
NSC
FINLAND

NANONEWS in

# 2022

## Editorial

Sanna Rauhamäki
Lotta-Riina Sundberg

## Figures

Minne Jartti
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University of Jyväskylä

## PREFACE

During this year the activities of the NSC have returned more or less back to normal. We have now been able to organize events, such as WeNSC, again on site and live, and connect more with each other (and have fun!). Also, the coffee room is nowadays busier during the lunch hour. These are very welcome changes after the COVID-19 pandemic drove us home and into our individual bubbles. However, crises are not over. War in Ukraine, energy crisis and delays in equipment deliveries continue to influence our daily lives, including research. Despite these, let's try to concentrate on the positive things in life.

One of these positive things could be that the Ylistönrinne campus renovation has started in NSC by expansion of lab facilities and refurnishing of small meeting rooms. Next year, the project moves on to Ambiotica, and at some stage our offices in the NSC are renovated as well. It will be exciting to see how the campus looks like after the changes have been done!

2022 is almost wrapped and soon it is time to relax over the holidays. Enjoy the end of the year, eat well and rest! I hope you all find an almond in the Christmas porridge and get a New Years' tin with a lot of rough surface!

Assoc. Prof. Lotta-Riina Sundberg
Scientific Director of NSC 2022-2023

## Announcements

**The 32nd Jyväskylä Summer School**
7.–18.8.2023

**Nanoscience Days 2023**
10.–11.10.2023

**NSC Paper of the Year Award**
December 2023

**All seminars and events in Year 2023:**
- **Light and Matter seminar**, Every second Monday at 9:00, YNC330
- **NSC Explain this!** at 14:00 first Wednesday of each month, NSC coffee room
- **Nanoseminar**, usually on Fridays at 13:00
- **Computational Chemistry Methods,** Thursdays at 15:00

**More information:**
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# Major EU Funding for Researchers at NSC

## JYU based company is the first Finnish recipient of an EIC Transition Challenges project

BiopSense, a company that sprouted from a local research project, received 2.5 m€ to develop solutions for monitoring cancer from liquid biopsies. Professor Marja Tiirola, the scientific advisor of BiopSense, explains that frequent monitoring assists with quick reactions when response to cancer medication is unsatisfactory. With their fully automated extraction and transfer cartridge of blood-based biomarkers, BiopSense aims at establishing liquid biopsies as a valid and cost-effective way to improve cancer therapies.

**Read more:** https://www.jyu.fi/en/current/archive/2022/01/company-with-roots-at-jyu-receives-20ac2-5-million-from-the-european-innovation-council-2013-biopsense-develops-new-ways-to-improve-cancer-therapy

## European Research Council Starting Grant for Kezilebieke Shawulienu

Assistant Professor, Academy Research Fellow Kezilebieke Shawulienu received 2 000 000 € funding from highly competitive ERC Starting Grant funding program. Kezilebieke Shawulienu's research concentrates on designer quantum materials which is a central research area within condensed matter physics. The grant supports setting up a dedicated research group to study topological quantum matter and the related physical properties that could ultimately lead to new technologies.

**Read more:** https://www.jyu.fi/en/current/archive/2022/01/major-eu-funding-for-research-on-nanomaterials

## Marie Skłodowska-Curie Actions funding for multiple projects at NSC

Academy Research Fellow Heikki Takala received 250 000 € for PhotoCyx project where the goal is to create a cyanobacterial expression tool responding to red light. This tool, based on phytochrome photoreceptor will allow precise and tunable control of cyanobacterial gene expression which in turn can be harnessed to produce important biochemicals such as biofuel and bioplastics.

Assistant Professor Suvi Ruuskanen received 199 000 € for PEARL project to investigate the role of non-genetic inheritance in birds as a response to polluted environments. This is the first project aspiring to shed light on paternally transmitted effects of pollution in avian models. In addition, the aim is to identify novel biomarkers of pollution exposure.

Professor Gerrit Groenhof and Assistant Professor Jussi Toppari received 199 000 € for ExVib project where the goal is to study chemical reactivity under vibration strong coupling to shed light on its effects on reactions and their mechanisms. Vibration strong coupling has the potential to change chemical reactivity but as of now, it has not been possible to predict the outcomes.

**Read more *(in Finnish)*:** https://www.jyu.fi/fi/ajankohtaista/arkisto/2022/08/jyvaskylan-yliopiston-luonnontieteiden-ja-it-n-tutkimukselle-rahoitusta ***(in English)*** https://cordis.europa.eu/project/id/101067311, https://cordis.europa.eu/project/id/101065928, https://cordis.europa.eu/project/id/101068621

# Significant project funding from Jane and Aatos Erkko Foundation

## Building the Future – Taking Action program to fund developing sensory materials from recycled raw materials

Professor Ari Väisänen leads a joint project between the Universities of Jyväskylä and Turku where the researchers intend to utilize recycled materials to produce sensor materials. The project received 500 000 € from Building the Future – Taking Action program which is a shared program between Jane and Aatos Erkko and Technology Industries of Finland Centennial Foundations to grow innovative business environments. According to Academy Fellow Jani Moilanen, a leader of a subproject, the recycled materials are suitable building blocks for next generation high-capacity hard disks and optical sensors.

