

# DAVID MCKEEN

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## Education

Ph.D., Physics, University of Chicago, 2010. Advisor: J. L. Rosner.

M.S., Physics, University of Chicago, 2007.

B.S. with Honors, Physics, California Institute of Technology, 2004.

## Professional Positions

Research Scientist, TRIUMF, 2018–Present.

Adjunct Assistant Professor, University of Victoria, 2018–Present.

Samuel P. Langley PITT PACC Fellow, University of Pittsburgh, 2016–2018.

Postdoctoral Research Associate, University of Washington, 2013–2016.

Postdoctoral Research Associate, University of Victoria, 2010–2013.

## Funding

NSERC Discovery Grant (Individual), "Explorations of the Frontier Beyond the Standard Model," 2019-2024

## Publications

1. Contribution to B. Batell, J. Berger, V. Brdar, A. D. Bross, J. M. Conrad, P. deNiverville, V. De Romeri, B. Dutta, S. Foroughi-Abari and M. Hostert, *et al.* "Dark Sector Studies with Neutrino Beams," [arXiv:2207.06898 [hep-ph]].
2. J. Coffey, D. McKeen, D. E. Morrissey and N. Raj, "Neutron star observations of pseudoscalar-mediated dark matter," [arXiv:2207.02221 [hep-ph]].
3. Contribution to G. Krnjaic, N. Toro, A. Berlin, B. Batell, N. Blinov, L. Darme, P. DeNiverville, P. Harris, C. Hearty and M. Hostert, *et al.* "Snowmass 2021 Rare & Precision Frontier (RF6): Dark Matter Production at Intensity-Frontier Experiments," [arXiv:2207.00597 [hep-ph]].
4. D. Croon, S. Ipek and D. McKeen, "Gravitational wave constraints on extended dark matter structures," [arXiv:2205.15396 [astro-ph.CO]].
5. Contribution to J. Elam *et al.* [REDTOP], "The REDTOP experiment: Rare  $\eta/\eta'$  Decays To Probe New Physics," [arXiv:2203.07651 [hep-ex]].
6. D. McKeen, M. Moore, D. E. Morrissey, M. Pospelov and H. Ramani, "Accelerating Earth-Bound Dark Matter," [arXiv:2202.08840 [hep-ph]].

