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Mitch Soderberg

Curriculum Vitae

Education

2006 **Ph.D., Physics**, *University of Michigan*, Ann Arbor, MI.

2000 **B.S., Physics**, *Truman State University*, Kirksville, MO.

Experience

2016–present **Associate Professor**, *Syracuse University*, Syracuse, NY.

2010–2016 **Assistant Professor**, *Syracuse University*, Syracuse, NY.

2010–2016 **Associate Scientist**, *Fermi National Accelerator Laboratory*, Batavia, IL.

2006–2010 **Postdoctoral Research Assosciate**, *Yale University*, New Haven, CT.

2000–2001 **High School Physics Teacher**, *St. Louis Priory School*, St. Louis, MO.

Experiment Collaboration History

2014–present **SBND (E-1053)**, Roles: Co-convener of TPC working group; Syracuse group responsible for production of 2 APAs.

2012–present **LArIAT (T-1034)**, Roles: Syracuse group led TPC re-furbishment/wiring/installation.

2008–present **LBNE/DUNE (E-1071)**, Roles: APA working group Coordinator; APA Consortium Design group Co-convener.

2007–present **MicroBooNE (E-974)**, Roles: Co-convener of Physics group; Co-convener of Cross-Sections working group; Editor and primary author of first collaboration publication detailing detector design and construction; Syracuse group played major roles in TPC fabrication/construction/installation.

2006–present **ArgoNeuT (T-962)**, Roles: Spokesperson since 2009; Leader of design/construction/installation/operation of the entire experiment, and major involvement in subsequent analysis program that has produced 9 publications.

2002–2006 **CDF (E-924)**, Dissertation: "Measurement of the $W^{\pm} + b\bar{b}$ Cross-Section in 695 pb^{-1} of $p\bar{p}$ Collisions at CDF II".

Research Interests

- **LArTPC Detector Development**: Since the beginning of my postdoctoral years I have been working on developing Liquid Argon Time Projection Chambers (LArTPCs) for use in the study of neutrinos. Progress has been rapid, and there is now a diverse program of running/under-construction LArTPC experiments at Fermilab/CERN, with the ultimate goal of building the 40,000 ton DUNE far detector. I am broadly interested in the design and performance of the TPC detector, and the construction details of these experiments on large scales. I am also interested in improving the instrumentation (e.g. purity monitors, tension measurements, material property studies, etc...) used to construct and operate these detectors.
- **Neutrino Interaction and Oscillation Physics**: The exquisite resolution provided by the LArTPC approach offers new opportunities for exploring the subtleties of neutrino-nucleus interactions. Understanding these subtleties has direct impact on the resolution that the initial neutrino's properties can be determined, which in turn determines our ultimate sensitivity to studying neutrino oscillations. I am interested in measurements of neutrino-nucleus interaction cross-sections, and exploring how these measurements can be used to test and improve accompanying theoretical models implemented in neutrino event generators.
- **Exotic Physics**: With larger detectors comes increased sensitivity to more exotic physics (e.g. supernova neutrinos, nucleon decay, multi-messenger astrophysical events, certain dark matter models). I am interested in exploring these topics with an eye towards measurements on DUNE and perhaps the SBN program.

Awards

Spring 2016	"Lunch on the Department" Teaching Award, Small Enrollment Course (PHY216)
Spring 2014	"Dinner on the Department" Teaching Award, Large Enrollment Course (PHY212)
Spring 2013	"Dinner on the Department" Teaching Award, Large Enrollment Course (PHY212)
Spring 2012	"Lunch on the Department" Teaching Award, Small Enrollment Course (PHY361)
2001-2003	Regents Fellowship, University of Michigan
May 2000	Departmental Honors in Physics, Truman State University
May 2000	Outstanding Senior in Physics, Truman State University

