

# MATHEUS HOSTERT

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## ACADEMIC POSITIONS

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### Four-year Joint Post-Doctoral Position

OCT. 2019 - PRESENT

Post-doctoral researcher at the Perimeter Institute and the University of Minnesota.

## EDUCATION

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### Ph.D. in Theoretical Physics – Durham University, United Kingdom

OCT. 2015 - SEP. 2019

Institute for Particle Physics Phenomenology (IPPP), Durham University.

Dissertation: Hidden Physics at the Neutrino Frontier: Tridents, Dark Forces, and Hidden Particles.

Supervisor: Prof. Silvia Pascoli. Dissertation Committee: Profs. David Cerdeño and Joachim Kopp.

### Bachelors degree in Physics – Federal University of Santa Catarina, Brazil

MAR. 2011 - JUN. 2015

With an year abroad at Durham University (SEPT. 2013 - SEPT. 2014) and honors in advanced mathematics.

## FELLOWSHIPS AND AWARDS

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**Science without Borders Ph.D. scholarship** (SEPT. 2015): excellence-based Brazilian scholarship for a full Ph.D. abroad.

**Science without Borders Undergraduate scholarship** (SEPT. 2013): excellence-based Brazilian scholarship for one year of undergraduate studies abroad.

**Research poster awards:** Neutrino 2020, NuPhys 2018, and NuPhys 2017.

## TEACHING AND OUTREACH

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### SCIENCE OUTREACH

- **Perimeter Summer School:** led a one-week project for high-school students at the Perimeter International Summer School for Young Physicists (ISSYP).
- **KITP Teacher's Conference 2022:** plenary speaker at the KITP teacher's conference.
- **Royal Society Summer Exhibition 2017 and 2018:** event organizer for the “modeling the invisible” exhibition and volunteer at the “ghosts in the universe” exhibition on neutrinos.
- **Celebrate Science 2018:** volunteer in regional outreach event for schools in County Durham.
- **Orkney Science Festival 2018:** volunteer in the International Orkney Science Festival, visiting schools in remote islands of the Orkney archipelago in the north of Scotland.
- **Pint of Science 2017:** event manager for a local outreach event in County Durham.

### TEACHING

- **Graduate tutor,** 2016 to 2018: led 2nd-year physics students in problem classes on advanced classical mechanics and quantum theory.
- **Undergraduate tutor,** 2012 to 2013: invited tutor for university-wide program mentoring first-year students at Federal University of Santa Catarina (UFSC).

## MENTORING

- **Student mentoring:** mentors three Ph.D. students in ongoing projects: Daniele Massaro and Jaime Hoefken at the University of Bologna, and Nicholas Kamp at MIT. Has mentored Dr. Asli Abdullahi and Nicolò Foppiani on multiple projects.

## ACADEMIC ENGAGEMENT

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### EQUITY, DIVERSITY, AND INCLUSION EFFORTS

- Member of the Inclusive Mentoring committee at the Perimeter Institute. In addition to mentoring Ph.D. students, I have also contributed to the faculty-postdoc mentoring system.
- Member of the Diversity & Inclusion Alliance of the College of Science and Engineering (CSE) at the University of Minnesota. Ensured that postdocs could provide direct feedback to the CSE Dean.

### TRAINING AND RESEARCH PLACEMENTS

- **InvisiblesPLUS network**, one month in 2019 at Columbia University, working with Prof. Georgia S. Karagiorgi and Dr. Mark Ross-Lonergan on MicroBooNE, one month in 2019 at Lawrence Berkeley National Laboratory with Prof. Christian Bauer, and two months in 2018 at Fermilab, working with Dr. Pedro Machado.
- **IPPP summer student**, 2014: undergraduate research on neutrino oscillations under the supervision of Prof. Silvia Pascoli.
- **Volunteer undergraduate researcher**, at the Federal University of Santa Catarina. In 2013, studied equations of state for stellar remnants under the supervision of Prof. Débora P. Menezes, and in 2015, studied symmetry non-restoration in quantum field theories under the supervision of Profs. Débora P. Menezes and Marcus E. B. Pinto.

### EXPERIMENTAL COLLABORATIONS

- Working with the **MicroBooNE** collaboration under a memorandum of understanding to search for neutrino-induced  $e^+e^-$  events.
- Collaborator in future experimental projects, including DUNE and  $\nu$ STORM, providing input on theoretical aspects.

### COMMUNITY ENGAGEMENT

- **Snowmass 2021:** Editor for the “neutrino frontier” whitepaper on sterile neutrinos and the “Rare processes and precision measurements” whitepaper on new physics in kaon and hyperon factories. Made substantial contributions to over seven white papers and led a letter of intent.
- **CERN FPC PBC:** a member of the Feebly Interacting Particle (FPC) working group, part of the Physics Beyond Colliders (PBC) effort at CERN. Currently building and maintaining a Python package that collects experimental limits on dark sectors.
- **Event organizer:** for the international workshop on Weak Interactions and Neutrinos (WIN) 2021 in Minnesota, US, and the Young Theorists Forums 9, 10, and 11 in Durham, UK. Convener for the IceDune workshop in 2021.

