# J. LUNA ZAGORAC

lunazagor lunazagor jlunazagorac 0000-0003-4504-1677 lzagorac@pitp.ca
Postdoctoral Fellow ⋄ Perimeter Institute ⋄ Waterloo, ON N2L 2Y5

## PROFILE

I'm a cosmologist through and through: passionate not just about what our silly little Universe is up to, but also the ways we as humans interact with and understand it. I love to work in radically interdisciplinary ways, from marrying quantum-inspired techniques and numerical simulations of wave dark matter to developing a Python package to map ancient Egyptian star data from hieroglyphs to virtual skies. I'm always keen to share my work & interests through scicomm, teaching, and mentoring.

## EMPLOYMENT

**Perimeter Institute for Theoretical Physics, Waterloo, ON** *Sep 2022 - Aug 2025*
Postdoctoral Fellow

## EDUCATION

**Yale University, New Haven, CT** *Aug 2016 - May 2022*
Ph.D. in Physics

**Colgate University, Hamilton, NY** *Aug 2012 - May 2016*
B.A. with Honors in Astronomy/Physics & Anthropology

## SKILLS AND QUALIFICATIONS

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|---|---|
| **Programming Languages** | Python, C/C++, MATLAB, Chapel, Pascal |
| **Python Packages** | Jupyter, MatPlotlib, Numba, NumPy, SciPy, PyFFTW, AstroPy |
| **Software & Tools** | LaTeX, Excel, Mathematica, ImageJ |
| **Communication skills** | Science & grant writing, outreach, public speaking, data visualization |
| **Certifications** | Yale Poorvu Center Certificate for Public Communication, Certificate of College Teaching Preparation |
| **Languages** | English & Serbian (native)<br>French, Italian & Arabic (limited proficiency)<br>Latin & Middle/Late Egyptian (intermediate) |

## HONORS & AWARDS

**Marie Sklodowska-Curie Postdoctoral Fellowship Seal of Excellence** *Feb 2025*
*Project proposal titled "Making Waves with Particles: Towards Scalable Hybrid Simulations of Ultra-Light Dark Matter" recognized as a high-quality project proposal in a highly competitive evaluation process.*

**Leigh Page Award for Excellence in Graduate Student Teaching** *Nov 2021*
*Award for $500 which recognizes broad and valuable contributions to physics education at Yale, science communication, and work fostering a welcoming learning environment for students.*

**Future Investigator in NASA Earth and Space Science and Technology** *May 2020*
*NASA Grant for* $90*k funding two years of doctoral work and independent investigations of ULDM.*

**Loyde and William C. G. Ortel Fellowship in Physics** *Nov 2020*
*Awarded to an outstanding student pursuing a Ph.D. in Physics.*

**Franke Science & Humanities Interdisciplinary Research Award** *Sep 2019*
*Yale Fellowship for $3000 funding two years of interdisciplinary work on Egyptian constellations.*

**Colgate Physics and Astronomy Department Founders Award** *Apr 2016*
*Awarded periodically to a senior who has demonstrated four years of outstanding progress and development of their understanding of physics or astronomy.*

**Sigma Pi Sigma Physics Honors Society** *Apr 2016*
*Honorary membership to Sigma Pi Sigma Honors Society.*

## PUBLICATIONS

[α] = alphabetical author list

9. **Zagorac** and Symons. "Modelling the Observational Method Behind Ramesside Star Clocks: Contextualizing Relevant Factors." *Submitted to JHA.*

8. Mirasola, Musoke, Neyrinck, Prescod-Weinstein, and **Zagorac**.[α] "The three phases of self-gravitating scalar field ground states." *arXiv: 2410.02663, submitted to PRD.*

7. Polzin et al. (including **Zagorac**). "Astronomy as a Field: A Guide for Aspiring Astrophysicists." *arXiv: 2312.04041, submitted to BAAS.*

6. Robles, **Zagorac**, and Padmanabhan. "Scalar Field Dark Matter: Impact of Supernovae-driven blowouts in the central densities of dwarf galaxies." *MNRAS, 532(2):1980–1990, August 2024.*

5. Gosenca, Eberhardt, Wang, Eggemeier, Kendall, **Zagorac**, and Easther. "Multifield Ultralight Dark Matter." *Physical Review D 107.8 (2023): 083014.*

