



NBIA NEWSLETTER

NEWS IN BRIEF

VILLUM YIP GRANTS

Three young NBIA researchers have been awarded grants from the Villum Young Investigator Programme (YIP).

Postdoctoral researcher Mauricio Bustamante has been awarded a YIP grant for his project "Pushing Neutrino Physics to the Cosmic Frontier." The project will harness the vast potential of high-energy cosmic neutrinos to explore uncharted particle physics at the highest known energies in the Universe, far beyond the reach of particle accelerators. The grant will allow him to recruit two Ph.D. students and one postdoc over the next five years.

Novo Nordisk Foundation Assistant Professor Amin Doostmohammadi has received a YIP grant for his project "Engines of Life: Bioinspired Self-pumping Fluids." It investigates the physical conditions for the development of self-pumping flows of active matter: systems as diverse as sperms, bacteria, and tissues. The grant supports the hire of two Ph.D. students and two postdocs as well as the purchase of high performance computing facilities.

Louis-Hansen Foundation Assistant Professor Johan Samsing has been awarded a YIP grant for the project "Gravitational Wave Astrophysics: Dynamical Formation of Black Hole Mergers." The project will investigate how current and future gravitational wave detections can be used to probe how and where black holes form and merge in our Universe. The grant will allow him to hire one Ph.D. student and two postdocs over the next five years.

CARLSBERG GRANT

Associate Professor D. Jason Koskinen has received a three-year Young Researcher Fellowship from the Carlsberg Foundation with the title "NuFront: Neutrinos at the Physics Frontier." The project involves developing new data analysis tools and machine learning algorithms to make precision measurements of neutrino oscillations using the IceCube detector. The Carlsberg grant also supports critical preparation and optimization of the IceCube-Upgrade and allows Jason to hire up to two postdocs and one Ph.D. student.

EU COFUND GRANT

NBIA has received an EU COFUND grant to partially fund a number of both Junior Fellowships and Senior Fellowships at the NBIA. Selected fellows will have the opportunity to visit one of five partner leading institutions in Europe: Oxford, Cambridge, Heidelberg, CERN, and Saclay for a period of up to 6 months. Appointments will be made for a period ranging between 12 and 36 months. Further information and details of how to apply can be found on the main [NBIA web page](#).

A MESSAGE FROM THE DIRECTOR

Poul Henrik Damgaard

This Spring Newsletter is brought to you at a time when essentially all communication, even internally at the NBIA, takes place by electronic means only. Now more than two weeks into the lockdown of Denmark and the closing of the university, research at the NBIA is still continuing at more or less normal rate. In contrast to historic times when scientific communication with colleagues in other countries was excruciatingly slow, and could only be in writing, we are blessed with a number of means to make up for the lack of personal contacts. Conference calls, 'Zoom', 'Skype', 'Teams', ... And yet it is not quite the same. A seminar attended on-line only just does not have the same impact. We will soon celebrate the 100-year anniversary of Niels Bohr's institute. Niels Bohr realized how powerful the direct personal interactions are in science, and he changed the way we work. Sparks fly, ideas pop up and are shot down again, the race is on to outsmart others and be first with the right idea: This is what happens when you bring together a group of ambitious and talented young scientists. How we already now long to return to this mode of operation at the NBIA! So far, we have been forced to cancel two workshops in the spring. Hopefully, we will soon be back at full force. In the meantime, let us rejoice in the fact that no less than three young NBIA scientists received prestigious Villum Young Investigator grants earlier this year. You can read more about it to the left on this page.

THE VIEW FROM THE BOARD

Andrew D. Jackson

Robert Frost's 1914 poem Mending Wall begins with the observation that "something there is that doesn't love a wall" and ends with the statement that "good fences make good neighbors." Frost is neither for nor against walls and would prefer first to decide "what I was walling in or walling out." His poem is remarkably relevant today. The coronavirus and the resulting need for social distancing has forced us to build walls on scales ranging from the interpersonal to the international. Mending these walls is likely to be a necessity for years to come, and it will influence behavior patterns in physics. Theoretical physics has traditionally been a collective activity in which the accomplishments of individuals are written down and shared with the broader community for thoughtful evaluation and reaction. With time, however, this "collective activity" has evolved into what is better described as a "social activity." Senior scientists are often too busy to actually read the papers of junior colleagues. As a result, the evaluation and hiring of younger physicists relies increasingly on impressions made by oral presentations and informal face-to-face discussions. Inevitably, increased socialization benefits those who do not challenge received wisdom and penalizes those who do. The walls of social distancing will slow this process and give us the opportunity to ensure that our hiring practices are tuned to identify and recruit the most promising young scientists. It is my hope that the NBIA will be a leader in this reassessment.

