

MATTHEW HOGAN

Curriculum Vitae

ADDRESS

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TELEPHONE

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PROFESSIONAL EMPLOYMENT

2011 – 2012

RESEARCH ASSISTANT AT UNIVERSITY OF CALIFORNIA, SANTA CRUZ, CA.

2012 – 2015

GRADUATE TEACHING ASSISTANT AT COLORADO STATE UNIV., FORT COLLINS, CO.

2015 – 2019

GRADUATE RESEARCH ASSISTANT AT COLORADO STATE UNIV., FORT COLLINS, CO.

2020 – PRESENT

RESEARCH SCIENTIST AT NORTHWEST RESEARCH ASSOCIATES

EDUCATION

2007 - 2012

UNDERGRADUATE AT UNIVERSITY OF CALIFORNIA, SANTA CRUZ, CA.

- ◆ Obtained B.S. in Physics. Thesis “An optical study of blazar variability”.

2012 - 2019

POST-GRADUATE STUDENT AT COLORADO STATE UNIV., FORT COLLINS, CO.

- ◆ High Energy Physics group in the Physics department
- ◆ Doctorate thesis: “Independent measurement of the T2K near detector constraint using the off-axis pi-zero detector”

RESEARCH INTERESTS

- ◆ Experimental physics and detector design
- ◆ Solar and atmospheric physics
- ◆ Numerical modeling and deep learning methods
- ◆ Machine learning methods for classification and regression problems
- ◆ Model parameter estimation with constraints
- ◆ Experimental detector design

AWARDS

- ◆ 2013: Student Presentation Award at APS Four Corners Meeting. “Improving Tau-Neutrino Background Reduction in the LBNE Fast Monte Carlo”

SPECIALTIES

- ◆ High energy Physics especially long-baseline neutrino oscillations
- ◆ Deep learning methods in classification and regression including random forests and k nearest neighbors
- ◆ Trained in using convolutional neural network for computer vision
- ◆ High dimensional parameter estimation techniques using maximal likelihood method
- ◆ Scientific programming and data analysis using C++ and Python
- ◆ High performance computing
- ◆ Data acquisition and hardware monitoring
- ◆ Linux & Unix computer system installation and maintenance
- ◆ Hands-on installation and maintenance of electronics, PSUs, and water-cooling systems
- ◆ Software and hardware documentation esp. in LaTeX
- ◆ Public speaking to technical and non-technical audiences

PUBLIC TALKS

- ◆ *Improving ν_τ Background Reduction using the LBNE Fast Monte Carlo*, AMERICAN PHYSICAL SOCIETY, Denver, CO. (2013).
- ◆ *Improving Background Rejection in the Next Generation Neutrino Oscillation Parameter Measurements*. AMERICAN PHYSICAL SOCIETY. Baltimore, MD. (2015).
- ◆ *Rejecting Non-MIP-Like Tracks using Boosted Decision Trees with the T2K Pi-Zero Subdetector*. AMERICAN PHYSICAL SOCIETY, Salt Lake City, UT. (2016).
- ◆ *Estimating the Secondary Interaction Systematic from Neutrino-Induced Pion Production in T2K*. AMERICAN PHYSICAL SOCIETY, Fort Collins, CO. (2017).
- ◆ *Data Mining and Machine Learning in Physics*, Fort Collins Data Science Meetup, Fort Collins, CO. (2019).
- ◆ Using the T2K pi-zero detector to measure the near detector constraint for the neutrino oscillation analysis, CU BOULDER HIGH ENERGY AND NUCLEAR PHYSICS SEMINAR, Boulder, CO. (2019).

PUBLICATIONS

1. M. Fumagalli *et al.*, “A search of CO emission lines in blazars: the low molecular gas content of BL Lac objects compared to quasars”, [Mon. Not. R. Astron. Soc. **424**, 2276–2283 \(2012\)](#).
2. C. Adams *et al.* (LBNE Collaboration), “The Long-Baseline Neutrino Experiment”, [arXiv: 1307.7335 \(2013\)](#).
3. K. Abe *et al.* (T2K Collaboration), “Measurement of Muon Antineutrino Oscillations with an Accelerator-produced Off-Axis Beam”, [Phys. Rev. Lett. **116**, 181801 \(2016\)](#).
4. K. Abe *et al.* (T2K Collaboration), “Measurement of double-differential muon neutrino charged-current interactions on C_8H_8 without pions in the final state using the T2K off-axis beam”, [Phys. Rev. D **93** 112012 \(2016\)](#).
5. K. Abe *et al.* (T2K Collaboration), “Measurement of Coherent π^+ Production in Low Energy Neutrino-Carbon Scattering”, [Phys. Rev. Lett. **117**, 192501 \(2016\)](#).

