Edmond Craig Dukes

Curriculum Vitae / January 2026

Personal Information

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Research Interests

I am an experimental elementary particle physicist at the University of Virginia where I lead the Frontier Physics Group, a team of two professors, a senior research scientist, one research associate, and a ever-changing bevy of graduate and undergraduate students. I have held visiting scientist positions at many of the major research laboratories in the world, including Brookhaven National Laboratory, CERN, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, and the Superconducting Super Collider. My research interests have varied over the years; currently they are focused on two outstanding issues regarding the formation of the universe. The first is the puzzling asymmetry between matter and antimatter in the universe. What happened to all the antimatter that was created in the big bang? The second is nature of dark matter. All we know about dark matter is that it interacts gravitationally and is roughly 85% of the total matter in the universe. My research group is presently engaged in three experiments that could help shed some light on these puzzles: Mu2e and NOvA, both mounted at Fermilab, and the Light Dark Matter eXperiment (LDMX), to be hosted at the Stanford Linear Accelerator Center (SLAC). NOvA, which has been taking data since 2014, is making seminal measurements of neutrino properties, as well as searching for magnetic monopoles and accelerator-produced dark matter. Mu2e is reaching the end of a long construction period — with my research group playing a major fabrication role — and will search for new physics beyond the standard model with unprecedented sensitivity. LDMX, which anticipates funding next year, will search for light dark matter with unprecedented sensitivity in a new electron beam at SLAC. Finally, my group has designed an experiment to probe the Great Pyramid of Khufu using high-resolution cosmic-ray muon tomography, for which we are currently seeking funding. We have also designed and fabricated a detector recently installed in the interior of the Temple of Kukulkán (El Castillo) at Chichén Itzá that is probing its interior.

Education

1977–1984	University of Michigan Ann Arbor, Michigan	PhD Physics
1972–1975	College of William and Mary Williamsburg, Virginia	BS with High Honors in Physics Phi Beta Kappa

Professional Experience

Dates	Position	Institution
Jan. 2002 – present	Professor	University of Virginia
Apr. 2017 – Dec. 2020	Graduate Faculty Scholar	Northern Illinois University
Jan. 2014 – Aug. 2014	Intensity Frontier Fellow	Fermilab
Jan. 2008 – Aug. 2008	Visiting Scientist	Fermilab
Aug. 2002 – Dec. 2007	Professor	University of Virginia
Sept. 1995 – Sept. 2002	Associate Professor	University of Virginia
Sept. 1998 – Aug. 1999	Research Fellow	Lawrence Berkeley National Laboratory
Sept. 1989 – Aug. 1995	Assistant Professor	University of Virginia
Nov. 1992 – Aug. 1993	Guest Scientist	Superconducting Super Collider
Jan. 1987 – June 1989	Research Fellow (CERN)	University of Michigan
Jan. 1985 – Jan. 1987	CERN Fellow	CERN
May 1980 – Dec. 1984	Research Assistant	University of Michigan
May 1980 – May 1982	Guest Jr. Research Associate	Brookhaven National Laboratory

Honors and Awards

Second place research award: Joint Institute of Nuclear Research, Russia 2019 for "Innovative method of light yield rising for scintillating detectors of Mu2e experiment," with A.Artikov, J.Budagov, D.Chokheli, Y.Davydov, C.Dukes, V.Glagolev, et al.

Certificate of Recognition presented by the University of Virginia Chapter of Sigma Xi, for his seminar *Is Matter Really Different from Antimatter*, 1992.

Phi Beta Kappa; 1975.

Professional and Honor Societies

American Association for the Advancement of Science
American Institute of Steel Construction
American Physical Society — Division of Particles and Fields
Brookhaven National Laboratory Users Group
Fermi National Accelerator Laboratory Users Group
IEEE Computer Society
Sigma Xi

Selected Local Administrative, Committee, And Public Services

Principal Investigator, Frontier Physics Group at the University of Virginia, 1997–present
Chair, High Energy Physics Seminar, 2001–2025
Chair, Colloquium Committee, 1999–2023
Faculty Associate for Undergraduate Advising, 1989–present.
James G. Beitchman Summer Graduate Fellowship Committee, 2020–present
Chair's Advisory Committee, 2020–2022
Chair, Graduate Admissions Committee, 2000–2021
Secretary–Treasurer for the Virginia chapter of Sigma Xi, 1994–2017.
Co-organizer of National Physics Day, April, 1995.
Member of the Commonwealth Center for Nuclear and Particle Physics, 1989–present.
Fellow of Hereford College of the University of Virginia, 1993-1995.

SELECTED NATIONAL ADMINISTRATIVE, COMMITTEE, AND PUBLIC SERVICES

Experiments

Head of the Mu2e Cosmic Ray Veto Group, 2009–present.

Chair, Mu2e Institutional Board, 2008–present.

Member Mu2e Speakers Board, 2008–present.

Member LDMX Collaboration Board, 2020–present.

Co-chair, NOvA Exotics group, 2012–2020.

Spokesperson, Experiment T-1043, Fermilab, 2013.

Head of the Mu2e Calorimeter Group, 2008–2009.

Member of the Steering Group for the Mu2e collaboration, 2006–2007.

Scientific co-spokesperson for the *HyperC*^{P} (E871) experiment at Fermilab, 1993–present.

Member NOvA Executive Committee, 2008–2012.

Member NOvA institutional board, 2005–present.

Member NOvA Speakers Board, 2008–2015.

Member MIPP institutional board, 2002–2007.

Journals

Editorial Board, *Advances in High Energy Physics*, 2001–2017.

Referee for Physical Review Letters, 1995–present.

Reviewer for Department of Energy proposals, 1995–present.

Other

Jesse Beams Award Committee of the Southeastern Section of the American Physical Society, 2025.

Tanaka Prize Committee, 2020.

Conferences

Member of the International Organizing Committee of the *International Conference on Charged Lepton Flavor Violation*, 2013–present.

Chair, Session on "Dark Matter Searches with Accelerator-based Experiments", *Southeastern Section of the American Physical Society Meeting (SESAPS 2025)*, James Madison University, Harrisonburg, VA, USA, October 24, 2025.

Chair, Session 14, *International Conference on Beyond the Standard Model: From Theory to Experiment (BSM 2023)*, Hurghada, Egypt, November 9, 2023.

Chair, Session at the 4^{th} *International Conference of Charged Lepton Flavor Violation (CLFV 2023)*, Heidelberg, Germany, June 21, 2023.

Chair, Detector Session, *Division of Particles and Fields Meeting, DPF 2021*, July 13, 2021.

Co-convenor of the Mu2e-II Cosmic Ray Veto Working Group for Snowmass 2021, 2020-2021.

Chair, Local Organizing Committee of the *2nd International Conference on Charged Lepton Flavor Violation*, 2015–2016.

Member of the Scientific Program Committee of *PASCOS 2016: 22nd International International Symposium on Particles, Strings and Cosmology*, XIIth Rencontres du Vietnam, ICISE, Quy Nhon, Vietnam.

Member of the Organizing Committee of *Beyond the Standard Model: The* 4^{th} *Family*, Quy Nhon, Vietnam, Dec. 16–21, 2012.

Member of the Local Organizing Committee of the *XIII*th *International Workshop on Neutrino Factories, Super beams and Beta beams* (NuFact'12).

Convener of the afternoon session of the 2011 BCVSPIN Advanced Study Institute in Particle Physics and cosmology, Hue, Vietnam, July 28, 2011.

Convener of Muon Working Group Session, 10th International Workshop on Neutrino Factories, Super beams and Beta Beams, Valencia, Spain, July 3, 2008.

Convener of *Lake Louise Winter Institute 2008* session, Lake Louise, February 22, 2008.

SELECTED NATIONAL ADMINISTRATIVE, COMMITTEE, AND PUBLIC SERVICES

Conferences (continued)

Co-convenor of Session IV (Light Quarks: Hadrons, Nuclei, Hypernuclei) of the *Particles and Nuclei International Conference (PANIC05)*, 2005.

Member of the Local Organizing Committee of the *2002 Meeting of the Division of Particles and Fields (DPF) of the American Physics Society*, 2000–2002.

Convener of Session VII (Flavor (B,K) Physics) of the *2002 Meeting of the Division of Particles and Fields (DPF) of the American Physics Society*, May 27, 2002.

Member of the Organizing Committee of the *Hyperon99 Hyperon Physics Symposium*, Fermilab, 27–29 September, 1999.

Member of the Organizing Committee of the *Workshop on B Physics at Hadron Accelerators, Snowmass, Colorado, June 21–July 2, 1993.*

Co-convener of the Electron and Gamma Detection Group of the *Workshop on B Physics at Hadron Accelerators, Snowmass, Colorado, June 21–July 2, 1993.*

Member of the Editorial Board of the *Workshop on B Physics at Hadron Accelerators, Snowmass, Colorado, June 21–July 2, 1993.*

Member of the *SSC Working Group on Neutrino Physics*, SSC, Dallas, Texas, 1992.

Reviews

Member of the DUNE experiment TMS Detector Review, Spring 2025.

Member of the Department of Energy Intensity Frontier Lab Comparitive Review Panel, October 28–31, 2024.

Member of the Department of Energy Intensity Frontier Comparitive Review Panel, March 6–9, 2023.

Member of the LDMX Trigger Scintillator Review Committee, June 2020.

Reviewer for the Netherlands Organization for Scientific Research, September 2016.

Member of the DUNE 35t review, June 2016.

Reviewer for the Swiss National Science Foundation, December 2015.

Member of the Fermilab Institutional Review by the Department of Enregy, February 10–13, 2015.

Member of the High Energy Physics Institutional Review of the Brookhaven National Laboratory by the Department of Energy, June 23–24, 2014.

Member of the Department of Energy Intensity Frontier Comparitive Review Panel, November 12–13, 2013.

Member of the Department of Energy Institutional Review Panel of Lawrence Berkeley National Laboratory (LBNL), June 11-12, 2013.

Member of the Department of Energy Intensity Frontier Comparitive Review Panel, November 5–6, 2012.

Member of the HEP Early Career Research Program Review Panel, January, 2011.

Review of the George Mason University particle physics program, 2009.

Member of NSF Elementary Particle Physics EPP2007 Panel, December 10–12, 2007.

Review of the Illinois Institute of Technology particle physics program, 2005.

Review of the University of Albany particle physics program, 1998.

Review of the Notre Dame University particle physics program, 2009.

Member of the expert review panel for assessment of the U.S. Department of Energy Large Computational Projects, Washington, D.C., July 13–15, 1994.

OUTREACH MEDIA

Talk: The Colonnades, Discussion with UVA Professsor Craig Dukes, July 8, 2024
The Columns, Vol. XXXII, No. 07, July 2024.

Interview: UVAToday, *What the Nuclear Fusion Breakthrough Means for the Future of Energy*, December 13, 2022.
Link

News Article: UVAToday, *Professor, Student Harness Space Particles to Scan Ancient Pyramids*, April 21, 2022.
Link

Interview: VPM (NPR Richmond), *UVA Physicists Contributing to $271 Million Experiment at Fermilab*, December 6, 2019.

News Article: Cavalier Daily, *U.Va. physicists explore subatomic questions in multi-million dollar, international experiments*, November 20, 2019.

News Article: UVAToday, *UVA Physicists Probing Ever Deeper Into the Stuff of the Universe*, June 12, 2018.

News Article: Fermilab News at Work, *Cosmic rays are a pain*, October 14, 2016.

Science fair judge: Charlottesville Catholic School, February 24, 2015.

News Article: UVAToday, *U.Va. Physicists Engage in Neutrino Research With Fermilab*, January 29, 2015.
Link

Science fair judge: Charlottesville Catholic School, March 7, 2014.

Fun with Gases, Presentation to the 6^{th} and 8^{the} grade classes at Charlottesville Catholic School, January 7, 2013.

News Article: UVA Arts & Sciences Magazine, *Stretch Your Mind: What the Matter? That's What Physicists in the College are Seeking to Detect*, Fall 2011.

News Article: UVAToday, *What's the Matter? That's What U.Va. Physicists Are Seeking to Detect*, December 3, 2010.
Link

News Article: Symmetry, *Virtual Particles*, July 2, 2009.

Fun with Gases, Presentation to the 2^{th} and 4^{the} grade classes at Charlottesville Catholic School, May 18, 2007.

Solids, Gases, and Liquids, Presentation to the 1^{th} and 3^{the} grade classes at Charlottesville Catholic School, May 15, 2006.

Teaching Activities

Note: independent study courses not included below.

