

Graduate Handbook - Astronomy Department

1. Welcome

Wesleyan University has one of the very few stand-alone Masters (MA) programs in astronomy in the country. 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 at another institution. A description of the program can be found here:

<https://www.wesleyan.edu/astro/grad-program/index.html>.

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. There are several additional channels throughout the university to discuss and report any issues that arise, like the [office for equity and inclusion](#), the [student ombuds](#), [CAPS](#), or the [director of graduate student services](#).¹ Many resources and various communities exist on campus to support equity and inclusion. While many of these are focused on undergraduates, they may also be of interest to graduate students: <https://www.wesleyan.edu/astro/Community.html>.

The graduate students in the Department are a critical community within our Department. You provide a crucial link between undergraduate life and graduate life. While you will share classes and research experiences with the undergraduate majors in the Department, you have a broader and more mature perspective than the undergraduates. We all benefit from the informal mentoring that occurs between you and the undergraduates. Likewise, you are likely to benefit

¹ Note: Faculty are mandatory reporters for Title IX. However, just because we report something to the Title IX office does not place you under an obligation to file a formal report – the Title IX office may reach out to make you aware of your options and the resources available to you, but you do not need to pursue them unless you want to. There are exceptions in case of immediate or ongoing threat to the safety of an individual or the community.

from formal and informal mentoring that you will receive from the more senior MA students, postdocs, and faculty in the Department.

1.2 Overview

While discussed in detail below, the requirements of an MA include: (1) 10 credits of coursework in astronomy and related subjects; (2) a qualifying exam that includes a written and oral component; and (3) the written completion and successful defense of a research project with one of the faculty. MA students will also work as teaching assistants (TAs) each semester. The Chair, your research advisor, all the faculty, and the Administrative Assistant are all available and interested in helping you with any questions or concerns you may have.

For issues common to graduate students in all departments, we strongly suggest reading through the [Wesleyan Graduate Handbook](#). Please review the [Living and Resources](#) documentation for an admitted student guide, housing information, family benefits, career resources, etc. Information about [financial support](#) is also available through the Graduate Studies website. Our department will provide you with a new(ish) Mac desktop for use during your MA year(s); you will share an office with one or two other people. The [freecycle](#) list is an active campus resource and time-honored way of finding free stuff to help furnish your apartment or office.

2. Courses

Our 2-year MA program requires 10 credits of coursework (the MA year of the BA/MA program requires 6 credits, and occasionally it is possible to transfer credits from the BA degree that were not used to fill a graduation requirement). Each MA student can create a personalized curriculum that best matches their academic needs. This usually includes a combination of upper level astronomy and physics courses. Each semester you must enroll in the advanced astronomy course (e.g., ASTR522 Modern Observational Techniques, ASTR521 Galactic Structure and Formation, ASTR524 Exoplanets: Formation, Detection, and Characterization, ASTR531 Stellar Structure and Evolution, ASTR532 Galaxies, Quasars, and Cosmology, ASTR540 Radio Astronomy). In your final year, you must also enroll in the graduate research credit associated with your thesis (e.g., ASTR549/550 Advanced Research Seminar, Grad). After the astronomy courses (4 total credits) and thesis courses (2 total credits), that leaves four credits (four courses) of your choosing to round out your academic preparation. These courses are typically taken in physics, mathematics, computer science, and Earth and environmental science. We encourage you to take these four external courses in your first year to leave time free in your second year to focus on research.

If you require any accommodations, please contact [Accessibility Services](#) as soon as possible after your arrival to begin the process of requesting accommodations and providing the necessary documentation. They are very helpful in navigating the process, so do not fear! The

office will issue a letter that you can share with faculty detailing the accommodations you will need in your courses.

One option for academic support that is available in most undergraduate classes, including to MA students enrolled in physics courses, is [peer tutoring through the Dean's office](#). (Tutors are typically not available for upper-level astronomy classes since all our majors are enrolled in the same class each semester, but these are not large classes and the professor will have many opportunities for office hours.)

2.1 Seminar Courses

Graduate students are also required 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. Seminars do not count towards the required number of credits for the MA degree.

2.2 Academic Advising

The Chair of the Department is your formal academic advisor. You will meet with them in preparation for selecting your courses. These meetings will occur immediately when you arrive, and during the official “planning period” each semester (noted on the University’s academic calendar): in November for the spring semester, in April for the following fall semester, and again in November for the final spring semester. Graduate students enroll through their WesPortal during the pre-registration adjustment period (except for the summer before your first year, when you skip pre-reg and enroll in the add/drop period during the first week of classes), and then make final changes during drop/add once the semester has started. You are also welcome to discuss your academic planning with your research advisor, or any of the faculty.

3. Research

A major component of the MA program is a deep 1+ year research project. This is a defining experience for all graduate programs and signals 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 Select Your Research Topic

A research advisor and project should be identified no later than the middle of the second semester. Of course, many students start before this time. You are welcome to begin research at any time after your arrival, and indeed, the more time you can devote to research the more impactful the experience will be.