NEW NBIA MEMBERS & VISITORS

This Spring, the NBIA welcomes two new staff members. You can find a brief description of their work below. We also give a warm welcome to our new Ph.D. students, **Raffael Gawatz**, **Ida E. Nielsen** and **Yueting Pan** (visiting from Beijing Normal University), and our new M.Sc. students, **Taro Valentin Brown**, **Gustav Uhre Jacobsen**, **Stef Koenis**, **Tetiana Kozynets**, **Rohan Kumar**, **John Montgomery**, **Jens Nyhegn**, **Marie-Louise Riis**, **Christian Dissing Schiøtt** and **Salik Ahmad Sultan**.



Chandana Mondal is a new postdoc working on active soft matter systems. She is interested in studying glassy behavior in such systems, the instabilities that occur naturally in the hydrodynamic approach to suspensions of self-driven organisms or filaments and the effect of finite geometries on these instabilities.



Evert Van Nieuwenburg joined as a new Louis-Hansen Assistant Professor, and studies the ways in which artificial intelligence and machine learning can help discover new breakthroughs in condensed matter physics and how they may help stabilize a quantum computer.

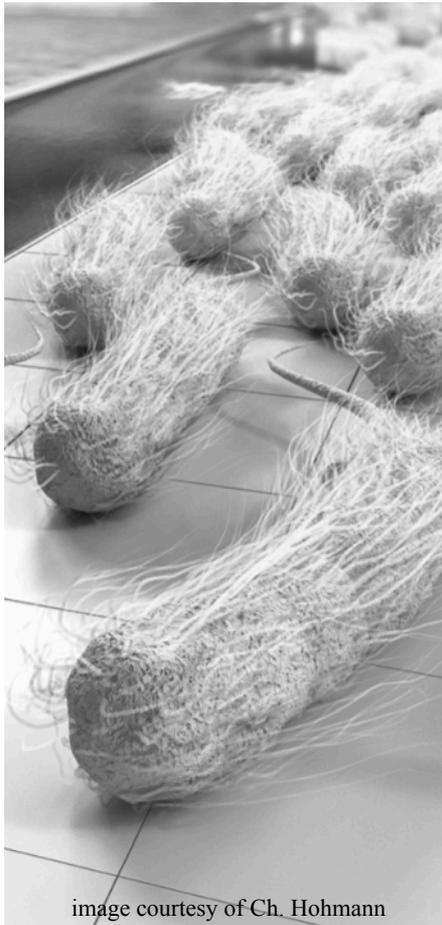


image courtesy of Ch. Hohmann

RESEARCH HIGHLIGHT on Soft Matter Physics and Active Matter

Amin Doostmohammadi

Soft matter physics lies at the heart of a quantitative understanding of many biological processes. From subcellular protein-driven flows to multicellular organ formation, biological matter continuously drives itself away from thermodynamic equilibrium using internal biochemical processes. In addition to their important biological roles, these intrinsically multiscale systems provide novel ideas for fundamental theories of non-equilibrium statistical physics and biomimetic inspiration for synthetic micro-machines capable of locomotion and self-organization. To tackle these diverse subjects, NBIA has recently launched an exciting new initiative to expand into soft matter physics and in particular the hot topic of active, self-organizing matter: Sperm cells, bacterial colonies, cellular tissues, and filaments inside living cells, all work as engines converting the chemical energy of their environment into motion, and are classified as “active materials.” Understanding the physics of active matter has enormous potential both for improved medical interventions and for targeted drug delivery. The key challenge is the gap between the scale of an individual particle and the scale of the collective motion. At NBIA we combine multiscale modeling — discrete and continuum simulations — with in-house experiments to address various aspects of complexities in active materials. This spans a wide range of problems from revealing the impact of mechanical forces on biochemical signalling in cells, investigating the dynamics of bacterial competition, to design and control of bio-inspired materials that are capable of self-organization, self-healing, and self-pumping.



UPCOMING WORKSHOPS

The present COVID-19 pandemic impacts the planning of NBIA activities. The following list of upcoming workshops is preliminary. An updated list can be found on our [NBIA web page](#).

- Current Themes in High Energy Physics and Cosmology (August 17–21)
- Simons Program: Frontiers of Cosmology and Gravitation (has been moved to **June 14–18, 2021**)

OUTREACH EVENTS AT NBIA

The Niels Bohr International Academy plans to continue the public lecture series “Frontiers of Physics” in fall 2020. These lectures are organized jointly with Folkeuniversitetet and will be held at the Niels Bohr Institute in the historic Auditorium A, from 5.15pm to 7.00pm. The talks on various topics in modern theoretical physics will be given in English by NBIA members. They will give you a glimpse of the questions, ideas and approaches right now at the scientific forefront. www.fukbh.dk

Niels Bohr International Academy, www.nbia.dk

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