteristics, we aim to enhance their compatibility with biological systems and their composition and structure, ensuring a tailored design for optimal interaction in biological environments. Additionally, our work explores the catalytic potential of these nanosystems, opening avenues for applications in drug delivery, diagnostics, and beyond. Through this multidimensional approach, we strive to contribute valuable insights to the evolving field of nanotechnology with a specific focus on enhancing biocompatibility for diverse biomedical applications.
3. NSC attracted me because of the research area of the Hannu's group. I wanted to explore the metal nanoclusters for real world application with the various computational approaches. At NSC, I've discovered robust computational resources that greatly support the execution of my envisioned project.
4. I have come up with a cost-effective method after the validation of different Density Functional Theory (DFT) with the standard wave function based theory (WFT) for different nanoclusters. I am looking forward to unravelling more mysteries in the new lab and building innovative approaches.
5. It would be great to have scientific gatherings and conferences within NSC to foster collaboration and knowledge exchange among researchers. Additionally, incorporating sports activities or planning group picnics or small tours for NSC members would provide a refreshing break and contribute to a more vibrant and cohesive community.

1. My name is Aino Rolig. I work in the group of Prof. Petri Pihko and my core field is organic synthetic chemistry.
2. My PhD project focuses on total synthesis. Currently I am working towards the total synthesis of a molecule called Humilisin E. This means a lof hours in the lab so I spend most of my time in the Department of Chemistry where my office and lab space is located. However, our group's weekly group meetings are usually held in NSC so usually I visit the building once a week.
3. The research group of Petri Pihko has been part of NSC for 15 years already, which has been and continues to be very important for us.
4. I spent half of 2023 doing my Master's thesis in which I worked in the same project as now in my PhD. In my thesis I was able to contribute into developing a working synthesis route for making the core of Humilisin E, which will hopefully be part of the total synthesis of the molecule one day.
5. Some kind of get-together which would allow to know people from other research groups better would be really nice!

1. Hey, my name is Heini Järvinen and my group leader is Prof. Jussi Toppari. My core field at NSC is DNA nanotechnology.
2. My project is focused on fabricating optical/plasmonic metamaterials using DNA-origami. I visit NSC almost daily.
3. I love the lack of boundaries at NSC. Atmosphere is very international and multidisciplinary. Great people with interesting research and skill.
4. We published two articles early this year about forming large-scale fishnet lattices on silicon surfaces (see publication) and tuning the interactions to create 3D tubes (see publication) out of the same DNA origami (Seeman tiles).
5. Let's go try archery!

Research Outreach and Highlights

Researchers' night

European science event, the Researchers' night, makes science familiar to the public. On 29th of September, coinciding with the City of Light event, the audience had the possibility to experience various activities. At the NSC, around 1350 visitors explored nanoscience through various workshops and demonstrations.
Read more: https://www.jyu.fi/en/news/almost-14000-visitors-to-the-researchers-night-in-jyvaskyla

NSDays 2023

The Nanoscience Days (*chair* Juha Muhonen) took place during 10th–11th October 2023. The event was held on-site, gathering 114 registered participants to follow 8 high-profile plenary lectures and a poster session with 44 presenters. The common interests between biologists, chemists, and physicists were distinctly represented in the wide range of interdisciplinary topics, generating a vibrant event that has become the highlight of otherwise somber October. As a novel practice for this year, five students were hired to support the chair and look after the practicalities of event such as the reception desk and running the mics.

IAB meeting

Every two year, the work at the NSC is evaluated by and international advisory board (IAB). This round, the IAB meeting followed the NSDays and took place on 12th and 13th of October. The current board consists of leading nanoscience researchers from various disciplines such as Prof. Peter Hegemann from Humboldt-Universität in Berlin, Prof. Jonathan Clayden from University of Bristol, Prof. Heiner Linke from Lund University, and Prof. Giulio Cerullo from University of Milan. Based on their feedback, NSC is at the cutting edge of nanoscience and the combination of biology, chemistry and physics is particularly noteworthy. The increase in EU funding is a exhibits excellent strategic take on hiring and supporting researchers. Since the NSC also has an important role in education and society, the board encourages the NSC to further highlight the impact of the research.
Read more (*in Finnish*):
https://www.jyu.fi/fi/uutinen/kansainvalista-kiitosta-nanotiedekeskuksen-toiminnalle-ja-tutkimuksen-laadulle

