### Publication List

#### Peter B. Denton

Updated: December 3, 2020\*†

### Articles

- [1] H. Davoudiasl, P. B. Denton, and D. A. McGady, "Ultralight Fermionic Dark Matter," arXiv:2008.06505 [hep-ph].
- [2] P. B. Denton and J. Gehrlein, "A Statistical Analysis of the COHERENT Data and Applications to New Physics," *PRL* (in press) (8, 2020), arXiv:2008.06062 [hep-ph].
- [3] P. B. Denton, J. Gehrlein, and R. Pestes, "CP-Violating Neutrino Non-Standard Interactions in Long-Baseline-Accelerator Data," arXiv:2008.01110 [hep-ph].
- [4] P. B. Denton and Y. Kini, "Ultra-High-Energy Tau Neutrino Cross Sections with GRAND and POEMMA," *PRD* (in press) (7, 2020), arXiv:2007.10334 [astro-ph.HE].
- [5] H. Davoudiasl, P. B. Denton, and J. Gehrlein, "An Attractive Scenario for Light Dark Matter Direct Detection," *Phys. Rev. D* 102 (7, 2020) 091701, arXiv:2007.04989 [hep-ph].
- [6] P. B. Denton and R. Pestes, "The Impact of Different Parameterizations on the Interpretation of CP Violation in Neutrino Oscillations," arXiv:2006.09384 [hep-ph].
- [7] A. Abdullahi and P. B. Denton, "Visible Decay of Astrophysical Neutrinos at IceCube," *Phys. Rev. D* **102** no. 2, (2020) 023018, arXiv:2005.07200 [hep-ph].
- [8] P. B. Denton, "A Return To Neutrino Normalcy," arXiv:2003.04319 [hep-ph].
- [9] **FASER** Collaboration, H. Abreu *et al.*, "Technical Proposal: FASERnu," arXiv:2001.03073 [physics.ins-det].

<sup>\*</sup>For the latest version see: peterdenton.github.io

<sup>&</sup>lt;sup>†</sup>Most author lists are in alphabetical order as that is the standard in particle physics.

- [10] P. B. Denton, S. J. Parke, and X. Zhang, "Fibonacci Fast Convergence for Neutrino Oscillations in Matter," *Phys. Lett.* B807 (2020) 135592, arXiv:1909.02009 [hep-ph].
- [11] P. B. Denton, S. J. Parke, T. Tao, and X. Zhang, "Eigenvectors from Eigenvalues," arXiv:1908.03795 [math.RA].
- [12] **FASER** Collaboration, H. Abreu *et al.*, "Detecting and Studying High-Energy Collider Neutrinos with FASER at the LHC," *Eur. Phys. J.* C80 no. 1, (2020) 61, arXiv:1908.02310 [hep-ex].
- [13] C. A. Argüelles *et al.*, "White Paper on New Opportunities at the Next-Generation Neutrino Experiments (Part 1: BSM Neutrino Physics and Dark Matter)," arXiv:1907.08311 [hep-ph].
- [14] P. B. Denton, S. J. Parke, and X. Zhang, "Eigenvalues: the Rosetta Stone for Neutrino Oscillations in Matter," *Phys. Rev. D* 101 (2020) 093001, arXiv:1907.02534 [hep-ph].
- [15] P. Bhupal Dev\*, K. Babu\*, P. B. Denton\*, P. A. Machado\*, et al., "Neutrino Non-Standard Interactions: A Status Report," SciPost Phys. Proc. 2 (2019) 001, arXiv:1907.00991 [hep-ph]. \*Co-Editors.
- [16] H. Davoudiasl and P. B. Denton, "Ultra Light Boson Dark Matter and Event Horizon Telescope Observations of M87\*," *Phys. Rev. Lett.* **123** (2019) 021102, arXiv:1904.09242 [astro-ph.CO].
- [17] G. A. Barenboim, P. B. Denton, and I. M. Oldengott, "Inflation meets neutrinos," *Phys. Rev.* **D99** (2019) 083515, arXiv:1903.02036 [astro-ph.CO].
- [18] P. B. Denton and S. J. Parke, "Simple and Precise Factorization of the Jarlskog Invariant for Neutrino Oscillations in Matter," *Phys. Rev.* D100 (2019) 053004, arXiv:1902.07185 [hep-ph].
- [19] G. Barenboim, P. B. Denton, S. J. Parke, and C. A. Ternes, "Neutrino oscillation probabilities through the looking glass," *Phys. Lett.* **B791** (2019) 351–360, arXiv:1902.00517 [hep-ph].
- [20] P. B. Denton, Y. Farzan, and I. M. Shoemaker, "Activating the fourth neutrino of the 3+1 scheme," *Phys. Rev.* **D99** no. 3, (2019) 035003, arXiv:1811.01310 [hep-ph].
- [21] GRAND Collaboration, J. Álvarez Muñiz et al., "The Giant Radio Array for Neutrino Detection (GRAND): Science and Design," Sci. China Phys. Mech. Astron. 63 no. 1, (2020) 219501, arXiv:1810.09994 [astro-ph.HE].
- [22] K. Møller, P. B. Denton, and I. Tamborra, "Cosmogenic Neutrinos Through the GRAND Lens Unveil the Nature of Cosmic Accelerators," JCAP 1905 (2019) 047, arXiv:1809.04866 [astro-ph.HE].

