

## David Jason Koskinen

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### PROFESSIONAL APPOINTMENTS

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Niels Bohr Institute	<b>Associate Professor</b>	Sept 2018 - present
- University of Copenhagen	<b>Assistant Professor</b>	Sept 2013 - Sept 2018
The Pennsylvania State University	<b>Postdoctoral Research Associate</b>	Jun 2009 - Aug 2013
	<b>Research Assistant</b>	Nov 2008 - May 2009

### EDUCATION

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University College London	<b>Ph.D., Physics</b>	2010
University of Minnesota-Duluth	<b>M.S., Physics</b>	2005
Rensselaer Polytechnic Institute	<b>B.S., Physics</b>	2002

### RESEARCH & INSTITUTIONAL RESPONSIBILITIES

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#### IceCube Experiment

2008 - present

- *Publication Committee* member 2017-present

Review IceCube journal articles and conference proceedings as part of a internal pre-submission process. The committee provides recommendations to the collaboration and paper authors regarding best practices.
- *Low-energy & Neutrino Oscillation working group* co-convenor 2014-2017

In addition to the low-energy work (partially detailed below), I oversaw all physics analysis and publications related to neutrino oscillation: tau neutrino appearance, muon neutrino disappearance, sterile neutrino searches, Lorentz invariance, neutrino mass ordering, etc. This covered  $\approx 20$  active analyzers at 11 different international universities.
- *Low-energy working group* co-convenor 2012-2014

Responsible for the data quality, Monte Carlo simulation tools, and initial background rejection and reconstruction techniques related to all physics analyses at neutrino energies  $< \mathcal{O}(300)$  GeV.
- *Simulation Coordination Committee* representative 2012-2014

Prioritize and allocate the IceCube collaboration-wide computer resources which produce Monte Carlo simulation.

- *Institution Leader* of the Niels Bohr Institute to the IceCube Board 2013-present  
Lead all IceCube-DeepCore-PINGU research and responsibilities at NBI.
- *Tau Neutrino Appearance*: Use neutrino angle and energy information to look for  $\nu_\mu \rightarrow \nu_\tau$  oscillation in the DeepCore detector, to measure the amount of  $\nu_\tau$  in the 3<sup>rd</sup> mass eigenstate,  $|U_{\tau 3}|^2$ .

### **PINGU & IceCube-Upgrade**

2010 - present

- The goal of the Precision IceCube Next Generation Upgrade (PINGU) is to infill the DeepCore sub-array and lower the neutrino energy threshold to  $\mathcal{O}(1)$  GeV while maintaining a multi-megaton fiducial volume. The PINGU effort has led to funding of a PINGU-like extension known as the ‘IceCube-Upgrade’ planned for 2022/23 with the primary goal of a sub-10% precision on tau neutrino appearance. My group leads the simulation, reconstruction, event selection, and analysis efforts for the IceCube-Upgrade to enhance the DeepCore neutrino oscillation searches, and provide access to the deep ice for R&D devices in support of the **M**ulti-megaton **I**ce **C**herenkov **A**rray (MICA), which is an ambitious project to develop a next generation detector with sensitivity down to  $\mathcal{O}(100)$  MeV.

### **MINOS Experiment**

1999 - 2008

- Ph.D. Thesis: “*MINOS sterile neutrino search*”. My thesis work centered on using the Far/Near extrapolation method to search for the existence of sterile neutrinos using neutral-current events. The results used both the normal 3 flavor normal hierarchy neutrino model as well as the Parke model. The analysis detailed in my thesis was used for the MINOS neutral-current related publications.
- Master Thesis: “*An overview of the Main Injector Neutrino Oscillation Search, the Rack Protection System and methods to degauss a large iron calorimeter particle detector*”.

