Sean Byrne

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GitHub: ByrneS45 — Website — U.S.M.C. Veteran

Research Profile

Experimental nuclear physicist with expertise in **nuclear data analysis, reaction-rate modeling, and gamma-ray spectroscopy**. Extensive experience developing **C++/Python/ROOT** software pipelines for large experimental datasets, translating experimental observables into reaction and decay information relevant to modeling and nuclear data libraries.

Education

University of Massachusetts Lowell — Ph.D. Candidate, Physics 2020–Present
Research: Nuclear astrophysics, gamma-ray spectroscopy, reaction-rate calculations (nuclear data driven)

University of Massachusetts Lowell — M.S., Physics 2023

Central Connecticut State University — B.S., Physics & Biomolecular Science (*Magna Cum Laude*) 2017–2020
Minors: Mathematics, Chemistry

Research Experience

Investigation of ^{57}Ni(p,γ)^{58}Cu in the νp process 2023–2026
University of Massachusetts Lowell / Argonne National Laboratory

- Conducted experiment with GAMMASPHERE (74 HPGe detectors) to study ^{58}Cu structure and decay pathways.
- Built level scheme using gamma-ray spectroscopy and angular distributions (data evaluation and consistency checks).
- Applied WinNet reaction networks to evaluate astrophysical impact.

Constraining the half-life of ^{72}Rb 2021–2023
University of Massachusetts Lowell — Advisor: Dr. Andrew Rogers

- Analyzed NSCL data with DDAS + ROOT to identify ^{72}Rb and measure half-life (decay data extraction).
- Used LISE++ for transmission corrections; applied TOF techniques for decay analysis.
- Modeled astrophysical consequences using MESA and OneZone.

Accretion disk effects in X-ray transient binary systems 2018–2020
Yale University — Advisor: Dr. Charles Bailyn

- Performed multi-night CCD observations (Palomar, LCO).
- Integrated data into eclipsing light-curve models; constrained system parameters statistically.

RR Lyrae as tracers of ultra-faint dwarf galaxies 2017–2018
Yale University — Advisor: Dr. Marla Geha

- Analyzed large public RR Lyrae datasets.

Microbial biofilm studies in *A. baumannii* 2018
Northeastern University — Advisor: Dr. Yunrong Chai

- Studied *A. baumannii* biofilms with *B. subtilis*; performed microscopy and gene editing.

Heat shock proteins in planarian regeneration 2017–2019
Central Connecticut State University — Advisor: Dr. Martin Kapper

- Measured heat shock protein expression via Western blot and PCR.

Professional Experience

Research Assistant, Physics Department, University of Massachusetts Lowell 2022–Present

- Designed, executed, and analyzed experimental nuclear physics measurements focused on gamma-ray spectroscopy and nuclear structure relevant to astrophysical reaction rates.
- Conducted experiments at U.S. national laboratories (ANL and FRIB), coordinating detector operations, beam conditions, and data acquisition systems.
- Developed and maintained Python and C++ (ROOT) analysis pipelines for large-volume coincidence data, including calibration, peak fitting, efficiency corrections, and uncertainty propagation.
- Performed computational modeling and sensitivity studies using nuclear reaction network codes (WinNet, MESA, OneZone) to assess the impact of experimental uncertainties on astrophysical and applied systems.
- Integrated laboratory hardware (HPGe detectors, NIM electronics, digital DAQ systems) with software-driven workflows to ensure reliable data collection and reproducibility.
- Prepared technical documentation, figures, and presentations for collaboration meetings, conferences, and reports, translating complex results for expert and non-expert audiences.
- Collaborated with multi-institution teams of experimentalists, theorists, and accelerator staff, contributing to experiment planning, troubleshooting, and post-run analysis.

Teaching Assistant, Physics Department, University of Massachusetts Lowell 2020–2022

- Instructed and supervised undergraduate physics laboratory and recitation sections, emphasizing experimental methods, measurement techniques, and uncertainty analysis.
- Prepared and delivered instructional material, demonstrations, and problem-solving sessions to support student learning across introductory and intermediate physics courses.
- Guided students in data collection, analysis, and scientific reporting, reinforcing best practices in documentation, reproducibility, and ethical research conduct.
- Evaluated laboratory reports, exams, and assignments; provided detailed, constructive feedback to improve technical writing and quantitative reasoning.
- Supported laboratory setup, calibration, and maintenance of instructional equipment, ensuring safe operation and compliance with departmental procedures.
- Mentored students from diverse academic backgrounds, strengthening communication skills and fostering inclusive, collaborative learning environments.

Tutor, Learning Center, Central Connecticut State University 2018–2020

- Tutored physics, chemistry (organic, general, bio and inorganic), Biology and mathematics (through Calculus III).
- Worked as a learning assistant for physics labs.

