

NBIA NEWSLETTER

NEWS IN BRIEF

ERC IN ASTROPHYSICS

Oliver Gressel has received an ERC Starting Grant to investigate the physical conditions in protoplanetary disks around young stars employing massive supercomputer simulations. This will allow astrophysicists to better understand the environments in which planets form and help interpret upcoming observations with the ALMA telescope.

ERC IN PARTICLE PHYSICS

Guido Festuccia has received an ERC Starting Grant to form a research group that will aim at solving some of the most complex problems associated with strongly coupled quantum field theories, exploring their connections with gravity, and making new connections between Physics and Mathematics.

YOUNG INVESTIGATOR AWARD

Michael Trott has received a Young Investigator Award from the Villum Foundation to study the properties of the Higgs boson recently discovered at the Large Hadron Collider.

OUTREACH AWARD

Jacob Bourjaily has received the Casey Award for public outreach from the Public Museum of Grand Rapids, Michigan, USA.

PRL EDITOR'S SUGGESTIONS

Emil Bjerrum-Bohr and collaborators have had a paper highlighted as an "Editors' Suggestion" of Physical Review Letters. The paper concerns the use gravity as an effective field theory, a systematic low-energy expansion of the otherwise unknown underlying quantum field theory of gravity.

A MESSAGE FROM THE DIRECTOR

Poul Henrik Damgaard

With this second NBIA Newsletter we are reaching out to a much larger group of people. Inspired by analogous initiatives at similar institutions abroad, we have set up an expanding 'Friends of the NBIA' group of interested individuals from the Copenhagen area, including almost all who followed our series of popular lectures 'News from the Niels Bohr International Academy' last fall. We are delighted to see this interest in the research that is taking place at the NBIA, and especially to have the opportunity to reach out with lectures about front-line research. The series of popular lectures continues this fall: you can see the program of talks elsewhere in this Newsletter.

As it is evident from the list of recent news items on the left, the past few months have been good for us. One of the Villum Young Investigator Grants for Associate Professors this year was awarded to NBIA scientist Michael Trott, who is spearheading a new and systematic way to analyze and understand upcoming data from the Large Hadron Collider at CERN. Two ERC Starting Grants from the EU were awarded to NBIA scientists: one to Oliver Gressel who works on the theory of astrophysical accretion disks, and one to Guido Festuccia who works on applications of supersymmetry in both particle and condensed matter physics contexts. All of these prestigious grants are given out on a highly competitive basis. Several other individual grants, including post-doctoral fellowships from both the Danish Science Research Council (FNU) and the EU Marie Curie Fellowship program have been awarded to members of the NBIA this past fall, again on a highly competitive basis. The first permanent hire in the 7-year history of the NBIA happened towards the end of 2014 when NBIA scientist Martin Pessah was promoted to Professor at the Niels Bohr Institute.

THE VIEW FROM THE BOARD

Andrew D. Jackson

The NBIA was founded on the conviction that talented scientists enjoy working with others of similar ability. All that we had to do was recruit the best. This strategy has succeeded. The scientific success and infectious enthusiasm of our young people and the strength of our scientific Board of Directors have given the NBIA plenty of attention and a strong international reputation. But Denmark is a peculiar country where international success is a necessary — but not sufficient — condition for national recognition. We will address this problem by forming an NBIA Director's Council consisting of an exciting collection of people from the worlds of business, politics and the arts, all of whom have made significant contributions to contemporary Danish society. Their role will be to assist the NBIA in becoming more visible within Denmark and to convince Danes that we are doing things that they can genuinely be proud of. I cannot announce the names of the members of the Director's Council, but you will be able to find out who they are in the next newsletter.

