

# Austen Gabrielpillai

## CURRICULUM VITAE

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

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## Education

### Columbia University

#### DOCTORATE OF PHILOSOPHY IN ASTROPHYSICS

- Advisor: Dr. Greg Bryan
- Thesis: TBD

New York

Sep. 2025 - Present

### The City University of New York – Graduate Center

#### MASTER OF SCIENCE IN ASTROPHYSICS

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

New York, NY

Aug. 2023 - Sep. 2025

### Rutgers University – New Brunswick

#### MASTER OF INFORMATION

- Concentration in Data Science

New Brunswick, NJ

Sep. 2018 - May 2020

### University of Illinois at Urbana-Champaign

#### BACHELOR OF SCIENCE IN ENGINEERING PHYSICS

- Concentration in Computer Science

Urbana, IL

Aug. 2013 - May 2017

## Professional Appointments

### NASA Goddard Space Flight Center / Catholic University of America

#### SCIENCE RESEARCHER (FULL-TIME APPOINTMENT)

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

Goddard, MD

Nov. 2020 - Aug. 2023

### Center for Computational Astrophysics, Flatiron Institute

#### RESEARCH ANALYST (PART-/FULL-TIME INTERNSHIP)

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

New York, NY

Jul. 2018 - Aug. 2020

### GSI Helmholtz Center for Heavy Ion Research / Technischen Universität Darmstadt

#### UNDERGRADUATE RESEARCH ASSISTANT (FULL-TIME INTERNSHIP)

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

Darmstadt, DE

May 2016 - Aug. 2016

## 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 eight 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.; LTU SYNTHOBS

Introducing sapphire III.

Modeling the surviving satellite population in Milky Way-like environments

*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*

**GABRIELPILLAI, AUSTEN**; WOLD, ISAK G. B.; MALHORTA, SANGEETA; RHOADS, JAMES E.; GAO, GUANGJUNG; KOEKEMOER, A. M.

[arXiv:2412.08883](#)

[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

**GABRIELPILLAI, AUSTEN**; SOMERVILLE, RACHEL S.; GENEL, SHY; RODRIGUEZ-GOMEZ, VICENTE; PANDYA, VIRAJ;

[arXiv:2111.03077](#)

YUNG, L. Y. AARON; HERNQUIST, LARS

## Co-AUTHOR

Introducing sapphire I.

Towards Interpretable Precision Astrophysics for Galaxy Formation

ApJ, *In prep.*

PANDYA, VIRAJ; BRYAN, GREG L.; MAKINEN, LUCAS T.; **GABRIELPILLAI, AUSTEN**; ET LTU

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**;

[arXiv:2508.21152](#)

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**;

[arXiv:2504.11566](#)

YUNG, L. Y. AARON

The relationship between galaxy size and halo properties: Insights from IllustrisTNG

MNRAS, *Submitted*

SOMERVILLE, RACHEL S.; **GABRIELPILLAI, AUSTEN**; HADZHIYSKA, BORYANA; GENEL, SHY

[arXiv:2502.03679](#)

Learning the Universe: Cosmological and Astrophysical Parameter Inference with Galaxy Luminosity Functions and Colours

MNRAS, *Submitted*

LOVELL, CHRISTOPHER C.; STARKENBURG, TJITSKE K.; HO, MATTHEW; ANGLÉS-ALCÁZAR, DANIEL; **GABRIELPILLAI, AUSTEN**; IYER, KARTHEIK G.;

[arXiv:2411.13960](#)

MATTHEWS, ALICE E.; ROPER; WILLIAM J; SOMERVILLE, RACHEL S.; SOMMOVIGO, LAURA; VILLAESCUSA-NAVARRO, FRANCISCO

[8] Learning the Universe: flexible, physically-motivated dust attenuation curves for synthetic observations

ApJ, *990*, 114

SOMMOVIGO, LAURA; COCHRANE, RACHEL K.; HAWYARD, CHRISTOPHER C.; SOMERVILLE, RACHEL S.; LOVELL, CHRIS C.; POPPING, GERGO;

[arXiv:2502.13240](#)

IYER, KARTHEIK; **GABRIELPILLAI, AUSTEN**; HO, MATTHEW; STEINWANDEL, ULRICH P; PEREZ, LUCIA A.

[7] Can we learn physical models from machine learning? A case study of galaxy sizes.

ApJ, *987*, 165

BUÇINCA-ÇUPALLAR, FESTA; MALLER, ARI; ACQUAVIVA, VIVIANA; **GABRIELPILLAI, AUSTEN**; SOMERVILLE, RACHEL S.

