

# Minnesota Institute for Astrophysics Graduate Handbook

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# 1. Purpose of this Document

This handbook is intended as a supplement to the official UMN graduate school page ([Graduate School](#)). It summarizes Astrophysics degree requirements and answers frequently asked questions about student goals and student-faculty relations. Although every effort has been made to maintain accuracy, you should always defer to the [Graduate School Catalog](#) in the event of any conflict with that document.

The Ph.D. program in Astrophysics is designed primarily to train individuals for careers in modern astrophysical or related research. Increasingly, Ph.D.s in the physical sciences are pursuing a broader range of careers, bringing to them both their technical knowledge as well as their skills and experience in research and problem-solving. All of these careers are very demanding and competitive. Hence, independent of what career path you follow, your principal goal throughout your graduate career should be to learn astrophysics and gain first-hand experience with the broad range of tools of a research scientist.

For many scientists, teaching is a critical component of their job. In the Astrophysics program, most students will receive training and experience in teaching. There are also a growing number of opportunities for enhancing this training and documenting your experience for help in your future employment.

This handbook should serve as a reference guide and a place to start. However, it cannot replace the invaluable information you can obtain by talking with your adviser, faculty members, or other graduate students. This handbook is also an evolving document, and your comments and suggestions for its improvement are always welcome.

## 2. Graduate Students and Faculty - Mutual Expectations

The purpose of this section is to provide graduate students with an idea of what is expected of them and also what they might reasonably expect from the faculty. In general terms, the faculty expect all graduate students to be working hard and making no less than “satisfactory progress”, as described further below, toward their intended degree. Graduate students can reasonably expect that the faculty provide them with instruction, advice, and access to resources. The faculty advisors will be the primary source of guidance toward the degree.

Due to the highly competitive nature of the job market in astrophysics, there are multiple, sometimes competing goals for the graduate program. While not all of our graduates proceed on to employment in astrophysics, all of the goals of our program are designed to best prepare a graduate student for such a career. This is based, in part, on the expectation that all entering graduate students have the long range goal of a career in astrophysics. However, it is also the aim of the faculty to help the graduate students develop skills which are “transferable”: (e.g., communication skills, computing expertise, project design and execution, etc.) with the goal to enhance their prospects for future employment, regardless of field.

### 2.1. What is “Satisfactory Progress”?

The Graduate School has performance standards ([performance](#)). This section outlines the specifics of the Astrophysics program. At one level, this is a simple question. The guidelines and requirements spelled out in [Section 4](#) and [Appendix A](#) describe the timelines for various goals to be accomplished. Graduate students should be familiar with these. The Graduate Faculty conduct an Annual Review each Spring to review the progress of each graduate student (Section 2.2).

A minimum GPA of 3 is required by the Graduate School for the Doctoral Degree. Note that to be competitive for fellowships later on, students usually need a GPA of no less than 3.5.

However, at a broader level, what constitutes “satisfactory progress” depends on the goals of the individual graduate student, and can be far more complex than the single characterization of an M.S. or Ph.D. degree. If eventual employment as a research astronomer is the desired goal, the job market can be much more demanding than the formal university requirements for a Ph.D. (successful post-doctoral candidates generally have research accomplishments in addition to their required thesis work). Thus, it is reasonable for graduate students to discuss their goals with faculty members and ask them for evaluations not only on the progress of their research, but also on their employment prospects.

## 2.2. The Faculty Roles

Faculty members have many different responsibilities for the graduate program; these fall within three main categories. For the most part, it is the faculty’s responsibility to provide access to first-rate resources for learning and research. Whether this is in the form of observing time on the world’s best telescopes, state-of-the-art computing facilities, grant support, or adequate office space, this is where the faculty spend a great deal of effort. Clearly, it is in the best interest of the graduate students to help in this effort, when possible.

It is also the graduate faculty’s responsibility to provide a curriculum which includes a large range of exposure to fundamental concepts, areas of important current research, and experiences with methods of research and problem solving.

