

# NBIA NEWSLETTER

## NEWS IN BRIEF

### ERC IN CONDENSED MATTER

Mark Rudner has been awarded with an ERC Starting Grant to expand his research group and explore new approaches in order to identify topological phenomena in driven systems and to obtain a broader and deeper understanding of quantum dynamics in non-equilibrium many-body systems.

### TWO VILLUM GRANTS

Jason Koskinen and newly hired Irene Tamborra have received Young Investigator Programme Grants from the Villum Foundation. Jason will test neutrino properties by adopting the Deep-Core sub-array of the IceCube Observatory. Irene will establish her research group to unveil the engine behind poorly known astrophysical transients by adopting neutrinos as messengers.

### SIMONS VISITING PROFESSORS

The NBIA has obtained generous support from the Simons Foundation under their "Targeted Grants to Institutes" program. The grant will help the funding of six Visiting Professorships starting July 2016 as well as thematic open programs.

### PUBLIC LECTURES AT NBIA

Thanks to the tremendous success we have had in previous years, we are proud to announce that NBIA is expanding the program of public lectures that we regularly organize with Folkeuniversitetet. The talks will be held in the historic Auditorium A at the Niels Bohr Institute, 24/10/16-22/11/16, 6.00pm-8.00pm. Sign up for courses 1052-1053 at <http://www.fukbh.dk>. More information is available on the next page.

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The Niels Bohr  
International Academy

## A MESSAGE FROM THE DIRECTOR

**Poul Henrik Damgaard**

This year, we add a new dimension to the NBIA activities. Thanks to an important grant from the prestigious **Simons Foundation**, we are launching a three-year program to host a number of Simons Visiting Professors. Concurrent with each of these positions, we will run thematic programs around scientific topics and new ideas that are of importance to the Simons Visiting Professors. The program starts already this fall with renowned cosmologist Viatcheslav Mukhanov, Professor of Physics and Head of the Astroparticle Physics Group at the Ludwig Maximilian University in Munich. Viatcheslav Mukhanov will spark a "Simons Program on Cosmology and Astroparticle Physics" until the end of the year. The first event in this program will be a two-week program on "Current Themes in Theoretical Particle Physics and Cosmology" in August, for which we expect an impressive list of leading figures in the field. Viatcheslav Mukhanov will also deliver one of the popular lectures in our series "News from the NBIA". An exciting new series of programs lies ahead of us.

## THE VIEW FROM THE BOARD

**Andrew D. Jackson**

There are many reasons why the continued success of the NBIA depends on its ability to attract the best and brightest young scientists from around the world. The success of our young people in attracting external resources — including significant support from ERC and Villum Foundation grants — has enabled the NBIA to maintain its current ambitious level of activity. It is a truism that nothing succeeds like success. There is no doubt that the scientific accomplishments of postdoctoral fellows past and current give the NBIA the visibility required to attract a steady stream of some 800+ annual applications to join us. The resources they have been awarded allow us to invite many of the best of those applicants to join us in Copenhagen. (See the group photo below. "Old timers" are hard to find!) Most importantly, we are proud of the scientific achievements of our young scientists. Their continued accomplishments will enable us to realize our goal of becoming the leading center for theoretical physics in Europe.



## UPCOMING EVENTS AT NBIA

### Workshops & PhD Schools

- First Workshop on the Physics of Excitatory Membranes (August 29-31)
- 4th ICM Theory and Computational Workshop (August 22-24)
- Current Themes in High Energy Physics and Cosmology (August 15-26)
- Fault-Tolerant Quantum Technologies (August 11-15)
- NBIA PhD-School: Neutrinos Underground & in the Heavens II (August 1-5)
- Strong and Electroweak Matter 2016 (July 14-27)
- Formation, Evolution, and Dynamics of Young Solar Systems (April 18-22)

