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# Matthew L. Strait

*Curriculum Vitae — March 9, 2018*

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Physics and Astronomy  
University of Minnesota  
116 Church St SE  
Minneapolis, MN 55455  
USA

+1 (612) 624-0511 (office)  
+1 (612) 501-2520 (cell)  
strait@physics.umn.edu

## EMPLOYMENT

Dec 2015 – Present	Researcher — NOvA/DUNE	University of MN
Oct 2010 – Nov 2015	Postdoc — Double Chooz/SNO+	University of Chicago
Jan 2006 – Sept 2010	Research Assistant — MINOS/NOvA	University of MN
Sept 2004–May 2006/2008	Teaching Assistant/REU Advisor	University of MN

## EDUCATION

Ph.D. Physics	University of Minnesota, Twin Cities Advisor: Dan Cronin-Hennessy	2010
B.A. Physics	Carleton College (magna cum laude) Advisor: Joel Weisberg	2003

## RESEARCH ACTIVITIES

### **NOvA** (2005 – 2010, 2015 – present)

NOvA observes the transitions  $\nu_\mu \rightarrow \nu_e$  and  $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$  in order to measure the CP-violating phase  $\delta$  and the neutrino mass ordering, as well as using the disappearance of  $\nu_\mu$  to measure  $\theta_{23}$  and  $\Delta m_{32}^2$ . My current work focuses on astrophysical analyses, including convening our “Exotics” group. I also work on neutron studies, detector simulation, and systematic errors in  $\nu_\mu$  disappearance. I have served as run coordinator.

### **DUNE** (2017 – present)

DUNE is a proposed long-baseline neutrino experiment that will measure the transitions  $\nu_\mu \rightarrow \nu_e$  and  $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$  to determine  $\delta_{\text{CP}}$  and the neutrino mass ordering. I am working on the cosmic ray tracker system for ProtoDUNE-SP, a prototype for DUNE that will run at CERN starting in 2018. The tracker will allow calibration of space charge effects without the need for an internal laser system.

### **SNO+** (2012 – 2015)

SNO+ is a neutrinoless double beta decay experiment which uses  $^{130}\text{Te}$  as its target isotope. While I was at UChicago, our role on SNO+ was development of the online monitoring system, level-2 trigger and supernova data buffer. We designed hardware and software to optimize supernova capabilities; I was deputy convenor of the SNO+ supernova group. Besides involvement in these activities, I headed the “code integrity committee,” which oversaw development of our Monte Carlo, reconstruction, calibration and analysis software.

### **Double Chooz** (2010 – 2015)

Double Chooz measures the neutrino mixing parameter  $\theta_{13}$  by observing the disappearance of reactor  $\bar{\nu}_e$ . I participated in the installation of the UChicago Outer Veto, wrote the event viewer, and contributed to calibration and reconstruction software. I wrote a high-resolution muon reconstruction that aids in suppression of cosmogenic backgrounds and allowed for my analysis of isotope production via muon capture.

### **MINOS** (2006 – 2010)

MINOS performed precision measurement of the neutrino mixing parameters  $\Delta m_{32}^2$  and  $\sin^2 2\theta_{23}$  by observing  $\nu_\mu$  disappearance. My thesis topic was “A Measurement of Oscillation Parameters using Antifiducial Charged Current Events in MINOS,” in which I analyzed the sample of beam events that occur in the exterior of the detector and in the surrounding rock.

## COLLABORATION SERVICE AND LEADERSHIP

NOvA:	Exotics (astrophysics and beyond-the-Standard-Model) group convener Run coordinator Major detector simulation improvements, leading to large reduction in systematic error Fiber aging studies and stringing machine R&D
DUNE:	Cosmic ray tracker group
SNO+:	Supernova working group, deputy convener Code integrity committee, chair Event viewer selection committee, chair; event viewer maintainer Online monitoring/data flow working group On-site construction shifts
Double Chooz:	High-precision muon reconstruction Outer Veto: installation and calibration; wrote event viewer Major efficiency improvements to reconstruction
MINOS:	Reconstruction batch processing working group Contributions to detector Monte Carlo Study of $\bar{\nu}_\mu$ disappearance using rock events

