Austen Gabrielpillai

Curriculum Vitae

Pupin Hall, Columbia University, 538 W. 120th St., New York, NY 10027

(+1) 732-284-6854 | a.gabrielpillai [@] gmail.com | aust427.github.io | Austen Gabrielpillai

Education

Columbia University — *New York*

Doctorate of Philosophy in Astrophysics — *Sep. 2025 - Present*

- Advisor: Dr. Greg Bryan
- Thesis: TBD

The City University of New York – Graduate Center — *New York, NY*

Master of Science in Astrophysics — *Aug. 2023 - Sep. 2025*

- Advisors: Drs. Viraj Pandya & Ariyeh Maller
- Thesis: "Satellite-host galaxy co-evolution with next-generation regulator models"

Rutgers University – New Brunswick — *New Brunswick, NJ*

Master of Information — *Sep. 2018 - May 2020*

- Concentration in Data Science

University of Illinois at Urbana-Champaign — *Urbana, IL*

Bachelor of Science in Engineering Physics — *Aug. 2013 - May 2017*

- Concentration in Computer Science

Professional Appointments

NASA Goddard Space Flight Center / Catholic University of America — *Goddard, MD*

Science Researcher (Full-time appointment) — *Nov. 2020 - Aug. 2023*

- Sponsors: Drs. James Rhoads & Sangeeta Malhotra
- CRESST II Task 665.018: "Preparing for *Roman Space Telescope* Wide Field Instrument spectroscopy"

Center for Computational Astrophysics, Flatiron Institute — *New York, NY*

Research Analyst (Part-/Full-time internship) — *Jul. 2018 - Aug. 2020*

- Advisor: Dr. Rachel Somerville
- Project: "Galaxy formation in the Santa Cruz semi-analytic model compared with IllustrisTNG"

GSI Helmholtz Center for Heavy Ion Research / Technischen Universität Darmstadt — *Darmstadt, DE*

Undergraduate Research Assistant (Full-time internship) — *May 2016 - Aug. 2016*

- Advisors: Drs. Zoran Andelkovic & Wilfried Nörtershäuser
- Project: "FPGA programming and ion beam cross-section quality analysis for FAIR pre-development"

Research Interests

I am a computational astrophysics graduate student and former data scientist applying numerical techniques toward studying the formation and evolution of galaxies across cosmic time. I have generated galaxy catalogs using a semi-analytic model for galaxy formation, created synthetic wide-field survey images for upcoming telescopes, and developed recipes for a robust regulator model. I have contributed to one first authored and five co-authored peer reviewed publications, resulting in an **h-index of 7** and a **total of 250 citations** (to date on NASA/ADS). My aim is to use my unique professional background to further test our physical understanding of the galaxies in our universe including our own.

Publications

First Author

Learning the Universe: the squishiness of galactic star formation histories — *ApJ, In prep.*

Gabrielpillai, Austen; Iyer, Kartheik G.; Starkenberg, Tjitske K.; Somerville, Rachel S.; Brown, Carly; Bryan, Greg L.; Ho, Matthew; Lovell, Christopher C; Perez, Lucia; Sommovigo, Laura

Semi-analytic satellites I. – constraining surviving satellite evolution in CGM co-evolution models — *ApJ, In prep.*

Gabrielpillai, Austen; Pandya, Viraj; Maller, Ari; Bryan, Greg; Somerville, Rachel S.; Starkenberg, Tjitske; Tonneson, Stephanie; Zhu, Jingyao; sapphire collaboration

Galaxy formation in the Santa Cruz semi-analytic model compared with IllustrisTNG – II. Galaxy scaling relations and residual evolution from z = 6 to 0 — *MNRAS, In prep.*

Gabrielpillai, Austen; Somerville, Rachel S.; Genel, Shy; Rodriguez-Gomez, Vicente; Diemer, Benedikt; Pandya, Viraj; Yung, L. Y. Aaron; Hernquist, Lars

ESpRESSO - forward modeling *Roman Space Telescope*'s spectroscopic instruments — *MNRAS, Submitted* — *arXiv:2412.08883*

Gabrielpillai, Austen; Wold, Isak G. B.; Malhortra, Sangeeta; Rhoads, James E.; Gao, Guangjung; Koekemoer, A. M.

