

Joshua R. Klein : CURRICULUM VITAE

November 28, 2022

University of Pennsylvania
Department of Physics and Astronomy
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Appointments:

University of Pennsylvania	Professor	2012---
University of Pennsylvania	Associate Professor	2008-2012
University of Texas at Austin	Assistant Professor	2002-2008
University of Pennsylvania	Research Assistant Professor	1999-2002
University of Pennsylvania	Postdoctoral Fellow	1994-1999
Princeton University	Instructor	1993-1994

Education:

Ph.D. Princeton University (Physics)	1994
Thesis Title: "A Strange Matter: Searching for the H Dibaryon"	
Advisor: Professor Val Fitch	
M.A. Princeton University (Physics)	1990
B.A. <i>magna cum laude</i> , Cornell University (Physics)	1988
Distinction in All Areas	
Phi Beta Kappa	
Dean's Scholar	

Scientific Offices Held:

Member, Deep Underground Neutrino Experiment Executive Committee	2015-2017
Chair, SNO+ Science Board	2010
US Spokesperson, SNO+ Experiment	2009-
Chair, Sudbury Neutrino Observatory (SNO) Science Board	2006
Co-chair, Solar and Atmospheric Neutrino Experiments Working Group, <i>American Physical Society Multidivisional Neutrino Study</i>	2004
SNO Physics Analysis Coordinator	1998-2003

Grants, Awards, Honors:

Edmund J. and Louise W. Kahn Endowed Term Professor	2018-2022
Lindback Award for Distinguished Teaching	2016
Breakthrough Prize in Physics (as a member of SNO Collaboration)	2015
Fellow, American Physical Society	2011
University Research Foundation Grant, University of Pennsylvania	2009
Teaching Excellence Award, College of Natural Sciences, UT Austin	2007
Big XII Faculty Fellowship	2005
Alfred P. Sloan Fellowship	2005
Outstanding Junior Investigator (OJI) Award, US Department of Energy	2004
Invited Speaker, <i>National Academy of Sciences Frontiers of Science Symposium</i>	2004
Sambamurti Prize, Brookhaven National Laboratory	2003

Selected Publications (Refereed): * indicates significant role in publication

1. A.S. Fruchter, *et al.*, “The Eclipsing Millisecond Pulsar PSR 1957+20,”
The Astrophysical Journal **351**:642-650 (1990)
- *2. J.R. Klein and S. E. Thorsett, “New Limits on Gravitational Symmetry Violations from Pulsar Measurements,” *Physics Letters* **A145**:79-81 (1990)
- *3. D.F. Cowen, *et al.*, “The Sudbury Neutrino Observatory Electronics Chain,”
IEEE Trans. Nucl. Sci. **42**:745-752, (1995)
- *4. J. Belz, *et al.*, “Search for the Weak Decay of an H Dibaryon,”
Phys. Rev. Lett. **76**: 3277-3280 (1996)
- *5. J. Belz, *et al.*, “Search for diffractive dissociation of a long-lived H dibaryon,”
Physical Review Rapid Communications **D53**: R3487-3491, (1996)
- *6. R.D. Cousins and J.R. Klein, “Calculation of H dibaryon production through coalescence,”
Physical Review **D56**:1673-1684, (1997)
- *7. J.R. Klein and A.K. Mann, “Prototype Detector for Ultrahigh Energy Neutrino Detection,”
Astroparticle Physics **10**:4-9, (1999)
8. J. Boger, *et al.*, “The Sudbury Neutrino Observatory,” *Nucl. Instrum. Meth.* **A449**:172—207, (2000)
- *9. Q.R. Ahmad, *et al.*, “Measurement of the Rate of $\nu_e + d \rightarrow p + p + e^-$ Interactions Produced by ^8B Solar Neutrinos at the Sudbury Neutrino Observatory,”
Phys. Rev. Lett. **87**:071301-1-6, (2001)
- *10. Q.R. Ahmad, *et al.*, “Measurement of the Day and Night Neutrino Energy Spectra at SNO and Constraints on Mixing Parameters,” *Phys. Rev. Lett.* **89**:011302-1-011302-5, (2002)
- *11. Q.R. Ahmad, *et al.*, “Direct Evidence for Neutrino Flavor Transformation from Neutral Current Reactions in the Sudbury Neutrino Observatory,” *Phys. Rev. Lett.* **89**:011301-1-6, (2002)
12. M. Diwan, *et al.*, “Very long baseline neutrino oscillation experiments for precise measurements of mixing parameters and CP violating effects,” *Phys. Rev.* **D68**:012002-1-10, (2003)
13. S. N. Ahmed, *et al.*, “Constraints on Nucleon Decay Via ‘Invisible’ Modes from the Sudbury Neutrino Observatory,” *Phys. Rev. Lett.* **92**:102004-1-4, (2004)
- *14. S. N. Ahmed, *et al.*, “Measurement of the Total Active ^8B Solar Neutrino Flux at the Sudbury Neutrino Observatory with Enhanced Neutral Current Sensitivity,”
Phys. Rev. Lett. **92**:181301-1-5, (2004)
15. B. Aharmim, *et al.*, “Electron Antineutrino Search at the Sudbury Neutrino Observatory,”
Phys. Rev. **D70**:093014-1-7, (2004)
16. B. Aharmim, *et al.*, “Search for Periodicities in the ^8B Solar Neutrino Flux Measured by the Sudbury Neutrino Observatory,” *Phys. Rev.* **D72**:052010-1-9 (2005)
- *17. Joshua R. Klein and Aaron Roodman, “Blind Analysis in Nuclear and Particle Physics,”
Ann. Rev. Nucl. Part. Sci. **55**:141-163, (2005)
- *18. B. Aharmim, *et al.*, “Electron Spectra, Fluxes, and Day-Night Asymmetries of ^8B Solar Neutrinos from Measurements with NaCl Dissolved in the Sudbury Neutrino Observatory Heavy Water Cherenkov Detector,” *Phys. Rev.* **C72**:052010-1-45, (2005)
19. B. Aharmim, *et al.*, “A Search for Neutrinos from the Solar hep Reaction and the Diffuse Supernova Neutrino Background with the Sudbury Neutrino Observatory,”
Astrophysical Journal, **653**: 1545-1551, (2006)
- *20. B. Aharmim *et al.*, “Measurement of the ν_e and Total ^8B Solar Neutrino Fluxes with the Sudbury Neutrino Observatory Phase I Data Set,” *Phys. Rev.* **C75**: 045502-045571, (2007)

