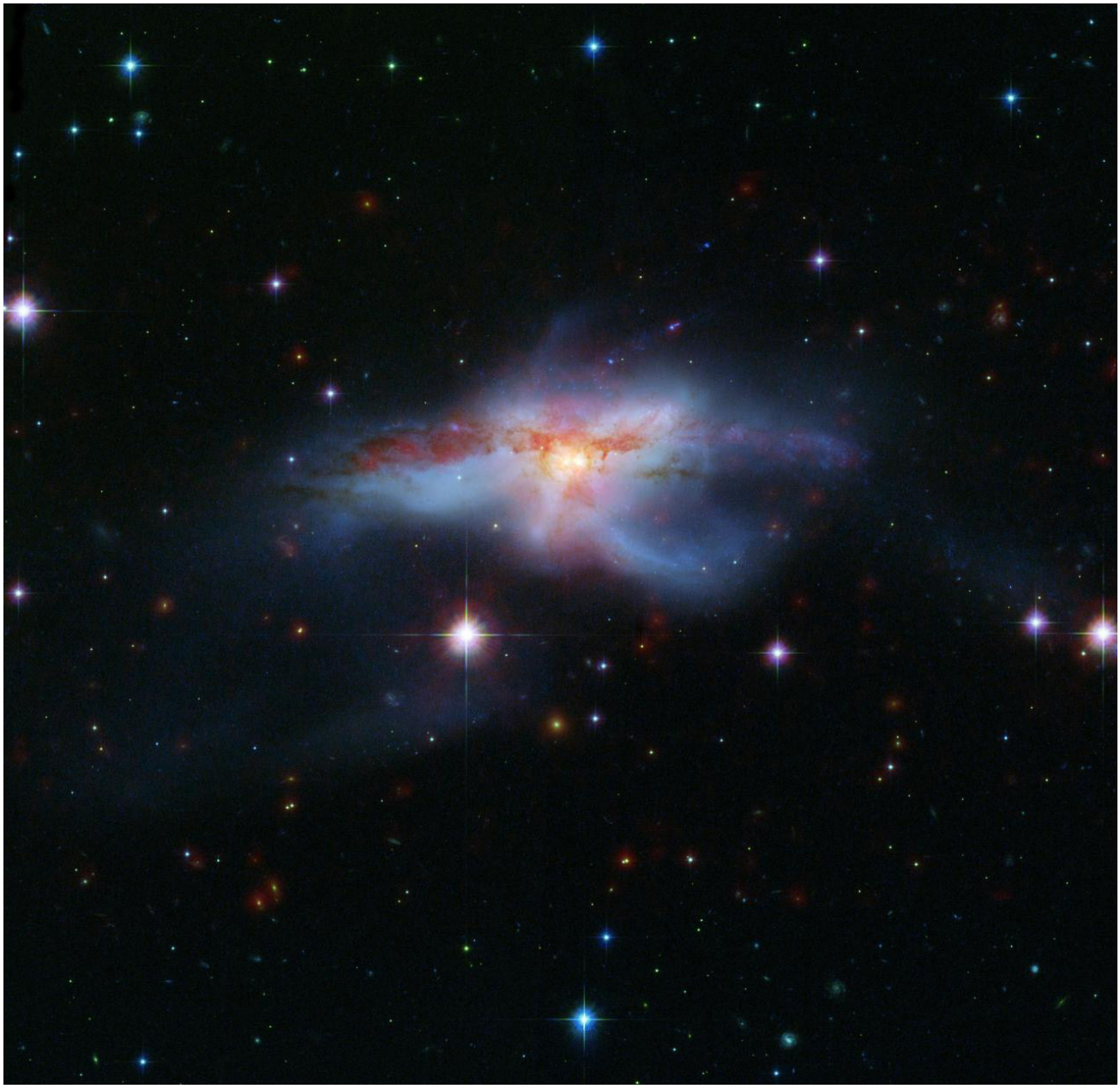
Advising Guidelines *for the* Yale Astronomy Graduate Program



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INTRODUCTION

Purpose of this document

Graduate study in Astronomy is more complex, demanding, and personal than that typically experienced by undergraduates. Over the typical 5-6 years of study, graduate students become an expert in the field of their thesis, gain a strong background in many other fields of astronomy and astrophysics, learn teaching skills, and prepare for careers in academia or elsewhere. They participate in departmental activities, lecture to peers and faculty, and collaborate with other scientists, often ones much more senior. To make the most of this experience, a student should be attentive to both the opportunities and the challenges, and this document is designed to help the student navigate the path from student to PhD Astronomer. It is mostly guidelines, but in places, such as the discussion of the qualifying exams, it sets forth rules, which are explicitly identified.

Overview of program goals

The major goal of Yale's Graduate Program in Astronomy is to educate students to become scientists and teachers. While the focus is on astronomy and astrophysics and their subfields, the acquired skills have opened careers in data analysis, instrumentation, and finance, in addition to professional astronomy.

The Yale Department of Astronomy is a community of scholars and a dedicated staff that assists with the mission of the Department. It is a community that respects every member regardless of their position, gender, race, sexual orientation, national origin, political views, and religious beliefs. It does not tolerate any form of discrimination. Its mission of education and scientific research is a collaborative effort, where excessive competitiveness has no place.

PROGRAM GUIDELINES

Funding

The Yale Graduate School of Arts and Sciences (GSAS) provides the student stipends and tuition for academic years 1 & 2, when students are enrolled in courses, and stipends for the summers between years 1 & 2 and 2 & 3, when students are working on research projects under the supervision of Yale faculty.

Once the student passes the qualifying exams, which are typically in June and July after their 4th semester, they are generally funded from either the research grant of their PhD faculty advisor or from a fellowship from an outside agency.

All students are encouraged to apply for fellowships, if they are eligible, such as the NSF graduate fellowship. These fellowships are prestigious awards that strengthen a student's CV, and in some cases provide additional stipend money for the student. They also help the advisor and the Department by reducing the demand for grant support or departmental funds.

