

Major's Handbook - Astronomy Department

1. Welcome

Wesleyan University has a vibrant and well-known astronomy department. It is a versatile program that prepares and enables graduates to go on to a wide range of different career trajectories in our field and neighboring fields, including pursuing a PhD. Many of our graduates go on to careers in data science, education and public outreach, systems engineering, and more. We are thrilled to welcome you to this program and our greater Wesleyan astronomy network.

1.1 Our Community

Our mission in the Department is to cultivate an environment where we are pushing the frontiers of astronomical research and pushing the frontiers of our personal astronomical knowledge. The nature of this enterprise is both collaborative and driven by individuals. It is therefore vital that all individuals feel welcome and supported by our environment. There are inequities and barriers that are clearly evident in our society as well as within our academic field. The data reveal generic trends, but it is important to recognize that these selective additional burdens are borne by individuals in our astronomy community and in our department. We continually work to maintain an inclusive and equitable department, and we maintain a commitment to each other at all levels of our community. If there are any concerns, questions, suggestions, or problems, please do not hesitate to reach out to a trusted individual so that the department can address it. Many resources and various communities exist on campus to support equity and inclusion: <https://www.wesleyan.edu/astro/Community.html>.

The undergraduate majors are the backbone of the Department, making up the largest constituency by number. The positive, tight-knit, and inclusive environment at the Observatory exists in large part thanks to our proactive and awesome majors.

2. Courses

Astronomy major requirements can be found in the Wesleyan Course Catalog: <https://catalog.wesleyan.edu/departments/astr/ugrd-astr/>.

2.1 Seminar Courses

Majors are expected (effectively required unless there is a valid rationale) to enroll in our departmental seminar course. These are 0.25-credit courses that are offered each semester. In the fall semester the seminar is ASTR430: Seminar on Astronomical Pedagogy, and in the

spring it is ASTR431: Research Discussions in Astronomy. These are low-workload courses (typically requiring a single presentation and weekly participation, perhaps with light reading/writing assignments as well). However, they are valuable community-building experiences. Essentially the entire department attends these weekly lunchtime seminars, and it is an opportunity for us to keep in touch with each other.

2.2 Academic Advising

The Chair of the Department is the default academic advisor for all majors. You will meet with your advisor in preparation for selecting your courses during pre-registration. You are also welcome to discuss your academic planning with your research advisor, or any of the faculty, and you may request that your academic advisor be changed to any faculty member in the Department. In addition to course requirements, feel free to bring up questions related to getting involved with research, applying to fellowships and grants, graduate school, career planning, study abroad, and other relevant topics.

2.3 The Capstone

Astronomy does not require a thesis, but it does require a capstone. The capstone could be a research tutorial or independent project; the minimum requirement is a presentation on a recent research paper or project during the ASTR431 seminar in the spring of senior year.

A thesis is required to be eligible for honors in the major. If you decide to undertake a thesis, you must enroll in 1.0 credits of senior thesis tutorials in both the fall and spring semesters. You should begin to identify an advisor and project during the spring of your junior year by talking with the faculty. It is ideal but not required that you begin thesis research the summer before the thesis year. A LaTeX template for the thesis is available [here](#). Undergraduates do not defend their theses; the thesis must be submitted to the university by the deadline, and then all the astronomy faculty not on sabbatical/leave will read each thesis, confer on their evaluation, and assign a consensus grade of credit only, honors, or high honors.

The department offers one academic award: the Littell Prize, which is based on excellence in one or more upper-level courses. We also consider performance outside the classroom (e.g., in research) and leadership/involvement in departmental activities. Winners are recognized in the Commencement program and receive a modest monetary prize.

3. Research

Being involved in cutting edge research is a deeply rewarding experience that provides a unique educational experience and gives you experience with the transition from foundational coursework to professional research that pushes the frontier of knowledge in our field. Research

involves taking ownership of your own project that grows out of the research of one of the faculty and involves their mentorship and collaboration.

