GRADUATE PROGRAM IN ASTRONOMY AT





Why Yale Astronomy for your Ph.D.?

Plenty of resources for research and a supportive intellectual community







ACCESS TO WORLD-CLASS **OBSERVING FACILITIES**

- We have excellent resources for observing, including on-campus observing facilities and telescope-time reserved specifically for our department members.
 - Keck: 24 nights per year
 - Palomar; 1/8 share
 - SDSS V: full partnership







EASY-ACCESS HIGH PERFORMANCE **COMPUTING FACILITIES**

The Yale Center for Research Computing (YCRC) provides HPC resources freely available for all students to use.







GUARANTEED FUNDING

Teaching beyond the University requirements is optional to earn some extra cash, but your main funding as a researcher is secure for 5-6 years.

SUPPORTIVE COMMUNITY

A fun and supportive graduate student community. Class of ~4-5 students admitted each year, and a total of ~25-30 students in the entire program.





A WIDE RANGE OF RESEARCH INTERESTS ACROSS FACULTY MEMBERS

For listing of faculty by research interest see: <u>https://astronomy.yale.edu/research</u>

EXOPLANETS GALAXY EVOLUTION COSMOLOGY STAR FORMATION SOLAR AND STELLAR ASTROPHYSICS ...AND MORE

Students complete 2 short research projects in their first two years *before* beginning PhD research. This allows for a fuller exploration of research opportunities.



RESEARCH AREAS OF YALE FACULTY observer theorist instrumentalist

Sun, Stellar Structure & Evolution - Sarbani Basu Stellar Populations, Galactic Structure - Bob Zinn **Star Formation** - Héctor Arce Black Holes & X-Ray Binaries - Charles Bailyn

Cosmology: Dark Matter, Lensing - Priya Natarajan Astroparticles (Dark Matter, Neutrinos) - Reina Maruyama Data Intensive Astrophysics - Earl Bellinger

https://astronomy.yale.edu/people/faculty

- **Exoplanets Malena Rice, new faculty hire (TBD)**
- Galaxy Structure, Formation & Evolution Jeff Kenney, Marla Geha, Pieter van Dokkum Frank van den Bosch
 - Active Galactic Nuclei Meg Urry, Paolo Coppi

 - Clusters Daisuke Nagai
 - Large-Scale Structure Nikhil Padmanabhan, Laura Newburgh

 - Instrumentation Andy Szymkowiak





ASTRONOMY GRADUATE COURSES

CORE (REQUIRED):

- Astro 500 The Physics of Astrophysics (usually in first year)
- Astro 520 Computational Methods
- Astro 555 Observational Astronomy
- Astro 560 ISM & Star Formation
- Astro 580 Research (taken twice for each of the 2 research projects)
- Astro 710 Professional Seminar (required every semester)
- Phys 590 Responsible Research by the Physical Scientist (ONCE)

SEMI-CORE (MUST TAKE ONE <u>OR</u> THE OTHER):

- Astro 530 Galaxies <u>OR</u> Astro 565 The Evolving Universe
- Astro 510 Stellar Populations <u>OR</u> Astro 550 Stellar Astrophysics **ELECTIVES (ALL OTHER COURSES):**
 - Dynamics, Galaxy Formation, Cosmology, Advanced Statistical Methods for Astronomy

• Examples: Astrophysical Flows, Exoplanets, Radio Astronomy, High-Energy Astrophysics, Stellar



ORGANIZATION OF ASTRONOMY AT YALE

- Astronomy Department Kline Tower

- (interdisciplinary activity in planets and exoplanets)





• Physics Department - Sloan, Wright Lab, and Kline Tower • Yale Center for Astronomy and Astrophysics - Kline Tower (institute bridges activity between Astronomy & Physics depts) • Earth & Planetary Science Department - Kline Geology Lab





RESEARCH PROJECTS

ALL STUDENTS CARRY OUT TWO RESEARCH PROJECTS IN THEIR FIRST TWO YEARS:

1 observational (data-based), 1 theory (model-based)

Good plan:

- for 1st project: start in 1st semester, finish in 2nd semester or summer (take for credit as A580 in 2nd semester)
- for 2nd project start in summer or 3rd semester, finish in 3rd or 4th semester (take for credit as A580 in 3rd or 4th semester)

The goal is to have at least one of the 2 research projects be publishable





CURRENT WEEKLY ASTRONOMY EVENTS



Astronomy Colloquium



Galaxy Lunch

Cosmology Seminar

Also: Public Night at LFOP - Tuesday evenings Astronomy Happy Hour (AHH) - Friday afternoons

Weekly activities are open to all department members



Exoplanets and Stars Seminar



Data Science x Astro Seminar (bi-weekly)



Software Journal Club









- <u>https://astronomy.yale.edu/about/climate-and-diversity</u> <u>https://astronomy.yale.edu/resources/astronomy-student-council</u>
- Astronomy Climate and Diversity Committee (ACDC) Astronomy Student Council (ASC) • Student representatives on Telescope Time Allocation Committee
- (TAC)
- meetings
- Mentorship of undergraduate students (Astro sibs) Outreach (Leitner Family Observatory & Planitarium, and more)

STUDENT INVOLVEMENT IN DEPARTMENT AFFAIRS

Voice opinion on curriculum, climate, other issues through surveys and









8-inch 1876 Reed Refractor

16-inch RCT with CCD Imagers, Spectrographs

ASTRONOMY EDUCATION AND OUTREACH CENTER:

- Weekly Public Nights planetarium shows, public observing
- Summer Research for High School Students (YSPA)
- Weekly area school group visits
- Teaching experience for grad/undergrad students
- Astro 1xx lab exercises
- Astronomy Department Events

Classroom/computer lab with museum-quality display panels

50-seat digital planetarium theater

Observing deck with piers for small telescopes





PLEASE COME JOIN US!

- Are you curious to learn and figure things out?
- Do you have desire for mastery and for learning new ways of problem-solving?
- Do you have core competence in foundational material physics and mathematics?
- Have you had exposure to research methods and experience with research project, if opportunities were available?
- Do you have the capacity to deal with the ups and downs that are part of long-term intellectual learning?
- Do you have enthusiasm for research?
- Are you excited to belong to a scientific community working on cutting-edge problems?





FOR MORE INFORMATION....

VISIT OUR WEBSITE AT: ASTRONOMY.YALE.EDU

https://www.facebook.com/YaleAstro

YaleAstronomy

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