If grant funding is not available, the Department will ensure through its emergency funds that every student making progress towards the degree is completely funded. The GSAS can also provide emergency funding, which is used as a last resort since it may result in a temporary reduction of the number of students admitted to the graduate program. Students on GSAS funding beyond year two will usually be expected to teach.

Funding includes a student's stipend and tuition as well as other miscellaneous fees. In Years 1 and 2, the Graduate School covers the cost of tuition, as part of the admission offer. In Years 3 and 4, the Graduate School covers half the cost of tuition, and the other half must be paid from another source (typically a faculty research grant or a fellowship). In Years 5 and beyond, only small continuing registration and miscellaneous fees are charged.

The Astronomy Department has a teaching requirement that must be met by all students. The teaching assignments associated with the teaching requirement are not directly related to the student's funding. If the Department has a need for additional teaching fellows, students may choose teaching assignments for additional pay once they have completed the teaching requirement.

Timeline for Degree

Students should aim to finish their PhD in 5 to 6 years or less. Extensions into the 7th year are possible if the Astronomy Department and the GSAS agree, and there is a funding source. However such extensions are discouraged since this could result temporarily in fewer students being admitted to the program.

The GSAS determines the appropriate total number of graduate students for each department. The number of new graduate students that can be admitted to the Astronomy Department in a given year depends on the total number of Astronomy graduate students. Generally, the target number of new students is equal to the number who have left the program in the past year. It is in the Department's and the student's interest to have students finish their PhDs in a timely manner, and then begin their professional lives.

Work-life balance

Graduate school can be a stressful time for many. The Department recognizes the importance of both mental health and physical health while encouraging students to find a healthy work-life balance.

- Students should be open about their mental health, and advisors should be sensitive to these issues and allow students to take time off if need be. Advisors and peers should encourage work-life balance.
- Advisors and students should be aware of available resources for mental health issues. A good place to start are the following websites:
- https://gsas.yale.edu/resources-students/health-wellness
- https://drive.google.com/file/d/1D0w7ruv6r6lwRvyHKgzZNyaZ2IC2Jr9F/view?usp=sharing
- While there are no strict guidelines for working hours, students and advisors should set expectations about the regularity of research updates, e.g. weekly meetings either individually or in a group setting. Advisors and students should also remember that research often takes time and incremental updates are important.
- Students should beware of burn-out. For example, working 10-12 hours a day for many consecutive days may be unhealthy. For some students, it helps to set consistent working hours. Students can also reach out to Lauren Horner if they are interested in getting help with maintaining a healthy work-life balance.
- Students should let advisors know in advance if they are planning on taking an extended break of more than a few days.

- Additionally, students should feel comfortable taking sick days or time off for an emergency if required
- An advisor should let a student know if they are unhappy with the amount of vacation time the student is taking, and if grossly exceeds the expectations set by the graduate school-- roughly 4 weeks per year including school and national holidays. If the problem persists the advisor should contact the DGS. Conversely, if a student feels that vacation time is being unjustly denied, the student should contact the DGS.
- The time before the qualifying exams can be extremely stressful. Students are often still taking classes and working on their second-year project during the time that they are preparing for their exams. Advisors and the instructors of courses should keep this in mind when setting expectations for students during this time
- Many theses involve observing runs when the student is either absent from New Haven or on a nocturnal schedule while remote observing. Students and advisors should plan ahead for the times surrounding observing runs such as rescheduling meetings or securing extensions on homework
- Students should be informed by their advisors of the amount of observing that is likely to be required for theses, and they should not be overly burdened with securing observations that are not directly tied to their theses.

THE FIRST TWO YEARS OF GRADUATE STUDY

The first two years of graduate study are critical for the successful completion of the Ph.D. degree. During this time, students broaden and deepen their knowledge of astronomy and related fields through coursework, they attain some competence in the computational, statistical, and mathematical methods used in modern astronomical research, and experience the challenges, successes, and pitfalls of doing research on unsolved astronomical problems. Through participation in Professional Seminar, the student will have learned many things related to success in careers in Astronomy and other fields, such as how to present research results both written and orally. Every year, during the spring semester of Professional Seminar, each student gives a presentation on their research to the Department. By the end of the 4th semester, the student will have picked a thesis topic and thesis adviser. Before the start of the 5th semester, the student will have taken the written and oral qualifying examinations. The student is also obligated to assist in the teaching mission of the Department by serving as a Teaching Fellow (TF) in typically the first 3 semesters of graduate study. (The required fourth semester of teaching is usually done in the first semester of the student's 3rd year.) Because of the varied activities discussed above, students must learn to balance carefully the time allotted to each. While the major responsibility rests with the student, the Department provides advisors to help design each student's program of study and to assist the student in other ways.

Responsibilities of the Student

During the first two years of study, students have several responsibilities. During the nine-month academic year, students are expected to attend classes and fulfill responsibilities as a teaching fellow. Teaching fellows and faculty members have distinct responsibilities to the class. (See the link here.) If the student feels the teaching faculty is asking them to take on too much responsibility as a TF, such as teaching lectures or making exams which are explicitly not allowed, they should contact the DGS. Additionally, students are expected to attend department events such as Colloquium, journal clubs and Professional Seminar. Finally, students are expected to complete two research projects and choose a thesis advisor. Both of these responsibilities are discussed in detail below. The first two years will likely be the busiest of the PhD, and students must learn to balance and prioritize between these expectations.

During the summer, there are far fewer responsibilities for students. In the summer after the first year, students are expected to remain on campus, except for vacation and/or conference travel, and continue work on one of their research projects. Students either work on finishing the first-year project or on starting the second project. During the second summer, the student will be busy preparing for and completing the two qualifying exams. For more details see the sections below. Once a student has been admitted to candidacy, work on the thesis can begin!

Advisors and Mentors

1. The Director of Graduate Studies (DGS) is the advisor of record for the first 2 years and continues to serve as the major advisor and later as student advocate after a student has selected a thesis advisor. The DGS welcomes the incoming class of new students and presents to them an overview of the graduate program, course offerings, and TF responsibilities. The DGS is responsible for reviewing and approving each student's course selection for every semester of graduate study. The DGS is responsible for selecting and assigning the students for the TF positions in the undergraduate courses and ensuring that the students are fulfilling their obligations and that the time demands of the TF positions do not exceed the allotted amounts. The DGS oversees the construction and execution of the written qualifying exam and participates in each oral exam. For the following types of questions, a student is encouraged to seek advice from the DGS.