- [23] P. B. Denton and S. J. Parke, "The Effective  $\Delta m_{ee}^2$  in Matter," *Phys. Rev.* **D98** (2018) 093001, arXiv:1808.09453 [hep-ph].
- [24] P. B. Denton, S. J. Parke, and X. Zhang, "Rotations Versus Perturbative Expansions for Calculating Neutrino Oscillation Probabilities in Matter," *Phys. Rev.* D98 no. 3, (2018) 033001, arXiv:1806.01277 [hep-ph].
- [25] P. B. Denton and I. Tamborra, "Invisible Neutrino Decay Resolves IceCube's Track and Cascade Tension," *Phys. Rev. Lett.* 121 no. 12, (2018) 121802, arXiv:1805.05950 [hep-ph].
- [26] P. B. Denton, Y. Farzan, and I. M. Shoemaker, "Testing large non-standard neutrino interactions with arbitrary mediator mass after COHERENT data," *JHEP* 07 (2018) 037, arXiv:1804.03660 [hep-ph].
- [27] K. Moller, A. M. Suliga, I. Tamborra, and P. B. Denton, "Measuring the supernova unknowns at the next-generation neutrino telescopes through the diffuse neutrino background," *JCAP* 1805 (2018) 066, arXiv:1804.03157 [astro-ph.HE].
- [28] P. B. Denton and I. Tamborra, "The Bright and Choked Gamma-Ray Burst Contribution to the IceCube and ANTARES Low-Energy Excess,"

  JCAP 1804 no. 04, (2018) 058, arXiv:1802.10098 [astro-ph.HE].
- [29] P. B. Denton and S. J. Parke, "Addendum to "Compact perturbative expressions for neutrino oscillations in matter"," *JHEP* 06 (2018) 109, arXiv:1801.06514 [hep-ph].
- [30] P. B. Denton and I. Tamborra, "Exploring the Properties of Choked Gamma-ray Bursts with IceCube's High-energy Neutrinos," *Astrophys. J.* **855** no. 1, (2018) 37, arXiv:1711.00470 [astro-ph.HE].
- [31] P. B. Denton, D. Marfatia, and T. J. Weiler, "The Galactic Contribution to IceCube's Astrophysical Neutrino Flux," *JCAP* 1708 no. 08, (2017) 033, arXiv:1703.09721 [astro-ph.HE].
- [32] P. Coloma, P. B. Denton, M. C. Gonzalez-Garcia, M. Maltoni, and T. Schwetz, "Curtailing the Dark Side in Non-Standard Neutrino Interactions," *JHEP* 04 (2017) 116, arXiv:1701.04828 [hep-ph].
- [33] P. B. Denton, H. Minakata, and S. J. Parke, "Compact Perturbative Expressions For Neutrino Oscillations in Matter," *JHEP* 06 (2016) 051, arXiv:1604.08167 [hep-ph].
- [34] P. B. Denton and T. J. Weiler, "Sensitivity of full-sky experiments to large scale cosmic ray anisotropies," *JHEAp* 8 (2015) 1–9, arXiv:1505.03922 [astro-ph.HE].
- [35] P. B. Denton and T. J. Weiler, "The Fortuitous Latitude of the Pierre Auger Observatory and Telescope Array for Reconstructing the Quadrupole Moment," *Astrophys. J.* 802 no. 1, (2015) 25, arXiv:1409.0883 [astro-ph.HE].