[1] Galaxy formation in the Santa Cruz semi-analytic model compared with IllustrisTNG – I. Galaxy scaling relations, dispersions, and residuals at z = 0 — *MNRAS, 517, 6091* — *arXiv:2111.03077*

Gabrielpillai, Austen; Somerville, Rachel S.; Genel, Shy; Rodriguez-Gomez, Vicente; Pandya, Viraj; Yung, L. Y. Aaron; Hernquist, Lars

Co-Author

Can we learn physical models from machine learning? A case study of galaxy sizes. — *MNRAS, In prep.*

Buçinca-Çupallar, Festa; Maller, Ari; Acquaviva, Viviana; **Gabrielpillai, Austen**; Somerville, Rachel S.

Learning the Universe: flexible, physically-motivated dust attenuation curves for synthetic observations — *MNRAS, Submitted*

Sommovigo, Laura; Cochrane, Rachel K.; Hawyard, Christopher C.; Somerville, Rachel S.; Lovell, Chris C.; Popping, Gergo; Iyer, Kartheik; **Gabrielpillai, Austen**; Ho, Matthew; Steinwandel, Ulrich P; Perez, Lucia A.

How does feedback affect the star formation histories of galaxies? — *ApJ, Submitted*

Iyer, Kartheik G; Starkenburg, Tjitske K.; Bryan, Greg L.; Anglés-Alcázar, Daniel; Cooray, Suchetha; **Gabrielpillai, Austen**; Genel, Shy; Hassan, Sultan; Jespersen, Christian Kraugh; Lovell, Christopher C.; Pacifici, Camilla; Somerville, Rachel S.; Tillman, Megan T.; Villaescusa-Navarro, Francisco; Wu, John F

Tracing the mass assembly history of local central supermassive black holes — *ApJ, Submitted*

Porras-Valverde, Antonio J.; Natarajan, Priyamvada; Ricarte, Angelo; Somerville, Rachel S.; **Gabrielpillai, Austen**; Yung, L. Y. Aaron

The relationship between galaxy size and halo properties: Insights from IllustrisTNG — *MNRAS, Submitted* — *arXiv:2502.03679*

Somerville, Rachel S.; **Gabrielpillai, Austen**; Hadzhiyska, Boryana; Genel, Shy

The mass-dependent UVJ diagram at cosmic noon: An unresolved challenge for galaxy evolution models and dust radiative transfer — *A&A, Submitted* — *arXiv:2501.12008*

Gebek, Andrea; Diemer, Benedikt; Martorano, Marco; van der Wal, Arjen; Pantoni, Lara; Baes, Maarten; **Gabrielpillai, Austen**; Kapoor, Anand Utsav; Osinga, Calvin; Nersesian, Angelos; Matsumoto, Kosei; Gordon, Karl

Learning the Universe: Cosmological and Astrophysical Parameter Inference with Galaxy Luminosity Functions and Colours — *MNRAS, Submitted* — *arXiv:2411.13960*

Lovell, Christopher C.; Starkenburg, Tjitske K.; Ho, Matthew; Anglés-Alcázar, Daniel; **Gabrielpillai, Austen**; Iyer, Kartheik G.; Matthews, Alice E.; Roper; William J; Somerville, Rachel S.; Sommovigo, Laura; Villaescusa-Navarro, Francisco

[5] Lyα at Cosmic Dawn with a Simulated *Roman* Grism Deep Field — *AJ, 167, 157* — *arXiv:2305.01562*

Wold, Isak; Tilvi, Vithal; Malhortra, Sangeeta; Rhoads, James E.; **Gabrielpillai, Austen**

[4] Constraining cosmology with machine learning and galaxy clustering: the new CAMELS-SAM suite — *ApJ, 954, 11* — *arXiv:2204.02408*