A. Questions related to the graduate courses in astronomy or related fields, including for example course selection for each semester, dropping or adding courses, and temporary incomplete grades.

B. Issues related to the TF responsibilities and assignments.

C. Requests for temporary leaves from graduate study for health or other reasons.

D. Problems related to interactions with other students, faculty, or staff of the Astronomy Department (see Mediation section of this document). Issues of gender or sexual harassment should be directed to the University's Title IX office.

2. The Chair of the Department has oversight responsibilities on all activities of the Department, including the Graduate Program. A student is encouraged to seek advice from the Chair regarding an issue that the DGS has not responded to satisfactorily or if the student feels uncomfortable bringing an issue to the attention of the DGS. See also: https://drive.google.com/file/d/12oSatzapLG9HJ_oC_kstYMYHOD-4zxpu/view?usp=sharing

3. It is expected that a student will develop a student-mentor relationship with one or more faculty members during the first two years of graduate study. A faculty mentor is someone who can give valuable advice about career choices, selection of graduate courses, and other issues. Seeking advice from a faculty mentor is encouraged, with the understanding that approval power for certain things, such as final course selection, remains with the DGS or the GSAS.

1st- and 2nd-Year Research Projects

The following discussion of these research projects is a combination of guidelines, suggestions, and requirements. The requirements of the student, in addition to performing the research, are a description of the project prior to starting it (2 below), enrollment in ASTR580 (3), and a final report on the research (5). At the start of the project, it is recommended that the student and advisor discuss together some of the sample questions found in Appendix 1.

1. Goals & types of projects

As part of the requirements for advancement to candidacy for the Ph.D in Astronomy, graduate students are required to complete 2 very different research projects. The main goals of the research projects are to get a taste of research with different advisors (and their differing mentoring styles & fields of expertise) and with different scientific approaches (e.g., data-based or model-based), in order to help the student choose a thesis project, and to generally aid in the student's professional development.

2. Brief description of the project given to DGS at start of the project

After finding a faculty supervisor and identifying a project, the student needs to submit to the DGS for their approval a brief (<1-page) description of the proposed project signed by the project advisor. This must be done before the student begins the project, and before the student signs up for ASTR580, the course designation for research projects.

The description should state the scientific approach (e.g., data-based, model-based, observational, theoretical, etc) and the expected final product (e.g., written report, talk, etc.). The DGS should ensure that the 2nd project is sufficiently different from the 1st project.

3. Timing of projects & course credit for the research project through ASTR580

It is recommended that students start their 1st project during their 1st semester, and no later than the start of their 2nd semester. It is recommended that students start their 2nd project during the summer between their 1st and 2nd year, and no later than the start of their 3rd semester. Students must submit their proposal for the 1st project no later than January 15 of their first year, and for the 2nd project no later than Sept 1 of their 2nd year.

Students need to register for the research course ASTR580 for each of the 2 projects. While projects can extend beyond the boundaries of one semester, a student can only get one ASTR580 credit for each project. It is recommended that the student sign up for official ASTR580 credit in the semester that the project will finish. Most students should sign up for ASTR580 credit for their 1st project in their 2nd semester, and sign up for ASTR580 credit for their 2nd project in their 3rd or 4th semester.

4. Expectations for students working on research projects

Students are required to have regular meetings with the project advisor while working on the project. The DGS will check-in at mid-semester with both the student and advisor to ensure that the project is on track.

5. Final report

Some final product from the project is required. This could be a written report, a talk, or something else that is agreed upon by the advisor and the DGS. If it is a written report, a copy should be given to the DGS. If it is a talk, it should be given to the department, at a forum such as Professional Seminar. (It can be the same talk that may be otherwise required at Professional Seminar.)

A written report can be in the form of a (draft) journal paper, but need not be a completed journal paper. It is important to have an introduction that explains the research topic in the context of the broader field, and a summary of what has been accomplished plus any conclusions reached.

6. Evaluation of project

The faculty advisor shall provide a written evaluation of the project following guidelines from the department on specific areas to evaluate. The evaluation form to be used should be made available to all students before their projects begin. The completed evaluation is given to the student and the DGS.

7. Who assigns the grade

The advisor assigns the grade, after completing the written evaluation of the project, or after the student delivers a talk on the project.

8. Expectations on publishing the research projects

It is not required that either research project will result in a journal paper, but it should be a goal to publish one of the 2 projects. Publishing a paper is an excellent learning experience, and publishing papers early in a students career will improve a student's CV. However it is not realistic to expect that every project will turn into a journal paper. Not every short research project will produce a publishable result and it takes significant additional work to make a paper publishable. It is not unusual for the paper from either the 1st or 2nd year projects to be completed and submitted for publication after advancement to candidacy. However, research projects should become journal papers only if it is in the student's overall best interest to do so, taking into account their particular situation including other responsibilities they may have (e.g., classes, preparing for or working on the thesis project, teaching). The main goals of the research projects are to get a taste of research with different advisors and with different scientific approaches (e.g., observational, theoretical), in order to help the student choose a thesis project. So while the standard for PhD research is publishable papers, the standard is not as high for a first/second year project.

9. Who can supervise research projects

Research projects generally need to be supervised by a Yale Astronomy Department faculty member. (This includes faculty with secondary appointments in Astronomy.) Projects may be supervised by a Yale faculty member outside the Astronomy Department only if co-supervised by an Astronomy Department faculty member and with prior permission from the DGS. In this case, the faculty advisor must write a ~1-page evaluation of the student's work at the end of the project, so the Astronomy faculty can evaluate the student's performance. Only in exceptional circumstances will post-doctoral fellows be allowed to supervise a project. In such cases a faculty member must play an active role in overseeing the project, and the project must be approved by the relevant faculty member and the DGS, and the postdoc and faculty advisors must each write a ~1-page evaluation of the student's work at the end of the project, so the Astronomy faculty can evaluate the student performance.

