

NBIA NEWSLETTER

NEWS IN BRIEF

HOMI BHABHA MEDAL

Subir Sarkar, Niels Bohr Professor, received the Homi Bhabha Medal and Prize 2017 for his distinguished contributions in the field of high energy cosmic ray physics and astroparticle physics.

GRIBOV MEDAL

Simon Caron-Huot, NBIA Visiting Professor, is this year's recipient of the Gribov Medal. He receives this prestigious award for his groundbreaking contributions to the understanding of the analytic structure of scattering amplitudes and their relation to Wilson loops.

EPS PRIZE

Itamar Procaccia, Simons Visiting Professor, is the recipient of this year's Statistical and Nonlinear Physics Prize from the European Physical Society (EPS). The prize is given to Itamar Procaccia for his seminal contributions to nonlinear physics and the development of powerful theoretical approaches to describe complex phenomena.

ERC STARTING GRANT

Jacob Bourjaily, NBIA Assistant Professor, has been awarded a prestigious Starting Grant of 12 MDKK from the European Research Council (ERC) of the European Union. Jacob will use the new grant to vastly expand his program of the computation of scattering amplitudes to very high order in perturbation theory. He will use novel methods with deep connections to new developments in mathematics.

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The Niels Bohr
 International Academy

A MESSAGE FROM THE DIRECTOR

Poul Henrik Damgaard

This year we welcome four new post-docs to the NBIA. You can read about their research interests further down in the Newsletter, where we also introduce you to Visiting Professor James Cline from McGill University and Simons Visiting Professor Itamar Procaccia from the Weizmann Institute. Itamar Procaccia is also part of the NBIA's International Advisory Board, and it is wonderful to have a member of this Board spending a prolonged period with us. In connection with Itamar Procaccia's visiting appointment, the NBIA is organizing a string of Simons Program workshops this fall on topics of interest to him. Subjects range from recent developments in the theory of turbulence (including the exciting phenomena associated with 'quantum turbulence') to unusual properties of certain materials. Itamar Procaccia will also give a public talk on the fascinating subject of "Numbers in Nature, Art and Architecture." Invitations to this lecture have already been sent out. In terms of outreach, we continue with the popular series of "News from the Niels Bohr International Academy" evening lectures this coming fall. You can read the detailed program on the next page. Meanwhile, research funding for the NBIA fortunately continues to progress. The EU provides the most prestigious research grants (known as 'ERC grants') available in Europe, awarded in a very tough international competition. The NBIA has done incredibly well in that context: In the past five years, five young scientists at the NBIA have received ERC Starting Grants. Just three weeks ago NBIA's Jacob Bourjaily received the latest — an ERC Starting Grant of 12 MDKK to support his program of a new formulation of scattering amplitudes. Another leap into exciting and world-leading research at the NBIA.

THE VIEW FROM THE BOARD

Andrew D. Jackson

Every year of postdoctoral funding that sends a Dane to study abroad represents a potential contribution to Danish "brain drain." When used to bring international applicants to Denmark, similar funding has the potential to contribute to Danish "brain gain." The NBIA has made a major contribution to realizing this potential. As a result, Matthias Christandl, Charles Marcus, Martin Pessah, Mark Rudner, Subir Sarkar, and Irene Tamborra have all become members of the University of Copenhagen faculty. Each of them has succeeded in the creation of exciting new research programs that have extended the scope of the NBIA and enhanced Denmark's reputation as an international leader in theoretical physics. As noted elsewhere in this Newsletter, our current post-doctoral fellows continue to have success in the increasingly stiff competition for international funding. (EU resources have become essential as Danish research funding is increasingly being diverted from the support of genuine brain gain to potential brain drain.) We have attracted the best and the brightest. The only limit to the number of brains that we can gain is that set by the number of available University positions. I am convinced that the success of NBIA's recruitment program is due to the uncompromising insistence that our post-doctoral fellows must meet the highest standards of scientific quality. Indeed, the de facto motto of the NBIA is " 'Good enough' is just not good enough"! We intend to keep it that way.

