Activities in the Astroparticle Physics Group
Niels Bohr Institute, Copenhagen (2013-16)

Niels Bohr Professorship 2013-18

http://astropart.nbi.ku.dk/
http://nbia.nbi.ku.dk/astropart/people/

Niels Bohr Professor
Jason Koskinen (2013-)

Administrator, NBIA
Anette Studsgard

Researcher-in-Charge
Poul Damgaard

Director, NBIA
Pavel Naselsky

Head, Particle
Peter Hansen

Physics & Cosmology
Irene Tamborra

Knud Højgaard
Assaf Ben-David (2013-15)

Assistant Professor
Will Shepherd (2015-16)

Mohamed Rameez (2016-)

Xiaoyuan Huang (2016-)

Just appointed

IceCube group

IceCube group

Post-docs

Roya Mohayaee (2015-16)

Jacques Colin (2015-16)

Jim Cline (2015)

PhD students

Michael Larson (2014-)

Morten Medici (2014-)

Jeppe Nielsen (2013-)

Amel Durakovic (2014-)

Jenni Adams (2013-14)

Visiting professors

Roya Mohayaee (2015-16)

Jim Cline (2015)

IceCube group

+ summer students
+ Master, Bachelor students
+ seminar speakers,
+ other visitors...
Paul Hunt
18 August 2016
Paul Hunt, LLU Munich, is visiting NIBA during 18-24 August with Amal Durakovic and Subir Sarkar

Steen Hannestad
01 August 2016
Steen Hannestad from Aarhus University lectured at the NBI School on Neutrininos Underground & in the Heavens II 1-5 A

Eligio Lisi
31 July 2016
Eligio Lisi from INFN Bari lectured at the NIBA PhD School on Underground & in the Heavens II 1-5 August

Teresa Montaruli
31 July 2016
Teresa Montaruli from University of Geneva lectured at the NBI School on Neutrininos Underground & in the Heavens II 1-5 A

Geroge Johnson
25 July 2016
George Johnson is a visiting DPN student of Subir Sarkar from University of Oxford during 25 July to 20 August

Pankaj Jain
23 June 2016
Professor Pankaj Jain (Indian Institute of Technology, Kanpur) is visiting the Niels Bohr International Academy June 28-29 to give a seminar on "Large Scale Aristotrey in the Universe" and have discussions with Raya Merayee and Subir Sarkar.

Kai Schmidt-Hoberg
21 June 2016
Dr Kai Schmidt-Hoberg (DESY, Hamburg) visited June 20-22 to give a seminar on "The case for dark matter self interactions - evidences and have discussions with Subir Sarkar.

Lisa Randall
8 June 2016
Professor Lisa Randall (Harvard) gave a HET/Discovery seminar on "New Models of Dark Matter".

Felix Yu
7 June 2016
Dr Felix Wu (NUI Galway) spoke in the HET/Discovery seminar on "The Cosmological Cuts and Mixing Resonance and HET searches".

Mauricio Bustamante
13 May 2016
Dr Mauricio Bustamante (OSU) visited 12-16 May to give a HET-Discovery seminar on "New physics in high-energy astrophysical neutrinos" and have discussions with Irene Tamborra.

Niayesh Afshordi
3 May 2016
Professor Niayesh Afshordi (Perimeter Institute, Waterloo) gave a HET-Discovery seminar on "Cosmological non-Constant Problem: Astrophysical limits of Particle Physics".

David Wiltshire
19 April 2016
Professor David Wiltshire (University of Canterbury) is visiting 17-19 June to speak in the HET-Discovery seminar on "Models of Inhomogeneity and Inflationary Cosmology" and have discussions with Raya Merayee.

Suvodip Mukherjee
18 March 2016
Mr Suvodip Mukherjee (IUCAA, Pune) is visiting the Niels Bohr International Academy & Discovery Center for 1 month from March 21. Read more

Kenneth Clark
08 February 2016
Kenneth Clark from University of Toronto will visit the Discovery Center and the Niels Bohr International Academy from February 27 for a period of 3 months. Read more

Ruth Durrer
7 January 2016
Ruth Durrer from University of Geneva will visit the Discovery Center and the Niels Bohr International Academy January 7-8 to give a seminar.

Krzysztof Gorski
14 December
Dr Kris Gorski (Caltech) is visiting 13-16 December to give a Discovery/NBIa seminar on "The Future of Cosmology with TPF and have discussions with Pavel Navody and Subir Sarkar.

Syksy Räsänen
11 December
Dr Syksy Räsänen (Helsinki) visited 10-14 December to examine Master's thesis of Ahti Heinonen and give a talk on "Gamma - the FIN metric".

