




Sean B. Foster

 [sbfoster12.github.io](https://github.com/sbfoster12) |  [sean-b-foster](#) |  sean.foster@uky.edu

EDUCATION

Ph.D. in physics, Boston University

May 2023

Thesis title: Measurement of the Muon Anomalous Precession Frequency in
Runs 2 & 3 of the Muon $g - 2$ Experiment at Fermilab ([View via OpenBU](#))

Boston, MA

Advisor: Rob Carey

M.A. in physics, Boston University

Jan. 2018

Boston, MA

Bachelor of Arts, Colgate University

May 2016

Salutatorian, *summa cum laude*, GPA: 4.04/4.00

Hamilton, NY

Major: Physics with High Honors; Minor: Philosophy

EMPLOYMENT

Postdoctoral Scholar

July 2023 - present

University of Kentucky

Lexington, KY

Department of Physics and Astronomy

Supervisors: Renee Fatemi and Tim Gorringer

Experiments: Muon $g - 2$ Experiment at Fermilab and Pioneer Experiment

Scientific Researcher

May 2023 - June 2023

Boston University

Boston, MA

Department of Physics

Supervisors: Lee Roberts and Rob Carey

Experiment: Muon $g - 2$ Experiment at Fermilab

RESEARCH EXPERIENCE

University of Kentucky

Postdoctoral scholar

July 2023 - present

Implemented updates to the Muon $g-2$ Geant4 simulation to include a Radio Frequency (RF) pulse to the electrostatic quadrupoles, an important update to compare with Run-5/6 data. Validation and analysis studies are underway. Developed a data unpacking program in C/C++ to convert — in real time — the raw binary data collected at a test beam run for calorimeter characterization at the Paul Scherrer Institute (PSI) for the Pioneer experiment. Actively participating in simulation and data acquisition R&D for Pioneer.

Boston University

Scientific Researcher

May 2023 - June 2023

Contributed to an extensive review process (internal to the collaboration) of the Muon $g-2$ Run-2/3 analysis. Scrutinized a precession frequency analysis method known as the kernel ratio method, which resulted in an understanding of how the method weighs the data, informing the appropriate fit start time for that analysis.

Synthesized the final Run-2/3 precession frequency analysis — which is performed by seven independent groups — into a presentation to the entire collaboration, showcasing the analysis techniques and the uncertainty estimation strategies.

Ph.D. Candidate

Apr. 2020 - May 2023

Led the Boston University precession frequency analysis of the Runs 2/3 data from the Muon $g - 2$ experiment at Fermilab, resulting in a 204 parts-per-billion (ppb) frequency measurement (group consisted of myself and then-postdocs James Mott and Andy Edmonds). Implemented and validated a robust pileup correction algorithm. Investigated an "early-to-late" bias, discovered part of its origin, and implemented an empirical correction, reducing the associated systematic uncertainty. Prepared histograms from large datasets using grid computing resources and designed fitting routines and visualization programs using C++, python, and bash scripting. Performed extensive cross-checks, comparisons, and systematic uncertainty studies. Shared and defended the analysis with the 20+ person precession frequency group and the 100+ person collaboration through presentations and a comprehensive analysis report.

Research Assistant

Muon $g-2$ Experiment

Jan. 2019 - Apr. 2020

Designed a scattering device to aid in the alignment of the tracking detectors and simulated its performance in Geant4. Device was built and used in the experiment in January 2022 and July 2023.

Prof. Wanzheng Hu's ultrafast spectroscopy lab

Fall 2018

Designed preliminary components of a pump-probe experiment as part of helping build up a femtosecond laser lab.

Prof. Shyamsunder Erramilli's ultrafast spectroscopy lab

Summer 2018

Designed and assembled a white light generator for a transient absorption spectrometer.

Prof. Martin Schmaltz's high energy phenomenology group

Summer 2017

Performed simulation studies of leptoquark models using MadGraph and compared to LHC data.

Colgate University

Research Assistant

Aug. 2015 - May 2016

Worked as part of a team — as a member of Prof. Jonathan Levine's research lab — designing spaceflight instruments for Lunar and Martian missions. Developed tools in MATLAB to perform mineral identification of rock samples using data collected with a resonance ionization mass spectrometer designed for radioisotopic dating.