UPCOMING EVENTS AT NBIA

Workshops & PhD Schools

- Current Themes in High Energy Physics and Cosmology (August 17-21)
- PhD School on Protoplanetary Disks and Planet Formation (August 3-7)
- Oxford-NBIA Colloquium (April 13-15)
- Cosmology and astro-particle physics: from the LHC to Planck (April 7-9)

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The Niels Bohr
International Academy

RESEARCH HIGHLIGHT on Theoretical Particle Physics

Michael Trott

With the discovery of a Higgs-like boson in 2012, a long sought after particle finally emerged onto the experimental stage in particle physics. Now that the Large Hadron collider (LHC) experiments, and other facilities, know that a scalar particle intimately connected with Electroweak symmetry breaking is experimentally accessible at 125 GeV, the detailed study of its properties is well under way. Many of the decays of this new particle have been already measured to 10% accuracy, and with the restart of the LHC in 2015, the precision of these measurements is expected to be pushed to the percent level in the coming years. These dramatic experimental advances require equally dramatic advances in the theoretical framework used. Due to the lack of evidence (to date) of states other than the Standard Model particles, it makes sense to study the Higgs in a general theoretical framework where all other states (and possibly new interactions) are assumed to be small deviations to the Standard Model theory, suppressed by a large mass scale. Systematically developing a theoretical framework of this form to study the Higgs, and to place it in the proper experimental context, is the prime focus of the Effective Field theory Phenomenology group at the NBIA. With the support of the European Research Council and the Villum Foundation, a focused theoretical effort of this form is rapidly growing at NBIA. The excellent academic environment, and the significant academic support for building up a theoretical effort of this form, has placed the NBIA at the forefront of this emerging science of precision Higgs phenomenology.



NEWS FROM THE NIELS BOHR INTERNATIONAL ACADEMY

These public lectures are organized jointly with Folkeuniversitetet and will be held at the historic Auditorium A at the Niels Bohr Institute, 1/10/15-29/10/15, 5.15pm-7.00pm. The lectures will be given in English by five NBIA members presenting different topics in modern theoretical physics. The purpose will be to give a glimpse of the questions, ideas, and approaches which are right now at the scientific forefront. Keep an eye on <http://www.fukbh.dk> for how to sign up!

1. Quantum Gravity (Emil Bjerrum-Bohr, 1/10)
2. Black Holes and Entropy (Cindy Keeler, 8/10)
3. The Dark Energy of the Universe (James Cline, 15/10)
4. Plasmas and the Sun-Earth Connection (Jacob Trier Frederiksen, 22/10)
5. Quantum Information Theory (Michael Kastoryano, 29/10)

NEW NBIA MEMBERS and VISITORS IN SPRING 2015



Cynthia Keeler joins the NBIA as a postdoc. After obtaining her PhD from University of California at Berkeley in 2008, she held postdoctoral positions at Harvard University (2008-2011) and University of Michigan (2011-2014). She arrived at NBI in Fall 2014, and will become a Marie Curie Fellow in the fall.

Cynthia's research is in the area of high energy theoretical physics, focusing on dualities between gravitational systems and strongly coupled field theories. She studies both novel forms of dualities which may allow applications to non-relativistic regimes, and novel calculation techniques to study the underpinnings of all gauge-gravity dualities.



Kelvin Richards is joining the NBIA as a visiting professor from January to June 2015. Kelvin is a Professor in Oceanography and the Director of the International Pacific Research Center at the University of Hawaii. His research interests include observations and modeling of ocean processes, turbulent dynamics in the ocean and atmosphere and its impact on the climate system, as well as the impact of physical processes on the marine ecosystem.

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Mike Schechter joins the NBIA and the Center for Quantum Devices as a postdoc. Mike obtained his Ph.D. at the University of Minnesota. His research involves understanding the low-temperature magnetic structure of atoms placed on a metallic or superconducting substrate. The intriguing interplay between the

magnetic and electronic properties of such systems may lead to important applications in future quantum information processing techniques or spintronic devices.



Ben Brown is a postdoc at the NBIA, in the Quantum Information group of Michael Kastoryano. He received his Ph.D. at Imperial College London in 2014, and arrived in early 2015 after completing a one year fellowship in the Controlled Quantum Dynamics Theory Group at Imperial College. His research interests include quantum error

correction and the application of topologically ordered phases for realizing scalable quantum computation.

We also welcome **Dennis Hansen** and **Sunny Vagnozzi**, who join the NBIA as MSc student and visiting student, respectively.