Geralyn (Sam) Zeller

Curriculum Vitae

Education

2002 **Ph.D., Physics**, *Northwestern University*, Measurement of the Weak Mixing Angle in Neutrino-Nucleon Scattering, advisor: Heidi Schellman.

1994 **B.A., Physics**, *Northwestern University*, with honors, Phi Beta Kappa.

Academic Positions

2017-present Deputy Division Head, Fermi National Accelerator Laboratory
2016-2017 Senior Scientist, Fermi National Accelerator Laboratory
2013-2016 Scientist, Fermi National Accelerator Laboratory
2009-2013 Associate Scientist, Fermi National Accelerator Laboratory
2007-2009 Director's Funded Research Associate, Los Alamos National Laboratory
2002-2007 Postdoctoral Research Associate, Columbia University

Awards and Honors

2012-2017 DOE Office of Science Early Career Award
2014 Strategic Lab Leadership Program, University of Chicago Booth School of Business
2010 Sambamurti Memorial Prize, Brookhaven National Laboratory
2009 U.S. National Academy of Sciences Kavli Fellow
2003 Mitsuyoshi Tanaka Dissertation Award in Experimental Particle Physics
1994 Pew Fellowship, Northwestern University
1990 Valedictorian, Glenbrook South High School

Leadership Positions

2012-present MicroBooNE Co-Spokesperson, elected
2017-present Deputy Division Head, Fermilab Neutrino Division
2018-present Co-Editor, DUNE Technical Design Report (TDR)
2015-2016 Department Head, Fermilab Neutrino Physics Department
2011-2013 DUNE Executive Committee, elected
2010-2014 DUNE Long Baseline Physics Working Group Co-Convener
2007-2012 MiniBooNE Analysis Co-Coordinator
2002-2007 MiniBooNE Neutrino Cross Section Convener

Collaboration Membership (past and present)

MicroBooNE, DUNE, SBN, LArIAT, ArgoNeuT, MiniBooNE, SciBooNE, NuTeV

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Physics Community Committees

2020 Institute of Nuclear Theory (INT) National Advisory Committee (NAC)

2020 LBNF/DUNE Joint Project Office (JPO) Review Office

2018 IUPAP International Neutrino Panel, 2 year term

2018 DPF Neutrino Whitepaper Co-Editor

2016 High Energy Physics Advisory Panel (HEPAP), 3 year term

2016 Chair, DUNE Co-Spokesperson Search Committee

2015 Symmetry Magazine Advisory Board, 2 year term

2015 APS Committee on Membership, 3 year term

2013 Snowmass Neutrino Working Group Co-Convener

2013 ICFA Neutrino Panel, 3 year term

2011 Intensity Frontier Neutrino Working Group Co-Convener

Fermilab Committees

2017 Fermilab Committee on Scientific Appointments (FCSA) (3 year term), Fermilab Committee of Champions (2 year term)

2016 Overhead Study Group, Administrative Staffing Study Group

2015 Budget Review Committee, Enterprise Risk Management Working Group, Science Advisory Committee (SAC) (2 year term), Strategic Theme Leader for Neutrinos

2013 Fermilab Deputy Director Search Committee

2012 Lederman Fellowship Committee (3 year term), LBNE Reconfiguration Committee Physics Working Group

2010 Employee Advisory Group (EAG), 3 year term

Conference Committees

2021 Lepton Photon 2021 International Advisory Committee

2020 Neutrino 2020 Co-Chair

2019 NNN2019 International Advisory Committee

2018 NNN2018 International Advisory Committee

2016 INT Workshop on Neutrino Interactions Co-Organizer, Neutrino 2016 International Advisory Committee, INSS Advisory Committee

2014 Neutrino 2014 International Advisory Committee, Midwest CUWiP Organizing Committee, NuInt14 Scientific Program Committee

2013 INT Workshop on Neutrino Interactions Co-Organizer

2012 NuInt12, NNN 2012, and CIPANP 2012 Organizing Committees

2011 DPF11 Neutrino Physics Co-Convener, NuInt11 Scientific Program Committee

2009 INSS Organizing Committee, NuInt09, NuFact09 Scientific Program Committees

2007 NuInt07 Scientific Program Committee

2005 NuInt05, NuFact05 Scientific Program Committees

MicroBooNE (2008-present) – liquid argon TPCs

- Co-Spokesperson of MicroBooNE, an international collaboration of 180+ scientists from 38 institutions in 5 countries. Under my co-leadership, the experiment has been running smoothly since the start of operations in October 2015 and has since produced 23 publications and 47 public notes showcasing first results on liquid argon TPC detector physics, event reconstruction, neutrino-argon scattering physics, and both electron neutrino and photon searches.