7. M. Hostert, D. McKeen, M. Pospelov and N. Raj, "Dark sectors in neutron-shining-through-a-wall and nuclear absorption signals," [arXiv:2201.02603 [hep-ph]].
8. M. A. Buen-Abad, R. Essig, D. McKeen and Y. M. Zhong, "Cosmological Constraints on Dark Matter Interactions with Ordinary Matter," Phys. Rept. **961**, 1-35 (2022) [arXiv:2107.12377 [astro-ph.CO]].
9. B. Batell, A. Freitas, A. Ismail, D. McKeen and M. Rai, "Renormalizable Models of Flavor-Specific Scalars," Phys. Rev. D **104**, 115032 (2021) [arXiv:2107.08059 [hep-ph]].
10. D. McKeen, M. Pospelov and N. Raj, "Neutron Star Internal Heating Constraints on Mirror Matter," Phys. Rev. Lett. **127**, 061805 (2021) [arXiv:2105.09951 [hep-ph]].
11. D. McKeen, M. Pospelov and N. Raj, "Cosmological and astrophysical probes of dark baryons," Phys. Rev. D **103**, 115002 (2021) [arXiv:2012.09865 [hep-ph]].
12. S. Friedrich, G. B. Kim, C. Bray, R. Cantor, J. Dilling, S. Fretwell, J. A. Hall, A. Lennarz, V. Lordi and P. Machule, *et al.* "Limits on the Existence of sub-MeV Sterile Neutrinos from the Decay of  $^7\text{Be}$  in Superconducting Quantum Sensors," Phys. Rev. Lett. **126**, 021803 (2021) [arXiv:2010.09603 [nucl-ex]].
13. Contribution to K. S. Babu, J. Barrow, Z. Berezhiani, L. Broussard, M. Demarteau, P. S. Bhupal Dev, J. de Vries, A. Fomin, S. Gardner and S. Girmohanta, *et al.* " $|\Delta\mathcal{B}| = 2$ : A State of the Field, and Looking Forward—A brief status report of theoretical and experimental physics opportunities," [arXiv:2010.02299 [hep-ph]].
14. Contribution to C. Alpigiani *et al.* [MATHUSLA], "An Update to the Letter of Intent for MATHUSLA: Search for Long-Lived Particles at the HL-LHC," [arXiv:2009.01693 [physics.ins-det]].
15. G. D. Kribs, D. McKeen and N. Raj, "Breaking up the Proton: An Affair with Dark Forces," Phys. Rev. Lett. **126**, 011801 (2021) [arXiv:2007.15655 [hep-ph]].
16. D. Croon, D. McKeen, N. Raj and Z. Wang, "Subaru-HSC through a different lens: Microlensing by extended dark matter structures," Phys. Rev. D **102**, 083021 (2020) [arXiv:2007.12697 [astro-ph.CO]].
17. D. McKeen, M. Pospelov and N. Raj, "Hydrogen Portal to Exotic Radioactivity," Phys. Rev. Lett. **125**, 231803 (2020) [arXiv:2006.15140 [hep-ph]].
18. D. McKeen and M. Pospelov, "How long does the hydrogen atom live?," [arXiv:2003.02270 [hep-ph]].
19. D. Croon, D. McKeen and N. Raj, "Gravitational microlensing by dark matter in extended structures," Phys. Rev. D **101**, 083013 (2020) [arXiv:2002.08962 [astro-ph.CO]].
20. C. Y. Chen, D. McKeen and M. Pospelov, "New physics via pion capture and simple nuclear reactions," Phys. Rev. D **100**, 095008 (2019) [arXiv:1905.12017 [hep-ph]].
21. D. Croon, N. Fernandez, D. McKeen and G. White, "Stability, reheating and leptogenesis," JHEP **1906**, 098 (2019) [arXiv:1903.08658 [hep-ph]].
22. D. McKeen, "Cosmic neutrino background search experiments as decaying dark matter detectors," Phys. Rev. D **100**, 015028 (2019) [arXiv:1812.08178 [hep-ph]].
23. D. McKeen and N. Raj, "Monochromatic dark neutrinos and boosted dark matter in noble liquid direct detection," Phys. Rev. D **99**, 103003 (2019) [arXiv:1812.05102 [hep-ph]].
24. B. Batell, A. Freitas, A. Ismail and D. McKeen, "Probing Light Dark Matter with a Hadrophilic Scalar Mediator," arXiv:1812.05103 [hep-ph].
25. Contribution to D. Curtin *et al.*, "Long-Lived Particles at the Energy Frontier: The MATHUSLA Physics Case," Rept. Prog. Phys. **82**, no. 11, 116201 (2019) [arXiv:1806.07396 [hep-ph]].