Finally, it is the faculty’s responsibility to provide feedback to the student. Formally, this is achieved through the Spring Annual Review of all graduate students by the faculty. Here the student’s progress is reviewed and goals are identified for the next year (i.e., “satisfactory progress” is defined). Graduate students participate directly in this evaluation by submitting a self-evaluation to the DGS prior to the review. The self-evaluation consists of answering questions which serve as an overview of the last year’s progress (see [Appendix C](#) for examples of questions). It is not expected that all graduate students will have accomplishments in every category, (especially true for students in their first year), but the evaluation should be seen as a list of what types of accomplishments the faculty are looking for. This self-evaluation also allows the graduate student an opportunity to define what they believe are reasonable goals for the next year. Since satisfactory progress is a prerequisite for departmental employment, the graduate student’s qualification for departmental support is part of this review process. The graduate students should discuss their self-evaluation with their adviser. The DGS is then responsible for providing to each graduate student a short written summary of the faculty’s discussion. This should not replace continuing discussions between faculty and advisees concerning the student’s progress. Any questions should be directed to your adviser and/or the DGS.

For first and second year graduate students, some feedback is also available in the form of grades in graduate course work. However, graduate students should be aware that grades of A and B are expected in graduate courses; a grade of C is considered unsatisfactory.

To get the most out of graduate school, graduate students need to go beyond these formal feedback mechanisms and to work with their faculty adviser(s) to establish well-defined goals and evaluate progress on a regular basis. Getting feedback on academic, technical, communication, and research skills has value for the student. Since, by definition, the results of research are unpredictable, a frequent review of progress and the re-evaluation of goals in this area is critical. Informal feedback from other faculty members, and even from fellow students, can help a student identify strengths and areas that need improvement.

## 3. Registration and Student Status

### 3.1. Registration and Course Requirements

For many reasons, such as deferment of student loans, eligibility for University employment, health benefits, access to University facilities, it is important for graduate students to maintain their full-time registration. A minimum of 6 credits is required to be considered full-time. Students who exceed 14 credits will be responsible for the cost of the excess credits. Students must register each semester; summer registration is usually reserved for thesis credits. The goal is to obtain the required number of credits (40) for the PhD program and to pass the oral exam in a timely manner so as to achieve ABD (all but degree) status as soon as possible. ABD status equals to full time registration and requires only one credit per semester.

You should register whether or not you are taking regular classes. When you are not taking any regular coursework, you should register for one of the following:

- AST 8990 - directed research
- AST 8777 - M.S. thesis credits — 10 in total are required
- AST 8666 - Doctoral pre-thesis credits
- AST 8888 - Doctoral thesis credits — if you have passed your Preliminary Oral Exam — 24 in total are required.

When you have completed all of your thesis credits and are ABD, register for 1 credit of 8444 each semester. Note that there are significant cost saving for achieving ABD status. All graduate students are required to register in the Graduate School every fall and spring term in order to maintain active status.

You should be registered before the first day of class in each semester. There is a \$50 late fee charged for registration during the first 14 days of classes. Registration is completed online via [MyU](#). Some of the 8000 level classes will require a permission number for registration; permission numbers are obtained from the departmental office. For advice on classes, talk to your adviser and DGS. Under some circumstances, it is possible that you will have a “hold” on your registration (see next section). These can be academic, financial, or bureaucratic in nature and you will not be able to register until it is resolved.

As discussed in Section [3.2.](#), graduate students receive waivers for their tuition. However, you will be responsible for certain fees each semester. These fees cover use of campus transportation, membership at the student gym, etc., and total about \$560. The fees can be paid all at once at the beginning of each semester, or in three installments.

The MyU portal ([MyU](#)) gives you access to your student account. This is where you pay your fees and can access your transcript and financial aid information.

### 3.2. Holds

Students occasionally will have a hold placed on their registration, preventing them from registering until the cause of the hold has been addressed. The established criteria are:

- i. GPA: your GPA has fallen below 3.0.
- ii. Incompletes: you have incompletes exceeding 6 credits.
- iii. You are overdue in submitting a degree program or thesis proposal.

Normally you will receive a warning the first semester the problem arises. The second semester your

registration materials will be withheld and can be obtained in 316 Johnston Hall only after the reason for the hold is removed or the DGS has approved your continued registration.

### 3.3. Tuition and Resident Status

Most TA & RA appointments are at the 50% level and receive a 100% tuition waiver. Graduate students holding assistantships will have tuition benefits capped at a maximum of 14 credits per semester during the academic year and 14 credits per term during the summer. Summer registration is generally reserved for Thesis Credits. Credits over 14 will be charged directly to any graduate student exceeding the cap.