- Led a team to better understand the functionality of liquid argon detectors for neutrino physics as part of a DOE Office of Science Early Career research grant awarded in 2012.

Future Neutrino Program (2010-present) – neutrino oscillations

- Co-Editor of the DUNE Far Detector Technical Design Report (TDR) and as part of this process, produced a 700+ page Interim Design Report in summer 2018 and a 1400+ page final Technical Design Report in fall 2019 (to be published in JINST). Former co-convener of the DUNE long-baseline physics working group, which quantitatively evaluated the ability to measure oscillation parameters associated with ν_e appearance and ν_μ disappearance. Our group produced the first sensitivity estimates for the experiment along with several related publications. Was elected by the collaboration to the DUNE Executive Committee for a term in 2011-2013.

- Served as one of four conveners of the Neutrino Working Group for the 2013 Snowmass study, which was tasked with evaluating options for the future neutrino program in the U.S. Guided the direction of 7 subgroups and 16 subgroup conveners. Organized three community-wide workshops with over 300 participants and produced a 50+ page summary document on neutrino physics in the report on Fundamental Physics at the Intensity Frontier (arXiv:1205.2671).

MiniBooNE (2002-2012) – neutrino interactions

- Former Analysis Co-Coordinator for MiniBooNE. Led the analysis of multiple neutrino cross section measurements, none of which were envisioned at the time the experiment was proposed. Defined the direction and content of these analyses from inception. Analysis of this data produced 12 pioneering publications. This work revealed the presence of a sizable source of un-modeled nuclear effects that has since changed the course of neutrino interaction physics and directly impacts the neutrino oscillation program.

- Recognized as a world expert in neutrino scattering. Co-organized two community workshops at INT ("Snowmass of Neutrino Scattering"), author of the neutrino cross section review in the Particle Data Book, and co-wrote a well-cited review article on this subject in the Review of Modern Physics in 2012.

NuTeV (1994-2002) – precision electroweak physics

- Involved in all aspects of the precision measurement of the weak mixing angle, $\sin^2\theta_W$, on NuTeV. This analysis was the subject of my thesis dissertation and is the physics for which the experiment was proposed and run. The final result was published in March 2002 and has been cited over 700 times. At the time, my work was featured in the Washington Post, Nature, CERN Courier, Chicago Tribune, Chicago Sun Times, MSNBC, BBC News, and USA Today. Was awarded a Tanaka dissertation award by the American Physical Society for this research in 2003.

Presentations (2008-2019)

