Alex M. Garcia

Contacts

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Awards

- Virginia Space Grant Consortium Research Fellow
  2024-2025, 2025-2026
- Graduate Teaching Award (UF)
  Spring 2023
- Outstanding Master's Thesis (UF)
  Fall 2022

Honors

- Outstanding Research Presentation (UF)
  Fall 2022
- Distinguished Contributions by a Graduate Student (UF)
  Fall 2022
- Distinguished Service and Citizenship (UF)
  Fall 2022
- Tutor of the Year Finalist; Honorable Mention (UIUC)
  Spring 2021
- Eagle Scout, Boy Scouts of America
  April 2015

Student Mentoring

- S. Ridolfo (Harvard)
  2025
- D. Robinson (UVA)
  2025

Education

University of Virginia
2023 – Present
Doctorate of Philosophy in Astronomy
Master of Science in Astronomy

University of Florida
2021 – 2023
Master of Science in Astronomy

University of Illinois
2017 – 2021
Bachelor's of Science in Engineering Physics (*Honors*)
Bachelor's of Science in Astronomy (*Distinction*)

Select Publications

Complete Publication List on last page; see also [NASA/ADS Library]
Summary: **24** total papers, **7** h-index, **125** total citations

First & Corresponding Author: (7 total)

- *Probing the Dark Matter Distributions of Milky Way Analogs in DREAMS and the Impact of Baryons*
- *Metallicity Gradients in Modern Cosmological Simulations I: Tension Between Smooth Stellar Feedback Models and Observations* [arXiv] **Submitted**
- **Star Formation Rates, Metallicities, and Stellar Masses on kpc-scales in TNG50* [arXiv] **Submitted**
- *Does the Fundamental Metallicity Relation Evolve with Redshift? II: The Evolution in Normalisation of the Mass-Metallicity Relation* [arXiv] [MNRAS]
- *Does the Fundamental Metallicity Relation Evolve with Redshift? I: The Correlation Between Offsets from the Mass-Metallicity Relation and Star Formation Rate* [arXiv] [MNRAS]
- *Interplay of Stellar and Gas-Phase Metallicities: Unveiling Insights for Stellar Feedback Modeling with Illustris, IllustrisTNG, and EAGLE* [arXiv] [MNRAS]
- *Gas-phase metallicity break radii of star-forming galaxies in IllustrisTNG* [arXiv] [MNRAS]

* Corresponding Author

Student Theses Supervised:

- L. Carnevale (Senior Thesis, UVA 2025) – *"The Mass Dependence of the Fundamental Metallicity Relation in Cosmological Simulations"*
- *Z. Stevens (Senior Thesis, UVA 2024) – *"Constraining the Splashback Radius in IllustrisTNG"*
- *C. O'Brien (Senior Thesis, Ohio State 2023) – *"Parameterizing Splashback Radius-Mass Relations of Galaxy Clusters with IllustrisTNG Simulations"*

* Co-supervised with P. Torrey

Research Experience

Graduate Researcher
2021 – Present
University of Virginia & University of Florida
P. Torrey

Undergraduate Researcher
2020 – 2021
University of Illinois
B. Dunne & Y. Shen

- M. Kulkarni (UVA)
  2025
- L. Carnevale (UVA)
  2024 - 2025
- I. Leisher (Grinnell College)
  2024 - 2025
- M. Liu (UVA)
  2024
- Z. Stevens (UVA)
  2023 - 2024
- C. O'Brien (UF REU)
  2022 - 2024

Service

Student-Postdoc Leadership Council
NSF-Simons CosmicAI Institute
2025 - Present

Host
Journal Club (UVA)
2024 - Present

Member
Dark Skies, Bright Kids Outreach Group (UVA)
2023 - Present

Referee
MNRAS
2023, 2024, 2025

Gradaute Student Rep.
Committee for DEI (UF)
2021 - 2023

Other Work

Planetarium Assistant
Kika Silva Pla Planetarium
Gainesville, FL
2021 - 2023

Tutor/Lead Tutor
College of Engineering (UIUC)
Urbana, IL
2018 - 2021

Contributed Talks & Presentations

Conference Contributions:

- Simulation Based Inference for Galaxy Evolution – Bristol, UK — *May 2025*
- DREAMS Workshop – New York, NY, USA — *May 2025*
- Student Research Conference – Hampton University, VA, USA — *April 2025*
- The Multi-phase ISM in Galaxies – Bologna, Italy **[Poster]** — *September 2024*
- Connecting Simulations and Observations – Barossa, Australia — *June 2024*
- Regulating Star Formation Across Time – STScI, USA **[Video]** — *April 2024*
- Building Galaxies from Scratch – Vienna, Austria **[Poster]** — *February 2024*
- Resolving Galaxy Ecosystems – Hong Kong — *December 2023*