The fee differential between “resident” and “non-resident” students is substantial. Regardless of your place of legal residency you are entitled to resident tuition rates if you are employed by the University at least 25% of full time. Students on appointments of at least 25% of full time get tuition rebates at a rate equal to two times their fractional appointment. This also entitles members of your immediate family to resident rates. Otherwise, to obtain “legal” resident status as a student you must demonstrate that you came to Minnesota primarily for some purpose other than education. For students who must pay, the tuition structure is complicated; you should obtain the official policies from the Graduate School.

## 4. Formal Requirements for the Ph.D.

Below is a summary of the Ph.D. requirements. You should also see [Appendix A](#) for a timeline and checklist of requirements.

### 4.1. Summary of Requirements

- [Classes](#) - Complete a minimum of 40 credits (a maximum of 9 at the 4000 level), including a year of Classical Physics (PHYS 5011-5012).
- [The Written Examination](#) - A comprehensive examination to be taken in mid January (expected to be passed by the middle of the second year).
- [Doctoral Degree Plan Form](#) - A form that documents your coursework that must be filed prior to scheduling your Preliminary Oral exam (the Graduate School recommends that the plan is filed a minimum of three months prior to the exam).
- [The Second Year Project](#) - A research project to be initiated no later than the summer after the first year and to be presented and defended by the end of the Fall semester of the third year as the Preliminary Oral Exam.
- [The Preliminary Oral Exam](#) - An oral examination to be taken no later than the end of the fall semester of the third year of study or earlier, which fulfills the formal Graduate School requirement. Note that passing the exam in the summer allows you to register for thesis credits in the fall semester.
- Doctoral [Thesis Credits](#) - Register for 24 Ph.D. thesis credits upon completion of the Preliminary Oral Exam.
- [The Ph.D Thesis](#)
- [The Final Oral Examination](#)

### 4.2. Classes

There are several things to consider in choosing classes. One of the things to consider is the formal requirements of the Ph.D. program. We aim to retain considerable flexibility in defining courses which can be included in either program. Be sure to discuss your class choices and any questions you may have with the

DGS. The Astrophysics program requires a minimum of 40 credits (with a maximum of 9 at the 4000 level). The Classical Physics sequence (PHYS 5011-5012) is required.

For new students, the DGS will look over your current transcript, and talk with you about any deficiencies in your undergraduate physics / astrophysics background. During your first year, it may be necessary to reinforce some of this undergraduate work, so that you can be successful in your graduate studies. Such classes may or may not count in your Ph.D. program, depending on their level.

An important consideration for beginning students is what will be included on the Graduate Written Examination (GWE). Although the GWE targets topics at the undergraduate level, these themes are reinforced in the graduate courses. Most courses are offered only every other year.

Each year, the faculty run special topics courses (AST 8110-8120). These are an opportunity to investigate cutting-edge research and techniques in a specific area, and you are encouraged to take them. Different courses are taught in different styles, and they are all valuable for a graduate student to experience. Some will be taught in a traditional lecture format, although the class will be small and there will be more time for questions and discussions. Others may be more project or problem-solving oriented, with students participating and presenting their work. Others may be seminar style, where a general focus is provided, but students provide much of the course content through their individual literature research. Each of these formats can be useful. However, both the instructor and student should make clear at the beginning of each course exactly what the expectations are.

#### **4.2.1. Graduate Courses of Interest to Astrophysics Students**

- AST 4001 - Stellar Interiors to Galactic Structure
- AST 4002 - Galaxies and Cosmology
- AST 4031 - Analysis of astronomical data
- AST 4041 - Computational Methods in the Physical Sciences
- AST 5012 - The Interstellar Medium
- AST 5022 - Relativity, Cosmology, and the Universe
- AST 5201 - Methods of Experimental Astrophysics
- AST 8001 - Astrophysical Radiative Processes
- AST 8011 - High Energy Astrophysics
- AST 8031 - Astrophysical Fluid Dynamics
- AST 8110 - Topics in Astrophysics (for example: Lensing, SNae, Galaxy Evolution)
- AST 8120 - Topics in Astrophysics
- AST 8200 - Seminar

The following are offered through the Physics graduate program:

- PHY 5001-5002 - Intro Quantum Mechanics I, II
- PHY 5011-5012 - Classical Physics I, II
- PHY 8011-8012 - Quantum Mechanics I, II
- PHY 8501-8502 - General Relativity & Cosmology
- PHY 8601-8602 - Plasma Physics I, II
- PHY 8611 - Cosmic Rays and Plasma Astrophysics
- PHY 8801-8802 - Nuclear Physics I, II

Courses related to thesis and research credits:

- AST 8333 - FTE: Master's
- AST 8444 - FTE: Doctoral
- AST 8666 - Doctoral Pre-Thesis Credits

- AST 8777 - Master's Thesis Credits
- AST 8888 - Doctoral Thesis Credits
- AST 8990 - Research in Astronomy and Astrophysics

Virtually any 4000-8000 level physics course could in principle be included in minor programs. Some not listed above which have obvious value in astrophysics are courses in statistical mechanics, nuclear physics, atomic and molecular structure, and elementary particles. Various courses from the mathematics and other departments are also frequently included in minors.

### 4.3. The Written Examination

All Ph.D. students must pass the Written Examination in Astrophysics, which takes place in mid January (Friday before classes start). It covers undergraduate astrophysics, at the level of our 4001/4002 courses. It also includes physics at the advanced undergraduate level, especially those portions with direct astrophysical application. The exam will offer questions covering a range of topics. Because our students come from various backgrounds with various research interests, we are more interested in problem solving ability rather than specific knowledge of certain topics. Thus the students will only be required to answer a certain fraction of the questions in the exam. Details will be provided by the GWE committee.

Preparing for this examination should be done in a careful and systematic way over an extended period of time. Last minute cramming is unlikely to be useful. Copies of recent exams are available, and are your best guide as to the content and style of the exam. ([Recent exams through 2016](#)).

The Written Examinations are first graded blindly, and then the Graduate Faculty meet as a whole to discuss the results. For all students, but especially those with marginal scores, other information concerning your professional development can be used to support a recommendation for passing the examination. Such factors include your class work, research work and other information faculty may have about your likely success in Ph.D. research.

### 4.4. Graduate Degree Plan Form

After passing the Written Examination, complete the [Graduate Degree Plan form](#). This will document which courses form the basis of your Ph.D. program. Include any transfer credits you have from graduate work at other institutions on this form for transfer approval. The form must be signed by your adviser, the DGS, and the Associate Dean for Research and Planning for the College of Science and Engineering. Turn the form into the Graduate Student Services and Progress (GSSP) office in 160 Williamson Hall. (See [Appendix B](#) for more information). The Graduate Degree Plan must be completed before you can register for your Preliminary Oral Examination.

When filling out the form, you can only include a maximum of 9 credits of 4xxx level courses. If this puts you below your 40 credits, the DGS can approve the form (the graduate school only requires 24 credits). Also, if the Associate Dean for Research and Planning for CSE is unavailable, the astrophysics graduate program coordinator (or the equivalent in physics) can sign in their place.

### 4.5. The Second Year Project

Each candidate for the Ph.D. in Astrophysics must complete a report on a research project under the supervision of a member of the Astrophysics Graduate Faculty prior to taking their Preliminary Oral Examination. The purpose of this project is to give the student experience in research and to demonstrate



their potential for Ph.D. thesis work. This project, known as the Second Year Project (SYP) is to be defended as the Preliminary Oral no later than Fall semester of the student's 3rd year of enrollment.

The nature and extent of the project is agreed upon by the student and their project supervisor. Preferably, the student will submit to their adviser a written abstract of the SYP which clearly defines the project (goals, methods, and timeline). Supervisors and students should consult with the DGS with any questions regarding the suitability of work to be submitted as the SYP. The general goal, as is the goal of all research, is that the work should be of publishable quality. However, the deadline of defending the SYP within the Fall semester of the third year is strict and an integral part of the overall program design (it is important that the faculty meet, assess the student's progress, and provide feedback to the student on the timeline of the SYP). Thus, recognizing that research cannot always be forced to meet deadlines (e.g., bad weather can prohibit observations, disk crashes can cause set-backs, discoveries can alter the direction of the research, collaborators may be slow in responding) actual publication is not a requirement. Even if the research project is not complete, the student should be able to write up what they have accomplished so far, defend their research within the context of the oral examination, and be prepared to discuss their future plans. Thus, results of the SYP should be written up in the form of a paper to be submitted to a journal, although actual submission is not required. This write-up will then be presented to the Orals Committee.

