J. LUNA ZAGORAC

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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

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) French, Italian & Arabic (limited proficiency) 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 UltraLight 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 $90k 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.

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

[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)	Oct 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

†**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

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

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

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 2023-2025
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

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*