

Kaili Cao

Eric and Wendy Schmidt AI in Science Postdoctoral Fellow, Michigan Institute for Data and AI in Society (MIDAS), University of Michigan, Ann Arbor, Michigan, United States

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Positions

2026 – 2028: Schmidt AI in Science Postdoctoral Fellow, University of Michigan, Ann Arbor, United States

2024 – present: Member, Asteroseismology Using The Galactic Bulge Time Domain Survey (Roman Space Telescope Wide-Field Science Team), Columbus, United States

2023 – present: Member, [Maximizing Cosmological Science with the Roman High Latitude Imaging Survey](#) (Roman Space Telescope Project Infrastructure Team), Pasadena, United States

2023 – 2026: Graduate Research Assistant, [Center for Cosmology and AstroParticle Physics \(CCAPP\)](#), The Ohio State University, Columbus, United States

2019: Visiting Undergraduate Student, Massachusetts Institute of Technology, Cambridge, United States

Education

2023 – 2026: Doctor of Philosophy, Physics, The Ohio State University, Columbus, United States
Dissertation: *Renovating Analysis Infrastructure for the Next Generation of Astronomical Surveys*

2021 – 2023: Master of Science, Physics, The Ohio State University, Columbus, United States

2020 – 2021: 31 credits, Computer Science and Technology, Nanjing University, Nanjing, China

2016 – 2020: Bachelor of Arts, French Language and Literature, Nanjing University, Nanjing, China

Honors and Awards

2026 – 2028: Eric and Wendy Schmidt AI in Science Postdoctoral Fellowship, Michigan Institute for Data and AI in Society, University of Michigan.

2023 – 2026: Research support as a member of NASA's Roman HLIS Cosmology Project Infrastructure Team and the Roman asteroseismology Wide-Field Science Team (as a PhD student).

Research Interests

Cosmology: Weak Gravitational Lensing, Cosmic Shear Measurement, Parameter Inference, Fisher Forecasts

Stellar Physics: Stellar Models, Stellar Evolution Code, Interior Physics, Asteroseismology, Red Giant Branch

Methods: Numerical Simulations, Numerical Methods, Image Processing, Data Analysis, Machine Learning

Publications

ORCID: [0000-0002-1699-6944](https://orcid.org/0000-0002-1699-6944); NASA ADS: [orcid:0000-0002-1699-6944](https://ui.adsabs.org/author/0000-0002-1699-6944)

First-Author Publications

Oct 2026: Kaili Cao, David H. Weinberg, Vivian Miranda, et al., [Fisher Forecasts for Cosmological Yields from \$3 \times 2\$ pt Analysis of the Roman Space Telescope High Latitude Imaging Survey](#), *The Astrophysical Journal*, Volume 1010, Number 1, October 2026, Page 21, [doi:10.3847/1538-4357/ae9bc0](https://doi.org/10.3847/1538-4357/ae9bc0)

Jul 2026: Kaili Cao, [Efficient Optimal Image Reconstruction for the Nancy Grace Roman Space Telescope and Beyond: II. Implementation of EFFORTLESS](#), *arXiv e-prints*, arXiv:2607.09862 [astro-ph.IM], July 2026, [doi:10.48550/arXiv.2607.09862](https://doi.org/10.48550/arXiv.2607.09862) [GitHub]

Jul 2026: Kaili Cao, [Efficient Optimal Image Reconstruction for the Nancy Grace Roman Space Telescope and Beyond: I. First Results with EFFORTLESS](#), *arXiv e-prints*, arXiv:2607.06674 [astro-ph.IM], July 2026, [doi:10.48550/arXiv.2607.06674](https://doi.org/10.48550/arXiv.2607.06674) [GitHub]

Mar 2026: Kaili Cao and Roman HLIS Cosmology PIT, [Linear Image Regridding and Coaddition with Oversampled Point Spread Functions: Lessons from 1D](#), *The Astronomical Journal*, Volume 171, Number 3, March 2026, Page 140, [doi:10.3847/1538-3881/ae356a](https://doi.org/10.3847/1538-3881/ae356a) [GitHub]

Feb 2026: Kaili Cao, Christopher M. Hirata, Katherine Laliotis, et al., [Simulating Image Coaddition with the Nancy Grace Roman Space Telescope. IV. Hyperparameter Optimization and Experimental Features](#), *The Astrophysical Journal*, Volume 998, Number 2, February 2026, Page 304, [doi:10.3847/1538-4357/ae3a97](https://doi.org/10.3847/1538-4357/ae3a97) [GitHub]