The results of the SYP are presented at the Preliminary Oral Examination for the Ph.D. (see Section [4.5](#)). The Examining Committee will determine whether the student is qualified to continue on to the Ph.D., based on the SYP, their responses to questions at the examination and record of performance in the Astrophysics Program, including course work, the Written Examination, and other research experience. **The student is responsible to summarize all relevant experience in the form of a Curriculum Vitae to be sent to the committee members prior to the exam. The student should also transmit the graduate transcript to the committee members.**

In the context of the SYP, for a student to be considered as making "satisfactory progress" in the Astrophysics program, the following timelines must be followed:

- i. Notification to the DGS of the title and supervisor of the Second Year Project by the end of the first year Spring Semester;
- ii. Submission of the written version of the SYP to the Examining Committee two weeks prior to the examination.
- iii. Submission of the student's CV and transcript 2 days prior to the exam.**
- iv. Passing the Ph.D. Preliminary Oral Examination by Fall Semester of the third year.

It is expected that students will begin working on their SYP no later than the summer of the first year. The SYP may or may not lead directly into Ph.D. thesis work; there is no presumption either way. Students may sometimes be able to obtain financial support as a Research Assistant, either during the academic year or summer, for work on their SYP. Such arrangements are made directly between the student and their supervisor, and are completely separate from the academic requirement itself.

## 4.6. The Preliminary Oral Examination

Admission to Ph.D. candidacy requires that you pass a preliminary oral examination. In preparation for this exam, the student will work with the DGS and the adviser to appoint a committee. The student will obtain the necessary paperwork, and complete the steps required by the University for the proper registration of your exam. You must submit the written version of your Second Year Project to your committee at least two weeks prior to the exam date. (See [Appendix B](#) for a checklist of the required steps and links to all necessary forms.)



The student will schedule the preliminary oral exam with the Graduate Student Services and Progress (GSSP) online as soon as the dates are set, but no later than one week prior to the examinations. At least one week prior to the exam, you will receive an email from GSSP with information regarding outstanding oral exam requirements, how to fulfill the requirements, and or the status of the form. GSSP verifies that all examination requirements have been completed before releasing a doctoral oral exam form. Start at least a month or two early to allow for GSSP processing times. You will be responsible to bring the oral exam form on the day of the exam.

In your preliminary oral exam, you will present the results of your Second Year Project and answer questions related to this work. You will be expected to demonstrate your understanding of that area, as well as any related background astrophysics and physics. The Committee will also be looking at the research techniques and thinking skills that you have developed.

The examining committee consists of four faculty members. According to Graduate School rules at least one member must represent a field outside the major. Consult with the DGS to determine your outside committee member. It is your responsibility to obtain the necessary forms and arrange with the committee a suitable time and place to take the exam. All members of the committee must attend the examination, and at least three of the four must agree in order for you to pass the exam. Once the Preliminary Oral Exam paperwork is processed, you may register for the Doctoral Thesis Credits. A possible outcome is "pass with reservations"; the committee members will notify you the requirements to remove the reservations and the deadline. However, a pass with reservation allows you sign up for doctoral thesis credits.

#### **4.7. Doctoral Thesis Credits**

You must register for 24 Ph.D. thesis credits. You have the possibility of taking 10 credits in one semester and 14 in another, to allow for additional an 4-credit graduate level course. Your Preliminary Oral Exam paperwork (with a 'pass' or 'pass with reservations' mark) must be submitted and processed before you can register. A minimum GPA of 3.0 is expected by the University.

#### **4.8. The Ph.D. Thesis**

The Ph.D Thesis is a substantial work of original research done under the supervision of an adviser from the Graduate Faculty and submitted in writing according to GS standards.

Each graduate student must identify a thesis adviser and topic and secure the agreement of the adviser. This is a serious commitment for both parties, and is usually done as part of a long-term discussion that may include small research projects, reading, etc. It is common for students to explore a few potential advisers / topics before making a final decision. Students and advisers should discuss the content and scope of the intended project, working styles and financial support expectations. The clearer the understandings are on these issues at the beginning (including what is uncertain), the smoother the working relationship will be.

The U of M requires that your thesis advisor be a member of the Astrophysics graduate faculty; outside advisors are not allowed.