- Boston University colloquium, New Frontiers in Neutrino Physics, November 12, 2019
- Notre Dame colloquium, Opening a New Chapter in Neutrino Physics, March 21, 2017
- IIT colloquium, The Future of Neutrino Physics, October 6, 2016
- UIUC colloquium, Opening a New Chapter in Neutrino Physics, September 2, 2015
- JLAB Workshop on Final State Interactions, Neutrino Cross Sections, May 14, 2015
- University of Chicago colloquium, Opening A New Chapter in Neutrino Physics, March 5, 2015
- Old Dominion University colloquium, Next Steps in Neutrino Physics, March 3, 2015
- School of the Art Institute of Chicago lecture, Particle Physics, February 24, 2015
- Fermilab Institutional Review, Current Neutrino Research and Operations, February 11, 2015
- Hadron Collider Physics Summer School lecture, Neutrinos, August 22, 2014
- LBNL invited talk, Time Projection Chambers in Neutrino Physics, May 2, 2014
- Fermilab Intensity Frontier seminar, Neutrino-Nucleus Interactions, February 13, 2014
- Case Western Reserve University colloquium, Next Steps in Neutrino Physics, January 23, 2014
- Wheaton College seminar, Mysterious Neutrinos, November 19, 2013
- SLAC Summer Institute lectures, Neutrino Sources and Detectors, July 15, 2013
- Lepton-Photon plenary, Long-Baseline Neutrino Measurements, San Francisco, June 27, 2013
- DOE Laboratory Research Review, Fermilab Short-Baseline Program, Maryland, May 21, 2013
- APS plenary, Recent Results & Future Opportunities in Neutrino Physics, Denver, April 16, 2013
- AAAS Annual Meeting, Neutrinos: Nature's Mysterious Messengers, Boston, Feb 15, 2013
- University of Pittsburgh workshop, Status of Neutrino Cross Sections, December 6, 2012
- Brown University colloquium, Tour of Neutrino Physics: This Decade and Beyond, Nov 5, 2012
- νSTORM workshop, Synergies Between νSTORM and Long-Baseline Neutrinos, Sept 21, 2012
- ECT workshop plenary, Neutrino-Nucleus Measurements, Trento, Italy, May 15, 2012
- University of Pennsylvania seminar, Unanswered Questions in Neutrino Scattering, April 17, 2012
- DPF Luncheon for Women in Physics keynote, Lessons for my Twenty Year Old Self, Apr 2, 2012
- Colorado State University colloquium, New Revelations on Neutrino Interactions, October 3, 2011
- PANIC plenary, Neutrino Cross Sections, MIT, July 26, 2011
- Fermilab Institutional Review, Neutrino Operations, June 6, 2011
- Short-Baseline workshop, Neutrino Interactions, Fermilab, May 13, 2011
- APS 2011 invited talk, Neutrino-Nucleus Cross Sections, Anaheim, CA, May 2, 2011
- Stony Brook colloquium, New Revelations on Neutrino Interactions, April 26, 2011
- NuInt11 conference summary, Highlights from NuInt11, Dehradun, India, March 11, 2011
- TRIUMF colloquium, New Revelations on Neutrino Scattering, January 20, 2011
- University of Michigan seminar, New Revelations on Neutrino-Nucleus Scattering, Dec 6, 2010
- Aditya Sambamurti award lecture, Neutrino Physics at MiniBooNE, BNL, July 20, 2010
- FRA Visiting Committee Meeting, Current and Near Term Neutrino Program, March 18, 2010
- CERN International Design Study meeting, Neutrino Cross Sections, March 17, 2010
- NDM09 plenary, The Long Baseline Neutrino Experiment, Madison, September 4, 2009
- Argonne seminar, Recent Neutrino Scattering Results from MiniBooNE, July 29, 2009
- International Neutrino Summer School, Neutrino Cross Sections from MeV to TeV, July 8, 2009
- BNL seminar, Recent Neutrino Scattering Results from MiniBooNE, June 18, 2009
- Fermilab Users' Meeting, Recent Results from MiniBooNE and SciBooNE, June 3, 2009
- Kansas State University colloquium, Neutrinos Don't Just Oscillate, Nov 17, 2008
- Elba-X workshop plenary, Neutrino Cross Sections at MiniBooNE, Elba, Italy, June 26, 2008
- Neutrino 2008 plenary, Low Energy Neutrino Cross Sections, New Zealand, May 28, 2008