Invited Seminars

- Cosmology Group – U. Maryland — *October 2024*
- Astronomy Seminar – Virginia Tech — *September 2024*
- Astronomy Seminar – Australian National University — *June 2024*

Other Formal Presentations:

- Conroy Group Meeting – CfA Harvard-Smithsonian — *April 2025*
- Astrophysics Theory Group – U. Virginia — *February 2025*
- Astrophysics Theory Group – U. Virginia — *September 2024*
- Ellison Group Meeting – U. Victoria *(virtual)* — *February 2024*
- Vogelsberger Group Meeting – MIT — *November 2023*
- Kewley Group Meeting – CfA Harvard-Smithsonian — *November 2023*
- Ellison Group Meeting – U. Victoria *(virtual)* — *May 2023*

Guest Lectures:

- McCormick Observatory Public Night – U. Virginia — *July 2024*
- ASTR 3830 (×3) – U. Virginia — *Spring 2024*
- ASTR 5110 – U. Virginia — *September 2023*

Teaching

Institution			Course	Semester
Virginia	ASTR	2110	Intro to Astrophysics	*FA 24*
		†1250	Alien Worlds	*SU 24*
		4470	Computational Astrophysics	*SP 24*
		3830	Planetary Astronomy (+Lab)	*SP 24*
		1220	Stars, Galaxies, and Universe	*SP 24*
		5110	Astronomical Techniques	*FA 23*
Florida	AST	†1022	Astronomy Laboratory	*SP 23*
		†1022	Astronomy Laboratory	*SP 22*
		1002	Discovering the Universe	*FA 21*
Illinois	ASTR	330	Extraterrestrial Life	*SP 21*
		330	Extraterrestrial Life	*W 21*
		100	Introduction to Astronomy	*FA 20*
		150	Killer Skies: Astro-Disasters	*FA 20*

† Primary instructor (UVA; Summer 2024 – UF; Spring 2023, 2022)

Complete Publication List

[NASA/ADS Library]

†First Author *Corresponding Author ‡Undergraduate Student Led

24. †**Garcia, A.**, et al. *"Probing the Dark Matter Distributions of Milky Way Analogs in DREAMS and the Impact of Baryons"*. 2025. In Prep.
23. Bhowmick, A., Blecha, L., Torrey, P., Kelley, L., **Garcia, A.,** et al. *"Assembling the earliest black hole populations from heavy seeds in the BRAHMA-CONSTRAINED simulations: Implications for $z \sim 6$ quasars and JWST discoveries at $z \sim 9-11$"*. 2025. ApJ. In Prep.
22. Silvestrini, M., et al., including **Garcia, A.** *"CASCO: Cosmological and AStrophysical parameters from Cosmological simulations and Observations IV. Constraining warm dark matter particle mass with dwarf galaxies using DREAMS simulations"*. 2025. A&A. In Prep.
21. ‡Carnevale, L., **Garcia, A.**, et al. *"The Mass Dependence of the Fundamental Metallicity Relation in Cosmological Simulations"*. 2025. In Prep
20. ‡Leisher, I., Torrey, P., Rose, J., **Garcia, A.**, Vogelseberger, M. *"Using Deep Learning Methods with Merger Tree Histories to Predict Warm Dark Matter Particle Mass"*. 2025. In Prep
19. Heretz, P., Triani, P., Battisti, A., Kewley, L., **Garcia, A.**, Torrey, P., Calzetti, D., Pope, A. *"A New Metallicity Diagnostic Suitable for Low Spectral Resolution Surveys of Star-Forming Galaxies"*. 2025. In Prep.
18. Garling, C., **Garcia, A.**, et al. *"Integrating Mass-Metallicity Relations with Resolved Star Formation Histories"*. In Prep.
17. Kho, J., Bhowmick, A., Torrey, P., **Garcia, A.**, Ahvazi, N., Blecha, L. *"Signatures of BH seeding on the $M_{\rm BH}-\sigma$ relation: Predictions from the `BRAHMA` simulations"*. 2025. ApJ. Submitted.
16. †**Garcia, A.**, Torrey, P., Bhagwat, A., Wright, R., Chen, Q., Grasha, K., Ridolfo, S., Hemler, Z., Sarkar, A., Chakraborty, P., Nelson, E., Sanders, R., Costa, T., Vogelsberger, M., Kewley, L., Ellison, S., Hernquist, L. *"Metallicity Gradients in Modern Cosmological Simulations I: Tension Between Smooth Stellar Feedback Models and Observations"*. 2025. ApJ. Submitted.
15. Chen, Q, **Garcia, A.**, Grasha, K., Wisnioski, E., Li, Z., Torrey, P., Remus, R., Kimming, L., Battisti, A., Buder, S. *"How Mergers and Flybys Shape Azimuthal Age Patterns in Spiral Galaxies"* 2025. MNRAS. Submitted.
14. *Qi, J., **Garcia, A.**, Torrey, P., Moreno J., Green, K., Evans, A., Hemler Z., Hernquist L., Ellison, S. *"Star Formation Rates, Metallicities, and Stellar Masses on kpc-scales in TNG50"*. 2025. ApJ. Submitted.
13. ‡Mostow, O., Torrey, P., Rose, J., **Garcia, A.**, Ahvazi, N., Lisanti, M., Kallivayalil, N. *"How Many Bursts Does it Take to Form a Core at the Center of a Galaxy?"*. 2025. ApJ. Submitted.
12. Kewley, L., Grasha, K., **Garcia, A.**, Torrey, P., Rich, J., Hemler, Z., Zhu, P., Chen, Q., Seibert, M., Hernquist, L., Madore, B., *"Extragalactic Archaeology via Gas-Phase Oxygen Abundace Gradients"*. 2025. Nature. Submitted.
11. Nyguen, T., et al., including **Garcia, A.** *"How DREAMS are made: Emulating subhalo populations under alternative dark matter scenarios with Diffusion Models"*. 2024. MNRAS. Submitted.
10. Chakraborty, P., Sarkar, A., Smith, R., Ferland, G., McDonald, M., Forman, W., Vogelsberger M., Torrey, P., **Garcia, A.**, Bautz, M., Foster, A., Miller, E., Grant, C. *"Unveiling the Cosmic Chemistry II: "direct" T_e based metallicity of galaxies at $3 < z < 10$ with JWST/NIRSpec"*. 2025. ApJ 985, 24.
9. Rose, J., et al., including **Garcia, A.** *"Introducing the DREAMS project: DaRk mattEr and Astrophysics with Machine learning and Simulations"*. 2025. ApJ. 982, 68.
8. †**Garcia, A.**, Torrey P., Ellison S., Grasha K., Chen Q., Hemler Z., Zimmerman D., Wright R., Zovaro H., Nelson E., Sanders R., Kewley L., Hernquist L. *"Does the Fundamental Metallicity Relation Evolve with Redshift? II: The Evolution in Normalisation of the Mass-Metallicity Relation"*. 2025. MNRAS 536, 119.
7. Sarkar, A., Chakraborty, P., Vogelsberger, M., McDonald, M., Torrey, P., **Garcia, A.**, Khullar, G., Ferland, G., Forman, W., Wolk, S., Schneider, B., Bautz, M., Miller, E., Grant, C., ZuHone, J. *"Unveiling the Cosmic Chemistry: Revisiting the Mass-Metallicity Relation with JWST/NIRSpec at $4 < z < 10$"*. 2025. ApJ 978 136.