#### **4.9. Thesis Work in Absentia**

Sometimes a student during his/her graduate career develops an interest in an area of research not directly performed by a faculty member in the Institute, or finds an opportunity with financial support, at a national observatory or other research institution. In these cases, it may be in the student's best interest to finish his/her thesis in absentia so he/she can directly work with an astronomer at another institution or use the

equipment and expertise located at a research institute. This is encouraged by the Institute in consultation with the faculty adviser.

The in absentia student must have completed all of his/her course work, passed the Preliminary Oral Exam and have a thesis topic before leaving Minnesota. He/she is also advised to visit the host institution for some time before deciding on the change of venue.

The faculty expects that he/she will continue to register for thesis credits and keep his/her faculty adviser and/or the DGS informed of his/her progress periodically. The faculty also expects that he/she will participate in the corresponding activities at the host institute as are required here. For example: attending colloquia, participating in public outreach and volunteering to give talks at the local equivalent of the journal club.

#### **4.10. The Final Oral Examination**

When your adviser agrees that the thesis is ready for defense you must fill out the appropriate forms at the Graduate School and distribute copies of the thesis to the reviewers. The forms can be found at this link <https://onestop.umn.edu/academics/graduate-student-services-and-progress-gssp> . When the thesis readers all certify that the thesis is ready for defense you may schedule the exam with your committee. Each member of the committee must have two weeks to review the thesis prior to the examination. This time can be modified only by unanimous consent of the committee.

The examining committee consists of at least four faculty members. According to Graduate School rules at least one reviewer member must represent a field outside the major. Consult with the DGS to determine your outside committee member. It is your responsibility to obtain the necessary forms and arrange with the committee a suitable time and place to take the exam. All members of the committee must attend the examination, and at least three of the four must agree in order for you to pass the exam.

The Graduate School must be notified a week in advance of the time and place for the exam. The final exam report form will be sent to your adviser. The Final Oral Defense must take place at least one academic term (15 weeks) after the Preliminary Oral Defense and within 5 years of the Preliminary Oral Defense. You must submit your application for degree by the first working day of the intended month of graduation.

The first part of the examination is a publicly advertised and attended presentation of your work. This is followed by a private examination by your committee. No more than one of the four examining faculty may dissent in approving your thesis defense.

### **5. Life in the Minnesota Institute for Astrophysics**

In addition to all the formal requirements for graduate degrees in Astrophysics, graduate students are expected to become a full part of our professional community. This means participating in a variety of program activities, like attending seminars, joining discussions about the department's programs and facilities, helping out where it is needed.

#### **5.1. Colloquia, Seminars, and Journal Club**

The MfA and the School of Physics and Astronomy offer a large number of scientific presentations every week. A weekly calendar of events can be found [online](#). Graduate students and Faculty are expected to be active participants in these programs.

- [Cosmology Lunchtime Seminar](#) - Mondays, 12:15 PM, Tate 201-20

The Cosmology Group have weekly lunchtime seminars typically featuring local speakers. Occasionally additional seminars are held that feature outside speakers. The Cosmology seminar can be taken for credits.

- **Astro-ph discussion** — Wednesdays, 12:00, MIfA interaction area  
Informal discussion of recent papers appeared on the astro archive. Sign up for the MIfA page of the archive ([voxcharta](#)) and vote on the paper that you would like to present. Bring your lunch!
- **[Physics & Astronomy Colloquium](#)** - Thursday, 3:35, Tate B50  
School of Physics and Astronomy Colloquia are intended for non-specialists and often contain topics of interest to astrophysics. Given the close links between much of astrophysics research and basic physics, and the need to think broadly in terms of future employment, graduate students and faculty are encouraged to attend these colloquia.
- **[Journal Club](#)** - Thursdays, 12:10, Tate 301-20  
Journal Club is a key opportunity for faculty and graduate students to hear about interesting research from around the world, either through reviews of published articles, preprints, or meeting reports. They also present an important opportunity for graduate students to practice their communication skills in front of a supportive audience, but one that can provide critical feedback for improvement. All graduate students are expected to make at least one (and preferably two) Journal Club presentation each year, and to attend each weekly session.