Year	Spring	Fall
2026	General Physics I (Physics 1425)	
2025	General Physics I (Physics 1425)	Energy, Physics, and Society (Physics 1110)
2024	General Physics I (Physics 1425)	Energy on this World and Elsewhere (Physics 1110)
2023	General Physics I (Physics 1425)	Energy on this World and Elsewhere (Physics 1110)
2022	Premed Physics II (Physics 2020)	Energy on this World and Elsewhere (Physics 1110)
2021	Research leave	Premed Physics I (Physics 2010)
2020	General Physics I (Physics 1425)*	Research leave
2019	General Physics I (Physics 1425)*	Research leave
2018	General Physics I (Physics 1425)*	Research leave
2017	General Physics I (Physics 1425)*	Research leave
2016	General Physics I (Physics 1425)*	Research leave
2015	General Physics I (Physics 1425)*	Research leave
2014	Research Leave: Fermilab	Energy on this World and Elsewhere
2013	Premed Physics II (Physics 2020)	Research Leave
2012	Workshop Physics I (Physics 1429)	Premed Physics I (Physics 2010)
2011	Workshop Physics I (Physics 1429)	Workshop Physics II (Physics 2419)
2010	Workshop Physics I (Physics 1429)	Workshop Physics II (Physics 2419)
2009	Workshop Physics I (Physics 142W)	Workshop Physics II (Physics 2419)
2008	Research Leave: Fermilab	General Physics II (Physics 241E)
2007	General Physics I (Physics 142)	Research Leave: Fermilab
2006	Premed Physics Lab (Physics 202L)	General Physics II (Physics 241E)
2005	Premed Physics Lab (Physics 202L)	Premed Physics Lab (Physics 201L)
2004	Premed Physics Lab (Physics 202L)	Premed Physics Lab (Physics 201L)
2003	Research leave	Premed Physics Lab (Physics 201L)
2002	Research leave	Premed Physics (Physics 201)*
2001	Research leave	Premed Physics (Physics 201)*
2000	Widely Applied Physics (Physics 312)	Premed Physics (Physics 201)*
1999	Research leave: Berkeley/Fermilab	Widely Applied Physics (Physics 311)
1998	Premed Physics (Physics 202)	Research leave: Berkeley
1997	Premed Physics (Physics 202)	Premed Physics (Physics 201)
1996	Premed Physics (Physics 202)	Premed Physics (Physics 201)
1995	Premed Physics (Physics 202)	Premed Physics (Physics 201)
1994	Premed Physics (Physics 202)	Premed Physics (Physics 201)
1993	Research leave: SSC	Premed Physics (Physics 201)
1992	Intermediate Lab I (Physics 317)	Research leave: SSC
1991	Research leave: Fermilab	Intermediate Lab II (Physics 318)
1990	Intermediate Lab I (Physics 317)	Intermediate Lab II (Physics 318)
1989		Research leave: Fermilab

*Double teaching load this semester.

SUPERVISED STUDENT RESEARCH

Postdocs/Research Scientists

- Ralf Ehrlich (2010–present)
  University of Virginia
- Natalie Harrison (2024–present)
  University of Virginia
- Matthew Reagan Solt (2020–2024)
  Senior Principal High Energy Physicist, Northrop Grumman
- Reddy Pratap Gandrajula (2020–2022)
  University of Virginia
- Michael Baird (2017–2021)
  University of Virginia
- Yuri Oksuzian (2012–2018)
  Scientist, Argonne National Laboratory
- Martin Frank (2011–2016)
  Professor, University of South Alabama
- Andrew Norman (2004–2010)
  Staff Scientist, Fermilab
- Gabriel Niculescu (2002–2003)
  Professor, James Madison University
- Romulus Godang (2000-2002)
  Professor, University of South Alabama
- Lanchu Lu (1999-2003)
  Professor, Radiation Medicine, The Ohio State University
- Casey Durandet (1996–1998)
  Professor, Paradise Valley Community College
- Sharon White
  Professor, University of Alabama

Graduate Students

- Tyler Horoho, *Searches for Sub-GeV Dark Matter with NOvA and LDMX and Performance Studies of the Cosmic Ray Veto for Mu2e*, June 27, 2025.
- Dayne Coveyou, *Search for Magnetic Monopoles with the NOvA Experiment*, work in progress.
- Steve Boi, *Design and Fabrication of a Novel Large-area, High-efficiency Cosmic Ray Veto Detector for the Mu2e Experiment*, April 2021.
- Enhao Song, *Search for Monopoles with the NOvA Experiment*, work suspended as he took a position with Google.
- Zukai Wang, *Search for Magnetic Monopoles with the NOvA Far Detector*, November 2015.
- Chad Materniak, *CP Violation in* Ξ *and* Λ *Hyperon Decays*, May 2009.
- Tim Holmstrom, *CP Violation in* Ξ *and* Λ *Hyperon Decays*, May 2003.
- Durgaprasad Rajaram, *Construction of the Hadronic Calorimeter for the HyperCP Experiment*, May 1995.
- Steven S. DeSanto, *Design and Construction of a High-Resolution Electromagnetic Calorimeter using Scintillating Fibers Embedded in a Lead Powder-Epoxy Absorber*, January 1993.
- Terence A. Wynne, *A Monte Carlo Simulation of a High-Resolution Scintillating Fiber Calorimeter using a Lead-Epoxy Absorber*, August 1992.

SUPERVISED STUDENT RESEARCH

Undergraduate Students

My research group typically includes a number of undergraduate students, most of them working during the summer, but some during the academic year as well. Below are listed only those students who have done research for credit with me.

Multidisciplinary Projects

- Mohit Srivastav, *Using Machine Learning to Improve the Signal Efficiency for the Mu2e Cosmic Ray Veto*, Computer Science 4998; Computer Science Distinguished Major Project, Spring 2021, Fall 2021.
- Joseph Purvis, *Design of a Module Installer for the Mu2e Experiment*, Engineering 4010; Capstone project, Fall 2014, Spring 2015.

Independent Study Projects (Physics 3995)

- Daniel Lee, *Position Resolution of Triangular Scintillation Counters*, Spring 2026.
- Luke Watson, *Simulation Studies of Triangular Scintillation Counters*, Fall 2025.
- Kristen Schumacher, *Measurements at Mu2e of the Cosmic Ray Flux using a Custom Built Cosmic Ray Telescope*, Fall 2018.
- Steven Stetzler, *Analysis of Test Beam Studies of a Scintillating Counters Read Out by Wavelength Shifting Fibers*, Spring 2017.
- Elton Ho, *Monte Carlo Study of the Neutron Response of a Scintillator for the Mu2e Experiment*, Fall 2012.
- Jason Gran, *Neutrino Oscillation Phenomenology*, Spring 2011.
- Hunter Tammaro, *NOvA Power Distribution Box Test Design*, Spring 2010.
- Machi Shields, *Resistive Plate Counters for the Mu2e Cosmic Ray Shield*, Summer 2009.
- Nicole Fields, *Neutrinos and NOvA*, Spring 2008.
- Nicole Fields, *Light Mixing of Lightguides*, Fall 2006.
- Elizabeth Xu, *The HyperCP Spectrometer*, Spring 2006.
- John Tener, *The Uniformity of Light Guides*, Spring 2006.
- Benjamin Streufert, *Tests of a Prototype Spark Chamber for a Large-Area Detector*, Spring 2005.
- Fred Ross, *Tests of a Prototype Spark Chamber for a Large-Area Detector*, Fall 2004.
- Jennifer Gannon, *HyperCP Experiment*, Summer 1998, Summer 1999.
- Matt Deming, *Construction and Test of the Muon Lifetime and Magnetic Moment Experiment*, August 1995.
- Alison Cohen, *Fabrication of an Undergraduate Muon Lifetime and Magnetic Moment Experiment*, December 1994.
- Matt Lane, *A Data Acquisition System for an Undergraduate Muon Experiment*, December 1994.
- Matt Weber, *Design and Construction of a Large Magnet for an Undergraduate Muon Experiment*, December 1994.
- Walter R. Swindell, *Cosmic Ray Muon Detector*, December 1992.
- Joshua S. Wells, *Design of a Rectangular Bore Magnet for an Elementary Muon Lifetime and Magnetic Moment Experiment*, April 1992.
- Tong-Uk Lee, *Phototube Performance in High-Rate Environment*, December 1991.
- Kan D. Fang, *Monte Carlo Results on Reflection Losses of Scintillating Fibers*, December 1991.
- David DeLalio, *Ray-Tracing Simulation of Cerenkov Radiation and RICH Vessels*, April 1990.

SUPERVISED STUDENT RESEARCH

Undergraduate Students doing Funded Research

These are students who have done non-credit research. It does not include the many students fabricating detectors such as the Mu2e Cosmic Ray Veto.

Jefferson Trust Funded Projects

The Jefferson Trust makes grants to innovative ideas that enrich the University of Virginia and the student experience.

- Benjamin Cohen, Eleanor Fetterer, Jolie Ng, and Luke Watson, *Design and Fabrication of a Detector to Search for Hidden Chambers in the Temple of Kukulcán at Chichén Itzá*, 2024.
- Sydney Roberts, *Search for Hidden Chambers in the Temple of Kukulcán at Chichén Itzá*, 2022–2023.
- Kristen Schumacher, *Measurements at Mu2e of the Cosmic Ray Flux using a Custom Built Cosmic Ray Telescope*, Fall 2018.

Research Experiences for Undergraduates (REU) Projects

- Marc Cousoulis, *Computer Simulation of a Ring Imaging Cerenkov Detector*, Summer 1991.
- Trey White, *Computer Aided Design of the E771 Electromagnetic Calorimeter*, Summer 1990.

Miscellaneous Undergraduate Students

- Hanyu Ma, *Comparision of G4Beamline Simulation and Theoretical Prediction*, Summer 2014.

  Hanyu Ma was an undergraduate student at Dickinson College who worked at her own expense and under my supervision and that of Yuri Oksuzian at Fermilab in the summer of 2014.

Current Research Activities

Light Dark Matter eXperiment (LDMX) (2019–present)
This is an experimental effort to probe thermal dark matter over most of the sub-GeV mass range, with orders of magnitude more sensitivity than any previous or proposed experiments. It addresses many of the science drivers that are highlighted in the 2017 US Cosmic Visions New Ideas in Dark Matter Community Report. The experiment will use a missing momentum technique to search for dark matter via dark bremsstrahlung in a new electron beam at the Stanford Linear Accelerator Center (SLAC). The detector employs a hadron calorimeter with excellent neutron detection efficiency and good angular coverage, whose technology was developed by my group for the Mu2e Cosmic Ray Veto detector. Although LDMX is not yet an approved experiment, a "Basic Research Needs for Dark Matter Small Projects New Initiatives" report came out at the end of 2018 that favorably mentions the missing momentum technique and LDMX. A Letter of Intent was submitted to the DOE in late April 2019 and a proposal in May. LDMX received Stage 1 approval from the US Department of Energy on February 28, 2020. The design was completed in 2021, prototypes were fabricated and tested on the bench and at CERN in early 2022, and a vertical-slice test was completed in late 2025 with the newly commissioned electron beam at SLAC. We have completed a detailed design of the hadronic calorimeter and completed the Technical Design Report. The University of Virginia group has completed an investigation of the prospects for a search for visible decays of dark matter particles, and leading the effort to understand the response of the hadronic calorimeter to neutral hadrons.

Exploring the Temple of Kukulcán (El Castillo) at Chichén Itzá (2020–present)
The pyramids of ancient Egypt and of pre-Hispanic Mesoamerica have fascinated people since the cultures that built them vanished into the annals of history. How were they built? What were they used for? Are there unknown internal substructures, perhaps hidden chambers that have yet to be discovered? My research group has designed and built a novel detector to be used to search for hidden structures in the Temple of Kukulcán at Chichén Itzá using cosmic-ray muon tomography. This work has been done in collaboration with groups from two US Department of Education-designated minority-serving institutions in Chicago: Chicago State University, a predominately black institution, and Dominican University, a Hispanic-serving institution. The detector, which is based on the design of the Cosmic Ray Veto detector my group designed and built for the Mu2e experiment, will serve as a prototype of a much larger detector designed for exploring hidden chambers in the Great Pyramid of Khufu in Egypt. Two detectors were built at the University of Virginia in 2024–2025, one of which was installed inside the pyramid in late January of 2026 and is presently taking data.

Exploring the Great Pyramid of Khufu (EGP) (2018–present)
In the fall of 2017 a French-Japanese research group announced the discovery of a new large void in the Great (Khafre) Pyramid at Giza. Their detector, sited inside the pyramid, was small and the evidence is not decisive. In early 2018 my research group and collaborators at Fermilab embarked on a study to determine if we could employ much larger detectors *outside* of the Great Pyramid of Khufu to decisively determine if such voids exist. We would use the technology developed for the Cosmic Ray Veto at the Mu2e experiment. Simulation studies done by my research group have been done and look very promising. We have partnered with collaborators from the Ancient Egypt Research Associated, Cairo University, Fermilab, the Oriental Institute at the University of Chicago, and the Glen R. Dash Charitable Foundation. We have received permission from Egypt's Ministry of Antiquities for this definitive follow-up experiment and are currently seeking funding from private and other sources.