4. **Zagorac**, Kendall, Padmanabhan, and Easther. "Soliton Formation and the Core-Halo Mass Relation for Synthetic ULDM Halos: An Eigenstate Perspective." *Physical Review D 107.8 (2023): 083513.*

3. **Zagorac**, Sands, Padmanabhan, and Easther. "Schrödinger-Poisson Solitons: Perturbation Theory." *Physical Review D 105.10 (2022): 103506.*

2. Padmanabhan, Ronaghan, **Zagorac**, and Easther. "Simulating Ultralight Dark Matter with Chapel: An Experience Report." (2019). *2020 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*

1. **Zagorac**, Easther, and Padmanabhan. "GUT-scale primordial black holes: mergers and gravitational waves." *Journal of Cosmology and Astroparticle Physics 2019.06 (2019): 052.*

## INVITED SEMINARS AND COLLOQUIA

[*] = Virtual

| | |
|---|---|
| George Mason University (Colloquium) | Sep 2025 |
| Bates College (Colloquium) | Dec 2024 |
| Bard College (Colloquium) | Nov 2024 |
| Kavli IPMU | Nov 2024 |
| McMaster University (Colloquium) | Sep 2024 |
| University of Oxford | Apr 2024 |
| American Museum of Natural History | Feb 2024 |
| Canadian Institute for Theoretical Astrophysics | Oct 2023 |
| University of Southern California | Sep 2023 |
| Jet Propulsion Laboratory | Sep 2023 |
| Colgate University (Colloquium) | Apr 2022 |
| Stockholm University[*] | Jan 2022 |
| Perimeter Institute[*] | Dec 2021 |
| Stony Brook University[*] | Nov 2021 |
| University College London[*] | Oct 2021 |
| Carnegie Observatories[*] | Oct 2021 |
| University of Hawaii Institute of Astronomy[*] | Oct 2021 |
| Northwestern University CIERA[*] | Oct 2021 |
| Newcastle University[*] | Sep 2021 |
| Center for Computational Astrophysics[*] | May 2020 |

## CONFERENCE PRESENTATIONS

† = Invited Speaker

**American Research Center in Egypt Annual Meeting** — Apr 2025
*On the Observational Method Behind Ramesside Star Clocks: Contextualizing Relevant Factors* — *San Francisco, CA*

**Kashiwa-no-ha Dark Matter and Cosmology Symposium** — Nov 2024
*On ground states of self-gravitating scalar fields* — *Tokyo, Japan*

**COSMO'24** — Oct 2024
*Not Really Quantum Cosmology: How far can we get by treating a DM halo like an atom?* — *Kyoto University Japan*

**Defining New Simulation Frontiers for Dark Matter Discovery** — Oct 2024
*An UltraShort Introduction to UltraLight Dark Matter* — *Toronto, ON*

†**Cosmic Signals of Dark Matter Physics: New Synergies** — Jun 2024
*Not Really Quantum Cosmology: How far can we get by treating a DM halo like an atom?* — *Kavli Institute for Theoretical Physics Santa Barbara, CA*

†**Canadian Association of Physicists Congress** — May 2024
*Keynote for Symposium on "Computational Advances in Astrophysics and Cosmology"* — *London, ON*

**Egyptian Cultural Heritage Now** — Nov 2023
*Using Python to Investigate Stellar Data from Ramesside Star Clocks* — *Cairo, Egypt*

**APS April Meeting** — Apr 2023
*Ultralight Dark Matter Dynamics in the Language of Eigenstates* — *Minneapolis, MN*

**Testing Gravity 2023** — Jan 2023
*UltraLight Dark Matter Dynamics in the Language of Eigenstates* — *Vancouver, BC*

**240th Meeting of the American Astronomical Society** — Jun 2022
*A Light in the Dark: UltraLight Dark Matter Phenomenology in Simulations* — *Virtual*

**Chapel Implementers and Users Workshop** — Jun 2022
*UltraLight Dark Matter in Simulations: A Chapel-Powered Eigenstate Perspective* — *Virtual*

**American Research Center in Egypt Annual Meeting** — Apr 2021
*In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks* — *Virtual*

**Aspen Winter Conference, A Rainbow of Dark Sectors** — Mar 2021
*UltraLight Dark Matter & Its Eigenstates* — *Virtual*

†**Connecticut Digital Humanities** — Feb 2021
*In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks* — *Virtual*

