

MATHEUS HOSTERT

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ACADEMIC POSITIONS

Harvard University — Neutrino Theory Network Fellowship Sept. 2023 - present
A Department of Energy fellowship to pursue research in neutrino physics at Harvard University.

Perimeter Institute & University of Minnesota — Joint Post-Doctoral Position Sept. 2019 - Sept. 2023
A joint four-year post-doctoral researcher appointment at the Perimeter Institute and the University of Minnesota.

EDUCATION

Ph.D. in Theoretical Physics – Durham University, United Kingdom Oct. 2015 - Sep. 2019
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 a year abroad at Durham University (Sept. 2013 - Sept. 2014) and honors in advanced mathematics.

FELLOWSHIPS AND AWARDS

Neutrino Theory Network fellowship (Jan. 2023): Fully funded postdoctoral position at Harvard University.

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

SCIENCE OUTREACH

- **Perimeter ISSYP 2022 and 2023:** led high-school students in a one-week project about neutrinos.
- **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 AND MENTORING

- **Student mentoring:** Has mentored several Ph.D. students in research projects in the past, including:
 - Daniele Massaro (University of Bologna)
 - Jaime Hoefken (University of Bologna)
 - Dr. Asli Abdullahi (Durham University)
 - Dr. Nicholas Kamp (MIT)

- Dr. Nicolò Foppiani (Harvard University)

Has also mentored one undergraduate student for a summer research project as part of the Perimeter Institute PSI Start program:

- Isaac Cheng (University of Waterloo)
- **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).

ACADEMIC ENGAGEMENT

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.
- **Undergraduate research**, at the Federal University of Santa Catarina with Profs. Débora P. Menezes and Marcus E. B. Pinto, and at Durham University with Prof. Silvia Pascoli.

EXPERIMENTAL COLLABORATIONS

- Working with the **MicroBooNE** collaboration in an analysis to search for neutrino-induced e^+e^- events.
- Previous collaborator in the Deep Underground Neutrino Experiment (DUNE), from 2015 and 2023.

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.
 - **Weak Interactions and Neutrinos 2021**: One of the primary event organizers for the 2021 edition in Minnesota, US.
 - **Young Theorists Forums 9, 10, and 11**: Event organizer for the annual one-day conference for graduate students in the UK.
- IceDune workshop 2021**: Convener of the Beyond the Standard Model physics session aimed at increasing the cross-talk between IceCube and DUNE collaborators.

TALKS AND SEMINARS

Invited talks

- April 2023 — American Physics Society April meeting, Minneapolis, USA
- December 2022 — NuTools workshop, Pittsburgh, USA
- September 2022 — ICTP Program on New Directions in Particle Physics, São Paulo, Brazil
- June 2022 — Neutrino Theory Workshop, NuTs, Madrid, Spain
- March 2022 — KITP, Interdisciplinary Developments in Neutrino Physics, Santa Barbara, USA
- October 2021 — Virginia Tech, neutrino seminar, Blacksbourg, USA
- September 2021 — UK Muon Collider and NuSTORM meeting, UK
- August 2021 — vSTORM collaboration meeting, CERN
- December 2020 — Snowmass Dark Sector Studies at High Intensities Frontier, USA
- 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
- October 2020 — PIKIMO 9, Kentucky, Kentucky, USA
- October 2020 — Snowmass Baryon and Lepton Number Violating Processes workshop, USA
- September 2020 — Snowmass Theory of neutrino physics mini-workshop, USA
- September 2020 — Snowmass Neutrino Frontier 03 kick-off meeting, USA
- December 2019 — NuPhys 2019, London, UK
- October 2019 — CERN Neutrino Platform Week 2019, CERN, Switzerland
- May 2019 — Neutrino Theory Network Workshop, Washington U., St Louis, St Louis, USA
- April 2019 — Prospects of Neutrino Physics, IPMU, Kashiwa, Japan
- December 2018 — Physics Opportunities at the Near Detector of DUNE (PONDD), Fermilab, Fermilab, USA
- June 2018 — Near detector workshop 2018, CERN, CERN, Switzerland

Invited parallel talks

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

Parallel and contributed talks

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

Invited seminars

- April 2023 — California Institute of Technology, Pasadena, USA
- December 2022 — Northwestern University, Evanston, USA
- December 2022 — Los Alamos National Laboratory, Los Alamos, USA
- November 2022 — Queen's University, Kingston, Canada
- November 2022 — King's College London, London, UK
- November 2022 — Carleton University, Ottawa, Canada
- March 2022 — University of Texas A&M, College Station, USA
- March 2022 — University of Toronto, Toronto, Canada

