

Thomas J Langford

Curriculum Vitae

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Education and Qualifications

- 2013 Ph.D. Physics University of Maryland, College Park
Measurement of the Surface and Underground Neutron Spectra with the UMD/NIST Fast Neutron Spectrometers
Advisor: Prof. Elizabeth J. Beise
- 2009 M.Sci. Physics University of Maryland, College Park
- 2007 B.Sci. Physics University of Maryland, College Park

Appointments

- 2018 - present **Associate Research Scientist** - Wright Laboratory, Yale University
- 2018 - present **Computational Research Support Analyst** - Yale Center for Research Computing
- 2013 - 2018 **Postdoctoral Research Associate** - Wright Laboratory, Yale University
Member of the Daya Bay, PROSPECT, and FaNS Collaborations
- 2011 - 2013 **NIST-ARRA Graduate Research Fellow** - University of Maryland
- 2007 - 2013 **Graduate Research Assistant** - University of Maryland

Research Activities

Precision Measurements of Neutrinos with Daya Bay, PROSPECT, and DUNE

- Spearheading multiple aspects of PROSPECT, a Yale-lead experiment to search for sterile neutrinos and measure the ^{235}U antineutrino spectrum
- Lead the technical R&D for PROSPECT's scintillator detector system, including characterization of ^6Li -loaded scintillator and test detectors
- Topical Physics Coordinator for PROSPECT's ^{235}U antineutrino spectrum measurement
- Co-author and co-editor of PROSPECT proposals for the DOE Intermediate Neutrino Program and Heising-Simons Foundation
- Steering the combined analysis between PROSPECT and Daya Bay to disentangle origin of the reactor antineutrino flux deficit and spectral anomaly
- Co-authored a study of *ab-initio* calculations of the reactor antineutrino spectrum, published in Physical Review Letters
- Working with scientists and engineers to prepare Wright Lab for DUNE Anode Plane Assembly construction

YCRC Computational Research Support

- Working to help students and faculty better utilize the Yale Center for Research Computing's High Performance Computing systems
- Developing and leading tutorials and workshops at YCRC and Wright Lab on scientific computing, including parallel programming with Python
- Acting as an interface between researchers in Wright Lab and the staff in YCRC to facilitate advancements in research computing

Professional Activities

Awards

- Sambamurti Memorial Lectureship, Brookhaven National Lab, 2019, https://sambamurti.phy.bnl.gov/lecturers/2019_Langford.html.

Teaching Experience

- Developed and taught *Parallel Programming with Python* tutorial, training university members on fundamentals and advanced parallel programming for data analysis - 2018-present
- Developed computing workshop series for Wright Laboratory providing targeted training for students, postdocs, and faculty.
- Guest lecturer for advanced undergraduate courses at the University of Maryland - 2012-2013

Supervised Students

- Supervised Yale undergraduate India Bhalla-Ladd for PHYS470, *Hiyashi: Light Yield and PSD Temperature Dependence of EJ-309 for PROSPECT*.
- Supervised Yale undergraduate Arina Bykadorova during her internship at Wright Laboratory, *Development of the PROSPECT Calibration Deployment System - Summer 2016 - Spring 2018*.
- Mentored undergraduate students Connor Thompson and Robert Valdillez during their summer internships at the National Institute of Standards and Technology - *Summer 2016*.
- Mentored undergraduate Nate Stemen during his summer internships at Wright Laboratory, *Pulse Shape Discrimination with Liquid Scintillators (Summer 2014), Optimization of Light Guides for PROSPECT (Summer 2015)*.
- Supervised Yale undergraduate Karl Medina during his undergraduate thesis, *Pulse Shape Discrimination with Liquid Scintillators* at Wright Laboratory - *Spring 2014*.
- Mentored undergraduate Geoffrey Ji during his internship with the Experimental Nuclear Physics Group at UMD - *Summer 2009, Spring 2012*.
- Guided and mentored Dylan Erwin for his undergraduate thesis, *MCNP modeling of the Fast Neutron Spectrometer for Underground Science - June 2009 - June 2010*

