

# J. LUNA ZAGORAC

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TSI Postdoctoral Fellow ◇ McGill University ◇ Montreal, QC

## 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

<b>McGill University, Montréal, QC</b> Trottier Space Institute Postdoctoral Fellow	<i>Sep 2025 - Aug 2028</i>
<b>Perimeter Institute for Theoretical Physics, Waterloo, ON</b> Postdoctoral Fellow	<i>Sep 2022 - Aug 2025</i>

## EDUCATION

<b>Yale University, New Haven, CT</b> Ph.D. in Physics	<i>Aug 2016 - May 2022</i>
<b>Colgate University, Hamilton, NY</b> B.A. with Honors in Astronomy/Physics & Anthropology	<i>Aug 2012 - May 2016</i>

## SKILLS AND QUALIFICATIONS

<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

<b>Marie Skłodowska-Curie Postdoctoral Fellowship Seal of Excellence</b> <i>Proposal titled "Making Waves with Particles: Towards Scalable Hybrid Simulations of UltraLight Dark Matter" recognized as a high-quality project proposal in a highly competitive evaluation process.</i>	<i>Feb 2025</i>
<b>Leigh Page Award for Excellence in Graduate Student Teaching</b> <i>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.</i>	<i>Nov 2021</i>
<b>Future Investigator in NASA Earth and Space Science and Technology</b> <i>NASA Grant for \$90k funding two years of doctoral work and independent investigations of ULDM.</i>	<i>May 2020</i>
<b>Loyde and William C. G. Ortel Fellowship in Physics</b> <i>Awarded to an outstanding student pursuing a Ph.D. in Physics.</i>	<i>Nov 2020</i>
<b>Franke Science &amp; Humanities Interdisciplinary Research Award</b> <i>Yale Fellowship for \$3000 funding two years of interdisciplinary work on Egyptian constellations.</i>	<i>Sep 2019</i>
<b>Colgate Physics and Astronomy Department Founders Award</b> <i>Awarded periodically to a senior who has demonstrated four years of outstanding progress and development of their understanding of physics or astronomy.</i>	<i>Apr 2016</i>
<b>Sigma Pi Sigma Physics Honors Society</b> <i>Honorary membership to Sigma Pi Sigma Honors Society.</i>	<i>Apr 2016</i>

## PUBLICATIONS

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<sup>α</sup> = 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**.<sup>α</sup> “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 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

McGill HEP Journal Club	Oct 2025
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

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<sup>†</sup> = Invited Speaker

### **Axions in Japan**

*Invited plenary speaker*

Nov 2025

*Tokyo, Japan*

### **American Research Center in Egypt Annual Meeting**

*On the Observational Method Behind Ramesside Star Clocks:  
Contextualizing Relevant Factors*

Apr 2025

*San Francisco, CA*

### **Kashiwa-no-ha Dark Matter and Cosmology Symposium**

*On ground states of self-gravitating scalar fields*

Nov 2024

*Tokyo, Japan*

### **COSMO'24**

*Not Really Quantum Cosmology:*

*How far can we get by treating a DM halo like an atom?*

Oct 2024

*Kyoto University*

*Japan*

### **Defining New Simulation Frontiers for Dark Matter Discovery**

*An UltraShort Introduction to UltraLight Dark Matter*

Oct 2024

*Toronto, ON*

### **<sup>†</sup>Cosmic Signals of Dark Matter Physics: New Synergies**

*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*

Jun 2024

### **<sup>†</sup>Canadian Association of Physicists Congress**

*Keynote for Symposium on “Computational Advances in Astrophysics and Cosmology”*

May 2024

*London, ON*

### **Egyptian Cultural Heritage Now**

*Using Python to Investigate Stellar Data from Ramesside Star Clocks*

Nov 2023

*Cairo, Egypt*

### **APS April Meeting**

*Ultralight Dark Matter Dynamics in the Language of Eigenstates*

Apr 2023

*Minneapolis, MN*

### **Testing Gravity 2023**

*UltraLight Dark Matter Dynamics in the Language of Eigenstates*

Jan 2023

*Vancouver, BC*

### **240th Meeting of the American Astronomical Society**

*A Light in the Dark: UltraLight Dark Matter Phenomenology in Simulations*

Jun 2022

*Virtual*

### **Chapel Implementers and Users Workshop**

*UltraLight Dark Matter in Simulations: A Chapel-Powered Eigenstate Perspective*

Jun 2022

*Virtual*

### **American Research Center in Egypt Annual Meeting**

*In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks*

Apr 2021

*Virtual*

### **Aspen Winter Conference, A Rainbow of Dark Sectors**

*UltraLight Dark Matter & Its Eigenstates*

Mar 2021

*Virtual*

### **<sup>†</sup>Connecticut Digital Humanities**

*In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks*

Feb 2021

*Virtual*

### **236th Meeting of the American Astronomical Society**

*Parametrizing UltraLight Dark Matter Haloes Through Binary Soliton Core Mergers*

Jun 2020

*Virtual*

### **235th Meeting of the American Astronomical Society**

*A Light in the Dark: Ultra Light Dark Matter in Theory and Simulation* *Hawaii Convention Center*