Perez, Lucia A.; Genel, Shy; Somerville, Rachel S.; Villaescusa-Navarro, Francisco; **Gabrielpillai, Austen**; Anglés-Alcázar, Daniel; Wandelt; Benjamin D.; Yung, L. Y. Aaron

[3] Finding Peas in the Early Universe with *JWST* — *ApJL, 942, 1* — *arXiv:2207.13020*

Rhoads, James E.; Wold, Isak G. B.; Harish, Santosh; Kim, Keunho J.; Pharo, John; Malhotra, Sangeeta; **Gabrielpillai, Austen**; Jiang, Tianxing; Yang, Haun

[2] Mangrove: Learning Galaxy Properties from Merger Trees — *ApJ, 941, 7* — *arXiv:2210.13473*

Jespersen, Christian Kraugh; Kranmer, Miles; Melchior, Peter; Ho, Shirley; Somerville, Rachel S.; **Gabrielpillai, Austen**

[1] Galaxy assembly bias and large-scale distribution: a comparison between IllustrisTNG and a semi-analytic model — *MNRAS, 508, 698* — *arXiv:2108.00006*

Hadzhiyska, Boryana; Liu, Sonya; Somerville, Rachel S.; **Gabrielpillai, Austen**; Bose, Sownak; Eisenstein, Daniel; Hernquist, Lars

Conference Proceedings / White Papers / Non-refereed

[1] REX, the Reionization Explorer: Science and Mission Overview — *SPIE, 130920U*

Malhotra, Sangeeta; Rhoads, James E.; Casey, Thomas; Pasquale, Bert; **Gabrielpillai, Austen**; Hutter, Anne; Khostovan, Ali Ahmad; Kruka, Jeffrey; Mosby, Gregory; Rauscher, Bernard J.; Wold, Isak G. B.; Yung, L. Y. Aaron; the REX team

Talks & Posters

Invited Talks

"Semi-analytic satellites – modeling satellite galaxy evolution in Milky Way-like systems" — *Piscataway, NJ*

Rutgers University - New Brunswick – Physics & Astronomy Department – Astro Journal Club — *Apr. 2025*

"Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems" — *Virtual*

University of California, Santa Cruz – CGI (Cosmology / Galaxies / IGM) Zoom Seminar — *Jan. 2025*

"Generating *Roman* spectroscopic simulations with ESpRESSO" — *Virtual*

NASA Goddard Space Flight Center – *Roman* Simulations Working Group Meeting — *Nov. 2024*

"Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems" — *New York, NY*

Columbia University – Astronomy Department – Galaxy seminar — *Nov. 2024*

"Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems" — *Princeton, NJ*

Princeton University - Astrophysical Sciences Department – 'Thunch' Talk — *Oct. 2024*

"Semi-analytic satellite evolution – ram pressure stripping in Milky Way-like systems" — *New York, NY*

Columbia University - Astronomy Department Pizza Lunch Talks - Whiteboard Talk — *Feb. 2024*

"ESpRESSO – Simulating *Roman* Spectroscopic Instruments" — *Virtual*

Princeton University - Astro Data Lab Group Meeting — *May 2022*

"An introduction to FlatHUB – an open source web-based query-able database for astrophysics" — *New York, NY*

Flatiron Institute - CCA Group Meeting — *Oct. 2018*

"Ion beam cross-section quality analysis for FAIR pre-development" — *Darmstadt, Germany*

TU Darmstadt - LaserSpHERe Working Group Meeting — *Aug. 2016*

Selected Talks

'Testing galactic star formation in the high-redshift universe' — *New York, NY*

Columbia University - Astronomy Department Pizza Lunch Talks - Chalkboard Talk — *Oct. 2025*

"Extending sapphire to model satellite-host galaxy co-evolution" — *New York, NY*

Columbia University - Astronomy Department - Astrofest 2025 — *Sep. 2025*

"Extending sapphire to model satellite-host galaxy co-evolution & the high-redshift universe" — *Santa Cruz, CA*