**236th Meeting of the American Astronomical Society** — Jun 2020
*Parametrizing UltraLight Dark Matter Haloes Through Binary Soliton Core Mergers* — *Virtual*

**235th Meeting of the American Astronomical Society** — Jan 2020
*A Light in the Dark: Ultra Light Dark Matter in Theory and Simulation* — *Hawaii Convention Center*

**Great Lakes Cosmology Workshop** — Aug 2019
*Pseudo-Spectral Solvers for Fuzzy Dark Matter* — *Rochester Institute of Technology*

**Tri-Institute Summer School on Elementary Particles** — Jul 2018
*Gravitational Wave Spectrum of Ultralight Primordial Black Holes* — *Perimeter Institute*

## POPULAR SCIENCE PRESENTATIONS

†**EinsteinPlus Workshop for Teachers** — Jul 2025
*A Bestiary of Dark Matter Candidates* — *Perimeter Institute*

†**Mexborough & Swinton Astronomical Society** — May 2025
*Digital Skies for Ancient Contexts:* — *Virtual*
*Using Python to Investigate Stellar Data from Ramesside Star Clocks*

†**Astronomical Society of Edinburgh** — June 2024
*Digital Skies for Ancient Contexts:* — *Virtual*
*Using Python to Investigate Stellar Data from Ramesside Star Clocks*

†**SciComm Collider 2** — May 2024
*Discussion leader for "Science Communications and the Humanities"* — *Perimeter Insitute*

†**iTelescope Webinar** — Dec 2023
*What we Can't See in the Universe (and Why it Might Be Fuzzy)* — *Virtual*

**Astronomy on Tap Kitchener-Waterloo** — Dec 2023
*A Bestiary of Dark Matter Candidates* — *Kitchener, ON*

†**Canadian Undergraduate Physics Conference** — Oct 2023
Panelist on *Change Your Basis: From Expert to Public* — *University of Waterloo*

†**Royal Astronomical Society of Canada Mississauga Centre Speaker Night** — Oct 2023
*What we Can't See in the Universe (and Why it Might Be Fuzzy)* — *Mississauga, ON*

†**SciComm Collider** — Apr 2023
*A Bestiary of Dark Matter Candidates* — *Perimeter Insitute*

†**David Dunlap Observatory Speaker's Night** — Dec 2022
*What we Can't See in the Universe (and Why it Might Be Fuzzy)* — *Virtual*

**Bay Area Science Festival "Astro Coffee"** — Oct 2020
*Cosmic Archaeology, or: How Do We Know the Things We Know?* — *Virtual*

**Ask a Scientist Webinar** — May 2020
*Dark Matter* — *Virtual*

**Astronomy on Tap New Haven** — Sep 2019
*Cosmic Archaeology, or: How Do We Know the Things We Know?* — *New Haven, CT*

**Yale 3 Minute Thesis Competition Finalist** — Apr 2019
*How Small Black Holes Teach Us about the Big Bang* — *Yale University*

## SCIENCE COMMUNICATION

**Public Communication Certificate** — Oct 2021
*Yale Poorvu Center for Teaching and Learning*
Certification in public communication through extensive preparation for the 3MT Competition. Areas: Text, Speech, and Visual Design; Feedback and Revision; Peer and Interdisciplinary Collaboration.

**Outreach Volunteering**

Volunteer, Explore Gallileo Exhibit at Perimeter Institute — *Feb 2024*
Volunteer, Dark Matter Night at Perimeter Institute — *Oct 2022*
Astronomy Ambassador, American Astronomical Society — *Jan 2020 - Present*
Volunteer, Yale Pathways to Science — *Fall 2018 - Spring 2019*
Activity Leader, CT Students Exploring Engineering Day — *Spring 2018*
Activity Leader, Girls Science Investigations — *Sep 2016 - Mar 2020*

**Writing**

STEM Pen Pal, Letters to a Pre-Scientist — *Sep 2024*
FirstPrinciples Contributing Author — *May 2024 - Present*
Astrobites Media Intern at AAS238 — *Jun 2021*
Astrobites Contributing Author (>20 articles and interviews) — *Dec 2019 - Dec 2021*
ComSciCon at the American Institute of Physics Participant — *Sep 2019*

## TEACHING EXPERIENCE

**Certificate of College Teaching Preparation (CCTP)** May 2022
*Yale Poorvu Center for Teaching and Learning*

A record of participation in teaching activities and reflections on those experiences. Earning the CCTP, also meets requirements for the Center for Integration of Research, Teaching and Learning Associate.