10. Using 1st/2nd-year research projects as part of PhD thesis.

This is allowed, if the PhD advisor thinks it is appropriate.

Choosing a Thesis advisor

Students should discuss with the advisors of their first and/or second year projects if they are interested in supervising a PhD thesis. It is perfectly acceptable to complete a research project with someone whom you do not wish to supervise your thesis. Students should finalize their choice of thesis advisor and approach them generally in the middle of the second year (Dec. - Feb.). The full thesis research plan need not be developed at this point, but an agreement between the student and advisor should be reached. Appendix 1 contains some sample questions for starting the dialogue between the student and advisor.

Advisors should be open and honest as early as possible about whether they are willing and able to advise a student for their thesis. This may begin at the prospective student visit, letting incoming students know if they have space in the research group, and should continue through the student's first two years as they start to work together. If anything changes, the advisor should let the student know as early as possible so that alternate arrangements can be made.

The Qualifying Exams

To advance to working full-time on the PhD dissertation, a student must first pass the written and oral exams that take place at the end of the student's second year.

A. The written exam

The written exam is given approximately 4 weeks after the end of the spring semesters. The rules for the written qualifying exam, which is based on coursework, are as follows: There is one question for each of the astronomy graduate courses offered during the previous 2 years. During the 3 hour exam, students need to answer 6 of the 10 to 14 questions. Each student may bring to the written exam one sheet of 8.5 x 11 inch paper on which are written equations or other information on both sides. To pass the written exam, a student must have an HP average, and no grades of F on any of the questions. A student who fails the written exam is given one additional attempt to pass, and the 2nd exam will be made up of questions from the courses that the student earned grades of F or P on the first attempt. The written exam must be passed before the oral exam is attempted.

B. The oral exam

The oral qualifying exams are generally scheduled about 4 weeks after the written exam by the DGS. The student has the choice of whether the exam is conducted in person or remotely. By May 1 the student should discuss with their advisor the scheduling of the oral exam and the preferences of the student and advisor for who might serve as the exam committee and the science advisory committee for the student's dissertation. The rules for the makeup of the exam committee are as follows: There must be at least 2 other Yale Astronomy faculty members on the committee, in addition to the advisor and the DGS. They may be the people who will serve for the next few years on the science committee, but need not be. The schedule of the exam is based on the availability of the student, the advisor, and the DGS. The DGS will ask other faculty to participate in the exam committee, taking into account the preferences of the student and advisor. Since many faculty members travel during the summer months, a students first choice for the thesis science committee may not be available and the oral exams should not be delayed unless the advisor or DGS is unavailable

The rules for the oral qualifying exam are as follows: The student must prepare a 45 min - 1 hour long presentation containing the scientific background to motivate the thesis, any relevant work done by the student in their first two years, and plans for what research will be conducted during the thesis. The student needs to show that the proposed research is new, scientifically interesting, and feasible with the available resources and within the ~3-4 year timeline for thesis research. The research plan can, but need not be, presented in terms of discrete projects, all centered around a common theme, with the idea that each project will result in a published research paper. Following the student's presentation, committee members will question the student on the research topic, the relevant background in Astronomy and in related fields and the research plan. The committee will assess whether the proposed research is scientifically interesting, feasible, and the student has sufficient background knowledge in the subject. A student who fails the oral exam will be given one additional attempt, which will be scheduled approximately 4 weeks after the first attempt.

Students should not worry if their thesis research strays from the plan they outlined during the oral exam. As new observations, instruments or insights occur it may be in a student's best interest to modify their plan or switch to a different project. However, if there are major changes to the direction of the thesis it is important for a student to have a meeting with their science committee.

Being Admitted to Candidacy for the PhD

After passing the written and oral qualifying exams, the last step before being admitted

to the PhD program ("candidacy" for a PhD) is to complete a written Thesis Prospectus. The Prospectus should be completed as soon as possible after the oral qualifying exam, but generally no later than the end of 5th semester. The purpose of the Prospectus to finalize the thesis plan before much time is spent on the thesis research.

The Thesis Prospectus should be a ~ 4-page written summary of the thesis research goals, with a timeline. An introduction should describe the problem and why it is important. There should be references to previous work in the field, but a long historical discussion is not necessary. It is important that the student describe the methods they will employ and why the research is novel and scientifically interesting. Figures can be included. It should be written for the general professional astronomer, not just for experts in the field of study, and should be readily understandable to any Yale Astronomy faculty member or graduate student. It should be written by the student, but with input from the advisor, who must approve it. The point of the Prospectus is to have a written plan for the thesis upon which both the student and advisor agree.

examples of prospecti are located at:
http://dev.astrointernal.yale.edu/grad-links/sample-astronomy-thesis-prospecti

Requirements for Master's Degrees

Astronomy does not have a masters program, and students are not admitted for a terminal master's degree. However, masters degrees can be awarded if students leave the program before completing a PhD degree, and are generally awarded en route to PhD students once they have completed certain requirements. There are two types of master's degree, an M.S. degree and the more advanced M.Phil. degree. The M.S. degree is awarded for successfully completing coursework. The M.Phil degree also requires the student to demonstrate competence in research. The more specific requirements for the degrees are:

M.S. (en route to the Ph.D.) Upon application, the department will recommend for the award of the M.S. degree any student who has taken at least nine courses and including at least one research project (ASTR 580), but not including Professional Seminar (ASTR 710). The student should have a grade average of High Pass or above in the courses and a grade of High Pass or above in the research project.

M.Phil. Upon application, the department will recommend for the award of the M.Phil. degree any student who has completed all the requirements of the Ph.D. degree, except the Ph.D. dissertation. This means taking and passing the written qualifying exam, but not necessarily the oral qualifying exam. A written master's thesis containing original astronomical research is also required. The written thesis must be comparable, in scope and quality, to an average journal paper, although it need not be published. It can be based on one of the 1st-2nd year research projects. The thesis will be evaluated by the advisor, the

DGS, and a third faculty member selected by the DGS. For students who remain in the PhD program, an M.Phil degree is awarded once they pass the qualifying exams, and they have published a journal paper comparable in scope and quality, to an average journal paper. The DGS will verify that they have met the paper requirement.

