Cailin Plunkett

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Research Interests

Probing black hole properties and binary star evolution using gravitational-wave and multimessenger data.

Education

Massachusetts Institute of Technology, Cambridge, MA   *Aug. 2023 – present*
Ph.D. candidate in Physics (advisor: Salvatore Vitale)

Amherst College, Amherst, MA   *Sept. 2019 – May 2023*
Bachelor of Arts in Physics and Mathematics. Summa cum laude with distinction (GPA: 4.0/4.0)

Awards and Honors

National

Graduate Research Fellowship, *National Science Foundation*	*2025–8*
LeRoy Apker Award, *American Physical Society*	*2023*
Phi Beta Kappa Membership	*2023*
Barry M. Goldwater Scholarship	*2022*

Institutional

Kellogg Fellowship ($90,000 over three years), *Amherst College*	*2025–8*
Three Minute Thesis, People's Choice Award, *Amherst College*	*2023*
Bancroft Prize in Public Speaking, *Amherst College*	*2023*
William Warren Stifler Prize in Physics, *Amherst College*	*2023*
Mary Dailey Irvine Outstanding Thesis, *Five College Astronomy Dept.*	*2023*
Porter Prize in Astronomy, *Amherst College*	*2020*

Publications

4. **Plunkett, C.**; Mould, M.; Vitale, S. "Constraining Population III stellar populations with next-generation gravitational-wave observatories." *PRD* 112, 023039 (2025).

3. **Plunkett, C.**; Follette, K.; Marleau, G-D; Nielsen, E. "Accreting companion occurrence rates using a new method to compute emission-line survey sensitivity." *AJ* 169 262 (2025).

2. **Plunkett, C.**; Hourihane, S.; Chatziioannou, K. "Concurrent estimation of noise and compact-binary signal parameters in gravitational-wave data." *PRD* 106, 104021 (2022).

1. Betti, S. et al., incl. **Plunkett, C.** "The Comprehensive Archive of Substellar and Planetary Accretion Rates." *AJ* 166 262 (2023).

Research

Pre-thesis Research (MIT) *Aug. 2023 – present*

Constraining Population III stellar demographics with next-generation gravitational-wave detectors

Mentored by Professor Salvatore Vitale and Matthew Mould

- Studied Population III stars with next-generation gravitational-wave detectors. Developed novel mixed-modeling approach to leverage both astrophysics-informed and astrophysics-agnostic models in inference. Incorporated astrophysical simulations into the Bayesian analysis pipeline, allowing for direct inference on the stellar properties while crucially accounting for machine-learning training uncertainty.

Undergraduate Senior Thesis (Amherst) *Aug. 2022 – May 2023*

Population properties of protoplanets

Mentored by Professor Katherine Follette

- Developed method to compute selection effects for direct-imaging searches for accreting companions under flexible astrophysical assumptions, enabling unbiased analyses of protoplanets' population properties. Placed the first-ever constraints on the rate of protoplanets.

- Thesis earned collegiate and national recognition, including the APS LeRoy Apker Award. Corresponding first-author paper has been accepted in *the Astronomical Journal*.

Michigan Physics REU *June 2022 – Aug. 2022*

Improving searches for continuous gravitational waves

Mentored by Professor Keith Riles

- Explored new ways to deepen searches for continuous gravitational waves. Developed method to divide data into equal "Fourier drift" segments, which *adapts* the search to periods of rapid change. Results show this method improves SNR at minimal computational cost.

Caltech LIGO SURF Program *June 2021 – Aug. 2021*

Marginalizing over noise uncertainty in gravitational-wave parameter estimation

Mentored by Professor Katerina Chatziioannou and Sophie Hourihane

- Studied key assumption about detector noise in gravitational-wave data analysis. Compared noise point-estimate and marginalized methods for real gravitational wave events. Developed model to explain minimal impact of noise uncertainty. Published first-author paper in *PRD*.

Amherst SURF *June 2020 – Jan. 2021*

Toward a comprehensive database of substellar accretion rates

Mentored by Professors Kate Follette and Kim Ward-Duong

- Unified parameter estimation techniques in an accreting object database to identify differences in planet and stellar formation. Coauthor on the publication in *AJ*, 2023.

Presentations

Invited
1. APS April Meeting, Sacramento, CA. *Apr. 2024.* "Protoplanet Population Properties: a new method to compute survey sensitivity."

Contributed
2. APS Global Physics Summit, Anaheim, CA. *Mar. 2025.* "Unveiling the stellar origins of high-redshift black hole mergers with next-generation gravitational-wave observatories."
1. APS April Meeting, New York, NY. *Apr. 2022.* "Marginalizing over noise uncertainty in gravitational-wave parameter estimation."

Leadership, Outreach, and Engagement

MIT Graduate Admissions Advisory Council   *Jan. 2024 – present*
- Representative on advisory council, aiming to improve equity in admissions and ensure all talented students receive due consideration. Organize and mentor for an application assistance program.

MIT Summer Research Program   *Jan. 2024 – present*
- Serve on admissions committee for summer program that targets students with limited access to research. Improve access to career preparation and networking resources.

MIT Graduate Women in Physics   *Oct. 2023 – present*
- Mentor two undergraduate women on personal, academic, and career matters.

Climate and Community Committee   *Oct. 2020 – May 2023*
- Co-chair of Physics and Astronomy Dept. committee charged with addressing systemic access issues and institutional barriers to success in physics and astronomy, both in and beyond the Department.

Spectra Phys. & Astro. Club   *Sept. 2021 – May 2023*
- Ran a club designed to support underrepresented physics students. Coordinated mentorship program and research internship symposium for two years. Designed application peer-review workshop.

Amherst Observatory   *Sept. 2022 – May 2023*
- Student manager of the observatory, which comprises five telescopes for teaching and recreation. Led training sessions and programmed middle school outreach events.