### **PROFESSIONAL ACTIVITIES**

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- Organizer and host of the *IceCube-Upgrade Simulation and Reconstruction Workshop* in 2018
- Convenor of the ‘Tau Neutrino Studies’ working group at the 2017 *Viet Nus workshop* focusing on neutrino challenges and limitations
- Guest Lecturer at the 2016 Niels Bohr International Academy Ph.D. school *Neutrinos Underground and in the Heavens II*
- Organizer and host of the 2015 Autumn IceCube collaboration meeting in Copenhagen
- Reviewer for French National Research Agency (ANR) – 2015
- Lecturer at the 2015 *Nordic Winter School on Cosmology and Particle Physics*
- Lecturer at the 2014 Niels Bohr International Academy Ph.D. school *Neutrinos Underground and in the Heavens*
- Board member of the *Discovery Center for Particle Physics* at the Niels Bohr Institute starting in 2014
- Organizer of the 2014 *Astroparticle Neutrino Physics in Antarctica Workshop* hosted at the Niels Bohr Institute
- Elected officer of the *Fermilab Graduate Student Association* from 2006-2007. I represented

the nearly 700 Fermilab graduate students to the lab Directorate, participated in an outreach endeavor with the Fermilab Users' Executive Committee on a lobbying trip to Congress, and addressed the High Energy Physics Advisory Panel (HEPAP) sub-panel on topics of attracting HEP students.

- Member of the *Fermilab Users' Executive Committee* from 2006-2007. In relation to being elected as an Officer of the Fermilab GSA, I was also a member of the *Government Relations* and *Non-U.S. Users* subcommittees of the Fermilab Users' Executive Committee.

## RESEARCH GRANTS

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- VILLUM FONDEN: Young Investigator Programme – ‘Neutrinos on Ice’  
Principal Investigator, 2016-2020 [proj. no. 13161] – DKK 4.91M

## ACADEMIC SUPERVISION

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- Morton A. Medici (Ph.D. student) 2013-2017  
- Ph.D. Thesis Topic: *Search for Dark Matter Annihilation in the Galactic Halo using IceCube*
- Michael J. Larson (Ph.D. student) 2014-2018  
- Ph.D. Thesis Topic: *Tau Neutrino Appearance in IceCube-DeepCore*
- Joakim Sandroos (Researcher) 2014-2015  
- Now a Ph.D. student at Johannes Gutenberg Universität Mainz  
- Research Topic: *Particle Identification in PINGU*
- Hans R. L. Larsen (Bachelor student) 2014  
- Bachelor Thesis: *Solar WIMP Detection Sensitivity in IceCube*
- Eva B. Hansen (Master student) 2015-2016  
- Master Thesis Topic: *Particle Identification and Background Rejection in PINGU*
- Itaakara Robertson (Bachelor student) 2015  
- Bachelor Thesis Topic: *Construction of a 3D IceCube Event Display*
- Christopher Nielsen (Bachelor student) 2016  
- Bachelor Thesis Topic: *Hit Cleaning Optimization for Neutrino Oscillation Studies in IceCube-DeepCore*
- Mikkel Jensen (Master student) 2016-2018  
- Master Thesis Topic: *Neutrino Decoherence in IceCube-DeepCore*
- Étienne Bourbeau (Ph.D. student) 2017-present  
- Ph.D. Thesis Topic: *Tau Neutrino Appearance and Searches for Neutrino Multiplet Correlations with Galaxies of  $Z < 0.03$*
- Leif Rasmussen & Christian Skjellerup (Bachelor students) 2017  
- Bachelor Thesis Topic: *Cosmic Ray Muon Rate Differences in IceCube*
- Mia-Louise Nielsen (Master student) 2018-present  
- Master Thesis Topic: *Transient Searches of Astrophysical Neutrino Emission in IceCube-DeepCore*
- Thomas Halberg (Master student) 2018-present  
- Master Thesis Topic: *Reconstruction of Neutrinos in IceCube*
- Ida Storehaug (Master student) 2018-present  
- Master Thesis Topic: *Uncertainties in the Atmospheric Neutrino Flux for Oscillation Mea-*

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- Leif Rasmussen (Master student) 2018-present  
- Master Thesis Topic: *TBD*