[6] The mass-dependent UVJ diagram at cosmic noon:

An unresolved challenge for galaxy evolution models and dust radiative transfer

A&A, *695*, A90

GEBEK, ANDREA; DIEMER, BENEDIKT; MARTORANO, MARCO; VAN DER WAL, ARJEN; PANTONI, LARA; BAES, MAARTEN; **GABRIELPILLAI, AUSTEN**;

[arXiv:2501.12008](#)

KAPOOR, ANAND UTSAV; OSINGA, CALVIN; NERSESIAN, ANGELOS; MATSUMOTO, KOSEI; GORDON, KARL

[5] Ly $\alpha$  at Cosmic Dawn with a Simulated *Roman* Grism Deep Field

AJ, *167*, 157

WOLD, ISAK; TILVI, VITHAL; MALHORTA, SANGEETA; RHOADS, JAMES E.; **GABRIELPILLAI, AUSTEN**

[arXiv:2305.01562](#)

[4] Constraining cosmology with machine learning and galaxy clustering: the new CAMELS-SAM suite

ApJ, *954*, 11

PEREZ, LUCIA A.; GENEL, SHY; SOMERVILLE, RACHEL S.; VILLAESCUSA-NAVARRO, FRANCISCO; **GABRIELPILLAI, AUSTEN**; ANGLÉS-ALCÁZAR,

[arXiv:2204.02408](#)

DANIEL; WANDELT; BENJAMIN D.; YUNG, L. Y. AARON

[3] Finding Peas in the Early Universe with *JWST*

ApJL, *942*, 1

RHOADS, JAMES E.; WOLD, ISAK G. B.; HARISH, SANTOSH; KIM, KEUNHO J.; PHARO, JOHN; MALHOTRA, SANGEETA;

[arXiv:2207.13020](#)

**GABRIELPILLAI, AUSTEN**; JIANG, TIANXING; YANG, HAUN

[2] Mangrove: Learning Galaxy Properties from Merger Trees

ApJ, *941*, 7

JESPERSEN, CHRISTIAN KRAUGH; KRANMER, MILES; MELCHIOR, PETER; HO, SHIRLEY; SOMERVILLE, RACHEL S.; **GABRIELPILLAI, AUSTEN**

[arXiv:2210.13473](#)

[1] Galaxy assembly bias and large-scale distribution: a comparison between IllustrisTNG and a semi-analytic model

MNRAS, *508*, 698

HADZHIYSKA, BORYANA; LIU, SONYA; SOMERVILLE, RACHEL S.; **GABRIELPILLAI, AUSTEN**; BOSE, SOWNAK; EISENSTEIN, DANIEL; HERNQUIST, LARS

[arXiv:2108.00006](#)

[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”	<i>Piscataway, NJ</i>
RUTGERS UNIVERSITY - NEW BRUNSWICK – PHYSICS & ASTRONOMY DEPARTMENT – ASTRO JOURNAL CLUB	<i>Apr. 2025</i>
“Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems”	<i>Virtual</i>
UNIVERSITY OF CALIFORNIA, SANTA CRUZ – CGI (COSMOLOGY / GALAXIES / IGM) ZOOM SEMINAR	<i>Jan. 2025</i>
“Generating <i>Roman</i> spectroscopic simulations with ESpresso”	<i>Virtual</i>
NASA GODDARD SPACE FLIGHT CENTER – <i>Roman</i> SIMULATIONS WORKING GROUP MEETING	<i>Nov. 2024</i>
“Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems”	<i>New York, NY</i>
COLUMBIA UNIVERSITY – ASTRONOMY DEPARTMENT – GALAXY SEMINAR	<i>Nov. 2024</i>
“Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems”	<i>Princeton, NJ</i>
PRINCETON UNIVERSITY - ASTROPHYSICAL SCIENCES DEPARTMENT – ‘THUNCH’ TALK	<i>Oct. 2024</i>
“Semi-analytic satellite evolution – ram pressure stripping in Milky Way-like systems”	<i>New York, NY</i>
COLUMBIA UNIVERSITY - ASTRONOMY DEPARTMENT PIZZA LUNCH TALKS - WHITEBOARD TALK	<i>Feb. 2024</i>
“ESpresso – Simulating <i>Roman</i> Spectroscopic Instruments”	<i>Virtual</i>
PRINCETON UNIVERSITY - ASTRO DATA LAB GROUP MEETING	<i>May 2022</i>
“An introduction to FlatHUB – an open source web-based query-able database for astrophysics”	<i>New York, NY</i>
FLATIRON INSTITUTE - CCA GROUP MEETING	<i>Oct. 2018</i>
“Ion beam cross-section quality analysis for FAIR pre-development”	<i>Darmstadt, Germany</i>
TU DARMSTADT - LASERSPHERE WORKING GROUP MEETING	<i>Aug. 2016</i>