Funding

2018–present	NSF – ($37,500) "Enabling Precision Neutrino Physics with DUNE: Development of Design and Production Plan for DUNE TPC Wire Planes", Co-PI, Sub-Award from U. Chicago
2017–present	NSF – ($858,000) "Neutrino Physics at Syracuse University", PI
2016–2017	DUNE Project – ($18,000), APA QA/QC Plan Development
2014–2018	NSF – ($564,700) "Neutrino Physics with Liquid Argon Detectors: Entering the Micro-BooNE Era", PI
2014–2018	NSF MRI – ($145,000) "Development of a Time Projection Chamber to Measure Neutrino Interactions in the LAr1 Near Detector", PI
2011–2015	NSF – ($420,000) "Neutrino Physics with Liquid Argon Detectors", PI

Service

- DOE Intensity Frontier Lab Comparative Review Panelist, 2018
- DOE Intensity Frontier University Comparative Review Panelist: 2015, 2016
- NSF Ad-Hoc Reviewer: 2014, 2015, 2016, 2017, 2018
- Co-convener of the Neutrino Detectors track at the 2011 Technology and Instrumentation in Particle Physics (TIPP) conference, held June 9-14, 2011 in Chicago, IL. Helped recruit and organize ∼45 talks, and served as editor of the proceedings for this part of the conference.
- Co-PI of the Syracuse QuarkNet center since its beginning in 2012, which aims to expose local high-school physics teachers and students to modern research in the field of particle physics.
- Director of Graduate Studies for the Syracuse Physics department since Fall 2017
- Referee for papers in *Journal of Instrumentation* (JINST) and *Advances in High Energy Physics*.
- Fermilab Users' Executive Committee: 2007–2009 (Secretary: 2008–2009).

Public Presentations

Oct-2017	"Particle Prospecting: Digging for Discovery with Neutrinos", Colgate University Colloquium, Hamilton, NY
Sept-2017	"Particle Puzzles: Studying Neutrinos and Quarks at SU", Syracuse University Colloquium, Syracuse, NY
Oct-2015	"Instrumentation and Neutrino Mass", CPAD Instrumentation Frontier Meeting, Arlington, TX
Sept-2015	"The Big Science of Little Neutrinos", Syracuse University Colloquium, Syracuse, NY
Feb-2015	"Liquid Argon Capabilities", Workshop on the Intermediate Neutrino Program (WINP2015), Brookhaven National Laboratory
Oct-2014	"Liquid Argon Detectors", two-part lecture at Neutrino Scattering Physics School, Fermi National Accelerator Laboratory
July-2014	"Status of the ArgoNeuT and MicroBooNE Experiments", Recontres du Vietnam Flavour Conference, Quy Nhon, Vietnam
May-2014	"What is the path forward for our precision neutrino oscillation needs?", NuINT 2014, Surrey, United Kingdom
Feb-2014	"Liquid Argon Time Projection Chambers for Neutrino Physics", Cornell University Seminar, Ithaca, NY
Nov-2013	"Liquid Argon Detector Developments in the U.S.", NNN13, Kashiwa, Japan
Nov-2013	"High Voltage in ArgoNeuT", High Voltage in Noble Liquids Workshop, Fermi National Accelerator Laboratory
Apr-2013	"The Naughty Neutrino", Presentation for Syracuse University Project Advance teachers, New York, New York
Mar-2013	"Calibrations with Muons in ArgoNeuT", LArTPC R&D Workshop, Fermi National Accelerator Laboratory
July-2012	"Liquid Argon Detector R&D", NuFACT2012, Williamsburg, VA
July-2012	"The ArgoNeuT and MicroBooNE Experiments at Fermi National Accelerator Laboratory", ICHEP2012, Melbourne, Australia

Oct-2011 "Liquid Argon Technology for Neutrinos", 7th International Design Study for Neutrino Factory, Arlington, VA

June-2011 "Future Neutrino Physics", DOE Institutional Review of Fermilab, Fermi National Accelerator Laboratory

May-2011 "The ArgoNeuT Project", Fermilab Short Baseline Neutrino Workshop, Fermi National Accelerator Laboratory

Apr-2011 "Reconstruction and Simulation for LArTPCs", DOE Office of Science Review of Options for Underground Science, Palo Alto, CA

Mar-2011 "Neutrino Data Analysis with the ArgoNeuT Project", Recontres de Moriond Electroweak 2011, La Thuile, Italy