Select Publications

- P. Abratenko *et al.*, "The Continuous Readout Stream of the MicroBooNE LAr TPC for Detection of Supernova Burst Neutrinos, arXiv:2008.13761 [physics.ins-det], submitted to JINST.
- P. Abratenko *et al.*,"Measurement of Space Charge Effects in the MicroBooNE LAr TPC Using Cosmic Muons", arXiv:2008.09765 [physics.ins-det], submitted to JINST.
- G.P. Zeller, "Neutrino Cross Section Review", Review of Particle Physics (Particle Data Group), PTEP 8, 083C01 (2020).
- P. Abratenko *et al.*, "First Measurement of Differential Charged Current Quasielastic-like Muon Neutrino-Argon Scattering Cross Sections with the MicroBooNE Detector", arXiv:2006.00108 [hep-ex], submitted to PRL.
- B. Abi *et al.*, "DUNE Far Detector Technical Design Report", volumes 1-4, arXiv:2002.03010, arXiv:2002.03008, arXiv:2002.03005, arXiv:2002.02967 [physics.ins-det], submitted to JINST.
- P. Abratenko *et al.*, "Search for Heavy Neutral Leptons Decaying into Muon-Pion pairs in the MicroBooNE Detector", Phys. Rev. D101, 052001 (2020).
- P. Abratenko *et al.*, "First Measurement of Inclusive Muon Neutrino Charged Current Differential Cross Sections on Argon at $E_\nu \sim 0.8$ GeV with the MicroBooNE Detector", Phys. Rev. Lett. 123, 131801 (2019).
- C. Adams *et al.*, "Measurement of Muon Neutrino Charged Current Neutral Pion Production on Argon in the MicroBooNE LAr TPC", Phys. Rev. D99, 091192(R) (2019).
- G.P. Zeller, "Neutrino Cross Section Review", Review of Particle Physics (Particle Data Group), Phys. Rev. D98, 030001 (2018).
- B. Abi *et al.*, "The DUNE Far Detector Interim Design Report", volumes 1-3, arXiv:1807.10340, arXiv:1807.10327, arXiv:1807.10334 [physics.ins-det] (2018).
- C. Adams *et al.*, "Comparison of Neutrino-Argon Multiplicity Distributions in MicroBooNE to GENIE Model Predictions", Eur. Phys. J. C79, 248 (2019).
- C. Adams *et al.*, "Ionization Electron Signal Processing in Single Phase LAr TPCs", JINST 13, P07007 (2018), JINST 13, P07006 (2018).
- R. Acciarri *et al.*, "The Pandora Multi-Algorithm Approach to Automated Pattern Recognition of Cosmic Ray Muon and Neutrino Events in MicroBooNE", Eur. Phys. J. C78, 82 (2018).
- R. Acciarri *et al.*, "Determination of Muon Momentum in the MicroBooNE LAr TPC Using an Improved Model of Multiple Coulomb Scattering", JINST 12 P10010 (2017).
- R. Acciarri *et al.*, "Measurement of Cosmic Ray Reconstruction Efficiencies in the MicroBooNE LAr TPC Using a Small External Cosmic Ray Counter", JINST 12 P12030 (2017).
- R. Acciarri *et al.*, "Michel Electron Reconstruction Using Cosmic Ray Data from the MicroBooNE LAr TPC", JINST 12, P09014 (2017).
- R. Acciarri *et al.*, "Noise Characterization & Filtering in MicroBooNE", JINST 12, P08003 (2017).
- R. Acciarri *et al.*, "Design and Construction of MicroBooNE Detector", JINST 12, P02017 (2017), **top cite 100+**
- G. Garvey, D. Harris, H. Tanaka, R. Tayloe, G.P. Zeller, "Recent Advances and Open Questions in Neutrino Quasi-Elastic Scattering and Photon Production", Phys. Rept. 580, 1 (2015).
- J.L. Hewett *et al.*, "Planning the Future of U.S. Particle Physics", arXiv:1401.6077 [hep-ex].
- R. Acciarri *et al.*, "Liquid Argon Dielectric Breakdown Studies with the MicroBooNE Purification System", JINST 9, P11001 (2014).
- J. Cao *et al.*, "Initial Report from the ICFA Neutrino Panel", arXiv:1405.7052 [physics.acc-ph].
- J. Grange, C. Juszczak, J. Sobczyk, G.P. Zeller, "Discrimination of Nuclear Effects in ν Scattering Through Comparisons of Low and Medium Energy Data", Phys. Rev. D89, 073018 (2014).