### SELECTED TALKS

‘Testing galactic star formation in the high-redshift universe’	<i>New York, NY</i>
COLUMBIA UNIVERSITY - ASTRONOMY DEPARTMENT PIZZA LUNCH TALKS - CHALKBOARD TALK	<i>Oct. 2025</i>
“Extending sapphire to model satellite-host galaxy co-evolution”	<i>New York, NY</i>
COLUMBIA UNIVERSITY - ASTRONOMY DEPARTMENT - ASTROFEST 2025	<i>Sep. 2025</i>
“Extending sapphire to model satellite-host galaxy co-evolution & the high-redshift universe”	<i>Santa Cruz, CA</i>
2025 SANTA CRUZ GALAXY WORKSHOP – SELECTED TALK	<i>Aug. 2025</i>
“Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems”	<i>Evanston, IL</i>
NORTHWESTERN UNIVERSITY - PHYSICS & ASTRONOMY DEPARTMENT - SEMINAR TALK	<i>Feb. 2025</i>
“Generating <i>Roman</i> spectroscopic simulations with ESpresso”	<i>National Harbor, MD</i>
THE 24TH AAS MEETING – <i>Roman</i> SPECTROSCOPY DATA CHALLENGE (PART 1/3) SPLINTER SESSION	<i>Jan. 2025</i>
“Pressure-regulated, feedback modulated star formation implemented in semi-analytic models”	<i>Hiroshima, Japan</i>
EVOLUTION OF DUST AND GAS THROUGHOUT COSMIC TIME - FLASH TALK	<i>Dec. 2024</i>
“Semi-analytic modeling surviving satellite populations in MW-like hosts with sapphire”	<i>Cambridge, MA</i>
HARVARD UNIVERSITY - HERNQUIST GROUP MEETING	<i>Nov. 2024</i>
“Semi-analytic satellites – modeling surviving satellite populations in Milky Way-like systems”	<i>New Haven, CT</i>
YALE UNIVERSITY - ASTRONOMY DEPARTMENT - GALAXY LUNCH TALK	<i>Oct. 2024</i>
“Semi-analytic bubbles - probing high redshift reionization sources with mock deep <i>Roman</i> surveys”	<i>Pasadena, CA (Remote)</i>
CHALLENGING THEORY WITH <i>Roman</i> : FROM PLANET FORMATION TO COSMOLOGY – SELECTED TALK	<i>Jul. 2024</i>
“ESpresso - high-fidelity realistic grism simulations for <i>Roman Space Telescope</i> ”	<i>Baltimore, MD</i>
<i>Roman</i> SCIENCE INSPIRED BY EMERGING <i>JWST</i> RESULTS – SELECTED TALK	<i>Jun. 2023</i>
“Revealing the subtle differences in the stellar-to-halo mass relationship through subhalo tracking”	<i>New York, NY</i>
SIMBA COLLABORATION MEETING 2023 – SELECTED TALK	<i>May 2023</i>

“ESpRESSO - mock <i>Roman Space Telescope</i> spectroscopic foreground simulations” THE 241TH AAS MEETING – HYPERWALL TALK	Seattle, WA Jan. 2023
“ <i>Roman</i> Grism Simulations with Multiple Orders and Distortions” Roman SCIENCE TEAM COMMUNITY BRIEFING – SELECTED TALK	Virtual Nov. 2021
“Comparing galaxy properties between IllustrisTNG and the Santa Cruz SAM at $z=0$ ” NASA GODDARD EARLY CAREER SCIENTIST FORUM – LIGHTNING TALK	Virtual Nov. 2021
“Roman Grism Simulations with Multiple Orders and Distortions” NASA GODDARD EARLY CAREER SCIENTIST FORUM – SELECTED TALK	Virtual Nov. 2021
“Mock Grism Simulations for <i>Roman Space Telescope</i> ” THE 238TH AAS MEETING – RESEARCH CONTRIBUTED TALK	Virtual Jun. 2021

## CONFERENCE POSTERS

“The squishiness of galactic star formation histories” THE 247TH AAS MEETING – POSTER #TBD	Phoenix, AZ Jan. 2026
“Modeling satellite evolution in a robust CGM co-evolution model” THE 245TH AAS MEETING – POSTER #109.08	National Harbor, MD Jan. 2025
“Pressure-regulated, feedback modulated star formation implemented in a semi-analytic model” EVOLUTION OF DUST AND GAS THROUGHOUT COSMIC TIME	Hiroshima, Japan Dec. 2024
“Emulating hydrodynamic simulations with semi-analytic modeling: comparing the evolution of global quantities in the Santa Cruz SAM and IllustrisTNG” THE 241TH AAS MEETING – POSTER #406.03	Seattle, WA Jan. 2023
“A High Fidelity Spectroscopic Simulation for <i>Roman Space Telescope</i> Grism Data” THE 240TH AAS MEETING – POSTER #302.02	Pasadena, CA Jun. 2022
“Emulating IllustrisTNG with the Santa Cruz SAM – comparing galaxy properties at $z = 0$ ” ASTRO POSTER 2022 - GALAXY EVOLUTION – POSTER #610	Virtual May 2022

