

# Austen Gabrielpillai

## CURRICULUM VITAE



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

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## Education

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### 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

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### 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

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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

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### 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.

*ApJ, In prep.*

Modeling the surviving satellite population in Milky Way-like environments

**GABRIELPILLAI, AUSTEN;** PANDYA, VIRAJ; MALLER, ARI; BRYAN, GREG; SOMERVILLE, RACHEL S.; STARKENBERG, TJITSKE; TONNESON, STEPHANIE;

ZHU, JINGYAO; SAPPHIRE COLLABORATION

## Co-AUTHOR

Introducing sapphire I.

ApJ, In prep.

Towards Interpretable Precision Astrophysics for Galaxy Formation

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**;

GENEL, SHY; HASSAN, SULTAN; JESPERSEN, CHRISTIAN KRAUGH; LOVELL, CHRISTOPHER C.; PACIFICO, CAMILLA; SOMERVILLE, RACHEL S.;

TILLMAN, MEGAN T.; VILLAESCUSA-NAVARRO, FRANCISCO; WU, JOHN F

arXiv:2508.21152

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

arXiv:2504.11566

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.;

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

arXiv:2411.13960

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

ApJ, 990, 114

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

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

arXiv:2502.13240

[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:

A&amp;A, 695, A90

An unresolved challenge for galaxy evolution models and dust radiative transfer

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

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

AJ, 167, 157

WOLD, ISAK; TILVI, VITHAL; MALHORTRA, 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

## 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 <i>Roman</i> spectroscopic simulations with ESpRESSO"	Virtual
NASA GODDARD SPACE FLIGHT CENTER – <i>Roman</i> 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 <i>Roman</i> 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 <i>Roman</i> spectroscopic simulations with ESpRESSO"	National Harbor, MD
THE 24TH AAS MEETING – <i>Roman</i> 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 <i>Roman</i> surveys"	Pasadena, CA (Remote)
CHALLENGING THEORY WITH <i>Roman</i> : FROM PLANET FORMATION TO COSMOLOGY – SELECTED TALK	Jul. 2024
"ESpRESSO - high-fidelity realistic grism simulations for <i>Roman Space Telescope</i> "	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 <i>Roman Space Telescope</i> 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 <i>Roman Space Telescope</i> ”	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 <i>Roman Space Telescope</i> 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

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<b>Spectroscopic Probes of Quantitative Reionization (SPQR)</b>	<i>Roman ROSES 2022</i>
<b>PI: JAMES RHOADS</b>	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

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### **Roman Space Telescope Wide Field Science Investigation Team**

<b>PI: JAMES RHOADS</b>	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](http://learning-the-universe.org)  
Jan. 2022 - Present

DIRECTOR: GREG BRYAN
Collaboration dedicated towards constraining the initial conditions of the universe utilizing machine learning and forward modeling processes.

### **Roman Space Telescope Cosmic Dawn Science Investigation Team**

<b>PI: JAMES RHOADS</b>	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

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NASA Exhibition at the 241st American Astronomical Society Meeting – <i>Roman Space Telescope</i> 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

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## sapphire

[Github](#)

### ROLE: CORE DEVELOPER

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

Python, Jupyter

## scsample

[Github](#)

### ROLE: LEAD DEVELOPER

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

Python, Jupyter

## ESpRESSO

[Github \(Private\)](#)

### ROLE: LEAD DEVELOPER

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

Python, Jupyter, Bash

## FlatHUB

[Github](#), [Website](#)

### ROLE: CONTRIBUTOR

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

Python, Haskell, TypeScript

## Membership & Involvement

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### 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

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### 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

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### Columbia University

Dept. of Astronomy; New York, NY

office hours, recitation

#### LECTURE TEACHING ASSISTANT

- ASTR GU4260: Modeling the Universe | Fall 2025

## Skills & Background

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### 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

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### Ariyeh Maller

[AMaller\[@\]citytech.cuny.edu](mailto: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](mailto: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](mailto: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