- [36] L. A. Anchordoqui, P. B. Denton, H. Goldberg, T. C. Paul, L. H. M. Da Silva, B. J. Vlcek, and T. J. Weiler, "Weinberg's Higgs portal confronting recent LUX and LHC results together with upper limits on  $B^+$  and  $K^+$  decay into invisibles," *Phys. Rev.* D89 no. 8, (2014) 083513, arXiv:1312.2547 [hep-ph].
- [37] P. B. Denton and T. J. Weiler, "Using Integral Dispersion Relations to Extend the LHC Reach for New Physics," *Phys. Rev.* **D89** no. 3, (2014) 035013, arXiv:1311.1248 [hep-ph].
- [38] N. Arsene, L. I. Caramete, P. B. Denton, and O. Micu, "Quantum Black Holes Effects on the Shape of Extensive Air Showers," arXiv:1310.2205 [hep-ph].

## Conference Proceedings

- [1] S. J. Parke, P. B. Denton, and H. Minakata, "Analytic Neutrino Oscillation Probabilities in Matter: Revisited," arXiv:1801.00752 [hep-ph].
- [2] JEM-EUSO Collaboration, P. B. Denton, L. A. Anchordoqui, A. A. Berlind, M. Richardson, and T. J. Weiler, "Sensitivity of orbiting JEM-EUSO to large-scale cosmic-ray anisotropies," *J. Phys. Conf. Ser.* 531 (2014) 012004, arXiv:1401.5757 [astro-ph.IM].

### **Talks**

- [1] "Ultralight Fermionic Dark Matter." https://www.ictp-saifr.org/dmw2020/. Talk at 3rd South American Dark Matter Workshop at ICTP in Sao Paulo December 2020.
- [2] "3+1+NSI and CP Violation.". Invited seminar at KIAS November 2020.
- [3] "CP Violation at Long-Baseline Neutrino Experiments." https://indico.bnl.gov/event/8008/. Talk at BNL HET Group October 2020.
- [4] "CP Violation at Long-Baseline Neutrino Experiments." https://npc.fnal.gov/neutrino-seminar-series/. Invited Neutrino Physics Center seminar October 2020 at Fermilab.
- [5] "The Lightest Dark Matter.". Invited seminar October 2020 at University of Sussex.
- [6] "Astrophysical Neutrino Decay." https://indico.cern.ch/event/868940/contributions/3899680/. Talk at ICHEP July 2020 in Prague (virtual).
- [7] "Visible Decay of Astrophysical Neutrinos." https://indico.bnl.gov/event/7985/. Talk at BNL HET Group May 2020.

- [8] "Ultralight Boson Dark Matter Constraints from Superradiance Leveraging the Event Horizon Telescope Collaboration's Observations of M87\*."

  https://indico.cern.ch/event/858682/contributions/3837326/. Talk at Pheno May 2020 in Pittsburgh, PA (virtual).
- [9] "Beyond the Standard Model physics with accelerator neutrino experiments." https://aps-april.onlineeventpro.freeman.com/sessions/15336169/subsession/25117238/Invited plenary at APS April Meeting 2020 (virtual).
- [10] "LMA-Dark: Large New Physics Effects in Neutrino Oscillations." https://indico.bnl.gov/event/7665/. Talk at BNL HET Group February 2020.
- [11] "Motivation for neutrino precision in oscillations." https://indico.bnl.gov/event/7282/. Invited talk at BNL Snowmass Intensity Frontier & Astrophysics Workshop February 2020.
- [12] "Recent results in neutrino oscillation theory."