Selected Refereed Publications (Continued):

21. B. Aharmim, *et al.*, “An Independent Measurement of the Total Active B-8 Solar Neutrino Flux Using an Array of He-3 Proportional Counters at the Sudbury Neutrino Observatory,” *Phys. Rev. Lett.*, **101**:111301-111305, (2008)
22. B. Aharmim, *et al.*, “Measurement of the Cosmic Ray and Neutrino-Induced Muon Flux at the Sudbury Neutrino Observatory,” *Phys. Rev.* **D80**:12001-12018, (2009)
- *23. B. Aharmim, *et al.*, “Searches for High-Frequency Variations in the ^8B Solar Neutrino Flux at the Sudbury Neutrino Observatory,” *Astrophysical Journal*, **710**:540-548 (2010)
- *24. M. Jerkins, J.R. Klein, J.H. Majors, M.G. Raizen and F. Robicheaux, “Using Cold Atoms to Measure Neutrino Mass,” *The New Journal of Physics*, **12**:043022-043031, (2010)
- *25. B. Aharmim, *et al.*, “Low Energy Threshold Analysis of the Phase I and Phase II Data Sets of the Sudbury Neutrino Observatory,” *Phys. Rev.* **C81**:055504-055557, (2010)
26. K. Boudjemline *et al.*, “The Calibration of the Sudbury Neutrino Observatory Using Distributed Radioactive Sources,” *Nucl. Instrum. Meth.* **A620**:171-181, (2010)
- *27. B. Aharmim, *et al.*, “Low Multiplicity Burst Search at the Sudbury Neutrino Observatory,” *Astrophys. J.* **728**:83-94, (2011)
28. B. Aharmim, *et al.*, “Combined Analysis of all Three Phases of Solar Neutrino Data from the Sudbury Neutrino Observatory,” *submitted to Phys. Rev. C* (2011).
29. B. Aharmim, *et al.*, “Measurement of the ν_e and Total ^8B Solar Neutrino Fluxes with the Sudbury Neutrino Observatory Phase II Data Set,” *Phys. Rev.* **C87**:015502-606 (2013).
- *30. J. Brack, *et al.*, “Characterization of the Hamamatsu R11780 12-inch Photomultiplier Tube,” *Nuclear Instruments and Methods A*:162-173, (2013)
- *31. R. Bonventre, A. LaTorre, J.R. Klein, *et al.*, “Non-Standard Models, Solar Neutrinos, and Large θ_{13} ,” *Phys. Rev.* **D88**:05310 (2013).
32. B. Aharmim, *et al.*, “A Search for Astrophysical Burst Signals at the Sudbury Neutrino Observatory” *Astropart Phys.* **55**:1-7 (2014).
- *33. M. Akashi-Ronquest *et al.*. “Improving Photoelectron Counting and Particle Identification in Scintillation Detectors with Bayesian Techniques,” *Astropart. Phys.*, **65**:40-54 (2014).
34. S. Andringa *et al.*. “Status and Future Prospects of the SNO+ Experiment,” *Advances in High Energy Physics*, 6194250 (2016).
- *35. A. Bellerive *et al.*. “The Sudbury Neutrino Observatory,” *Nucl. Phys.* **B908**:30-51 (2016)
- *36. N. Barros, *et al.*, “Characterization of the ETEL D784UKFLB 11 in. Photomultiplier Tube,” *Nucl. Instrum. Meth.* **A852**:15-19 (2017).
37. B. Aharmim *et al.*, “Search for neutron-antineutron oscillations at the Sudbury Neutrino Observatory,” *Phys.Rev.* **D96** 092005 (2017).
- *38. M. Anderson *et al.*, [SNO+ Collaboration], “Search for invisible modes of nucleon decay in water with the SNO+ detector,” *Phys. Rev.D* **99**, no. 3, 032008 (2019)
- *39. M. Anderson *et al.*, [SNO+ Collaboration], “Measurement of the ^8B solar neutrino flux in SNO+ with very low backgrounds,” *Phys. Rev. D* **99**, no. 1, 012012 (2019)
40. B. Aharmim *et al.* [SNO Collaboration], “Constraints on Neutrino Lifetime from the Sudbury Neutrino Observatory,” *Phys. Rev. D* **99**, no. 3, 032013 (2019)
41. M. Akashi-Ronquest *et al.* [MiniCLEAN Collaboration], “Triplet Lifetime in Gaseous Argon,” *Eur. Phys. J A* **55** 10, 176 (2019)
42. B. Aharmim *et al.* [SNO Collaboration], “Tests of Lorentz invariance at the Sudbury Neutrino Observatory,” *Phys. Rev. D* **98**, no. 11, 112013 (2018)