3.1 When and How to Get Involved with Research

Getting involved with research is easy! We recommend that you begin by perusing the websites of faculty in the department to get a sense of what we work on, and then schedule one-on-one meetings with any faculty you might want to work with to discuss their research and possible projects you could work on. You can also get a sense of what the faculty research areas are by talking with other graduate and undergraduate students who are doing research. You are encouraged to talk to all the faculty, no matter what your initial leanings are in terms of research. You never know what projects may pique your interest, and it is a wonderful way for you to get to know the faculty better. Please don't be shy – we do this all the time! Different faculty are looking for different skills and experiences in beginning research students (e.g., some faculty prefer that students wait to begin research until after taking ASTR155 and/or 210/211), but it is not unusual to begin research as early as freshman year, or as late as the beginning of senior year. Beginning earlier often means you spend more time building foundational research skills and background knowledge, but persisting in research over the course of multiple years allows you to go deeper into your research and/or try out different topics.

3.2 ASTR423/424: Advanced Research Seminar, Undergraduate

Students who engage in research with a faculty member during the semester generally do so for course credit (if you are involved in the McNair program, be sure to discuss opportunities for pay with your advisor and Ronnie Hendrix). After discussing the scope and time commitment of your project with your advisor no later than the first week of the semester, you should add a research tutorial through WesPortal during the add/drop period (ASTR423 in the fall or ASTR424 in the spring).

Research experience is unlike your academic experiences in the classroom, and is incredibly useful as you are considering various career paths. However, you only receive this benefit if you have time to devote to doing research. So, it is critical that you have time available in your semester to be involved in research. There are various credit levels you can select for ASTR423/424 (e.g., 0.25-1 credit). A 0.25-credit commitment might involve 2-3 hours per week (e.g., attending meetings and doing readings/tutorials), a 0.5-credit commitment is typically equivalent to ~4-6 hours per week, and a full credit would be the equivalent commitment as a full course and be 10+ hours per week.

3.3 Summer Research Opportunities

The VVO basement is always humming with activity during the summers from our student researchers, who are paid approximately \$5000 for their work on campus. The most common route for securing a research position is through the [College of Integrative Sciences Research in](#)

[the Sciences](#) program. Note that you must have identified an advisor and discussed your project with the advisor before applying. The application deadline is usually in early March. Other common sources of support for staying on campus to do summer research include [NASA CT Space Grant](#) Undergraduate Research Fellowships (usually with mid-October and mid-February deadlines each year), [McNair](#), the CIS major, the [Quantitative Analysis Center](#), or the [Student Affairs RISE fellowship](#). Faculty can also apply for university funds on behalf of one student per year (also with a March deadline), and may have grant funding to support additional students; please discuss potential funding sources with your advisor.

Off-campus astronomy summer research opportunities include a research exchange through the [Keck Northeast Astronomy Consortium](#) (of which Wesleyan is a member), the [NSF REU program](#) that has many sites around the country, [NASA summer internships](#), and a variety of programs both in the US and abroad; two international programs attended by Wesleyan students recently are [DAWN-IRES](#) in Copenhagen and [LEAPS](#) in Leiden. These programs are typically highly competitive and admissions criteria are a bit idiosyncratic (often by the individual advisor), so we recommend applying to many different programs to maximize your chances of acceptance (there is no application fee). Your chances increase with each year of experience in our program, but our juniors typically do very well and it is not unusual for our sophomores to secure off-campus opportunities, especially if they already have a summer of on-campus research under their belts. Most program deadlines are in February.

Opportunities tend to be more limited for international students, but the KNAC research exchange program funds international students and here is a spreadsheet of [astronomy summer programs open to](#) international students. A compilation of summer STEM research programs open to undocumented/DACA students in the US is located [here](#).

3.4 Travel to Meetings

It is not uncommon for students, mainly in their final year, to present their research at a national or international scientific meeting. The most common meeting is the winter meeting of the American Astronomical Society (AAS; [aas.org](#)) which is held in early January. Discuss the opportunity with your research advisor no later than the start of fall semester. In particular, discuss the possibilities of financial support to cover the costs and plan to apply for a NASA CT Space Grant travel grant.

5. CAing

Depending on which courses are offered in a given semester, there may be opportunities to work as a Course Assistant (CA) for pay, or (less commonly) as a Teaching Apprentice (TA) for course credit. Typically these opportunities will be announced and applications solicited during the summer months (for fall courses) or late in the fall semester (for spring courses), but if you are particularly interested, don't hesitate to talk with the chair or the faculty member teaching a

particular course. You do not need to have earned an A in a course in order to work as a CA! It is much more important that you made use of multiple methods to learn the material, that you are able to be supportive and encouraging towards struggling students, and that you are reliable and diligent about your CA assignments. Typically CA assignments are for 5-8 hours per week, and might involve helping to run evening observing sessions, weekly TA/CA-led help sessions, or objective grading assignments. Undergrads should not regularly spend more than 10 hours per week on a CA assignment (please talk to your supervising instructor if you find that you are regularly spending more than 10 hours/week on your CA work).