Jonathan Cornell
15 November
Jonathan Cornell from Cornell University is visiting the Discovery Center from November 15-20 to give a seminar and discuss with Subir Sarkar. Read more

Katherine Freese
01 October
Katherine Freese from Norbert is visiting the Discovery Center Niels Bohr International Academy October 1-4. Read more

Philipp Mertsch
25 September
Philipp Mertsch from Stanford University is visiting the Discovery Center and the Niels Bohr International Academy September 25-30 to Subir Sarkar. Read more

Kimmo Kainulainen
22 September
Kimmo Kainulainen from Jyväskyla University is visiting the Discovery Center and the Niels Bohr International Academy September.

Subodh Patil
04 September
Subodh Patil from CERN will visit the Discovery Center and the Niels Bohr International Academy in period 13-19 September

Irene Tamborra
03 September
Irene Tamborra from University of Amsterdam will visit the Discovery Center and the Niels Bohr International Academy in October.

Steven Abel
05 November
Stiven Abel, Durham University is visiting the Discovery Center October 10-12. December. Read more

Jonathan Davis
29 October
Jonathan Davis from Durham is visiting the Discovery Center and the Niels Bohr International Academy October 29-31. October 2014 to give a seminar. Read more

Patrick Fox
23 September
Patrick Fox, Fermilab is visiting the Discovery Center and Niels Bohr International Academy September 24-29, 2014 to work with Tristan Denner. Read more

Joachim Kopp
06 June 2016
Joachim Kopp, Max Planck Institute for Nuclear Physics, will visit the Discovery Center and the Niels Bohr International Academy June 8-15 to work with Tristan Denner and to give a seminar. Read more

Igor Novikov
04 April 2014
Igor Novikov from Moscow is visiting the Niels Bohr Academy and the Discovery Center in the period April 4 - April 13. Read more

and many more...
NBI-forskere er med i front

Blandt artiklens forfattere er fem forskere fra Niels Bohr Institutet (NBI) på Københavns Universitet, for NBI er nemlig med i IceCube-samarbejdet. En lille gruppe på instituttet arbejder med at analysere data fra detekturen.

Have galactic 'radio loops' been mistaken for B-mode polarization?

En ny studie af forskere fra Niels Bohr Institutet (NBI) på Københavns Universitet har ifølge en ny studie af forskere fra Niels Bohr Institutet (NBI) på Københavns Universitet, for NBI er nemlig med i IceCube-samarbejdet. En lille gruppe på instituttet arbejder med at analysere data fra detekturen.

Radio loop emissions, rather than signatures of the early universe, could account for the observation of B-mode polarization announced by the BICEP2 collaboration earlier this year. That is the claim of a trio of cosmologists that has found evidence that local structures in our galaxy generate a polarized signal that was previously unknown to astronomers studying the cosmic microwave background (CMB).

The new foreground, which can be detected in the radio and microwave frequencies, is present at high galactic latitudes and could potentially be misinterpreted as a B-mode polarization signal caused by primordial gravitational waves, thus casting doubt on the BICEP2 finding.

Professor Brian K提交的 "Radio loop emissions, rather than signatures of the early universe, could account for the observation of B-mode polarization announced by the BICEP2 collaboration earlier this year. That is the claim of a trio of cosmologists that has found evidence that local structures in our galaxy generate a polarized signal that was previously unknown to astronomers studying the cosmic microwave background (CMB).

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http://nbia.nbi.ku.dk/astropart/news/
PUBLICATIONS

First combined search for neutrino point-sources in the Southern Hemisphere with the ANTARES and IceCube neutrino telescopes. / Adrán-Martín Z., Albert, A; André, C; Anton, G; Ardid, M; Aubert, J-J; Baret, B; Barrios-Martí, J; Basa, S; Bertin, V; Bormuth, R; Medici, Morten Ankersen; Koskinen, David Jason; Larson, Michael James; Sarkar, Subir.

The prompt atmospheric neutrino flux in the light of LHCb. / Gauld, Rhorry; Rojo, Juan; Rottoli, Luca; Sarkar, Subir; Talbert, Jim.

Search for features in the spectrum of primordial perturbations using Planck and other datasets. / Hunt, Paul; Sarkar, Subir.
In: Journal of Cosmology and Astroparticle Physics, Vol. 2015, No. 12, 052, 27.12.2015. Research - peer-review. Journal article

On the interpretation of dark matter self-interactions in Abell 3827. / Kahlhoefer, Felix; Schmidt-Hoberg, Kai; Kummer, Janis; Sarkar, Subir.

Fingerprints of Galactic Loop I on the Cosmic Microwave Background. / Liu, Hao; Mertsch, Philipp; Sarkar, Subir.