  https://www.physics.umass.edu/events/2019-11-15-recent-results-neutrino-oscillation
  Invited seminar at UMass Amherst November 2019.
- [13] "Realizing the physics goals at DUNE."

  https://indico.fnal.gov/event/21535/other-view. Invited talk at Modules Of Opportunity for DUNE workshop at BNL November 2019.
- [14] "Recent results in neutrino oscillation theory."

  https://physics.osu.edu/events/high-energy-physics-seminar-peter-dentonbrookahavenInvited seminar at OSU November 2019.
- [15] "New physics probes in future neutrino experiments." https://indico.bnl.gov/event/6652/. Invited colloquium at BNL October 2019.
- [16] "Recent results in neutrino oscillation theory."

  https://indico.cern.ch/event/800930/contributions/3557081/. Talk at CERN
  Neutrino Platform October 2019.
- [17] "Neutrino theory in the coming years." https://indico.bnl.gov/event/6710/.
  Invited talk at BNL Snowmass Discussion October 2019.
- [18] "Recent results in neutrino oscillation theory." https://theory.fnal.gov/events/event/tbd-neutrinos/. Invited theory seminar at Fermilab September 2019.
- [19] "Exact neutrino oscillation probabilities in matter."

  https://indico.ific.uv.es/event/3649/contributions/11349/. Talk given at TomFest at Vanderbilt August 2019.
- [20] "Neutrino oscillation probabilities in matter."

  https://indico.cern.ch/event/782953/contributions/3444777/. Talk given at the 2019 DPF meeting at Northeastern July 2019.

- [21] "Neutrino self interactions in the early universe." <a href="https://indico.cern.ch/event/812851/contributions/3432032/">https://indico.cern.ch/event/812851/contributions/3432032/</a>. Invited talk at NTN NSI Workshop at Wash U May 2019.
- [22] "Partial neutrino decay resolves icecube's track and cascade tension." https://indico.bnl.gov/event/5875/. Talk at BNL HET Group May 2019.
- [23] "Neutrino Oscillation Probabilities in Matter."

  http://theory.physics.uci.edu/seminars.html. Invited seminar at UC Irvine May 2019.
- [24] "Neutrino Oscillation Probabilities in Matter."

  http://www.theory.caltech.edu/people/carol/seminar.html. Seminar at Caltech May 2019.
- [25] "Partial Neutrino Decay Addresses the Track Cascade Tension at IceCube." https://indico.cern.ch/event/777988/contributions/3410555/. Talk at Pheno May 2019 in Pittsburgh, PA.
- [26] "Neutrino Oscillation Probabilities in Matter." <a href="https://www.phys.psu.edu/seminars/all-seminars">https://www.phys.psu.edu/seminars/all-seminars</a>. Invited seminar at Penn State April 2019.
- [27] "Neutrino Oscillation Probabilities in Matter." https://www.phys.vt.edu/Talks/NeutrinoPhysicsSeminar.html. Invited seminar at Virginia Tech February 2019.
- [28] "Analytic and Compact Expressions for Neutrino Oscillations in Matter." https://dx.doi.org/10.5281/zenodo.2642372. Invited talk at PONDD workshop at Fermilab December 2018.
- [29] "Finding the Unexpected in IceCube.". **Invited** N-Talk at Niels Bohr International Academy September 2018 in Copenhagen.
- [30] "High Energy Neutrino Parameter Estimation.". **Invited** talk at GRAND workshop at IAP August 2018.
- [31] "New Neutrino Interactions: Breaking Degeneracies and Relaxing Sterile Tensions.". **Invited** seminar at BNL August 2018.
- [32] "Analytic and compact perturbative expressions for neutrino oscillations in matter." <a href="https://indico.cern.ch/event/686555/contributions/2977525/">https://indico.cern.ch/event/686555/contributions/2977525/</a>. Talk at the International Conference of High Energy Physics (ICHEP) July 2018 in Seoul.
- [33] "Gamma Ray Bursts, Supernovae, Neutrinos, and IceCube.". **Invited** talk at IIHE April 2018 in Brussels.
- [34] "Gamma Ray Bursts, Supernovae, Neutrinos, and IceCube.". **Invited** talk at DESY January 2018 in Zeuthen.