## PUBLICATIONS

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The following is a selected list of publications for which I was one of the primary contributors. Author lists are displayed alphabetically, as is the standard in particle physics. A complete list can be found at [inspirehep.net/authors/1621061](https://inspirehep.net/authors/1621061).

### Selected peer-reviewed publications

1. MicroBooNE and the  $\nu_e$  Interpretation of the MiniBooNE Low-Energy Excess, C. A. Argüelles, I. Esteban, M. Hostert, Kevin J. Kelly, J. Kopp, P. A. N. Machado, I. Martinez-Soler, Y. F. Perez-Gonzalez, Phys.Rev.Lett. 128 (2022) 24 241802, 2021, arXiv:2111.10359 [hep-ph], citations: **38**.
2. Heavy neutral leptons below the kaon mass at hodoscopic neutrino detectors, Carlos A. Argüelles, Nicolò Foppiani, Matheus Hostert, Phys.Rev.D 105 (2022) 9 095006, 2021, arXiv:2109.03831 [hep-ph], citations: **17**.
3. Novel multilepton signatures of dark sectors in light meson decays, Matheus Hostert, Maxim Pospelov, Phys.Rev.D 105 (2022) 1 015017, 2020, arXiv:2012.02142 [hep-ph], citations: **12**.
4. Constraints on decaying sterile neutrinos from solar antineutrinos, Matheus Hostert, Maxim Pospelov, Phys.Rev.D 104 (2021) 5 055031, 2020, arXiv:2008.11851 [hep-ph], citations: **15**.
5. A dark seesaw solution to low energy anomalies: MiniBooNE, the muon ( $g-2$ ), and BaBar, Asli Abdullahi, Matheus Hostert, Silvia Pascoli, Phys.Lett.B 820 (2021) 136531, 2020, arXiv:2007.11813 [hep-ph], citations: **45**.
6. Pair production of dark particles in meson decays, Matheus Hostert, Kunio Kaneta, Maxim Pospelov, Phys.Rev.D 102 (2020) 5 055016, 2020, arXiv:2005.07102 [hep-ph], citations: **15**.
7. Neutrino Masses from a Dark Neutrino Sector below the Electroweak Scale, Peter Ballett, Matheus Hostert, Silvia Pascoli, Phys.Rev.D 99 (2019) 9 091701, 2019, arXiv:1903.07590 [hep-ph], citations: **43**.
8. Dark Neutrinos and a Three Portal Connection to the Standard Model, Peter Ballett, Matheus Hostert, Silvia Pascoli, Phys.Rev.D 101 (2020) 11 115025, 2019, arXiv:1903.07589 [hep-ph], citations: **61**.
9.  $Z$ 's in neutrino scattering at DUNE, Peter Ballett, Matheus Hostert, Silvia Pascoli, Yuber F. Perez-Gonzalez, Zahra Tabrizi, Renata Zukanovich Funchal, Phys.Rev.D 100 (2019) 5 055012, 2019, arXiv:1902.08579 [hep-ph], citations: **55**.
10. Neutrino trident production at near detectors, Matheus Hostert, PoS NOW2018 (2019) 037, 2019, citations: **1**.
11. Testing New Physics Explanations of the MiniBooNE Anomaly at Neutrino Scattering Experiments, Carlos A. Argüelles, Matheus Hostert, Yu-Dai Tsai, Phys.Rev.Lett. 123 (2019) 26 261801, 2018, arXiv:1812.08768 [hep-ph], citations: **62**.
12. Neutrino Trident Scattering at Near Detectors, Peter Ballett, Matheus Hostert, Silvia Pascoli, Yuber F. Perez-Gonzalez, Zahra Tabrizi, Renata Zukanovich Funchal, JHEP 01 (2019) 119, 2018, arXiv:1807.10973 [hep-ph], citations: **45**.

#### **Under review or non-peer reviewed publications**

1. DarkNews: a Python-based event generator for heavy neutral lepton production in neutrino-nucleus scattering, Asli M. Abdullahi, Jaime Hoefken Zink, Matheus Hostert, Daniele Massaro, Silvia Pascoli, preprint, 2022, arXiv:2207.04137 [hep-ph].
2. Dipole-Coupled Neutrino Explanations of the MiniBooNE Excess Including Constraints from MINERvA Data, Nicholas W. Kamp, Matheus Hostert, Austin Schneider, Stefano Vergani, Carlos A. Argüelles, Janet M. Conrad, Michael H. Shaevitz, Melissa A. Uchida, preprint, 2022, arXiv:2206.07100 [hep-ph], citations: **2**.
3. Efficiently Exploring Multi-Dimensional Parameter Spaces Beyond the Standard Model, Carlos A. Argüelles, Nicolò Foppiani, Matheus Hostert, preprint, 2022, arXiv:2205.12273 [hep-ph].
4. Dark sectors in neutron-shining-through-a-wall and nuclear absorption signals, Matheus Hostert, David McKeen, Maxim Pospelov, Nirmal Raj, preprint, 2022, arXiv:2201.02603 [hep-ph], citations: **6**.
5. Hidden Physics at the Neutrino Frontier: Tridents, Dark Forces, and Hidden Particles, Matheus. Hostert, thesis, 2019.
6. Light Sterile Neutrinos at  $\nu$ STORM: Decoherence and CP violation, Peter Ballett, Matheus Hostert, Silvia Pascoli, proceedings, 2017, arXiv:1705.09214 [hep-ph], citations: **1**.

