LUC BARRETT

Experimental Physics Student - Amherst, MA
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EDUCATION

Master of Science - Computer Science, University of Massachusetts - Amherst — Sept 2024 -
Bay State Fellow

F24 Planned Coursework: Machine Learning†, Classical Mechanics†, Teaching Assistants as Tomorrow's Faculty†

Bachelor of Science - Physics, University of Massachusetts - Amherst — Jan 2020 - May 2024
GPA: 3.97 | *Commonwealth Honors Scholar, Phi Beta Kappa, Phi Kappa Phi*

Thesis: *Characterization of Drifting Charge Clusters in Liquid Xenon Produced by a Laser-Driven Photocathode for the nEXO Experiment*

Relevant Coursework: Quantum Computation: Physical Perspective*, Quantum Mechanics, Classical Mechanics, Electrodynamics, Statistical Mechanics, Computational Physics, Techniques of Theoretical Physics, Intermediate Laboratory

Bachelor of Science - Computer Science, University of Massachusetts - Amherst — Jan 2020 - May 2024

Relevant Coursework: Quantum Information Systems†, Quantum Algorithms, Artificial Intelligence, Machine Learning, Applications of Natural Language Processing, Computer Systems Principles, Data Structures & Algorithms, Reasoning Under Uncertainty

Bachelor of Science - Mathematics , University of Massachusetts - Amherst — Jan 2020 - May 2024

Relevant Coursework: Calculus I-III, Ordinary Differential Equations, Applied Linear Algebra*, Nonlinear Dynamics & Chaos Theory with Applications*, Real Analysis I*, Partial Differential Equations*, Differential Geometry*

** indiciates masters-level course (5xx)* *† indiciates graduate-level course (6xx+)*

RESEARCH EXPERIENCE

Research Assistant: nEXO — Jun 2023 -
University of Massachusetts - Amherst Department of Physics — *Amherst, MA*
PI: Prof. Krishna Kumar — Full-time/Independent Study

As part of the nEXO Collaboration, we are working towards developing an in-situ electron lifetime monitoring system as a component of the time projection chamber. My projects have so far included:
- Working on characterization of the signal processing chain (mainly charge sensitive preamplifier and shaper units)
- Design and creation of custom tools to aid in the precise assembly of the drift cell
- Data analysis and interpretation of the data taken from the electrode stack

Research Assistant: Quantum Information — Sept 2023 -
University of Massachusetts - Amherst College of Information and Computer Science — *Amherst, MA*
PI: Prof. Stefan Krastanov — Independent Study

Focused on development of a package/API written in Julia that includes tools to simulate gaussian quantum systems, designed to be publicly available upon completion. The package will support at least:
- Creation of arbitrary Gaussian states
- Many common gaussian operations (displace, rotate, squeeze, beam-splitter, etc)
- Arbitary multi-mode states
- Homodyne/heterodyne detection

Research Assistant: MOLLER — April 2022 - Jun 2023
University of Massachusetts - Amherst Department of Physics — *Amherst, MA*
PI: Prof. Krishna Kumar — Full-time/Independent Study

As part of the MOLLER Collaboration, we worked on various projects related to the research & development for the MOLLER experiment. My projects here have included:
- Designing an algorithm to smooth a rough simulation-generated contour curve without losing critical details
  - Used to generate a 3D profile of the electron signal that could be used by engineers in CAD
- Creation of a tool to simulate path-traced rays of light/radiation that could cause the creation secondary background sources
  - Recieved travel award to present this work in a poster session at the Fall 2023 joint meeting of the APS and JPS divisions of nuclear physics
  - "Program to Identify Secondary Background Sources in the MOLLER Experiment"
- Set up and configure a compute cluster running Ubuntu and Slurm for lab members to run batch simulation and data analysis tasks

SOFTWARE SKILLS

Languages	Python, Rust, C, C++, Javascript/Typescript, Julia, Java, Kotlin
Tools & Frameworks	PyTorch, ROOT, Geant4, Numpy, QuantumOptics.jl, QuTiP, Slurm, Nginx, Node.js, Next.js, React, LaTeX
Software	Git/Github, Linux, Fusion360, Solidworks, Cura, VSCode, PyCharm

TEACHING EXPERIENCE

Undergraduate Course Assistant - CS490Q: Quantum Information Science Spring 2024
University of Massachusetts - Amherst *Amherst, MA*
Supervisor: Prof. Stefan Krastanov

An introduction to quantum information science & quantum algorithms, targeted towards junior and senior physics or computer science majors. My responsibilities included grading homeworks and exams and holding office hours/review sessions.

Teaching Assistant - PHYS281: Computational Physics Spring 2022 & Fall 2023
University of Massachusetts - Amherst *Amherst, MA*
Supervisors: Prof. Stephane Willocq (S22), Prof. Shubha Tewari (F23)

A Python based course for sophomore physics students to learn programming techniques, numerical methods, and data analysis relevant to physics. I attended class meetings to assist students in working on in-class exercises, graded assignments, and hosted weekly office hours.

Teaching Assistant - PHYS181: Intro to Mechanics Fall 2021
University of Massachusetts - Amherst *Amherst, MA*
Supervisor: Prof. Narayanan Menon

This course serves as an introduction to the major, where students learn calculus based classical mechanics. I attended Team Based Learning (TBL) sessions in-class to assist students with problem sets and provide support, hosted office hours outside of class, and ran exam review sessions.

MENTORING EXPERIENCE

Peer Mentor: Physics Fall 2022 - May 2024
University of Massachusetts - Amherst Department of Physics *Amherst, MA*

I was invited by faculty members from the Department of Physics to serve as a mentor, where each year ('22-'23 and '23-'24) I was paired with three incoming freshman to provide with academic or social support and help them navigate the major, especially during the first year as they settle into the program.

Peer Mentor: CS Fall 2023 - May 2024
University of Massachusetts - Amherst College of Information and Computer Science *Amherst, MA*

I was accepted to serve as a peer mentor for the Computer Science Department, where I was paired with one incoming freshman student who had similar intersts. I was paired with a student double majoring in Physics & Computer Science, who I meet with regularly to help navigate the challenges of the double major.

HONORS & AWARDS

Bay State Fellowship: Competitive fellowship awarding a teaching assistantship position, providing a full tution waiver, health waiver, and stipend for up to four semesters for a masters degree in computer science. (Awarded S24)

Kandula Sastry Undergraduate Award: To encourage and recognize outstanding undergraduates in Physics, this award is given annually to the outstanding undergraduate student in the department. (S24)

LeRoy F. Cook Jr. Memorial Award: Presented to 1-2 undergraduate Physics majors for academic excellence, particularly those with involvement in teaching or outreach. (S23)

APS DNP 2023 Meeting: Awarded funding to travel to and attend the 2023 joint APS DNP / JNP meeting to present work as part of the MOLLER Collaboration. Link to poster. (F23)

Phi Beta Kappa: Honor society honoring students who achieve excellence in a broad-based exploration of the arts and sciences. (S24)

Phi Kappa Phi: Invite-only honor society admitting the top 7.5% of the junior class. (S23)

Dean's List: Awarded for all previous full-time semesters for obtaining a semester GPA of 3.5 or greater. (S20, F21, S22, F22, S23, F23)

EXTRA-CURRICULAR ACTIVITIES

Society of Physics Students: Ambassador Fall 2021 - May 2024
University of Massachusetts - Amherst *Amherst, MA*

I was elected in Fall of 2021 to serve as the '24 class Ambassador for the local chapter of the Society of Physics Students. My roles mainly included helping run and advertise events, as well as collecting feedback and interest from the general student body.