

Education

The City University of New York

MASTER OF SCIENCE IN ASTROPHYSICS

- Advisors: Viraj Pandya & Ari Maller
- Thesis: "Constraining satellite-host galaxy co-evolution with next-generation semi-analytic models"

New York, NY

Aug. 2023 - Present

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: 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: 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: Zoran Andelkovic & Wilfried Nörtershäuser
- Project: "Ion beam cross-section quality analysis for FAIR pre-development"

Darmstadt, DE

May 2016 - Aug. 2016

Research Interests

I am an astrophysics graduate student and former data scientist applying computational 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, and assisted with semi-analytic model recipe development. I have contributed to one first authored and eight co-authored peer reviewed publications, resulting in an h-index of 5 and a total of 138 citations (to date on [NASA/ADS](#)). My aim is to use my unique educational and professional background to further test our physical understanding of the galaxies in our universe including as our own.

Publications

FIRST AUTHOR

Semi-analytic satellites I. – constraining satellite evolution in CGM co-evolution models

ApJ, In prep.

GABRIELPILLAI, AUSTEN; PANDYA, VIRAJ; MALLER, ARI; BRYAN, GREG; SOMERVILLE, RACHEL S.; CARR, CHRIS; FIELDING, DRUMMOND; GREENE, JENNY; JIANG, FANGZHOU; STARKENBERG, TJITSKE; TONNESON, STEPHANIE; ZHU, JINGYAO

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

[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;
YUNG, L. Y. AARON; HERNQUIST, LARS

arXiv:2111.03077

Co-AUTHOR

The mass-dependent UVJ diagram at cosmic noon:

An unresolved challenge for galaxy evolution models and dust radiative transfer

GEBEK, ANDREA; DIEMER, BENEDIKT; MARTORANO, MARCO; VAN DER WAL, ARJEN; **GABRIELPILLAI, AUSTEN**; OSINGA, CALVIN; BAES, MAARTEN; MATSUMOTO, KOSEI; AKINS, HOLLIS;

A&A, In prep.

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

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

MNRAS, In prep.

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

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

MNRAS, In prep.

[7] Tracing the mass assembly history of local central supermassive black holes

PORRAS-VALVERDE, ANTONIO J.; NATARAJAN, PRIYAMVADA; RICARTE, ANGELO; SOMERVILLE, RACHEL S.; **GABRIELPILLAI, AUSTEN**; GENEL, SHY; YUNG, L. Y. AARON

ApJ, in review

[6] REX, the Reionization Explorer: Science and Mission Overview

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

SPIE, In review

[5] Ly α at Cosmic Dawn with a Simulated *Roman* Grism Deep Field

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

AJ, 167, 157

[arXiv:2305.01562](#)

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

PEREZ, LUCIA A.; GENEL, SHY; SOMERVILLE, RACHEL S.; VILLAESCUSA-NAVARRO, FRANCISCO; **GABRIELPILLAI, AUSTEN**; ANGLÉS-ALCÁZAR, DANIEL; WANDELT, BENJAMIN D.; YUNG, L. Y. AARON

ApJ, 954, 11

[arXiv:2108.00006](#)

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

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

GABRIELPILLAI, AUSTEN; JIANG, TIANXING; YANG, HAUN

ApJL, 942, 1

[arXiv:2207.13020](#)

[2] Mangrove: Learning Galaxy Properties from Merger Trees

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

ApJ, 941, 7

[arXiv:2210.13473](#)

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

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

MNRAS, 508, 698

[arXiv:2108.00006](#)

Talks & Posters

INVITED TALKS

”Ion beam cross-section quality analysis for FAIR pre-development”

LASERSPHERE WORKING GROUP MEETING

Darmstadt, DE

Aug. 2016

”An introduction to FlatHUB – an open source web-based query-able database for astrophysics”

FLATIRON INSTITUTE - CCA GROUP MEETING

New York, NY

Oct. 2018

”ESpRESSO – Simulating *Roman* Spectroscopic Instruments”

PRINCETON UNIVERSITY - ASTRO DATA LAB GROUP MEETING

Virtual

May 2022

”Semi-analytic satellite evolution – modeling ram pressure stripping in Milky Way-like systems”