The Nobel Evening

This year, offered by the University of Jyväskylä, the Nanoscience Center and Keskisuomalainen, the Nobel Evening was organized both as an onsite and an online event on 12th of December 2023 in Lähde library. During the event, experts from University of Jyväskylä introduced this year's Nobel Prize winners. Three of the five experts were from the Nanoscience Center. Maija Vihinen-Ranta introduced the Nobel awarded to developing effective mRNA vaccines against COVID-19. Mika Pettersson discussed the Nobel awarded to experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter, while Juha Muhonen presented the Nobel awarded to the discovery and development of quantum dots. The Nobel Evening was opened by the Rector Jari Ojala and after the fascinating talks, the Scientific Director of the NSC Lotta-Riina Sundberg gave the closing words. The event was hosted by science journalist Mari Heikkilä.
Read more *(in Finnish)*:
https://www.jyu.fi/fi/tapahtumat/vuoden-tiedehelmet-esitellaan-nobel-tiedeillassa

Greetings from the new assistant of NSC

My name is Satu Kosonen, and I started working as an assistant at the NSC and the department of chemistry in the beginning of May 2023. Before coming to JYU, I worked for several years in different positions in Posti (Finnish mail). My past worklife has always included days with bigger and smaller suprises and I am happy to see, that the trend continues in here. I am not a total stranger with natural sciences either: I have a little bit of experience of studying at the department of chemistry. It is nice to meet you all, I look forward to working together with you!

Highlights at NSC in 2023*

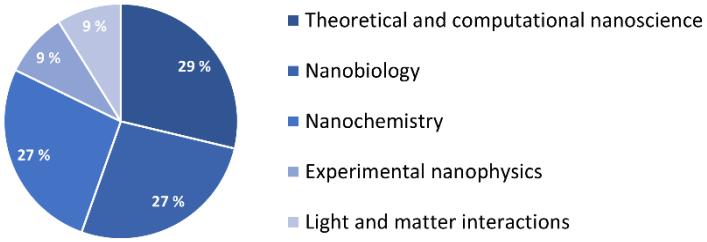
- I. Sokolovskii, R.H. Tichauer, D. Morozov, J. Feist and G. Groenhof. *"Multi-scale molecular dynamics simulations of enhanced energy transfer in organic molecules under strong coupling"*. Nat. Commun. 2023, 14, 6613.
- G. Stefanucci, R. van Leeuwen and E. Perfetto. *"In and Out-of-Equilibrium Ab Initio Theory of Electrons and Phonons."* Phys. Rev. X 2023, 13, 031026.
- Z. Geng and I. Maasilta. *"Complete tunneling of acoustic waves between piezoelectric crystals."* Commun. Phys. 2023, 6, 178.
- M. Laajala, M. Zwaagstra, M. Martikainen, M. P. Nekoua, M. Benkahla, F. Sane, E. Gervais, G. Campagnola, A. Honkimaa, A.-B. Sioofy-Khojine, H. Hyöty, R. Ojha, M. Bailliot, G. Balistreri, O. Peersen, D. Hober, F. Van Kuppeveld, and V. Marjomäki. *"Vemurafenib Inhibits Acute and Chronic Enterovirus Infection by Affecting Cellular Kinase Phosphatidylinositol 4-Kinase Type IIIβ"*. Microbiology Spectrum, 2023, 11, e00552-23.
- K. Pyo, M.F. Matus, E. Hulkko, P. Myllyperkiö, S. Malola, T. Kumpulainen, H. Häkkinen and M. Pettersson. *"Atomistic View of the Energy Transfer in a Fluorophore-Functionalized Gold Nanocluster"* J. Am. Chem. Soc. 2023, *145* (27), 14697–14704.
- K. Tapio, C. Kielar, J. M. Parikka, A. Keller, H. Järvinen, K. Fahmy, and J. J. Toppari. *"Large-Scale Formation of DNA Origami Lattices on Silicon"*. Chem. Mater. 2023, 35, 1961.
- M. F. Matus and H. Häkkinen. *"Understanding ligand-protected noble metal nanoclusters at work."* Nat. Rev. Mater. 2023, 8, 372–389.
- T. A. Puurtinen and I. J. Maasilta. *"Effective medium theory for the low-temperature heat capacity of a metasolid plate."* Commun. Mater. 2023, 4, 1.

37
Group leaders*

161
Researchers*

101
Peer-reviewed publications**

Top 5	Author (No. of Publications)
1.	Hannu Häkkinen (14)
2.	Karoliina Honkala (12)
3.	Sami Malola (11)
4.	Mika Pettersson, Marko Melander, Maria Matus (7)
5.	Perttu Permi (6)



*Data taken from NSC websites on 1.12.2023
**Data taken from Scopus on 13.12.2023, affiliation search with keywords: Nanosci* and Univ* Jyvaskyla