Jan 2026: Kaili Cao and Marc H. Pinsonneault, [Modeling APOKASC-3 Red Giants. I. The First Dredge-up and Red Giant Branch Bump](#), *The Astrophysical Journal*, Volume 997, Number 1, January 2026, Page 120, [doi:10.3847/1538-4357/ae22d1](https://doi.org/10.3847/1538-4357/ae22d1) [GitHub, Zenodo]

Dec 2025: Kaili Cao, [ContEvol Formalism: Numerical Methods Based on Hermite Spline Optimization](#), *Mathematics*, Volume 13, Issue 24, December 2025, Article Number 3981, [doi:10.3390/math13243981](https://doi.org/10.3390/math13243981) [GitHub]

Sep 2025: Kaili Cao and Marc H. Pinsonneault, [Toward Accurate Asteroseismic Masses for Luminous Giants](#), *The Astrophysical Journal Letters*, Volume 990, Number 1, September 2025, Page L26, [doi:10.3847/2041-8213/adfa12](https://doi.org/10.3847/2041-8213/adfa12)

Apr 2025: Kaili Cao, Christopher M. Hirata, Katherine Laliotis, et al., [Simulating Image Coaddition with the Nancy Grace Roman Space Telescope. III. Software Improvements and New Linear Algebra Strategies](#), *The Astrophysical Journal Supplement Series*, Volume 277, Number 2, April 2025, Page 55, [doi:10.3847/1538-4365/adb580](#) [GitHub]

May 2021: Kaili Cao, David J. Barnes, and Mark Vogelsberger, [Studying galaxy cluster morphological metrics with MOCK-X](#), *Monthly Notices of the Royal Astronomical Society*, Volume 503, Issue 3, May 2021, Pages 3394–3413, [doi:10.1093/mnras/stab605](#)

Coauthored Publications in Cosmology

Jul 2026: Chun-Hao To, Tae-Hyeon Shin, Chihway Chang, et al. (with **Kaili Cao** as 10th of 21 authors), [Robust Photometry for Roman High-Latitude Imaging Survey Cosmology Using Roman and Rubin Imaging](#), *arXiv e-prints*, arXiv:2607.09849 [astro-ph.IM], July 2026, [doi:10.48550/arXiv.2607.09849](#)

Jun 2026: Junzhou Zhang, Chihway Chang, Jiachuan Xu, et al. (with **Kaili Cao** as 7th of 9 authors), [Accurate modeling for \$3 \times 2\$ pt analyses in Roman and Rubin: a study of model approximations](#), *arXiv e-prints*, arXiv:2606.23781 [astro-ph.CO], June 2026, [doi:10.48550/arXiv.2606.23781](#)

Apr 2026: Katherine Laliotis, Christopher M. Hirata, Emily Macbeth, and **Kaili Cao**, [Removing correlated noise stripes from the Nancy Grace Roman Space Telescope survey images](#), *Publications of the Astronomical Society of Japan*, Volume 78, Issue 2, April 2026, Page 810–823, [doi:10.1093/pasj/psag020](#) [GitHub]

Dec 2025: OpenUniverse, The LSST Dark Energy Science Collaboration, The Roman HLIS Project Infrastructure Team, et al. (authors in alphabetical order, including **K. Cao**), [OpenUniverse2024: a shared, simulated view of the sky for the next generation of cosmological surveys](#), *Monthly Notices of the Royal Astronomical Society*, Volume 544, Issue 4, December 2025, Pages 3799–3823, [doi:10.1093/mnras/staf1833](#)

Dec 2024: Katherine Laliotis, Emily Macbeth, Christopher M. Hirata, et al. (with **Kaili Cao** as 4th of 6 authors), [Analysis of Biasing from Noise from the Nancy Grace Roman Space Telescope: Implications for Weak Lensing](#), *Publications of the Astronomical Society of the Pacific*, Volume 136, Number 12, December 2024, Page 124506, [doi:10.1088/1538-3873/ad9bec](#)

Mar 2024: Masaya Yamamoto, Katherine Laliotis, Emily Macbeth, et al. (with **Kaili Cao** as 7th of 19 authors), [Simulating image coaddition with the Nancy Grace Roman Space Telescope - II. Analysis of the simulated images and implications for weak lensing](#), *Monthly Notices of the Royal Astronomical Society*, Volume 528, Issue 4, March 2024, Pages 6680–6705, [doi:10.1093/mnras/stae177](#)