Selected Refereed Publications (Continued):

- *43. B. Aharmim *et al.* [SNO Collaboration], “Measurement of Neutron Production in Atmospheric Neutrino Interactions at the Sudbury Neutrino Observatory,” *Phys. Rev. D* 99, no. 11, 112007 (2019)
- 44. B. Aharmim *et al.* [SNO Collaboration], “Cosmogenic Neutron Production at the Sudbury Neutrino Observatory,” *Phys. Rev. D* 100, no. 11, 112005 (2019)
- *45. M. Askins *et al.* [Theia Collaboration], “THEIA: An Advanced Optical Neutrino Detector,” *Eur. Phys. J. C* 80 (2020) 5, 416.
- 46. D. Adams *et al.*, “Design and Performance of a 35-tonne liquid argon time projection chamber as a prototype for very large detectors,” *JINST* 15 (2020) 03 P03035
- *47. Tanner Kaptanoglu, Meng Luo, Benjamin Land, Amanda Bacon, and Josh Klein, “Spectral Photon Sorting for Large-Scale Cherenkov and Scintillation Detectors,” *Phys. Rev. D* 101 7, 072002 (2020)
- 48. M.R. Anderson *et al.*, [SNO+ Collaboration] “Measurement of neutron-proton capture in the SNO+ water phase,” *Phys. Rev. C* 102 1, 014002, (2020)
- *49. B. Abi *et al.*, [DUNE Collaboration], “First Results on ProtoDUNE SP liquid argon time projection chamber performance from a beam test at the CERN Neutrino Platform,” *JINST* 15 12, P12004 (2020)
- *50. B. Aharmim *et al.*, [SNO Collaboration], “Search for hep solar neutrinos and the diffuse supernova neutrino backgrounds with all three phases at the Sudbury Neutrino Observatory,” *Phys. Rev. D* 102 6, 062006 (2020)
- 51. B. Abi *et al.*, [DUNE Collaboration], "Prospects for beyond the Standard Model physics searches at the Deep Underground Neutrino Experiment," *Eur.Phys.J.C* 81 (2021)
- 52. M.R. Anderson *et al.* (SNO+ Collaboration), "Development, characterisation, and deployment of the SNO+ liquid scintillator," *JINST* 16 (2021) 05, P05009
- 53. M.R. Anderson *et al.*, [SNO+ Collaboration], "Optical calibration of the SNO+ detector in the water phase with deployed sources," *JINST* 16 (2021) 10, P10021
- *54. V. Albanese *et al.*, [SNO+ Collaboration], "The SNO+ experiment," *JINST* 16 (2021) 08, P08059
- *55. A. Abed *et al.*, [DUNE Collaboration], "Design, construction and operation of the ProtoDUNE-SP Liquid Argon TPC", *JINST* 17 (2022) 01, P01005

Publications (Unrefereed):