## PRIMARY PUBLICATIONS

- Y. Abe et al. (Double Chooz Collaboration), *Muon capture on light isotopes measured with the Double Chooz detector*, Phys. Rev. C **93**, 054608 (2016), [arXiv:1512.07562](#). **Corresponding author; All data analysis; Paper writing.**
- P. Adamson et al. (NOvA Collaboration), *First measurement of electron neutrino appearance in NOvA*, Phys. Rev. Lett. **116**, 151806 (2016), [arXiv:1601.05022](#), P. Adamson et al. (NOvA Collaboration), *First measurement of muon-neutrino disappearance in NOvA*, Phys. Rev. D **93**, 051104 (2016), [arXiv:1601.05037](#). **First NOvA papers, authorship represents my graduate work on R&D.**
- S. Andringa et al. (SNO+ Collaboration), *Current status and future prospects of the SNO+ experiment*, Adv. High Energy Phys. **2016**, 6194250 (2016), [arXiv:1508.05759](#). **Contributions to supernova and invisible nucleon decay sections.**
- Y. Abe et al. (Double Chooz Collaboration), *Precision muon reconstruction in Double Chooz*, Nucl. Instrum. Methods **A764**, 330–339 (2014), [arXiv:1405.6227](#) **Corresponding author; Describes my reconstruction work; Paper writing.**
- Y. Abe et al. (Double Chooz Collaboration), *Improved measurements of the neutrino mixing angle  $\theta_{13}$  with the Double Chooz detector*, JHEP **10**, 086 (2014), [arXiv:1406.7763](#), [Erratum: JHEP02,074(2015)]. **My reconstruction algorithm was used to reduce  $^9\text{Li}$  background by half.**
- J. R. Alonso et al., *Advanced Scintillator Detector Concept (ASDC): A Concept Paper on the Physics Potential of Water-Based Liquid Scintillator*, (2014), [arXiv:1409.5864](#). **Significant input to supernova section.**
- Y. Abe et al. (Double Chooz Collaboration), *Reactor electron antineutrino disappearance in the Double Chooz experiment*, Phys. Rev. **D86**, 052008 (2012), [arXiv:1207.6632](#). **First Double Chooz analysis to use the UChicago Outer Veto.**
- P. Adamson et al. (MINOS Collaboration), *Measurement of the neutrino mass splitting and flavor mixing by MINOS*, Phys. Rev. Lett. **106**, 181801 (2011), [arXiv:1103.0340](#). **Includes my thesis work: partially contained events.**

- P. Adamson et al. (MINOS Collaboration), *Search for the disappearance of muon antineutrinos in the NuMI neutrino beam*, Phys. Rev. **D84**, 071103 (2011), [arXiv:1108.1509](#). **Cross-check of surprising result using partially contained events.**
- M. Strait, D. Cronin-Hennessy and K. Arms, *Interaction rate of polystyrene fiber optics with pseudocumene-based liquid scintillator*, Nucl. Instrum. Methods **A615**, 33–36 (2010), [doi:10.1016/j.nima.2010.01.002](#). **Design of procedures; Bench work; Paper writing.**