Current Research Activities

Mu2e Experiment (2006–present)

My research group's long-term efforts are focused on the Mu2e experiment and the search for beyond-the-standard-model physics through charged lepton flavor violation. The goal of the Mu2e experiment is to search for the forbidden lepton-violating process $\mu^-(Z,A) \rightarrow e^-(Z,A)$ at a level of 2×10^{-17}, *four orders of magnitude beyond the present level of sensitivity.* This will make it sensitive to mass scales far beyond what can be probed directly at colliders such as the Large Hadron Collider (LHC). The experiment is is a key part of the intensity frontier physics program at Fermilab, which is a top priority of the Department of Energy: having been called an "*Absolutely Central Facility*" in a presentation at the March 2013 High Energy Physics Advisory Panel (HEPAP) meeting in Washington, D.C. and reiterated in the most recent P5 report mapping out the priorities of the field for the next decade ore more. The Mu2e collaboration submitted a proposal, edited by me, in the fall of 2008 which was approved by Fermilab in November, 2008. The collaboration is currently at the end of a ten-year fabrication period, with first data anticipated in late 2027.

I currently serve as chair of the Institution Board, and I sit on the Speaker's Board and Executive Board. I lead the Cosmic Ray Veto (CRV) detector effort, the only subsystem headed by a university collaborator, the fabrication of which at the University of Virginia was completed in the summer of 2023. The CRV is a 335 m^2 detector that surrounds the spectrometer and is used to detect, with better than a 0.9999 efficiency, and veto cosmic-ray muon induced backgrounds. This while operating in a nasty, high-radiation environment. The CRV consists of 5,344 scintillator counters, each with two embedded wavelength-shifting fibers, and read out with silicon photomultipliers. Mu2e was approved in the fall of 2008, received CD-1 approval in mid-2012, CD-3 approval in mid-2016. We completed much of the final engineering design of the CRV in 2018, completed the simulation studies with the final design and layout, led the final test-beam run, and started fabrication of the di-counters in 2018. Module fabrication started in early 2019 and was completed in mid-2023. Fabrication of the CRV — for which we received $4,363,543 in funding in addition to our DOE grant — was the largest construction project of the UVA High Energy Physics group since its inception over thirty-five years ago. The main focus of our future work on Mu2e is preparing and carrying out the detector Key Performance Parameters (KPP) work for the CRV, installing and commissioning the CRV, and taking physics data.

Current Research Activities

NOvA Experiment (E871) (2003–present)

In the twenty years since the discovery of neutrino mass through neutrino oscillations — the first evidence of physics beyond the standard model — much has been learned about neutrinos, although much remains yet to be learned. NOvA is a long-baseline neutrino oscillation experiment designed to search for electron-neutrino appearance in a muon-neutrino beam produced at Fermilab. It is making a variety of seminal measurements of neutrino properties, in particular a measurement of the neutrino mass hierarchy, the octant of the largest neutrino mixing angle, and whether *CP* is violated in the neutrino sector. NOvA is one of the flagship experiments of the Fermilab experimental program, indeed the US domestic particle physics program. It consists of two detectors, a far detector sited in northern Minnesota, and a near detector on-site at Fermilab. The far detector, at 14,000 tons, is one of the largest ever built. Construction started in 2009 and was completed in the summer of 2014. NOvA started taking data in late 2014 and will complete data taking in 2027. Our first three publications were all "Editor's Suggestions" in Physical Review Letters and Physical Review D.

I have been a member of NOvA since 2004. My group designed and fabricated the Power Distribution System that provides power to all of the electronics. This huge system consists of 213 UVa-designed power distribution boxes, 4021 circuit boards, 78 breaker boxes, 12,060 cables, 3.7 km of cable trays, 720 cable-tray supports, 90 PDB/DCM tables, and 21 relay racks. My group also was responsible for the initial design of the Detector Controls and Monitoring System that essentially runs the detector and insures it is working properly. We led the Block Instrumentation Group, which outfits the far detector with an array of sensors to enable its proper fabrication and to monitor its structural integrity. Finally, we led the Data-driven Trigger Group through its design and commissioning. We received $2,462,116 for these fabrication tasks, which were completed in the summer of 2014.

I started and co-led the NOvA Exotics Group from 2012–2020 under whose aegis my initial physics goal of performing a sensitive search for magnetic monopoles fell. NOvA is uniquely sensitive to regions of phase space, in monopole mass and energy, that have not yet been probed. Recent publications indicate no monopoles with a sensitivity that trumps all previous searches in a large mass range. My group has also worked on the mainstream neutrino oscillation analyses. However, we are currently leading a search for dark matter with the NOvA near detector.

Besides heading the Power Distribution Group, I have twice been elected to serve on the NOvA Executive Committee, co-chaired the Exotics analysis group through its inception, and was a member of the Speakers Board. I currently serve on the Institution Board .

Members of my research group have served as leaders, or co-leaders, of the Computing Group, Data-Driven Trigger Group, Reconstruction Group, 3-Flavor Group, and have served as Run Coordinators and DAQ experts.

PAST RESEARCH ACTIVITIES

MIPP Experiment (E907) (2002–2006)

The Fermilab MIPP experiment (E907) employs an open-geometry spectrometer to measure hadronic particle production with good particle identification at incident beam energies from 5 GeV/c to 120 GeV/c using proton, anti-proton, kaon, pion, muon and electron beams. The goal of MIPP is to explore a variety of phenomena in hadronic particle production with a full-acceptance detector, including hadronic fragmentation scaling laws, searches for exotic particle states and resonances, strangeness propagation through nuclear matter, measurements relevant to proton radiography imaging techniques, and important measurements needed for the MINOS experiment as well as atmospheric neutrino experiments. Our group was responsible for the installation, maintenance, and operation of the hadronic calorimeter, the design and installation of the trigger, the operation of the drift and beam chambers, the design and installation of the scintillating fiber crosshair detector, and the design and implementation of the high-voltage control system and monitoring interfaces. Data taking commenced in the spring of 2005, after a commissioning run in 2004, and continued into the spring of 2006. Unfortunately, funding constraints and responsibilities elsewhere led my group to curtail its MIPP effort in 2006.

CKM Experiment (E921) (1999–2003)

The primary goal of the CKM experiment was to test the hypothesis that the sole source of CP violation lies with the imaginary phase of the CKM matrix. This was to have been done by a precision measurement of the CKM matrix element V_{td} through the super-rare decay: $K^+ \to \pi^+\nu\nu$. The experiment was approved in June, 2001. It was a major new initiative and was expected to *"form the core of a 120 GeV fixed target program"* at Fermilab. Unfortunately, due to budget constraints, Fermilab decided in the fall of 2003 not to go forward with the experiment. Our group was responsible for the simulation, design and fabrication of several major elements of the CKM spectrometer: the Upstream Magnetic Spectrometer (UMS), the Kaon Entrance Angle Tagger (KEAT), the Beam Time Stamp Module (BTSM), and front-end electronics for the entire spectrometer. The wire chambers for the UMS and KEAT were to be state-of-the-art, with extremely high rate capability and and very low mass. I designed a prototype wire chamber, based on our *HyperC*^{P} design, which my group fabricated at Virginia in the summer of 2003. I also designed a prototype of the Beam Time Stamp Module which was fabricated by a student of mine at Virginia.

PAST RESEARCH ACTIVITIES

***HyperCP* Experiment (E871)** (1993–present)

I serve as the scientific spokesperson of this Fermilab experiment (with Kam-Biu Luk), which was the first major *new* experimental effort initiated by the newly formed Experimental High Energy Physics group at the University of Virginia. The *HyperCP* experiment, a collaboration of Academica Sinica, Berkeley, Lawrence Berkeley National Laboratory, Fermilab, University of Guanajuato, Illinois Institute of Technology, University of Lausanne, University of Michigan, University of South Alabama, and the University of Virginia, was designed to search for rare phenomena in the decays of charged-strange particles, in particular *CP* violation in Ξ and Λ hyperon decays with a sensitivity far beyond previous limits. *HyperCP* was only one of two new experiments approved at Fermilab for the 1996–1997 fixed-target run and one of only two experiments that took data in the 1999–2000 fixed target run. The experiment recorded the largest number of events ever by a particle physics experiment: 231 billion events on 29,401 magnetic tapes (119.5 TB).

The UVa group had a leading role in the construction of the spectrometer, including the design and construction of the hadronic calorimeter, the trigger, the front wire chambers, and 20,000 channels of preamplifiers. I was directly responsible for the design and fabrication of the calorimeter and the trigger. All of the precision measurements have been made by the UVa group, and we have been written of co-written roughly half of the 14 *HyperCP* papers published to date. Highlights of the *HyperCP* physics results include:

- The most sensitive search for *CP* violation in hyperon decays, with a twenty times smaller error than that of the previous best result, and the first such result that constrains some SUSY predictions of an effect.
- First observation of the FCNC $K^- \to \pi^-\mu^+\mu^-$ and resolution of a discrepancy in two BNL measurements of the $K^+ \to \pi^+\mu^+\mu^-$ branching ratio.
- First reported high-statistics high-resolution search for pentaquark, and one of the first null results.
- First evidence of parity violation in Ω^- decays, with the measurement of a nonzero α decay parameter, currently the most precisely measured hyperon α parameter.
- First precision test of *CP* violation in Ω^- decays.
- Observation of the rarest baryon decay ever, $\Sigma^+ \to p\mu^+\mu^-$. Evidence suggests that the decay proceeds via an hitherto unknown intermediate state, consistent with the sgoldstino.
- First precision measurement of the β parameter in $\Xi^- \to \Lambda\pi^-$ decays, suggesting that it is larger than recent chiral-perturbation theory predictions. It is the most precisely known β parameter.
- Searches for forbidden hyperon decays that go orders of magnitude in sensitivity beyond previous results.

RESEARCH ACTIVITIES

SFT Experiment (1990–1994)
My interest in fundamental symmetries included the exploration of *CP* violation in the decays of hadrons composed of the b quark. I was a major player in a large collaboration — led by Brad Cox of the University of Virginia — which intended to explore *CP* violation in beauty mesons by extracting a fraction of the 20 TeV proton beam of the Superconducting Super Collider (SSC) and transporting it to a fixed-target spectrometer. The project was called the Super Fixed Target facility (SFT) and I was the head of the calorimetry group. From Nov. 1992 to Aug. 1993 I was on research leave at the SSC laboratory, exploring the experimental possibilities of the SSC to see *CP* violation in the B system. While there I designed, with Brett Parker of the SSC and Thornton Murphy of Fermilab, the crystal extraction beam line needed to extract the protons from the collider to the SFT experimental hall. I also helped organize the *Workshop on B Physics at Hadron Accelerators*, which was sponsored by the SSC and Fermilab and held at Snowmass, Colorado in the summer of 1993. In addition, I was the head of the *Electron and Gamma Identification Group* of the workshop. The demise of the SSC changed the focus of this future experimental activity from the SSC to the LHC, at the European Center for Particle Physics Research (CERN) in Geneva, Switzerland. Again the High Energy Group at the University of Virginia took a leading role in the design of a new experiment (LHC-B) with identical physics goals as the SFT. The experiment was approved in 1998. In 1998 we were informed that because of political considerations at the highest levels the Department of Energy could not support any U.S. collaborators on LHC-B and hence I withdrew from the experiment.

E771 Experiment (1989–2000)
The main thrust of my research effort from 1989 through 1992 was focused on the Fermilab experiment E771, for which I was the head of the calorimetry group. The goal of the experiment was the study of heavy quark production and decay, mainly through high p_T muons and high-mass muon pairs. In January of 1992 we concluded the data taking part of the experiment, having accumulated approximately 200 million triggers. Analysis of the data finished in 2000 with our last publication being on the hadroproduction of the χ_1 and χ_2, the ratio of the two being of considerable interest because it is a sensitive test of the mechanism for charm production. Other publications include including a measurement of the B cross section in 800 GeV/c pN interactions, a measurement of the J/ψ, ψ', and Υ cross sections, and a search for the flavor changing neutral current decay $D^\circ \to \mu^+\mu^-$.