White Papers

1. J. R. Alonso *et al.*, “Advanced Scintillator Detector Concept (ASDC): A Concept Paper on the Physics Potential of a Water-based Liquid Scintillator Detector,” arXiv:1409:5864 (2014).
2. Joshua R. Klein *et al.*, “Future Advances in Photon-based Neutrino Detectors: A SNOWMASS White Paper,” arXiv:2203.07479 (2022)

Proceedings

1. J.R. Klein, for the SNO Collaboration, “The Sudbury Neutrino Observatory at Turn-On,” Published in *Neutrinos in the new millennium*, 113-123, (1999).
2. J.R. Klein, for the SNO Collaboration, “Sudbury Neutrino Observatory: Status and Progress,” Published in *Neutrino Telescopes*, vol. 1, 115-116 (1999).
Energy Physics, vol II, 921-924 (2001).
3. Joshua R. Klein, “First Solar Neutrino Observations at the Sudbury Neutrino Observatory”, Published in *Proceedings of the 30th International Conference on High*
4. Joshua R. Klein, for the SNO Collaboration, “Solar Neutrino Results from the Sudbury Neutrino Observatory”, *Int. J. Mod. Phys. A*, p. 3378-3392, (2002).

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Proceedings (continued)

5. Joshua R. Klein, for the SNO Collaboration, “The Sudbury Neutrino Observatory,” in *The Proceedings of the 4th Tropical Workshop in Neutrinos and Flavor Physics,*” AIP Conf.Proc.**689**:16-31, (2003)
6. Joshua R. Klein, “Neutrino Physics: Results,” in *The Proceedings of Science: The European Physical Society International Europhysics Conference on High Energy Physics,*” **PoS HEP2005**:407-421, (2006)
7. Joshua R. Klein, “Future ‘Realtime’ Solar Neutrino Experiments” in *The 23rd International Conference on Neutrino Physics and Astrophysics (Neutrino 2008),*” **J.Phys.Conf.Ser.** **136**:022004-022011, (2008)

Popular Articles and Reports

1. Arthur B. McDonald, Joshua R. Klein, and David L. Wark, “Solving the Solar Neutrino Problem,” *Scientific American* (April 2003), pp. 40-49, reprinted in *Scientific American Special Edition: The Frontiers of Physics* (December-February 2006), pp.22-31.
2. Joshua Klein, “Mining Sunshine,” *Beam Line*, vol. 31, no. 3 (Fall 2001), pp 17-25.
3. Solar and Atmospheric Neutrino Experiments Working Group, “Report of the Solar and Atmospheric Neutrino Experiments Working Group of the APS Multidivisional Neutrino Study”, hep-ex/0412016, (2004).
3. APS Multidivisional Neutrino Study, “The Neutrino Matrix”, ed. S.J. Freedman and Boris K. Kayser, physics/04111216, (2004)

Public/General Audience Lectures:

- “Solving Neutrino Mysteries with the Sun,” lecture given as part of Franklin Institute “Starry Night” series, October 2016.
- “What are the Smallest Things in the Universe?” class given at Millburn Middle School, Millburn, NJ.
- “What is Discovery?” *Panel in History of Science*, Drexel University, February 2013.
- “How Does the Sun Shine?”, class given at Glenside Elementary School, Short Hills, NJ, February 2009
- “*Like Dustmaids Down a Drafty Hall: Catching Particles from the Center of the Sun,*”
Public Lecture in Celebration of the Einstein World Year of Physics, Austin, Texas, 2008.
- “Darkness Upon the Face of the Deep”, *College of Natural Sciences Dean’s Scholars Luncheon*, University of Texas at Austin, February 2008
- “Going Over to the Dark Side,” Saturday Morning Physics, University of Texas at Austin, 2007.
- “The Triumph of a Chemist,” American Chemical Society Student Chapter of Austin, October 3, 2006.
- “Particles, the Universe, and Everything”, *College of Natural Sciences Dean’s Scholars Luncheon*, University of Texas at Austin, April 2006
- “How Weird is Our World? Reactor Antineutrinos as the Gateway to Even Stranger Physics”, *APS NeutrinoFest*, American Physical Society April Meeting, Tampa, Fl., April 2005.
- “How (Not?) to Win a Nobel Prize: The Story of Solar Neutrinos”, *College of Natural Sciences Dean’s Scholars Luncheon*, University of Texas at Austin, February 2005
- “Mining Sunshine”, *Junior Honors Colloquium*, University of Texas at Austin, July 2003
- “From the Sun to the Neutrino and Back Again and Back Again Again,” *National Academy of Sciences Frontiers of Science Symposium*, National Academy of Sciences National Meeting, Washington, DC, April 18, 2004.
- “Solving the Solar Neutrino Problem,” American Chemical Society Club of Austin, November 6, 2003.
- “Dustmaids Down a Drafty Hall: Neutrinos at the Sudbury Neutrino Observatory”, Brookhaven National Laboratory Sambamurti Prize Lectureship, Brookhaven, NY, July 25, 2003.
- “Solar Neutrino Astronomy: Birth after Thirty Years of Labor”, *University of Texas QUEST Program*, Austin, Texas, Feb. 13, 2003.