To select a research advisor, schedule one-on-one meetings with the faculty to discuss their research and possible MA research projects. You can get a sense of what the faculty research areas are by looking at the Department website and 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 all of us to get to know each other better. The goal is to match you up with a research project that you are interested in taking ownership of and to make sure the working relationship with your advisor can be a positive and productive one. When you are ready, email each faculty member to schedule a time to meet and discuss research. Don't be shy – we do this all the time! The faculty member will tell you about the broad scope of their research program, give you some examples of potential projects, find out more about your skills and interests, and you will have the opportunity to ask any questions you might have.

3.2 Thesis Committee

Your thesis committee will be assigned during the summer between your first and second years in the program, and will consist of your advisor plus two other faculty, one of whom will be appointed as chair of the committee and is responsible for scheduling the meetings. You should expect the committee to meet at least once in the fall semester and at least once before spring break, but it is not uncommon for the committee to decide that additional meetings would be beneficial. The goal of having a thesis committee is to make sure that you have faculty beyond your advisor that you can look to for help and advice on your research progress, and the goal of the meetings is to take a step back and reflect on your progress and the remaining path to your thesis defense. Thesis committee meetings will generally begin with a presentation in which the student describes the context and scope of their thesis project, shows recent results and discusses the current status along with any open issues, and ends with an estimated timeline for both analysis and writing that culminates in a spring thesis defense. The committee will then discuss progress and goals and any issues encountered along the way, to ensure that everyone converges on a successful defense.

3.3 The Summer (and Other Breaks)

Graduate students are required to spend the summer doing research at Wesleyan with their faculty advisor. Short breaks during the summer should be made in consultation with your faculty advisor. We do expect graduate students to take breaks! A typical schedule might

involve ~2 weeks' vacation time during the summer (often during August), a week around the winter holidays, and an additional week after the end of the spring semester or spread throughout the year; please talk to your advisor about your particular situation. Conference and observing travel do not count as vacation time. Otherwise, students are expected and encouraged to be generally present on campus during normal working hours, which helps with coordination with your research group and study groups.

Especially in the second year, it is common for graduate students to return to Wesleyan soon after the new year and to spend most of the month of January and the spring break at Wesleyan. These are the last remaining opportunities to have uninterrupted time to do thesis research and writing, and are therefore extremely valuable.

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 the third 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 (see below).

3.5 Thesis Defense

Preparation for your thesis defense begins in April when preliminary forms are due to the Graduate Office. These include a title to your thesis and the composition of your thesis committee (which are determined in consultation with your research advisor and the Chair).

A written thesis document and an oral defense are required at the end of your second year. Take a look at previous MA theses at the Wesleyan Science Library, online or on the shelf, to get a sense of the scale of this work (you can also search the digital archive [here](#); filter by Discipline: Astronomy). These are substantial documents that often evolve into published papers in professional journals. A complete version of your thesis must be submitted to your thesis committee preferably two weeks but no later than one week before your oral defense, and the finalized version (including edits suggested by the committee) is due before your scheduled exit interview. A template for the thesis document can be found [here](#).

The oral defense is scheduled for 90 minutes. The first 10 minutes will be a short presentation with slides. This is not meant to be comprehensive, but an elevator speech of sorts (perhaps a long elevator ride) that gives a short summary, or highlights one particularly important part of the work, or discusses future work in the context of the results of the thesis. Then 70 minutes are allocated to questions driven by the details in the thesis, although any topic is fair game. Be aware that the conversation may veer into somewhat distant territory, but do not feel that you should study topics unrelated to your thesis in preparation for this (the oral defense is not like

the qualifying exam). For example, if your thesis is on spectroscopy of AGN, we might ask you to explain fundamental concepts related to how spectral lines are generated or why their profiles look the way they do, but we will not ask you about the C/O ratio in exoplanet atmospheres. Finally, the last 10 minutes are for the committee to deliberate and provide feedback.

At your defense, you will receive suggested changes from your readers, from minor typos to more significant comments. You have roughly 48 hours to make these changes to your thesis before your exit interview. Your advisor will assign a grade for your thesis tutorial; the committee will assign a letter grade for the thesis document and a separate grade for your oral defense. A failing grade in any of these categories can result in ending the program without an MA degree.

4. Qualifying Exam

At the end of your first academic year you are required to take the MA qualifying exam. It is typically scheduled around the first week of June, and the date will be set by the end of exam week in the spring semester. This is a two-part exam. The first is a 4-hour written exam in which you will be given about 8 open-ended questions. Approximately half are drawn from the advanced astronomy classes you took in your first year and the other half are general astronomy questions. You can get copies of previous exams from the chair or Administrative Assistant in the Department Office to look at some examples. Please make the chair aware if you have academic accommodations from the accessibility office that would apply during the exam.