6. Beyond the BA

6.1 Applying to fellowships and scholarships

Astronomy students routinely apply for and receive competitive fellowships at the state and national level. Here are a few fellowships that our students have successfully applied to recently:

NASA CT Space Grant (many fellowships/scholarships including undergraduate research fellowships, undergraduate scholarships, undergraduate travel grants, and community college transfer students). Talk to a faculty member for advice, but our students have a great track record of applying to these grants.

Barry M. Goldwater Scholarship - This is a competitive national scholarship awarded to sophomores (less commonly) and juniors (more commonly) on the basis of research achievement and potential in the sciences. It provides a \$7500 scholarship for each remaining year of college after the award. There is a campus-level competition before going on to the national competition. Talk to a faculty member and the Wesleyan Fellowships office about applying, ideally beginning the summer before you apply. Campus applications are typically due in the fall, and the national competition takes place in the spring.

Fulbright Scholarship - This is a competitive national scholarship that allows you to spend a year after graduation studying abroad in a foreign country. You are only eligible to apply during your senior year, and you must already have identified a host country/institution before applying. Summer research can help with these placements, as can your faculty advisor. You should definitely talk to the Wesleyan fellowships office if you plan to apply.

NSF Graduate Research Fellowship Program: The NSF GRFP is a competitive national fellowship that funds three years of graduate-level research. In addition to the funding, it offers flexibility in choice of research topic and location since you effectively bring your own funding to a PhD program. You typically have two years of eligibility for this fellowship: your senior year of college, and your first year of graduate school. Your research advisor and the Wesleyan fellowships office can help you prepare to apply to this fellowship, which is typically due in October of senior year (though you should begin your application over the summer).

6.2 The BA/MA program

The Department offers a path to the MA degree for Wesleyan undergraduates through the BA/MA program. Students accepted into this program enroll for an additional year (tuition-free) to complete the MA requirements. Students on financial aid may be eligible for cost-of-living assistance as well. BA/MA students need to show proficiency at the equivalent of the BA in Astronomy. Six credits are required in the final year (two for thesis research, two associated with the advanced astronomy courses if they have not already been taken, and the rest in another subject). Sometimes it is possible to use credits that were taken during undergraduate years if they were not used to satisfy graduation or major requirements. BA/MA students do not take the qualifying exam if ASTR155 has been successfully completed. BA/MA students are not required to TA, but may apply for TA opportunities if they are available in a given semester.

6.3 Applying to PhD programs

Applying to PhD programs in astronomy is a well-trodden path in our department. You can get excellent advice from faculty, grad students, and postdocs, as well as from recent alumni of our program who are generally eager to share their advice and experiences with current students. Generally speaking, an ideal timeline looks like this:

- **Before senior year:** explore research! Research is the best way to find out if you are likely to enjoy grad school (which is all about research rather than classes), and also the best way to prepare for entry to grad school (which effectively requires a set of substantive research opportunities as well as a full set of physics and astronomy courses). As a general rule, if you expect to apply to PhD programs, you should plan to spend at least two summers doing research, which might include one summer on campus and one at an off-campus research program like an REU.
- **Consider a double-major in physics.** We strongly encourage any student considering applying to PhD programs in astronomy to complete at least MATH222, PHYS316, PHYS324, and PHYS313. At that point, you might as well finish the physics major by taking an upper-level lab or two! Remember that advanced astronomy courses can count as 1-2 of your upper-level electives for the physics department, with permission.
- **Summer before senior year:** [Start looking at different programs](#) and planning where to apply. Talk to the faculty and the fellowships office about applying for the NSF GRFP. If you plan to take the General or Physics GRE, begin studying and doing the practice tests. If you will need fee waivers for applications, take note of the process for each program to which you plan to apply; sometimes the application deadline is earlier or a limited number of fee waivers are available on a first-come, first-served basis, so it may be in your interest to apply early.
- **Early fall:** Draft your statements of purpose, get advice from faculty about your list of programs to apply to, ask recommenders if they are willing to write letters for you, and get feedback on drafts of your GRFP statements (the deadline for applying to the GRFP is usually in early October). Some programs still require scores from either the General

or Physics GRE test as part of your application; the general GRE can be taken anytime, but the physics subject test is only offered on certain dates, with two typically falling in the fall semester.