February 2022 — TRIUMF/University of Victoria, Victoria, Canada
 January 2022 — University of Kentucky, Kentucky, USA
 December 2021 — SLAC, Stanford National Laboratory, USA
 November 2021 — Harvard University, family meeting, Boston, USA
 September 2021 — Perimeter Institute, particle physics seminar, Waterloo, Canada
 May 2021 — McGill University, Montreal, Canada
 April 2021 — ETH, Zurich, Zurich, Switzerland
 April 2021 — C3P, UCLouvain, Louvain, Belgium
 April 2021 — Carleton University, Carleton, Canada
 March 2021 — University of California Santa Cruz, Santa Cruz, USA
 March 2021 — Neutrino Seminar, Fermilab, Fermilab, USA
 June 2020 — JGU Theorie Palaver, Mainz, Munich, Germany
 May 2020 — Brookhaven Neutrino Theory Virtual Seminars, Brookhaven National Laboratory, USA
 February 2020 — Fermilab Theory Seminar, Fermilab, USA
 August 2019 — Columbia University, New York, USA
 August 2019 — MicroBooNE collaboration call, USA
 May 2019 — IFIC, Valencia, Valencia, Spain
 March 2019 — Queen Mary University of London, London, UK
 November 2018 — Max-Planck-Institut für Kernphysik, Heidelberg, Heidelberg, Germany
 June 2018 — Perimeter Institute, Waterloo, Canada
 May 2018 — Fermilab Theory Seminar, Fermilab, USA

PUBLICATIONS

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.

Peer-reviewed publications

1. Effective portals to heavy neutral leptons, Enrique Fernández-Martínez, Manuel González-López, Josu Hernández-García, Matheus Hostert, Jacobo López-Pavón, JHEP 09 (2023) 001, arXiv:2304.06772 [hep-ph], citations: 9.
2. Constraining light thermal inelastic dark matter with NA64, Martina Mongillo, Asli Abdullahi, Benjamin Banto Oberhauser, Paolo Crivelli, Matheus Hostert, Daniele Massaro, Laura Molina Bueno, Silvia Pascoli, Eur.Phys.J.C 83 (2023) 5 391, arXiv:2302.05414 [hep-ph], citations: 4.
3. Semi-Visible Dark Photon Phenomenology at the GeV Scale, Asli M. Abdullahi, Matheus Hostert, Daniele Massaro, Silvia Pascoli, Phys.Rev.D 108 (2023) 1 015032, arXiv:2302.05410 [hep-ph], citations: 6.
4. Implications of MicroBooNE's low sensitivity to electron antineutrino interactions in the search for the Mini-BooNE excess, Nicholas W. Kamp, Matheus Hostert, Carlos A. Argüelles, Janet M. Conrad, Michael H. Shaevitz, Phys.Rev.D 107 (2023) 9 092002, arXiv:2301.12573 [hep-ph], citations: 2.
5. Dipole-coupled heavy-neutral-lepton 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, Phys.Rev.D 107 (2023) 5 055009, arXiv:2206.07100 [hep-ph], citations: 15.
6. Efficiently exploring multidimensional parameter spaces beyond the Standard Model, Carlos A. Argüelles, Nicolò Foppiani, Matheus Hostert, Phys.Rev.D 107 (2023) 3 035027, arXiv:2205.12273 [hep-ph], citations: 5.
7. Dark sectors in neutron-shining-through-a-wall and nuclear-absorption signals, Matheus Hostert, David McKeen, Maxim Pospelov, Nirmal Raj, Phys.Rev.D 107 (2023) 7 075034, arXiv:2201.02603 [hep-ph], citations: 8.

8. MicroBooNE and the ν_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, arXiv:2111.10359 [hep-ph], citations: **60**.
9. 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, arXiv:2109.03831 [hep-ph], citations: **34**.
10. Novel multilepton signatures of dark sectors in light meson decays, Matheus Hostert, Maxim Pospelov, *Phys.Rev.D* 105 (2022) 1 015017, arXiv:2012.02142 [hep-ph], citations: **22**.
11. Constraints on decaying sterile neutrinos from solar antineutrinos, Matheus Hostert, Maxim Pospelov, *Phys.Rev.D* 104 (2021) 5 055031, arXiv:2008.11851 [hep-ph], citations: **19**.
12. 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, arXiv:2007.11813 [hep-ph], citations: **58**.
13. Pair production of dark particles in meson decays, Matheus Hostert, Kunio Kaneta, Maxim Pospelov, *Phys.Rev.D* 102 (2020) 5 055016, arXiv:2005.07102 [hep-ph], citations: **22**.
14. Neutrino Masses from a Dark Neutrino Sector below the Electroweak Scale, Peter Ballett, Matheus Hostert, Silvia Pascoli, *Phys.Rev.D* 99 (2019) 9 091701, arXiv:1903.07590 [hep-ph], citations: **47**.
15. Dark Neutrinos and a Three Portal Connection to the Standard Model, Peter Ballett, Matheus Hostert, Silvia Pascoli, *Phys.Rev.D* 101 (2020) 11 115025, arXiv:1903.07589 [hep-ph], citations: **73**.
16. 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, arXiv:1902.08579 [hep-ph], citations: **63**.
17. Neutrino trident production at near detectors, Matheus Hostert, *PoS NOW2018* (2019) 037, citations: **1**.
18. 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, arXiv:1812.08768 [hep-ph], citations: **70**.
19. 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, arXiv:1807.10973 [hep-ph], citations: **50**.

