NBIA NEWSLETTER

A MESSAGE FROM THE DIRECTOR

Poul Henrik Damgaard

While there are exceptionally good possibilities for research funding from both private and public foundations in Denmark, we must not overlook the comparable funding opportunities at the European level. The competition is fierce at the EU but the big advantage is that there is no regard to how many grants a given country or a given institution receives: all applicants are treated on an equal footing with the same stringent and very competitive criteria. As the funding opportunities for individual post-doctoral fellowships attached to an institution in Denmark have dwindled to almost zero (there is now only a scheme for bringing back Danes currently working abroad), the Marie Skłodowska-Curie Actions (MSCA) Individual Fellowships have become increasingly important for NBIA precisely because it is totally unbiased. Last year NBIA received four such individual two-year fellowships and this year we received a record five. This should be seen in the light of altogether around 135 such individual fellowships being awarded in physics in total in the EU. These years, NBIA thus receives around 3-4% of all MSCA Individual Fellowships in physics. Other EU funding programs are very important for us, too. NBIA's INTERACTIONS COFUND program is now running in its fourth year, providing important co-funding fellowships that require matching funds from Danish research grants. Finally, NBIA is proud of its record in terms of individual research grants from the European Research Foundation. Last year, Amin Doostmohammadi and Johan Samsing both received ERC Starting Grants and just a few weeks ago Irene Tamborra received an ERC Consolidator Grant. We congratulate all NBIA awardees with these brilliant achievements that are so important for us all.

UPCOMING WORKSHOPS AND SCHOOLS

Please visit our NBIA web page for details and updates.

- 26th Capra Meeting on Radiation Reaction in General Relativity (July 3-7)
- Workshop on Hyperboloidal Methods "Infinity on a Grid-shell" (July 10-13)
- 3rd PhD Summer School on Neutrinos "Here, There & Everywhere" (July 17-21)

NEWS IN BRIEF

LARS KANN-RASMUSSEN PRIZE 2022 FOR JOHAN SAMSING

Louis-Hansen Foundation Assistant Professor Johan Samsing has been awarded with the Lars Kann-Rasmussen Prize 2022 for his work on mergers of compact astrophysical objects. The Lars Kann-Rasmussen Prize is awarded annually to a young scientist who has already made unique contributions to physics and related areas. Johan receives the Prize for his seminal contributions to the understanding of new mechanisms under which compact astrophysical objects can merge under the emission of distinct gravitational wave signals, thus leading to a precise determination of the astrophysical environments in which such binary gravitational mergers can occur.

MULTIPLE GRANTS FOR WERIA PEZESHKIAN

Novo Nordisk Foundation Assistant Professor Weria Pezeshkian has been awarded a Sapere Aude Starting Grant from Denmark's Independent Research Fund for his project titled "Coupling Architectures of the Cellular Powerhouse to Energy Production States Using Computational Microscopy" and a Project Grant in the Natural and Technical Sciences 2022 from the Novo Nordisk Foundation for his project titled "Unraveling Conformations of High-genus Membranes." These grants will support the hire of three PhD students and two post-doctoral researchers.

VILLUM GRANT FOR JOSE MARÍA EZQUIAGA

NBIA Assistant Professor Jose María Ezquiaga receives a prestigious Villum Young Investigator Grant to conduct the project "Exploring the Uncharted Universe with Gravitational Waves." This project will exploit the recently discovered gravitational waves - ripples in space and time produced by extreme gravitational systems like colliding black holes - to open unique opportunities for exploring the cosmos. The grant from the Villum Foundation will allow Jose to build a team of PhD students and postdocs working at the interface of gravitational waves, cosmology and fundamental physics.

RESEARCH HIGHLIGHT on Gravitational Physics

Maarten van der Meer

The mergers of pairs of black holes are among the most luminous events in the Universe, briefly out radiating all visible stars. Yet, according to general relativity, they are also among the simplest, with a merger fully characterized by just 10 intrinsic parameters. The combination of these two remarkable facts makes binary black hole mergers ideal probes both for astrophysics and fundamental physics. Moreover, the advent of gravitational wave detectors like LIGO, Virgo, and KAGRA makes it possible to observe these events. In the Strong gravity group, we study the dynamics of these binaries in their highly non-linear stages. We study the impact of astrophysical environments such as dark matter clouds, or new physical effects beyond general relativity, and their observable signatures. However, even in the case of "plain" vacuum general relativity is a hard, not fully solved problem, which we strive to tackle in our group. This is important, since the better we understand the baseline signal, the more sensitive we become to small deviations due to new physics.

OUTREACH EVENT AT NBIA

The lecture series "From the Research Frontier at the Niels Bohr International Academy" shows a glimpse of various exciting front lines of modern research and was created in collaboration with the Niels Bohr International Academy (NBIA). All lectures take place at 17.15-19.00 in the fabled Auditorium A, Niels Bohr Institute, Blegdamsvej 17.