2025 Santa Cruz Galaxy Workshop – Selected Talk — *Aug. 2025*

"Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems" — *Evanston, IL*

Northwestern University - Physics & Astronomy Department - Seminar Talk — *Feb. 2025*

"Generating *Roman* spectroscopic simulations with ESpRESSO" — *National Harbor, MD*

The 24th AAS Meeting – *Roman* Spectroscopy Data Challenge (Part 1/3) Splinter Session — *Jan. 2025*

"Pressure-regulated, feedback modulated star formation implemented in semi-analytic models" — *Hiroshima, Japan*

Evolution of Dust and Gas throughout Cosmic Time - Flash Talk — *Dec. 2024*

"Semi-analytic modeling surviving satellite populations in MW-like hosts with `sapphire`" — *Cambridge, MA*

Harvard University - Hernquist Group Meeting — *Nov. 2024*

"Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems" — *New Haven, CT*

Yale University - Astronomy Department - Galaxy Lunch Talk — *Oct. 2024*

"Semi-analytic bubbles - probing high redshift reionization sources with mock deep *Roman* surveys" — *Pasadena, CA (Remote)*

Challenging Theory with *Roman*: From Planet Formation to Cosmology – selected talk — *Jul. 2024*

"ESpRESSO - high-fidelity realistic grism simulations for *Roman Space Telescope*" — *Baltimore, MD*

Roman Science Inspired by Emerging *JWST* Results – selected talk — *Jun. 2023*

"Revealing the subtle differences in the stellar-to-halo mass relationship through subhalo tracking" — *New York, NY*

SIMBA Collaboration Meeting 2023 – Selected Talk — *May 2023*

"ESpRESSO - mock *Roman Space Telescope* spectroscopic foreground simulations" — *Seattle, WA*
The 241th AAS Meeting – hyperwall talk — *Jan. 2023*

"*Roman* Grism Simulations with Multiple Orders and Distortions" — *Virtual*
Roman Science Team Community Briefing – selected talk — *Nov. 2021*

"Comparing galaxy properties between IllustrisTNG and the Santa Cruz SAM at z=0" — *Virtual*
NASA Goddard Early Career Scientist Forum – Lightning Talk — *Nov. 2021*

"Roman Grism Simulations with Multiple Orders and Distortions" — *Virtual*
NASA Goddard Early Career Scientist Forum – Selected Talk — *Nov. 2021*

"Mock Grism Simulations for *Roman Space Telescope*" — *Virtual*
The 238th AAS Meeting – research contributed talk — *Jun. 2021*

Conference Posters

"The squishiness of galactic star formation histories" — *Phoenix, AZ*
The 247th AAS Meeting – Poster #TBD — *Jan. 2026*

"Modeling satellite evolution in a robust CGM co-evolution model" — *National Harbor, MD*
The 245th AAS Meeting – Poster #109.08 — *Jan. 2025*

"Pressure-regulated, feedback modulated star formation implemented in a semi-analytic model' — *Hiroshima, Japan*
Evolution of Dust and Gas throughout Cosmic Time — *Dec. 2024*

"Emulating hydrodynamic simulations with semi-analytic modeling:
comparing the evolution of global quantities in the Santa Cruz SAM and IllustrisTNG" — *Seattle, WA*
The 241th AAS Meeting – Poster #406.03 — *Jan. 2023*

"A High Fidelity Spectroscopic Simulation for *Roman Space Telescope* Grism Data" — *Pasadena, CA*
The 240th AAS Meeting – Poster #302.02 — *Jun. 2022*

"Emulating IllustrisTNG with the Santa Cruz SAM – comparing galaxy properties at z = 0" — *Virtual*
Astro PoSTER 2022 - Galaxy Evolution – Poster #610 — *May 2022*

Grants Awarded as Co-Investigator

Spectroscopic Probes of Quantitative Reionization (SPQR) — *Roman ROSES 2022*
PI: James Rhoads — *Sep. 2023 - Sep. 2027*
- NASA-funded *Roman Space Telescope* Wide Field Science (WFS, large) Investigation Team focused on studying the Epoch of Reionization"

