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 theoretical particle 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. Joachim Kopp and David Cerdeño.

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

MENTORING

- **Perimeter ISSYP 2022** and **2023**: led high-school students in a one-week project about neutrinos.
- **Student mentoring**: Has mentored several Ph.D. and undergraduate students in research projects.

  Mentoring in graduate student research projects:

  - Jaime Hoefken (University of Bologna, 2022 to 2023): mentoring in two publications,
  - Daniele Massaro (University of Bologna, 2021 to 2023): mentoring in four publications,
  - Asli Abdullahi (Durham University, 2020 to 2021): mentoring in two publications,
  - Nicholas Kamp (MIT, 2021 to 2022): mentoring in two publications,
  - Nicolò Foppiani (Harvard University, 2020 to 2022): mentoring in two publications.

  Mentoring in undergraduate research student mentoring:

  - Isaac Cheng (University of Waterloo, 2023): primary advisor in PSI Start Summer project at the Perimeter Institute working on the cosmic neutrino background asymmetry.
  - Nathan Gershengorn (Harvard University, current): research on the effect of matter potentials on the cosmic neutrino background asymmetry,

    - Luc Bojorquez-Lopez (Harvard University, current): researching the beam-induced neutrino rate at muon collider detectors,

- **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).

SCIENCE OUTREACH

- **Perimeter ISSYP 2022** and **2023**: tutor at two edition of the International Summer School for Young Physicists at Perimeter.
- **KITP Teacher's Conference 2022**: speaker at the KITP teacher's conference.
- **IceCube comics**: translated all the Rosie & Gibbs comics about IceCube to Brazilian Portuguese.
- **Royal Society Summer Exhibition 2017** and **2018**: event organizer for the "modeling the invisible" exhibition and the "ghosts in the universe" exhibition.
- **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.

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.

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**: primary event organizers for the 2021 edition in Minnesota, US.

  IceDune workshop 2021: convener of the Beyond the Standard Model physics session aimed at increasing the cross-talk between IceCube and DUNE collaborators.
- **Young Theorists Forums 9, 10, and 11**: event organizer for the annual one-day conference for graduate students in the UK.
- **Journal refereeing**: refereed for Physical Review Letters, Physical Review D, Journal of High Energy Physics, and European Physics Journal C.

EXPERIMENTAL COLLABORATIONS

- New member of the **IceCube** collaboration.
- In a Memorandum of Understanding to collaborate with **MicroBooNE** in an analysis to search for dark sectors.
- Member of the **Deep Underground Neutrino Experiment (DUNE)** from 2015 to 2023.

TRAINING AND RESEARCH PLACEMENTS

- **Invisibles network research placements**:
  - Columbia University for one month in 2019,
  - Lawrence Berkeley National Laboratory for one month in 2019,
  - Fermi National Laboratory Theory Division for two months in 2018.
- **Undergraduate research** at the Federal University of Santa Catarina working with Profs. Débora P. Menezes and Marcus E. B. Pinto, and at Durham University with Prof. Silvia Pascoli.

TALKS AND SEMINARS

Invited talks

June 2023	—	PhenoBR 2023, Brazilian virtual conference
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, Blacksbourgh, 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

October 2023 — University of Massachussetts, Amherst, USA
April 2023 — Columbia University, New York, USA
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 fur 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. New physics in multi-electron muon decays, MH, Tony Menzo, Maxim Pospelov, Jure Zupan, JHEP 10 (2023) 006, arXiv:2306.15631 [hep-ph].
2. Pion decay constraints on exotic 17 MeV vector bosons, MH, Maxim Pospelov, Phys.Rev.D 108 (2023) 5 055011, arXiv:2306.15077 [hep-ph], citations: **1**.
3. Effective portals to heavy neutral leptons, Enrique Fernández-Martínez, Manuel González-López, Josu Hernández-García, MH, Jacobo López-Pavón, JHEP 09 (2023) 001, arXiv:2304.06772 [hep-ph], citations: **11**.
4. Constraining light thermal inelastic dark matter with NA64, Martina Mongillo, Asli Abdullahi, Benjamin Banto Oberhauser, Paolo Crivelli, MH, Daniele Massaro, Laura Molina Bueno, Silvia Pascoli, Eur.Phys.J.C 83 (2023) 5 391, arXiv:2302.05414 [hep-ph], citations: **4**.
5. Semi-Visible Dark Photon Phenomenology at the GeV Scale, Asli M. Abdullahi, MH, Daniele Massaro, Silvia Pascoli, Phys.Rev.D 108 (2023) 1 015032, arXiv:2302.05410 [hep-ph], citations: **6**.
6. Implications of MicroBooNE's low sensitivity to electron antineutrino interactions in the search for the MiniBooNE excess, Nicholas W. Kamp, MH, Carlos A. Argüelles, Janet M. Conrad, Michael H. Shaevitz, Phys.Rev.D 107 (2023) 9 092002, arXiv:2301.12573 [hep-ph], citations: **2**.
7. Dipole-coupled heavy-neutral-lepton explanations of the MiniBooNE excess including constraints from MINERvA data, Nicholas W. Kamp, MH, 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**.
8. Efficiently exploring multidimensional parameter spaces beyond the Standard Model, Carlos A. Argüelles, Nicolò Foppiani, MH, Phys.Rev.D 107 (2023) 3 035027, arXiv:2205.12273 [hep-ph], citations: **5**.
9. Dark sectors in neutron-shining-through-a-wall and nuclear-absorption signals, MH, David McKeen, Maxim Pospelov, Nirmal Raj, Phys.Rev.D 107 (2023) 7 075034, arXiv:2201.02603 [hep-ph], citations: **9**.
10. MicroBooNE and the νe 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: **64**.
11. Heavy neutral leptons below the kaon mass at hodoscopic neutrino detectors, Carlos A. Argüelles, Nicolò Foppiani, MH, Phys.Rev.D 105 (2022) 9 095006, arXiv:2109.03831 [hep-ph], citations: **36**.
12. Novel multilepton signatures of dark sectors in light meson decays, MH, Maxim Pospelov, Phys.Rev.D 105 (2022) 1 015017, arXiv:2012.02142 [hep-ph], citations: **24**.
13. Constraints on decaying sterile neutrinos from solar antineutrinos, MH, Maxim Pospelov, Phys.Rev.D 104 (2021) 5 055031, arXiv:2008.11851 [hep-ph], citations: **19**.
14. A dark seesaw solution to low energy anomalies: MiniBooNE, the muon (g−2), and BaBar, Asli Abdullahi, MH, Silvia Pascoli, Phys.Lett.B 820 (2021) 136531, arXiv:2007.11813 [hep-ph], citations: **58**.
15. Pair production of dark particles in meson decays, MH, Kunio Kaneta, Maxim Pospelov, Phys.Rev.D 102 (2020) 5 055016, arXiv:2005.07102 [hep-ph], citations: **22**.
16. Neutrino Masses from a Dark Neutrino Sector below the Electroweak Scale, Peter Ballett, MH, Silvia Pascoli, Phys.Rev.D 99 (2019) 9 091701, arXiv:1903.07590 [hep-ph], citations: **47**.

