

CATHERINE PETRETTI

Ph.D. Candidate, Harvard University

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RESEARCH INTERESTS

- **Cosmological models:** early-universe cosmology, cosmic inflation, cosmic topology, dark matter models
- **Data analysis:** cosmic microwave background, large-scale structure surveys, gravitational waves
- **Cosmic tensions:** large-scale anisotropy, nature of dark energy, Hubble tension

EDUCATION

Harvard University	Cambridge, MA
Ph.D. , Astronomy & Astrophysics	2022–2027
Advisor: Xingang Chen	
Dissertation: “Probing the primordial Universe with the Cosmic Microwave Background”	
A.M. , Astronomy & Astrophysics	2025
Villanova University	Villanova, PA
B.S. , Astronomy & Astrophysics, <i>summa cum laude</i>	2018–2022

RESEARCH EXPERIENCE

Graduate Student Researcher, Harvard University (Advisor: Xingang Chen)	2022–Present
Member, COMPACT Collaboration	2024–Present
Research Assistant, MIT Haystack Observatory (Advisors: Kazunori Akiyama, Lynn D. Matthews)	2021–2023
Undergraduate Research Assistant, Villanova University (Advisor: Joseph Neilsen)	2019–2022
NSF REU Student, MIT Haystack Observatory (Advisors: Vincent Fish, Kazunori Akiyama)	2020

PUBLICATIONS

First and Second Author Publications

Martin Barandiaran, M.^{*}, **Petretti, C.^{*}**, Akrami, Y., Alestas, G., Anselmi, S., Carrón Duque, J., Copi, C.J., Cornet-Gomez, F., Lu, L.H., Jaffe, A.H., Kosowsky, A., Mihaylov, D.P., Negro, A., Ortega Gómez, J.J., Pereira, T.S., Samandar, A., Starkman, G.D., Tamosiunas, A. (COMPACT Collaboration). “Cosmic topology. Part II. Eigenmodes and Correlation Matrices of Lens Spaces.” *In Prep.*

Petretti, C., Singh, P., Braglia, M., Chen, X., Fan, J., and Li, L. “CMB Constraints on Pre-Inflationary Axion Dark Matter Isocurvature.” [arXiv:2606.11312](https://arxiv.org/abs/2606.11312). *Under Peer Review.*

Petretti, C., Braglia, M., Chen, X., Hazra, D.K., and Paban, S. (2025) “Investigating the origin of CMB large-scale features using LiteBIRD and CMB-S4.” *Journal of Cosmology and Astroparticle Physics*, **06 (2025)**, 035.

Petretti, C., Neilsen, J. and Homan, J. (2023) “Determining the Orbital Period and Wind Geometry in GRO J1655–40.” *The Astrophysical Journal*, **957** 44.

Petretti, C. and Guinan, E. (2021) “Analysis of High-precision TESS Photometry of the Black Hole X-Ray Binary Cygnus X-1: Evidence of Intrinsic Variability of the Luminous Blue Supergiant Component.” *Research Notes of the AAS*, **5** 263.

Petretti, C., Akiyama, K., and Matthews, L.D. (2021) “Evaluation of the ngVLA Revision D array configuration for stellar imaging.” [arXiv:2110.01625](https://arxiv.org/abs/2110.01625).

^{*} Equal contribution.

SELECTED HONORS AND AWARDS

Sigma Xi Scientific Research Honor Society, Member	2025
Special Teaching Recognition, Harvard University	2023
Graduate School of Arts and Sciences Prize Fellowship, Harvard University	2022
Phi Beta Kappa Honor Society, Member, Villanova University	2022
Jason A. Cardelli Memorial Award for Undergraduate Research, Villanova University	2022
Edward F. Jenkins OSA Medallion for Academic Excellence, Villanova University	2022
Sigma Pi Sigma Physics Honor Society, Member, Villanova University	2022
NEROC Symposium Award, MIT Haystack Observatory	2022
Edward F. Jenkins, OSA Scholarship for Academic Achievement, Villanova University	2021
Barry Goldwater Scholarship	2021
National Hispanic Scholarship	2020
Villanova Undergraduate Research Fellowship (VURF), Villanova University	2019
Match Research Program for First Year Students, Villanova University	2019