COLUMBIA UNIVERSITY - ASTRONOMY DEPARTMENT PIZZA LUNCH TALKS - WHITEBOARD TALK

New York, NY

Feb. 2024

SELECTED TALKS

”Mock Grism Simulations for *Roman Space Telescope*”

THE 238TH AAS MEETING – RESEARCH CONTRIBUTED TALK

Virtual

Jun. 2021

”Roman Grism Simulations with Multiple Orders and Distortions”

NASA GODDARD EARLY CAREER SCIENTIST FORUM – 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”

Roman SCIENCE TEAM COMMUNITY BRIEFING – SELECTED TALK

Virtual

Nov. 2021

"ESpRESSO - mock <i>Roman Space Telescope</i> spectroscopic foreground simulations"	Seattle, WA
THE 241TH AAS MEETING – HYPERWALL TALK	Jan. 2023
"Revealing the subtle differences in the stellar-to-halo mass relationship between different models through subhalo tracking"	New York, NY
SIMBA COLLABORATION MEETING 2023 – SELECTED TALK	May 2023
"ESpRESSO - high-fidelity realistic grism simulations for <i>Roman Space Telescope</i> "	Baltimore, MD
Roman SCIENCE INSPIRED BY EMERGING <i>JWST</i> RESULTS – SELECTED TALK	Jun. 2023
"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

CONFERENCE POSTERS

"Emulating IllustrisTNG with the Santa Cruz SAM – comparing galaxy properties at $z = 0$ "	Virtual
ASTRO POSTER 2022 - GALAXY EVOLUTION – POSTER #610	May 2022
"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 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

Collaborations

***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

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

The CAMELS project: Cosmology and Astrophysics with Machine Learning Simulations

camel-simulations.org

PIs: FRANCISCO VILLAESCUSA-NAVARRO, DANIEL ANGLES-ALCAZAR, SHY GENEL

Jun. 2023 - Present

Collaboration dedicated towards bridging astrophysics and cosmology through machine learning and numerical simulations.

- Graduate student & CAMELS-SAM affiliate member

***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

Grants Awarded as Co-Investigator

Spectroscopic Probes of Quantitative Reionization (SPQR)

Roman ROSES 2022

PI: JAMES RHOADS

Sep. 2023 - Sep. 2027

- Wide field science (large) program

Scientific Service

NASA Exhibition at the 241st American Astronomical Society Meeting – *Roman Space Telescope* Booth

Seattle, WA

VOLUNTEER

Jan. 2023

NASA Astrophysics Research and Analysis + Strategic Astrophysics Technology 2023 Review Panel

Remote

EXECUTIVE SECRETARY

Apr. 2024

Scientific Software

scsample

ROLE: PRIMARY DEVELOPER

- Module to query Santa Cruz semi-analytic model TNG-SAM and CAMELS-SAM hdf5 files

[Github](#)

Python, Jupyter

ESpresso

ROLE: PRIMARY DEVELOPER

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

[Github \(Private\)](#)

Python, Jupyter, Bash

FlatHUB

ROLE: CONTRIBUTOR

- Website for hosting astrophysical theory catalogs with query and download tools

[Github](#)

Python, Haskell, TypeScript

Membership & Involvement

American Astronomical Society (AAS)

GRADUATE STUDENT MEMBER

May 2021 - present

Astronomy Graduate Student Congress

CUNY GRADUATE CENTER REPRESENTATIVE

Apr. 2024 - Present

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

James Rhoads

[james.e.rhoads \[at\] nasa.gov](mailto:james.e.rhoads@nasa.gov)

- Research Astronomer at NASA Goddard Space Flight Center, Observational Cosmology Laboratory
- CRESST II sponsor (Nov. 2020 - Aug. 2023)
- Collaborator on Roman Space Telescope preparatory work

Ari Maller

[AMaller \[at\] 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)

Rachel Somerville

[rsomerville \[at\] flatironinstitute.org](mailto:rsomerville@flatironinstitute.org)

- Galaxy Formation Group Leader at Center of Computational Astrophysics, Flatiron Institute
- Internship advisor (Jul. 2018 - Aug. 2020)
- Main collaborator and supervisor for the Santa Cruz Semi-analytic model vs. IllustrisTNG paper series