Collaborations

***Roman Space Telescope* Wide Field Science Investigation Team**
PI: James Rhoads — *Sep. 2023 - Present*
NASA-funded Wide Field Science (large) investigation team conducting studies of the epoch of "Reionization" with Roman Space Telescope.
- Co-investigator and Computational-PI
- Slitless Spectroscopy Tools & Big Data Working Groups member

Simons Collaboration on Learning the Universe (LtU) — *learning-the-universe.org*
Director: Greg Bryan — *Jan. 2022 - Present*
Collaboration dedicated towards constraining the initial conditions of the universe utilizing machine learning and forward modeling processes.
- Synthetic Observations Working Group & LtU Connections member

***Roman Space Telescope* Cosmic Dawn Science Investigation Team**
PI: James Rhoads — *Nov. 2020 - Nov. 2021*
NASA-funded Science Investigation Team conducting studies of the epoch of "Cosmic Dawn" with Roman Space Telescope.
- Post-baccalaureate member

Scientific Service

NASA Exhibition at the 241st American Astronomical Society Meeting – *Roman Space Telescope* Booth — *Seattle, WA*
Community Outreach Volunteer — *Jan. 2023*

NASA Astrophysics Research and Analysis + Strategic Astrophysics Technology 2023 Review Panel — *Remote*
Executive Secretary — *Apr. 2024*

Scientific Software Development

sapphire *Github*

Role: Core Developer *Python, Jupyter*

- Semi-analytic CGM regulator model for galaxy formation and evolution

scsample *Github*

Role: Lead Developer *Python, Jupyter*

- Module to query Santa Cruz semi-analytic model hdf5 files (galaxy / halo catalogs, merger trees, star formation histories)

ESpRESSO *Github (Private)*

Role: Lead Developer *Python, Jupyter, Bash*

- Package developed to forward model *Roman Space Telescope* grism and prism observations accounting for instrument effects

FlatHUB *Github, Website*

Role: Contributor *Python, Haskell, TypeScript*

- Web portal for hosting astrophysical theory catalogs with query, visualization, and download tools

Membership & Involvement

American Astronomical Society (AAS)

Graduate Student Member *May 2021 - Present*

CUNY Graduate Council

MS in Astrophysics Representative *Oct. 2024 - Jun. 2025*

Astronomy Graduate Student Congress

CUNY Graduate Center Representative *Apr. 2024 - Oct. 2024*

Advising and Mentorship

Peer Mentorship

Emily McPike | CUNY Graduate Center *Sep. 2024 - Aug. 2025*

Andrea Bracamonte | CUNY Graduate Center *Sep. 2024 - Aug. 2025*

Shawn Ray | CUNY Graduate Center *Feb. 2025 - Aug. 2025*

Teaching Experience

Columbia University *Dept. of Astronomy; New York, NY*

Lecture Teaching Assistant *office hours, recitation*

- ASTR GU4260: Modeling the Universe | Fall 2025

Skills & Background

Programming Python (fluent), JavaScript (proficient), HTML & CSS (proficient), C++ (familiar), C (familiar), SQL (familiar), IDL (familiar)

Software Jupyter Notebook, PyCharm, Microsoft Visual Studio, Adobe Photoshop, Github, LaTeX

Nationalities Canada, United States

References

Ariyeh Maller *AMaller [@] citytech.cuny.edu*

- Professor at City University of New York – City Tech and City University of New York – Graduate Center
- Master's thesis co-advisor (Sep. 2023 - Present)

Aleksandra Kuznetsova *aleksandra.kuznetsova [@] uconn.edu*

- Assistant Professor at University of Connecticut
- Former course instructor for "Star and Planet Formation" at CUNY Graduate Center

Rachel Somerville *rsomerville [@] flatironinstitute.org*

- Galaxy Formation Group Leader at Center of Computational Astrophysics, Flatiron Institute
- Internship advisor (Jul. 2018 - Aug. 2020)
- Long-time collaborator for work involving the Santa Cruz Semi-analytic model