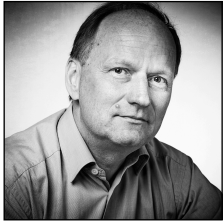


NBIA NEWSLETTER



A MESSAGE FROM THE DIRECTOR

Poul Henrik Damgaard

Combining Einstein's theory of general relativity with quantum mechanics has been at the top of the agenda of theoretical physics for almost a century. Curiously, the issue was touched upon by Max Planck already in 1899, long before both quantum mechanics and general relativity were developed. This was one year before Planck's discovery of the spectral formula for black-body radiation that in textbooks today is taken to be the beginning of the quantum era of science. Planck had the brilliant insight to see that by introducing a new dimensional constant of Nature (h , Planck's constant, introduced by him in order to match experimental data for Wien's law of radiation) one could define new universal units of length, mass, time, and temperature - those that we today call Planck units. These are totally universal because they refer to nothing specific at all: they are the units our Universe has been born with. Particularly interesting here is the Planck length constructed out of the speed of light c (relativity), G (Newton's gravity constant) and h (quantum mechanics) which we today reinterpret as the length scale at which relativistic gravity meets quantum mechanics. This natural scale of quantum gravity is so small (around 10^{-35} m) that the issue could be postponed until other fundamental physics laws had been uncovered. Today, there is no excuse for not considering it. In the text below this, NBIA Assistant Professor Alessia Platania briefly describes some of the work she and her Villum Young Investigator group is pursuing on the problem. A whole new series of weekly quantum gravity seminars, organized by Alessia Platania and her group, has also seen the light at NBIA, thus keeping us all abreast on new research in that area.

RESEARCH HIGHLIGHT on Quantum Gravity

Alessia Platania

General relativity provides a remarkably successful description of gravity at large scales. However, at high energies, where quantum effects become important, a complete theory of quantum gravity remains elusive. Several candidate theories, such as string theory and asymptotically safe gravity, propose different ways to unify gravity with quantum physics. A key challenge is determining which of these approaches to quantum gravity, if any, describes our universe. Comparing and testing alternative theories is an outstanding open problem. One difficulty is that different theories are formulated in distinct mathematical languages, making direct comparisons challenging. Additionally, gravity is a multi-scale phenomenon: while quantum gravity lives at Planckian scales, observational data span vastly different regimes, and theoretical constraints are often formulated at the level of effective field theory. At NBIA, the group led by Alessia Platania explores systematic ways to bridge these gaps, and test different theories. The core idea is to look at quantum gravity through the lens of effective field theory. Specifically, the group employs the mathematical version of a microscope to translate different high-energy features of gravity into their low-energy "landscapes"—the set of effective field theories stemming from different ultraviolet completions of gravity. This strategy allows to systematically identify intersections between theories and assess their compatibility with theoretical and observational constraints—ultimately helping to pinpoint the most promising ways to quantize gravity and their implications for cosmology and black-hole physics.



NEWS IN BRIEF

MERAC Prize to Johan Samsing

Assistant Professor Johan Samsing receives the European MERAC AWARD 2025 for "Best Early Career Researcher" from the European Astronomical Society, for his groundbreaking contribution to Gravitational Wave Astrophysics, and in particular for his work in understanding how black holes meet and collide in our universe. The MERAC Prize is awarded every two years by one of the European Astronomical Society. It is considered one of the most prestigious awards dedicated to young researchers in the field of astrophysics.

Jacob Bourjaily receives Lars Kann-Rasmussen Prize

At a ceremony on February 24, former NBIA Associate Prof. Jacob Bourjaily received the Lars Kann-Rasmussen Prize for 2025 "for his fundamental and original contributions to quantum field theory, guided by an on-going quest for both simplifications and deeper understanding". The Prize was presented by Lars Kann-Rasmussen to Jacob Bourjaily in Auditorium A following speeches by Deputy Dean of Research Lise Arleth, Head of Institute Joachim Mathiesen, and NBIA Director Poul Henrik Damgaard.

New Members of NBIA's Scientific Advisory Board

Julia Yeomans (Oxford University) and Charles Marcus (University of Washington and NBI) will join NBIA's International Science Advisory Board starting in 2025.