Cornell University

Research Experience for Undergraduates (REU) participant

Summer 2014

Summer REU student at the Cornell Laboratory for Accelerator-based Sciences and Education (CLASSE), mentored by Walter Hartung and Kiran Sonnad. Performed measurements and simulation to understand two processes that contribute to electron clouds in particle accelerators: 1) measured the secondary electron yield of various materials in a test-stand setup with LabView data acquisition software and 2) developed a MATLAB simulation tool to study photon reflectivity of various materials relevant in accelerator design. ([Final report](#) & [Final presentation](#)).

TEACHING EXPERIENCE

Boston University Department of Physics

Teaching Fellow

PY 105 with Professor Andrew Duffy	Spring 2019
PY 105, PY 106 with Dr. Erik Lascaris	Summer 2018
PY 106 with Professor Andrew Duffy	Spring 2018
PY 105 with Professor Andrew Duffy	Fall 2017
PY 211, PY 212 with Professor Andrew Duffy and Dr. Grace Mohamedi	Summer 2017
PY 106 with Professor Rob Carey	Spring 2017
PY 105 with Professor Jim Rohlf	Fall 2016
→ PY 105 and PY106 are algebra-based courses on Newtonian mechanics and electricity & magnetism respectively, primarily for premedical students	
→ PY 211 and PY 212 are calculus-based courses on Newtonian mechanics and electricity & magnetism respectively, primarily for engineering students	

Colgate University Department of Physics and Astronomy

Teaching assistant and peer tutor 2013-2016

Teaching assistant for first and second year courses for physics majors and premedical students, primarily leading problem-set help sessions. Conducted on-on-one peer tutoring to 1-2 students per semester.

PUBLICATIONS

Aguillard, D. P. et al. (Feb. 2024). “Detailed Report on the Measurement of the Positive Muon Anomalous Magnetic Moment to 0.20 ppm”. In: submitted to Phys. Rev. D. arXiv: [2402.15410 \[hep-ex\]](#).

Aguillard, D. P. et al. (2023). “Measurement of the Positive Muon Anomalous Magnetic Moment to 0.20 ppm”. In: *Phys. Rev. Lett.* 131.16, p. 161802. doi: [10.1103/PhysRevLett.131.161802](#). arXiv: [2308.06230 \[hep-ex\]](#).

Levine, Jonathan et al. (May 2023). “Dating Granites Using CODEX, with Application to In Situ Dating on the Moon”. In: *The Planetary Science Journal* 4.5, p. 92. doi: [10.3847/PSJ/accd6c](#). URL: <https://dx.doi.org/10.3847/PSJ/accd6c>.

King, B. T. et al. (2022). “The straw tracking detector for the Fermilab Muon g-2 Experiment”. In: *JINST* 17.02, P02035. doi: [10.1088/1748-0221/17/02/P02035](#). arXiv: [2111.02076 \[physics.ins-det\]](#).

Abi, B. et al. (2021). “Measurement of the Positive Muon Anomalous Magnetic Moment to 0.46 ppm”. In: *Phys. Rev. Lett.* 126.14, p. 141801. doi: [10.1103/PhysRevLett.126.141801](#). arXiv: [2104.03281 \[hep-ex\]](#).

TALKS AND PRESENTATIONS

APS April Meeting 2024

Apr. 2024

Beam dynamics corrections to the measurement of the muon magnetic anomaly in the Muon g-2 Experiment at Fermilab (contributed talk, [Abstract: T11.00003](#))