AMS-02 data confront acceleration of cosmic ray secondaries in nearby sources. / Mertsch, Philipp; Sarkar, Subir.

http://nbia.nbi.ku.dk/astropart/publications/

+ 25 conference proceedings
+ 3 reports
+ 37 papers by Group members
+ 3 Master's thesis
+ 1 Bachelor's thesis

• 23 plenary/invited talks at international conferences
• 5 lecture courses at advanced schools
• 17 seminars/colloquia at universities & institutes
News from the Niels Bohr International Academy
Hold 10.00 - 5 mandage
kl. 17.15 - 19.00 (10/11 - 8/12)

Ved ph.d. Jacob Bourjolly,
Københavns Universitet, cand.
scient. Christine Hartmann,
Københavns Universitet, adjunkt,
ph.d. Oliver Gressel, Københavns
Universitet, pb.d. Assaf Ben-David,
Københavns Universitet, professor,
ph.d. Subir Sarkar, Københavns
Universitet. Coordinating: lektor,
ph.d. Martin Pessah, Københavns
Universitet

The Niels Bohr International
Academy was established in 2007
as a research unit under the Niels
Bohr Institute to attract talented
young scientists from all over the
world to Denmark.

The lectures will be given
by five different scientists and
present five different topics in
modern theoretical physics. The
purpose will be to give a glimpse
of the questions, ideas, and ap-
proaches which are right now at
the scientific forefront. The lectur-
es will be given in English.

1. Revolutions in our under-
standing of the laws of nature (JB)
2. The Higgs particle was found
   - what is next? (CH)
3. How we think the planets were
   born (OG)
4. The earliest picture of the Uni-
   verse (ABD)
5. Discovering dark matter (SS)

Sted: Niels Bohr Institutet,
Blegdamsvej 17

http://nbia.nbi.ku.dk/astropart/outreach/
The interface between astrophysics & cosmology and fundamental physics is undergoing a revolution. Studies of the Hubble expansion, surveys of galaxies and maps of the cosmic microwave background have provided a wealth of data which have answered basic questions concerning the geometry and content of the universe. However this poses even more fundamental questions e.g.

• What is the dark matter — is it made of relic particles arising in new physics beyond the Standard Model of particle physics?
• Is dark energy really accelerating the universe or is it just an illusion due to interpreting the data using an oversimplified cosmological model?
• What is the physical mechanism for primordial inflation which generated the seed density fluctuations which have grown into galaxies?
• How was the matter-antimatter asymmetry of the universe created?
• What are the sources of high energy cosmic rays and how does Nature accelerate particles to such huge energies?

To tackle such complex interconnected issues requires new theoretical ideas and a fresh look at the extant data, as well as a concerted experimental programme.
I: A new window on the universe

An IceCube group was established at NBI … just before the breakthrough discovery of high energy cosmic neutrinos. Their sources – as yet unidentified – are among the most powerful accelerators in the universe!

Our theoretical input was the calculation of the $\nu$-N deep inelastic scattering #-section, using HERA data on parton distribution functions.

With Amanda Cooper-Sarkar & Philipp Mertsch
Journal of High Energy Physics 2013

The most important background to the cosmic signal is the 'prompt neutrino' flux from atmospheric charm production … we have constrained this directly using LHCb data

With Rhorry Gauld et al.
II: An important finding

The smoking gun of inflation in the early universe is a relic background of gravitational waves which imprint a characteristic ‘B-mode’ polarisation in the CMB.

We showed however that CMB maps are contaminated even at high galactic latitude by a blackbody-like foreground (probably from magnetised dust grains) which casts doubt on the detection.

With Hao Liu & Philipp Mertsch
III: A real surprise

The Hubble diagram of Type Ia supernovae when analysed in a statistically rigorous manner is consistent with expansion of the universe at an uniform rate – with no evidence for acceleration!

This calls into question whether the universe is really dominated by ‘dark energy’ (or is it instead ‘back reaction’ of inhomogeneities)?

With Jeppe Trøst Nielsen and Alberto Guffanti
Nature Scientific Reports 2016
IV: A possible signal of new physics?

The PAMELA ‘anomaly’ (of a rising $e^+$ fraction in cosmic rays) has been confirmed by AMS-02 ... and interpreted as due to dark matter annihilation.

We show that this can be instead an astrophysical background due to a nearby SNR shock wave accelerating cosmic rays. Our model predicts that $B/C$ & $\dot{\bar{p}}/p$ should flatten with energy ... as has been tentatively confirmed by AMS-02!

With Philipp Mertsch (Stanford)
Physical Review D 2014
V: An exciting possibility

Dark matter is usually assumed to be collisionless, however there are indications that it is self-interacting. If true this would rule out most popular candidates such as neutralinos, neutrinos or axions.

We show that this can be tested by observations of merging galaxy clusters and even reveal the nature of the scattering.

With Felix Kahlhoefer, Janis Kummer and Kai Schmidt-Hoberg (DESY) + Mads Frandsen (CP3)

VISSIONS FOR THE FUTURE

- Pursue interesting goals (not necessarily fashionable ones)
- Theory must work with experiment
- Network widely (particularly to benefit young researchers)

http://astropart.nbi.ku.dk/