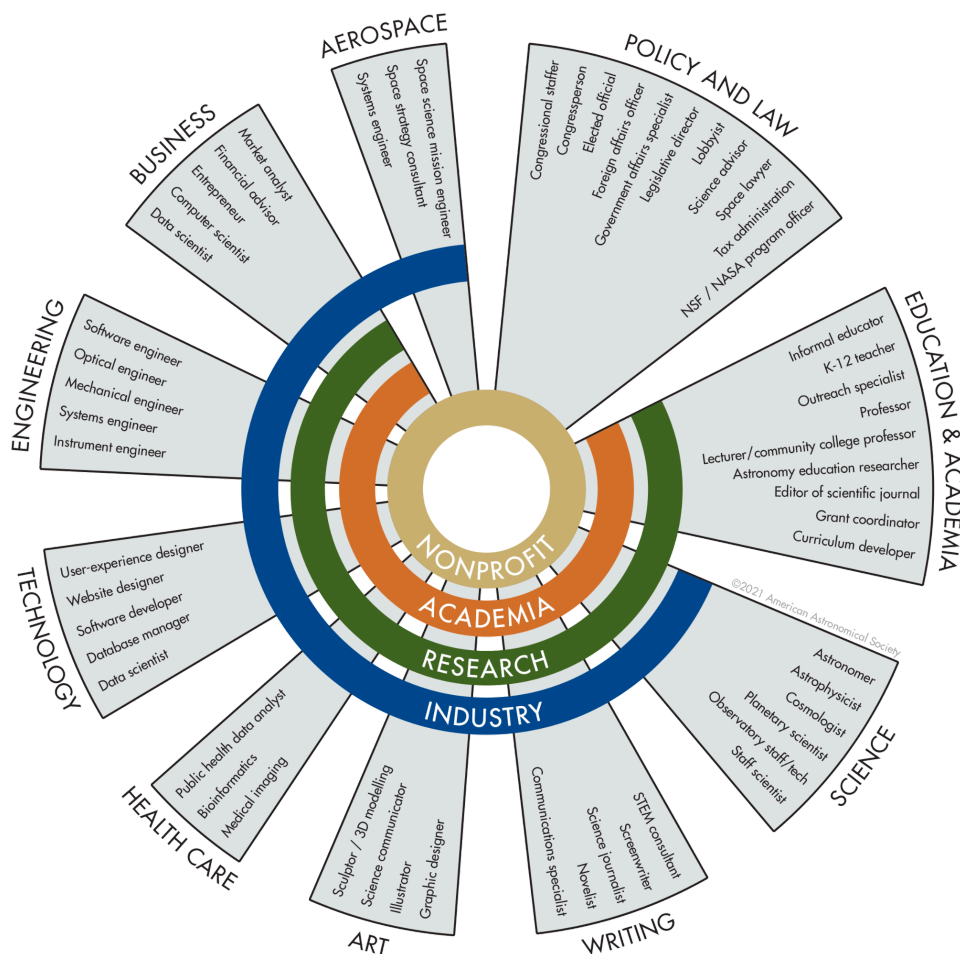
- **November:** get feedback on your statement of purpose from your research advisor, another faculty member, and any willing students/postdocs. Please don't skip this step! The format of grad school statements of purpose is very different from that of college application essays, so please run it by someone familiar with this form of writing before submitting your application. Give enough time for them to read it carefully, and for you to implement their feedback.
- **December:** apply! Most applications are due in early- to mid-December, although a few are due in January or even later. Be aware that many programs don't allow recommenders to submit letters until you have submitted your full application, so plan ahead to allow as much time as possible for your recommenders to upload their letters.
- **Jan/Feb:** If you're lucky, you might get some interviews (but don't panic if you don't; many programs do not include interviews as a component of their admissions process). Recent alumni are often the best resource for discussing interview strategies; the Gordon Career Center can also help, as can your faculty advisor. [This advice document](#) was compiled in 2022 by Wesleyan science students from a variety of NSM departments.
- **Feb 15:** First-round offers of admission are usually released around this date. Then there is generally a LONG and excruciating wait for second-round offers from the waitlist (because grad school visits happen during March, and the deadline for students with first-round offers to make a decision is April 15). Please try not to panic if you don't get first-round offers, and do your best to remain patient! If you are on the waitlist for one or more programs, it's generally a very good sign.
- **March:** visits for admitted students. This is your chance to check out a department, talk to its faculty and students, ask questions about the program, and explore its environment. Visit any program you are seriously considering; if you're lucky enough to have many offers of admission, it's probably in your best interests to limit the number of visits to around 4 or fewer, and decline other offers promptly.
- **April:** first-round decisions due. Once you have visited any programs to which you were admitted, it is best to make a decision as soon as you have all the information you need. When you make your decision, you should immediately notify the school you choose of your acceptance, AND you should notify any other schools that you are declining their offer (or that you wish to withdraw from the waitlist). Be courteous but clear: this will allow the program to make offers to other students who are on the waitlist.
- **If you aren't admitted:** Try not to panic, and also try not to let it shatter your self-esteem or your identity as a scientist. PhD admissions in astronomy are extremely competitive and have only become more so over time. These days it is not uncommon for students to need to apply two or even three times before receiving offers of admission; the biggest things you can do to positively impact your probability of admission (assuming you've already worked to get the best grades you can in your classes) are generally gaining more research experience and ideally publishing a paper. One of the best ways to do

