MATHEUS HOSTERT

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ACADEMIC POSITIONS

Harvard University — Neutrino Theory Network Fellowship Expected start date: Sept. 2023

A three-year fellowship at Harvard University.

Perimeter Institute & University of Minnesota — Joint Post-Doctoral Position Oct. 2019 - present

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 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 AND 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 Drs. Asli Abdullahi and Nicolò Foppiani on multiple projects.
- **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.
- Collaborator in future experimental projects, including DUNE and νSTORM, 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

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. 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: 10.
2. 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: 1.
3. The present and future status of heavy neutral leptons, Asli M. Abdullahi, Pablo Barham Alzas, Brian Batell, James Beacham, Alexey Boyarsky, Saneli Carbajal, Animesh Chatterjee, Jose I. Crespo-Anadon, Frank F. Deppisch, Jaehoon Yu, J.Phys.G 50 (2023) 2 020501, arXiv:2203.08039 [hep-ph], citations: **76**.

4. New physics searches at kaon and hyperon factories, Evgueni Goudzovski, Diego Redigolo, Kohsaku Tobioka, Jure Zupan, Gonzalo Alonso-Álvarez, Daniele S. M. Alves, Saurabh Bansal, Martin Bauer, Joachim Brod, Robert Ziegler, Rept.Prog.Phys. 86 (2023) 1 016201, arXiv:2201.07805 [hep-ph], citations: **51**.

5. 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: 7.

6. 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: **55**.

7. 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: **27**.

8. Feebly-interacting particles: FIPs 2020 workshop report, Prateek Agrawal, Martin Bauer, James Beacham, Asher Berlin, Alexey Boyarsky, Susana Cebrian, Xabier Cid-Vidal, David d'Enterria, Albert De Roeck, Yu-Dai Tsai, Eur.Phys.J.C 81 (2021) 11 1015, arXiv:2102.12143 [hep-ph], citations: **174**.

9. 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: **18**.

10. Constraints on decaying sterile neutrinos from solar antineutrinos, MH, Maxim Pospelov, Phys.Rev.D 104 (2021) 5 055031, arXiv:2008.11851 [hep-ph], citations: **18**.

11. 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: **50**.

12. 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**.

13. New opportunities at the next-generation neutrino experiments I: BSM neutrino physics and dark matter, C. A. Argüelles, A. J. Aurisano, B. Batell, J. Berger, M. Bishai, T. Boschi, N. Byrnes, A. Chatterjee, A. Chodos, C. Zhang, Rept.Prog.Phys. 83 (2020) 12 124201, arXiv:1907.08311 [hep-ph], citations: **71**.

14. Neutrino Non-Standard Interactions: A Status Report, P. S. Bhupal Dev, K. S. Babu, Peter B. Denton, Pedro A. N. Machado, Carlos A. Argüelles, Joshua L. Barrow, Sabya Sachi Chatterjee, Mu-Chun Chen, André de Gouvêa, Xun-Jie Xu, SciPost Phys.Proc. 2 (2019) 001, arXiv:1907.00991 [hep-ph], citations: **149**.

15. 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: **46**.

16. 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: **66**.

17. 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: **60**.

18. Neutrino trident production at near detectors, MH, PoS NOW2018 (2019) 037, citations: 1.

19. 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: **66**.

20. 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: **48**.

Under review or non-peer reviewed publications

1. Effective portals to heavy neutral leptons, Enrique Fernández-Martínez, Manuel González-López, Josu Hernández-García, MH, Jacobo López-Pavón, preprint, 2023, arXiv:2304.06772 [hep-ph].

2. 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, preprint, 2023, arXiv:2302.05414 [hep-ph], citations: 1.
3. Semi-Visible Dark Photons below the Electroweak Scale, Asli M. Abdullahi, MH, Daniele Massaro, Silvia Pascoli, preprint, 2023, arXiv:2302.05410 [hep-ph], citations: 1.
4. 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, preprint, 2023, arXiv:2301.12573 [hep-ph].
5. Dark Sector Studies with Neutrino Beams, Brian Batell, Joshua Berger, Vedran Brdar, Alan D. Bross, Janet M. Conrad, Patrick deNiverville, Valentina De Romeri, Bhaskar Dutta, Saeid Foroughi-Abari, Jaehoon Yu, proceedings, 2022, arXiv:2207.06898 [hep-ph], citations: **11**.
6. 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: 5.
7. 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 [hep-ph], citations: **16**.
8. 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 [hep-ph], citations: 6.
9. White Paper on Light Sterile Neutrino Searches and Related Phenomenology, M. A. Acero, C. A. Argüelles, M. Hostert, D. Kalra, G. Karagiorgi, K. J. Kelly, B. Littlejohn, P. Machado, W. Pettus, B. Zamorano, preprint, 2022, arXiv:2203.07323 [hep-ex], citations: **34**.
10. Neutrino Self-Interactions: A White Paper, Jeffrey M. Berryman, Nikita Blinov, Vedran Brdar, Thejs Brinckmann, Mauricio Bustamante, Francis-Yan Cyr-Racine, Anirban Das, André de Gouvêa, Peter B. Denton, Yue Zhang, proceedings, 2022, arXiv:2203.01955 [hep-ph], citations: **23**.
11. Forward Physics Facility - Snowmass 2021 Letter of Interest, Roshan Mammen Abraham, Henso Abreu, Yoav Afik, Sanjib Kumar Agarwalla, Juliette Alimena, Luis Alfredo Anchordoqui, Claire Antel, Akitaka Ariga, Tomoko Ariga, Yi-Ming Zhong, preprint, 2020, citations: **17**.
12. Hidden Physics at the Neutrino Frontier: Tridents, Dark Forces, and Hidden Particles, Matheus. Hostert, thesis, 2019.
13. 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 2020 workshop report, Prateek Agrawal et al, Eur.Phys.J.C 81 (2021) 11 1015, 2021, arXiv:2102.12143, citations: **143**.

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

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

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, 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

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