17. Dark Neutrinos and a Three Portal Connection to the Standard Model, Peter Ballett, MH, Silvia Pascoli, Phys.Rev.D 101 (2020) 11 115025, arXiv:1903.07589 [hep-ph], citations: **74**.
18. Z's in neutrino scattering at DUNE, Peter Ballett, MH, 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**.
19. Neutrino trident production at near detectors, MH, PoS NOW2018 (2019) 037, citations: **1**.
20. Testing New Physics Explanations of the MiniBooNE Anomaly at Neutrino Scattering Experiments, Carlos A. Argüelles, MH, Yu-Dai Tsai, Phys.Rev.Lett. 123 (2019) 26 261801, arXiv:1812.08768 [hep-ph], citations: **72**.
21. Neutrino Trident Scattering at Near Detectors, Peter Ballett, MH, Silvia Pascoli, Yuber F. Perez-Gonzalez, Zahra Tabrizi, Renata Zukanovich Funchal, JHEP 01 (2019) 119, arXiv:1807.10973 [hep-ph], citations: **51**.

Under review or non-peer reviewed publications

1. A panorama of new-physics explanations to the MiniBooNE excess, Asli M. Abdullahi, Jaime Hoefken Zink, MH, Daniele Massaro, Silvia Pascoli, preprint, 2023, arXiv:2308.02543 [hep-ph], citations: **1**.
2. DarkNews: a Python-based event generator for heavy neutral lepton production in neutrino-nucleus scattering, Asli M. Abdullahi, Jaime Hoefken Zink, MH, Daniele Massaro, Silvia Pascoli, preprint, 2022, arXiv:2207.04137 [hep-ph], citations: **6**.
3. Hidden Physics at the Neutrino Frontier: Tridents, Dark Forces, and Hidden Particles, MH, thesis, 2019.
4. Light Sterile Neutrinos at νSTORM: Decoherence and CP violation, Peter Ballett, MH, 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: **25**.

   — Contributor to the “New Ideas” section.

2. The present and future status of heavy neutral leptons, Asli M. Abdullahi et al, J.Phys.G 50 (2023) 2 020501, arXiv:2203.08039 [hep-ph], citations: **106**.

   — Contributor to the “Theory of Heavy Neutral Leptons: Dark Sectors” section.

3. 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 ”Heavy Neutral Leptons” section.

4. 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: **208**.

   — One of the main contributors to the sections on heavy neutral leptons.

5. Neutrino Non-Standard Interactions: A Status Report, P. S. Bhupal Dev et al, SciPost Phys.Proc. 2 (2019) 001, 2019, arXiv:1907.00991, citations: **168**.

   — Writing of the sections on neutrino trident production and neutrino-electron scattering.

6. Dark Sector Studies with Neutrino Beams, Brian Batell et al, proceedings, 2022, arXiv:2207.06898, citations: **20**.

   — Led the contributions on non-minimal heavy neutral lepton models.

7. The Physics Case for a Neutrino Factory, Alex Bogacz et al, proceedings, 2022, arXiv:2203.08094, citations: **6**.

— One of the main contributors to the beyond-the-Standard-Model motivations for a neutrino factory.

8. White Paper on Light Sterile Neutrino Searches and Related Phenomenology, M. A. Acero et al, 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.

9. Neutrino Self-Interactions: A White Paper, Jeffrey M. Berryman et al, proceedings, 2022, arXiv:2203.01955, citations: **48**.

   — Contributor to the section on neutrino-self-interactions via the neutrino mixing portal.

10. New physics searches at kaon and hyperon factories, Evgueni Goudzovski, et al, Rept.Prog.Phys. 86 (2023) 1 016201, arXiv:2201.07805 [hep-ph], citations: **70**.

    — Co-editor on sections about effective isospin violation in kaon decays and on the production of multiple light particles in kaon decays.

11. A Snowmass Whitepaper: Dark Matter Production at Intensity-Frontier Experiments, G. Krnjaic et al, preprint, 2022, arXiv:2207.00597, citations: **25**.

    — Contributor to sections on dark matter detection using neutrinos and on neutrophilic dark matter models.