6. K. Abe *et al.* (T2K Collaboration), “First measurement of the muon neutrino charged current single pion production cross section on water with the T2K near detector”, [Phys. Rev. D **95**, 012010, \(2017\)](#).
7. K. Abe *et al.* (T2K Collaboration), “Combined Analysis of Neutrino and Antineutrino Oscillations at T2K”, [Phys. Rev. Lett. **118**, 151801 \(2017\)](#).
8. K. Abe *et al.* (T2K Collaboration), “Search for Lorentz and CPT violation using sidereal time dependence of neutrino flavor transitions over a short baseline”, [Phys. Rev. D **95**, 111101\(R\) \(2017\)](#).
9. K. Abe *et al.* (T2K Collaboration), “Updated T2K measurements of muon neutrino and antineutrino disappearance using 1.5×10^{21} protons on target”, [Phys. Rev. D **96**, 011102\(R\), \(2017\)](#).
10. K. Abe *et al.* (The T2K Collaboration), “Measurement of $\bar{\nu}$ and ν charged current inclusive cross sections and their ratio with the T2K off-axis near detector”, [Phys. Rev. D **96**, 052001 \(2017\)](#).
11. K. Abe *et al.* (The T2K Collaboration), “Measurement of neutrino and antineutrino oscillations by the T2K experiment including a new additional sample and ν_e interactions at the far detector”, [Phys. Rev. D **96**, 092006 \(2018\)](#).
12. K. Abe *et al.* (T2K Collaboration), “First measurement of the ν_μ charged-current cross section on a water target without pions in the final state”, [Phys. Rev. D **97**, 012001 \(2017\)](#).
13. K. Abe *et al.* (T2K Collaboration), “Measurement of the single π^0 production rate in neutral current neutrino interactions on water”, [Phys. Rev. D **97**, 032002 \(2018\)](#).
14. K. Abe *et al.* (T2K Collaboration), “Measurement of inclusive double-differential ν_μ charged-current cross section with improved acceptance in the T2K off-axis near detector”, [Phys. Rev. D **98**, 012004 \(2018\)](#).
15. K. Abe *et al.* (T2K Collaboration), “Characterization of nuclear effects in muon-neutrino scattering on hydrocarbon with a measurement of final-state kinematics and correlations in charged-current pionless interactions at T2K”, [Phys. Rev. D **98**, 032003 \(2018\)](#).
16. K. Abe *et al.* (T2K Collaboration), “Search for CP Violation in Neutrino and Antineutrino Oscillations by the T2K Experiment with 1.2×10^{21} Protons on Target”, [Phys. Rev. Lett. **121**, 171802 \(2018\)](#).
17. K. Abe *et al.* (T2K Collaboration), “Search for light sterile neutrinos with the T2K far detector Super-Kamiokande at a baseline of 295 km”, [Phys. Rev. D **99**, 071103\(R\) \(2019\)](#).
18. K. Abe *et al.* (T2K Collaboration), “Search for heavy neutrinos with the T2K near detector ND280”, [Phys. Rev. D **100**, 052006 \(2019\)](#).
19. K. Abe *et al.* (T2K Collaboration), “Constraint on the Matter-Antimatter Symmetry-Violating Phase in Neutrino Oscillations”, [arXiv preprint: 1910.03887 \(2019\)](#).
20. K. Abe *et al.* (T2K Collaboration), “Single differential single pion production cross section on water in the T2K off-axis pi-zero detector”, **In preparation**.

POSTERS

1. *Improving Background Reduction in the Next Generation Neutrino Oscillation Parameter Measurements* (with D. Cherdack and R. Wilson), Graduate Student Showcase at Colorado State University, Fort Collins, CO. (2015).
2. *Estimating a Systematic Uncertainty in High Energy Particle Physics* (with D. Cherdack and J. Schwehr), Graduate Student Showcase at Colorado State University, Fort Collins, CO. (2017).
3. *Experiences in High Energy Neutrino Physics*, Graduate Student Showcase at Colorado State University, Fort Collins, CO. (2018).

COLLABORATIONS

2013-2014

LONG BASELINE NEUTRINO EXPERIMENT

- ◆ M.S. project in NC and ν_τ background reduction using machine learning in oscillation analysis

2014-2019

TOKAI TO KAMIOKA EXPERIMENT (JAPAN)

- ◆ Expert for the off-axis pi-zero detector (PØD) and other off-axis Trip-T ASIC detectors
- ◆ DAQ and detector expert shifter
- ◆ Contributor to CC- $1\pi^+$ analysis using off-axis PØD
- ◆ Main analyzer of independent near detector constraint measurement using PØD

2019

SBN-FD (ICARUS EXPERIMENT)

- ◆ Data acquisition system installation