Outreach Activities

- Poster Session Judge for the Yale Undergraduate Research Association Symposium - *September 2018*
- Developed activity station for the Yale Pathways to Science events at Wright Lab - *April 2018*
- Lead tours of Wright Lab for Alumni Reunion Weekends - *Spring 2017, 2018, 2019*
- Assisted in the organization of the Yale Parents Leadership Council visit to Wright Lab *Fall 2017*
- High school outreach at Walt Whitman High School in Bethesda, MD. Spoke to physics students about pursuing physics in graduate school and as a career - *Spring 2009, 2010, 2011*

Departmental Activities

- Student Member of the UMD Physics Council *October 2009 - 2013*
- Student Member of the UMD Graduate Committee *March 2009 - 2013*
- Member of the UMD Physics Departmental Chair Reappointment Committee *Fall 2010*

Conference Organization

- Member of the Local Organizing Committee for the Workshop on the Intermediate Neutrino Program at Brookhaven National Lab in January, 2015.

Journal Referee

- Active referee for *Physical Review Letters*, *Physical Review C*, *European Journal of Physics C*, *Physical Review Applied*, and *Nuclear Instrumentation and Methods A*.

Seminars and Invited Talks

- “Fingerprinting a Nuclear Reactor with Neutrinos,” Sambamurti Memorial Lectureship, Brookhaven National Lab, Upton NY, July 25, 2019. https://sambamurti.phy.bnl.gov/lecturers/2019_Langford.html.
- “HPC & Big Data: Probing the smallest particles in the universe,” SuperComputing 2018, Dallas TX, November 14, 2018.
- “PROSPECT: The Precision Reactor Oscillation and Spectrum Experiment,” University of Maryland, College Park MD October 31, 2018.
- “PROSPECT: The Precision Reactor Oscillation and Spectrum Experiment,” NEUTRINO2018, Heidelberg, DE, June 8, 2018. <https://doi.org/10.5281/zenodo.1287000>.
- “The search for sterile neutrinos at reactors and underground laboratories,” April Meeting of the American Physical Society, Washington DC, January 30, 2017.
- “Reactor Antineutrinos: Discoveries, Anomalies, and Opportunities,” NACS Colloquium, Lawrence Livermore National Lab, Livermore CA, January 18, 2017.
- “Reactor Antineutrinos: Discoveries, Anomalies, and Opportunities,” Colorado State University, Fort Collins CO, January 12, 2017.
- “PROSPECT: A Reactor Oscillation and Spectrum Experiment at HFIR,” Neutrinos in Nuclear Physics Workshop, Knoxville TN, July 30, 2016.
- “Neutrino mixing and sterile neutrino search at Daya Bay,” XIIIth International Conference on Heavy Quarks and Leptons, Virginia Tech, Blacksburg VA, May 23, 2016.
- “PROSPECT: The Precision Oscillation and Spectrum Experiment,” Department of Physics, Applied Physics, and Astronomy Colloquium, Rensselaer Polytechnic Institute, Troy, NY, April 6, 2016.
- “Neutrons and Neutrinos: Capture-tagged Detectors for Nuclear Science,” Department of Nuclear Engineering, University of California, Berkeley, February 19, 2016.
- “PROSPECT: The Precision Oscillation and Spectrum Experiment,” Triangle University Nuclear Laboratory, Durham, NC, February 4, 2016.
- “Timing Requirements for Inverse Beta Decay Detectors,” PSEC4A Workshop, Massachusetts Institute of Technology, December 14, 2015.
- “PROSPECT: Precision Oscillation and Spectrum Experiment,” Neutrino Oscillation Workshop, Otranto, Italy, September 12, 2014.
- “The UMD/NIST Fast Neutron Spectrometers”, Yale University, New Haven, CT, February 18, 2014.
- “The UMD/NIST Fast Neutron Spectrometers”, University of Washington, Seattle, WA, June 13, 2013.
- “The UMD/NIST Fast Neutron Spectrometers”, Indiana University, Bloomington IN, April 26, 2013.
- “Fast Neutron Spectroscopy with CAEN V1720s”, CAEN Technologies, Viareggio, Italy, April 15, 2013.

- “FaNS-2: Spectroscopy of Cosmic Ray Induced Neutrons,” National Institute for Standards and Technology, Gaithersburg, MD, July 31, 2012.
- “Fast Neutron Detection Greater than 200 MeV,” National Institute for Standards and Technology, Gaithersburg, MD, November 1, 2011.