## RESEARCH HIGHLIGHT on Neutrino Astrophysics

Irene Tamborra

These are exciting times for neutrino astro-physicists. On the one hand, the last Nobel Prize in Physics recognized the experimental efforts intended to prove the astonishing oscillatory nature of neutrinos. On the other hand, the IceCube telescope, a giant detector at the South Pole, just paved the way for a new neutrino astronomy era by detecting cosmic neutrinos with PeV energy, the highest energy ever observed in neutrinos. Neutrinos, however, still remain puzzling particles whose properties have not yet been fully disclosed. In fact world-leading institutions, such as CERN and Fermilab, have marked neutrino physics as research priority for the coming years, and several future-generation neutrino telescopes should become operative within the next decade. Among other sources, neutrinos are copiously produced in astrophysical environments ranging from stationary stellar sources to violent transient phenomena, which encompass a variety of energy spectra and time scales. Being weakly interacting, neutrinos escape unimpeded and carry information about their otherwise not accessible sources. Nevertheless, neutrinos strongly affect the source dynamics in ways that we still need to grasp. The prime focus of the NBIA neutrino astrophysics group is to shed light on the role of neutrinos in astrophysical environments, such as core-collapse supernovae and gamma-ray bursts, and to adopt neutrinos to learn about the source properties. Thanks to the Knud Højgaard and the Villum Foundations, this new born group joins the ongoing local efforts in astroparticle physics, aiming to place the NBIA at the forefront of this exciting and rapidly developing field.



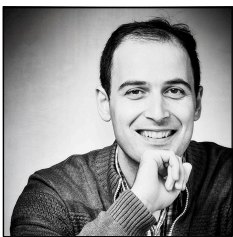
## NEWS FROM THE NIELS BOHR INTERNATIONAL ACADEMY

These public lectures are organized jointly with Folkeuniversitetet and will be held at the Niels Bohr Institute in the historic Auditorium A, from 6:00pm to 8:00pm. The talks on various topics in modern theoretical physics will be given in English by NBIA members on two different dates. They will give you a glimpse of the questions, ideas and approaches that are right now at the scientific forefront. Sign up for courses 1052-1053 on <http://www.fukbh.dk>

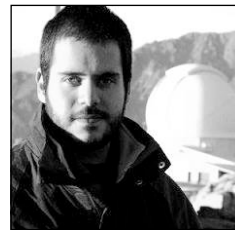
1. The Pauli Principle  
(Jan-Philip Solovej, 24-25/10)
2. Inflation and Modern Cosmology  
(Slava Mukhanov, 31/10-1/11)
3. What is Dark Matter?  
(Will Shepherd, 7-8/11)
4. Supernova Explosions and Neutrinos  
(Irene Tamborra, 14-15/11)
5. Towards Quantum Computing  
(Charles Marcus, 21-22/11)

## NEW NBIA MEMBERS AND VISITORS

This Spring, NBIA is joined by several new members, as well as visitors **Changyong Liu** (1.6.15-31.5.16) from NWSUAF in China, and **Roya Mohayaee** (1.9.15-31.8.16), and **Jacques Colin** (1.9.15-31.8.16), both from Institut d'As-trophysique de Paris.



**Ervand Kandelaki** is a new postdoc at NBIA working on non-equilibrium condensed matter physics. He is interested in understanding interactions on periodically driven many-body systems and studying related topological phases.



**Pablo Benítez-Llambay** joins the NBIA as a postdoc. He received his PhD from the University of Córdoba, Argentina, in 2015. His research focuses on planet-disk interaction and planetary migration in different physical environments.



**Shunji Matsuura** is a postdoc at the NBIA and the QDev. Shunji's research is in the areas of theoretical physics and quantum computations, focusing on topological phases, quantum entanglement, and quantum annealing.



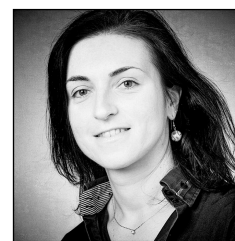
**So Matsuura** is a Visiting Professor from Keio University. His research focuses on the non-perturbative aspects of supersymmetric gauge theories. He is interested in supersymmetric lattice or matrix formulations.



**David McGady** is a postdoc whose research interests in quantum field theory include the S-matrix, new emergent symmetries and dualities between various dimensions, and ties to condensed matter and modular forms.



**Philipp Mertsch** joins NBIA as Assistant Professor. He has broad interest in high-energy astrophysics. Most recently, he has been working on modelling Galactic diffuse emission with applications to searches for dark matter and B-modes from inflation.



**Irene Tamborra** joins the NBIA as Knud Højgaard Assistant Professor. Her research activity is in theoretical astroparticle physics, it revolves around the role of active and sterile neutrinos in astrophysics and cosmology.