Dec-2010 "Liquid Argon Projects in the U.S.", NNN10, Toyama, Japan

Oct-2010 "Frozen in Time: Neutrino Physics with Liquid Argon Detectors", University of Rochester Seminar, Rochester, NY

Oct-2010 "ArgoNeuT: University/Lab R&D Experience", Fermilab Workshop on Detector R&D, Fermi National Accelerator Laboratory

June-2010 "Status of ArgoNeuT and MicroBooNE Experiments", Neutrino 2010, Athens, Greece

Apr-2010 "Frozen in Time: Neutrino Physics with Liquid Argon Detectors", University of Houston Colloquium, Houston, TX

Mar-2010 "Frozen in Time: Neutrino Physics with Liquid Argon Detectors", Syracuse University Colloquium, Syracuse, NY

Feb-2010 "Entering an Era of Precision Neutrino Physics", University of Virginia Colloquium, Charlottesville, VA

Jan-2010 "Development of Liquid Argon Time Projection Chambers in the U.S.", Indiana University Seminar, Bloomington, IN

Nov-2009 "Development of Liquid Argon Time Projection Chambers in the U.S.", Rutgers University Seminar, Piscataway, NJ

Oct-2009 "Development of Liquid Argon Time Projection Chambers in the U.S.", CalTech Seminar, Pasadena, CA

Sept-2009 "Development of Liquid Argon Time Projection Chambers in the U.S.", University of Michigan Seminar, Ann Arbor, MI

Sept-2009 "Development of Liquid Argon Time Projection Chambers in the U.S.", SLAC National Accelerator Seminar, Palo Alto, CA

Sept-2009 "Future Long Baseline Experiments: Options for U.S.", WIN09, Perugia, Italy

July-2009 "ArgoNeuT: A Liquid Argon Time Projection Chamber Test in the NuMI Beamline", DPF 2009, Detroit, MI

May-2009 "MicroBooNE: A New Liquid Argon Time Projection Chamber Experiment", NuINT2009, Sitges, Spain

Feb-2009 "Liquid Argon Time Projection Chambers: U.S. R&D and Physics Program", 45th Karpacz Winter School in Theoretical Physics, Ladek-Zdroj, Poland

Sept-2008 "Liquid Argon Time Projection Chambers: U.S. R&D and Physics Program", Institut de Physique Nucleaire Seminar, Orsay, France

Sept-2008 "Liquid Argon Time Projection Chambers: U.S. R&D", NNN08, Paris, France

Apr-2008 "Liquid Argon Time Projection Chambers: R&D Towards Kiloton Class Detectors", APS April Meeting, St. Louis, MO

Nov-2007 "Liquid Argon Time Projection Chambers and Project X", Project X: 1st Workshop on Physics, Fermi National Accelerator Laboratory

Selected Publications

[25] **ArgoNeuT Collaboration**, *First measurement of the cross section for ν_μ and $\overline{\nu_\mu}$ induced single charged pion production on argon using ArgoNeuT*, Phys. Rev., D98:052002, 2018.

[24] **ArgoNeuT Collaboration**, *Measurement of ν_μ and $\overline{\nu_\mu}$ neutral current $\pi^0 \to \gamma\gamma$ production in the ArgoNeuT detector*, Phys. Rev., D96:012006, 2017.

[23] **ArgoNeuT Collaboration**, *First Observation of Low Energy Electron Neutrinos in a Liquid Argon Time Projection Chamber*, Phys. Rev., D95:072005, 2017.

[22] **R. Acciarri et al.**, *Construction and Assembly of the Wire Planes for the MicroBooNE Time Projection Chamber*, JINST 12 (2017) no. 03, T03003.

[21] **MicroBooNE Collaboration**, *Design and Construction of the MicroBooNE Detector*, JINST 12 (2017) no. 02, P02017.

[20] **F. Cavanna, O. Palamara, R. Schiavilla, M. Soderberg, R.B. Wiringa**, *Neutrino-nucleus interactions and the short-range structure of nuclei*, nucl-ex/1501.01983 (2015).