**Read more:** https://www.jyu.fi/en/current/archive/2022/02/rare-earth-elements-are-used-in-wind-turbines-and-electric-cars-2013-a-substantial-funding-granted-for-developing-sensory-materials-from-recycled-raw-materials

## Jane and Aatos Erkko Foundation to fund virus research and low-dimensional metals

Maija Vihinen-Ranta's group received 726 00 € funding from Jane and Aatos Erkko Foundation for a project titled "The Impact of Cellular Structures on Nuclear Egress of Herpesvisur Capsids". The project spans from 2023 to 2025 and pursues to further the understanding of viral nuclear dynamics and interaction by utilizing multidisciplinary approaches and latest imaging techniques.

**Read more:** https://www.jyu.fi/en/current/archive/2022/05/funding-from-jane-and-aatos-erkko-foundation-to-vihinen-ranta-group-for-virus-research

Four-year project lead by Professor Pekka Koskinen received 450 000 € funding from Jane and Aatos Erkko Foundation. The project focuses on utilizing rare metals in a sustainable manner. The current methods are not sustainable, and a solution could be found in the development of applications and methods that use less of said rare metals. Here one-atomic-layer 2D metal films are studied using computational methods to produce large and stable films that could be utilized in various applications.

**Read more *(in Finnish)*:** https://www.jyu.fi/fi/ajankohtaista/arkisto/2022/06/kohti-kestavaa-metallien-hyodyntamista-tutkimusprojektissa-kehitetaan-entista-lujempia-ja-ohuempia-metallikalvoja

# Business Finland Co-Innovation funding for a joint project on sustainable aviation fuel and chemicals

Professor Karoliina Honkala is responsible for the work related to computational chemistry in a joint Business Finland Co-Innovation project between University of Jyväskylä, Åbo Academi, and VTT as well as multiple commercial partners. The aim of the project Synjet is to improve the conversion efficiency and profitability when using renewable feedstocks and turning them into valuable products. Aviation fuels are the main target of the project, but the studied routes can be used to synthesize other chemical industry products as well. The multidisciplinary approach of the project has significant implications for reaching the national carbon emission reduction goals.

**Read more:** https://www.jyu.fi/en/current/archive/2022/05/promising-new-routes-for-sustainable-aviation-fuel-and-chemicals

## Academy Projects (01.09.2022 - 31.08.2026):

### 599 488 € for supramolecular and mechanochemistry of iodine(I) complexes

Professor Kari Rissanen received 599 488 € funding for preparing new reactive and/or supramolecular complexes having iodine atom with formal oxidation state of +1. These complexes can be either cationic with a $[N\text{-}I\text{-}N]^+$ moiety comprising a three-center four-electron bond or neutral O-I-N moiety. Both are stable yet highly reactive and can thus be utilized as structural elements in a complex or supramolecular assembly, or as reagents in certain organic transformations The project will produce several new iodine(I) complexes and study their properties in carefully chosen organic transformations

**More information:**
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### 212 338 € for modeling water transport in wood

Senior researcher Arttu Miettinen received 212 338 € for taking part in a consortium called WaterInWood, developing a model for water transport in wood using image-based modeling. The project titled "Image-based Modeling for Water Transport in Wood Including Material Biodegradation" focuses on developing a comprehensive multi-phase model for moisture transport both in wood and modified wood, also when biodegradation is present. The results will support the development of safer and more durable wood products in addition to innovative technologies to protect wood from varying climates. The project is led by Stefania Fortino from VTT Technical Research Centre of Finland Ltd and involves researchers also from Natural Resources Institute Finland. The project duration is three years (01.09.2022-31.08.2025).

**More information:**
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**Read more on the projects *(in Finnish)*:** https://www.jyu.fi/fi/ajankohtaista/arkisto/2022/06/sa-n-luonnontieteiden-ja-tekniikan-tutkimuksen-toimikunnalta-rahoitusta-viidelle-jyvaskylan-yliopiston-tutkimukselle

### 500 000 € for studying bacteriophage ecology in mucosa

Associate Professor Lotta-Riina Sundberg received 500 000 € funding for a project "Ecology of bacteriophages in mucosa during vertebrate host lifespan". Mucosal surfaces protect us from pathogens but as we age, these surfaces are weakened, making us more prone for infections. Naturally occurring bacteriophages on mucosal surfaces may protect us from bacterial infections. Accordingly, this project focuses on the ecology and interactions of bacteriophages in mucosa. The purpose is to determine factors that affect the success of phage therapy.

**More information:**
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### 480 240 € for studying genes producing antibiotic resistance

Academy Research Fellow Matti Jalasvuori received 480 240 € funding for a project "Rediscovering plasmid-dependent RNA-bacteriophages: isolation and in vitro evolution of phages to control antibiotic resistance and model viral adaptation to new receptors". Since antibiotic resistance genes are typically located in plasmids, the antibiotic resistance crisis is in fact a plasmid crisis. However, there are plasmid-dependent bacteriophages that bind to plasmid-encoded features on bacterial cells to cause infection. These phages can be thus harnessed for applications to target antibiotic resistant bacteria. The current plasmid dependent phages cover only a fraction of know resistance plasmids which is why the proposed project seeks to isolate new plasmid dependent phages and utilize artificial evolution to expand their host range.