Under review or non-peer reviewed publications

1. A panorama of new-physics explanations to the MiniBooNE excess, Asli M. Abdullahi, Jaime Hoefken Zink, Matheus Hostert, Daniele Massaro, Silvia Pascoli, preprint, 2023, arXiv:2308.02543 [hep-ph].
2. New physics in multi-electron muon decays, Matheus Hostert, Tony Menzo, Maxim Pospelov, Jure Zupan, preprint, 2023, arXiv:2306.15631 [hep-ph].
3. Pion decay constraints on exotic 17 MeV vector bosons, Matheus Hostert, Maxim Pospelov, preprint, 2023, arXiv:2306.15077 [hep-ph], citations: **1**.
4. 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], citations: **6**.
5. Hidden Physics at the Neutrino Frontier: Tridents, Dark Forces, and Hidden Particles, Matheus. Hostert, thesis, 2019.
6. Light Sterile Neutrinos at ν STORM: Decoherence and CP violation, Peter Ballett, Matheus Hostert, Silvia Pascoli, proceedings, 2017, arXiv:1705.09214 [hep-ph], citations: **1**.

Community white papers and large collaborations

A list of community papers to which I contributed significantly, highlighting my participation below each entry.

1. Feebly Interacting Particles: FIPs 2022 workshop report, C. Antel et al, proceedings, 2023, arXiv:2305.01715 [hep-ph], citations: **20**.
— Contributor to the “New Ideas” section.
2. Feebly-interacting particles: FIPs 2020 workshop report, Prateek Agrawal et al, Eur.Phys.J.C 81 (2021) 11 1015, 2021, arXiv:2102.12143, citations: **143**.
— Contributor to the sections on heavy neutral leptons.
3. New opportunities at the next-generation neutrino experiments I: BSM neutrino physics and dark matter, C. A. Argüelles et al, Rept.Prog.Phys. 83 (2020) 12 124201, 2019, arXiv:1907.08311, citations: **65**.
— One of the main contributors to the sections on heavy neutral leptons.
4. Neutrino Non-Standard Interactions: A Status Report, P. S. Bhupal Dev et al, SciPost Phys.Proc. 2 (2019) 001, 2019, arXiv:1907.00991, citations: **135**.
— Writing of the sections on neutrino trident production and neutrino-electron scattering.
5. Dark Sector Studies with Neutrino Beams, Brian Batell et al, proceedings, 2022, arXiv:2207.06898, citations: **5**.
— Led the contributions on non-minimal heavy neutral lepton models.
6. The Physics Case for a Neutrino Factory, Alex Bogacz, Vedran Brdar, Alan Bross, André de Gouvêa, Jean-Pierre Delahaye, Patrick Huber, MH, Kevin J. Kelly, Ken Long, Zahra Tabrizi, proceedings, 2022, arXiv:2203.08094, citations: **4**.
— One of the main contributors to the beyond-the-Standard-Model motivations for a neutrino factory.
7. White Paper on Light Sterile Neutrino Searches and Related Phenomenology, M. A. Acero, C. A. Argüelles, MH, D. Kalra, G. Karagiorgi, K. J. Kelly, B. Littlejohn, P. Machado, W. Pettus, B. Zamorano, preprint, 2022, arXiv:2203.07323, citations: **17**.
— Co-editor in charge of requesting contributions on beyond-the-Standard-Model explanations of the short-baseline anomalies. Also contributed to a substantial portion of the final text.
8. Neutrino Self-Interactions: A White Paper, Jeffrey M. Berryman et al, proceedings, 2022, arXiv:2203.01955, citations: **17**.
— Contributor to the section on neutrino-self-interactions via the neutrino mixing portal.
9. New Physics Searches at Kaon and Hyperon Factories, Evgueni Goudzovski et al, preprint, 2022, arXiv:2201.07805, citations: **30**.
— Co-editor on sections about effective isospin violation in kaon decays and on the production of multiple light particles in kaon decays.
10. A Snowmass Whitepaper: Dark Matter Production at Intensity-Frontier Experiments, G. Krnjaic, N. Toro, A. Berlin, B. Batell, N. Blinov, L. Darme, P. DeNiverville, P. Harris, C. Hearty, Y. -D. Tsai, preprint, 2022, arXiv:2207.00597, citations: **9**.
— Contributor to sections on dark matter detection using neutrinos and on neutrophilic dark matter models.