PEPSCI Calorimeter Project (1990–1996)
Because of the large interaction rates (over 10^7 per second) anticipated for *any* experiment studying *CP* violation in the B system at hadron accelerators, fast radiation hard calorimetry is needed. To respond to this need I developed a novel calorimeter fabricated out of a matrix of 1 mm diameter scintillating fibers (SCIFI) embedded in a lead powder-epoxy slurry. It is called a powder-epoxy (PEPSCI) calorimeter. Besides providing a simple method of constructing SCIFI calorimeters of arbitrary shapes, the method allows considerable flexibility in tuning the calorimeter sampling fraction to the performance requirements. In June of 1992 I tested the calorimeter at the AGS at Brookhaven National Laboratory. The results were excellent and were reported at a talk I gave at the *III International Conference on Calorimetry in High Energy Physics*. Unfortunately, the demise of the SSC eliminated the need for such a calorimeter and I discontinued working in this area.

TRAP Project (1990–1996)
In order to facilitate the design of the light guides for the PEPSCI calorimeter I wrote (with the help of several undergraduate physics majors) a ray tracing program which tracks light through various optical surfaces. The results were reported at a talk I gave at the *First International Conference on Calorimetry in High Energy Physics*. The program has been very useful and has been utilized for other projects, such as the design of the RICH for the P867 and SFT experiments, as well as for the design of light guides for the *HyperCP* hadronic calorimeter. The program has been used by high energy physicists at CERN, TRIUMPH, CEBAF, as well as other institutions.

RESEARCH ACTIVITIES

UA6 Experiment (1985–1999)
UA6 was the first experiment to employ a gas-jet target inside a storage ring in conjunction with a fully instrumented magnetic spectrometer. The experiment made detailed comparisons of several different physical processes in pp and $\overline{p}p$ interactions at $\sqrt{s} = 24.3$ GeV at the Sp$\overline{\text{p}}$S collider at CERN in Geneva, Switzerland. These include direct photon production, J/ψ production, and low-t elastic scattering. I participated in all the runs of the experiment, first as a CERN fellow and then as an assistant professor at the University of Virginia. The last run ended in December 1990, marking the end of a very successful physics program. My major contributions to the experiment were the writing of the charged particle tracking code and the design and construction of an upgrade to the electromagnetic calorimeter. Highlights of the UA6 physics results include: (1) a new determination of the strong coupling constant from our direct photon cross sections: $\alpha_s(M_Z^2) = 0.1112 \pm 0.0016(\text{stat}) \pm 0.0033(\text{syst})^{+0.0077}_{-0.0034}(\text{theo})$; (2) the first direct comparison of direct photon production from pp and $\overline{p}p$ interactions, where the unique ability of the experiment to measure direct photons in both pp and $\overline{p}p$ collisions allowed us to isolate the contribution of leading-order diagram, the annihilation process $q + \bar{q} \rightarrow \gamma + g$; (3) a comparison of J/$\psi$ production from incident protons and antiprotons; (4) a precise determination of the proton gluon distribution; (5) the measurement of the inclusive π° and η cross sections in $\overline{p}p$ and pp collisions; and (6) a precise comparison of $\overline{p}p$ and pp forward elastic scattering.

Fermilab Neutral Hyperon Group (1979–1984)
I collaborated on two experiments with the Fermilab Neutral Hyperon Group: a high statistics study of the β-decay of the Λ (E361) and the first precise measurement of the magnetic moments and polarization of the charged hyperons: Σ^-, Σ^+, and Ξ^- (E620). The magnetic moment measurements showed that the naive quark model describes most of the salient features of hyperon magnetic moments, with the worst disagreement being 0.25 μ_N. They also showed the theory, however, to be incomplete and the discrepancy between experiment and theory remains a glaring reminder of our inability to fully understand the static properties of baryons.

The E620 experiment discovered polarization in the inclusive production of the Σ^+, Σ^-, and Ξ^- hyperons. The Σ^+ and Σ^- hyperons were found to have large polarizations in a direction opposite to that of the Ξ^- (and the Λ). There is as yet no convincing theoretical understanding of the origin of the polarization. Indeed since these pioneering experiments further investigations of the hyperon polarization have only served to confuse the picture. The importance of these experiments was acknowledged by the awarding of the 1994 W.K.H. Panofsky Prize of the American Physical Society to L. Pondrom and T. Devlin of the neutral hyperon group.

Brookhaven Experiment E744 (1980–1984)
In this, my thesis experiment, I played a major role in the setting up and running of the experiment, as well as analysis of the data, in a small collaboration of eleven physicists and students. The polarization analysis of the Λ and the Σ° hyperons, carried out solely by me, involved the development of a new method to analyze the Σ° polarization through its decay product, the Λ. The experiment was the first to observe Σ° polarization and reveal it to be opposite in direction to the Λ as predicted by all models of hyperon polarization in inclusive production. It was also the first to measure the ratio of Σ° to Λ production.

Research Support

I am, and have been since its inception in 1997, the P.I. of the Task C grant from the US Department of Energy. That, and other sources of external funding for which I serve as P.I. have totaled $15,689,000, with an average of $1,106,000 per year the past ten years. No more than two faculty have been on the grant during this time. The grant presently supports: the summer salary of myself and Craig Group; one research scientist, two postdocs; a technician; and a number of graduate and undergraduate students.

This grant was shared with Prof. Nelson from 1997–2005, and Prof. Hirosky from 2006–2011, and Prof. Group half-time from 2012–2014 and full time since. In addition, from 1989 through 1996 I shared a grant with Profs. Conetti, Cox, and Nelson which received $4,587,000 from the DOE and the Southern Association of High Energy Physicists (SAHEP). I have also received $64,705 from the National Science Foundation while at the University of Virginia and $26,650 from the Jefferson Trust Foundation, both for research with undergraduate students. A year-by-year itemization of my research funding is given below.

2025

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: LDMX, NOVA, and Mu2e
Amount: $550,000* (P.I.)
Date: April 1, 2025 – March 31, 2026

Sponsor: Department of Energy
Title: Fermilab Lab Service Account
Amount: $23,000* (P.I.)
Date: April 1, 2025 – March 31, 2026

Sponsor: Fermi National Accelerator Lab
Title: Development of New Plastic Scintillators
Amount: $19,782 (P.I.)
Date: June 18, 2024 – August 30, 2025

2024

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: LDMX, NOVA, and Mu2e
Amount: $500,000* (P.I.)
Date: April 1, 2024 – March 31, 2025

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $206,951* (P.I.)
Date: October 1, 2022 – December 31, 2025

Sponsor: Fermi National Accelerator Lab
Title: Development of New Plastic Scintillators
Amount: $9,999 (P.I.)
Date: August 31, 2024 – September 30, 2024

Sponsor: Department of Energy
Title: DOE's Office of Science Graduate Student Research (SCGSR)
Amount: $43,200††
Date: January 1, 2024 – December 31, 2024

Sponsor: Jefferson Trust
Title: Search for Hidden Chambers in the Temple of Kukulcan at Chichen Itza
Amount: $35,834 (P.I.)
Date: April 1, 2022 – September 30, 2024

2023

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: LDMX, NOVA, and Mu2e
Amount: $435,000* (P.I.)
Date: April 1, 2023 – March 31, 2024

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $206,951* (P.I.)
Date: October 1, 2022 – September 30, 2024

Sponsor: Jefferson Trust
Title: Search for Hidden Chambers in the Temple of Kukulcan at Chichen Itza
Amount: $35,834 (P.I.)
Date: April 1, 2022 – September 30, 2024

Sponsor: Stanford Linear Accelerator Center
Title: Light Dark Matter Experiment (LDMX)
Amount: $46,290*
Date: July 1, 2021 – September 30, 2022

2022

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: LDMX, NOVA, and Mu2e
Amount: $474,352* (P.I.)
Date: April 1, 2022 – March 31, 2023

Sponsor: Fermi National Accelerator Lab
Title: Triangular Quadcounters
Amount: $3,500 * (P.I.)
Date: September 1, 2021 – September 30, 2022

Sponsor: Fermi National Accelerator Lab
Title: Development and Implementation of a Cosmic Ray Veto Algorithm for Mu2e
Amount: $9,526 (P.I.)
Date: October 1, 2021 – September 30, 2022

Sponsor: Jefferson Trust
Title: Search for Hidden Chambers in the Temple of Kukulcan at Chichen Itza
Amount: $35,834 (P.I.)
Date: April 1, 2022 – September 30, 2024

Sponsor: Stanford Linear Accelerator Center
Title: Light Dark Matter Experiment (LDMX)
Amount: $46,290*
Date: July 1, 2021 – September 30, 2022

Sponsor: Stanford Linear Accelerator Center
Title: The Light Dark Matter Experiment, LDMX Travel Supplement
Amount: $17,662*
Date: July 1, 2021 – September 30, 2022

2021

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $400,000* (P.I.)
Date: April 1, 2021 – March 31, 2022

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $164,304 * (P.I.)
Date: September 20, 2021 – September 30, 2022

Sponsor: Virginia Space Grant Consortium
Title: Using Machine Language to Improve the Signal Efficiency for the Mu2e Cosmic Ray Veto
Amount: $8,000 (P.I.)
Date: August 16, 2021 – May 27, 2022

2020

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $534,000* (P.I.)
Date: April 1, 2020 – March 31, 2021

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $592,764* (P.I.)
Date: November 30, 2020 – September 30, 2022

2019

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $545,000* (P.I.)
Date: April 1, 2019 – March 31, 2020

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $807,170* (P.I.)
Date: January 20, 2019 – September 30, 2020

2018

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $540,000* (P.I.)
Date: April 1, 2018 – March 31, 2019

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $1,474,604* (P.I.)
Date: March 1, 2018 – September 30, 2020

2017

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $505,000* (P.I.)
Date: April 1, 2017 – March 31, 2018

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $536,526* (P.I.)
Date: October 1, 2016 – September 30, 2017

Sponsor: The Jefferson Trust
Title: Undergraduate Explorations with Cosmic Rays
Amount: $26,650 (P.I.)
Date: April 1, 2017 – September 30, 2018

2016

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $515,000* (P.I.)
Date: April 1, 2016 – March 31, 2017

Sponsor: Department of Energy
Title: 2016 International Conference on Charged Lepton Flavor Violation
Amount: $10,000* (P.I.)
Date: April 1, 2016 – September 30, 2016

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $359,854* (P.I.)
Date: October 1, 2015 – September 30, 2016

2015

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $485,000† (P.I.)
Date: April 1, 2015 – March 31, 2016

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $70,577* (P.I.)
Date: January 1, 2015 – September 30, 2017

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $92,138 (P.I.)
Date: March 1, 2015 – April 30, 2016

2014

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $471,000† (P.I.)
Date: April 1, 2014 – March 31, 2015

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $410,124* (P.I.)
Date: January 1, 2014 – September 30, 2017

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $38,217 (P.I.)
Date: November 1, 2013 – August 31, 2014

Sponsor: Universities Research Association, Inc.
Title: Probing the Intensity Frontier with Mu2e and NOvA
Amount: $25,000 (P.I.)
Date: January 1, 2014 – May 31, 2014

Sponsor: Fermi National Accelerator Lab
Title: Intensity Frontier Fellowship
Amount: $46,086 (P.I.)
Date: January 1, 2014 – August 31, 2014

2013

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $410,000† (P.I.)
Date: April 1, 2013 – March 31, 2014

Sponsor: Fermi National Accelerator Lab
Title: Mu2e Experiment
Amount: $290,656 (P.I.)
Date: October 1, 2012 – December 31, 2013

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $78,113 (P.I.)
Date: June 24, 2013 – October 31, 2013

Sponsor: Universities Research Association, Inc.
Title: Search for Magnetic Monopoles in the NOvA Far Detector
Amount: $20,452 (P.I.)
Date: January 1, 2013 – August 31, 2013

2012

Sponsor: Department of Energy
Title: Research in the Intensity Frontier: NOVA and Mu2e
Amount: $357,000† (P.I.)

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $37,368 (P.I.)

2011

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $321,000‡ (P.I.)

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $1,761,403 (P.I.) (for FY11, FY12, FY13)

2010

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $462,000‡ (P.I.)

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $299,499 (P.I.)

2009

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $467,000‡ (P.I.)

Sponsor: Fermi National Accelerator Lab
Title: NOvA Experiment
Amount: $194,799 (P.I.)

2008

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $336,000‡ (P.I.)

Sponsor: Fermi National Accelerator Lab
Title: NOvA Detector Project
Amount: $51,717 (P.I.)

2007

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $330,000‡ (P.I.)

2006

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $364,000‡ (P.I.)

2005

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $250,000§ (P.I.)

2004

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $204,00§ (P.I.)

2003

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $233,100§ (P.I.)

2002

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $261,000§ (P.I.)

Sponsor: National Science Foundation
Title: Funding to Organize DPF2002 at The College of William and Mary
Amount: $18,000¶

Sponsor: Department of Energy
Title: Funding to Organize DPF2002 at The College of William and Mary
Amount: $35,000¶

2001

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $332,800§ (P.I.)