**More information:**
Matti Jalasvuori, matti.jalasvuori@jyu.fi

**Read more on the projects *(in Finnish)*:** https://www.jyu.fi/fi/ajankohtaista/arkisto/2022/05/akatemialta-rahoitusta-viidelle-jyvaskylan-yliopiston-tutkimukselle

# NSC and Converis – important updates for NSC staff

The possibility to acknowledge NSC within the Converis research information system has become clearer during the past year. Here are some of the changes that have been made and the dedicated instructions for the NSC staff.

## NSC affiliation required updating

During the year, it was realized that the NSC affiliation in Converis did not correspond with the way NSC affiliation was otherwise understood. As the first step of action, the current NSC staff list was used to identify personnel that should belong to the NSC follow-up group in Converis. If the affiliation was missing from an NSC staff member, it was added. Thanks to the process, the affiliation has now been provided to everyone. Potential changes to the NSC staff will be checked regularly but the Converis affiliation can be adjusted by the user as well. Open the edit menu from the top of your profile and navigate to the research profile subtab. At the bottom of the page, it is possible to adjust the follow-up group. Search for NSC and pick Nanoscience Center as seen in the figure underneath.

## Publications by NSC staff are affiliated with NSC automatically

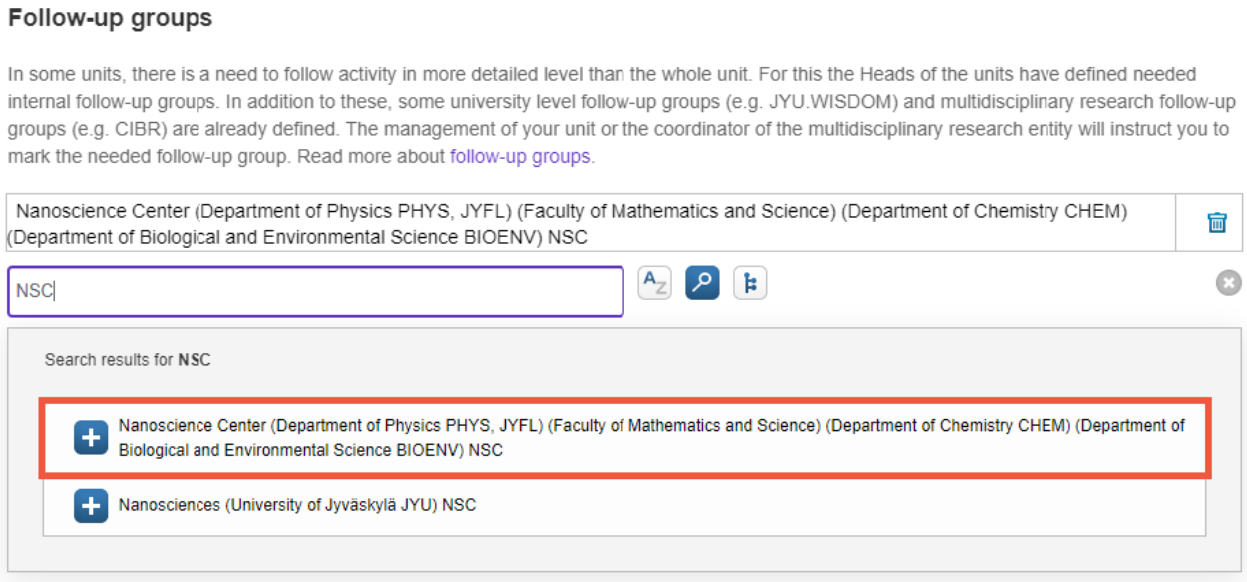
To make NSC affiliation of publications clearer. going forward, the NSC affiliation is added automatically if the author is part of NSC follow-up group in Converis. In this case it does not matter whether the NSC affiliation has been included as one of the affiliations on the publication itself. This will aid with identifying NSC publications where the affiliation might have been accidentally missing. The author is able to adjust the affiliation in case this automation makes erroneous assumptions.

## Keep your Converis profile updated

Visibility of one's research can be improved by keeping Converis profile updated. Once the website update realizes, researchers will have public profiles with automatically updated details from Converis. In addition, it is recommended to connect your ORCID digital identifier with your Converis profile. This way information included in Coveris will transfer automatically to ORCID.

**More information:**
https://uno.jyu.fi/en/current/archive/2022/11/20221114-converisreporting

If you need to update and modify your public research profile, the instructions are found under Converis in UNO Staff Portal. You can find your profile by following the section dedicated to experts. The required updates like adding a research interest or ORCID digital identifier can be accomplished by following the instructions on how to edit the research profile.



# WeNSC – Workshop for Enhancing NSC

As the restrictions for gathering started to fade a way in the beginning of 2022, the NSC board became hopeful and initiated the plans to organize the Workshop for Enhancing NSC, also known as WeNSC. The previous event had taken place in spring 2019, which meant that over three years had passed since the NSC staff had come together in an event like this. It was decided that the event would be held in September and a team of six was recruited to act as the organizing committee of the event.

### Dedicated program to enhance the community

WeNSC takes 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 researcher on all levels. This year, the program was combination of important talks, getting to know the NSC research, and a panel discussion with NSC alumni representatives.

