

Postdoctoral Research Fellow · ML for Astrophysics

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### Summary\_

Postdoctoral research fellow at Ciela Institute, joint with Université de Montréal and Mila. Developing and employing machine learning approaches to astrophysics. Extensive experience in gravitational microlensing searches for free-floating planets and light primordial black holes.

# Education\_

University of California, Santa Cruz	Santa Cruz, CA
Ph.D. IN Physics	2018 - 2024
Colgate University	Hamilton, NY
B.A. IN PHYSICS	2014 - 2018
<ul><li>Summa Cum Laude</li><li>Graduated with Honors in Physics</li></ul>	
Middlesex Community College	Middletown, CT
A.A. IN LIBERAL ARTS	2012 - 2014
• Phi Theta Kappa	
Research and Teaching Experience	
Mila and Ciela Institute, Université de Montréal	Montréal, QC
Postdoctoral Researcher - Machine Learning for Astrophysics	2024 – Present
TO FILL IN	
University of California, Santa Cruz	Santa Cruz, CA
Ph.D. Candidate in Physics	2018 – Present
<ul> <li>Conducted theoretical research in gravitational microlensing, dark matter phenomenology, and primordial black holes.</li> <li>Authored multiple peer-reviewed publications and conference proceedings.</li> <li>Presented research at international conferences and seminars.</li> </ul>	

Collaborated with interdisciplinary research teams and contributed to open-source code development for astrophysical inference.

### University of California, Santa Cruz

TEACHING ASSISTANT

- Led discussion sections, laboratory instruction, and grading for introductory and advanced physics courses (including Physics 5 series, Physics 6 series, Physics 110A).
- Developed supplementary materials, lesson plans, and problem sets.

• Recognized with the Outstanding TA Award (2020) for teaching excellence.

### **Colgate University**

Undergraduate Researcher

- Performed theoretical and computational research in fuzzy dark matter models and mass spectrometry instrumentation development.
- Presented findings at multiple research symposia and conferences.
- Recipient of the Joseph C. Amato and Anthony F. Aveni Research Award (2018).

### NASA GSFC

NASA GODDARD SPACE FLIGHT CENTER SUMMER RESEARCH INTERN

- · Conducted research on unsupervised machine learning techniques applied to solar wind and foreshock acceleration data.
- Presented findings at the NASA Goddard Summer Research Symposium.

#### Cal-Bridge Program & UCSC SPS/WIPA Mentoring Program

Mentor

- Provided career, academic, and research mentorship to undergraduate students from underrepresented backgrounds in STEM.
- Advised students on graduate applications, research opportunities, and technical skill development.

# Publications.

A full, up-to-date list of publications is available at: https://scholar.google.com/citations?user=LTkI43kAAAAJ&hl=en.

### Hamilton, NY

Santa Cruz, CA

2018 – Present

### 2015 - 2018

### Greenbelt, MD

Summer 2018

#### Santa Cruz, CA

2019 - 2021

- Smyth, N.; Perreault-Levasseur, L.; Hezaveh, Y. Microlensing Searches with Bayesian Evidence Networks. (In preparation).
- Kunimoto, M.; DeRocco, W.; Smyth, N.; Bryson, S.; Gaudi, S. Searching for Free-Floating Planets with TESS: I. Results from a First Search of Sectors 61 – 65. arXiv:2404.11666.
- Koulen, J.; Profumo, S.; Smyth, N. Constraints on Primordial Black Holes from N-body simulations of the Eridanus II Stellar Cluster. arXiv:2403.19015.
- DeRocco, W.; Smyth, N.; Takhistov, V. New Light on Dark Extended Lenses with the Roman Space Telescope. arXiv:2312.14782, Astrophys.J.Lett. 965 (2024) 1, L3.
- DeRocco, W.; Frangipane, E.; Hamer, N.; Profumo, S.; **Smyth, N.** *Revealing Terrestrial-Mass Primordial Black Holes with the Nancy Grace Roman Space Telescope*. arXiv:2311.00751, *Phys. Rev. D* 109 (2024) 2, 023013.
- Lehmann, B.; Morrison, L.; Profumo, S.; Smyth, N. Kinetic Recoupling of Dark Matter. arXiv:2310.20513, JCAP 07 (2024) 049.
- Dror, J.; Freytsis, M.; Shih, D.; **Smyth, N.**; Taylor, S. *Fast Parameter Inference on Pulsar Timing Arrays with Normalizing Flows*. arXiv:2310.12209, *Phys.Rev.Lett.* 133 (2024) 1, 011402.
- DeRocco, W.; Smyth, N.; Profumo, S. Constraints on Sub-Terrestrial Free-Floating Planets from Subaru Microlensing Observations. arXiv:2308.13593, MNRAS 527, (2023) 3, 8921-8930.
- Fernandez, N.; Ghalsasi, A.; Patel, H.; Profumo, S.; Smyth, N. Dark Black Holes in the Mass Gap. arXiv:2208.08557, JCAP 01 (2024) 064.
- Morrison, L.; Profumo, S.; Smyth, N.; Tamanas, J. Simulation-Based Inference for Efficient Theory Space Sampling: An Application to Supersymmetric Explanations of the Anomalous Muon g-2. arXiv:2203.13403, Phys. Rev. D 106, 115016 (2022).
- Smyth, N.; Santos-Olmsted, L.; Profumo, S. Gravitational Baryogenesis and Dark Matter from Light Black Holes. arXiv:2110.14660, JCAP 03 (2022) 03, 013.
- Smyth, N.; Huckabee, G.; Profumo, S. Optimal Observing Strategies for Velocity-Suppressed Dark Matter Annihilation. arXiv:2105.03438, Phys. Rev. D 104 (2021) 12, 123003.
- Smyth, N.; Profumo, S.; English, S.; Jeltema, T.; McKinnon, K.; Guhathakurta, P. Updated Constraints on Asteroid-Mass Primordial Black Holes as Dark Matter. Phys. Rev. D 101 (2020) 6, 063005.
- Anderson, F.S.; Levine, J.; **Smyth, N.**; Tebolt, M.; Whitaker, T.J. *Multianalytical Science with the CODEX In-Situ Dating Spectrometer*. 48th Lunar and Planetary Science Conference (2017).

