Sean B. Foster

sbfoster12.github.io | sean-b-foster | sfoster@amherst.edu

Education

Ph.D. in physics, Boston University — May 2023, Boston, MA
Thesis title: Measurement of the Muon Anomalous Precession Frequency in Runs 2 & 3 of the Muon $g-2$ Experiment at Fermilab (View via OpenBU)
Advisor: Prof. Rob Carey

M.A. in physics, Boston University — Jan. 2018, Boston, MA

Bachelor of Arts, Colgate University — May 2016, Hamilton, NY
Salutatorian, *summa cum laude*, GPA: 4.04/4.00
Major: Physics with High Honors; Minor: Philosophy

Employment

Visiting Assistant Professor of Physics — July 2025 - present, Amherst, MA
Amherst College
Department of Physics and Astronomy

Postdoctoral Scholar — July 2023 - June 2025, Lexington, KY
University of Kentucky
Department of Physics and Astronomy
Supervisors: Prof. Renee Fatemi and Prof. Tim Gorringe
Experiments: Muon $g-2$ Experiment and the Pioneer Experiment

Instructor — Spring 2025, Hamilton, NY
Colgate University
Department of Physics and Astronomy

Scientific Researcher — May 2023 - June 2023, Boston, MA
Boston University
Department of Physics
Supervisors: Lee Roberts and Rob Carey
Experiment: Muon $g-2$ Experiment

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 weights 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

Beesley, O. et al. (2025). ''Measurements of a LYSO crystal array from threshold to 100MeV''. In: *Nucl. Instrum. Methods Phys. Res. A.* 1075, p. 170320. ISSN: 0168-9002. DOI: https://doi.org/10.1016/j.nima.2025.170320. URL: https://www.sciencedirect.com/science/article/pii/S0168900225001214.

Aguillard, D. P. et al. (2024). ''Detailed report on the measurement of the positive muon anomalous magnetic moment to 0.20 ppm''. In: *Phys. Rev. D* 110 (3), p. 032009. DOI: 10.1103/PhysRevD.110.032009. URL: https://link.aps.org/doi/10.1103/PhysRevD.110.032009.

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, J. et al. (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].

Conferences Proceedings and Presentations

Colgate University Department of Physics and Astronomy Colloquium — Sept. 2024
Measuring the muon's wobble: Latest results from the Muon g-2 Experiment at Fermilab (colloquium) — Hamilton, NY

2024 Joint Photonuclear Reactions and Frontiers & Careers Workshop — Aug. 2024
Status of the Muon g-2 Experiment at Fermilab (invited talk, Abstract) — Cambridge, MA

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 — Oct. 2023
Measuring the muon's wobble: New results from the Muon g-2 Experiment at Fermilab (colloquium, Abstract) — Amherst, MA

EPS-HEP Conference 2023 — Aug. 2023
Measurement of the muon anomalous precession frequency ω_a in the Fermilab Muon g-2 Experiment (contributed talk, PoS(EPS-HEP2023)359) — Hamburg, Germany

Muon4Future Workshop — May 2023
Muon g-2 and EDM at Fermilab (invited talk, PoS(Muon4Future2023)016) — Venice, Italy

University of Kentucky Department of Physics and Astronomy Colloquium — Mar. 2022
Measuring the muon's wobble: Analysis of the Runs 2 & 3 data from the Muon g-2 Experiment at Fermilab (colloquium, Abstract) — Lexington, KY

APS April Meeting 2022 — Apr. 2022
Ratio Method to Extract the Anomalous Muon Spin Precession Frequency in the Fermilab Muon g-2 Experiment (contributed talk, Abstract: G08.00004) — New York City, NY

47th Lunar and Planetary Science Conference — Mar. 2016
Using Laser Ablation Mass Spectrometry to Aid Resonance Ionization in Spaceflight Dating (poster, Abstract #2070) — Houston, TX

Syracuse University Undergraduate Research Day — Dec. 2015
Mineral Identification using a Prototype Dating Spectrometer (contributed talk) — Syracuse, NY

Mohawk Valley Astronomical Society Monthly Meeting — Sept. 2015
Mineral Identification using a Prototype Dating Spectrometer (outreach talk) — Waterville, NY

NY6 Upstate New York Undergraduate Research Conference Sept. 2015
Mineral Identification using a Prototype Dating Spectrometer (contributed talk) Hamilton, NY

Colgate University's Ho Symposium for Summer Student Research Sept. 2015
Mineral Identification using a Prototype Dating Spectrometer (invited talk) Hamilton, NY

Leadership and Service

Publications Committee co-Chair Jul. 2024 - present
Muon g-2 Experiment, *appointed*

Ensure the duties of the publications committee are carried out. Currently, co-organizing the review of four papers within the collaboration.

co-Organizer of g2outreach Apr. 2022 - present
Muon g-2 Experiment

Co-organizing an effort to create a masterclass on the Muon g-2 experiment for high school students. Leading the development of an interactive data analysis tool for students to get experience working with data and see what it is like to do research on a particle physics experiment.

g2early Publications Committee Representative Aug. 2023 - present
Muon g-2 Experiment, *elected 2023, re-elected 2024*

Participate in publication committee meetings of the Muon g-2 experiment as a representative of the early career group (g2early). Keep g2early – the experiment's early career group – informed of publications policy changes and raise relevant issues to the committee. Provide editorial feedback on manuscripts: physics papers, technical papers, and conference proceedings.

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, *elected*

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 — Spring 2015 - present
Invited Member

American Physical Society — Fall 2013 - present
Member

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, ROOT, GEANT4