After the bus ride to the venue, the event kicked off with scientific speed date between junior and senior participants. Loud and keen discussions ensued as 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 participants were given little bit of time to prepare their group presentations with the help of anything but PowerPoint before everyone got together for the talks of the day. First, Prof. Ari Jokinen from department of Physics (JYU) and Council of Natural Sciences, Academy of Finland, discussed research funding. Then, Jarno Mikkonen from Research and Innovation Services talked about patenting and valorization of science. Both presentations provided valuable insights to important aspects of conducting science and realizing the potential of one's ideas.

Before moving to the evening program, the first set of group presentations were set in motion. The audience got to enjoy very creative performances that had everything from dangerous props to unforgettable commitments to a role, not to mention belly laughs inducing humor. Then it was time to re-energize with outdoor activities or attending a yoga lesson before moving on to dinner and evening program.

The evening program was set off with a bang as the Nano Band got the audience feel like dancing by performing banger after banger. It was probably a good thing that the sauna was ready after the exhilarating performance. Accordingly, the evening continued with sauna and barbeque, and the bravest were rumored to continue the evening until the wee hours of the night.

Friday was welcomed gently with the possibility to familiarize oneself with the area or to gather likeminded people for outdoor activities like team sports. Since the next session consisted of the remaining group presentations, some also took the time to hone their performances. As we learned the previous day, the groups had truly had their creative caps on when designing the presentations and the second day brought forward another set of inventive creations. Consequently, the anything but PowerPoint format turned out to be so successful that the performances returned as Nano Theater during the Researcher's night couple weeks later. At Konnevesi, once all the performances had been seen, the audience voted for the best performance. As a results, Noora Aho, Pavel Buslaev and Ilia Sokolovskii won the award for the best project presentation of WeNSC 2022.

In the afternoon, the participants joined a panel discussion with two NSC alumni, Juhani Julin from Bluefors and Tero Isotalo from Kyocera Tikitin. Unfortunately, the third panelist, Mikko Leskinen from Fermion had to cancel his participation at the last minute. Short presentations from the panelists lead the discussion to the intricacies of academy and industry, widening the horizon for each of the participants.

All in all, it was a great and awaited pleasure to bring the NSC staff together to build connections and develop the NSC activities. Although the organizing committee is already working on ironing out some of the kinks for the next edition, there are undeniable advantages to gathering outside the typical work setting. The next WeNSC has already been booked, it will take place **April 19th and 20th 2023**, and the organizing committee has begun to design the program. Based on feedback, the NSC staff can expect more differentiated program for the junior and senior staff.

Thus, mark your calendars and get ready for the spring 2023. It might even be worth it to follow this excellent tip from one of the participating groups. They ventured to Konnevesi already before the event to have their own group meeting which was then followed by WeNSC. The group made it a multiday retreat and warmly recommend this format to other research groups as well. There are alternative accommodation options available nearby, should you prefer little bit more private setting.

# Introducing new NSC group leader

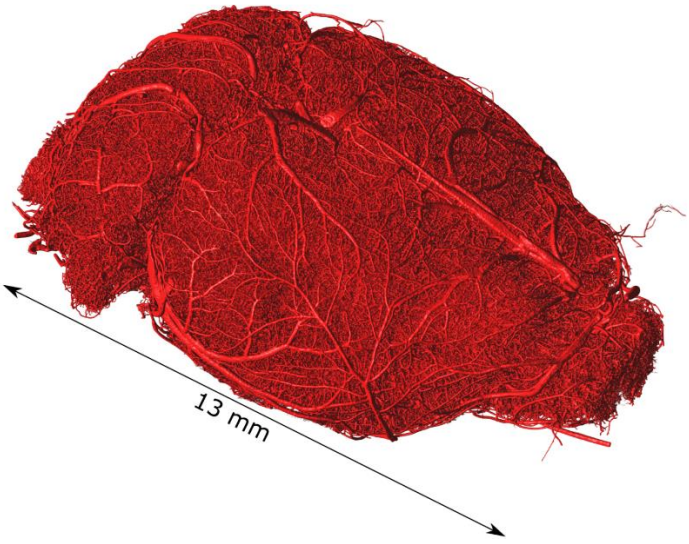
My name is Arttu Miettinen, and I work at the Department of Physics and NSC as a senior researcher, and in the Mid Sweden University as a guest researcher. Before the current positions, I spent some time at EPFL, ETH Zürich, and Paul Scherrer Institute as a post-doc.

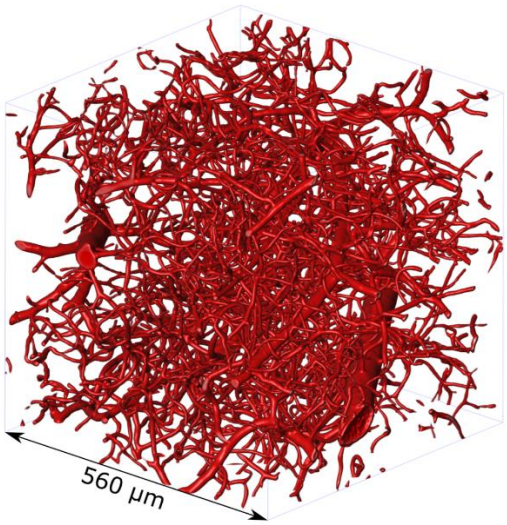
I lead the Complex Materials research group and run the X-ray Tomography Laboratory after retirement of the previous group leader, Prof. Markku Kataja. The focus of our research is characterization of the structure of materials by imaging methods. Often, we combine complex X-ray micro- and nanotomography measurements ¬to quantitative image analysis and other flavors of microscopy. Image analysis method and software development is also very much in our scope. In essence, we turn multidimensional image data into numbers describing the structure of the sample.