PRESENTATIONS

Invited Talks

Physics Department Seminar , Case Western Reserve University, Cleveland, OH. “Investigating the Origin of CMB Large-Scale Features Using LiteBIRD and CMB-S4.”	Feb 2026
President's Advisory Council Meeting , Villanova University, Virtual. “Mapping a Black Hole Wind: Determining the Orbital Period and Wind Geometry in GRO J1655-40.”	Apr 2021

Contributed & Local Talks

Student Faculty Forum , Harvard University, Cambridge, MA. “Studying the Topology of the Universe with the CMB.”	Mar 2026
ITC Luncheon, Center for Astrophysics , Cambridge, MA. “Constraining Dark Matter Isocurvature Fluctuations with the CMB.” (video)	Feb 2026
33rd Texas Symposium on Relativistic Astrophysics , Tempe, AZ. “Investigating the Origin of CMB Large-Scale Features Using LiteBIRD and CMB-S4.”	Dec 2025
246th Meeting of the American Astronomical Society , Anchorage, AK. “Investigating the Origin of CMB Large-Scale Features Using LiteBIRD and CMB-S4.”	Jun 2025
ITC Luncheon , Center for Astrophysics, Cambridge, MA. “Investigating the Origin of CMB Large-Scale Features Using LiteBIRD and CMB-S4.” (video)	Nov 2024
6th Annual NEROC Symposium , MIT Haystack Observatory, Virtual. “Next Generation Very Large Array: Evaluation of the Revision D Array Configuration for Stellar Imaging.” Recipient of the NEROC Symposium Award for best student presentation.	Mar 2022
APS Conference for Undergraduate Women in Physics , Virtual. “Simulating Observations of M87* with the Event Horizon Telescope and Space VLBI.”	Jan 2021
REU/UROP Research Symposium , MIT Haystack Observatory, Virtual. “Simulating Observations of M87* with the Event Horizon Telescope and Space VLBI.”	Aug 2020

Posters

Tri-Institute Summer School on Elementary Particles , Perimeter Institute, Waterloo, ON. “Unlocking the Hidden Potential of the CMB: A Forecast Analysis for LiteBIRD Measurements to Distinguish between Inflationary Models.”	Jun 2023
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- 240th Meeting of the American Astronomical Society**, Virtual. Jun 2022
 “Next Generation Very Large Array: Evaluation of the Revision D Array Configuration for Stellar Imaging.”
- Student Research Symposium**, Villanova University, Villanova, PA. Nov 2021
 “Next Generation Very Large Array: Evaluation of the Revision D Array Configuration for Stellar Imaging.”
- 237th Meeting of the American Astronomical Society**, Virtual. Jan 2021
 “Simulating Observations of M87* with the Event Horizon Telescope and Space VLBI.”
- Student Research Symposium**, Villanova University, Villanova, PA. Sep 2019
 “Mapping a Black Hole Wind: Determining the Orbital Period and Wind Geometry in GRO J1655-40.”

TEACHING EXPERIENCE

- Astrophysics**, Teaching Assistant, Indigo Research Intensive Seasonal (IRIS) Program Summer 2025, 2026
 International program guiding high school students in independent astrophysics research.
- Cosmology**, Teaching Fellow, Harvard University Fall 2024
- General Relativity**, Teaching Fellow, Harvard University Fall 2023, 2024
- General Astronomy Lab**, Teaching Assistant, Villanova University Spring 2022
- Observational Astronomy Lab**, Teaching Assistant, Villanova University Fall 2020, Spring 2021
- General Physics Lab**, Teaching Assistant, Villanova University Fall 2019

OUTREACH

- Editor, *Science in the News*, graduate student-led blog, Harvard University 2025–Present
- Guest Speaker, Earth & Space Reports hosted by Dr. William Waller ([video](#)) 2025
- Student Editorial Board, *Veritas: Villanova Undergraduate Research Journal*, Villanova University 2021–2022
- Peer Mentor, Department of Astrophysics & Planetary Science, Villanova University 2022
- Secretary, Villanova Astronomical Society, Villanova University 2020–2021
- Public Observatory Attendant, Villanova University 2018–2019

REFERENCES

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Dhiraj Kumar Hazra

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