Feb 2024: Christopher M. Hirata, Masaya Yamamoto, Katherine Laliotis, et al. (with **Kaili Cao** as 7th of 19 authors), [Simulating image coaddition with the Nancy Grace Roman Space Telescope - I. Simulation methodology and general results](#), *Monthly Notices of the Royal Astronomical Society*, Volume 528, Issue 2, February 2024, Pages 2533–2561, [doi:10.1093/mnras/stae182](#)

Sep 2021: David J. Barnes, Mark Vogelsberger, Francesca A. Pearce, et al. (with **Kaili Cao** as 6th of 8 authors), [Characterizing hydrostatic mass bias with MOCK-X](#),

Monthly Notices of the Royal Astronomical Society, Volume 506, Issue 2, September 2021, Pages 2533–2550, [doi:10.1093/mnras/stab1276](https://doi.org/10.1093/mnras/stab1276)

Coauthored Publications in Stellar Astrophysics

Aug 2026: Marc H. Pinsonneault, Jennifer L. van Saders, Lyra Cao, et al. (with **Kaili Cao** as 13th of 14 authors), [The YREC Stellar Evolution Code: Public Data Release](#), *The Astrophysical Journal*, Volume 1006, Number 2, August 2026, Page 220, [doi:10.3847/1538-4357/ae71cf](https://doi.org/10.3847/1538-4357/ae71cf) [[GitHub](#)]

Oct 2025: B. Liagre, R. A. García, S. Mathur, et al. (with **K. Cao** as 7th of 12 authors), [Beyond the Nyquist frequency: Asteroseismic catalog of undersampled Kepler late subgiants and early red giants](#), *Astronomy & Astrophysics*, Volume 702, October 2025, Article Number A144, [doi:10.1051/0004-6361/202555167](https://doi.org/10.1051/0004-6361/202555167)

Jul 2025: Trevor J. Weiss, Noah J. Downing, Marc H. Pinsonneault, et al. (with **Kaili Cao** as 7th of 13 authors), [Modeling Asteroseismic Yields for the Roman Galactic Bulge Time-domain Survey](#), *The Astrophysical Journal*, Volume 987, Number 2, July 2025, Page 181, [doi:10.3847/1538-4357/adde5b](https://doi.org/10.3847/1538-4357/adde5b)

May 2025: M. Vrad, M. H. Pinsonneault, Y. Elsworth, et al. (with **K. Cao** as 11th of 15 authors), [Red giant evolutionary status determination: The complete Kepler catalog](#), *Astronomy & Astrophysics*, Volume 697, May 2025, Article Number A165, [doi:10.1051/0004-6361/202452635](https://doi.org/10.1051/0004-6361/202452635)

Feb 2025: Marc H. Pinsonneault, Joel C. Zinn, Jamie Tayar, et al. (with **Kaili Cao** as 19th of 41 authors), [APOKASC-3: The Third Joint Spectroscopic and Asteroseismic Catalog for Evolved Stars in the Kepler Fields](#), *The Astrophysical Journal Supplement Series*, Volume 276, Number 2, February 2025, Page 69, [doi:10.3847/1538-4365/ad9fef](https://doi.org/10.3847/1538-4365/ad9fef)

May 2024: John D. Roberts, Marc H. Pinsonneault, Jennifer A. Johnson, et al. (with **Kaili Cao** as 11th of 19 authors), [Nature versus nurture: distinguishing effects from stellar processing and chemical evolution on carbon and nitrogen in red giant stars](#), *Monthly Notices of the Royal Astronomical Society*, Volume 530, Issue 1, May 2024, Pages 149–166, [doi:10.1093/mnras/stae820](https://doi.org/10.1093/mnras/stae820)

Selected Presentations

2026

Jul 2026: Fisher Forecasts for Cosmological Yields from 3×2 pt Analysis of the Roman Space Telescope High Latitude Imaging Survey (poster), *Shifting Landscapes in Astrophysics: New Frontiers to Explore with Roman*, Pasadena, United States. [[Poster](#), [Lightning talk video](#), [Lightning talk slides](#)]

Jul 2026: Effortless: Efficient Optimal Image Reconstruction for Roman and Beyond (poster), *Shifting Landscapes in Astrophysics: New Frontiers to Explore with Roman*, Pasadena, United States. [[Poster](#), [Lightning talk video](#), [Lightning talk slides](#)]

Jun 2026: Renovating Analysis Infrastructure for the Next Generation of Astronomical Surveys (dissertation defense), *The Ohio State University*, Columbus, United States. [[Slides](#)]

Apr 2026: Weak Gravitational Lensing Cosmology with the Roman Space

Telescope High Latitude Imaging Survey (seminar), *Cosmology Group Seminar* (University of Michigan), Ann Arbor, United States. [[Slides](#)]