RESPONSIBILITIES OF THE STUDENT AND ADVISOR POST-CANDIDACY

Student Responsibilities

A. Thesis Research

The contents of the PhD dissertation and its timely completion are fundamentally the responsibility of the student-author. While the thesis topic, scope, and many of the technical details of the thesis may be a collaborative effort between the student and the thesis advisor, the student is expected to do the lion's share of the work and the writing that goes into the thesis and any papers that make up its subparts. The student is expected to develop a command of the literature of the thesis topic and related fields and to learn or develop the tools necessary for the research. At the start of the project, a student may need to rely heavily on the direction given by the advisor, but with time, the student should take more and more of the initiative in the research. By the end of the thesis project, the student is expected to have matured into a competent and independent researcher in Astronomy.

B. Graduate School and Departmental Requirements

The thesis project will undoubtedly demand much of a student's time and effort post the qualifying exam. Nonetheless, the student has other important obligations. If the Graduate School Teaching Obligation has not yet been met, this should be completed by the end of the 3rd year of graduate study. The Thesis Prospectus should be completed soon after the oral qualifying exam, and no later than the end of the 5th semester. In every semester, the student must enroll and participate in the Professional Seminar and each week attend the colloquium and at least one other forum where Astronomy is discussed. Student participation in other activities such as public outreach is encouraged, but they should not be so time consuming to slow the time to degree. Teaching beyond the requirement is encouraged as long as the thesis advisor agrees that it is unlikely to hinder the student's research effort.

Advisor Responsibilities

A. Research facilitator

While the choice of the thesis advisor is the responsibility of the student, the choice of the thesis project is a collaborative effort between the student and the advisor. The choice of the research project is predicated on the expected intellectual impact of the work, timeliness, and assessment of the competitiveness of the subject matter. If the advisor has a group of students under direction, it is essential that each have a separate thesis project and that boundaries exist between the projects so that misunderstandings and competition for goals and resources do not arise. It is primarily the advisor's responsibility to steer a student away from projects that will have limited impact, are too ambitious in scientific scope, place unrealistic demands on available resources, are up against stiff competition from other researchers who have a head-start, or are a poor match to the student's abilities. It is not uncommon for the thesis project to undergo considerable evolution as the research proceeds because of its successes or setbacks, other advances in its field, and the availability of new resources. The advisor is expected to be aware of these developments and advise the student accordingly.

While the thesis project may have one major goal and address a single substantial science question or a multiple set of related questions, the expectation is that at least 3 referred published papers will result from the student's thesis work. It is often best to subdivide the thesis into a series of intermediate goals that will result in publishable results in typically 3 to 5 papers before graduation. The advisor is expected to assist the student in identifying publishable results and in the preparation for publication, if not as a co-author at least as first referee. The advisor is expected to assist the student with their thesis research and provide assistance in the student's preparation for talks, but not for the oral qualifying exam.

Throughout the thesis project, the advisor should be aware of the resources that are necessary for the project to be brought to conclusion within the normal time to degree. The advisor should assist the student with obtaining the necessary resources such as telescope time and high-speed computer access. At least once per year (e.g., at the time of the progress committee meeting), the advisor will assess whether the student is on track to graduate on the 5-6 year schedule. If either the advisor or the student have concerns about research progress, a meeting with the science committee should be scheduled.

The timely dissemination of the results of the thesis project is extremely important for the career of the student, and the advisor is expected to take an active role in identifying conferences for the student to attend and, if possible, providing the necessary funds through grants. When appropriate, advisors should include students in collaborations to foster networking, and encourage students to give talks in and outside of the Department.

B. Student Mentor and Advocate

In most cases, the thesis advisor is the student's major mentor and advocate. The advisor is expected to provide advice and encouragement on the student's activities within the Department as well as on the thesis research and to assist the student's search for employment after graduation. Thus, the student-advisor relationship is important to maintain on friendly, professional terms. The advisor should be willing to meet with the student frequently. It is recommended that there be routine meetings either one-to-one or in a group setting on a weekly basis, and at least a one-to-one meeting per month. Advisors should develop a mutual understanding of the student's goals after graduating through on-going conversations, and are expected to write timely letters of recommendation.

Progress Meetings

Starting in their third academic year (after students passed their written and oral quals), students meet once a year with the Student Progress Committee (SPC) to discuss the progress in their dissertation during the previous year and plans for the coming year. Graduate students are not required to meet with the SPC in the year they expect to defend their thesis.

The committee is typically composed of two (and sometimes three) faculty members; a committee chair, the DGS and an additional faculty member if necessary. Before the meeting the student should have submitted their Dissertation Progress Report (DPR) to the GSAS by the end of the spring semester so that both the student's advisor and DGS could approve it before the Progress Report meeting and for the faculty in the SPC to have been able to read it.

The committee meets first only with the student for about 30 minutes, and then, right after, only with the student's faculty advisor(s). The SPC chair leads the meeting by asking the student about several topics, including (but not limited to) the following :

- How often they meet with their advisors and whether the student is satisfied with the frequency and nature of the meetings
- The papers that the student has worked on and published over the last year
- The research projects/papers that the student plan to work on in the following year
- The frequency at which the student reads recent research papers
- The number of talks the student has given and the ones the student plans to give in the following year
- The number of conferences attended by the students and the ones the student plans to attend.
- Expected timeline for finishing dissertation and plans for job search (for the more

senior students).

- Concerns about the advisor, other faculty, other students or the graduate program.

The discussion during the meeting with the student's faculty thesis advisor(s) is guided by the discussion with the student, the DPR filled out by the student and the questions listed in the Astronomy Student Committee Meeting Progress Report (attached below in Appendix A2). The SPC members, with the faculty advisor(s), check the boxes in the report. Then, the SPC chair writes out comments, and suggestions to the student and the faculty where appropriate. Once the report is verified by the other faculty members of the SPC, the report is sent to the student, the advisor(s) and the astronomy graduate registrar for record-keeping.