Jan 2020

### **Great Lakes Cosmology Workshop**

*Pseudo-Spectral Solvers for Fuzzy Dark Matter*

Aug 2019

*Rochester Institute of Technology*

### **Tri-Institute Summer School on Elementary Particles**

*Gravitational Wave Spectrum of Ultralight Primordial Black Holes*

Jul 2018

*Perimeter Institute*

## POPULAR SCIENCE PRESENTATIONS

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† <b>EinsteinPlus Workshop for Teachers</b> <i>A Bestiary of Dark Matter Candidates</i>	Jul 2025 <i>Perimeter Institute</i>
† <b>Mexborough &amp; Swinton Astronomical Society</b> <i>Digital Skies for Ancient Contexts:</i> <i>Using Python to Investigate Stellar Data from Ramesside Star Clocks</i>	May 2025 <i>Virtual</i>
† <b>Astronomical Society of Edinburgh</b> <i>Digital Skies for Ancient Contexts:</i> <i>Using Python to Investigate Stellar Data from Ramesside Star Clocks</i>	June 2024 <i>Virtual</i>
† <b>SciComm Collider 2</b> <i>Discussion leader for “Science Communications and the Humanities”</i>	May 2024 <i>Perimeter Institute</i>
† <b>iTelescope Webinar</b> <i>What we Can't See in the Universe (and Why it Might Be Fuzzy)</i>	Dec 2023 <i>Virtual</i>
<b>Astronomy on Tap Kitchener-Waterloo</b> <i>A Bestiary of Dark Matter Candidates</i>	Dec 2023 <i>Kitchener, ON</i>
† <b>Canadian Undergraduate Physics Conference</b> <i>Panelist on Change Your Basis: From Expert to Public</i>	Oct 2023 <i>University of Waterloo</i>
† <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 <i>Mississauga, ON</i>
† <b>SciComm Collider</b> <i>A Bestiary of Dark Matter Candidates</i>	Apr 2023 <i>Perimeter Institute</i>
† <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 <i>Virtual</i>
<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>

## SCIENCE COMMUNICATION

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<b>Public Communication Certificate</b> <i>Yale Poorvu Center for Teaching and Learning</i>	Oct 2021
Certification in public communication through extensive preparation for the 3MT Competition. Areas: Text, Speech, and Visual Design; Feedback and Revision; Peer and Interdisciplinary Collaboration.	
<b>Outreach Volunteering</b>	
STEM Pen Pal, Letters to a Pre-Scientist	<i>Sep 2024 - Present</i>
Volunteer, Ask a Scientist at Perimeter Institute	<i>July 2025</i>
Volunteer, Explore Gallileo Exhibit at Perimeter Institute	<i>Feb 2024</i>
Volunteer, Dark Matter Night at Perimeter Institute	<i>Oct 2022</i>
Astronomy Ambassador, American Astronomical Society	<i>Jan 2020 - 2022</i>

Volunteer, Yale Pathways to Science	<i>Fall 2018 - Spring 2019</i>
Activity Leader, CT Students Exploring Engineering Day	<i>Spring 2018</i>
Activity Leader, Girls Science Investigations	<i>Sep 2016 - Mar 2020</i>

## Writing

FirstPrinciples Contributing Author	<i>May 2024 - Present</i>
Astrobites Media Intern at AAS238	<i>Jun 2021</i>
Astrobites Contributing Author (>20 <a href="#">articles and interviews</a> )	<i>Dec 2019 - Dec 2021</i>
ComSciCon at the American Institute of Physics Participant	<i>Sep 2019</i>

## TEACHING EXPERIENCE

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<b>Certificate of College Teaching Preparation (CCTP)</b>	May 2022
<i>Yale Poorvu Center for Teaching and Learning</i>	

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

<i>SIRUS B Virtual Events for Remote Gathering and Engagement</i>	<i>Jan 2024</i>
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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>	<i>June 2023</i>
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Lecture on “Axion-Like Particles (and Why We Love Them).”

<i>The Yale Summer Program in Astrophysics</i>	<i>Jul 2022</i>
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Lecture on “Comparing Cosmologies: the History of the Cosmos from Pyramids to Space Telescopes.”

<i>Yale Institute of Sacred Music</i>	<i>Mar 2021</i>
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Lecture in graduate-level religion class on “Cosmogonies, Cosmologies, & Time”

<i>Yale Bootcamp on Physics Fundamentals</i>	<i>Summer 2019 - 2021</i>
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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

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

## SERVICE & LEADERSHIP

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### Committee Work

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

### 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	<i>Sep 2020 - May 2022</i>
McDougal Graduate Student Life Fellow at Yale	<i>Aug 2018 - May 2019</i>
Graduate Affiliate, Pauli Murray College at Yale	<i>Fall 2017 - Spring 2022</i>

## MENTORSHIP

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<b>Perimeter Institute PSI Start Summer Undergraduate Research Project</b>	2024
<i>Dynamical Heating in Early Fuzzy Galaxies</i>	<i>with Prof. Katie Mack</i>
Nikki Veilleux (Bishop's University)	

<b>Perimeter Institute PSI Winter School Masters Research Project</b>	2023
<i>Dynamical Heating in Early Fuzzy Galaxies</i>	<i>with Prof. Katie Mack</i>
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):	<i>Jun 2021 - May 2023</i>
<i>Stellar Streams in UltraLight Dark Matter Halos</i>	
Isabel Sands (Ph.D. at Caltech starting 2021):	<i>Jan 2020 - Jun 2021</i>
<i>Constructing a Binary Soliton Merger Library</i>	
<i>Linear Approximations to UltraLight Dark Matter Stationary States</i>	

### Other Formalized Mentoring Activities

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