**INVITED CONFERENCES & WORKSHOPS** 

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13. *IceCube and Gen2: Atmospheric and Oscillation Results and Status*  
Next Generation Nucleon Decay and Neutrino Detectors (NNN17) - University of Warwick - October 27, 2017.
12. *Neutrino Physics with the PINGU Extension to IceCube*  
TeV Particle Astrophysics 2016 (TeVPA) - CERN - September 12, 2016.
11. *Atmospheric neutrino results from IceCube/DeepCore and plans for PINGU*  
The XXVII International Conference on Neutrino Physics and Astrophysics (Neutrino 2016) - Imperial College London - July 6, 2016.
10. *Neutrino Oscillation and Resolving the Neutrino Mass Ordering*  
ICNFP2015: International Conference on New Frontiers in Physics - Kolymbari, Greece - August 29, 2015.
9. *Future Atmospheric Neutrino Experiments*  
NuPhys2014: Prospects in Neutrino Physics - Queen Mary University of London - December 16, 2014.
8. *IceCube Results and PINGU Perspectives*  
Neutrino Oscillation Workshop - Conca Specchiulla, Italy - September 12, 2014.
7. *Results from IceCube and Prospects for PINGU*  
Interplay of Particle and Astroparticle Physics - Queen Mary University of London - August 19, 2014.
6. *Dark Matter Searches and Astrophysical Neutrinos in IceCube*  
Origin of Mass 2014 - CP<sup>3</sup> Origins - May 22, 2014.
5. *PINGU: Resolving the Neutrino Mass Hierarchy at the South Pole*  
New Directions in Neutrino Physics - Aspen Center for Physics - February 7, 2013.
4. *PINGU and O(1) GeV cross-sections*  
Flux Measurement and Determination in the Intensity Frontier Era Neutrino Beams - University of Pittsburgh - December 7, 2012.
3. *IceCube, DeepCore and PINGU*  
Next Generation Nucleon Decay and Neutrino Detectors (NNN12) - Fermilab - October 5, 2012.
2. *IceCube-DeepCore*  
Implications of Neutrino Flavor Oscillations (INFO11) - Santa Fe, New Mexico - June 7, 2011.
1. *IceCube Neutrino Telescope*  
23<sup>rd</sup> International Workshop on Weak Interactions and Neutrinos (WIN'11) - Cape Town, South Africa - January 31, 2011.

**INVITED COLLOQUIA & SEMINARS** 

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26. *Fundamental Neutrino Physics with a Gigaton of Ice*  
Experimental Particle and Astro-Particle Physics Seminar - University of Zurich - May 28, 2018.

25. *Fundamental Neutrino Physics with a Gigaton of Ice*  
Particle Physics Seminar - University of Oxford - May 1, 2018.
24. *Neutrinos on Ice*  
Annual Meeting of the Danish Physical Society - Fænø Sund - May 22, 2017.
23. *Neutrinos on Ice*  
Oskar Klein Center Colloquium - University of Stockholm - February 21, 2017.
22. *Neutrinos on Ice: Using IceCube to Chase a Ghost Particle*  
Physics and Astronomy Colloquium - University of Southampton - October 10, 2014.
21. *Using the IceCube Neutrino Observatory to Study Inner and Outer Space*  
DTU Space Seminar - Technical University of Denmark - December 5, 2013.
20. *Connecting Inner and Outer Space: Astroparticle Physics Big and Small*  
Annual Meeting of the Danish Physical Society - University of Copenhagen - November 14, 2013.
19. *PINGU: Neutrino Hierarchy Determination at the South Pole*  
Intensity Frontier Department Physics Discussions - Fermilab - April 11, 2013.
18. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Astro/Particle Seminar - University of Cincinnati - February 26, 2013.
17. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Institute for Nuclear and Particle Astrophysics Seminar - Lawrence Berkeley National Laboratory - February 22, 2013.
16. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Discovery Center Seminar - Niels Bohr Institute - February 20, 2013.
15. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Nuclear/Particle Physics Seminar - University of Colorado at Boulder - February 11, 2013.
14. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Laboratory for Particle Physics and Cosmology Seminar - Harvard University - December 12, 2012.
13. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Lunchtime Seminar - Massachusetts Institute of Technology - December 11, 2012.
12. *Neutrinos at the South Pole*  
Particle Physics Seminar - Universität Würzburg - September 27, 2012.
11. *IceCube-DeepCore-PINGU: Atmospheric Neutrino Physics at the South Pole*  
Particle Physics Seminar - Brookhaven National Laboratory - September 6, 2012.
10. *Neutrino Oscillations at the South Pole*  
Nuclear/Particle/Astro/Cosmo Forum - University of Wisconsin-Madison - February 27, 2012.
9. *IceCube-DeepCore-PINGU: Fundamental Neutrino Physics at the South Pole*  
Nuclear Physics, Astronomy, and Astrophysics Joint Seminar - Stony Brook University - December 8, 2011.
8. *IceCube-DeepCore-PINGU: Neutrino Physics at the South Pole*  
Physics Seminar - University of Minnesota-Duluth - November 15, 2011.
7. *IceCube-DeepCore: The biggest little neutrino detector at the South Pole*  
Particle Seminar - Columbia University - March 9, 2011.
6. *DeepCore - Extending the energy reach of neutrinos in IceCube*  
Physics and Astronomy Colloquium - University of Alabama - December 1, 2010.
5. *Neutrino Oscillations and (dis)appearance prospects for IceCube-DeepCore*  
CCAPP Seminar - The Ohio State University's Center for Cosmology and AstroParticle