NEW NBIA MEMBERS

This Spring, NBIA welcomes new staff members. We also give a warm welcome to our new PhD students, **Simon Guldager Andersen** and **Francesco Ferrarin**.

Francesco del Porro is a new Postdoc in the Quantum Gravity group. He investigates different approaches to Quantum Gravity, including Asymptotic Safety, black hole physics and semiclassical effects in gravity.



Timofey Kozhukhov is a postdoctoral researcher working on computational biophysics. He is interested in designing numerical tools for the simulation of active matter, building towards the studies of biological mechanoreciprocity.



PUBLIC LECTURES AT NBIA

Frontiers of Physics: News from NBIA

This year, the series of public lectures organized by Assoc. Prof. Emil J. Bjerrum-Bohr (NBI) will feature Prof. Mogens Høgh Jensen (NBI), Associate Prof. Morten Bo Madsen (NBI), Associate Prof. You Zhou (NBI), Prof. Vitor Cardoso (NBI) and Prof. Julia Yeomans (Oxford).

This series of public lectures offers an exciting opportunity to stay up-to-date with the latest news from the Niels Bohr International Academy. In these events, five distinguished scientists will share their fascinating research. The lectures take place in the historic Auditorium A of the Niels Bohr Institute.

The tiles for the lectures for 2025 are detailed below.

1. Mathematics that describes the Complexity of Life (MHJ)
2. Colonizing Mars: Preparing For a New Era of Exploration (MBM)
3. ALICE in Wonderland: Mystery of the Early Universe (YZ)
4. The dark Universe: what's lurking out there? (VC)
5. The Physics of Living Matter (JY)

Time: Tuesdays from 17:15 to 19:00 (7/10-11/11), except 14/10

Venue: Auditorium A, The Niels Bohr Institute, Blegdamsvej 17

UPCOMING WORKSHOPS AND SCHOOLS

Please visit our [NBIA web page](#) for details and updates.

- Open Problems in Astrophysical Dynamics (June 10-13)
- PhD Summer School on Neutrinos (July 7-11)
- Current themes in Astro and Particle Physics (Aug. 25-29)

Coordinator: Gosia Dekempe (Tel. +45 35 33 78 70)

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Niels Bohr International Academy - www.nbia.dk

Niels Bohr Institute, Blegdamsvej 17, 2100, Copenhagen, DK

NEWS IN BRIEF (continued)

Two MSCA Fellowships to NBIA

Two young scientists have been awarded Individual EU MSCA Fellowships in the Theoretical Astrophysics group at the NBIA.

János Takátsy will work on the project “Cosmic Bells: Unveiling the composition of neutron stars with tidal oscillations”. János will combine field theoretical predictions with few-body simulations, to facilitate new methods for neutron star composition studies, which are pivotal for understanding strongly interacting matter.

Lorenz Zwick will work on a project titled “AstroWaveforms: Decoding the astrophysics of black hole binaries in individual gravitational wave signals”. Lorenz's work will demonstrate how the detection of environmental effects can reveal the physics of black hole environments.

Ziqi Yan receives Villum Young Investigator Grant

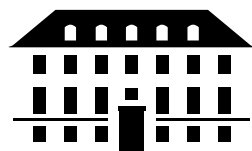
New Assistant Professor Ziqi Yan will join NBIA this coming fall with a Villum Young Investigator grant titled “Emergent Universe from Matrix Quantum Mechanics.” Ziqi's research lies at the interface of string theory, quantum field theory, and condensed matter theory, currently focusing on M-theory and their implications for holography and cosmology. With this grant, he will establish a junior research group with a postdoc and a PhD student.

Amin Doostmohammadi receives Carlsberg Foundation Infrastructure Grant

With an Infrastructure Grant from the Carlsberg Foundation, Amin Doostmohammadi and his group will acquire a Brillouin microscope to enable the exploration of mechanical properties of living systems at unprecedented scales. This advanced imaging tool will be the first of its kind in Denmark, extending the Niels Bohr Institute's research capacity, and opening new research opportunities.

Veria Pezeshkian receives 2024 Frank Blaney Award

Novo Nordisk Foundation Assistant Professor Veria Pezeshkian is the recipient of this year's Frank Blaney Award, which is administered by the international Molecular Graphics and Modelling Society, and whose objective is to support young researchers in the field of molecular modelling and computational molecular science.



The Niels Bohr
International Academy