The research group consists of three PhD students, one post-doc, a laboratory engineer, and a varying number of research trainees and students. Current research topics include hydromechanics of swelling clays, moisture kinetics of wood materials, soil micro- and nanostructure characterization related to soil improvement and carbon storage, and terapixel-scale tomographic imaging to determine the structure of entire mouse organs with µm-scale resolution (see figure underneath).

In the future, I wish to strengthen the position of the research group as the leading X-ray tomography laboratory in Finland. On this road, I look forward to establishing fruitful collaborations with NSC groups working with applications of imaging and image analysis.

**More information:**
http://r.jyu.fi/complex_materials
http://r.jyu.fi/ct_lab



# IIT – Andrei Beliaev and Abhishek Pathak introduce the new collaboration program with the Indian Institutes of Technology

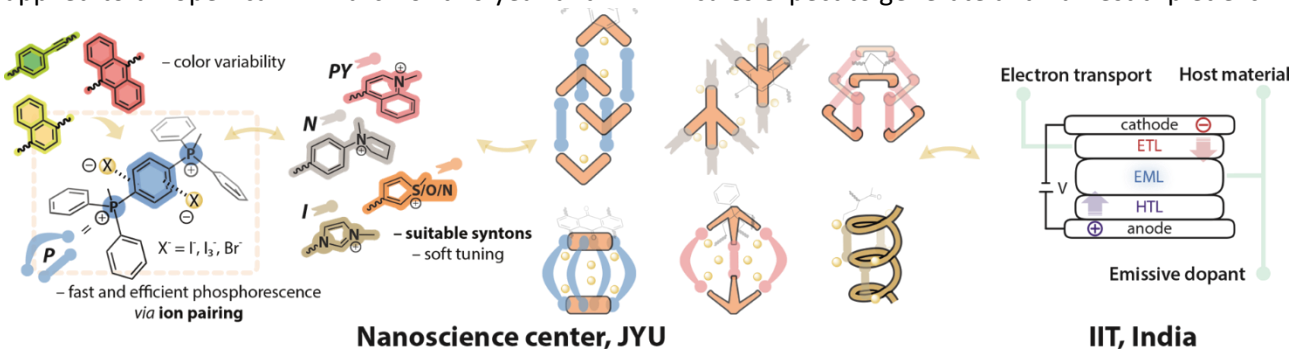
In 2022, the Ministry of Education provided earmarked funds for the faculty to be used to strengthen collaboration with Indian Institutes of Technology (IIT). The Dean decided to allocate the funding to NSC and as a result, NSC was able to hire two new Post Docs to two-year projects for this distinctive program. As a result, Dr. Andrei Beliaev and Dr. Abhishek Pathak were hired and now they have an opportunity to introduce the unique collaboration project with IITs and share their vision for the future.

## Indian Institutes of Technology

The history of the Indian Institutes of Technology or IIT dates back to the middle of the previous century when the first "Higher Technical Institution" in Kharagpur was established. Since then, the family of IITs has expanded to 23 interconnected members across the whole country, acting as an internationally recognized educational unit with research emphasis focused on high-end technologies. Accordingly, IITs are globally appreciated engineering and technological institutes in India and have maintained quality education with internationally acclaimed research facilities. IIT is established to train world-class scientists, engineers, and technologists. Thus, with the status of Institutes of National Importance, IITs increase industrial development and manufacturing by training the engineering expertise of the country. The program initiated between NSC and few of the 23 IITs, focuses on establishing new collaborative touches, aiming at mutually beneficial cooperation, comprehensive research, and both cultural and scientific exchange.

## Introduction to the Post Doc projects

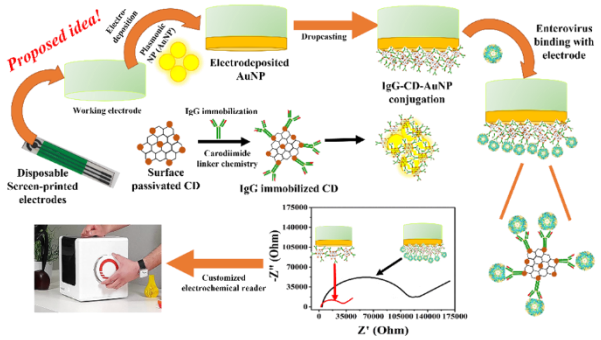
**Andrei:** Driven by passion to conduct my research in Finland with the project *"Nanoscopic entities generating fast triplet excitons for optronics"* I applied to an open call in March of this year and through a few stages of interviews later I become an NSC staff member of two research groups led by Ass. Prof. Fabien Cougnon and Dr. Tatu Kumpulainen. The research is focused on the design of novel hybrid ionic-based materials of nanoscopic size (rings and catenates, knots, nanoaggregates, capsules, molecular motors and supramolecular cages, see figure), exhibiting efficient phosphorescence with fast radiative decays and high quantum efficiencies, to provide a fundamentally new class of optically functional materials for innovative photonic sensors, light-emitting diodes, data storage, and luminescence switches. It is anticipated that phosphorescence is generated via the modulation of strong intra- and intermolecular interactions of conjugated systems with heavy atoms in cation-anion pairs. The proposed interdisciplinary studies include the synthesis, experimental and theoretical investigations of new generations of luminophores, constructed of (i) tunable optically active π–conjugated core decorated with (ii) positively charged pair functionalities, and bonded (iii) with flexible aliphatic or more rigid aromatic spacers (see figure). A key point of this study is the further utilization of the obtained materials in the device fabrication using facilities of the IIT centers in Kanpur and Delhi. As synthesized molecules expect to generate and harvest triplet exci-