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Public/General Audience Lectures (Continued):

- “Unraveling the Solar Neutrino Problem”, *University of Texas Physics Department Saturday Morning Physics*, Austin, Texas, November 2002.
- “Solar Neutrinos”, *Jefferson Laboratory Teacher Day*, Norfolk, Va., November 2002.
- “Solar Neutrino Astronomy: Birth After Thirty Years of Labor”, *American Association of Physics Teachers National Meeting*, Philadelphia, PA, January 2002.
- “Detecting Solar Neutrinos”, *Penn Summer Science Academy*, Summer 2001.

Invited Talks

- “Beyond the Next Generation: INO, T2HKK, ESSnuSB, Theia,” plenary talk given at Neutrino 2021 Conference (held virtually), 2020.
- “Neutrinos in Nuclear Physics,” talk given at International Union of Physics and Applied Physics workshop, London, 2019.
- “Solving the Solar Neutrino Problem,” talk given as part of Rowan University Colloquium Series December 2017.
- “Future DAQ Needs for the Intensity Frontier,” given at Future DAQ R&D Workshop, University of New Mexico, October 201.
- “Fast Timing for Separation of Cherenkov and Scintillation Light for THEIA,” talk given at “Fast Timing Workshop,” at CERN, Feb 2017.
- “Neutrinos, Antineutrinos, and No Neutrinos,” colloquium at University of Minnesota, May 2016.
- “Physics Program of a Water-based Liquid Scintillator Detector,” talk given at the *Next-Generation Neutrino and Nucleon Decay Workshop (NNN15)*, Stony Brook, NY, October 2015.
- “New Technologies for Neutrino Astrophysics,” talk given at the *CPAD Instrumentation Frontier Workshop*, Arlington, TX, October 2015.
- “THEIA: An Advanced Scintillator Detector at LBNF,” talk given as part of the *University of Colorado Boulder, Seminar Series*, July 2015.
- “THEIA: An Advanced Scintillator Detector at LBNF,” talk given as part of the *Fermi National Laboratory Seminar Series*, April 2015.
- “Neutrinos, Antineutrinos, and No Neutrinos,” talk given as part of *Temple University Colloquium Series*, Philadelphia, PA, March 2015.
- “Upgrades to Existing Experiments,” plenary talk given at the *Workshop for the Intermediate Neutrino Program*, February 2015.
- “Goals of Long Baseline Neutrino Experiments,” talk given as part of Fermi National Accelerator Laboratory *The Allure of Ultra-Sensitive Experiments* series, Batavia, IL, May 2014.
- “Neutrinos, Antineutrinos, and No Neutrinos,” talk given as part of *Queens University Colloquium Series*, Kingston, ON, Canada, June 2013.
- “Neutrinos, Antineutrinos, and No Neutrinos,” talk given as part of *Stanford Linear Accelerator Colloquium Series*, Palo Alto, CA, May 2013.
- “SNO+ Status Update,” *International Symposium on Opportunities in Underground Physics*, Monterey, CA, May 2013.
- “Neutrino Mixing Past, (Present), and Future,” *Research Symposium in Celebration of the Retirement of Anthony Baltz*, Brookhaven National Laboratory, March 28, 2012.
- “From Anomaly to Problem to Physics: Lessons from Solar Neutrinos,” *Fermi National Laboratory Colloquium Series*, March 21, 2012.
- “Future Solar Neutrino Experiments,” *Department of Energy Intensity Frontier Workshop*, Bethesda, MD, November 2011.
- “Sudbury Neutrino Observatory Results and Prospects,” *XXIV International Conference on Neutrino Physics and Astrophysics (Neutrino 2010)*, Athens, Greece, 2010.
- “Into the Muck: Results from SNO’s Low Energy Threshold Analysis,” Cornell University High Energy Physics Seminar series, Ithaca, NY, March 2010.