## TALKS AND SEMINARS

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A selected list of presentations at high-profile meetings is shown below. For a complete list, see [mhostert.com/talks/](https://mhostert.com/talks/).

### Plenary talks

- April 2019 — Prospects of Neutrino Physics, IPMU, Kashiwa, Japan
- October 2019 — CERN Neutrino Platform Week 2019, CERN, Switzerland
- December 2019 — NuPhys 2019, London, UK
- November 2020 — Central American meeting of High Energy Physics, Cosmology and High Energy Astrophysics, Cidade da Guatemala, Central America
- October 2020 — 3rd South American Dark Matter Workshop, ICTP, São Paulo, Brazil
- March 2022 — KITP, Interdisciplinary Developments in Neutrino Physics, Santa Barbara, USA

### Invited talks

- June 2018 — Near detector workshop 2018, CERN, CERN, Switzerland
- December 2018 — Physics Opportunities at the Near Detector of DUNE (PONDD), Fermilab, Fermilab, USA
- May 2019 — Neutrino Theory Network Workshop, Washington U., St Louis, St Louis, USA
- September 2020 — Snowmass Neutrino Frontier 03 kick-off meeting, USA
- September 2020 — Snowmass Theory of neutrino physics mini-workshop, USA
- October 2020 — Snowmass Baryon and Lepton Number Violating Processes workshop, USA
- October 2020 — PIKIMO 9, Kentucky, Kentucky, USA
- December 2020 — Snowmass Dark Sector Studies at High Intensities Frontier, USA
- August 2021 — vSTORM collaboration meeting, CERN
- September 2021 — UK Muon Collider and NuSTORM meeting, UK
- October 2021 — Virginia Tech, neutrino seminar, Blacksbourg, USA
- June 2022 — Neutrino Theory Workshop, NuTs, Madrid, Spain
- September 2022 — ICTP Program on New Directions in Particle Physics, São Paulo, Brazil

### Invited parallel talks

- May 2018 — Phenomenology Symposium 2018, Pittsburgh, USA
- August 2018 — NuFact 2018, Virginia, Blacksbourg, USA
- September 2018 — Neutrino Oscillation Workshop 2018, Ostuni, Italy
- November 2021 — Brookhaven Forum 2021, Brookhaven National Laboratory, USA

### Parallel talks

- June 2019 — Invisibles Workshop 2019, Valencia, Valencia, Spain
- May 2020 — Phenomenology Symposium 2020, Pittsburgh, Pittsburgh, USA
- June 2020 — Neutrino 2020, University of Chicago, Chicago, USA
- July 2020 — ICHEP 2020, Prague, Czech Republic
- February 2021 — XIX International Workshop on Neutrino Telescopes, Italy
- April 2021 — American Physics Society April Meeting, USA
- July 2021 — American Physics Society Division of Particles and Fields meeting, USA
- July 2022 — Snowmass 2022, Seattle, USA
- August 2022 — TeVPA 2022, Kingston, Canada
- September 2022 — CIPANP 2022, Orlando, USA

### Invited seminars

- May 2018 — Fermilab Theory Seminar, Fermilab, USA
- June 2018 — Perimeter Institute, Waterloo, Canada
- November 2018 — Max-Planck-Institut für Kernphysik, Heidelberg, Heidelberg, Germany
- March 2019 — Queen Mary University of London, London, UK
- May 2019 — IFIC, Valencia, Valencia, Spain
- August 2019 — MicroBooNE collaboration call, USA

August 2019	—	Columbia University, New York, USA
February 2020	—	Fermilab Theory Seminar, Fermilab, USA
May 2020	—	Brookhaven Neutrino Theory Virtual Seminars, Brookhaven National Laboratory, USA
June 2020	—	JGU Theorie Palaver, Mainz, Munich, Germany
March 2021	—	Neutrino Seminar, Fermilab, Fermilab, USA
March 2021	—	University of California Santa Cruz, Santa Cruz, USA
April 2021	—	Carleton University, Carleton, Canada
April 2021	—	C3P, UCLouvain, Louvain, Belgium
April 2021	—	ETH, Zurich, Zurich, Switzerland
May 2021	—	McGill University, Montreal, Canada
September 2021	—	Perimeter Institute, particle physics seminar, Waterloo, Canada
November 2021	—	Harvard University, family meeting, Boston, USA
December 2021	—	SLAC, Stanford National Laboratory, USA
January 2022	—	University of Kentucky, Kentucky, USA
February 2022	—	TRIUMF/University of Victoria, Victoria, Canada
March 2022	—	University of Toronto, Toronto, Canada
March 2022	—	University of Texas A&M, College Station, USA