**Concept design:** Interaction of the heavy counterion and charged chromophore leads to effective spin-flip change, allowing generation of emissive triplet states. The inclusion of such molecular building blocks in nano-objects makes them potential for efficient OLED. Structural and synthetic parts are performed at the NSC and Department of Chemistry, whereas the second stage – photonic device fabrication using synthesized materials – at one of the IIT centers.

tons they could serve as electron transport, host, and emissive materials in sandwich-type devices. Thus, selected candidates will be applied as materials to improve the electron injection/ transporting ability in multilayer OLEDs and organic photovoltaic (OPV) cells.

**Abhishek:** I have been recruited as a post-doctoral researcher to an interdisciplinary project under led by Prof. Varpu Marjomäki and Assoc. Prof. Jussi Toppari. The envisioned project proposed the applications of nanotechnology and biology to develop nanoparticle based optical and electrochemical biosensors for the detection of viruses. This collaboration allows me to join NSC to utilize several facilities for the synthesis and characterization of nanoparticles and use them for the development of biosensors. My research focuses on nanobiotechnology, especially on the synthesis of fluorescence carbon dots with its application in biosensor development for the sensitive detection of viruses. The project titled *"Rapid detection of enterovirus and virus uncoating using fluorescent carbon dots"* includes the design of nitrogen and sulfur doped surface passivated carbon dots with higher quantum yield. The bright fluorescent and multi-emissive carbon dots functionalized with the virus-specific antibodies and complementary oligonucleotide chain is developed to perform sensitive and selective detection of virus RNA and capsids and assist with revealing more details of the uncoating process during infection. The preliminary information about the uncoating suggests that at 37°C the viral genome (RNA) is released after entering endocytic vesicles during 2 h time before the RNA finally is released to the cytoplasm to promote genome replication and translation. Due to the lack of tools to directly visualize virus uncoating in endosomes, more details are still uncovered. The novel functionalized fluorescent CD are expected to facilitate the visualization and measurement of RNA release in cells. After the optimization of RNA visualization and measurement, a microfluidic device can be designed to use fluorescent carbon dots for detection. A custom-built set-up will be designed and built together with IIT. The standardized system can be assembled using 3D printed casing. The proposed reader can be used for a pilot scale study on clinical samples. We foresee good collaboration opportunities such as biomedical & instrumentation-based companies, healthcare, point-of-care diagnostics, biosensors-based research, and of course IIT.



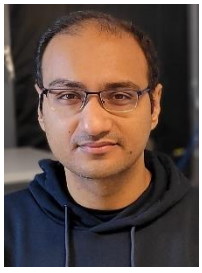

**Project idea:** The development of electrochemical biosensors to detect virus capsids by using surface functionalized fluorescent carbon dots in collaboration with NSC and IIT.

## Expectations for 2023

**Andrei:** Thus, for the following year, I'm looking forward to visiting India for a few months, which has been supported by the Otto A. Malm foundation recently. Within the following next months, I expect an acceleration of joint activities such as collaborative research, short and long-term internships to and from IIT network university, and together seminars leading to strengthening international connections and attracting the young generation for choosing JYU as a perfect host place for their research. Ultimately, the Indian institutes of Technology provide excellent research possibilities for fruitful collaboration on the proposed project. The research will undoubtedly benefit from this cooperation as the important contributions of highly competent partners make the investigation outcome more comprehensive. From another point of view, research collaborators from IITs will get access to the modern hi-end research infrastructure of the NSC at the University of Jyväskylä to enhance their own research to a certain extent.

**Abhishek:** The upcoming year is expected to be quite intriguing in terms of research outcomes from the designated project. The collaboration between NSC and IIT promises a quality research advancement. We aim at the establishment of virus detection sensors as a proof-of-concept followed by investigations on scalability of the idea to translate it into working prototype. The potential research groups from NSC and IIT ensures to address the challenges systematically with well-equipped technologies. I am also anticipating that the research development would bring us publications, invention disclosures and grants depending on the progress made under the current project.

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 2022?
5. What should researchers at NSC do together in year 2023?