- [35] "Gamma Ray Bursts, Supernovae, Neutrinos, and IceCube.". **Invited** talk at Arizona State University January 2018.
- [36] "Supernova Gamma Ray Burst Neutrino Connection.". **Invited** SUPER-STARS talk at DARK Cosmology Center November 2017 in Copenhagen.
- [37] "Gamma Ray Bursts, Supernovae, Neutrinos, and IceCube.". **Invited** N-Talk at Niels Bohr International Academy November 2017 in Copenhagen.
- [38] "Analytic and compact perturbative expressions for neutrino oscillations in matter.". **Invited** seminar at Campinas State University October 2017.
- [39] "COHERENT and the LMA-Dark NSI Solution." https://indico.uu.se/event/324/session/20/contribution/182. Invited talk at the NUFACT 2017 workshop September 2017 in Uppsala.
- [40] "What We Can Tell About the Sources of IceCube's Neutrinos, and What IceCube Can Tell Us About Gamma Ray Bursts."

  http://astro.fnal.gov/events/event/tbd-35/. Astrophysics theory seminar at Fermilab August 2017 in Batavia, IL.
- [41] "The Galactic Contribution to IceCube's Astrophysical Neutrino Flux."

  <a href="https://indico.cern.ch/event/615891/contributions/2608935/">https://indico.cern.ch/event/615891/contributions/2608935/</a>. Talk at TeV Particle Astrophysics at CCAPP in Columbus, OH.
- [42] "Finding Anisotropies in Cosmic Rays and Neutrinos."

  http://nbia.nbi.ku.dk/nbia-seminars/nbia-seminar-peter-denton/. Invited
  seminar at the Niels Bohr International Academy astroparticle seminar April 2017 in Copenhagen.
- [43] "Analytic and compact perturbative expressions for neutrino oscillations in matter.".

  Talk at the Center of Excellence for Particle Physics at the Terascale at the

  University of Melbourne December 2016.
- [44] "Spherical Harmonics as a Tool for Finding Anisotropies in UHECR and Astrophysical Neutrino Fluxes.". **Invited** talk at the Danish Astroparticle Physics Meeting October 2016 in Odense.
- [45] "The Standard Neutrino Oscillation Parameters and a Surprising Alternative Solution.". **Invited** N-Talk at Niels Bohr International Academy September 2016 in Copenhagen.
- [46] "Analytic and compact perturbative expressions for neutrino oscillations in matter." <a href="http://indico.cern.ch/event/432527/contributions/1071859/">http://indico.cern.ch/event/432527/contributions/1071859/</a>. Talk at the International Conference of High Energy Physics (ICHEP) August 2016 in Chicago, IL.

- [47] "Analytic and compact perturbative expressions for neutrino oscillations in matter." <a href="http://theory.fnal.gov/seminars/seminars.html">http://theory.fnal.gov/seminars/seminars.html</a>. Invited talk at the Fermilab theory seminar July 2016 in Batavia, IL.
- [48] "Methods for Probing New Physics at High Energies."

  <a href="https://events.vanderbilt.edu/index.php?eID=90084">https://events.vanderbilt.edu/index.php?eID=90084</a>. Successful dissertation defense at Vanderbilt University June 2016 in Nashville, TN.
- [49] "Analytic and compact perturbative expressions for neutrino oscillations in matter." <a href="http://www.ccsem.infn.it/issp2016/index.html">http://www.ccsem.infn.it/issp2016/index.html</a>. Talk at the International School of Subnuclear Physics May 2016 in Erice, Sicily.
- [50] "Analytic and compact perturbative expressions for neutrino oscillations in matter." <a href="https://indico.cern.ch/event/489180/contributions/2158195/">https://indico.cern.ch/event/489180/contributions/2158195/</a>. Talk at Pheno May 2016 in Pittsburgh, PA.
- [51] "Cosmic Ray Anisotropy with Partial Sky Exposure.". **Invited** seminar November 2015 at CCAPP.
- [52] "The Effect of a Maximum Lepton Energy on the Stability of Pions and Cosmic Ray Physics." http://meetings.aps.org/link/BAPS.2015.APR.M14.1. Talk at the APS April meeting 2015 in Baltimore, MD.
- [53] "Particle Physics at the Highest Energies.". **Invited** seminar December 2014 at the University of Wisconsin Madison.
- [54] "Sensitivity of orbiting JEM-EUSO to large-scale cosmic-ray anisotropies.". Talk at the Cosmic Ray Anisotropy Workshop September 2013 in Madison, WI.
- [55] "Using dispersion relations to look for new physics in pp elastic scattering at the LHC." http://meetings.aps.org/link/BAPS.2013.APR.H12.8. Talk at the APS April meeting 2013 in Denver, CO.