#### OTHER COLLABORATION PUBLICATIONS

- P. Adamson et al. (NOvA Collaboration), *Search for active-sterile neutrino mixing using neutral-current interactions in NOvA*, Phys. Rev. D **96**, 072006 (2017), [arXiv:1706.04592](#)
- P. Adamson et al. (NOvA Collaboration), *Measurement of the neutrino mixing angle  $\theta_{23}$  in NOvA*, Phys. Rev. Lett. **118**, 151802 (2017), [arXiv:1701.05891](#)
- P. Adamson et al. (NOvA Collaboration), *Constraints on oscillation parameters from  $\nu_e$  appearance and  $\nu_\mu$  disappearance in NOvA*, Phys. Rev. Lett. **118**(23), 231801 (2017), [arXiv:1703.03328](#)
- Y. Abe et al. (Double Chooz Collaboration), *Characterization of the spontaneous light emission of the PMTs used in the Double Chooz experiment*, JINST **11**(08), P08001 (2016), [arXiv:1604.06895](#)
- Y. Abe et al. (Double Chooz Collaboration), *Measurement of  $\theta_{13}$  in Double Chooz using neutron captures on hydrogen with novel background rejection techniques*, JHEP **1**, 163 (2016), [arXiv:1510.08937](#)
- Y. Abe et al. (Double Chooz Collaboration), *Ortho-positronium observation in the Double Chooz experiment*, JHEP **10**, 32 (2014), [arXiv:1407.6913](#)
- Y. Abe et al. (Double Chooz Collaboration), *Background-independent measurement of  $\theta_{13}$  in Double Chooz*, Physics Letters B **735**, 51–56 (2014), [arXiv:1401.5981](#)
- Y. Abe et al. (Double Chooz Collaboration), *First measurement of  $\theta_{13}$  from delayed neutron capture on hydrogen in the Double Chooz experiment*, Phys. Lett. **B723**, 66–70 (2013), [arXiv:1301.2948](#)
- Y. Abe et al. (Double Chooz Collaboration), *Direct measurement of backgrounds using reactor-off data in Double Chooz*, Phys. Rev. **D87**, 011102 (2013), [arXiv:1210.3748](#)
- Y. Abe et al. (Double Chooz Collaboration), *First test of Lorentz violation with a reactor-based antineutrino experiment*, Phys. Rev. **D86**, 112009 (2012), [arXiv:1209.5810](#)
- P. Adamson et al. (MINOS Collaboration), *Measurements of atmospheric neutrinos and antineutrinos in the MINOS far detector*, Phys. Rev. **D86**, 052007 (2012), [arXiv:1208.2915](#)
- Y. Abe et al. (Double Chooz Collaboration), *Reactor electron antineutrino disappearance in the Double Chooz experiment*, Phys. Rev. **D86**, 052008 (2012), [arXiv:1207.6632](#)
- P. Adamson et al. (MINOS Collaboration), *An improved measurement of muon antineutrino disappearance in MINOS*, Phys. Rev. Lett. **108**, 191801 (2012), [arXiv:1202.2772](#)
- P. Adamson et al. (MINOS Collaboration), *Search for Lorentz invariance and CPT violation with muon antineutrinos in the MINOS near detector*, Phys. Rev. **D85**, 031101 (2012), [arXiv:1201.2631](#)
- Y. Abe et al. (Double Chooz Collaboration), *Indication for the disappearance of reactor electron antineutrinos in the Double Chooz experiment*, Phys. Rev. Lett. **108**, 131801 (2012), [arXiv:1112.6353](#)
- Y. Abe et al. (Double Chooz Collaboration), *Indication for the disappearance of reactor electron antineutrinos in the Double Chooz experiment*, Phys. Rev. Lett. **108**, 131801 (2012), [arXiv:1112.6353](#)
- P. Adamson et al. (MINOS Collaboration), *Active to sterile neutrino mixing limits from neutral-current interactions in MINOS*, Phys. Rev. Lett. **107**, 011802 (2011), [arXiv:1104.3922](#)
- P. Adamson et al. (MINOS Collaboration), *First direct observation of muon antineutrino disappearance*, Phys. Rev. Lett. **107**, 021801 (2011), [arXiv:1104.0344](#)

- P. Adamson et al. (MINOS Collaboration), *Measurement of the underground atmospheric muon charge ratio using the MINOS near detector*, Phys. Rev. **D83**, 032011 (2011), [arXiv:1012.3391](#)
- P. Adamson et al. (MINOS Collaboration), *Observation in the MINOS far detector of the shadowing of cosmic rays by the Sun and Moon*, Astropart. Phys. **34**, 457–466 (2011), [arXiv:1008.1719](#)
- P. Adamson et al. (MINOS Collaboration), *A search for Lorentz invariance and CPT violation with the MINOS far detector*, Phys. Rev. Lett. **105**, 151601 (2010), [arXiv:1007.2791](#)
- P. Adamson et al. (MINOS Collaboration), *New constraints on muon-neutrino to electron-neutrino transitions in MINOS*, Phys. Rev. **D82**, 051102 (2010), [arXiv:1006.0996](#)
- P. Adamson et al. (MINOS Collaboration), *Search for sterile neutrino mixing in the MINOS long baseline experiment*, Phys. Rev. **D81**, 052004 (2010), [arXiv:1001.0336](#)
- P. Adamson et al. (MINOS Collaboration), *Observation of muon intensity variations by season with the MINOS far detector*, Phys. Rev. **D81**, 012001 (2010), [arXiv:0909.4012](#)
- P. Adamson et al. (MINOS Collaboration), *Neutrino and antineutrino inclusive charged-current cross section measurements with the MINOS near detector*, Phys. Rev. **D81**, 072002 (2010), [arXiv:0910.2201](#)
- P. Adamson et al. (MINOS Collaboration), *Search for muon-neutrino to electron-neutrino transitions in MINOS*, Phys. Rev. Lett. **103**, 261802 (2009), [arXiv:0909.4996](#)
- S. Osprey et al. (MINOS Collaboration), *Sudden stratospheric warmings seen in MINOS deep underground muon data*, Geophys. Res. Lett. **36**, L05809 (2009), [doi:10.1029/2008GL036359](#)
- P. Adamson et al. (MINOS Collaboration), *Search for active neutrino disappearance using neutral-current interactions in the MINOS long-baseline experiment*, Phys. Rev. Lett. **101**, 221804 (2008), [arXiv:0807.2424](#)
- P. Adamson et al. (MINOS Collaboration), *Testing Lorentz invariance and CPT conservation with NuMI neutrinos in the MINOS near detector*, Phys. Rev. Lett. **101**, 151601 (2008), [arXiv:0806.4945](#)
- P. Adamson et al. (MINOS Collaboration), *Measurement of neutrino oscillations with the MINOS detectors in the NuMI beam*, Phys. Rev. Lett. **101**, 131802 (2008), [arXiv:0806.2237](#)
- P. Adamson et al. (MINOS Collaboration), *A study of muon neutrino disappearance using the Fermilab Main Injector neutrino beam*, Phys. Rev. **D77**, 072002 (2008), [arXiv:0711.0769](#)