26. J. A. Evans and D. McKeen, "The Light Gluino Gap," arXiv:1803.01880 [hep-ph].
27. D. McKeen, A. E. Nelson, S. Reddy and D. Zhou, "Neutron stars exclude light dark baryons," Phys. Rev. Lett. **121**, 061802 (2018) [arXiv:1802.08244 [hep-ph]].
28. B. Batell, A. Freitas, A. Ismail and D. McKeen, "Flavor-specific scalar mediators," Phys. Rev. D **98**, 055026 (2018) [arXiv:1712.10022 [hep-ph]].
29. B. Batell, T. Han, D. McKeen and B. Shams Es Haghi, Phys. Rev. D **97**, 075016 (2018) [arXiv:1709.07001 [hep-ph]].
30. K. Aitken, D. McKeen, T. Neder and A. E. Nelson, "Baryogenesis from Oscillations of Charmed or Beautiful Baryons," Phys. Rev. D **96**, 075009 (2017) [arXiv:1708.01259 [hep-ph]].
31. Y. S. Liu, D. McKeen and G. A. Miller, "The Validity of the Weizsacker-Williams Approximation and the Analysis of Beam Dump Experiments," Phys. Rev. D **95**, 036010 (2017) [arXiv:1609.06781 [hep-ph]].
32. A. Ghalsasi, D. McKeen and A. E. Nelson, "Probing nonstandard neutrino cosmology with terrestrial neutrino experiments," Phys. Rev. D **95**, 115039 (2017) [arXiv:1609.06326 [hep-ph]].
33. Contribution to J. Alexander *et al.*, "Dark Sectors 2016 Workshop: Community Report," arXiv:1608.08632 [hep-ph].
34. B. Batell, N. Lange, D. McKeen, M. Pospelov and A. Ritz, "Muon anomalous magnetic moment through the leptonic Higgs portal," Phys. Rev. D **95**, 075003 (2017) [arXiv:1606.04943 [hep-ph]].
35. Y. S. Liu, D. McKeen and G. A. Miller, "Electrophobic Scalar Boson and Muonic Puzzles," Phys. Rev. Lett. **117**, 101801 (2016) [arXiv:1605.04612 [hep-ph]].
36. P. Draper and D. McKeen, "Diphotons, New Vacuum Angles, and Strong CP," JHEP **1604**, 127 (2016) [arXiv:1602.03604 [hep-ph]].
37. D. McKeen and A. E. Nelson, "CP Violating Baryon Oscillations," Phys. Rev. D **94**, 076002 (2016) [arXiv:1512.05359 [hep-ph]].
38. A. Ghalsasi, D. McKeen and A. E. Nelson, "Baryogenesis via Mesino Oscillations," Phys. Rev. D **92**, 076014 (2015) [arXiv:1508.05392 [hep-ph]].
39. S. Alekhin *et al.*, "A facility to Search for Hidden Particles at the CERN SPS: the SHiP physics case," Rept. Prog. Phys. **79**, no. 12, 124201 (2016) [arXiv:1504.04855 [hep-ph]].
40. C. Adams *et al.*, "The Intermediate Neutrino Program," arXiv:1503.06637 [hep-ex].
41. B. Bertoni, S. Ipek, D. McKeen and A. E. Nelson, "Constraints and consequences of reducing small scale structure via large dark matter-neutrino interactions," JHEP **1504**, 170 (2015) [arXiv:1412.3113 [hep-ph]].
42. BABAR Collaboration, as an associate member, "Search for new  $\pi^0$ -like particles produced in association with a  $\tau$ -lepton pair," Phys. Rev. D **90**, 112011 (2014) [arXiv:1411.1806 [hep-ex]].
43. S. Ipek, D. McKeen and A. E. Nelson, "CP Violation in Pseudo-Dirac Fermion Oscillations," Phys. Rev. D **90**, 076005 (2014) [arXiv:1407.8193 [hep-ph]].
44. B. Batell, P. deNiverville, D. McKeen, M. Pospelov and A. Ritz, "Leptophobic Dark Matter at Neutrino Factories," Phys. Rev. D **90**, 115014 (2014) [arXiv:1405.7049 [hep-ph]].
45. S. Ipek, D. McKeen and A. E. Nelson, "A Renormalizable Model for the Galactic Center Gamma Ray Excess from Dark Matter Annihilation," Phys. Rev. D **90**, 055021 (2014) [arXiv:1404.3716 [hep-ph]].