## Grants Awarded as Co-Investigator

<b>Spectroscopic Probes of Quantitative Reionization (SPQR)</b> PI: JAMES RHOADS	<a href="#">Roman ROSES 2022</a> Sep. 2023 - Sep. 2027
• NASA-funded <i>Roman Space Telescope</i> Wide Field Science (WFS, large) Investigation Team focused on studying the Epoch of Reionization”	

## Collaborations

<b><i>Roman Space Telescope</i> Wide Field Science Investigation Team</b> PI: JAMES RHOADS	Sep. 2023 - Present
NASA-funded <i>Wide Field Science</i> (large) investigation team conducting studies of the epoch of “Reionization” with <i>Roman Space Telescope</i> .	
• Co-investigator and Computational-PI	
• Slitless Spectroscopy Tools & Big Data Working Groups member	
<b>Simons Collaboration on Learning the Universe (LtU)</b> DIRECTOR: GREG BRYAN	<a href="#">learning-the-universe.org</a> 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	
<b><i>Roman Space Telescope</i> Cosmic Dawn Science Investigation Team</b> PI: JAMES RHOADS	Nov. 2020 - Nov. 2021
NASA-funded <i>Science Investigation Team</i> conducting studies of the epoch of “Cosmic Dawn” with <i>Roman Space Telescope</i> .	
• Post-baccalaureate member	

## Scientific Service

NASA Exhibition at the 241st American Astronomical Society Meeting – <i>Roman Space Telescope</i> Booth COMMUNITY OUTREACH VOLUNTEER	Seattle, WA Jan. 2023
NASA Astrophysics Research and Analysis + Strategic Astrophysics Technology 2023 Review Panel EXECUTIVE SECRETARY	Remote Apr. 2024

# Scientific Software Development

<b>sapphire</b> ROLE: CORE DEVELOPER <ul style="list-style-type: none"><li>Semi-analytic CGM regulator model for galaxy formation and evolution</li></ul>	<a href="#">Github</a> <i>Python, Jupyter</i>
<b>scsample</b> ROLE: LEAD DEVELOPER <ul style="list-style-type: none"><li>Module to query Santa Cruz semi-analytic model hdf5 files (galaxy / halo catalogs, merger trees, star formation histories)</li></ul>	<a href="#">Github</a> <i>Python, Jupyter</i>
<b>ESpRESSO</b> ROLE: LEAD DEVELOPER <ul style="list-style-type: none"><li>Package developed to forward model <i>Roman Space Telescope</i> grism and prism observations accounting for instrument effects</li></ul>	<a href="#">Github (Private)</a> <i>Python, Jupyter, Bash</i>
<b>FlatHUB</b> ROLE: CONTRIBUTOR <ul style="list-style-type: none"><li>Web portal for hosting astrophysical theory catalogs with query, visualization, and download tools</li></ul>	<a href="#">Github</a> , <a href="#">Website</a> <i>Python, Haskell, TypeScript</i>

# 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

<b>Columbia University</b> LECTURE TEACHING ASSISTANT <ul style="list-style-type: none"><li>ASTR GU4260: Modeling the Universe   Fall 2025</li></ul>	<i>Dept. of Astronomy; New York, NY</i> <i>office hours, recitation</i>
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# Skills & Background

<b>Programming</b>	Python (fluent), JavaScript (proficient), HTML & CSS (proficient), C++ (familiar), C (familiar), SQL (familiar), IDL (familiar)
<b>Software</b>	Jupyter Notebook, PyCharm, Microsoft Visual Studio, Adobe Photoshop, Github, LaTeX
<b>Nationalities</b>	Canada, United States

# References

<b>Ariyeh Maller</b> <ul style="list-style-type: none"><li>Professor at City University of New York – City Tech and City University of New York – Graduate Center</li><li>Master’s thesis co-advisor (Sep. 2023 - Present)</li></ul>	<a href="#">AMaller [at] citytech.cuny.edu</a>
<b>Aleksandra Kuznetsova</b> <ul style="list-style-type: none"><li>Assistant Professor at University of Connecticut</li><li>Former course instructor for “Star and Planet Formation” at CUNY Graduate Center</li></ul>	<a href="#">aleksandra.kuznetsova [at] uconn.edu</a>
<b>Rachel Somerville</b> <ul style="list-style-type: none"><li>Galaxy Formation Group Leader at Center of Computational Astrophysics, Flatiron Institute</li><li>Internship advisor (Jul. 2018 - Aug. 2020)</li><li>Long-time collaborator for work involving the Santa Cruz Semi-analytic model</li></ul>	<a href="#">rsomerville [at] flatironinstitute.org</a>