J. LUNA ZAGORAC

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Physics PhD Candidate ◇ Yale University ◇ New Haven, CT 06511
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EDUCATION

Yale University, New Haven, CT *August 2016 - Present*
Ph.D. anticipated in August, 2022

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

Old Rochester Regional High School, Mattapoisett, MA *August 2011 - June 2012*
Foreign Exchange Student

Prva beogradska gimnazija, Belgrade, Serbia *September 2008 - June 2011*
Vuk Stefanović-Karadžić Honors High School Student

SKILLS AND QUALIFICATIONS

Programming Languages	Python, C/C++, MATLAB, Chapel, Pascal
Python Packages	Jupyter, Matplotlib, Numpy, Scipy, PyFFTW
Software & Tools	LaTeX, Excel, Mathematica, ImageJ, Slurm & PBS schedulers
Languages	English & Serbian (native) French & Italian (proficient), Arabic (conversational) Latin & Middle/Late Egyptian (intermediate)

RESEARCH EXPERIENCE

UltraLight Dark Matter Simulations and Observational Constraints Jan 2019 - Present
Professor Nikhil Padmanabhan & Professor Richard Easther *Yale University*

Developing the ChapelUltra pseudo-spectral solver, oprimizing it for HPC use, and using it to simulate UltraLight Dark Matter, and comparing with data to assess candidate feasibility. Tests of ULDM include parametrizing binary collisions of ULDM haloes, modelling stellar streams in a ULDM halo, and interactions of baryonic disks and ULDM. Project supported by FINESST grant.

An Astronomical View of Ancient Egyptian Star Clocks Sep 2019 - May 2021
Professor Priya Natarajan & Professor John Coleman Darnell *Yale University*

Interdisciplinary project funded by the Franke Program in the Humanities & Natural Sciences at Yale focused on developing the code decanO.py to track and analyze the movement of Ancient Egyptian decans in the night sky and compare the results with primary sources. The goal of this project is a full mapping between the Ancient Egyptian decan constellations and modern constellations.

Gravitational Signatures of Primordial Black Holes September 2017 - March 2019
Professor Nikhil Padmanabhan & Professor Richard Easther *Yale University*

Modeled primordial black hole creation mechanisms in the early universe, constrained their 2-body interactions and dynamics, and calculated resultant gravitational wave spectra from mergers for allowed parameter space. Publication in JCAP.

Particle Mesh Code for Bi- and Power Spectra January 2017 - August 2017
Professor Nikhil Padmanabhan *Yale University*

Wrote particle mesh code to calculate the power spectrum and bispectrum from GADGET-2 simulation data in C++. Tested the code by generating a Gaussian random field to run through the code and compared results with analytically calculated power spectra and bispectra for the Gaussian case.

Data Reduction for SMARTS Consortium at Yale November 2016 - May 2017
Professor Charles Bailyn *Yale University*

Reduced a backlog of AGN spectra collected by the Yale SMARTS Consortium using Yale's software pipeline. Prepared data for online publication for use by collaborators.

Supermassive WIMP Production in the Early Universe August 2015 - May 2016
Professor Patrick Crotty *Colgate University*

Wrote senior honors thesis titled "Constraining WIMPzilla Production in the Inflationary Phase of the Early Universe." Wrote an equation solver in Python, using Numpy and Scipy for analysis and Matplotlib for visualizations. Varied coefficients describing shape of sigmoid inflaton field and calculated resulting DM abundances with assumed particle mass. Presented preliminary results at Syracuse University Undergraduate Research Day.

Volunteer Archaeologist at South Asasif Conservation Project June - July 2015
Dr. Elena Pischikova *Luxor, Egypt*

Supervised team of workers doing excavation; organized, labeled, and stored finds, and documented site progress daily. Used dumpy-level photography and measurements to produce accurate technical drawings of the site. Wrote up extensive field reports for the site director.

Observations and Analysis of 2014 Flare of Blazar 3C454.3 June 2014 - August 2014
Professor Thomas Balonek *Colgate University*

Observed AGN at Foggy Bottom Observatory at Colgate University on a 16-inch, Newtonian-Cassegrain telescope. Reduced all data using UNIX, IRAF, and Pascal-based software, with analysis focusing on 3C454.3 and its historic flare that summer. Compared our optical data with Yale SMARTS data of the same object to find excellent agreement, as well as radio data from the Submillimeter Array. No correlation between radio and optical flares was found.

TEACHING EXPERIENCE

Curriculum Development & Lecturing June - August 2019, 2020
Yale Bootcamp on Physics Fundamentals

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

Head Teaching Fellow Positions August 2017 - May 2018
PHYS170/171 - University Physics for the Life Sciences

Organized other teaching fellows, staffed weekly help sessions and office hours, held review sessions on material before exams, graded weekly homework, proctored and graded exams.