[19] **ArgoNeuT Collaboration**, *First Measurement of Neutrino and Antineutrino Coherent Charged Pion Production on Argon*, PRL 113 (2014) no. 26, 261801.

[18] **ArgoNeuT Collaboration**, *Detection of back-to-back proton pairs in charged-current neutrino interactions with the ArgoNeuT detector in the NuMI low energy beam line*, Phys. Rev., D90:012008, 2014.

[17] **ArgoNeuT Collaboration**, *Measurements of Inclusive Muon Neutrino and Antineutrino Charged Current Differential Cross Sections on Argon in the NuMI Antineutrino Beam*, Phys. Rev., D89:112003, 2014.

[16] **B. Rebel et al**, *High Voltage in Noble Liquids for High Energy Physics*, hep-ex/1403.3613 (2014).

[15] **LArIAT Collaboration**, *LArIAT: Liquid Argon in a Testbeam*, hep-ex/1405.4261 (2014).

[14] **SBND Collaboration**, *LAr1-ND (SBND): Testing Neutrino Anomalies with Multiple LArTPC Detectors at Fermilab*, hep-ex/1309.7987 (2013).

[13] **ArgoNeuT Collaboration**, *A study of electron recombination using highly ionizing particles in the ArgoNeuT Liquid Argon TPC*, JINST (2013) no. 08, P08005.

[12] **C. Adams et al**, *Scientific Opportunities with the Long-Baseline Neutrino Experiment*, hep-ex/1307.7335 (2013).

[11] **C. Bromberg et al**, *Liquid Argon Time Projection Chamber Research and Development in the United States*, hep-ex/1307.8166 (2013).

[10] **ArgoNeuT Collaboration**, *The ArgoNeuT Detector in the NuMI Low-Energy Beam Line at Fermilab*, JINST (2012) no. 07, P10019.

[9] **ArgoNeuT Collaboration**, *Analysis of a Large Sample of Neutrino-induced Muons with the ArgoNeuT Detector*, JINST (2012) no. 07, P10020.

[8] **ArgoNeuT Collaboration**, *First Measurements of Inclusive Muon Neutrino Charged Current Differential Cross Sections on Argon*, PRL 108 (2012), 161802.

[7] **M. Soderberg**, *Liquid Argon Neutrino Detector Development at Fermilab*, Proceedings to Neutrino 2010 Conference, Nuclear Physics B - Proceedings Supplements, Volumes 229-232 (2012).

[6] **M. Soderberg**, *Liquid-Argon Time Projection Chambers in the U.S.*, Proceedings to 45th Winter School in Theoretical Physics in Ladek-Zdroj, Poland (2009), arXiv:0910:3553.

[5] **M. Soderberg**, *MicroBooNE: A New Liquid Argon Time Projection Chamber Experiment*, Proceedings to NuINT2009 (2009), arXiv:0910.3497.

[4] **M. Soderberg**, *ArgoNeuT: A Liquid Argon Time Projection Chamber Test in the NuMI Beamline*, Proceedings to DPF 2009, arXiv:0910.3433.

[3] **CDF Collaboration**, *Measurement of the b-jet Cross Section in Events with a W Boson in p-pbar Collisions at sqrts=1.96TeV*, PRL 104 (2010) 131801.

[2] **A. Curioni et al**, *A Regenerable Filter for Liquid Argon Purification*, NIM A605:306-311 (2009).

[1] **A. Curioni, B. Fleming, M. Soderberg**, *The Yale liquid argon time projection chamber*, arXiv:0708.0875.

Group Members

- Postdoctoral Researchers
  - Pip Hamilton (2016–)
  - Jonathan Asaadi (2012-2015) – Asst. Prof., University of Texas at Arlington
- Graduate Students
  - Ohana Rodrigues (2017–)
  - Avinay Bhat (2015–)
  - Greg Pulliam (2013–)
  - Jessica Esquivel (2011–2018) – Postdoc on Muon g-2 experiment at Fermilab
- Undergraduate Students
  - 9 undergraduates employed in last 7 years