Contributed Talks

- “Probing Nuclear Data with the PROSPECT Reactor Experiment,” Fall Meeting of the APS Division of Nuclear Physics, 2019.
- “PROSPECT: The Precision Reactor Oscillation and Spectrum Experiment,” Fall Meeting of the APS Division of Nuclear Physics, 2016.
- “PROSPECT: The Precision Reactor Oscillation and Spectrum Experiment,” Fall Meeting of the APS Division of Nuclear Physics, 2015.
- “PROSPECT Background Studies and Operation of Li-Loaded Liquid Scintillator Detectors at a Research Reactor,” April Meeting of the American Physical Society, 2015. BAPS.2015.APR.E7.2.
- “Background Characterization for PROSPECT: a US Short-baseline Neutrino Oscillation Experiment,” April Meeting of the American Physical Society, 2014. BAPS.2014.APR.K12.2.
- “Neutron Capture-gated Spectroscopy with FaNS,” T.J. Langford, E.J. Beise, H. Breuer, C.R. Heimbach, J.S. Nico, AARM Workshop, Chicago, IL, March 20, 2014.
- “A Fast Neutron Spectrometer for Underground Science,” T.J. Langford, E.J. Beise, H. Breuer, C.R. Heimbach, J.S. Nico, Low Radioactivity Techniques Workshop, Assergi, Italy, April 10, 2013.
- “The UMD-NIST Fast Neutron Spectrometer,” T. Langford, E. Beise, H. Breuer, C. Heimbach, J. Nico. Cosmogenic Activity and Backgrounds Workshop, Berkeley, CA, April 13, 2011.
- “Development of a segmented fast neutron spectrometer based on ^6Li -loaded liquid scintillator for measuring neutron background,” C. Bass, T. Langford, E. Beise, H. Breuer, D. Erwin, C. Heimbach, J. Nico. April Meeting of the American Physical Society, 2010. BAPS.2010.APR.Y10.1.
- “A fast neutron spectrometer for underground science,” T. Langford, E. Beise, H. Breuer, D. Erwin, C. Bass, C. Heimbach, J. Nico. April Meeting of the American Physical Society, 2010. BAPS.2010.APR.Y10.2.

Publications

Selected publications

1. Ashenfelter, J. et al. (2019c). Measurement of the Antineutrino Spectrum from ^{235}U Fission at HFIR with PROSPECT. *Phys. Rev. Lett.* **122**(25), 251801. arXiv: 1812.10877 [nucl-ex].
2. Ashenfelter, J. et al. (2018a). First search for short-baseline neutrino oscillations at HFIR with PROSPECT. *Phys. Rev. Lett.* **121**(25), 251802. arXiv: 1806.02784 [hep-ex].
3. An, F. P. et al. (2016e). Measurement of the Reactor Antineutrino Flux and Spectrum at Daya Bay. *Phys. Rev. Lett.* **116**, 061801. arXiv: 1508.04233 [hep-ex].
4. Dwyer, D. and T. J. Langford (2015). Spectral Structure of Electron Antineutrinos from Nuclear Reactors. *Phys.Rev.Lett.* **114**(1), 012502. arXiv: 1407.1281 [nucl-ex].

PhD thesis

1. Langford, T. J. (2013). "Measurement of the Surface and Underground Neutron Spectra with the UMD/NIST Fast Neutron Spectrometers". PhD thesis. UNIVERSITY OF MARYLAND, COLLEGE PARK.