- Physics - October 19, 2010.
4. *Initial Sterile Neutrino results from MINOS*  
New Perspectives - Fermilab - June 3, 2008.
  3. *NuMI Muon Monitor Studies and First Results from the MINOS Sterile Neutrino Search*  
HEP Astrophysics Seminar - Pennsylvania State University - May 15, 2008.
  2. *NuMI Muon Monitor Studies and First Results from the MINOS Sterile Neutrino Search*  
Neutrino Physics Seminar - Lawrence Berkeley National Laboratory - May 13, 2008.
  1. *NuMI Muon Monitor Studies and First Results from the MINOS Sterile Neutrino Search*  
Joint HEP Neutrino Physics Seminar - University of Wisconsin-Madison - April 25, 2008.

## OTHER PRESENTATIONS

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- *IceCube*  
Danish National Astronomy Meeting - Odense, Denmark - June 17, 2014
- *Physics potential of the IceCube DeepCore detector*  
Neutrino 2010 (poster session) - Athens, Greece - June 18, 2010.
- *Measurement of the NuMI Neutrino Flux using the Accompanying Muon Beam*  
Users' Meeting (poster session) - Fermilab - June 6, 2007.
- *Flux from NuMI muon monitors*  
The IOP Nuclear and Particle Physics Divisional Conference - University of Surrey, England - April 4, 2007.

## Selected Publications

- [1] M. G. Aartsen et al. Search for Neutrinos from Dark Matter Self-Annihilations in the center of the Milky Way with 3 years of IceCube/DeepCore. *Eur. Phys. J.*, C77(9):627, 2017. arXiv:1705.08103.
- [2] M. G. Aartsen et al. Searches for Sterile Neutrinos with the IceCube Detector. *Phys. Rev. Lett.*, 117(7):071801, 2016. arXiv:1605.01990.
- [3] M.G. Aartsen et al. Letter of Intent: The Precision IceCube Next Generation Upgrade (PINGU). 2014. arXiv:1401.2046.
- [4] M.G. Aartsen et al. Measurement of the Atmospheric  $\nu_e$  flux in IceCube. *Phys.Rev.Lett.*, 110:151105, 2013. arXiv:1212.4760.
- [5] R. Abbasi et al. The Design and Performance of IceCube DeepCore. *Astropart.Phys.*, 35:615–624, 2012. arXiv:1109.6096.
- [6] D. Jason Koskinen. IceCube-DeepCore-PINGU: Fundamental neutrino and dark matter physics at the South Pole. *Mod.Phys.Lett.*, A26:2899–2915, 2011.
- [7] P. Adamson et al. Search for sterile neutrino mixing in the MINOS long baseline experiment. *Phys.Rev.*, D81:052004, 2010. arXiv:1001.0336.
- [8] P. Adamson et al. Measurement of Neutrino Oscillations with the MINOS Detectors in the NuMI Beam. *Phys. Rev. Lett.*, 101:131802, 2008. arXiv:0806.2237.
- [9] P. Adamson et al. Search for active neutrino disappearance using neutral-current interactions in the MINOS long-baseline experiment. *Phys.Rev.Lett.*, 101:221804, 2008. arXiv:0807.2424.

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