1. I'm Abhishek Pathak, a Postdoctoral researcher in Prof. Varpu Marjomäki´s and Assoc. Prof. Jussi Toppari's groups. Over time, I have developed my expertise in the development of optical and electrochemical sensors using novel carbon quantum dots for the detection of biological entities such as biomarkers, biochemical assay, and microbial pathogens.
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 optoelectronic 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 level of professionalism and opportunities you get at NSC is impeccable. I would like to gain experience especially in the interdisciplinary environment by collaborating with the top-notch researchers in understanding the dynamics involve in the development of nanoprobe based biosensors.
4. I was involved in the development of the immunoassay type biosensors for the rapid detection and quantification of exosomes for screening non-small cell lung cancer (see publication).
5. I'm yet to explore the various activities going around but the lively atmosphere at the coffee room and in general makes NSC quite interesting. However, the sports activities and various interactive outings is something I'm looking for.

1. I'm Andrei Beliaev, and since July 2022 I'm a member of two research groups led by Dr. Tatu Kumpulainen, Molecular Photochemistry and Photophysics, and Assoc. Prof. Fabien Cougnon, Supramolecular chemistry.
2. Thus, my interdisciplinary project lies on the joint border of supramolecular chemistry and photophysics. The research includes syntheses of sophisticated luminescent entities branched with phosphonium chromophores and is further accompanied by a comprehensive study of their emission properties. The main goal is the utilization of promising materials in the construction of organic light-emitting devices. Since most of my work is performed in the laboratories, I visit NSC daily.
3. NSC attracted me as a place with a modern infrastructure and diverse open-minded researchers from different fields. On another hand, it is a great challenge for me to adjust my skills to nano-objects, improve my knowledge and study a new environment here.
4. The current year appears to be full of novel scientific adventures, however, a significant finding related to fast triplet emission from metal-free luminophores opens a pathway for highly efficient materials.
5. Even though Nanosauna is meant to be a calming and relaxing place after brainstorming, it would be awesome once a year to have a conference or scientific meeting right there. Moreover, I'm looking forward to the winter activities we can manage together.

1. I'm Dattatraya (Datta) Uttam Ukale, a postdoctoral researcher, working in Assoc. Prof. Fabien Cougnon's group at NSC.
2. We are mainly working in the field of molecular nanotopology especially exploring the molecular knots and links. I'm involved mainly in the developing the multiply-entangled de novo proteins. The aim of project is to identify a protein sequence that promotes its spontaneous folding into a knot. In addition to these, I'm also working on developing the molecular knots and links by exploiting the hydrophobic effects.

3. NSC is interdisciplinary research with well-equipped facilities, covers the research from all-natural sciences to the applied research at nanoscale, to explore and become a research expert in a wide range of applied research fields.
4. Our group developed the focus on synthesizing molecular knots and links effects by using innovative strategy (hydrophobic effect) in an aqueous medium. We are also working to synthesize the solomon links which will be useful for the recognitions of metal-ions.
5. During the following year, we are looking to collaborate with different research groups to work together.

1. My name is Alice Gable and I started my PhD studies in Fabien Cougnon´s group in October 2022. My core field at NSC is supramolecular chemistry.
2. My PhD project is about Multiply-entangled de novo proteins. We're trying to identify a protein sequence that promote its spontaneous folding into a knot. Finding such a sequence would allow to expand the range of de novo proteins available through rational design. I spent every day of the week at NSC because it is where I work and study for my PhD
3. I wanted to be part of NSC because I'm very interested on the research topic of the Cougnon´s group and I found here a PhD project that suits my interest in chemistry. Moreover, NSC has an attractive interdisciplinary environment.
4. I spent most of the year 2022 being a master´s student. During my master's degree internship I was able to synthesize a novel photoswitchable bis-dipyrromethane molecule that could serve as a photoswitchable moeity in the construction of calix[4]pyrrole receptor. For my PhD project I changed topic, working now on molecular knots, and I am very excited about this new area of research in supramolecular chemistry that I am just starting to discover and explore.
5. In year 2023, researchers at NSC should do some get-together activity (some outdoor activity like hiking ect...), 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 Batuhan Dogan, a doctoral student here in NSC and I work with Janne Ihalainen and Riitta Nissinen. My core field is Ecology and Functioning of Phototrophic Microbiome of Arctic Plants.
2. Right now, I have been working on identifying key Aerobic Anoxygenic Phototrophic Bacteria species associated with different plant species, habitats and seasons. I will also work on photosensory proteins such as bacteriophytochromes, LOV-domains, cryptochromes and rhodopsins, and their characterization.
3. The reason why I want to be a part of NSC is the high momentum and love of research at NSC. I am very happy to be at the center of fast-paced research.
4. In 2022, I learned new things about Rhodopsin- and Bacteriochlorophyll-Based Dual Phototrophy and I look forward to applying them in my own work based on my whole genome sequencing results.
5. It would be great to be involved in more journal club activities and more after-work activities.

1. My name is Kushagri Arora. I have joined Dr. Gerrit Groenhof's group as a PhD student. My core field at NSC is computational biomolecular chemistry.
2. My project involves understanding the effect of pH on various biological systems such as ATP synthase, phytochromes, and insect odorant binding proteins (OBPs). The work is done computationally using the constant pH molecular dynamics implementation (in GROMACS), recently developed by the group. I visit NSC five days a week.
3. I want to be a part of the NSC because it hosts researchers from different fields, which allows interdisciplinary research and provides opportunities to learn about the various approaches to a research question.
4. We were able to observe conformational changes in insect OBPs that occur as a result of pH changes in the sensillar lymph environment, using constant pH molecular dynamics. Further work is being carried out to better understand the mechanism of this change in protein secondary structure.
5. It would be nice to have get-togethers where we can come to know about the research going on in other groups.