Thesis (science) Committee Meetings

Students may have a Thesis (science) Committee, composed of faculty members who have expertise in some aspect of the thesis, to provide advice to the student and advisor. It may be preferable to have the thesis committee members also serve on the qualifying exam committee and/or serve as thesis readers, but this is not required.

Since the department has yearly Progress Meetings for all PhD students, regular Thesis Committee Meetings are not required, although may be beneficial. A Thesis Committee Meeting is held when the student or advisor wants one, or when it is recommended by the Progress Committee.

The point of the Progress Meetings is to evaluate the progress made by the student in the past year, but not to evaluate or discuss the science. In contrast, the point of Thesis Committee Meetings is to update the committee members on the scientific aspects of the thesis, and get their input on the content and direction of the thesis. Generally the student will give some kind of presentation to update the committee, and then can ask the committee for input. It is supposed to be helpful to the student and the adviser. There is no set format, and nothing needs to be reported to the department, although the adviser should participate.

Job Market and Career advising

Advising on the job market and career for graduate students in the astronomy department takes place at different levels: by the student's thesis advisor; the Student Progress Committee (see below); and as part of the Professional Seminar course, which all graduate students are required to attend every semester.

Faculty thesis advisors should discuss post-PhD career plans as early as possible with the student, but no later than one year before the student's planned PhD defense. For example if the student plans to defend their thesis by the end of the Spring semester or sum-

mer, and plans to continue in academia after graduating, then it would be best to start discussing career options and post-graduate school plans with the thesis advisor by late summer/early fall of the year before the student plans to defend. This is because most applications to postdoctoral fellowships and positions (as well as faculty positions) are due starting late October/early November. The faculty advisor should discuss with the student the kinds of positions, and the research and places they are interested in. This will help the student decide on where to plan to give talks about their research during the fall semester

The Student Progress Committee (SPC) should be aware of the student's graduation plans. Depending on the student's year, the SPC will provide advice on places the student may want to apply for jobs. The SPC and the thesis science committee members should advise the student on who could be a good reference letter writer for the student's job applications.

"Professional Seminar" meets once a week for 1.5 hrs and covers science and professional topics in astronomy. Topics discussed in the Professional Seminar (mostly in the Fall semester, with student research presentations happening in the spring) include: best practices for writing papers and abstract, as well as for giving oral and poster presentations, job applications, guidelines for writing successful proposals, and discussion of non-academic careers.

CONFLICTS AND MEDIATION

The student-advisor relationship must be based on mutual respect and trust. However, conflicts between students and faculty mentors/advisors may arise, and though uncommon, they can be demoralizing and difficult to resolve. Faculty have substantial power in the lives of grad students; they help direct research, set expectations for day-to-day work effort and ultimately write letters of recommendation that impact future opportunities for students.

Faculty members are expected to adhere to the best standards of conduct and be mindful of the impact their behavior may have on students, given the power differential between students and faculty. Without compromising high standards and expectations for excellence, faculty advisors are expected to support and encourage at the same time that they ask rigorous questions and challenge students. All interactions between faculty and students should be carried out without animosity or aggression.

Depending on personalities (both of the student and the faculty member), students can be hesitant about raising concerns. It is recommended that a complaint be brought to the attention of the DGS or the Chair. If a student feels uncomfortable describing the complaint with these individuals, they may discuss it with another faculty member or the Dean's designee of the Graduate School, Michelle Nearon, or the Associate Dean for Aca-

demic Support, Allegra di Bonaventura. Another avenue is during the annual dissertation progress meeting when the committee asks if there are any conflicts, which can be then communicated in confidence by either the student or the faculty mentor. There are three possible courses of action by the alerted faculty member or the progress committee.

1. They can act in an ombuds role, listening and making suggestions in confidence. This is not appropriate for serious issues that are causing stress or physical safety concerns.
2. With the permission of the reporting individual, they can intervene with the faculty member or student mentioned in the complaint. This might be most appropriate for relative minor concerns that are programmatic rather than interpersonal.
3. For more serious concerns[1] or if the outcome of either 1 or 2 above has not alleviated the issue, the student or the faculty member can elect mediation. The goal of mediation is to bring neutral parties to help negotiate concerns of the students and faculty.

If mediation is needed to negotiate concerns, two faculty members would be appointed by the Chair to serve as advocates. The advocates should explicitly represent one party (not both). For example, in the case of a dispute or concern between a faculty advisor and student, one advocate would work with the faculty member and one would work with the student. The advocates would meet with the individuals that they represent to develop a full understanding of the situation as seen from the perspective of that individual. The advocates might then meet with each other and work toward a common understanding, always keeping their duty to fairly represent their "client". The advocates might present possible resolutions to the individuals that they represent. They might try to share the perspective of the other party involved in the dispute. They might meet as a group to facilitate discussion. The goal is a positive resolution to complaints.

Specifically, the Yale Faculty Handbook (Section II B) describes the expectation for faculty interactions with students:

> **Their Role as Educators.** The integrity of the teacher-student relationship is crucial to the University's educational mission. This relationship vests considerable trust in the faculty member, who, in turn, bears authority and accountability as mentor, educator, and evaluator. When acting in their role as teachers, members of the Yale faculty treat students and trainees with respect. They set an example of academic integrity and educate their students and trainees in the requirements of honest scholarship. They evaluate their students' and trainees' work solely on the basis of its intellectual merit and adherence to course or program requirements. They maintain proper professional boundaries and never exploit the unequal institutional power inherent in the relationship between faculty member and student or trainee.

1 Note that any serious concerns about sexual harassment must be reported to the Title IX office, and any behavior that violate the faculty code of conduct should be reported to the department Chair and ultimately to the Dean of Faculty.

THE THESIS DEFENSE: TIMELINES, POLICIES, & PROCEDURES

TLDR: Timeline

1. Selection of readers (~3 months before anticipated oral exam)
2. Thesis draft circulated to readers (6 weeks before anticipated oral exam)
3. Preliminary reader's reports due (2 weeks before anticipated oral exam)
4. Oral Exam
5. Public thesis defense (~2-30 days after oral exam)
6. Submission of "final" written thesis to graduate school (sometime after oral exam)

Full Timeline and Policies & Procedures

1. Selection of readers (~3 months before anticipated oral exam)
Student & advisor discuss choice of readers with DGS; DGS must approve the readers. This step taken when advisor thinks thesis is ~90% done (e.g. all science paper chapters done & only introductory & concluding chapters to be done). Once the DGS approves the readers, the student should fill out the "ONR" readers form and submit it to the DGS assistant.