#### Notes

[1] P. B. Denton, H. Minakata, and S. J. Parke, "Comment on 1801.10488v3,". https://zenodo.org/record/1177535.

### Code

- [1] P. B. Denton, "Peterdenton/nu-pert-compare: v1.0.0," Jan., 2019. https://doi.org/10.5281/zenodo.2547029. https://github.com/PeterDenton/Nu-Pert-Compare.
- [2] P. B. Denton, "ANA v1.0.0: Astrophysical Neutrino Anisotropy," Mar., 2017. https://doi.org/10.5281/zenodo.438675. https://github.com/PeterDenton/ANA.

[3] P. B. Denton, "Nu-Pert v0.2.2: Analytic and compact perturbative expressions for neutrino oscillations in matter," June, 2016.

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https://doi.org/10.5281/zenodo.54629.
https://github.com/PeterDenton/Nu-Pert.
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### Miscellaneous

- [1] P. B. Denton\* *et al.*, "Neutrino Non-Standard Interactions." Snowmass 2021: LOI, August, 2020.
  - https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF3\_NF1-CF7\_CF0-TF11\_\*Editor.
- [2] P. B. Denton\* and S. J. Parke, "Direct Probes of the Matter Effect in Neutrino Oscillations." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF1\_NF3-TF0\_TF0\_Peter \*Editor.
- [3] M. Bustamante\*, P. B. Denton\*, S. Wissel\*, et al., "Ultra-High-Energy Neutrinos." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF4\_NF6-CF7\_CF3-TF9\_T\*Editor.
- [4] P. B. Denton\* et al., "Computing Neutrino Oscillations in Matter Efficiently." Snowmass 2021: LOI, July, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF8-CompF2-005.pdf. \*Editor.
- [5] L. A. Anchordoqui, M. Bustamante, et al., "Cosmic Neutrino Probes of Fundamental Physics." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF7\_CF1-NF4\_NF3-TF11\_
- [6] L. A. Anchordoqui et al., "Synergy of astro-particle physics and collider physics." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF7\_CF0-EF6\_EF7-NF5\_N
- [7] D. Soldin et al., "Studies of the Muon Excess in Cosmic Ray Air Showers." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF7\_CF0-EF6\_EF7-AF4\_A
- [8] J. L. Feng, F. Kling, et al., "Forward Physics Facility." Snowmass 2021: LOI, August, 2020.
- [9] L. Johns et al., "Supernova neutrinos and particle-physics opportunities." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF8\_NF4-CF3\_CF7-TF9\_T

- [10] K. Scholberg *et al.*, "Neutrino Opportunities at the ORNL Second Target Station." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF6\_NF9-CF1\_CF0-TF11\_
- [11] M. Hostert *et al.*, "Opportunities and signatures of non-minimal Heavy Neutral Leptons." Snowmass 2021: LOI, August, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF2\_NF3-EF9\_EF0-RF4\_F
- [12] D. A. Sierra *et al.*, "Coherent elastic neutrino-nucleus scattering: Theoretical and experimental impact." Snowmass 2021: LOI, May, 2020. https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF0-002.pdf.

# Thesis

[1] P. B. Denton, Methods for Probing New Physics at High Energies. PhD thesis, Vanderbilt U., 2016-12-18.

http://etd.library.vanderbilt.edu/available/etd-07052016-131020/.