Mar 2026: Hot-wiring the Roman Sky: Resolving the Undersampling Crisis with Fast

IMCOM for Real-Time Discovery (contributed talk), *RAPID Response: Hot-wiring the Next Generation of Time-Domain Science* (Caltech/IPAC), Pasadena, United States. (Fast IMCOM is the earlier name of Effortless.) [[Slides](#)]

Jan 2026: Fisher Forecasts for Cosmological Yields from 3×2 pt Analysis of the Roman

Space Telescope High Latitude Imaging Survey (poster), *Arizona Winter School on Multi-Probe Cosmology in the Roman ST Era* (University of Arizona), Tucson, United States. [[Poster](#), an earlier version of the July 2026 poster]

Jan 2026: Fast IMCOM: Unlocking New Scientific Frontiers with High-Fidelity Image Coaddition

(contributed oral presentation), *247th Meeting of the American Astronomical Society*, Phoenix, United States. (Fast IMCOM is the earlier name of Effortless.) [[Slides](#), [Abstract](#)]

2025

Nov 2025: Early Career Scientist Talk: Stage IV Observation, Stage IV Computation,

Roman HLIS Cosmology PIT Face-to-Face Meeting 2025 (University of Pennsylvania), Philadelphia, United States. [[Slides](#)]

Oct 2025: Testing Stellar Theory with Joint Spectroscopic and Asteroseismic Catalogs (invited seminar talk), *AstroCoffee* (University of Pittsburgh), Pittsburgh, United States. [[Slides](#)]

Oct 2025: Forecasts for weak lensing cosmology with Roman Space Telescope

(contributed parallel talk), *28th International Conference on Particle Physics and Cosmology (COSMO-25)*, Pittsburgh, United States. [[Slides](#)]

Oct 2025: Toward Accurate Asteroseismic Masses for Luminous Giants (invited talk, online),

Galactic Genesis Working Group (SDSS-V Milky Way Mapper). [[Slides](#)]

Aug 2025: PyIMCOM Hack Session 2025, Shear and Clustering Measurement Working Group

Hack Week (Roman HLIS Cosmology PIT), Columbus, United States. [[Slides](#)]

2024 and Before

Jul 2024: IMCOM: optimized image coaddition pipeline for Roman weak lensing cosmology

(contributed talk), *Challenging Theory with Roman: From Planet Formation to Cosmology*, Pasadena, United States. [[Abstract](#) (please search for “IMCOM”), [Slides](#), [Video](#)]

Sep 2022: Theoretical predictions concerning the first dredge-up (presentation), Summer

Research Poster Session (The Ohio State University), Columbus, United States. [[Slides](#)]

Aug 2019: How to define a relaxed cluster?, Summer MKI Undergraduate Research Forum

(SMURF; Massachusetts Institute of Technology), Cambridge, United States. [[Slides](#)]

Teaching Experience

2025: Microteaching Lesson, College Teaching (ESEPSY 7404), The Ohio State University, Columbus, United States

Planned a lesson by backward design, “Basic Counting: Permutations and Combinations,” and taught it to my peers, mostly from outside mathematics. Scored 33/35 by the instructor; median 48/50 from 14 classmates. [[Slides](#)]

2022 – 2023: Instructor, Online Python Tutorial

46 students in 4 cohorts, mostly first-time programmers from the humanities and social sciences; 28 took an active part. Gave lectures, designed exercises, revised the study guide from students’ feedback, and mentored personal projects.

2021 – 2023: Teaching Associate (Grader), Physics 7501 & 7502: (Graduate) Quantum Mechanics, The Ohio State University, Columbus, United States

Miscellany: Taught or tutored college mathematics (2017, 2018, 2020, 2023), college physics (2023), graduate school application (2022, 2023, 2024), French phonology (2017, 2018), etc.

Service

2026 – present: Lead, MapHub (the MIDAS arXiv Preprint Hub), a carpentry of the Schmidt AI in Science Fellowship, with Kyle Heyblom, Eva Albalghiti and Dimitrios Simatos.

2025: Tutorial, PyIMCOM, at an internal hack week of the Roman HLIS Cosmology Project Infrastructure Team.

Skills

Programming: Python (main), C/C++, Fortran, Shell/Perl, Wolfram Mathematica

Languages: Chinese (native), English (working proficiency), French (undergraduate major)

Certificates: Productivity Program (The Ohio State University, 2021), Responsible Conduct of Research (The Ohio State University, 2024), Data Science Boot Camp (The Erdős Institute, 2025)

References

Available on request.