This is a good time for the student to review the Graduate School's website regarding the dissertation: https://gsas.yale.edu/academic-requirements/dissertations (Nothing needs to be submitted to the graduate school yet. This is merely information on what needs to be submitted once the student gets to that stage, #6 below.)

Readers:

Astronomy departmental policies:

A. minimum of 3 readers, maximum of 5.

B. the advisor must be a reader; if multiple advisors, only 1 advisor can be a reader.

C. at least 2 readers must be department/Yale faculty members who are not the student's advisor. Of these, at least one must be an Astronomy department faculty member. Any non-departmental Yale faculty reader should be an expert in some aspect of the candidate's research.

D. at least 1 reader must be external, must hold a faculty position or equivalent, must be considered an expert in some aspect of the candidate's research, and is sufficiently senior and sufficiently independent of advisor & student.

Yale policies:

A. minimum of 3 readers, maximum of 5

B. at least 2 readers must be Yale faculty

C. all readers must hold the Ph.D. degree as well as a faculty position or be considered otherwise qualified to evaluate the dissertation

D. DGS must approve the readers.

2. Thesis draft circulated to readers (6 weeks before anticipated oral exam)

Student sends advanced draft of thesis to all readers & DGS. DGS sends instructions to readers.

The thesis must include introduction and conclusion sections, and advanced drafts of these must be included in the version of the thesis sent to the readers. The intended audience of the introduction is fellow graduate students and professional astronomers who are not experts in the field. The introduction should explain the research topic in the context of the broader field. The conclusion section should contain a summary of the conclusions, implications for the broader field, and may contain thoughts about future prospects.

3. Preliminary reader's reports due (2 weeks before anticipated oral exam)

Preliminary reader's reports due to DGS; decision made whether to hold or postpone defense.

The oral exam is held only after the DGS receives positive preliminary reader's reports from all readers. A positive report is one that says that the thesis is done or very nearly done, and will clearly be an acceptable thesis in terms of scope and quality. (Quality: most of the written thesis must be at least close-to-submittable to journals.)

If all reader's reports are positive, the oral exam will be held as originally scheduled, and copies of the written thesis are made available to faculty who will participate in the oral exam. If any of the reader's reports are negative, the oral exam is postponed. The decision is made by DGS, who must approve the scheduling of the oral exam.

All reports should specify any changes to the written thesis that the reader would require in order to make the thesis acceptable in scope and quality, and to write a positive formal reader's report. The readers will later be asked to submit a formal reader's report to the graduate school. The preliminary reader's report submitted to the department can be considered a draft of that formal reader's report.

If the reader's reports are positive, the student uses the preliminary reader's reports to make minor modifications to the thesis (if necessary), before submitting a properly formatted "final version" of the thesis to the Graduate School.

If the reader's reports are not all positive, the student uses the preliminary reader's reports to make the necessary modifications to the thesis. Once these modifications are made, and the student and advisor think that the written thesis will now be acceptable, the revised version is sent to all readers for an updated evaluation. Once all readers give a positive evaluation, the defense can be scheduled.

4. Oral Exam

Student presentation plus questioning by faculty only; not open to general department or public; no public talk or event or department party. Copies of written thesis made available to all faculty members prior to oral exam.

The goal of the oral exam is to establish whether the student has a good understanding of the written thesis and its general field and related background. (As such, it doesn't make sense to hold it before the written thesis is done or very nearly done.)

At the oral exam the student gives a ~45-minute presentation to the faculty. The faculty advisor can give limited help to the student in the preparation of the talk. The talk should be the work of the student, but the advisor can offer comments on drafts of the talk. During the talk the faculty should ask only questions of clarification, saving substantive questions for the period after the talk.

Immediately after the presentation, the faculty question the student for a maximum of 2 hours. Then the student is excused, and the faculty discuss and then vote whether to pass the student on the thesis, taking into account both the written thesis and the oral exam. Faculty can abstain in the voting. All faculty members are strongly encouraged to attend the oral exam if they are in town. There must be at least 5 Yale faculty members present (this can include Lecturers), plus the external reader if possible. The DGS should ensure that there will be enough faculty present. The vote must be unanimous (all yes or abstentions) for the student to pass. If there is only 1 no vote, under exceptional circumstances it can be overruled by agreement of the chair, the DGS, and the advisor. In such a case, the dissenting faculty member should submit a written statement explaining their position.

All faculty members at the oral exam must have the opportunity to review the written thesis before the exam, and should be prepared to ask questions at the exam.

Students not passing the questioning at the oral exam receive a second chance to do so, normally within a month or two. We expect this to occur sometimes. Not passing need not be considered a disaster for the student, but might rather be a matter of "I haven't passed yet".

5. Public thesis defense (at least 2 days after oral exam)

Student gives a public talk.

This public talk is required, since it is important for students to share their work with the general department. It can be scheduled at any time at least 2 days after the oral exam. In exceptional circumstances, this 2-day requirement can be waived by the DGS. Family and friends are encouraged to attend to make the occasion more festive.

6. Submission of "final" written thesis to Graduate School

The student should use the preliminary readers' reports to revise the written thesis, as necessary. A thesis can be submitted to the Graduate School at any time, but should not be done until it is likely to generate positive reader's reports. Any one negative reader's report will cause a significant delay in the thesis, since in such a case a revised thesis will have to be resubmitted to the Graduate School.

There are several things that the student needs to do at the time of submission. See: http://gsas.yale.edu/sites/default/files/files-forms/dissertationchecklistpetition.pdf

The deadlines for submission are Oct 1 in order to get a December degree, and March 1 in order to get a May degree.