2000

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $281,000§ (P.I.)

1999

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $262,000§ (P.I.)

Sponsor: Lawrence Berkeley National Laboratory
Title: Physicist Staff Scientist
Amount: $36,000

1998

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $195,000[§] (P.I.)

1997

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $195,000[§] (P.I.)

1996

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $115,000 (P.I.) + $575,000[**]

1995

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $115,000 (P.I.) + $585,000[**]

1994

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $585,000[‖]

1993

Sponsor: National Science Foundation
Title: New Experiments to Revitalize Upper-Level Undergraduate Laboratories
Amount: $46,705[**]

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $610,000[‖]

Sponsor: Texas National Research Laboratory Commission
Title: SAHEP Initiative for SSC Research and Education
Amount: $90,000[‖]

Sponsor: Superconducting Super Collider
Title: CP Violation in Beauty Mesons
Amount: $32,754

Sponsor: Superconducting Super Collider
Title: High Resolution Electromagnetic Calorimeter Techniques
Amount: $16,000

1992

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $575,000‖

Sponsor: Texas National Research Laboratory Commission
Title: SAHEP Initiative for SSC Research and Education
Amount: $277,000‖

1991

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $430,000‖

Sponsor: Texas National Research Laboratory Commission
Title: SAHEP Initiative for SSC Research and Education
Amount: $118,000‖

1990

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $255,000‖

1989

Sponsor: Department of Energy
Title: University of Virginia Experimental High Energy Physics
Amount: $208,000‖

*With Craig Group.
†With partial support for Craig Group.
‡‡Partial support for research scientist Ralf Ehrlich.
††DOE Office of Science Graduate Student Fellowship for Tyler Horoho.
‡With partial support for Robert Hirosky.
§With Ken Nelson.
¶With P.Q. Hung *et al.*
‖With Sergio Conetti, Brad Cox, and Ken Nelson.
**With Bascom Deaver and Bellave Shivaram.

Seminars, Colloquia, Talks, Workshops

I have given over two-hundred talks at various institutions since I arrived at the University of Virginia in the fall of 1989, not including the many talks given at collaboration meetings on the many experiments with which I have been involved. They are listed below.

211. *Probing the Structures of Pyramids using Cosmic Ray Muons: from Giza to Chichen Itza and Points in Between*
Colloquium
University of Michigan, Ann Arobor, MI, USA
January 7, 2026

210. *Probing the Structures of Pyramids using Cosmic Ray Muons: from Giza to Chichen Itza and Points in Between*
Invited Banquet Talk
Southeastern Section of the American Physical Society Meeting (SESAPS 2025)
James Madison University, Harrisonbug, VA, USA
October 24, 2025

209. *Chair, Session on "Dark Matter Searches with Accelerator-based Experiments"*
Southeastern Section of the American Physical Society Meeting (SESAPS 2025)
James Madison University, Harrisonburg, VA, USA
October 24, 2025

208. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
Kansas State University
Manhattan, KS, USA
October 6, 2025

207. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
University of South Alabama
Mobile, AL, USA
September 26, 2025

206. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
University of Minnesota Duluth
Boston, MA, USA
September 19, 2025

205. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting, Fermilab
Franscati, Italy
June 13, 2025

204. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
Boston University
Boston, MA, USA
April 8, 2025

203. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
Illinois Institute of Technology
Chicago, IL, USA
March 13, 2025

202. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
University of Minnesota
Minneapolis, MN, USA
January 11, 2025

201. *Probing the Structure of the Great Pyramid using Cosmic Ray Tomography*
Invited Talk
Muography Workshop
Santa Fe, USA
November 5, 2024

200. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
Institute of Physics at the Czech Academy
Prague, Czech Republic
August 21, 2024

199. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Invited talk
The Colonnades
Charlottesville, VA, USA
July 8, 2024

198. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
University of Virginia
Charlottesville, VA, USA
April 26, 2024

197. *Probing the Structures of Pyramids Using Cosmic Ray Muon Tomography*
Colloquium
Department of Radiation Oncology, The Ohio State University
Columbus, OH, USA
March 4, 2024

196. *LDMX: A Search for Dark Matter Using a High Intensity Electron Beam*
Invited Talk
Beyond Standard Model: From Theory to Experiment
Hurghada, Egypt
November 6, 2023

195. *Probing the Structures of Pyramids Using Cosmic Ray Muons*
Colloquium
James Madison University
Harrisonburg, VA, USA
November 2, 2023

194. *Mu2e: Using Rare Muon Decays to Probe the Frontiers of Physics*
Invited talk
25^{th} International Spin Symposium
Durham, USA
September 27, 2023

193. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting, Fermilab

Batavia, IL, USA
November 14, 2022

192. *A Search for Dark Matter Using a High Intensity Electron Beam*
Invited talk
Interplay Between Particle and Astroparticle Physics (IPA2022)
Vienna, Austria
September 9, 2022

191. *Fabrication of a High Efficiency Cosmic Ray Veto Detector for the Mu2e Experiment at Fermilab*
Seminar
MATHUSLA collaboration
Virtual
April 5, 2022

190. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 4, 2022

189. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting,
Fermilab
Batavia, IL, USA
November 10, 2021

188. *Mu2e-II: The Mu2e Experiment in the PIP-II Era*
Invited Talk
The 20th International Workshop on Neutrinos from Accelerators (NUFACT2021)
Virtual meeting
September 8, 2021

187. *Mu2e-II Cosmic Ray Veto Triangular Quadcounter Module Update*
Mu2e-II Workshop
Virtual meeting
July 21, 2021

186. *Chaired Detector Session 4C*
APS Divisions of Particles and Fields conference,
Virtual meeting
July 13, 2021

185. *A Novel Scintillator Detector for the Mu2e-II Experiment and a Muon Tomography Probe of the Interior of the Great Pyramid*
Talk
APS Divisions of Particles and Fields conference
Virtual meeting
July 13, 2021

184. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 23, 2021

183. *A High Efficiency Cosmic Ray Veto Detector for the Mu2e Experiment at Fermilab*
Talk
International Conference on Technology and Instrumentation in Particle Physics
Virtual Meeting
May 25, 2021

182. *A Novel Scintillator Detector for the Mu2e-II Experiment and a Search for Hidden Chambers in the Great Pyramid*
Talk
CPAD Instrumentation Frontier Workshop 2021
Virtual Meeting
March 18, 2021

181. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 10, 2021

180. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 21, 2020

179. *A Triangular Counter Based Cosmic Ray Veto Module*
Talk
Mu2e-II Snowmass 21 Workshop
Virtual Meeting
September 23, 2020

178. *Cosmic Ray Detector Design*
Talk
Exploring the Great Pyramid (EGP) Workshop
Virtual Meeting
September 21, 2020

177. *The Mu2e Experiment at Fermilab: Status and Plans*
Invited Talk (cancelled due to COVID-19)
Interplay Between Particle and Astroparticle Physics 2020 (IPA2020)
Wien, Austria
September 7–11, 2020

176. *Mu2e-II: An Upgrade of the Mu2e Experiment for the Fermilab PIP-II Era*
Invited Talk (cancelled due to COVID-19)
The 22nd International Workshop on Neutrinos from Accelerators (NUFACT2020)
Cagliari, Italy
August 24–29, 2020

175. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 17, 2020

174. *A Novel High Rate Readout System for a High Efficiency Cosmic Ray Veto for the Mu2e Experiment*
Poster (cancelled due to COVID-19)

Technology and Instrumentation in Particle Physics (TIPP2020) conference
Whistler, Canada
May 24–29, 2020

173. *A High Efficiency Cosmic Ray Veto Detector for the Mu2e Experiment at Fermilab*
Talk (cancelled due to COVID-19)
Technology and Instrumentation in Particle Physics (TIPP2020) conference
Whistler, Canada
May 24–29, 2020

172. *A High Efficiency Cosmic Ray Veto Detector for the Mu2e Experiment at Fermilab*
Talk
APS April 2020 Meeting
Washington DC, USA
April 20, 2020

171. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting, Fermilab
Batavia, IL, USA
February 27, 2020

170. *Status of the Cosmic Ray Veto*
Plenary talk given at the DOE Independent Project Review for Mu2e
Fermilab
Batavia, IL, USA
December 10, 2019

169. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 17, 2019

168. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting, Fermilab
Batavia, IL, USA
May 22, 2019

167. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
February 21, 2019

166. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 18, 2018

165. *Cosmic Ray Veto Construction Readiness Review*
Organized and led the Cosmic Ray Veto Construction Readiness Review for electronics, module design, and module fabrication,
Fermilab
Batavia, IL, USA
October 16, 2018

164. *Status of the Cosmic Ray Veto*
Plenary talk given at the DOE Independent Project Review for Mu2e,
Fermilab
Batavia, IL, USA
October 2, 2018

163. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 26, 2018

162. *Cosmic Ray Veto Construction Readiness Review*
Organized and led the Cosmic Ray Veto Construction Readiness Review for di-counter production
Fermilab
Batavia, IL, USA
May 21, 2018

161. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 1, 2018

160. *Mu2e: Probing the Frontiers of Physics Using a Rare Muon Decay*
Invited Talk
84th Annual Meeting of the APS Southeastern Section (SESAPS 2017)
Georgia College, GA, USA
November 16, 2017

159. *Cosmic Ray Veto Construction Readiness Review*
Organized and led the Cosmic Ray Veto Construction Readiness Review for extrusions, fibers, and photodetectors.
Fermilab
Batavia, IL, USA
October 19, 2017

158. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 19, 2017

157. *Mu2e: Using Rare Muon Decays to Probe the Energy Frontier*
Invited Talk
The 19th International Workshop on Neutrinos from Accelerators (NUFACT2017)
Uppsala University, Lund, Sweden
September 29, 2017

156. *Cosmic Rays are a Pain: the Mu2e Cosmic Ray Veto*
Fermilab Summer School Lecture
Fermilab
Batavia, IL, USA
August 3, 2017

155. *A High Efficiency Cosmic Ray Veto for the Mu2e Experiment at Fermilab*
Talk, Division of Particles and Fields (DPF) Meeting

Fermilab
Batavia, IL, USA
August 2, 2017

154. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 20, 2017

153. *Status of the Cosmic Ray Veto*
Plenary talk given at the DOE Independent Project Review for Mu2e
Fermilab
Batavia, IL, USA
July 25, 2017

152. *Using Heisenberg's Uncertainty Principle to Probe Physics Beyond the Standard Model*
Colloquium
George Mason University
Fairfax, VA, USA
March 3, 2017

151. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
February 9, 2017

150. *How to Probe the Energy Frontier Using Heisenberg's Uncertainty Principle*
Seminar
University of Maryland
College Park, MD, USA
November 16, 2016

149. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 20, 2016

148. *How to Probe the Energy Frontier Using Rare Particle Decays*
Colloquium
Virginia Tech
Blacksburg, VA, USA
September 30, 2016

147. *Mu2e: Using Rare Particle Decays to Probe the Energy Frontier*
Seminar
SeaQuest Academy
Fermilab
Batavia, IL, USA
September 15, 2016

146. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Summer Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
July 25–26, 2016

145. *Status of the Cosmic Ray Veto*
Plenary talk given at the DOE CD-3c Review for Mu2e,
Fermilab
Batavia, IL, USA
June 14, 2016

144. *Status of the Cosmic Ray Veto*
Plenary talk given at the Fermilab Director's CD-3c Review for Mu2e
Fermilab
Batavia, IL, USA
April 19, 2016

143. *Cosmic Ray Veto Design Review*
Organized, reviewed, and gave introductory talk for this review of the Mu2e Cosmic Ray Veto design
Fermilab
Batavia, IL, USA
February 22–23, 2016

142. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
February 11, 2016

141. *Mu2e: Using Rare Particle Decays to Probe the Energy Frontier*
Seminar
Institute for High Energy Physics
Protvino, Russia
November 18, 2015

140. *Probing the Frontiers of Physics Using Rare Particle Decays: Using Heisenberg's Uncertainty Principle to trump Einstein's Mass-Energy Relationship*
Colloquium
University of Florida
Gainsville, Florida, USA
October 15, 2015

139. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Fall Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 7, 2015

138. *Probing the Frontiers of Physics Using Rare Particle Decays: Using Heisenberg's Uncertainty Principle to trump Einstein's Mass-Energy Relationship*
Colloquium
Kansas State University, Manhattan, Kansas, USA
October 5, 2015

137. *Cosmic Ray Veto Technical Oversight Committee Meeting*
Organized, led, and gave a talk at this review of the Cosmic Ray Veto by the Technical Oversight Committee
Fermilab
Batavia, IL, USA
September 23, 2015