## STUDENTS SUPERVISED

- Kevin Labe — Graduate student at University of Chicago. Supernova trigger and invisible nucleon decay in SNO+; Dissertation: “Tests of Lorentz Invariance at the Sudbury Neutrino Observatory”, 2017.
- Emily Conover — Graduate student at University of Chicago. Dissertation: “Muon-induced backgrounds in the Double Chooz neutrino oscillation experiment”, 2014.
- Keith Crum — Graduate student at University of Chicago. Dissertation: “A Measurement Of  $\sin^2 \theta_{13}$  with The Double Chooz Experiment”, 2014.
- Tony LaTorre — Graduate student at University of Chicago. Online monitoring, supernova trigger, solar neutrinos with SNO+.
- Vladimir Bychkov — Graduate student at University of Minnesota: Oscillation study of uncontained  $\nu_\mu$  events in NOvA. PhD expected 2018.
- Andrew Vold — Graduate student at University of Minnesota. Alternative  $\nu_e$  identification in NOvA. PhD expected 2018.

- Dmitrii Torbunov — Graduate student at University of Minnesota. Energy reconstruction for  $\nu_\mu$  events in NOvA; Nucleon decay in DUNE.
- Jay Cushing — Undergraduate student at University of Chicago. Improvements to SNO+ offline software and databases; Double Chooz assembly.
- Alex Diaz — Undergraduate student at University of Chicago. Monte Carlo studies of supernova directionality with water volume of SNO+; Double Chooz assembly.
- Hadar Lazar — Undergraduate student at University of Chicago. Test stand studies of organic scintillator time structure.

### AWARDS, POSTERS AND TALKS

- Fermilab Neutrino Physics Center Scholar, 2017–2018, “Travel support for NOvA collaboration on astrophysical analyses and for work on the ProtoDUNE cosmic ray tracker.” \$4k.
- Universities Research Association Visiting Scholar, 2017–2018, “Travel support for NOvA Exotics group and ProtoDUNE cosmic ray tracker collaboration.” \$8k.
- “Demystifying Neutrinos with the NOvA Experiment,” Physics Colloquium, University of Minnesota-Duluth, March 3, 2017.
- “NOvA: Status and Recent Results”, invited plenary talk, MIAMI 2016, Fort Lauderdale, FL.
- Universities Research Association Visiting Scholar, 2016–2017, “Travel support for NOvA collaboration on electron neutrino selection, run coordination, meetings and workshops.” \$9k.
- Poster: “Nuclear Muon Capture Measurements on Light Isotopes in Double Chooz,” Neutrino 2016, London, UK. Proceedings: [doi:10.1088/1742-6596/888/1/012167](https://doi.org/10.1088/1742-6596/888/1/012167).
- “Status of SNO+,” invited plenary talk, Lake Louise Winter Institute 2015.
- Poster: “Supernova Detection in SNO+,” Neutrino 2014, Boston, MA.
- Poster: “Muon Reconstruction in Double Chooz,” NuPhys 2013, London, UK. Proceedings: [doi:10.1088/1742-6596/598/1/012031](https://doi.org/10.1088/1742-6596/598/1/012031)
- “Status and First Results from Double Chooz,” High Energy Physics Seminar, University of Pittsburgh, February 29, 2012.
- “Neutrino Oscillations and the MINOS Experiment,” Physics Colloquium, St. Olaf College, March 24, 2010.
- “Anti-fiducial Muons in MINOS,” High Energy Physics Seminar, University of Minnesota, April 13, 2010.
- “New Results from MINOS,” invited plenary talk, PHENO 2010, Madison, WI.