The GSAS is the entity that decides whether a PhD is awarded. They base their decision on 3 things: a submitted and properly formatted written thesis, satisfactory readers reports from each of the readers, and notification from the department's DGS that the student has met all of the department's requirements for the PhD. In the Astronomy Department these requirements include course work and teaching, as well as a satisfactory PhD thesis. Thus once a student has passed their oral exam and public thesis defense, the DGS can tell the graduate school that the department's requirements for the PhD have been met, but the PhD is not awarded until all the GSAS's requirements are met.

EXAMPLES OF THESIS COMPLETION TIMELINES

December degree:

- April-June thesis committee meeting to help prepare for oral exam (optional)
- June 1 readers selected
- July 15 thesis draft circulated to readers
- Aug15 preliminary readers reports say thesis ready; oral exam on track
- Sept 1 oral exam
- Sept 15 public thesis defense

May degree:

- Sept-Nov thesis committee meeting to help prepare for oral exam (optional)
- Nov 1 readers selected
- Dec 15 thesis draft circulated to readers
- Jan 15 preliminary readers reports say thesis ready; oral exam on track
- Feb 1 oral exam
- Feb 15 public thesis defense
- Mar 1 submit final written thesis to graduate school

Attempt at May degree delayed (written thesis not ready):

- Sept-Nov thesis committee meeting to help prepare for oral exam (optional)
- Nov 1 readers selected
- Dec 15 thesis draft circulated to readers
- Jan 15 preliminary readers reports say thesis not ready; oral exam postponed
- Mar 1 rescheduled oral exam
- Mar 15 public thesis defense
- Apr 1 submit final written thesis to graduate school (too late for May degree)

Attempt at May degree delayed (oral exam not passed on 1st attempt):

- Sept-Nov thesis committee meeting to help prepare for oral exam (optional)
- Nov 1 readers selected
- Dec 15 thesis draft circulated to readers
- Jan 15 preliminary readers reports say thesis ready; oral exam on track
- Feb 1 oral exam (student does not pass)
- Apr 1 second oral exam (student passes)
- Apr 15 public thesis Defense
- May 1 submit final written thesis to graduate school (too late for May degree)

A1: SUGGESTED QUESTIONS FOR ADVISORS AND STUDENTS

The following is a list of questions that may be used by students and advisers to establish productive channels of communication and work processes. We recommend students and advisors review this list together at the beginning of the advising relationship to facilitate conversations about how to work together most effectively.

1. What is each party's preferred mode of communication (e.g. email, phone call, video chat, in person, text, etc.)?
2. What are each party's expectations for the student's weekly work schedule (days, times of day, etc.)?
3. What are the expectations for message responses?
4. What is each party's expectation of the student's time to degree?
5. What are each party's expectations regarding the student's conference attendance and funding?
6. Is the student expected to seek a secondary adviser or other mentorship within the department? Outside of the department?
7. When the student collaborates on work with others, what is the adviser's expectation regarding the adviser's role in that work and subsequent authorship?
8. What is the adviser's approach to authorship?
9. What are the student's expectations for authorship?
10. How many publications does the adviser/department expect from the student before graduation?
11. What is the adviser's expectation for the student's research in semesters that the student has to fulfill other requirements (classes, teaching, qualifying exams, etc.)?
12. What are the adviser's or program's expectations regarding the student's mentoring of more junior graduate students or undergraduates recruited by the adviser?
13. What are the student's expectations for opportunities to mentor more junior graduate students and/or undergraduates?
14. What professional development programs (writing, teaching, outreach, etc.) is the student interested in participating in?
15. About which career paths can the student approach the adviser for support and when should the student seek career support elsewhere?

A2: PROGRESS COMMITTEE REPORT FORM

Student Progress Committee Report Form

Name of student: _____ **Date of meeting:** _____
Name of thesis advisor: _____
Year of study: _____
Committee members in attendance:

Please assess the abilities/accomplishments of the student in each of the areas listed below by checking the appropriate descriptor and providing comments where appropriate.

Answer the questions below by circling the appropriate answer.

1. Progress made since the last Committee meeting:
   excellent ***good*** ***sufficient*** ***of concern***

2. Knowledge of the scientific literature relevant to the research project:
   excellent ***good*** ***sufficient*** ***of concern***
   If an issue of concern to the committee, please explain briefly below:

3. Thinking deeply/critically about research project, seeing the "big picture":
   excellent ***good*** ***sufficient*** ***of concern***
   If an issue of concern to the committee, please explain briefly below:

4. Demonstrating initiative and independence in research:
   e***xcellent*** ***good*** ***sufficient*** ***of concern***

5. Motivation and work ethic and participation in department activities:
   excellent ***good*** ***sufficient*** ***of concern***
   If an issue of concern to the committee, please explain briefly below:

6. Technical competence in appropriate research skills:
   excellent ***good*** ***sufficient*** ***of concern***
   If an issue of concern to the committee, please explain briefly below:

7. Quality and clarity of written presentations:
   excellent ***good*** ***sufficient*** ***of concern***

8. Quality and clarity of oral presentations:
excellent ***good*** ***sufficient*** ***of concern***
If an issue of concern to the committee, please explain briefly below:

9. Status/rate of publications:
excellent ***good*** ***sufficient*** ***of concern***

10. When does the Committee anticipate the student's graduation? _____

11. When should the next committee meeting be held?
3 months ***6 months*** ***9 months*** ***12 months***

Please indicate the Committee's expectations and requirements, making reference (where appropriate) to the specific aims stated in the student's Annual Report.

12. Is the Committee in agreement with the student's aims and priorities for the next 12 months as stated in the student's Annual Report? ***yes*** ***no***
If not, please explain briefly below:

13. Is the Committee in agreement with the student's proposed thesis outline and plan for graduation (if such has been presented)? ***yes*** ***no***
If not, please explain briefly below:

14. Is there a need for the student's "science" thesis committee to meet? ***yes*** ***no***

15. Provide additional comments (e.g., areas where student should aim for improvement), if desired.

Should the student be placed On Notice that they are not performing satisfactorily? If so, indicate what the student is expected to accomplish before the next Committee meeting in order to be removed from probationary status:

Name of Committee Chair _____

Signature of Committee Chair _____