136. *Probing the Frontiers of Physics Using Rare Particle Decays: Using Heisenberg's Uncertainty Principle to trump Einstein's Mass-Energy Relationship*

Chichester Colloquium
Longwood University, Franklin, Virginia, USA
September 17, 2015

135. *Cosmic Ray Veto Technical Oversight Committee Review*
Organized, reviewed, and gave introductory talk for this technical review of the Mu2e Cosmic Ray Veto design
Fermilab
Batavia, IL, USA
September 23, 2015

134. *Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Spring Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
April 16, 2015

133. *Mu2e: Probing the Frontiers of Physics Using Rare Particle Decay*
Invited Talk
Lake Louise Winter Institute
Lake Louise, Canada
February 19, 2015

132. *Mu2e Cosmic Ray Veto Workshop*
Organized and led workshop for the Cosmic Ray Veto Group at the Winter Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
December 3, 2014

131. *Cosmic Ray Veto Status*
Talk given at Mu2e Project Management Group Meeting
Fermilab
Batavia, IL, USA
November 11, 2014

130. *Status of the Cosmic Ray Veto*
Plenary talk given at the DOE CD-2/3b Review for Mu2e
Fermilab
Batavia, IL, USA
October 21, 2014

129. *Exotics Summary Talk*
NOvA Collaboration Meeting
University of Minnesota
Minneapolis, USA
July 25, 2014

128. *Exotics Working Group Session*
Organized and co-lead parallel sessions for Exotics Working Group
NOvA Collaboration Meeting
University of Minnesota
Minneapolis, USA
July 21-25, 2014

127. *Status of the Cosmic Ray Veto*
Plenary talk given at the Director's CD-2/3b Review for Mu2e
Fermilab
Batavia, IL, USA
July 8–10, 2014

126. *Mu2e Cosmic Ray Veto Mini Review*
Organized, led, and gave two talks at a review of the Mu2e Cosmic Ray Veto
Fermilab
Batavia, IL, USA
June 14, 2014

125. *Cosmic Ray Veto Status*
Talk given at Mu2e Project Management Group Meeting
Fermilab
Batavia, IL, USA
March 26, 2014

124. *Cosmic Ray Veto Design Status*
Plenary talk given at Mu2e Spring Collaboration Meeting
Fermilab
Batavia, IL, USA
March 13, 2014

123. *Mu2e Cosmic Ray Veto Working Group Session*
Organized and lead parallel session for the Cosmic Ray Veto Group, and gave one talk, Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 13, 2014

122. *Probing the Frontiers of Physics Using Rare Particle Decay*
Colloquium
Wichita State University
Wichita, KS, USA
February 26, 2014

121. *Exotics Working Group Session*
Organized and co-lead parallel sessions for Exotics Working Group, NOvA Collaboration Meeting
Caltech, Pasadena, CA, USA
January 9-12, 2014

120. *Mu2e CRV Status*
Plenary talk, Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 8, 2013

119. *Mu2e Collaboration Meeting*
Organized and lead parallel sessions for the Cosmic Ray Veto Group, Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 6–7, 2013

118. *Mu2e Cosmic Ray Veto Status*
Talk given at Mu2e Project Management Group Meeting
Fermilab
Batavia, IL, USA
September 24, 2013

117. *Probing the Frontiers of Physics Using Rare Particle Decays*
Colloquium
Illinois Institute of Technology, Chicago, IL, USA
September 12, 2013

116. *Cosmic Ray Backgrounds and How to Kill Them*
Talk given at Mu2e Weekly Group Meeting
Fermilab
Batavia, IL, USA
September 10, 2013

115. *Cosmic Ray Veto Working Group Session*
Organized and lead parallel session for the Cosmic Ray Veto Group, and gave one talk, Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
July 16, 2013

114. *Exotics Working Group Session*
Organized and co-lead parallel sessions for Exotics Working Group, and gave one talk, NOvA Collaboration Meeting
Argonne National Laboratory
Lemont, IL, USA
July 8-12, 2013

113. *Mu2e Cosmic Ray Veto Status*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 29, 2013

112. *Cosmic Ray Veto Working Group Sessions*
Organized and lead two parallel sessions, Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 27-28, 2013

111. *Mu2e Cosmic Ray Veto*
Talk given at Mu2e Project Management Group Meeting
Fermilab
Batavia, IL, USA
February 19, 2013

110. *Cosmic Ray Veto Working Group Session*
Organized and lead parallel session, and gave two talks
Fermilab
Batavia, IL, USA
February 1, 2013

109. *NOvA Exotic Working Group Summary*
Plenary Talk
NOvA Collaboration Meeting
Southern Methodist University
Dallas, TX, USA
January 27, 2013

108. *Exotic Working Group Session*
Organized and lead working group session, NOvA Collaboration Meeting
Southern Methodist University
Dallas, TX, USA
January 26, 2013

107. *Status of the Cosmic Ray Veto*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
November 10, 2012

106. *NOvA Exotics Working Group Summary*
Plenary Talk
NOvA Collaboration Meeting
Fermilab
Batavia, IL, USA
October 20, 2012

105. *Status of the Cosmic Ray Veto*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 27, 2012

104. *Cosmic Ray Veto Simulations Goals*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 25, 2012

103. *Mu2e Cosmic Ray Veto*
Plenary Talk
Department of Energy CD-1 Review of Mu2e
Fermilab
Batavia, IL, USA
June 5, 2012

102. *Mu2e Cosmic Ray Veto*
Breakout Talk
Department of Energy CD-1 Review of Mu2e
Fermilab
Batavia, IL, USA
June 6, 2012

101. *Mu2e: Using Rare Particle Decays to Probe the Energy Frontier*
Seminar
Columbia University
New York, NY, USA
April 18, 2012

100. *Mu2e Cosmic Ray Veto*
Plenary Talk
Director's CD-1 Review of Mu2e
Fermilab
Batavia, IL, USA
April 3, 2012

99. *Status of the Cosmic Ray Veto*
Plenary Talk

Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
January 28, 2012

98. *Accelerator Based Neutrino Physics at Fermilab*
Invited Talk
2011 BCVSPIN Advanced Study Institute in Particle Physics and Cosmology
Hue, Vietnam
July 27, 2011

97. *Beyond E=mc^2: Using Rare Particle Decays to Probe the Energy Frontier*
Invited Talk
2011 BCVSPIN Advanced Study Institute in Particle Physics and Cosmology
Hue, Vietnam
July 27, 2011

96. *Cosmic Ray Veto Status*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
July 20, 2011

95. *WBS 8 Cosmic Ray Veto*
Plenary Talk
Independent Design Review of Mu2e
Fermilab
Batavia, IL, USA
May 3, 2011

94. *Cosmic Ray Veto Status*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
March 13, 2011

93. *Beyond E=mc^2: Using Rare Particle Decays to Probe the Energy Frontier*
Seminar
Triangle Universities Nuclear Laboratory (TUNL),
Durham, NC, USA
February 24, 2011

92. *Cosmic Ray Veto System*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
October 30, 2010

91. *Beyond E=mc^2: Using Rare Particle Decays to Probe the Energy Frontier*
Colloquium
University of Houston
Houston, TX, USA
October 5, 2010

90. *Mu2e: A High-Sensitivity Search for Charged Lepton Flavor Violation at Fermilab*
Invited Talk
The 11th International Workshop on Tau Lepton Physics
Manchester, UK
September 13, 2010

89. *Cosmic Ray Veto System: Road to CD-1*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
June 4, 2010

88. *Beyond E=mc^2: Using Rare Particle Decays to Probe the Energy Frontier*
Seminar
Argonne National Laboratory
Lemont, IL, USA
May 5, 2010

87. *Accelerator Based Neutrino Physics at Fermilab*
Seminar
University of Illinois
Urbana-Champaign, IL, USA
December 3, 2009

86. *Charged Lepton Flavor Violation in Muon and Tau Decays*
Invited Talk
Flavor Physics and CP Violation 2009 Conference
Lake Placid, NY, USA
May 27 – June 1, 2009

85. *Beyond E = mc^2: Using Rare Decays to Probe the Energy Frontier*
Colloquium
College of William & Mary
Williamsburg, VA, USA
May 19, 2009

84. *Beyond E = mc^2: Using Rare Decays to Probe the Energy Frontier*
Colloquium
Illinois Institute of Technology
Chicago, IL, USA
April 25, 2009

83. *Beyond E = mc^2: Using Rare Decays to Probe the Energy Frontier*
Colloquium
James Madison University
Harrisonberg, VA, USA
April 9, 2009

82. *Beyond E = mc^2: Using Rare Decays to Probe the Energy Frontier*
Colloquium
University of Virginia
Charlottesville, VA, USA
March 20, 2009

81. *Beyond E = mc^2: Rare Particle Decays*
Invited Talk

American Associate for the Advancement of Science Annual Meeting
Chicago, IL, USA
February 13, 2009

80. *Accelerator Based Neutrino Physics at Fermilab*
Invited Talk
75th Annual Meeting of the Southeastern Section of the American Physical Society
North Carolina State University
Chapel Hill, NC, USA
November 31, 2008

79. *Thoughts on the Mu2e Electromagnetic Calorimeter*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
September 27, 2008

78. *Proposal Status*
Plenary Talk
Mu2e Collaboration Meeting
Fermilab
Batavia, IL, USA
September 27, 2008

77. *The Mu2e Detector*
Talk
Fermilab Director's Review of Mu2e
Fermilab
Batavia, IL, USA
September 26, 2008

76. *The Mu2e Experiment*
Invited Talk
MANX08 Meeting
Fermilab
Batavia, IL, USA
July 15, 2008

75. *A High-Sensitivity Search for Charged Lepton Flavor Violation at Fermilab*
Invited Talk
10th International Workshop on Neutrino Factories, Super beams and Beta Beams
Valencia, Spain
July 3, 2008

74. *A High-Sensitivity Search for Charged Lepton Flavor Violation at Fermilab*
Seminar
University of Minnesota,
Minneapolis, MN, USA
May 6, 2008

73. *A High-Sensitivity Search for Charged Lepton Flavor Violation at Fermilab*
Seminar
Duke University
Durham, NC, USA
March 31, 2008

72. *Prospects for a High-Sensitivity Lepton Flavor Violation Search at Fermilab*
Invited Talk
Lake Louise Winter Institute 2008
Lake Louise, Canada
February 21, 2008

71. *The Search for New Physics in Hyperon Decays*
Seminar
Carnegie Mellon University
Pittsburgh, PA, USA
March 28, 2007

70. *The Search for New Physics in Hyperon Decays*
Invited Talk
International Conference on Heavy Quarks and Leptons,
Munich, Germany
October 16, 2006

69. *The Search for CP Violation in Hyperon Decays*
Invited Talk
BEACH06
Lancaster, UK
July 6, 2006

68. *The Search for New Physics in Hyperon Decays*
Invited Talk
Los Alamos National Laboratory
Los Alamos, NM, USA
April 26, 2006

67. *Hints of New Physics in the Decay* $\Sigma^+ \to p\mu^+\mu^-$
Invited Talk
Rencontres de Moriond
La Tuile, Italy
March 12, 2006

66. *Cascade Physics with the HyperC*^{P} *Spectrometer at Fermilab*
Invited Talk
Cascade Physics: A New Window on Baryon Spectroscopy
Thomas Jefferson National Accelerator Facility
Newport News, VA, USA
SDecember 2, 2005

65. *What's the Matter with Antimatter?*
Invited Talk
Shenandoah Astronomical Society
Winchester, VA, USA
May 2, 2005

64. *Evidence for New Physics in the Decay* $\Sigma^+ \to p\mu^+\mu^-$
Talk
APS April 2005 Meeting
Tampa Bay, FL, USA
April 19, 2005

63. *Search for CP Violation in Hyperon Decays with the HyperC*^{P} *Spectrometer at Fermilab*
Talk

Division of Particles and Fields (DPF) Meeting
Riverside, CA, USA
August 27, 2004

62. *Search for CP Violation in Hyperon Decays*
Invited talk, XXIV Physics in Collision, Boston, MA, USA
June 27, 2004

61. *Search for CP Violation in Hyperon Decays with the HyperCP Spectrometer at Fermilab*
Invited talk
DAΦNE 2004
Frascati, Italy
June 7, 2004.