46. S. G. Karshenboim, D. McKeen and M. Pospelov, "Constraints on muon-specific dark forces," Phys. Rev. D **90**, 073004 (2014) [arXiv:1401.6154 [hep-ph]].
47. D. Curtin, R. Essig, S. Gori, P. Jaiswal, A. Katz, T. Liu, Z. Liu, D. McKeen *et al.*, "Exotic Decays of the 125 GeV Higgs Boson," Phys. Rev. D **90**, 075004 (2014) [arXiv:1312.4992 [hep-ph]].
48. Contribution to J. Albrecht *et al.* [Intensity Frontier Charged Lepton Working Group Collaboration], "Working Group Report: Charged Leptons," arXiv:1311.5278 [hep-ex].
49. Contribution to R. Essig *et al.*, "Working Group Report: New Light Weakly Coupled Particles," arXiv:1311.0029 [hep-ph].
50. Contribution to A. S. Kronfeld *et al.*, "Project X: Physics Opportunities," arXiv:1306.5009 [hep-ex].
51. D. McKeen, M. Pospelov and A. Ritz, "Electric dipole moment signatures of PeV-scale superpartners," Phys. Rev. D **87**, 113002 (2013) [arXiv:1303.1172 [hep-ph]].
52. Contribution to A. A. Aguilar-Arevalo, B. Batell, R. Cooper, P. deNiverville, R. Dharmapalan, Z. Djurcic, R. Ford and F. G. Garcia *et al.*, "Low Mass WIMP Searches with a Neutrino Experiment: A Proposal for Further MiniBooNE Running," arXiv:1211.2258 [hep-ex].
53. D. McKeen, M. Pospelov and A. Ritz, "Modified Higgs branching ratios versus CP and lepton flavor violation," Phys. Rev. D **86**, 113004 (2012) [arXiv:1208.4597 [hep-ph]].
54. B. Batell, D. McKeen and M. Pospelov, "Singlet Neighbors of the Higgs Boson," JHEP **1210**, 104 (2012) [arXiv:1207.6252 [hep-ph]].
55. D. McKeen and M. Pospelov, "Testing Parity with Atomic Radiative Capture of  $\mu^-$ ," Phys. Rev. Lett. **108**, 263401 (2012) [arXiv:1205.6525 [hep-ph]].
56. P. deNiverville, D. McKeen and A. Ritz, "Signatures of sub-GeV dark matter beams at neutrino experiments," Phys. Rev. D **86**, 035022 (2012) [arXiv:1205.3499 [hep-ph]].
57. Contribution to J. L. Hewett, H. Weerts, R. Brock, J. N. Butler, B. C. K. Casey, J. Collar, A. de Gouvea and R. Essig *et al.*, "Fundamental Physics at the Intensity Frontier," arXiv:1205.2671 [hep-ex].
58. P. Draper and D. McKeen, "Diphotons from Tetraphotons in the Decay of a 125 GeV Higgs at the LHC," Phys. Rev. D **85**, 115023 (2012) [arXiv:1204.1061 [hep-ph]].
59. D. McKeen, M. Pospelov and J. M. Roney, "The Pion-Photon Transition Form Factor and New Physics in the  $\tau$  Sector," Phys. Rev. D **85**, 053002 (2012) [arXiv:1112.2207 [hep-ph]].
60. B. Batell, D. McKeen and M. Pospelov, "New Parity-Violating Muonic Forces and the Proton Charge Radius," Phys. Rev. Lett. **107**, 011803 (2011) [arXiv:1103.0721 [hep-ph]].
61. D. McKeen and M. Pospelov, "Muon Capture Constraints on Sterile Neutrino Properties," Phys. Rev. D **82**, 113018 (2010) [arXiv:1011.3046 [hep-ph]].
62. Q. H. Cao, D. McKeen, J. L. Rosner, G. Shaughnessy and C. E. M. Wagner, "Forward-Backward Asymmetry of Top Quark Pair Production," Phys. Rev. D **81**, 114004 (2010) [arXiv:1003.3461 [hep-ph]].
63. D. McKeen, "Contributions to the Muon's Anomalous Magnetic Moment from a Hidden Sector," Annals Phys. **326**, 1501 (2011) [arXiv:0912.1076 [hep-ph]].
64. D. McKeen, "WIMPlless Dark Matter and Meson Decays with Missing Energy," Phys. Rev. D **79**, 114001 (2009) [arXiv:0903.4982 [hep-ph]].

65. D. McKeen, "Constraining Light Bosons with Radiative  $\Upsilon(1S)$  Decays," Phys. Rev. D **79**, 015007 (2009) [arXiv:0809.4787 [hep-ph]].
66. D. McKeen, J. L. Rosner and A. M. Thalapillil, "Masses and Mixings in a Grand Unified Toy Model," Phys. Rev. D **76**, 073014 (2007) [arXiv:hep-ph/0703177].