Refereed research papers

1. Adey, D. et al. (2019a). A high precision calibration of the nonlinear energy response at Daya Bay. *Nucl. Instrum. Meth.* **A940**, 230–242. arXiv: 1902.08241 [physics.ins-det].
2. Adey, D. et al. (2019b). Extraction of the ^{235}U and ^{239}Pu Antineutrino Spectra at Daya Bay. *Phys. Rev. Lett.* **123**(11), 111801. arXiv: 1904.07812 [hep-ex].
3. Ashenfelter, J. et al. (2019a). A Low Mass Optical Grid for the PROSPECT Reactor Antineutrino Detector. *JINST* **14**(04), P04014. arXiv: 1902.06430 [physics.ins-det].
4. Ashenfelter, J. et al. (2019b). Lithium-loaded Liquid Scintillator Production for the PROSPECT experiment. *JINST* **14**(03), P03026. arXiv: 1901.05569 [physics.ins-det].
5. Ashenfelter, J. et al. (2019c). Measurement of the Antineutrino Spectrum from ^{235}U Fission at HFIR with PROSPECT. *Phys. Rev. Lett.* **122**(25), 251801. arXiv: 1812.10877 [nucl-ex].
6. Ashenfelter, J. et al. (2019d). The Radioactive Source Calibration System of the PROSPECT Reactor Antineutrino Detector. *Nucl. Instrum. Meth.* **A944**, 2019. arXiv: 1906.07244 [physics.ins-det].
7. Adey, D. et al. (2018a). Improved Measurement of the Reactor Antineutrino Flux at Daya Bay. arXiv: 1808.10836 [hep-ex].
8. Adey, D. et al. (2018b). Measurement of the Electron Antineutrino Oscillation with 1958 Days of Operation at Daya Bay. *Phys. Rev. Lett.* **121**(24), 241805. arXiv: 1809.02261 [hep-ex].
9. Adey, D. et al. (2018c). Search for a time-varying electron antineutrino signal at Daya Bay. *Phys. Rev.* **D98**(9), 092013. arXiv: 1809.04660 [hep-ex].
10. An, F. P. et al. (2018a). Seasonal Variation of the Underground Cosmic Muon Flux Observed at Daya Bay. *JCAP* **1801**(01), 001. arXiv: 1708.01265 [physics.ins-det].
11. An, F. P. et al. (2018b). Cosmogenic neutron production at Daya Bay. *Phys. Rev.* **D97**(5), 052009. arXiv: 1711.00588 [hep-ex].
12. Ashenfelter, J. et al. (2018a). First search for short-baseline neutrino oscillations at HFIR with PROSPECT. *Phys. Rev. Lett.* **121**(25), 251802. arXiv: 1806.02784 [hep-ex].
13. Ashenfelter, J. et al. (2018b). Performance of a segmented ^6Li -loaded liquid scintillator detector for the PROSPECT experiment. *JINST* **13**(06), P06023. arXiv: 1805.09245 [physics.ins-det].
14. An, F. P. et al. (2017a). Evolution of the Reactor Antineutrino Flux and Spectrum at Daya Bay. *Submitted to: Phys. Rev. Lett.* arXiv: 1704.01082 [hep-ex].