60. *Precision Measurements with the HyperCP Spectrometer at Fermilab*
Seminar
Thomas Jefferson National Accelerator Facility
Newport News, VA, USA
December 10, 2003

59. *Precision Measurements with the HyperCP Spectrometer at Fermilab*
Seminar
Brookhaven National Laboratory
Upton, NY, USA
July 10, 2003

58. *CKM: Attacking the Cabibbo-Kobayashi-Maskawa Matrix Using Charged Kaons at Fermilab*
Seminar
Caltech
Pasadena, CA, USA
May 27, 2003

57. *CKM: Attacking the Cabibbo-Kobayashi-Maskawa Matrix Using Charged Kaons at Fermilab*
Talk
Division of Particles and Fields (DPF) Meeting
Williamsburg, VA, USA
May 26, 2002

56. *CKM: Attacking the Cabibbo-Kobayashi-Maskawa Matrix Using Charged Kaons at Fermilab*
Seminar
Thomas Jefferson National Accelerator Facility
Newport News, VA, USA
May 3, 2002

55. *CKM: Attacking the Cabibbo-Kobayashi-Maskawa Matrix Using Charged Kaons at Fermilab*
Seminar
University of Virginia
Charlottesville, VA, USA
May 1, 2002

54. *CKM: Attacking the CKM Matrix Using Charged Kaons at Fermilab*
Seminar
University of Illinois
Urbana-Champaign, IL, USA
April 8, 2002

53. *FCNC Kaon Decays from HyperCP: $K^{\pm} \to \pi^{\pm}\mu^{+}\mu^{-}$*
    Talk
    XXXVIIth Rencontres de Moriond
    Les Arcs, France
    March 11, 2002

52. *Precision measurements with the HyperCP Spectrometer at Fermilab*
    Talk
    SESAPS meeting
    Charlottesville, VA, USA
    November 4, 2001

51. *Report from the UMS Working Group*
    Talk
    CKM Workshop
    Ann Arbor, MI, USA
    July 26, 2001

50. *Some Random Lessons from HyperCP*
    Talk
    CKM Workshop
    Ann Arbor, MI, USA
    July 23, 2001

49. *Status of the UMS Spectrometer*
    Talk
    CKM Workshop
    Ann Arbor, MI, USA
    July 23, 2001

48. *The Search for Direct CP Violation in Hyperon Decays: Results from the HyperCP Experiment*
    Talk
    International Conference on High Energy Physics of the European Physical Society (EPS2001)
    Budapest, Hungary
    July 12, 2001

47. *The Upstream Magnetic Spectrometer*
    Talk
    CKM Technical Review
    Fermilab
    Batavia, IL, USA
    May 15, 2001

46. *Results from the HyperCP Experiment at Fermilab: The Search for Direct CP Violation in Hyperon Decays*
    Talk
    14^{th} International Spin Physics Symposium
    Osaka, Japan
    October 17, 2000

45. *Why we are Here: Cosmology Meets the Asymmetry Between Matter and Antimatter*
    Colloquium
    Wayne State University
    Detroit, MI, USA
    November 4, 1999

44. *Performance of the HyperCP Spectrometer*
    Fermilab Director's Review Presentation

Fermilab
Batavia, IL, USA
December 8, 1998

43. *Searching for Direct CP Violation with Hyperons: the HyperCP Experiment at Fermilab*
Seminar
University of Chicago
Chicago, IL, USA
November 23, 1998

42. *Searching for Direct CP Violation with Hyperons: the HyperCP Experiment at Fermilab*
Seminar
Cornell University
Ithaca, NY, USA
November 20, 1998

41. *Why we are Here: Cosmology Meets the Asymmetry Between Matter and Antimatter*
Colloquium
New Mexico State University
Las Cruces, NM, USA
November 13, 1998

40. *The Search for Direct CP violation in Hyperon Decays: Results from the HyperCP Experiment at Fermilab*
Invited Talk
3^{rd} International Conference on Hyperons, Charm, and Beauty Hadrons
Genoa, Italy
July 2, 1998

39. *Proposal to Continue the Study of Hyperon CP Violation in FY99*
Fermilab HyperCP-99 PAC Presentation
Fermilab
Batavia, IL, USA
May 15, 1998

38. *Why we are here: Cosmology and the Asymmetry Between Matter and Antimatter*
Invited talk
Society of Physics Students
University of Virginia
Charlottesville, VA, USA
April 17, 1998

37. *Proposal to Continue the Study of Hyperon CP Violation in FY99*
Presentation to the Department of Energy
DOE, Germantown MD, USA
March 3, 1998

36. *Proposal to Continue the Study of Hyperon CP Violation in FY99*
Fermilab HyperCP-99 PAC Presentation
Fermilab
Batavia, IL, USA
January 9, 1998

35. *HyperCP Status Report*
Fermilab All Experimenters Meeting
Fermilab
Batavia, IL, USA
August 18, 1997

34. *CP Violation in Hyperon Decays*
Talk
Workshop on Heavy Quarks at Fixed Target
St. Goar, Germany
October 4, 1996

33. *Why we are here: Cosmology and the Asymmetry Between Matter and Antimatter*
Invited talk
Society of Physics Students
University of Virginia
Charlottesville, VA, USA
April 11, 1996

32. *The HyperCP Experiment at Fermilab*
Presentation for the DOE Review of Fermilab
Fermilab
Batavia, IL, USA
April 2, 1996

31. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
Seminar
University of Maryland
College Park, MD, USA
February 22, 1995

30. *Why we are here: Cosmology and the Asymmetry Between Matter and Antimatter*
Colloquium
College of William & Mary
Williamsburg, VA, USA
February 10, 1995

29. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
Seminar
Saclay, France
January 13, 1995

28. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
EP Seminar
CERN
Geneva Switzerland
January 16, 1995

27. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
Seminar
CEBAF
Newport News, VA, USA
November 21, 1994

26. *Unravelling the Mysteries of the Asymmetry Between Matter and Antimatter using Hyperons*
Colloquium
University of Virginia
Charlottesville, VA, USA
October 28, 1994

25. *A New Fermilab Experiment to Search for CP Violation in Hyperon Decays*
Talk, Eleventh International Symposium on High Energy Spin Physics
Indiana University

Bloomington, IN, USA
September 20, 1994

24. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
Seminar
Université de Lausanne
Lausanne, Switzerland
August 26, 1994

23. *A New Method of Searching for Direct CP Violation: the HyperCP Experiment at Fermilab*
Seminar
University of Trieste
Trieste, Italy
August 17, 1994

22. *P871 – the Search for CP Violation in the Decays of* $\Xi^-/\overline{\Xi}^+$ *and* $\Lambda/\overline{\Lambda}$ *Hyperons*
Presentation to the Fermilab Program Advisory Committee
Fermilab
Batavia, IL, USA
April 7, 1994

21. *P871 – the Search for CP Violation in the Decays of* $\Xi^-/\overline{\Xi}^+$ *and* $\Lambda/\overline{\Lambda}$ *Hyperons*
Presentation to the Fermilab Appeal Committee
Fermilab
Batavia, IL, USA
April 1, 1994

20. *The Changing Art of the Modern Elementary Particle Experimentalist: How Particle Physics Experiments Became Big Science*
Colloquium, Commonwealth Center for Literary and Cultural Change
University of Virginia
Charlottesville, VA, USA
October 20, 1993

19. *Summary Talk of the Electron and Gamma Identification Group*
Workshop on B Physics at Hadron Accelerators
Snowmass, Colorado, USA
July 1, 1993

18. *Electromagnetic Calorimetry for the SSC*
Talk
Workshop on B Physics at Hadron Accelerators
Snowmass, Colorado, USA
June 29, 1993

17. *Parasitic Extraction of Protons from the SSC Collider*
Seminar
Accelerator Department, SSC Laboratory
Dallas, TX, USA
June 2, 1993

16. *Options for CP Violation at the SSC*
Seminar
Physics Department, SSC Laboratory
Dallas, TX, USA
May 19, 1993

15. *Prospects for Detecting CP Violation at the SSC*
    Seminar
    University of Texas
    Austin, TX, USA
    May 3, 1993

14. *The New Quest for CP Violation*
    Seminar
    Université de Lausanne
    Lausanne, Switzerland
    March 26, 1993

13. *The Quest for CP Violation at the SSC*
    Seminar
    University of Michigan
    Ann Arbor, MI, USA
    October 12, 1992

12. *The PEPSCI Calorimeter Project*
    Invited Talk
    III International Conference on Calorimetry in High Energy Physics
    Corpus Christi, TX, USA
    October 2, 1992

11. *Calorimetry at the SFT*
    Talk
    Fixed Target B Physics Workshop
    SSC Laboratory
    Dallas, TX, USA
    June 30, 1992

10. *The New Search for CP Violation*
    Colloquium
    University of Virginia
    Charlottesville, VA, USA
    April 13, 1992

9. *Is Matter Really Different than Anti-matter?*
    Invited Talk
    Sigma Xi
    University of Virginia
    Charlottesville, VA, USA
    January 28, 1992

8. *Measuring the Amount of Glue Holding the Proton Together*
    Colloquium
    College of William & Mary
    Williamsburg, VA, USA
    January 11, 1991

7. *Monte Carlo Results on the Design of Light Guides for Scintillating Fiber Calorimeters*
    Talk, First International Conference on Calorimetry in High Energy Physics
    Fermilab
    Batavia, IL, USA
    October 30, 1990

6. *Direct Photon Physics from UA6*
   Seminar
   University of South Carolina
   Columbia, SC, USA
   May 4, 1989

5. *Measuring the Amount of Glue Holding the Proton Together*
   Seminar
   University of Virginia
   Charlottesville, VA, USA
   January 26, 1989

4. *Measuring the Amount of Glue Holding the Proton Together*
   Seminar
   Fermilab
   Batavia, IL, USA
   January 23, 1989

3. *Physics with the Hydrogen Cluster-Jet Internal Target at the SPS Collider — CERN Experiment UA6*
   Invited Talk
   Topical Conference on Electronuclear Physics with Internal Targets
   Stanford Linear Accelerator Center
   Palo Alto, CA, USA
   January 10, 1989

2. *Measurement of the Ratio of* Σ°/Λ *Inclusive Production and the* Σ° *and* Λ *Polarizations by 28.5 GeV/c Protons on Beryllium*
   Invited Talk
   Eighth International Symposium on High-Energy Spin Physics,
   Minneapolis, MN, USA
   September 12–17, 1988

1. *Preliminary Results from Experiment UA6 on Inclusive* π°*,* η*, and* γ *Production from* $\bar{p}p$ *Collisions at* $\sqrt{s} = 24.3$ *GeV*
   Invited Talk
   Twenty-First Rencontre de Moriond,
   Les Arcs, Savoie, France
   March 17, 1986

Refereed Publications

95. *Explanation of the seasonal variation of cosmic multiple muon events observed with the NOvA Near Detector*, with S. Abubakar *et al.* (NOvA Collaboration), Phys. Rev. D **113**, 012001 (2026).

94. *Ionization-based search for magnetic monopoles using the NOvA Far Detector*, with S. Abubakar *et al.* (NOvA Collaboration), arXiv:2512:20294 (2025).

93. *Measurement of π^0 Production in $\bar{\nu}_\mu$ Charged-Current Interactions in the NOvA Near Detector*, with S. Abubakar *et al.* (NOvA Collaboration), arXiv:2511:05807 (2025).

92. *Performance studies of the Mu2e cosmic ray veto detector*, with S. Corrodi, M. Devilbiss, E. Craig Dukes, R. Ehrlich, R. Craig Group, T. Horoho, Y. Oksuzian, P. Rubinov, M. Solt, and Y. Wu, Nucl. Instrum. Methods, **1083**, 171083 (2026).

91. *Temperature-Dependent Calibration Procedures for the Silicon Photomultiplier Readout of the Cosmic Ray Veto Detector for the Mu2e Experiment*, with L. Curtis, E. Craig Dukes, Ralf Ehrlich, Josh Greaves, Craig Group, Karl Hardrick, Yuri Oksuzian, Paul Rubinov, Matthew Solt, Yongyi Wu, and Anran Zhao, Nucl. Instrum. Methods, **1081**, 170809 (2026).

90. *Joint neutrino oscillation analysis from the T2K and NOvA experiments*, with K. Abe *et al.* (NOvA and T2K Collaborations), Nature 646 (2025) 8086, 818-824.

89. *Precision Measurement of Neutrino Oscillation Parameters with 10 Years of Data from the NOvA Experiment*, with S. Abubakar *et al.* (NOvA Collaboration), Phys. Rev. Lett. **136**, 011802 (2025).

88. Sensitivity of an Early Dark Matter Search using the Electromagnetic Calorimeter as a Target for the Light Dark Matter eXperiments, With T. Åkesson *et al.* (LDMX Collaboration), J. High Energy. Phys. **2025**, 150 (2025).

87. *Measurement of $d^2\sigma/d|\vec{q}|dE_{avail}$ in charged current ν_μ-nucleus interactions at $< E_\nu > = 1.86$ GeV using the NOvA Near Detector*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **111**, 052009 (2025).