Invited Talks (continued)

- “Into the Muck: Results from SNO’s Low Energy Threshold Analysis,”
University of Illinois at Urbana-Champaign HEP Seminar series, Champagne, IL, 2009.
- “Solar and Atmospheric Neutrinos: What’s Left to do?” Workshop on Next Generation Neutron Decay and Neutrino Detectors (NNN09), Estes Park, CO, September 2009.
- “Status of the Sudbury Neutrino Observatory,” Topics in Astroparticle and Underground Physics (TAUP) Conference, Rome, Italy, July 2009.
- “Neutrinos from Fermilab, the Sky, the Earth, the Sun and the Stars, to Homestake,” SUSY09, Boston, MA, June 2009
- “Solar and Supernova Neutrinos in Very Large Water Cherenkov and Liquid Argon Detectors,”
Workshop on Underground Detectors Investigating Grand Unification,
Brookhaven National Laboratory, September 2008
- “Future ‘Realtime’ Solar Neutrino Experiments,” *The 23rd International Conference on Neutrino Physics and Astrophysics (Neutrino 2008)*, Christchurch, New Zealand, 2008
- “Into the Muck: Low Energy Particle Physics at the Sudbury Neutrino Observatory and Beyond,” *University of Texas at Austin Colloquium Series*, Austin, TX, September 2007
- “The SNO+ Double Beta Decay Experiment”, *University of Chicago HEP Seminar Series*, Chicago, IL, May 2007
- “Into the Muck: Lowering the Energy Threshold of the Sudbury Neutrino Observatory”,
University of Pennsylvania Colloquium Series, Philadelphia, PA, January 2007
- “Neutrino Update: SNO, KamLAND, and Super-Kamiokande”,
Particles, Strings, and Cosmology (PASCOS) 2006, Columbus, OH, September 2006
- “Into the Muck: Lowering the Energy Threshold of the Sudbury Neutrino Observatory”,
Lawrence Berkeley National Laboratory Research Progress Meeting,
Berkeley, CA, March 2006
- “Neutrino Physics: Recent Results and Prospects”,
Cal. Tech. Physics Research Conference (Colloquium Series), Pasadena, CA, March 2006
- “The Crazy Aunt in the Attic: Non-standard Neutrino Oscillation Scenarios,”
Lawrence Berkeley National Laboratory Research Progress Meeting,
Berkeley, CA, December 2005
- “Exploring Neutrino Oscillations with Continuous-Source Neutrino Experiments”,
University of Washington Colloquium Series, Seattle, WA, November 2005..
- “Exploring Neutrino Oscillations with Continuous-Source Neutrino Experiments”,
Penn State University Colloquium Series, State College, PA, November 2005..
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, ACU Physics Department Seminar Series, Abilene, TX, November 2005.
- “Exploring the ν World: Searches for New Physics with Continuous-Source Neutrino Experiments”,
KSU Colloquium Series, Kansas State University, Manhattan, KS, October 2005
- “Neutrino Results”, Plenary lecture given at the *European Physical Society High Energy Particle Physics 2005 Conference*, Lisbon, Portugal, July 2005.
- “Recent Advances in Neutrino Physics”, *Gordon Research Conference*, Bates College, July 2005.
Frontiers in Contemporary Physics, Vanderbilt University, Nashville, TN, May 2005.
- “What Has SNO Taught Us?”, *MeV Antineutrino Detector Simulation Workshop*,
Kansas State University, June 2005.
- “Neutrino Experimental Summary”, *XXth International Conference on Weak Interactions and Neutrinos (WIN ’05)*, Delphi, Greece, June 2005.
- “Non-Accelerator Neutrino Experiments (I and II)”, Pedagogical lectures given at Vanderbilt Summer School, 2005.

Invited Talks (continued)