"*Reductionism strikes back*" - October 10, 2023
Asst. Prof. Berislav Buca, NBI

"*What matters to life? Searching for low-dimensional meaning in high-dimensional data*" - October 24, 2023
Assoc. Prof. Rosemary Braun, Northwestern University

"*Unveiling the Dark Universe with Gravitational Waves*"
October 31, 2023
Asst. Prof. Jose María Ezquiaga, NBI

"*The melting platform: Are climate extremes man-made?*"
November 7, 2023
Prof. Jens Hesselbjerg Christensen, NBI

"*Computational Microscopy of Cells*" - November 14, 2023
Asst. Prof. Weria Pezeshkian, NBI

organized by Assoc. Prof. Emil J. Bjerrum-Bohr, NBI

NEWS IN BRIEF (CONTINUED)

ERC CONSOLIDATOR GRANT FOR IRENE TAMBORRA

As the only recipient from the faculty of science this year, NBIA Professor Irene Tamborra has just been awarded an ERC Consolidator Grant from the EU. Irene Tamborra's ERC project aims at solving one of the most urgent riddles in modern particle astrophysics: how elementary particles, such as neutrinos, affect the physics of spectacular cosmic fireworks in the death of massive stars as core-collapse supernova explosions and in the merger of two neutron stars or a neutron star and a black hole.

FIVE INDIVIDUAL EU MSCA FELLOWSHIPS TO NBI

This year NBIA breaks a new record by five NBIA scientists receiving EU Marie Skłodowska-Curie Actions (MSCA) Individual Fellowships. The topics range from astrophysics, gravitational wave physics, to biophysics. We congratulate the awardees and list their research projects below.

Thomas Berlok has been awarded a Fellowship for the project "The plasma physics of galaxy clusters in a cosmological context" focussing on the physics of the intracluster medium found in galaxy clusters. This project will produce the first cosmological galaxy cluster simulations that move beyond the collisional assumption.

Jonas Berx has received a Fellowship to work on the project titled "Stochastic thermodynamics of biochemical replication." This project aims to utilize the recently developed framework of stochastic thermodynamics to study replication processes found in small biological systems.

Sarah Pearson has received a Fellowship for the project titled "Extragalactic Stellar Streams as Astrophysical Tools to Decipher Dark Matter." Sarah's project will lay the theoretical groundwork and fill the missing gaps in our knowledge of thin stellar streams from star clusters in other galaxies than the Milky Way.

Weria Pezeshkian has been awarded a Fellowship to work on the project "Conformations of High Topological Genus Membranes." The aim of Weria's project is to use a bottom-up computational approach, by combining multiple molecular simulation methods, to characterize the shape of high-genus membranes.

Alessandro Alberto Trani has been awarded a Fellowship for a project entitled "Unveiling galactic nuclei with gravitational waves." The project focuses on black hole mergers occurring in galactic nuclei, where the presence of a supermassive black hole and an accretion disc may uniquely affect the properties of the gravitational waves that we detect on Earth.

NEW NBIA MEMBERS AND VISITORS

This Spring, the NBIA welcomes a number of new staff members and visitors. You can find a brief description of their work below. We also give a warm welcome to our new PhD students, Marie Cornelius Hansen, Varun Venkatesh, and Pedro Dedin, our visiting PhD students, Antonio Ambrosone and Antonio Capanema, as well as our new MSc students Simon Guldager Andersen, Jonah Tobias Baerman, Júlia Cabrera Cortada, Patrizio Cugia di Sant'Orsola, Yoshiaki Horiike, Oddyseas Lazaridis, Yuchan Miao, Gowtham Rishi Mukkamala, Idris Nurlu, and Henri Schmidt.

Berislav Buča is a new Villum Young Investigator Assistant Professor. Previously, he worked at Oxford University. His field of research is non-equilibrium quantum many-body physics. At NBIA he will study exact solutions of many-body dynamics enabling study of otherwise intractable phases of matter.

Adam Chalabi is a new postdoc whose interests include conformal field theory, gauge theory, and supersymmetry. His current work investigates the role of boundaries and defects in conformal field theory. Many of the systems that Adam studies are inspired by string theory or condensed matter physics.

Jayeeta Chattopadhyay is a new post-doctoral researcher interested in active matter. Her research focuses on studying liquid-crystalline properties of rod-like particles through computer simulation. She will work on the collective cell integration phenomena.

Gosia Dekempe is our new NBIA administrator, responsible for onboarding new employees, coordination of guests and visitors, as well as organization of events, seminars, and communication. She holds a master's degree in economics from the Main School of Economics in Warsaw, Poland

Prashant Singh is a post-doctoral researcher whose research focuses on non-equilibrium statistical mechanics. He has worked on several topics such as active particles and stochastic resetting. Currently, he is exploring the field of stochastic thermodynamics with focus on its applications in biological settings.

Kristian Thijssen is a new postdoc in computational physicist interested in the dynamics of emergent collective phenomena, for instance in bacteria colonies, and how these systems can be controlled. Currently, he is looking at how these systems interact with reconfigurable surroundings and possible feedback loops.

Alessandro Alberto Trani works on few-body gravitational dynamics in the context of planets, black holes, and multiple systems. He joined NBIA as a Senior Interactions Fellow, and was recently awarded a Marie Curie fellowship to investigate the formation of gravitational wave sources in galactic nuclei.

Ding-Fang Zeng is a professor from Beijing University of Technology, visiting NBIA for one year. His primary research interests are Hawking radiation and the related missing information puzzle. He studies gravity-induced spontaneous radiation and the atom-like inner structure of black holes.

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