- M. Bass *et al.*, "Baseline Optimization for the Measurement of CP Violation and Mass Hierarchy in a Long-Baseline Neutrino Experiment", Phys. Rev. D91, 052015 (2015).
- A. de Gouvea, K. Pitts, K. Scholberg, G.P. Zeller, "Working Group Report: Neutrinos", arXiv:1310.4340 [hep-ex], **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of Antineutrino Neutral Current Elastic Differential Cross Sections", Phys Rev. D91, 012004 (2015).
- A.A. Aguilar-Arevalo *et al.*, "Improved Search for Muon to Electron Antineutrino Oscillations in the MiniBooNE Experiment", Phys. Rev. Lett. 110, 161801 (2013), **top cite 500+**.
- A.A. Aguilar-Arevalo *et al.*, "First Measurement of the Muon Antineutrino Charged Current Quasi-Elastic Double Differential Cross Section", Phys Rev. D88, 032001 (2013), **top cite 100+**.
- J.A. Formaggio and G.P. Zeller, "From eV to EeV: Neutrino Cross Sections Across Energy Scales", Rev. Mod. Phys. 84, 1307 (2012), **top cite 350+**.
- H. Gallagher, G. Garvey, and G.P. Zeller, "Neutrino-Nucleus Interactions", Annual Review of Nuclear and Particle Science 61, 355 (2011).
- J.L. Hewett *et al.*, "Fundamental Physics at the Intensity Frontier", arXiv:1205.2671 [hep-ex], **top cite 300+**.
- T. Akiri *et al.*, "The 2010 Interim Report of the Long-Baseline Neutrino Experiment Collaboration Physics Working Groups", arXiv:1110.6249 [hep-ex], **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of the Neutrino Component of an Antineutrino Beam Observed by a Non-Magnetized Detector", Phys. Rev. D84, 072005 (2011).
- A.A. Aguilar-Arevalo *et al.*, "Measurement of ν_μ Charged Current π^0 Production Cross Sections on Mineral Oil at $E_\nu = 0.5 - 2.0$ GeV", Phys. Rev. D83, 052009 (2011), **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of ν_μ Charged Current π^+ Production Cross Sections on Mineral Oil", Phys. Rev. D83, 052007 (2011), **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of the ν_μ Neutral Current Elastic Differential Cross Section on Mineral Oil at $E_\nu \sim 1$ GeV", Phys. Rev. D82, 092005 (2010), **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "First Measurement of the Muon Neutrino Charged Current Quasi-Elastic Double Differential Cross Section", Phys. Rev. D81, 092005 (2010), **top cite 500+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of ν_μ and anti-ν_μ Neutral Current Single π^0 Production Cross Sections on Mineral Oil", Phys. Rev. D81, 013005 (2010), **top cite 100+**.
- A.A. Aguilar-Arevalo *et al.*, "Measurement of the ν_μ Charged Current π^+ to Quasi-Elastic Ratio on Mineral Oil in a 0.8 GeV Neutrino Beam", Phys. Rev. Lett. 103, 081801 (2009).
- A.A. Aguilar-Arevalo *et al.*, "Unexplained Excess of Electron-Like Events from a 1 GeV Neutrino Beam", Phys. Rev. Lett. 102, 101802 (2009), **top cite 400+**.
- A.A. Aguilar-Arevalo *et al.*, "The Neutrino Flux Prediction at MiniBooNE", Phys. Rev. D79, 072002 (2009), **top cite 300+**.
- A.A. Aguilar-Arevalo *et al.*, "First Observation of Coherent π^0 Production in Neutrino-Nucleus Interactions with $E_\nu < 2$ GeV", Phys. Lett. B664, 41 (2008), **top cite 100+**.
- I. Schienbien *et al.*, "Review of Target Mass Corrections", J. Phys. G. Nucl. Part. Phys. 35, 053101 (2008).
- A.A. Aguilar-Arevalo *et al.*, "Measurement of Muon Neutrino Quasi-Elastic Scattering on Carbon", Phys. Lett. 100, 032301 (2008), **top cite 250+**.
- A.A. Aguilar-Arevalo *et al.*, "A Search for Electron Neutrino Appearance at the $\Delta m^2 \sim 1$ eV^2 Scale", Phys. Rev. Lett. 98, 231801 (2007), **top cite 600+**.
- G.P. Zeller *et al.*, "On the Effect of Asymmetric Strange Seas and Isospin Violating Parton Distribution Functions on the Weak Mixing Angle Measured in the NuTeV Experiment", Phys.

Rev. D65, 111103, (2002), **top cite 100+**.

- G.P. Zeller *et al.*, "Precise Determination of Electroweak Parameters in Neutrino–Nucleon Scattering", Phys. Rev. Lett. 88, 091802 (2002), Ph.D. thesis results, **top cite 750+**.

Postdocs

- Steven Gardiner (2018-present): GENIE, MicroBooNE
- Anne Schukraft (2013-2016): MicroBooNE
- Roberto Acciarri (2013-2016): LArIAT