## Seminars and Talks

1. Seattle Snowmass Summer Meeting, University of Washington, "New Ideas in Baryogenesis," July 23, 2022
2. Summiting the Unknown Workshop, University of Washington, "Pseudoscalars, Neutron Stars, and other Dark Matters," July 16, 2022
3. Korea Institute for Advanced Study HEP Seminar, "Accelerating Earth-Bound Dark Matter," June 21, 2022
4. CAP 2022 Seminar, McMaster University, "(New) Physics at Future Colliders," June 7, 2022
5. Physics of This Universe Workshop, Johns Hopkins University, "Dark Baryons near a GeV," June 2, 2022
6. IPP 50th Anniversary Symposium, Ottawa, "Standard Model Tensions: the Anomalies," May 28, 2022
7. Munich SFB Colloquium, "Some Idiosyncratic Thoughts on Baryon Number Violation," May 3, 2022
8. Indian Institute of Science Education and Research Seminar, "Dark Baryons near a GeV," October 26, 2021
9. BeEST Collaboration Meeting, "Neutrinos and Physics Beyond the Standard Model," June 17, 2021
10. Johns Hopkins Cosmology Seminar, "Cosmological and astrophysical probes of dark baryons," May 3, 2021
11. Virginia Tech Seminar, "Dark Baryons near a GeV," March 31, 2021
12. Snowmass RF6: Dark Sectors, "Thermal Freeze Out and the Neutrino Portal" December 4, 2020
13. Snowmass RP4: Theoretical Innovations for Future Experiments Regarding Baryon Number Violation, "Perspectives on Baryon Number Violation" August 6, 2020
14. INT Workshop on Beyond the Standard Model with Nuclei, Seattle, "Dark Baryons near a GeV," July 20, 2020
15. IPP Townhall, "New Physics in a Hidden Sector," July 15, 2020
16. BLV2020, "Dark Baryons near a GeV," July 8, 2020
17. Jozef Stefan Institute Seminar, Ljubljana, "How long does the hydrogen atom live?" June 2, 2020
18. BeEST Collaboration Meeting, "keV Neutrino Extensions to the Standard Model," May 14, 2020
19. INT Workshop on Neutrino Physics, Seattle, "Decaying Dark Matter and Searches for the Cosmic Neutrino Background," Feb. 5, 2020
20. Université de Montréal Colloquium, Montréal, "Dark Matter and Hidden Sectors" November 22, 2019
21. Carleton University Colloquium, Ottawa, "Dark Matter and Hidden Sectors" November 19, 2019
22. BLV2019, Madrid, "Low-scale Baryogenesis and Baryon Number Violation," October 22, 2019
23. STRONG-DM Workshop, Vienna, "Cosmic Neutrino Searches as Dark Matter Detectors," August 6, 2019
24. QTS2019, Montreal, "Dark Matter and Neutrinos," July 2, 2019

25. Canadian Association of Physicists Congress, Simon Fraser University, "Dark Matter in a Dark Sector," June 4, 2019
26. MIAPP Flavour Workshop, Munich, "Baryogenesis from Hadron Oscillations," May 24, 2019
27. FPCP Conference, Victoria, "The Flavour of Cosmology," May 7, 2019
28. LBNL Seminar, Berkeley, "Connections Between the Hard to See: Dark Matter and Neutrinos," May 1, 2019
29. University of Texas Seminar, Austin, "Connections Between the Hard to See: Dark Matter and Neutrinos," April 23, 2019
30. WNPPC Conference, Banff, "Dark Matter: WIMPS and Beyond," February 16, 2019
31. McGill University Seminar, Montreal, "Connections Between the Hard to See: Dark Matter and Neutrinos," February 13, 2019
32. York University Seminar, Toronto, "Connections Between the Hard to See: Dark Matter and Neutrinos," February 12, 2019
33. University of Manitoba Colloquium, Winnipeg, "Dark Matter: What and Why?" February 11, 2019
34. University of Winnipeg Colloquium, Winnipeg, "Dark Matter: What and Why?" February 11, 2019
35. KEK Theory Meeting, "Cosmic Neutrino Searches as Dark Matter Detectors," December 6, 2018
36. NuTheories Workshop, Pittsburgh, "Cosmic Neutrino Searches as Dark Matter Detectors," November 5, 2018
37. University of Michigan Brown Bag Seminar, "Dark Matter–Neutrino Interactions," October 24, 2018
38. Interplay between Particle and Astroparticle physics, Cincinnati, "New Low Scale Baryogenesis Models," October 10, 2018
39. BaBar Physics Jamboree, "Oscillations, Baryogenesis, and Exotic Hadron Decays," October 3, 2018
40. Heavy Quarks and Leptons 2018, Yamagata, Japan, "Lepton Flavor Violation and Dark Sectors," June 1, 2018.
41. Kavli IPMU Particle Theory Seminar, "938 MeV dark matter, neutron decay, and neutron stars," May 28, 2018.
42. University of Oregon Workshop: Explorations Beyond the Standard Model, "938 MeV dark matter, neutron decay, and neutron stars," May 15, 2018.
43. KITP Program: High Energy Physics at the Sensitivity Frontier, "938 MeV dark matter, neutron decay, and neutron stars," April 25, 2018.
44. University of California, Irvine, Particle Theory Seminar, "938 MeV dark matter, neutron decay, and neutron stars," April 18, 2018.
45. University of Cincinnati Seminar, "Dark Matter through the Dirac Neutrino Portal," February 6, 2018.
46. Cornell University Seminar, "Dark Matter through the Dirac Neutrino Portal," February 2, 2018.
47. Case Western Reserve University Seminar, "Dark Matter through the Dirac Neutrino Portal," January 30, 2018.

