

# 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

- ◇ J. Barry  
*2025*
- ◇ L. Wu  
*2025*

## Education

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

**University of Florida**      Master of Science in Astronomy  
*2021 – 2023*

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

## Select Publications

Complete Publication List on last page; see also [NASA/ADS Library]  
*Summary: 28 total papers, 9 h-index, 173 total citations*

**First (& Co-First) Author: (7 total)**

- ◇ *The DREAMS Project: The Relative Impact of Astrophysics and Halo-to-Halo Variation on the Dark Matter Density Profiles of Milky Way-Mass Halos*
- ◇ *Metallicity Gradients in Modern Cosmological Simulations I: Tension Between Smooth Stellar Feedback Models and Observations* [arXiv] [ApJ]
- ◇ *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]

**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**      University of Virginia & University of Florida  
*2021 – Present*      P. Torrey

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

◇ D. Robinson  
2025

◇ M. Kulkarni  
2025

◇ L. Carnevale  
2024 - 2025

◇ I. Leisher  
2024 - 2025

◇ M. Liu  
2024

◇ Z. Stevens  
2023 - 2024

◇ C. O'Brien  
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:

- ◇ GOALS Workshop – Charlottesville, USA *September 2025*
- ◇ Open SkAI – Chicago, USA [Poster] *September 2025*
- ◇ 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*

### Public Talks:

- ◇ Astronomy on Tap – U. Virginia *November 2025*
- ◇ McCormick Observatory Public Night – U. Virginia *July 2024*

## Teaching

Institution		Course		Semester
Virginia	ASTR	1210	◇ Intro Sky & Solar System	FA 25
		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)

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## Complete Publication List

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[NASA/ADS Library]

†First Author    ‡Undergraduate Student Led

28. Rose, J., et al. including **Garcia, A.**. DREAMS CDM Central Galaxies
27. †**Garcia, A.**, et al. “*The DREAMS Project: The Relative Impact of Astrophysics and Halo-to-Halo Variation on the Dark Matter Density Profiles of Milky Way-Mass Halos*”. 2025. In Prep.
26. Rose, J., et al. including **Garcia, A.**. “*The DREAMS Project: Disentangling the Impact of Cosmic Variance and Baryonic Feedback on Satellite Galaxies*”. 2025. In Prep.
25. Bhowmick, A., Blecha, L., Torrey, P., Kelley, L., Natarajan, P., Weinberger, R., **Garcia, A.**, Hernquist, L., Di Matteo, T., Somerville, R., Vogelsberger, M. “*Heavy seeds and the first black holes: Insights from the BRAHMA simulations*”. 2025. ApJ. In Prep.
24. ‡Carnevale, L., **Garcia, A.**, et al. “*The Mass Dependence of the Fundamental Metallicity Relation in Cosmological Simulations*”. 2025. In Prep
23. ‡Leisher, I., Torrey, P., **Garcia, A.**, Rose, J., Narayanan, D., Zimmerman, D., Vogelsberger, M., et al. “*Linking Warm Dark Matter to Merger Tree Histories via Deep Learning Networks*”. 2025. In Prep
22. Heretz, P., **Garcia, A.**, Triani, P., Battisti, A., Torrey, P., Pope, A., Calzetti, D., Kewley, L. “*A New Metallicity Diagnostic Suitable for Low Spectral Resolution Surveys of Star-Forming Galaxies*”. 2025. In Prep.
21. Garling, C., **Garcia, A.**, et al. “*Integrating Mass-Metallicity Relations with Resolved Star Formation Histories*”. In Prep.
20. Jain, S., Sanders, R., Khostovan, A., Jones, T., Shapley, A., Reddy, N., **Garcia, A.**, Torrey, P., Coil, A. “*A Uniform Analysis of Gas-phase Metallicity Evolution with 1 – 3 Gyr Time Sampling over the Past 12 Billion Years*”. 2025. Submitted.
19. Silvestrini, M., Torta, C., Busillo, V., Farahi, A., **Garcia, A.**, Kallivayalil, N., Napolitano, R., Rose, J., Torrey, P., Villaescusa-Navarro, F., Vogelsberger, M. “*CASCO: Cosmological and Astrophysical parameters from Cosmological simulations and Observations IV. Testing warm dark matter cosmologies with galaxy scaling relations: a joint simulation–observation study using DREAMS simulations*”. 2025. A&A. Submitted.
18. Costanza, B., Wang, B., Villaescusa-Navarro, F., **Garcia, A.**, Rose, J., Vogelsberger, M., Torrey, P., Farahi, A., Shen, X., Leisher, I. “*On the Sensitivity of Different Galaxy Properties to Warm Dark Matter*”. 2025. ApJ. Submitted.
17. Kho, J., Bhowmick, A., Torrey, P., **Garcia, A.**, Ahvazi, N., Blecha, L. “*Signatures of BH seeding on the  $M_{\text{BH}} - \sigma$  relation: Predictions from the BRAHMA simulations*”. 2025. ApJ. Submitted.
16. 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.
15. †Qi, J. & **Garcia, A.** (equal contribution from Qi and Garcia), Robinson, D., 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.
14. ‡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.
13. 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 Abundance Gradients*”. 2025. Nature. Submitted.
12. 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.
11. †**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. 989 147.

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., Nelson, 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., Schechter, 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.