Teaching Fellow Positions Fall 2016 - Fall 2020

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*
PHYS165/166 - General Physics Laboratory *Fall 2016 - Spring 2017*

HONORS & AWARDS

Loyde and William C. G. Ortel Fellowship in Physics	*November 2020*
Future Investigator in NASA Earth and Space Science and Technology (FINESST)	*May 2020*
Franke Program in Science & The Humanities Interdisciplinary Research Award	*September 2019*
Colgate Physics and Astronomy Department Founders Award	*April 2016*
Sigma Pi Sigma Physics Honors Society	*April 2016*
Alumni Memorial Scholar at Colgate University	*August 2012 - May 2016*

PUBLICATIONS

Padmanabhan, Ronaghan, **Zagorac**, and Easther. "Simulating Ultralight Dark Matter with Chapel : An Experience Report." *In preparation.*

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

Balonek, Weaver, Didio, Jenks, Morris, Stahlin, **Zagorac**, Chapman, D'Auteuil, Karnes, Reding. The Optical Variability of the Blazar 3C 454.3. Over Three Decades from the Colgate University Foggy Bottom Observatory. In American Astronomical Society Meeting Abstracts 229 2017 Jan (Vol. 229).

Balonek, Weaver, Didio, Jenks, Morris, **Zagorac**, D'Auteuil, Karnes, Reding, Rose, Rilinger. The 2013-2015 Optical Outburst and Historic Light Curve of the Blazar 3C 454.3. In American Astronomical Society Meeting Abstracts 227 2016 Jan (Vol. 227).

PRESENTATIONS

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

Poster: Aspen Winter Conference, A Rainbow of Dark Sectors March 2021
UltraLight Dark Matter & Its Eigenstates *Virtual*

Talk: Connecticut Digital Humanities February 2021
In Search of Lost Time: An Astronomical View of Ancient Egyptian Star Clocks *Virtual*

Talk: Bay Area Science Festival Science Cafe Mini-Talks in Astronomy October 2020
Cosmic Archaeology, or: How Do We Know the Things We Know? *Virtual*

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

Invited Talk: Center for Computational Astrophysics May 2020
Parametrizing UltraLight Dark Matter Haloes Through Binary Soliton Core Mergers *Virtual*

Talk: Weak Interaction Discussion Group at Yale May 2020
Parametrizing UltraLight Dark Matter Haloes Through Binary Soliton Core Mergers *Virtual*

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

Presentation: Great Lakes Cosmology Workshop August 2019
Pseudo-Spectral Solvers for Fuzzy Dark Matter *Rochester Institute of Technology*

Poster: Tri-Institute Summer School on Elementary Particles July 2018
Gravitational Wave Spectrum of Ultralight Primordial Black Holes *Perimeter Institute*

Presentation: Colgate University Honors Thesis Defense April 2016
Saving Tokyo: Constraining WIMPzilla Production in the Early Universe *Colgate University*

Presentation: Syracuse University Undergraduate Research Day December 2015
Constraining WIMPzilla Production in the Early Universe *Syracuse University*

Presentation: Keck Northeastern Astronomy Consortium November 2014
The Optical and Radio Variability of the Blazar 3C 454.3 *Swarthmore College*

Presentation: Colgate Physics & Astronomy Welcome Seminar September 2014
The Variability of Blazar 3C 454.3 *Colgate University*

SERVICE & LEADERSHIP

Yale Digital Humanities Lab Consultant *September 2020 - Present*
Astrobites Diversity, Equity, and Inclusion Committee Member *March 2020 - Present*
Physics Climate and Diversity Committee Member *January 2018 - May 2020*
McDougal Graduate Student Life Fellow at Yale *August 2018 - May 2019*
Graduate Affiliate, Pauli Murray College *Fall 2017 - Present*

SCIENCE WRITING & OUTREACH

American Astronomical Society's Astronomy Ambassador *January 2020 - Present*
Ask a Scientist Presenter *May 2020*
Astrobites Contributing Author *December 2019 - Present*
Astronomy on Tap Presenter: *Cosmic Archaeology* *August 2019*
Yale 3 Minute Thesis Competition Finalist *April 2019*
Volunteer, Yale Pathways to Science *Fall 2018 - Spring 2019*
Activity Leader, CT Students Exploring Engineering Day *Spring 2018*
Activity Leader, Girls Science Investigations *September 2016 - Present*

MENTORSHIP

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*

PROFESSIONAL ASSOCIATIONS

American Astronomical Society
American Physical Society
American Research Center in Egypt