- “SNO and The Solar Neutrino Sector”, *Aspen Winter 2005: The Highest Energy Physics*, Aspen Center for Physics, Aspen, CO, February 2005.
- “SNO: Results and Future”, *University of Chicago High Energy Physics Seminar Series*, Chicago, IL, November 23, 2004
- “The ‘Crazy Aunt in the Attic’: Non-Standard Neutrino Oscillation Scenarios”, *University of Chicago Lunchtime Seminar Series*, Chicago, IL, November 23, 2004..
- “Solar, Atmospheric, and Reactor Neutrino Experiments”, *American Physical Society April Meeting*, Denver, CO, May 2, 2004
- “First Results from SNO Phase II: The End of Solar Maximal Mixing,” *California Institute of Technology High Energy Seminar Series*, Pasadena, CA, January 12, 2004.
- “From the Sun to the Neutrino and Back Again and Back Again Again,” *Beckman US Frontiers of Science Symposium*, National Academy of Sciences Beckman Center, Irvine, CA, November, 2003.
- “Unraveling the Solar Neutrino Problem,” *Southwest Texas University (Texas State) Physics Department Colloquium Series*, San Marcos, Texas, October 2003
- “First Results from SNO Phase II,” *Stanford Linear Accelerator Center Seminar Series*, Stanford, CA, September 2003.
- “The Sudbury Neutrino Observatory”, *4th Tropical Workshop in Neutrinos and Flavor Physics*, Cairns, Australia, July 9, 2003.
- “Future Neutrino Experiments”, *Symposium in Honor of John Bahcall, Ray Davis, and Matsutoshi Koshiba on their Receipt of the Franklin Medal*, University of Pennsylvania, Philadelphia, April 24, 2003
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *Michigan State University Colloquium Series*, Lansing, MI, April 8, 2003.
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *University of Minnesota Colloquium Series*, Minneapolis, MN, December 3, 2002.
- “Into Uncharted Waters: The Past, Present, and Future Exploration of Neutrino Physics”, Plenary talk at the *IEEE NSS Conference*, Norfolk, VA, November 2002
- “Recent Solar Neutrino Results”, plenary talk at the *Texas Branch of the American Physical Society Meeting in Brownsville, TX*, October 12, 2002.
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *University of Michigan Seminar Series*, Ann Arbor, MI, September 30, 2002.
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *Southern Methodist University Physics Department Seminar Series*, Dallas, TX, Sept 23, 2002.:
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *University of Texas at Arlington Particle Physics Seminar Series*, Arlington, TX, Sept 24, 2002.
- “Solar Neutrino Results from SNO”, *UCLA Physics Department Colloquium Series*, Los Angeles, CA, May 5, 2002.
- “Neutrino Results: Past, Present, and Future”, *PHENO 2002 Conference*, Madison, Wisconsin, April, 2002.
- “First Neutral Current Results from SNO”, *Fermilab Joint Experimental/Theoretical Seminar*, Fermi National Laboratory, Batavia, Illinois, April, 2002.
- “Solar Neutrino Results from SNO”, *Massachusetts Institute of Technology High Energy Physics Colloquium Series*, Boston, MA, April, 2002.

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Invited Talks (continued)

- “Solar Neutrino Results from SNO”, *California Institute of Technology High Energy Physics Seminar Series, Pasadena, CA, March, 2002.*
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *Lawrence Berkeley National Laboratory Research Progress Meeting, Berkeley, CA, February 2002*
- “Solar Neutrino Results from the Sudbury Neutrino Observatory”, *Brookhaven National Laboratory High Energy Physics Seminar Series, Upton, NY, Nov. 15, 2001.*
- “Solar Neutrino Results from the Sudbury Neutrino Observatory”, *University of Rochester High Energy Physics Seminar Series, Rochester, NY, Oct. 30, 2001.*
- “Unraveling the Solar Neutrino Problem at the Sudbury Neutrino Observatory”, *Stanford University Applied Physics/ Physics Department Colloquium Series, Palo Alto, CA, Oct 15, 2001.*
- “Solar Neutrino Results from SNO”, *Cornell University Physics Department Colloquium Series, Ithaca, NY, Sept. 17, 2001.*
- “Solar Neutrinos”, *The 2001 Aspen Winter Conference on Particle Physics, Aspen, 2001.*
- “Solar Neutrinos at SNO”, *ICHEP 2000: The XXXth International Conference on High Energy Physics, Osaka, Japan, 2000.*
- “The Sudbury Neutrino Observatory at Turn-On”, *Neutrinos in the New Millennium, Baltimore, 1999.*
- “The Sudbury Neutrino Observatory”, *Johns Hopkins Colloquium Series, March, 1999.*
- “SNO Status and Progress”, *8th International Workshop on Neutrino Telescopes, Venice, Italy, February 1999.*
- “Criteria for Detection of Ultra-high Energy Neutrinos”, *Aspen Summer Workshop on Neutrino Astrophysics, Aspen Institute for Physics, July, 1998.*

Service:

To the Field

Member, DOE/NSF Nuclear Sciences Advisory Committee (NSAC)	2021--
Member, DOE Office of Nuclear Physics Portfolio Review Panel	2021
Co-convenor, SNOWMASS Neutrino Detector Topical Group	2020--
Member, National Science Foundation Review Panel	2020
Member, DOE Intensity Frontier Comparative Review Panel	2019
Member, DOE US-Japan R&D Review Panel	2017
Member, APS Division of Particles and Fields Executive Committee	2016—2018
Member, DOE/NSF CUORE Review Committee	2016--
Member, Department of Energy/NSF High Energy Physics Advisory Panel (HEPAP)	2015--2017
Member, Fermi National Laboratory Physics Advisory Committee (PAC)	2014--
Member, Hyper-Kamiokande Advisory Committee	2015—
Chair, Writing Committee for Double Beta Decay Experiments as part of Department of Energy, Office of Nuclear Physics Long Range Plan	2014
Member, Scientific Advisory Committee for <i>Workshop on Intermediate Neutrino Program</i>	2014
Member, LBNF International Governance Committee	2014
Member, Department of Energy/Office of Nuclear Physics, MAJORANA Demonstrator Review Panel	2014
Member, National Science Foundation Review Panel	2014

