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Dilys Ruan Ph.D. Candidate

Education

Dept. of Physics and Astronomy, Rutgers University — New Brunswick, NJ
Ph.D. in Physics and Astronomy — 2020 - July 2026 *(expected)*
- Advisor: Prof. Alyson Brooks
- Thesis: Dwarf Galaxy Simulations and HI Gas Kinematics

Dept. of Physics and Astronomy, University of New Mexico — Albuquerque, NM
B.S. in Astrophysics — 2016 - 2020
- Magna cum laude, Minor in Mathematics

Research Projects

HI Moment Maps and Dark Matter Models | PI: Alyson Brooks — **in progress**
- Use HALOTOOLS to make weak lensing shear profiles for galaxies simulated with cold dark matter (CDM) and self-interacting dark matter (SIDM). Theory work in collaboration with the Merian survey, which targets nearby dwarf galaxies.
- Compare shape of HI profiles at different viewing angles of the galaxy, and determine whether these shapes differ between dark matter models.

V/σ and Rotation Curve Methods | PI: Alyson Brooks — **in progress**
- Use Pynbody to make line-of-sight maps of surface density, velocity, and velocity dispersion with different galaxy components (e.g., young stars, old stars, cold gas).
- Use Martini and PyBBAROLO, which consider observational noise, to create rotation curves and velocity moment maps (flux, velocity, and dispersion). Will compare rotation curves from observational methods (Martini and PyBBAROLO) and simulation methods (Pynbody).

Baryonic Tully Fisher Relationship (bTFR) | PI: Alyson Brooks — **2024-2025**
- Found a turndown in the bTFR, which suggests that feedback uniquely affects dwarf galaxies so that they have less baryonic mass compared to their dark matter halo. Also found that only spatially-resolved HI observations with low enough sensitivities can measure a turndown and accurately trace the dark matter halo.
- Used Pynbody to compare HI rotation speeds with different definitions of gravitational potential, with spatially resolved versus unresolved methods, and with different HI sensitivity limits.

Statistical Bias in Strong Gravitational Lensing | PI: Chuck Keeton — **2021-2023**
- Found statistical bias in the Hubble constant in mock strong lensing galaxy-galaxy systems due to radial profile degeneracy.
- Used pyGRAVLENS to create mock quadruply lensed systems and their respective time delays and image positions. Then used EMCEE to find the best-fit Hubble constant, external shear, and ellipticities corresponding to the image information.

Off-Pulse Emission from Pulsar B0950+08 | PI: Greg Taylor (UNM) — **2019-2020**
- Found off-pulse emission from the nearby, bright pulsar B0950+08. Concluded this emission is not magnetospheric in origin, and instead is likely from a pulsar wind nebula due to its size.
- Reduced ELWA (Very Large Array + Long Wavelength Array) data using AIPS. Did flux subtraction between the total emission and pulsar in AIPS.
- Constrained spectral indices for B0950+08 and its off-pulse emission with our observations and other surveys (VLSSr, TGSS, NVSS, FIRST, and VLASS).

Awards

NASA FINESST Fellowship 2025-2026
Noemie Koller Scholarship 2025
School of Graduate Studies Louis Bevier Fellowship, *alternate* 2025
School of Graduate Studies Travel Award 2025
School of Arts and Sciences Excellence Fellowship Spring 2025
Van Dyke Fund Travel Award Summer 2023
Richard J. Plano Outstanding Teaching Assistant Award 2021

Conferences / Talks

Galread Seminar, *talk, Princeton University* 11/21/2025
Astro Seminar, *talk, American Museum of Natural History* 11/13/2025
Galactic Frontiers II, *poster, Dartmouth University* 6/23/2025
Astro Seminar, *talk, Columbia University* 4/10/2025
Little Galaxies Seminar, *talk, Ohio State University* 3/24/2025
Small Galaxies, Cosmic Questions - II, *poster, Durham University* 7/29/2024
Dwarf Galaxies, Star Clusters, and Streams in the LSST Era, *poster, KICP* 7/8/2024
Lensing at Different Scales, *poster, KICP* 7/31/2023
Galactic Frontiers: Dwarf Galaxies in the Local Volume & Beyond, *CCA* 7/24/2023
241st American Astronomical Society Meeting, *poster, Seattle, WA* 1/8/2023
Long Wavelength Array Users Meeting, *talk, University of New Mexico* 8/1/2019

Skills

Coding Languages: `Python`, `MATLAB` || **Software and Packages**: `Pynbody`, `TIPSY`, `MARTINI`, `pyBBAROLO`, `halotools`, `GALA`, `pyGRAVLENS`, `EMCEE`, `AIPS`

Research Mentoring

Gabriel Cruz, *Post-Baccalaureate* **Fall 2025 - present**
Goal: use machine learning to tie star formation rate, mass, and inclination to HI profiles.

Chris Le, *Honor's Thesis → Post-Baccalaureate* **Fall 2024 - present**
Goal: quantify differences in rotation curves from observational software 3DBBAROLO vs. simulations. Generate mock data cubes with MARTINI at different viewing angles.

Aniruddha Madhava, *ARESTY student* **Fall 2023**
Reviewed literature for their first-author paper on systematic errors in cluster lens models.

Io Kovach, *REU Student* **Summer 2022**
Goal: quantified bias from lensing models in the pyGRAVLENS code for TNG50 galaxies.

Service / Outreach

Astronomy Journal Club, *Co-Organizer* **Fall 2023 - Fall 2025**
Organized weekly meetings with talks + paper discussions. Modified format to include research talks in the first half and prioritized early career astronomers (internal & external).

Equity & Inclusion Journal Club, *Co-Organizer* **Fall 2021 - Fall 2023**
Organized monthly meetings to discuss ways to broaden participation in the field.

Rutgers AAUP-AFT, *Department Representative* **Fall 2024 - present**
Organize coffee hours and canvassing to meet union members and improve conditions.

New Brunswick Physics Demo Group, *Presenter* **2021 - present**
Visit a local high school every semester and present interactive demos of relevant concepts.

Physics & Astronomy Graduate Student Organization, *Co-President* **2023 - 2024**
Addressed grad student issues and organized biweekly dinner seminars.

ASPIRE, *Reviewer + Panelist* **2023 - 2025**
Reviewed grad school and REU app materials for students and joined an in-class panel.

Mock Qualifier Exams, *Co-Organizer* **Fall 2025 - present**
Arranged mock committees + materials to simulate the qualifying exam for grad students.

Publications

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1. "Predictions for Detecting a Turndown in the baryonic Tully Fisher Relation", **D. Ruan**, A. Brooks, A. Cruz, A. Peter, B. Keller, T. Quinn, J. Wadesley, 2025, MNRAS, 541, p. 2180.
2. "Statistical bias in the Hubble constant and mass power law slope for galaxy-scale mock lenses", **D. Ruan** & C. R. Keeton, 2023, eprint arXiv:2309.16529
3. "Discovery of a Pulsar Wind Nebula around B0950+08", **D. Ruan**, G. B. Taylor, J. Dowell, K. Stovall, P. B. Demorest, 2020, MNRAS, 495, 2, p. 2125-2134.