6. Chen, Q., Grahsa, K., Battisti A., Wisnioski, E., Li, Z., Park, H., Groves, B., Torrey, P., Mendel, T., Madore, B., Seibert, M., Sextl, E., **Garcia, A.**, Rich, J., Beaton, R., Kewley, L. *"Quantifying azimuthal variations within the interstellar medium of spiral galaxies with the TYPHOON survey"*. 2024. MNRAS 534, 883.
5. Shurui, L., Villascusa-Navarro, F., Rose, J., Torrey, P., Farahi, A., Kollman, K., **Garcia, A.**, Roy, S., Vogelsberger M., Kallivayalil, N., Cai, F., Luo, W. *"Can we constrain warm dark matter masses with individual galaxies?"*. 2024. ApJ 970, 170.
4. †**Garcia, A.**, Torrey, P., Ellison, S., Grasha, K., Hernquist, L., Zovaro, H., Chen, Q., Hemler, Z., Kewley, L., Nelson, E., Wright, R. *"Does the Fundamental Metallicity Relation Evolve with Redshift? I: The Correlation Between Offsets from the Mass-Metallicity Relation and Star Formation Rate"*. 2024. MNRAS 531, 1398.
3. †**Garcia, A.**, Torrey, P., Grasha, K., Hernquist, L., Ellison, S., Zovaro, H., Hemler, Z., Neloson, E., Kewley, L. *"Interplay of Stellar and Gas-Phase Metallicities: Unveiling Insights for Stellar Feedback Modeling with Illustris, IllustrisTNG, and EAGLE"*. 2024. MNRAS 529, 3342.
2. ‡Hartley, A., Nelson, E., Suess, K., **Garcia, A.**, Park, M., Hernquist, L., Bezanson, R., Nevin, R., Pillepich, A., Schecter, A., Terrazas, B., Torrey, P., Wellons, S., Whitaker, K., Williams, C. *"The First Quiescent Galaxies in TNG300"*. 2023. MNRAS 522, 3138.
1. †**Garcia, A.**, Torrey P., Hemler Z., Hernquist, L., Kewley L., Nelson E, Grasha K., Zovaro H., Chen Q., *"Gas-phase metallicity break radii of star-forming galaxies in IllustrisTNG"*. 2023. MNRAS 519, 4716.