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Service:

To the Field (continued)

Member, Department of Energy/Office of High Energy Physics, Committee of Visitors	2014
Member, National Science Foundation, Particle Astrophysics Review Panel	2013
Member, Department of Energy/NSF Nuclear Sciences Advisory Committee (NSAC)	2010-2012
Member, Department of Energy Office of High Energy Physics University Comparative Review Panel	2012
Member, Department of Energy Office of High Energy Physics Career Award Review Panel	2012
Member, Organizing Committee for conference on <i>Advances in Neutrino Technology</i>	2011
Member, Review Panel for <i>Quadrennial Low Energy Physics Program at US National Laboratories</i> , Department of Energy, Office of Nuclear Physics	2011
Member, Department of Energy/Office of Nuclear Physics MAJORANA Annual Review Panel	2011
Member, SNOLab Strategic Planning Group	2010-2011
Member, Department of Energy/Office of High Energy Physics, University of Minnesota Review Panel	2010
Member, Lawrence Berkeley National Laboratory Director's Physics Division Review Committee	2010
Member, Department of Energy/Office of Nuclear Physics MAJORANA CD-1 Review Panel	2010
Member, National Science Foundation, Particle and Nuclear Astrophysics Review Panel	2010
Member, Department of Energy/Office of Nuclear Physics MAJORANA Review Panel	2009
Member, Department of Energy/Office of Nuclear Physics Triangle Universities National Lab (TUNL) Review Panel	2008
Member, Department of Energy/ONP, CUORE Review Panel	2007
Member, Homestake Underground Laboratory Physics Advisory Committee	2006-2007
Member, Department of Energy/Office of High Energy Physics Daya Bay Physics Review Panel	2006
Member, Organizing Committee for the Neutrinos, Neutrons, and Fundamental Symmetries program for the Department of Energy Long Range Plan in Nuclear Physics	2006
Member, Department of Energy/Office of Nuclear Physics Double Beta Decay Review Committee	2006
Co-convenor, Neutrino Working Group, <i>XXth International Weak Interactions and Neutrinos Workshop</i>	2005
Co-convenor, "Popularizing Particle Physics," session at APS/Division of Particles and Fields Meeting, Riverside, CA	2004

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Service:

To the Field (continued)

Member, <i>APS Neutrino Study</i> Writing Committee	2004
Co-chair, Solar and Atmospheric Neutrino Experiments Working Group, <i>American Physical Society Neutrino Study</i>	2004
National Academy of Sciences Frontiers of Science Organizing Committee	2004

To the Department/School/University

Provost's Teaching Award Committee	2020
Member, Graduate Council of the Faculties	2018-2021
Associate Chair for Graduate Affairs, Dept. of Physics and Astronomy	2017-2021
Chair, Prof. Christopher Mauger Mentoring Committee	2016-2019
Member, Department of Physics and Astronomy Undergraduate Committee	2016-2018
Chair, Department of Physics and Astronomy Faculty Search Committee	2014-2015
Member, Department of Physics and Astronomy Planning Committee	2014-2021
Member, Provost's Academic Planning and Budget Committee	2013-2016
Member, AAU STEM Advisory Committee	2013-2014
Member, Physics 101/102 Curriculum Committee	2013-2014
Chair, School of Arts and Sciences Curriculum Committee	2012-2013
Member, University of Pennsylvania Facilities Committee	2011-2013
Member, School of Arts and Sciences Curriculum Committee	2011-2013
Member, Hearings List for Faculty Grievance Commission	2011-2014
Member-at-Large, Faculty Senate Executive Committee	2010-2013
School of Arts and Sciences Pre-Major Advisor	2010-2018
Chair, Organizing Committee, "Crossroads in Particle Physics,"	2010
Research symposium in honor of Prof. Eugene W. Beier (GeneFest 2010), Penn	2010
Member, Department of Physics and Astronomy Space Committee, U. Penn	2009-2012
Member, Department of Physics and Astronomy Undergraduate Committee, U. Penn	2009-2016
Chair, Department of Physics and Astronomy Colloquium Committee, U. Penn	2008-2009
Chair, Physics Department Graduate Recruitment Committee, UT Austin	2006-2008
Member, Physics Department Graduate Recruitment Committee, UT Austin	2003

Collaborations

- Deep Underground Neutrino Experiment (DUNE) Collaboration (over 1000 members from a dozen countries)
- SNO+ Collaboration (150 members from Canada, UK, Portugal, Germany, and Mexico)
- SBND Collaboration (250 members from a dozen countries)

Courses Taught at Penn

Astro 001, Physics 101/102, Physics 140/150, Physics 141/151, Physics 562