Sacramento, CA

Amherst College Physics and Astronomy Department Colloquium Measuring the muon's wobble: New results from the Muon g-2 Experiment at Fermilab (colloquium, Abstract)	Oct. 2023 Amherst, MA
EPS-HEP Conference 2023 Measurement of the muon anomalous precession frequency ω_a in the Fermilab Muon g2 Experiment (contributed talk, PoS(EPS-HEP2023)359)	Aug. 2023 Hamburg, Germany
Muon4Future Workshop Muon g-2 and EDM at Fermilab (invited talk, PoS(Muon4Future2023)016)	May 2023 Venice, Italy
University of Kentucky Department of Physics and Astronomy Colloquium Measuring the muon's wobble: Analysis of the Runs 2 & 3 data from the Muon g-2 Experiment at Fermilab (colloquium, Abstract)	Mar. 2022 Lexington, KY
APS April Meeting 2022 Ratio Method to Extract the Anomalous Muon Spin Precession Frequency in the Fermilab Muon g-2 Experiment (contributed talk, Abstract: G08.00004)	Apr. 2022 New York City, NY
47th Lunar and Planetary Science Conference Using Laser Ablation Mass Spectrometry to Aid Resonance Ionization in Spaceflight Dating (poster, Abstract #2070)	Mar. 2016 Houston, TX
Syracuse University Undergraduate Research Day Mineral Identification using a Prototype Dating Spectrometer (contributed talk)	Dec. 2015 Syracuse, NY
Mohawk Valley Astronomical Society Monthly Meeting Mineral Identification using a Prototype Dating Spectrometer (outreach talk)	Sept. 2015 Waterville, NY
NY6 Upstate New York Undergraduate Research Conference Mineral Identification using a Prototype Dating Spectrometer (contributed talk)	Sept. 2015 Hamilton, NY
Colgate Universitys Ho Symposium for Summer Student Research Mineral Identification using a Prototype Dating Spectrometer (invited talk)	Sept. 2015 Hamilton, NY

LEADERSHIP AND SERVICE

g2early Publication Committee Representative Muon g-2 Experiment Participate in publication committee meetings of the Muon g-2 experiment as a representative of the early career group (g2early). Keep g2early informed of publications policy changes and raise relevant issues to the committee. Provide editorial feedback on manuscripts, some of which include physics papers, technical papers, and conference proceedings.	Aug. 2023 - present
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Run Coordinator

Oct. 2021 - Aug. 2022

Muon g-2 Experiment

Led day-to-day operations of the Muon g-2 experiment at Fermilab during Run-5 for two four-week periods during the run and a one-week period during the summer shutdown. Created daily run plans and ensured that any issues were identified and directed to the appropriate experts. Managed the shifters who monitor the experiment 24/7. Reviewed and approved work requests from scientists, engineers, and operators. Led the toolbox and weekly operations meetings, provided updates at the weekly big analysis meeting, and provided updates to the accelerator division.

g2early Management Meeting Representative

Oct. 2021 - Sept. 2022

Muon g-2 Experiment

Participated in management meetings and analysis meetings for the Muon g-2 Experiment, as a representative of the early career scientists (g2early). Communicated relevant issues between g2early and the committee.

Teaching Fellow Peer Mentor

Sept. 2017 - May 2019

Boston University

Peer mentor to first year physics graduate students, primarily providing guidance, support, and resources towards teaching in one's first year of graduate school.

MENTORING

Undergraduate student mentoring

Caleb West '26, University of Kentucky

2024 - present

Meera Patel '22, Boston University

2020 - 2022

Ryan McCarthy '20, Boston University

2019 - 2020

Graduate student mentoring

Jack Carlton, University of Kentucky

2023 - present

Scott Israel, Boston University

2023 - present

AWARDS & MEMBERSHIPS

Outstanding Teaching Fellow in the Department of Physics

May 2018

*Awarded by the Graduate School of Arts and Sciences of Boston University***Department of Physics Teaching Fellow of the Year**

Apr. 2018

*Awarded by the Boston University Department of Physics***Physics and Astronomy Alumni Award**

Spring 2016

*Awarded by Colgate University***Charles A. Dana Scholar**

Spring 2015

*Awarded by Colgate University***Phi Beta Kappa National Honor Society**

Fall 2015 - present

*Elected Member***Sigma Pi Sigma Physics Student Honor Society**

Spring 2015 - present

*Invited Member***Charles A. Dana Scholar**

Spring 2014

*Awarded by Colgate University***Edwin Foster Kingsbury Prize**

Spring 2014

Awarded by Colgate University

Phi Eta Sigma National Honor Society

Invited Member

Spring 2015 - present

American Physical Society

Member

Fall 2013 - present

IN THE NEWS

Quoted in University of Kentucky [article](#) on the Muon g-2 Run-2/3 result.

Aug. 2023

Interview with [Innovation News Network](#) ahead of the Muon g-2 Run-2/3 release.

July 2023

SKILLS

Scripting & Programming Languages: Bash, C, C++, Python, MATLAB

Operating Systems: Linux, macOS

Other Skills: Git, \LaTeX , Mathematica, Geant4