

# J. LUNA ZAGORAC

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Postdoctoral Fellow ◇ Perimeter Institute ◇ Waterloo, ON N2L 2Y5

## PROFILE

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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

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

## EDUCATION

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

## HONORS & AWARDS

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

**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.*

**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.*

**Alumni Memorial Scholar at Colgate University** *Aug 2012*  
*Scholars are selected at the time of admission to Colgate for their dedication and interest in scholarship and have the opportunity to apply for grants totaling up to \$5,000 to fund independent research.*

## PUBLICATIONS

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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.” *arXiv: 2308.14691*, submitted to *MNRAS*.
5. Gosenca, Eberhardt, Wang, Eggemeier, Kendall, **Zagorac**, and Easter. “Multifield Ultralight Dark Matter.” *Physical Review D* 107.8 (2023): 083014.
4. **Zagorac**, Kendall, Padmanabhan, and Easter. “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 Easter. “Schrödinger-Poisson Solitons: Perturbation Theory.” *Physical Review D* 105.10 (2022): 103506.
2. Padmanabhan, Ronaghan, **Zagorac**, and Easter. “Simulating Ultralight Dark Matter with Chapel: An Experience Report.” (2019). *2020 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*
1. **Zagorac**, Easter, 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

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\* = Virtual

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	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

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† = Invited Speaker

† <b>Cosmic Signals of Dark Matter Physics: New Synergies</b>	June 2024
<i>Not Really Quantum Cosmology:</i>	<i>Kavli Institute for Theoretical Physics</i>
<i>How far can we get by treating a DM halo like an atom?</i>	<i>Santa Barbara, CA</i>
† <b>Canadian Association of Physicists Congress</b>	May 2024
<i>Keynote for Symposium on “Computational Advances in Astrophysics and Cosmology”</i>	<i>London, ON</i>
<b>Egyptian Cultural Heritage Now</b>	Nov 2023
<i>Using Python to Investigate Stellar Data from Ramesside Star Clocks</i>	<i>Cairo, Egypt</i>

<b>APS April Meeting</b> <i>Ultralight Dark Matter Dynamics in the Language of Eigenstates</i>	Apr 2023 Minneapolis, MN
<b>Testing Gravity 2023</b> <i>UltraLight Dark Matter Dynamics in the Language of Eigenstates</i>	Jan 2023 Simon Fraser University
<b>240th Meeting of the American Astronomical Society</b> <i>A Light in the Dark: UltraLight Dark Matter Phenomenology in Simulations</i>	Jun 2022 Virtual
<b>Chapel Implementers and Users Workshop</b> <i>UltraLight Dark Matter in Simulations: A Chapel-Powered Eigenstate Perspective</i>	Jun 2022 Virtual
<b>American Research Center in Egypt Annual Meeting</b> <i>In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks</i>	Apr 2021 Virtual
<b>Aspen Winter Conference, A Rainbow of Dark Sectors</b> <i>UltraLight Dark Matter &amp; Its Eigenstates</i>	Mar 2021 Virtual
<b>†Connecticut Digital Humanities</b> <i>In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks</i>	Feb 2021 Virtual
<b>236th Meeting of the American Astronomical Society</b> <i>Parametrizing UltraLight Dark Matter Haloes Through Binary Soliton Core Mergers</i>	Jun 2020 Virtual
<b>235th Meeting of the American Astronomical Society</b> <i>A Light in the Dark: Ultra Light Dark Matter in Theory and Simulation</i>	Jan 2020 Hawaii Convention Center
<b>Great Lakes Cosmology Workshop</b> <i>Pseudo-Spectral Solvers for Fuzzy Dark Matter</i>	Aug 2019 Rochester Institute of Technology
<b>Tri-Institute Summer School on Elementary Particles</b> <i>Gravitational Wave Spectrum of Ultralight Primordial Black Holes</i>	Jul 2018 Perimeter Institute

## POPULAR SCIENCE PRESENTATIONS

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† = Invited Speaker

<b>†Astronomical Society of Edinburgh</b> <i>Digital Skies for Ancient Contexts: Using Python to Investigate Stellar Data from Ramesside Star Clocks</i>	June 2024 Virtual
<b>†SciComm Collider 2</b> <i>Discussion leader for “Science Communications and the Humanities”</i>	May 2024 Perimeter Institute
<b>†iTelescope Webinar</b> <i>What we Can’t See in the Universe (and Why it Might Be Fuzzy)</i>	Dec 2023 Virtual
<b>Astronomy on Tap Kitchener-Waterloo</b> <i>A Bestiary of Dark Matter Candidates</i>	Dec 2023 Kitchener, ON
<b>†Canadian Undergraduate Physics Conference</b> Panelist on <i>Change Your Basis: From Expert to Public</i>	Oct 2023 University of Waterloo
<b>†Royal Astronomical Society of Canada Mississauga Centre Speaker Night</b> <i>What we Can’t See in the Universe (and Why it Might Be Fuzzy)</i>	Oct 2023 Mississauga, ON
<b>†SciComm Collider</b> <i>A Bestiary of Dark Matter Candidates</i>	Apr 2023 Perimeter Institute
<b>†David Dunlap Observatory Speaker’s Night</b> <i>What we Can’t See in the Universe (and Why it Might Be Fuzzy)</i>	Dec 2022 Virtual

<b>Bay Area Science Festival “Astro Coffee”</b> <i>Cosmic Archaeology, or: How Do We Know the Things We Know?</i>	Oct 2020 <i>Virtual</i>
<b>Ask a Scientist Webinar</b> <i>Dark Matter</i>	May 2020 <i>Virtual</i>
<b>Astronomy on Tap New Haven</b> <i>Cosmic Archaeology, or: How Do We Know the Things We Know?</i>	Sep 2019 <i>New Haven, CT</i>
<b>Yale 3 Minute Thesis Competition Finalist</b> <i>How Small Black Holes Teach Us about the Big Bang</i>	Apr 2019 <i>Yale University</i>

## TEACHING EXPERIENCE

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<b>Certificate of College Teaching Preparation (CCTP)</b> <i>Yale Poorvu Center for Teaching and Learning</i>	May 2022
A record of participation in teaching activities and reflections on those experiences. Earning the CCTP, also meets requirements for the <a href="#">Center for Integration of Research, Teaching and Learning</a> Associate.	
<b>Curriculum Development &amp; Lecturing</b> <i>SIRUS B Virtual Events for Remote Gathering and Engagement</i>	Jan 2024
Lecture on “Cosmology and Dark Matter” as part of programming for Hawaiian middle school girls.	
<i>Tri-Institute Summer School on Elementary Particles (TRISEP)</i>	June 2023
Lecture on “Axion-Like Particles (and Why We Love Them).”	
<i>The Yale Summer Program in Astrophysics</i>	Jul 2022
Lecture on “Comparing Cosmologies: the History of the Cosmos from Pyramids to Space Telescopes.”	
<i>Yale Institute of Sacred Music</i>	Mar 2021
Lecture in graduate-level religion class on “Cosmogonies, Cosmologies, & Time”	
<i>Yale Bootcamp on Physics Fundamentals</i>	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.	
<b>Teaching Fellow Positions</b>	
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

## SCIENCE COMMUNICATION

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### 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, 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

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*

## SERVICE & LEADERSHIP

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### Committee Work

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

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

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

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### Perimeter Institute PSI Start Summer School 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

*2023-2024*

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*

## **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*