15. An, F. P. et al. (2017b). Measurement of electron antineutrino oscillation based on 1230 days of operation of the Daya Bay experiment. *Phys. Rev.* **D95**(7), 072006. arXiv: 1610.04802 [hep-ex].
16. Adamson, P. et al. (2016). Limits on Active to Sterile Neutrino Oscillations from Disappearance Searches in the MINOS, Daya Bay, and Bugey-3 Experiments. *Phys. Rev. Lett.* **117**(15), 151801. arXiv: 1607.01177 [hep-ex].
17. An, F. P. et al. (2016a). New measurement of θ_{13} via neutron capture on hydrogen at Daya Bay. *Phys. Rev.* **D93**(7), 072011. arXiv: 1603.03549 [hep-ex].
18. An, F. P. et al. (2016b). The Detector System of The Daya Bay Reactor Neutrino Experiment. *Nucl. Instrum. Meth.* **A811**, 133–161. arXiv: 1508.03943 [physics.ins-det].
19. An, F. P. et al. (2016c). Improved Measurement of the Reactor Antineutrino Flux and Spectrum at Daya Bay. *Chin. Phys.* **C2017**, 41. arXiv: 1607.05378 [hep-ex].
20. An, F. P. et al. (2016d). Improved Search for a Light Sterile Neutrino with the Full Configuration of the Daya Bay Experiment. *Phys. Rev. Lett.* **117**(15), 151802. arXiv: 1607.01174 [hep-ex].
21. An, F. P. et al. (2016e). Measurement of the Reactor Antineutrino Flux and Spectrum at Daya Bay. *Phys. Rev. Lett.* **116**, 061801. arXiv: 1508.04233 [hep-ex].
22. Ashenfelter, J. et al. (2016a). Background Radiation Measurements at High Power Research Reactors. *Nucl. Instrum. Meth* **A806**, 401–419. arXiv: 1506.03547 [physics.ins-det].
23. Ashenfelter, J. et al. (2016b). The PROSPECT Physics Program. *J. Phys.* **G43**(11), 113001. arXiv: 1512.02202 [physics.ins-det].
24. Langford, T. J., E. J. Beise, H. Breuer, C. R. Heimbach, G. Ji, and J. S. Nico (2016). Development and Characterization of a High Sensitivity Segmented Fast Neutron Spectrometer (FaNS-2). *Jour. of Inst.* **11**(01), P01006. arXiv: 1510.07607 [physics.ins-det].
25. An, F. P. et al. (2015). New Measurement of Antineutrino Oscillation with the Full Detector Configuration at Daya Bay. *Phys. Rev. Lett.* **115**(11), 111802. arXiv: 1505.03456 [hep-ex].
26. Ashenfelter, J. et al. (2015). Light Collection and Pulse-Shape Discrimination in Elongated Scintillator Cells for the PROSPECT Reactor Antineutrino Experiment. *Jour. of Inst.* **10**(11), P11004. arXiv: 1508.06575 [physics.ins-det].
27. Dwyer, D. and T. J. Langford (2015). Spectral Structure of Electron Antineutrinos from Nuclear Reactors. *Phys.Rev.Lett.* **114**(1), 012502. arXiv: 1407.1281 [nucl-ex].
28. Langford, T. J., C. D. Bass, E. J. Beise, H. Breuer, D. K. Erwin, et al. (2015). Fast Neutron Detection with a Segmented Spectrometer. *Nucl.Instrum.Meth.* **A771**, 78–87. arXiv: 1407.6601 [physics.ins-det].
29. Ashenfelter, J. et al. (2013). PROSPECT - A Precision Reactor Oscillation and Spectrum Experiment at Short Baselines. arXiv: 1309.7647 [physics.ins-det].
30. Bass, C. D., E. J. Beise, H. Breuer, C. R. Heimbach, T. J. Langford, et al. (2013). Characterization of a Li-6 loaded liquid organic scintillator for fast neutron spectrometry and thermal neutron detection. *Appl. Radiat. Isot.* **77**, 130–138. arXiv: 1206.4036 [physics.ins-det].
31. Langford, T. J., C. D. Bass, E. J. Beise, H. Breuer, D. K. Erwin, et al. (2013). Event Identification in ^3He Proportional Counters Using Risetime Discrimination. *Nucl.Instrum.Meth.* **A717**, 51–57. arXiv: 1212.4724 [physics.ins-det].
32. Dobi, A., C. G. Davis, C. Hall, T. J. Langford, S. Slutsky, et al. (2011). Detection of krypton in xenon for dark matter applications. *Nucl. Instrum. Meth.* **A665**, 1–6. arXiv: 1103.2714 [astro-ph.IM].
33. Dobi, A., D. Leonard, C. Hall, L. Kaufman, T. J. Langford, et al. (2010). Study of a zirconium getter for purification of xenon gas. *Nucl. Instrum. Meth.* **A620**, 594–598. arXiv: 1002.2791 [physics.ins-det].
34. Leonard, D., A. Dobi, C. Hall, L. Kaufman, T. J. Langford, et al. (2010). A simple high-sensitivity technique for purity analysis of xenon gas. *Nucl. Instrum. Meth.* **A621**, 678–684. arXiv: 1002.2742 [physics.ins-det].

35. Slutsky, S., Y.-R. Yen, H. Breuer, A. Dobi, C. Hall, et al. (2009). A Xenon Condenser with a Remote Liquid Storage Vessel. *Nucl. Instrum. Meth.* **A610**, 669–676. arXiv: 0907.2172 [physics.ins-det].

Conference proceedings

1. Langford, T. J. (June 2018). *PROSPECT: The Precision Reactor Oscillation and Spectrum Experiment*. <https://doi.org/10.5281/zenodo.1287000>.
2. Adams, C., J. Alonso, A. Ankowski, J. Asaadi, J. Ashenfelter, et al. (2015). The Intermediate Neutrino Program. arXiv: 1503.06637 [hep-ex].
3. Langford, T. J. (2014). PROSPECT - A precision oscillation and spectrum experiment. arXiv: 1501.00194 [physics.ins-det].
4. Kishek, R., G. Bai, B. Beaudoin, S. Bernal, D. Feldman, et al. (2007). The University of Maryland Electron Ring (UMER) enters a new regime of high-tune-shift rings. *Conf.Proc.* **C070625**, 820.

References

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