The second part is a 90-minute oral exam. You will have an opportunity to revise or expand upon any answers from your written exam, and then you will be asked further questions from the committee, which is all the faculty not on sabbatical/leave at the time. Questions often grow out of the written exam questions, but can also be on any astronomical topic. The last 10 minutes are for us to deliberate and provide immediate feedback. Since the goal of the qualifying exam is to ensure that you possess broad understanding of fundamental concepts in astronomy at the ASTR155 level, as well as the level of depth expected after the advanced classes in your first year, if those conditions are not satisfied then generally the result will be a plan to ameliorate any remaining gaps; one common plan involves repeating a TA assignment as part of the fall ASTR155 course. No student has ever been asked to leave the program after an unsatisfactory qualifying exam.

5. TAing

All 2-year MA students are required to be a Teaching Assistant (TA) each semester. Duties can include grading, office hours, classroom assistance, review sessions, and running evening labs/nighttime observing. Typically, first-semester MA students are asked to TA ASTR155, Introduction to Astrophysics, which is our advanced introductory course in astronomy. This is an

excellent overview of the most important topics in modern astrophysics and is an important learning experience that can help identify gaps to focus on with respect to the qualifying exam. TA assignments are made by the Chair and will be announced in the weeks prior to the semester. The average weekly commitment should be approximately 10 hours; however, some weeks may be heavier than others, and occasionally a heavy TA time commitment in one semester might be balanced by a lighter TA workload in an adjacent semester. Part of adjusting to TA responsibilities may also include figuring out how to become efficient with your workload. Please talk to your supervising instructor if your workload regularly exceeds 10 hours over the course of several weeks.

One common responsibility of TAs is to run observing nights for the introductory classes using the observatory's suite of telescopes (8", 20", and/or 24"). Training on these telescopes will be offered by Prof. Kilgard early in the fall semester; you should plan to attend at least one training session and you should also plan to schedule time to practice on your own before running observing sessions or public nights. Arriving early to ensure adequate time for setup is also encouraged.

6. 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 to complete the MA requirements. 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 two in another subject). BA/MA students do not take the qualifying exam as long as ASTR155 has been successfully completed. BA/MA students are not required to TA. Sometimes there are opportunities to work as a TA for pay; please inquire with the department chair if interested.

7. Beyond the MA

7.1 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 (several fellowships/scholarships including graduate research fellowships and travel grants, though our students often derive little/no benefit directly from graduate research fellowships). Talk to a faculty member for advice, but our students have a great track record of applying to these grants, and we strongly recommend applying during the fall of your second year for a travel fellowship to support attendance at AAS in January.

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 one year of eligibility for this fellowship during your time in the MA program. Your research advisor and the Wesleyan fellowships office can help you prepare to apply to this fellowship, which is typically due in October of your first year (though you should begin your application over the summer).

7.2 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 your final year:** do lots of research! Research is the best way to find out if you are likely to enjoy a PhD program (which is all about research rather than classes), and also the best way to prepare for entry to a PhD program (which effectively requires a set of substantive research opportunities as well as a full set of physics and astronomy courses).
- **Upper-level physics courses.** We strongly encourage any student considering applying to PhD programs in astronomy to have completed MATH222, PHYS316, PHYS324, and PHYS313 (or the equivalent at their BA institution).
- **Summer before your last year:** [Start looking at different programs](#) and planning where to apply. 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. Some programs still require scores from either the General or Physics GRE (PGRE) test as part of your application; the general GRE can be taken anytime, but the physics subject test is only offered on certain dates, mostly in the fall semester. (Many/most PhD programs have now done away with at least the PGRE, so it is certainly possible to choose to apply only to programs that don't require the PGRE).
- **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 – and give them time to give you 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 wait list (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 wait list 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 promptly decline other offers.
- **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 wait list). Be courteous but clear: this will allow the program to make offers to other students who are on the wait list.
- **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 search 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).

7.3 Career opportunities for astronomy MAs

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 with a degree in astronomy.

<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.

8. Other Departmental Activities

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

8.1 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 graduate students to attend colloquia. The graduate students have the special honor of hosting the speaker for lunch on the day of their colloquium. This is a wonderful opportunity to have your own access to a top-notch researcher to discuss anything. Often topics involve research, career advice, etc, but the graduate students run the lunch.

8.2 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.

8.3 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.

8.4 NASA CT Space Grant

NASA funds "Space Grants" in almost all states. Connecticut has a strong Space Grant that funds many academic opportunities. The CT Space Grant Campus Director will likely make you

aware of upcoming opportunities, but they can also be found at: www.ctspacegrant.org. Of particular note, graduate students should plan to apply for a travel grant to support the cost of going to a scientific meeting.

8.5 Planetary Science Graduate Concentration

Wesleyan has a unique interdisciplinary program in planetary science. It includes a graduate concentration in planetary science. If your research or interests involve planetary science consider participating in this program: <https://www.wesleyan.edu/planetary/Graduate.html>. Note that completing the planetary science concentration requires that you enroll in at least three semesters of the planetary science seminar (ASTR/E&ES 555) and at least one course outside the department (a relevant 200-level or higher course in E&ES, BIOL, CHEM, etc).