Karolina Garcia

CAPS Postdoctoral Fellow
Center for AstroPhysical Surveys (CAPS)
National Center for Supercomputing Applications (NCSA)
University of Illinois Urbana-Champaign

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Research Interests

Galaxy formation and evolution; interstellar medium physics; cosmological hydrodynamical simulations; molecular and atomic line emission; line-intensity mapping; radiative transfer; machine learning; large-scale structure.

Academic Appointments

CAPS Postdoctoral Fellow 2024–present
Center for AstroPhysical Surveys, National Center for Supercomputing Applications, University of Illinois Urbana-Champaign

Education

Ph.D. in Astronomy 2024
University of Florida, Gainesville, USA

M.S. in Astronomy 2019
University of Florida, Gainesville, USA

M.S. in Astronomy 2018
Federal University of Rio de Janeiro (UFRJ), Brazil

B.S. in Industrial Engineering 2014
Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Brazil
Minor in Entrepreneurship

Research Experience

Postdoctoral Research Fellow
University of Illinois Urbana-Champaign 2024–present

- Lead the development of SLICK-2, a computational framework for modeling multi-line emission from the interstellar medium in cosmological hydrodynamical simulations while preserving diverse gas physical conditions.
- Model CO, [CI], and [CII] emission across cosmic time, including luminosity functions, CO spectral line energy distributions, and line-intensity mapping power spectra.
- Investigate the impact of AGN radiation fields on atomic and molecular line emission and their implications for galaxy evolution and cosmological observables.
- Develop and validate predictions connecting galaxy-scale ISM physics with line-intensity mapping observations.
- Lead the analysis of a high-redshift galaxy cluster catalog in the Boötes field, including photometric-redshift characterization, purity, completeness, and comparisons with existing catalogs.
- Contribute to the Terahertz Intensity Mapper (TIM) collaboration.

Graduate Researcher
University of Florida 2018–2024

- Developed SLICK, a framework combining interstellar medium modeling, radiative transfer, and machine learning to predict molecular line luminosities in cosmological simulations.
- Developed improved line-of-sight estimators for the anisotropic three-point correlation function of galaxies, with applications to large-scale structure surveys.
- Tested galaxy cluster detection algorithms for Euclid, characterizing detection purity and completeness.
- Contributed to the identification and characterization of high-redshift galaxy clusters using Spitzer observations.

Graduate Researcher
Federal University of Rio de Janeiro 2016–2018

- Investigated survey strategies for constraining cosmological peculiar velocity fields using Type Ia supernovae in LSST-like surveys.
- Contributed to supernova detection pipeline development for J-PAS and J-PLUS.

Undergraduate Researcher
PUC-Rio 2011–2012

- Investigated nanocomposites exhibiting negative thermal expansion.

Awards and Fellowships

CAPS Postdoctoral Fellowship, University of Illinois Urbana-Champaign 2024–present

BOE Summer Fellowship, University of Florida 2018

CNPq Master's Research Fellowship, Federal University of Rio de Janeiro 2016–2018

Petrobras Undergraduate Research Fellowship, PUC-Rio 2011–2012

Publications and Manuscripts

Refereed Publications

Bracks, J. S., et al., including Garcia, K. (2026)
Forecasting the Cross Correlation of Terahertz Intensity Mapper [C II] Line Intensity Maps with Euclid Galaxies. *The Astrophysical Journal*, 1005, 17.

Anirudh, R., et al., including Garcia, K. (2025)
Predicting the Resolved CO Emission of $z = 1$–3 Star-forming Galaxies. *Astronomy & Astrophysics*, 699, A19.

Karoumpis, C., et al., including Garcia, K. (2024)
C II
Line Intensity Mapping the Epoch of Reionization with the Prime-Cam on FYST: II. CO Foreground Masking Based on an External Catalog. *Astronomy & Astrophysics*, 691, A262.

Garcia, K., Narayanan, D., Popping, G., Anirudh, R., Sutherland, S., & Kaasinen, M. (2024)
SLICK: Modeling a Universe of Molecular Line Luminosities in Hydrodynamical Simulations. *The Astrophysical Journal*, 974, 197.

Thongkham, K., et al., including Garcia, K. (2024)
The Massive and Distant Clusters of WISE Survey 2: Second Data Release. *arXiv:2410.15303*.

Garcia, K., & Slepian, Z. (2022)
Improving the Line of Sight for the Anisotropic 3-Point Correlation Function of Galaxies: Centroid and Unit-Vector-Average Methods Scaling as $\mathcal{O}(N^2)$. *Monthly Notices of the Royal Astronomical Society*, 515, 1199–1217.