### Fellowships, Honors & Awards

2020–2023 NSF Graduate Research Fellowship, National Science Foundation

- 2022 ARCS Foundation Scholar, Achievement Rewards for College Scientists Foundation
- 2021 Elmer A. Fridley Scholarship, UCSC Physical Sciences
- 2020 Best Presentation in Physical Sciences, UCSC Graduate Research Symposium
- 2020 **Outstanding TA Award**, UCSC Physics Department
- 2020 Nominated Associate Member, Sigma Xi Scientific Research Honor Society
- 2018 Joseph C. Amato and Anthony F. Aveni Research Award, Colgate University
- 2018 **Benton Scholars Award**, Colgate University
- 2018 **Regents Fellowship**, University of California, Santa Cruz
- 2018 Mini-grant Award, Colgate University (Volcanology Field Study)
- 2014–2018 **Dean's Award with Distinction**, Colgate University
  - 2018 **Member**, Sigma Pi Sigma Physics Honor Society
  - 2015 Music and Youth Initiative Fellowship, Roxbury, MA
  - 2014 **Member**, Phi Theta Kappa Honor Society

### Presentations

### CONTRIBUTED AND INVITED TALKS

### **CRAQ Astronomy Seminar**

CENTER FOR RESEARCH IN ASTROPHYSICS OF QUEBEC

• "Searching for Free-Floating Planets with TESS and Challenges for Future Microlensing Surveys"

### 27th International Microlensing Conference

South African Astronomical Observatory

• "Searching for Free-Floating Planets with TESS and Challenges for Future Microlensing Surveys"

Montréal, QC Feb. 2025

Café IREx	Montréal, QC
TROTTIER INSTITUTE FOR RESEARCH ON EXOPLANETS	Jan. 2025
"Searching for Free-Floating Planets with TESS and Challenges for Future Microlensing Surveys"	
Theory Group Colloquium	Santa Cruz, CA
"Interdisciplinary Approaches to Illuminating the Dark Universe"	WUY. 2024
SITP Theory Seminar	Stanford, CA
Stanford Institute for Theoretical Physics	Jan. 2024
"Beyond the Visible: Exploring the Dark Universe with Gravitational Microlensing"	
KIPAC Tea Talk	Stanford, CA
<ul> <li>KAVLI INSTITUTE FOR PARTICLE ASTROPHYSICS AND COSMOLOGY</li> <li>"Beyond the Visible: Exploring the Dark Universe with Gravitational Microlensing"</li> </ul>	Dec. 2023
PITT PACC Workshop: Atomic Dark Matter	Pittsburgh, PA
UNIVERSITY OF PITTSBURGH <ul> <li>"Dark Black Holes in the Mass Gap"</li> </ul>	Jan. 2023
Oral Qualifying Exam	Santa Cruz, CA
UNIVERSITY OF CALIFORNIA, SANTA CRUZ  • "The ABCs of PBHs: Atomic Dark Matter Baryogenesis and Charged Relics"	Jun. 2021
Phenomenology Conference (Pheno 2021)	Dittsburgh DA
University of Pittsburgh	May. 2021
"Optimal Observation Strategies for Velocity-Suppressed Dark Matter Annihilation"	
Phenomenology Conference (Pheno 2020)	Pittsburgh, PA
	May. 2020
"Updated Constraints on Asteroid-Mass Primordial Black Holes as Dark Matter"	
ICNFP 2020	Kolymbari, Greece (Virtual)
"Updated Constraints on Asteroid-Mass Primordial Black Holes as Dark Matter"	001.2020
Graduate Research Symposium	Santa Cruz, CA
University of California, Santa Cruz	May. 2020
"Primordial Black Holes as Dark Matter"	
SCIPP Seminar	Santa Cruz, CA
"Updated Constraints on Asteroid-Mass Primordial Black Holes as Dark Matter"	Mui. 2020
Rochester Physics Symposium	Rochester, NY
University of Rochester	Apr. 2018
"Aspects of Fuzzy Cold Dark Matter"	
Honors Research Symposium	Hamilton, NY
"Aspects of Fuzzy Cold Dark Matter"	May. 2018
Senior Research Symposium	Hamilton, NY
Colgate University	Dec. 2017
• "Fuzzy Cold Dark Matter"	
Undergraduate Research Symposium	Syracuse, NY
• "Fuzzy Cold Dark Matter"	Sep. 2017
Poster Presentations	
ARCS Foundation Scholar Symposium	San Francisco. CA
ARCS FOUNDATION	Apr. 2023
"Learning Pulsar Timing Array Data"	