UPCOMING EVENTS AT NBIA

Workshops

- Simons Program: Transition to Turbulence (October 23-27)
- Simons Program: Nonlinear Physics of Soft and Hard Materials (November 20-23)

RESEARCH HIGHLIGHT on Astroparticle Physics

Markus Ahlers

Among the most extraordinary phenomena in our Universe is the existence of high-energy cosmic messengers in the form of cosmic rays, gamma rays, and neutrinos. The record holders are cosmic rays that can reach energies that are ten million times higher than the energies achievable in man-made accelerators like the Large Hadron Collider. The question where or how these particles can be accelerated to these extreme energies has puzzled scientists for more than a century.



Neutrino astronomy is a key to directly solving this puzzle: cosmic ray sources can be exposed by observing the high-energy neutrinos produced in cosmic ray interactions with gas or radiation. Neutrinos interact only weakly with matter and can thus cross cosmic distances without being absorbed or scattered. Researchers at NBI are part of a large international collaboration that searches for these elusive particles with the IceCube observatory - a gigaton ice Cherenkov telescope located at the South Pole. Only recently, IceCube was able to first identify a flux of high-energy astrophysical neutrinos that is consistent with a diffuse flux emerging from a currently unknown population of extra-galactic sources. This observation marks the birth of neutrino astronomy and opens a new window onto the high-energy Universe. The identification and characterisation of these sources is part of ongoing research of the Astroparticle Physics group at NBI. One strategy followed by Assistant Professor Markus Ahlers consists of identifying neutrino source models that provide a consistent description of multi-messenger data including cosmic rays and gamma rays. These source hypotheses can then be tested in dedicated data analyses by the NBI IceCube group.

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 5:15pm to 7:00pm. The talks on various topics in modern theoretical physics will be given in English by NBIA members, each on two different dates. They will give you a glimpse of the questions, ideas and approaches right now at the scientific forefront. Online registration will soon be open at <http://www.fukbh.dk>.

1. Enigmatic Protoplanetary Disks (Oliver Gressel, 7-9/11)
2. The quest for Quantum Gravity (Matt von Hippel, 14-16/11)
3. Tales of the Particle World (Ilaria Brivio, 21-23/11)
4. Gravitational Echoes from the Past (Pavel Naselsky, 28-30/11)
5. Seeing the Edge of the Universe (Subir Sarkar, 5-7/12)

NEW NBIA MEMBERS AND VISITORS

This Fall, NBIA welcomes a number of new postdoctoral members and visitors working in a wide range of fields within Physics as described below. We give a warm welcome to our new PhD students Andreas Helset and José Pedro Vieira, who is a visitor from University of Sussex, as well as our new MSc students Abdurrahman Barzinji, Solvej Knudsen, Klaes Møller, and Anna Suliga. We also welcome Assistant Professor Jane Dai who has just started her joint appointment between DARK, CTA, and NBIA. You can read more about her research interests in the next Newsletter.



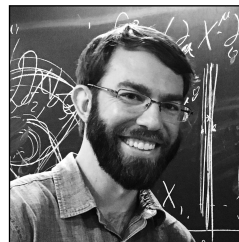
Mauricio Bustamante is a new postdoc at the NBIA. His area of research is high-energy astroparticle physics. He works on modelling the emission of astrophysical neutrinos and ultra-high-energy cosmic rays, and exploring new physics at the highest energies.



Carlos Cardona is a new postdoc at the NBIA. His research interests focus on physical and mathematical aspects of scattering amplitudes in high energy physics, as well as the study of dualities between gravity theories and conformal field theories.



Jim Cline is a visiting professor from McGill University (Montreal) during Fall 2017. His interests include astroparticle and collider phenomenology, models of dark matter, and the baryon asymmetry of the universe.



Andrew McLeod studies the mathematical structure of scattering amplitudes in quantum field theory, working to elucidate their unexpected properties and develop novel computational techniques. He joins the NBIA as a postdoc.



Itamar Procaccia is Simons Visiting Professor at the NBIA this fall. He is a physicist (and chemist) who works on the interface of subjects in statistical physics, nonlinear dynamics and the theory of turbulence.



Matt von Hippel is a new NBIA postdoc focused on scattering amplitudes. Recently he has worked on bootstrapping amplitudes in $N=4$ super Yang-Mills from an ansatz of polylogarithms with physical constraints.