Garcia, K., Quartin, M., & Siffert, B. B. (2020)
On the Amount of Peculiar Velocity Field Information in Supernovae from LSST and Beyond. *Physics of the Dark Universe*, 29, 100519.

Lyra, W., Rice, M., Adler-Belendez, D., et al., including Garcia, K. (2020)
Ad Astra Academy: Using Space Exploration to Promote Student Learning and Motivation in the City of God, Rio de Janeiro, Brazil. *Communicating Astronomy with the Public Journal*, 27.

Cenarro, A. J., Moles, M., Cristobal-Hornillos, D., et al., including Garcia, K. (2019)
J-PLUS: The Javalambre Photometric Local Universe Survey. *Astronomy & Astrophysics*, 622, A176.

Preprints

Agrawal, S., et al., including Garcia, K. (2026)
A New Window into the Baryon Cycle at Cosmic Noon with Line Intensity Mapping: Forecasts for Auto- and Cross-correlations in [CII]-158 μm, HI 21 cm, $CO_{J+1\rightarrow J}$, and Hα Galaxies. *arXiv:2602.24120.*

Submitted Manuscripts

- **Garcia, K., et al.** The IRAC Distant Cluster Survey. *Submitted.*

Manuscripts in Preparation

- **Garcia, K.** SLICK-2: Modeling Multi-Line Interstellar Medium Emission Across Cosmological Volumes. *In preparation.*
- **Garcia, K., et al.** The Impact of AGN Radiation on Interstellar Medium Line Emission in Cosmological Simulations. *In preparation.*
- **Garcia, K., et al.** Predictions for Line-Intensity Mapping from SLICK. *In preparation.*

Invited Talks and Selected Presentations

Illuminating the Active Universe, ESO	09/2026
Annual Meeting of the German Astronomical Society, MPIA	09/2026
Line Intensity Mapping 2026, Caltech	08/2026
Galaxies and AGN Journal Club, STScI/JHU	03/2026
mm Universe 2025, Caltech	06/2025
Infrared Fine-Structure Lines Workshop 2025, Winona State University	06/2025
Line Intensity Mapping 2025, Caltech	06/2025
ALMABO24, University of Bologna	09/2024
Line Intensity Mapping 2024, University of Illinois	06/2024
TIM Collaboration Annual Meeting, University of Illinois	06/2024
CCA Cosmology Group Meeting, Flatiron Institute	12/2023
CCA Galaxy Formation Seminar, Flatiron Institute	12/2023
Galaxies and AGN Journal Club, STScI/JHU	12/2023
Argelander Institute for Astronomy, University of Bonn (invited)	05/2023
ESO Lunch Talk, Munich (invited)	04/2023
Present and Future of Line-Intensity Mapping, Max Planck Institute for Astrophysics	04/2023

Professional Service

- Workshop co-organizer, AI Workshop, Fermilab (2026).
- LIM modeling session co-organizer, Line Intensity Mapping 2026, Caltech (2026).
- Event lead organizer, Women in Physics meet Sonia Guimarães, University of Illinois Urbana-Champaign (2024).
- Newsletter and Press Release Committee, University of Florida Astronomy Department (2021–2024).

Teaching and Mentoring

Teaching Assistant
University of Florida 2021

- Discover the Universe.
- Observational Techniques.

Volunteer Physics Teacher
INVEST Course, Brazil 2015–2016

- Provided weekly physics instruction to low-income students preparing for university entrance examinations.

Mathematics Tutor
Colégio PH, Brazil 2011–2012

Science Communication and Public Engagement

Independent Science Communicator 2026–present

- Create accessible, research-informed astronomy and cosmology content in Portuguese, reaching an audience of over 50,000 followers on Instagram.

AstroTubers — Co-founder 2017–2024

- Co-founded a Brazilian astronomy outreach initiative producing educational videos and making astrophysics accessible to Portuguese-speaking audiences.

Ad Astra Academy — Team Member 2015–present

- Contributed to science education and outreach initiatives connecting space exploration with underserved communities in Brazil.

Additional Professional Experience

Finance Analyst and Intern, Shell, Brazil 2013–2016

Developed financial reporting and automation tools, supported global key-account operations, and contributed to performance monitoring.

Pricing Strategy Consultant, Hyper Consulting 2015

Consulting project for Coca-Cola.

Facilities Intern, Vale S.A. 2013