# Research Outreach and Highlights

**Nordic Femtochemistry 2022**

After long wait and cancellations, the Nordic Femtochemistry meeting took place from 8th to 10th of June 2022, bringing together femtosecond scientists in Nordic and Baltic countries. The meeting was held at the Jyväskylä city center, and it provided a wide array of plenary speakers, and invited and contributed talks, combined with a poster session, sponsor presentations and a lab tour. The event organized even managed to fit in some cultural program as on the first night, the participants were welcomed to Jyväskylä with a dinner in the City Hall. All in all, the event brought together 57 scientists utilizing ultrafast lasers even beyond spectroscopy and imaging as well as control and processing of material. It is also worth mentioning that Nordic Femtochemistry 2022 gathered mostly international audience as 70 % of the participants were for example from Sweden, Denmark, Estonia, Lithuania, Germany, and Czech Republic.

**Researchers' night**

European science event, the Researchers' night, makes science familiar to the public. On 30th of September, coinciding with the City of Light event, the audience had the possibility to experience Researcher's night on-site. At the NSC, around 900 visitors explored nanoscience through various workshops and demonstrations. The research groups also presented their work in Nano-Theater.
**Read more:**
https://www.jyu.fi/en/current/archive/2022/10/8-600-visitors-at-the-researchers2019-night-in-jyvaskyla

**NSDays 2022**

The Nanoscience Days (*chair* Marko Melander) took place during 4th–5th October 2022. The event was held on-site, gathering 160 participants to follow high-profile plenary lectures, contributed communications selected based on abstracts, and a poster session. The topics consisted of a wide range of common interests between biologists, chemists, and physicists, generating a truly interdisciplinary event that has become the hallmark of NSDays.

**The Nobel Evening**


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 13th of December 2022. Typically for post COVID-19 events, the Nobel Evening had approximately 500 viewers online but only around 60 attendees onsite. The event followed the tried-and-tested format where the experts from University of Jyväskylä introduced this year's Nobel Prize winners. Two of the experts were supposed to be from the Nanoscience Center but in the end, Petri Pihko was unable to attend, and the chemistry Nobel awarded to the development of click chemistry and bioorthogonal chemistry was not introduced. This method laid the foundation for functionalized chemistry where molecular building blocks snap together and was then harnessed for mapping cells, contributing for example to more targeted cancer treatments. Tero Heikkilä discussed the physics Nobel awarded to experiments with entangled photons. The awardees demonstrated in groundbreaking experiments the potential to explore and control particles that are in entangled states, pioneering quantum information science. After the intriguing talks, the Scientific Director of the NSC Lotta-Riina Sundberg gave the closing words of the evening.
**Read more *(in Finnish)*:**
https://www.jyu.fi/fi/ajankohtaista/arkisto/2022/10/nobel-ilta-fysiikan-kemian-laaketieteen-kirjallisuuden-ja-taloustieteen-palkitut-aiheet-esittelyssa

## Greetings from the new assistant of NSC

My name is Kirsi Veijonen, and I started working as an assistant at the NSC on 1st of December 2022. My main responsibilities are at the Department of Chemistry, and at NSC I work part-time with a limited job description. I have worked almost four years at the university; at the Faculty of Information Technology for two years, and another two years at Chemistry. Previously, I worked as an assistant with entrepreneurs at Keski-Suomen Yrittäjät, and before that at Valtra Engineering & AGCO Corporation. Nice to meet you all!

## Highlights at NSC in 2022*

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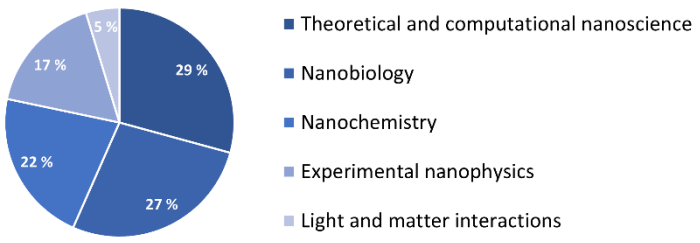
- V. Aho, S. Salminen, S. Mattola, A. Gupta, F. Flomm, B. Sodeik, J.B. Bosse, M. Vihinen-Ranta. *"Infection-induced chromatin modifications facilitate translocation of herpes simplex virus capsids to the inner nuclear membrane"*, PloS Pathogens 2021, 17(12): e1010132.

**37**
Group leaders*

**162**
Researchers*

**106**
Peer-reviewed publications**

| Top 5 | Author (No. of Publications) |
|---|---|
| 1. | Hannu Häkkinen (12) |
| 2. | Sami Malola (11) |
| 3. | Tero T. Heikkilä, Heikki M. Tuononen, Pauli Virtanen (7) |
| 4. | Gerrit Groenhof, Karoliina Honkala, Varpu Marjomäki (6) |
| 5. | Marko M. Melander, Lotta-Riina Sundberg, Perttu Permi (5) |




*Data taken from NSC websites on 9.12.2022

**Data taken from Scopus on 14.12.2022, affiliation search with keywords: Nanosci* and Univ* Jyvaskyla