86. *Dual-Baseline Search for Active-to-Sterile Neutrino Oscillations in NOvA*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. Lett. **134**, 081804 (2025).

85. *Search for CP-violating Non-Standard Interactions at the NOvA Experiment*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. Lett. **133**, 201802 (2024).

84. *Expanding neutrino oscillation parameter measurements in NOvA using a Bayesian approach*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **110** 012005 (2024).

83. *Advanced Radiation Panel design for applications in National Security and Food Safety*, A. Bross, E.C. Dukes, S. Hansen, A. Pla-Dalmau, and P. Rubinov, JINST **19** P06009 (2024).

82. *Photon-rejection Power of the Light Dark Matter eXperiment in an 8 GeV Beam*, with T. Åkesson *et al.* (LDMX collaboration), J. High Energ. Phys. **2023**, 92 (2023).

81. *Measurement of ν_μ charged-current inclusive π^0 production in the NOvA near detector*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **107**, 112008 (2023).

80. *Performance of the Wavelength-shifting fiber upgrade for the Mu2e cosmic-ray veto detector*, D. Coveyou, E.C. Dukes, R.C. Group, Y. Oksuzian, S. Roberts, and M. Solt, JINST **18** T05004 (2023).

79. *Measurement of the double-differential muon-neutrino charged-current inclusive cross section in the NOvA near detector*, with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **107**, 052011 (2023).

78. *Mu2e Run I Sensitivity Projections for the Neutrinoless Conversion Search in Aluminum*,
with K. Bryum *et al.* (Mu2e Collaboration), Universe 2023, 9(1), 54 (2023).

77. *Qualification study of SiPMs on a large scale for the CMVD Experiment*,
with M. Jangra *et al.*, JINST **17** (2022) 07, P07019.

76. *Monte Carlo method for constructing confidence intervals with unconstrained and constrained nuisance parameters in the NOvA experiment*,
with M.A. Acero *et al.*, JINST **20** T02001 (2025).

75. *Measurement of the ν_e-Nucleus Charged-Current Double-Differential Cross Section at $\langle E \rangle = 2.4$ GeV using NOvA*,
with M.A. Acero *et al.*, Phys. Rev. Lett. **130**, 051802 (2023) arXiv:2206.10585 (2022).

74. *Improved Measurement of Neutrino Oscillation Parameters by the NOvA Experiment*, with M.A. Acero *et al.* (NOvA Collaboration),
Phys. Rev. D **106** 032004 (2022).

73. *Tomographic Muon Imaging of the Great Pyramid of Giza*,
A.D.Bross, E.C. Dukes, R. Ehrlich, E. Fernandez, S. Dukes, M. Gobashy, I. Jamieson, P.J. La Rivière, M. Liu, G. Marouard, N. oeller, A. Pla-Dalmau, P. Rubinov, O. Shohoud, P. Vargas, and T. Welch, J. Adv. Instrum. Sci. 280 (2022).

72. *Measurement of the Double-Differential Muon-neutrino Charged-Current Inclusive Cross Section in the NOvA Near Detector*,
with M.A. Acero *et al.* (NOvA collaboration), arXiv.2109.12220 (2021).

71. *Characterization of Silicon-Photomultipliers for a Cosmic Muon Veto detector*,
with M. Jangra *et al.*, JINST **16** (2021) 11, P11029.

70. *Extended search for supernova-like neutrinos in NOvA coincident with LIGO/Virgo detections*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **104**, 063024 (2021).

69. *Search for active-sterile antineutrino mixing using neutral-current interactions with the NOvA experiment*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. Lett. **127**, 201801 (2021).

68. *Seasonal variation of multiple-muon cosmic ray air showers observed in the NOvA detector on the surface*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **104**, 012014 (2021).

67. *Search for slow magnetic monopoles with the NOvA detector on the surface*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **103**, 012007 (2021).

66. *Adjusting Neutrino Interaction Models and Evaluating Uncertainties using NOvA Near Detector Data*,
with M.A. Acero *et al.* (NOvA Collaboration), Eur. Phys. J. C**80** 1119 (2020).

65. *Supernova neutrino detection in NOvA*,
with M.A. Acero *et al.* (NOvA Collaboration), J. Cosmol. Astropart. Phys., 2020, 10, 014 (2020).

64. *Search for multi-messenger signals in NOvA coincident with LIGO/Virgo detections*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **101**, 112006 (2020).

63. *A High Efficiency Photon Veto for the Light Dark Matter eXperiment*,
with T. Åkesson *et al.* (LDMX Collaboration), J. High Energy Phys. **2020**, 3 (2020).

62. *First Measurement of Neutrino Oscillation Parameters using Neutrinos and Antineutrinos by NOvA*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. Lett. **123**, 151803 (2019).

61. *Observation of seasonal variation of atmospheric multiple-muon events in the NOvA Near Detector*,
with M.A. Acero *et al.* (NOvA Collaboration), Phys. Rev. D **99**, 122004 (2019).

60. *Measurement of Neutrino-Induced Neutral-Current Coherent π° Production in the NOvA Near Detector*, with M.A. Acera *et al.* (NOvA Collaboration), Phys. Rev. D **102**, 012004 (2019).

59. *Radiation Tests of Hamamatsu Multi-Pixel Photon Counters*, G. Blazey, J. Colston, A. Dyshkant, K. Francis, J. Kalnins, S. A. Uzunyan, V. Zutshi, S. Hansen, P. Rubinov, E. C. Dukes, Y. Oksuzian, and M. Pankuch, Nucl. Instrum. Methods, **A927**, 463 (2019).

58. *Performance of Wavelength-Shifting Fibers for the Mu2e Cosmic Ray Veto Detector*, E.C. Dukes, P.J. Farris, R.C. Group, T. Lam, D. Shooltz, Y. Oksuzian, JINST **13**, P12028 (2018).

57. *New Constraints on Oscillation Parameters from ν_e Appearance and ν_μ Disappearance in the NOvA Experiment*, with M.A. Acera *et al.* (NOvA Collaboration), Phys. Rev. **D98**, 03212 (2018).

56. *The NOvA Power Distribution System*, E.C. Dukes, R. Ehrlich, S. Goadhouse, L. Mualem, A. Norman, and R. Tesareck, Nucl. Instrum. Meth. **A902**, 123 (2018).

55. *Photoelectron Yields of Scintillation Counters with Embedded Wavelength-Shifting Fibers Read Out With Silicon Photomultipliers*, A. Artikov, V. Baranov, G. Blazey, N. Chen, D. Chokheli, Y. Davydov, E.C. Dukes, A. Dychkant, R. Ehrlich, K. Francis, M.J. Frank, V. Glagolev, C. Group, S. Hansen, S. Magill, Y. Oksuzian, A. Pla-Dalmau, P. Rubinov, A. Simonenko, E. Song, S. Stetzler, Y. Wu, S. Uzunyan, and V. Zutshi, Nucl. Instrum. Meth. **A890**, 84 (2018).

54. *Search for active-sterile neutrino mixing using neutral-current interactions in NOvA*, with P. Adamson et al. (NOvA Collaboration), Phys. Rev. D **96**, 072006 (2017).

53. *Constraints on oscillation parameters from $\nu_{\rm e}$ appearance and ν_μ disappearance in NOvA*, with P. Adamson et al. (NOvA Collaboration), Phys. Rev. Lett. **118**, 231801 (2017).

52. *Measurement of the Neutrino Mixing Angle θ_{23} in NOvA*, with P. Adamson et al. (NOvA Collaboration), Phys. Rev. Lett. **118**, 151802 (2017).

51. *First measurement of muon-neutrino disappearance in NOvA*, with P. Adamson et al. (NOvA Collaboration), Phys. Rev. D **93**, 051104(R) (2016).

50. *First Measuremrents of Electron Neutrino Appearance in NOvA*, with P. Adamson et al. (NOvA Collaboration), Phys. Ref. Lett. **116**, 151806 (2016).

49. *Measurement of Charged Pion Production Yields off the NuMI Target*, with J.M. Paley *et al.*, Phys. Rev. D **90**, 032001 (2014).

48. *Forward Neutron Production at the Fermilab Main Injector*, with T. S. Nigmanov *et al.*, Phys. Rev. D **83**, 012002 (2011).

47. *Study of the rare hyperon decay $\Omega^\mp \to \Xi^\mp \pi^+ \pi^-$*, with O. Kamaev *et al.*, Phys. Lett. B 693, 236 (2010).

46. *Charged Kaon Mass Measurement using the Cerenkov Effect*, with N. Graf *et al.*, Nucl. Instrum. Meth. **A615**, 27 (2010).

45. *Electromagnetic and hadron calorimeters in the MIPP experiment*, with T.S. Nigmanov, H.R. Gustafson, M.J. Longo, H.K. Park, D. Rajaram, C. Dukes, L.C. Lu, C. Materniak, K. Nelson, A. Norman, H. Meyer, A. Lebedev, S. Seun, N. Graf, J.M. Paley, G. Aydin, Y. Gunaydin, and D.E. Miller, Nucl. Instrum. Meth. **A598**, (2009).

44. *Measurement of the Asymmetry in the Decay $\overline{\Omega}^+ \to \overline{\Lambda} K^+ \to \overline{p}\pi^+ K^+$*, with L.C. Lu *et al.*, Phys. Rev. Lett. **96**, 242001 (2006).

43. *Observation of Parity Violation in $\Omega^- \to \Lambda K^-$ Decays*, with L.C. Lu *et al.*, Phys. Lett. B **617**, 11 (2005).

42. *Search for the Lepton-Number-Violating Decay $\Xi^- \to p\mu^-\mu^-$*,
with D. Rajaram *et al.*, Phys. Rev. Lett. **94**, 181801 (2005).

41. *HyperCP: A high-rate spectrometer for the study of charged hyperon and kaon decays*,
with R. Burnstein *et al.*, Nucl. Instrum. and Methods A **541**, 516 (2005).

40. *Search for $\Delta S = 2$ Nonleptonic Hyperon Decays*,
with C.G. White *et al.*, Phys. Rev. Lett. **94**, 101804 (2005).

39. *Measurement of the α Asymmetry Parameter for the $\Omega^- \to \Lambda K^-$ Decay*,
with Y.C. Chen *et al.*, Phys. Rev. D **71**, 051102(R) (2005).

38. *Evidence for the decay $\Sigma^+ \to p\mu^+\mu^-$*
with H.K. Park *et al.*, Phys. Rev. Lett. **94**, 021801 (2005).

37. *Search for CP Violation in $\Xi^\pm \to \Lambda\pi^\pm \to p^\mp\pi^\pm\pi^\pm$ Decays*,
with T. Holmstrom *et al.*, Phys. Rev. Lett. **93**, 262001 (2004).

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with M.J. Longo *et al.*, Phys. Rev. D **70**, 111101(R) (2004).

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with M. Huang *et al.*, Phys. Rev. Lett. **93**, 011802 (2004).

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with J. Engelfried *et al.*, Nucl. Instrum. Methods A **502**, 62 (2003).

33. *Observation of the Decay $K^- \to \pi^-\mu^+\mu^-$ and Measurements of the Branching Ratios for $K^\pm \to \pi^\pm\mu^+\mu^-$*,
with H.K. Park *et al.*, Phys. Rev. Lett. **88** (2002) 111801.

32. *Hadroproduction of the χ_1 and χ_2 States of Charmonium in 800 GeV/c Proton-Silicon Interactions*,
with T. Alexopoulos *et al.*, Phys. Rev. D **62** 032006 (2000).

31. *A High-Throughput Data Acquisition System for the HyperCP Experiment*,
Y.C. Chen, K.C. Cheng, W.-S. Choong, E.C. Dukes, P. Gu, C. Ho, C. James, D.M. Kaplan, W.R. Luebke, K.B. Luk, K. Nelson, H. Rubin, J.P. Sheng, C.G. White, C.S. Yu, Nucl. Instrum. Methods **A455** (2000) 424.

30. *A New Determination of α_s using Direct Photon Production Cross Sections in pp and $\overline{p}p$ Collisions at $\sqrt{s} = 24.3$ GeV*,
with M. Werlen *et al.*, Phys. Lett. B **452** 201, (1999).

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with T. Alexopoulos *et al.*, Phys. Rev. Lett. **82** (1999) 41.

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with G. Ballocchi *et al.*, Phys. Lett. **B436** 222, (1998).

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with T. Alexopoulos *et al.*, Phys. Rev. D**55**, 3927 (1997).

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with T. Alexopoulos *et al*, Phys. Rev. Lett. **77** (1996) 2381.

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with T. Alexopoulos *et al.*, Nucl. Instrum. Methods **A376** (1996) 375.

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Proposals

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