48. University of Sydney Remote Seminar, "Oscillations and Baryogenesis," November 3, 2017.
49. INT Workshop on Neutron-Antineutron Oscillations, Seattle, WA, "Baryon Oscillations and CP Violation," Oct. 26, 2017.
50. Princeton University Pheno & Vino Seminar, "Dark Matter through the Dirac Neutrino Portal," September 26, 2017.
51. Amherst Center for Fundamental Interactions Workshop, UMass Amherst, "Sterile Neutrino Portals," July 19, 2017.
52. Weak Interactions and Neutrinos 2017, Irvine, CA, "Neutrino Portal Dark Matter," June 23, 2017.
53. TRIUMF Colloquium, "New Models of Baryogenesis," May 11, 2017.
54. Wayne State Theory Seminar, "Neutrino Portal Dark Matter," April 22, 2017.
55. New Physics Interpretations at the LHC 2 Workshop, Argonne National Laboratory, "Light Gluino Window," April 7, 2017.
56. Particle Physics in 2017: From the LHC to Dark Matter and Beyond, Aspen, CO, "Oscillations and Baryogenesis," March 23, 2017.
57. CERN-EPFL-Korea TH Institute, CERN, "Dark Matter-Neutrino Interactions," March 3, 2017.
58. Arizona State University Seminar, "Neutrinos and Dark Matter—Connections Between the Difficult to Detect," February 15, 2017.
59. UMass ACFI Seminar, "New Strategies in Baryogenesis and Dark Matter," February 7, 2017.
60. Brookhaven National Laboratory Theory Seminar, "New Models of Baryogenesis," January 26, 2017.
61. NuFact2016, Quy Nhon, Vietnam, "Searches for Dark Sector Particles at Neutrino Experiments," August 24, 2016.
62. Santa Fe Summer Workshop, "Composite States at the LHC," July 7, 2016.
63. Belle II Theory Interface Platform, University of Pittsburgh, "Fun with Taus: New Physics in Tau decay and Production," May 25, 2016.
64. University of Oregon, Emerging New Physics Workshop, "750 GeV vs. CP," May 20, 2016.
65. Argonne National Laboratory, Division Seminar, "What can we learn from neutrinos?" April 26, 2016.
66. University of Illinois, Urbana-Champaign, Particle Theory Seminar, "Dark Matter Interactions," April 25, 2016.
67. TRIUMF, Theory Group Seminar, "750 GeV Lessons," April 12, 2016.
68. Fermilab Particle Theory Seminar, "What can we learn from neutrinos?" March 24, 2016.
69. Washington University in St. Louis, Department of Physics Colloquium, "Dark Matter Interactions," February 22, 2016.
70. University of California, Riverside, Department of Physics & Astronomy Colloquium, "Dark Matter Interactions," February 17, 2016.
71. University of Wisconsin, Particle Theory Seminar, "Oscillations & Baryogenesis," February 2, 2016.