Combat Engineer (Sergeant, E-5), United States Marine Corps 2013–2018

- Led and supervised engineering teams in construction, demolition, and expeditionary infrastructure projects under strict safety and compliance standards.
- Supported airfield damage repair and runway restoration operations at MCAS Yuma, AZ, coordinating equipment, materials, and personnel to restore operational capability under time constraints.
- Deployed to Japan and cross-trained with allied partner nations during joint engineering exercises focused on infrastructure resilience, mobility, and contingency response.
- Served as Safety and Training Officer, conducting risk assessments, ensuring compliance with explosives handling and environmental regulations, and delivering technical training.
- Coordinated logistics, tasking, and reporting across multidisciplinary teams, strengthening planning, documentation, and technical communication skills.

Publications

First-Author

- S. Byrne, *Constraining the Half-Life of ^{72}Rb*, University of Massachusetts Lowell, 2024. United States – Massachusetts: ProQuest.

Co-Authored

- C. O'Shea, G. Lotay, D.T. Doherty, ... **S. Byrne**, et al., *The rate of the astrophysical $^{48}Cr(p,\gamma)^{49}Mn$ reaction and its influence on the potential A=48 waiting point in the rp process*, **Physics Letters B** 854, 138740 (2024). DOI: 10.1016/j.physletb.2024.138740

Co-Authored (To Be Submitted)

- C. O'Shea, G. Lotay, A. Gade, ... **S. Byrne**, et al., *Single-nucleon transfer unveils NiCu cycle in astrophysical X-ray bursts* (in review, 2025).
- S. Waniganeththi, A. Rogers, ... **S. Byrne**, et al., *Investigation of the missing isomer in the rare-earth nucleus ^{158}Pm* (in review, 2025).

Presentations & Posters

- 2025 — Low Energy Community Meeting (TAMU): *Investigation of the $^{57}Ni(p,\gamma)^{58}Cu$ reaction*
- 2025 — GRC Nuclear Chemistry (Colby College): *Investigation of the $^{57}Ni(p,\gamma)^{58}Cu$ reaction*
- 2025 — IReNA-CeNAM, Athens, OH: *$^{57}Ni(p,\gamma)^{58}Cu$ in the νp process*
- 2024 — APS DNP, Boston, MA: *$^{57}Ni(p,\gamma)^{58}Cu$ in the νp process*
- 2024 — Nuclear Structure, Argonne: *Constraining the Half-life of ^{72}Rb*
- 2020 — AAS, Honolulu, HI: *Accretion disk effects in X-ray transients*
- 2019 — APS New England, Springfield, MA: *Soft X-ray transient XTE J1118*
- 2018 — CUR REU Symposium, Washington, DC: A. baumannii *stress responses*
- 2018 — Eastern Science Colleges Conference, Ithaca, NY: *HSP70's role in planarian regeneration*

Summer Schools & Workshops

- 2025 — IReNA-CeNAM Frontiers in Nuclear Astrophysics Summer School
- 2025 — Open Questions in Nuclear Astrophysics Hackathon
- 2023 — Exotic Beam Summer School (FRIB/MSU)
- 2022 — Frontiers in Nuclear Astrophysics Junior Researcher Workshop, Notre Dame
- 2019 — Summer REU, Yale Astronomy Department
- 2018 — CUR REU, Northeastern University (Microbiology)
- 2017 — Warrior Scholar Program (Yale)

Technical Skills

Programming & Software: Python, C++, ROOT, Bash, Git/GitHub, LaTeX; Linux/Unix and Windows environments; WSL

Data Analysis & Visualization: Large-dataset processing; coincidence/spectral analysis; peak fitting; efficiency calibration; uncertainty propagation; Monte Carlo methods; statistical modeling; custom pipeline/tool development

Modeling & Simulation: Nuclear reaction networks (MESA, WinNet, OneZone, RatesMC); sensitivity studies; parameter scans; physics-based modeling; computational uncertainty quantification; Monte Carlo transport (general)

Experimental & DAQ: Gamma-ray spectroscopy; HPGe and scintillator detector systems; signal processing; calibration/energy alignment workflows; CDD data analysis

Laboratory Hardware & Instrumentation: Oscilloscopes; RF/DC sources; NIM electronics/modules; vacuum/beamline systems; nuclear instrumentation modules

Scientific Tools: RadWare; IRAF; LISE++
Professional Skills: Critical thinking, problem solving, rigorous documentation; experiment design; technical writing; briefing/presentations; collaboration across institutions; mentoring,advocating and training

Honors & Awards

- 2024 — UML Physics Department Service Award
- 2023 — UML Student Veteran of the Year
- 2020 — FAMOUS Travel Grant (AAS)
- 2019 — CT NASA Undergraduate Fellowship
- 2018 — NSF REU (Northeastern University)
- 2018 — CCSU Research Grant
- 2017 — Warrior Scholar Program (Yale STEM)

Leadership & Service

- Co-Chair, Gordon Research Seminar 2025–2027
- Committee Member, ECR ARUNA Committee 2025-2026
- Nuclear Physics Day Washington DC 2025
- President, Graduate Physics Association (UML) 2022–2025
- Vice President, Graduate Physics Association (UML) 2025–2026
- Treasury Board Member, Graduate Student Activities 2025–2026
- President, Student Veterans Organization (UML) 2021–2022
- Steward, UML GEO 2020–2025
- Volunteer Firefighter, Hazardville Fire Department, CT 2006–2010