**Curriculum Development & Lecturing**

*SIRUS B Virtual Events for Remote Gathering and Engagement* *Jan 2024*

Lecture on "Cosmology and Dark Matter" as part of programming for Hawaiian middle school girls.

*Tri-Institute Summer School on Elementary Particles (TRISEP)* *June 2023*

Lecture on "Axion-Like Particles (and Why We Love Them)."

*The Yale Summer Program in Astrophysics* *Jul 2022*

Lecture on "Comparing Cosmologies: the History of the Cosmos from Pyramids to Space Telescopes."

*Yale Institute of Sacred Music* *Mar 2021*

Lecture in graduate-level religion class on "Cosmogonies, Cosmologies, & Time"

*Yale Bootcamp on Physics Fundamentals* *Summer 2019 - 2021*

Co-developed a curriculum for 20 hours of Classical Mechanics instruction, met weekly with staff supervisor to polish lectures and example problems. Delivered 10 hours of lecture at the Bootcamp. Developed a Mathematica tutorial for incoming graduate students. Re-vamped the curriculum and moved it online for Summer 2020 and Summer 2021.

**Teaching Fellow Positions**

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|---|---|
| S&DS176 - YData: Humanities Data Mining | *Spring 2022* |
| PHYS/ASTR600 - Cosmology | *Fall 2020* |
| PHYS442 - Introduction to Nuclear and Elementary Particle Physics | *Spring 2020* |
| PHYS410 - Classical Mechanics | *Fall 2019* |
| ASTR343 - Gravity, Astrophysics, and Cosmology | *Spring 2019* |
| PHYS170/171 - University Physics for the Life Sciences | *Fall 2017 - Spring 2018* |
| PHYS165/166 - General Physics Laboratory | *Fall 2016 - Spring 2017* |

## SERVICE & LEADERSHIP

**Committee Work**

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|---|---|
| Perimeter Institute Anti-Racism Working Group Member | *Sep 2022 - Present* |
| Astrobites Diversity, Equity, and Inclusion Committee Member | *Mar 2020 - Dec 2021* |
| Physics Climate and Diversity Committee Member | *Jan 2018 - May 2020* |

**Conference & Seminar Organization**

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|---|---|
| Co-organizer: Black in Physics Week at Yale Event Series | 2020 |
| Volunteer: Conference for Undergraduate Women in Physics | 2019-2020 |
| Co-organizer: Equity in the Job Search Symposium | 2018-2019 |

**University Positions**

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|---|---|
| Yale Digital Humanities Lab Consultant | *Sep 2020 - May 2022* |
| McDougal Graduate Student Life Fellow at Yale | *Aug 2018 - May 2019* |
| Graduate Affiliate, Pauli Murray College at Yale | *Fall 2017 - Spring 2022* |

## MENTORSHIP

**Perimeter Institute PSI Start Summer Undergraduate Research Project** 2024
*Dynamical Heating in Early Fuzzy Galaxies* *with Prof. Katie Mack*

Nikki Veilleux (Bishop's University)

**Perimeter Institute PSI Winter School Masters Research Project** 2023
*Dynamical Heating in Early Fuzzy Galaxies* *with Prof. Katie Mack*

Cole Coughlin (Ph.D. at PI starting 2023)
Anna Knörr (Ph.D at Harvard starting 2024)

**Perimeter Institute Postoc-PhD Mentoring**

Alice Chen, Samantha Hergott 2023-2025
Maxence Corman, Ramiro Cayuso 2022-2023

**Yale Undergraduate Researchers Supervised**

Claire Recamier (Researcher at Los Alamos National Lab starting 2023): *Jun 2021 - May 2023*
*Stellar Streams in UltraLight Dark Matter Halos*

Isabel Sands (Ph.D. at Caltech starting 2021): *Jan 2020 - Jun 2021*
*Constructing a Binary Soliton Merger Library*
*Linear Approximations to UltraLight Dark Matter Stationary States*

**Other Formalized Mentoring Activities**

SU(5) Group Mentor *Fall 2020*
Científico Latino Graduate Student Mentoring Initiative (GSMI) Mentor *Fall 2019*
Women in Science at Yale (WISAY) Mentor *2016-2019*