72. DUNE Collaboration Meeting, UT Arlington, "Searching for Light Dark Matter at Neutrino Experiments," January 12, 2016.
73. SLAC Theory Seminar, "Dark Matter Interactions," September 25, 2015.
74. Plenary talk at PPC 2015, Deadwood, SD, "The Neutrino-Dark Matter Connection," July 2, 2015.
75. Conference on the Intersections of Particle and Nuclear Physics, Vail, CO, "Exotic Higgs Decays," May 20, 2015.
76. Stony Brook University, YITP Seminar, "Neutrino-Dark Matter Coupling," February 2, 2015.
77. University of Washington, Institute for Nuclear Theory *Nuclear Aspects of Dark Matter Searches* Workshop, "Dark Matter-Neutrino Coupling, or on the Structure Function of Dark Matter," December 11, 2014.
78. Perimeter Institute, Particle Physics Seminar, "Dark matter coupling with a sterile neutrino inhibits the birth of small scale structure: implications and tests," December 2, 2014.
79. University of Washington, Dark Universe Science Center Seminar, "Dark matter coupling with a sterile neutrino inhibits the birth of small scale structure: implications and tests," October 22, 2014.
80. TRIUMF, Theory Group Seminar, "Dark matter coupling with a sterile neutrino inhibits the birth of small scale structure: implications and tests," October 14, 2014.
81. Theoretical Perspectives on New Physics at the Intensity Frontier Workshop, Victoria, BC, "Light Scalars Through the Leptonic Higgs Portal," September 11, 2014.
82. New Perspectives on Dark Matter Workshop, Fermilab, "Light Dark Matter and Proton Beam Dumps," April 28, 2014.
83. Fermilab Particle Theory Seminar, "Particle Physics Implications of 30 GeV Dark Matter Annihilating to b Quarks," April 15, 2014.
84. Plenary talk at HIGGS2 Workshop, Duke University, "Overivew on Dark Particles: New Physics at an MeV," June 3, 2013.
85. University of Chicago Theory Seminar, "Higgs Discovery: Could There be New Physics?," December 12, 2012.
86. University of Michigan Brown Bag Theory Seminar, "Higgs Discovery: Could There be New Physics?," November 14, 2012.
87. University of Washington Theory Seminar, "Higgs Discovery: Could There be New Physics?," October 30, 2012.
88. SLAC Theory Seminar, "Higgs Discovery: Could There be New Physics?," October 24, 2012.
89. UC Berkeley 4D Seminar, "Higgs Discovery: Could There be New Physics?," October 22, 2012.
90. Frontiers Beyond the Standard Model III meeting, University of Minnesota, "Four Photons faking Two Photons in Higgs Decays," October 11, 2012.
91. Brookhaven National Laboratory Theory Seminar, "Higgs Discovery: Could There be New Physics?," October 10, 2012.
92. Stony Brook University, YITP Seminar, "Higgs Discovery: Could There be New Physics?," October 4, 2012.
93. Johns Hopkins, Particle Theory Seminar, "Higgs Discovery: Could There be New Physics?," October 2, 2012.



94. University of Maryland, Elementary Particle Theory Seminar, "Higgs Discovery: Could There be New Physics?," October 1, 2012.
95. TRIUMF, Theory Group Seminar, "Higgs Discovery: Could There be New Physics?," September 18, 2012.
96. Intensity Frontier Workshop, "Parity-Violating Muonic Forces," December 1, 2011.
97. SLAC, BaBar Collaboration Meeting, "Interpreting BaBar's  $\gamma\gamma^*-\pi^0$  Form Factor Measurement," November 7, 2011.
98. Perimeter Institute, Unravelling Dark Matter Conference, "A Composite Model of Dark Matter," September 24, 2011.
99. UC Irvine, Joint Particle Seminar, "New Parity-Violating Muonic Forces," April 13, 2011.
100. Perimeter Institute, Particle Physics Seminar, "Muon Capture Constraints on Sterile Neutrino Properties," February 15, 2011.
101. TRIUMF, Theory Group Seminar, "Muon Capture Constraints on Sterile Neutrino Properties," November 16, 2010.
102. Perimeter Institute, Particle Physics Seminar, "WIMPlless Dark Matter and Meson Decays," April 20, 2010.
103. Pheno 2009, "WIMPlless Dark Matter and Meson Decays with Missing Energy," May 12, 2009.
104. Argonne National Laboratory Theory Seminar, "WIMPlless Dark Matter and Meson Decays with Missing Energy," April 28, 2009.
105. University of Chicago HEP Lunch Seminar, "WIMPlless Dark Matter," October 6, 2008.

## Professional Activities

Referee for Physical Review Letters, Physical Review D, Physics Letters B, Journal of High Energy Physics, Journal of Cosmology and Astroparticle Physics, Physics of the Dark Universe, Nature Communications, European Physical Journal C.

Co-organizer of Theory Canada XIV Conference, University of British Columbia, June 2018. Co-organizer of "Dark Matter in its Natural Habitat" Workshop, TRIUMF, Feb. 2018. Co-organizer of Digging Deeper at LHC Run II (Feb. 2017, Pittsburgh) and Light Dark World II (Oct. 2017, Pittsburgh) workshops. Co-organizer of Pheno 17 and Pheno 18 symposia.

## Research and Teaching Experience

Research Assistant, Univ. of Chicago Theory Group, with advisor J. L. Rosner

Grader, Physics 443 and 444—Quantum Field Theory I and II, 2005-2006.

Grader, Physics 363—Particle Physics, 2005-2006.

Teaching Assistant, Physics 211—Advanced Laboratory, Winter 2009.

Teaching Assistant, Physics 142—Electricity and Magnetism, Winter 2008.

Teaching Assistant, Physics 132—Electricity and Magnetism, Winter 2007.

Teaching Assistant, Physics 131—Classical Mechanics, Fall 2006.