### NASA Summer Research Symposium

NASA GODDARD SPACE FLIGHT CENTER

• "Unsupervised Machine Learning as a Tool for Understanding Foreshock Acceleration"

### NY6 Undergraduate Research Conference

COLGATE UNIVERSITY

• "Supporting the Development of an In-Situ Mass Spectrometer"

### Summer Research Symposium

Colgate University

• "Supporting the Development of an In-Situ Mass Spectrometer"

## Mentorship

### **Cal-Bridge Program**

Mentor

- Provided mentorship and tutoring for the Cal-Bridge Program, an NSF-funded initiative supporting CSU physics majors from diverse backgrounds.
- Guided students through graduate school applications, research development, and professional skills growth.

### Society of Physics Students / Women in Physics and Astronomy (UCSC)

Mentor

- Participated in SPS/WIPA mentoring program, offering academic, career, and personal mentorship to undergraduate physics students.
- Helped mentees identify research opportunities and prepare for graduate school.

### **Music and Youth Initiative Fellowship**

Fellow

- Designed and taught music lessons (guitar, bass, drums, and production) to underserved youth at the Yawkey Boys and Girls Club.
- Provided free instruments and instruction to students daily for 10 weeks.

# **Professional Activities & Outreach**

### **Physics of the Dark Universe Journal**

Reviewer

• Provided peer review for submissions in the field of astrophysics and dark matter phenomenology.

### **STEM Diversity Program, UCSC**

Workshop Designer and Facilitator

- Created and co-led a five-session interactive workshop series on writing successful graduate school and fellowship applications.
- Delivered condensed versions of the workshop for the UCSC Genomics Institute, CSUMB's UROC Program, and the UCSC Physics Department.
- Shared curriculum and assessment materials; worked with program coordinators to institutionalize the series.

### **Colgate University Physics Club**

President

- Revived and led the Colgate Physics Club.
- Organized weekly colloquia, created opportunities for student research presentations, and hosted public science events for hundreds of attendees.

# Extracurricular Activity

### **PoApper (Developers' Network of POSTECH)**

Core Member & President at 2013

- Reformed the society focusing on software engineering and building network on and off campus.
- Proposed various marketing and network activities to raise awareness.

### PLUS (Laboratory for UNIX Security in POSTECH)

Member

- Gained expertise in hacking & security areas, especially about internal of operating system based on UNIX and several exploit techniques.
- Participated on several hacking competition and won a good award.
- Conducted periodic security checks on overall IT system as a member of POSTECH CERT.
- Conducted penetration testing commissioned by national agency and corporation.

# Teaching & Pedagogy

Greenbelt, MD Aug. 2018

### Hamilton, NY

Sep. 2016

### Hamilton, NY

Aug. 2016

### Santa Cruz, CA

2019 - 2021

#### Santa Cruz, CA 2019 – 2021

### Summer 2015 ).

Roxbury, MA

Remote 2020 – Present

### Santa Cruz, CA

### 2020 – Present

Hamilton, NY 2018 – 2019 Academic Year

> Pohang, S.Korea Jun. 2010 - Jun. 2017

### Pohang, S.Korea

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Sep. 2010 - Oct. 2011

### Advent of the Atomic Bomb, Colgate University

Co-Designer and Alumni Liaison

- Developed an online platform for the course and recruited over 70 alumni participants.
- Served as liaison between alumni and students, fostering interactive historical discussion.
- Helped organize a field trip to Washington D.C. to meet with the National Nuclear Security Administration and the Arms Control Association.

### University of California, Santa Cruz

TEACHING ASSISTANT

- Constructed lesson plans and teaching materials, led laboratory experiments and discussion sections, and created supplemental resources for future TAs.
- Courses taught:
  - Physics 133 (Summer 2023)
  - Physics 6A (Summer 2022)
  - Physics 6C (Spring 2020, Summer 2020)
  - Physics 110A (Winter 2020)
  - Physics 5D (Fall 2019)
  - Physics 5C (Spring 2019)
  - Physics 5M (Winter 2019)
  - Physics 5N (Fall 2018, Fall 2023)

### **Colgate University**

TEACHING ASSISTANT

· Led lab sections, discussion groups, and provided academic support for undergraduates.

- Courses taught:
  - Electricity and Magnetism (Fall 2017)
  - Cosc101 (Spring 2017, Fall 2017)
  - Cosc102 (Spring 2017)
  - Fundamental Physics 2 (Spring 2016)
  - Fundamental Physics 1 (Fall 2015)

### Santa Cruz, CA

2018 - 2023

Hamilton, NY 2015 – 2017

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