this is to seek out [post-baccalaureate](#) research positions or telescope operator positions at, e.g., a university, a NASA center, an observatory, or a research institute (like STScI). The AAS job register is a great way to keep abreast of these opportunities.

6.4 Career opportunities for astronomy BAs

There are many impactful and rewarding careers that allow you to use the skills you have gained as an astronomy major. The AAS employment committee is a fantastic resource, and has organized this excellent infographic to help you think about different categories of jobs that you are prepared to pursue as an astronomy major.

<https://aas.org/careers/astronomy-powered-careers>



Alumni are a fantastic resource as you consider these careers. Recent alumni from our program are working in essentially every sector of this diagram (perhaps most commonly in data science / software, education and public outreach, and aerospace / engineering), and are generally happy to share their advice and experiences in finding a job and navigating life after Wesleyan. You can find alumni contact information through the Gordon Career Center, or by

asking faculty or the department administrative assistant for help in identifying and contacting alumni from our program with relevant career experience. You should also plan to attend our astronomy alumni career panels, which are organized about once per year as part of the colloquium series.

7. Other Departmental Activities

We are a small but vibrant community. There are a number of exciting activities that may be of interest to you.

7.1 Colloquia

We have approximately five Departmental Colloquia each semester. We bring in world-experts in a variety of topics to present their cutting edge research. We expect all majors to attend all colloquia, and you are strongly encouraged to join the speaker for tea before the talk. This is a wonderful opportunity to find out about the breadth of research in the field beyond the topics covered by Wesleyan faculty, and to meet and talk with outstanding researchers (including potential PhD thesis advisors) from a variety of institutions around the region.

7.2 Outreach

We have numerous public outreach events at the Observatory. The current structure involves giving presentations to adults about any aspect of astronomy or space science every Wednesday evening, and leading space-themed activities for children once a month. Observing takes place after the presentation/activity as long as the sky is clear. You can sign up to give a presentation, help lead kids' night activities, or operate the telescopes. We encourage you to participate in outreach activities a minimum of 1-2 times per semester. You will get paid for your time. There are also sporadic activities like hosting scout troops at the observatory or bringing the planetarium to a local school. Please let Roy know if you are interested in participating in these sporadic activities.

7.3 Kitchen (and Other Common Areas)

There are a number of common areas in the Observatory that require a communal responsibility for their care. In particular, we have a small kitchen in the basement. Please clean up after yourself and be responsible for your food in the refrigerator. As we all know, often it requires more than just dealing with your own items to keep a communal area clean, and we want to make sure the same individuals are not saddled with the task of dealing with it, so if you see something that needs to be done, even if you were not responsible for it, consider helping to take care of it. Please also check to ensure that all windows are closed, doors are locked, and lights are turned off before you leave the building each day.

7.4 Planetary Science Minor

Wesleyan has a unique interdisciplinary program in planetary science. It includes a minor in planetary science. If your research or interests involve planetary science consider participating in this program: <https://www.wesleyan.edu/planetary/Undergraduate%20Program/index.html>.