In preparing for a Journal Club (JC) presentation, the following guidelines may be useful:

- i. **Choice of paper.** The choice of the paper can be crucial to the success of the JC presentation. Choose a paper which is interesting to you and which you judge will be interesting to the audience. Ask faculty or other graduate students for suggestions if you are stuck on this. “Discovery” papers are more likely to be of general interest than “technical” papers. For example, it is often the case that we hear about astrophysical discoveries through press releases which give very little information. Reviewing the relevant journal article will generally be appreciated. The length of the paper can also be important. If you choose a very short paper (e.g., a Nature paper or an ApJ letter) you may find that most of the background has been left out so that you have to read a number of other articles just to set the stage. On the other hand, it may be difficult to do justice to a very long paper in the time allotted. Choosing a paper outside your direct area of research is often a good idea. It will broaden your horizons and is likely to be of more general interest to those present. Often it is easy to find an article which peripherally relates to your studies, and therefore is of use to you outside the scope of the presentation. There are now suggestions for articles listed on the journal club website.
- ii. **Allot enough time.** Usually it is best to pick the article up to a week in advance. This allows you to give the paper a quick read (and reject it if it isn't as interesting as you had hoped), note the background articles that you'll need to read, and identify the parts of the paper on which you will have to work to understand. Often discussing the article with another grad student or faculty member will help you to sort out which bits need further work.
- iii. **Prepare a clear presentation.** There are many points to this. Some may seem obvious, but violations are frequent. Prepare visual aids (view graphs and powerpoint are both available) that can be read easily from the back of the room (this includes the labeling on the axes of graphs). Speak clearly and loudly so that everyone can hear. Highlight important points. Maintain eye contact. Prepare a presentation which is appropriate to the time allotted (20 minutes) and allow for (and encourage) questions from the audience.

iv. **Seek feedback.** When your presentation is over, seek out advice on how you could improve your presentation style.

■ [MifA Colloquium](#) - Fridays, 2:30 PM, Tate 301-20

Astrophysics Colloquia generally feature outside speakers presenting current research on a wide variety of topics. These form a critical part of the continuing professional development of both faculty and students. The MifA colloquium can be taken for credits.

Graduate students typically meet with the speaker on Friday mornings. You are encouraged to participate in these sessions.

Dinner arrangements for speakers are made with that week's host — in many cases graduate students are welcome to attend and 50% of their meals are subsidized by the department.

## 5.2. Getting Involved in Research

Most beginning graduate students have only vague notions of the area of research they wish to pursue seriously. Some have had extensive exposure to active research as undergraduates, but many have not. It is important for each of you to become familiar with serious research in the Institute from the very beginning of your career. You are expected to participate in the weekly Journal Club and colloquia. Make a habit of reading current journals and preprints and discussing research activities with other graduate students and faculty. Most important, you should take initiatives to become directly involved in meaningful research.

Personal involvement may develop in several ways. For example, in the Fall after you arrive the Director of Graduate Studies (DGS) can discuss your research preferences with you and help you make arrangements with a faculty member to work on a research project. Ask around. Don't be afraid to propose projects of your own. Many good research projects are initiated by graduate students. The faculty will assist you in developing projects and preparing proposals.

For satisfactory progress, by the end of the Spring of your first year, you should have found an adviser and started working on your second year project.

## 5.3. Financial Aid

The department tries as best it can to provide financial support for all graduate students who are making satisfactory progress toward a degree, so that they can concentrate on their studies and research. This support currently comes in five forms:

- Teaching Assistantships (TA's) — awarded by the Department;
- Research Assistantships (RA's) — arranged with individual faculty members using research grant funds
- Graduate School and Dissertation Fellowships, by Department nomination for college-wide competitions
- Miscellaneous fellowships — search the web and see the DGS
- Tuition and other subsidies, awarded through the Department.

Most graduate students will be supported initially through teaching assistantships. Provided you make satisfactory progress toward your degree, and provided your teaching is satisfactory, MifA will make every effort to supply TA support for two academic years. Our ability to provide this support depends, of course, upon MifA's ability to obtain sufficient funding for TA's from the College of Science and Engineering. Beyond the second year you should try to obtain support as an RA, if at all possible.

All of MfA graduate students are supported full time during the summer. Some summer TA support has been available to graduate students who were not yet supported full time as RA's. However, its nature and extent are variable, so you should discuss this with the DGS early in the spring.

As part of the Ph.D. program, you are required to participate in research projects. Some of these can be supported through external research grants, but others may not. By your third year you should ordinarily plan on finding support as an RA.

It is important to realize that all RA support in the Department comes through externally funded research grants (primarily through the NSF and NASA). Faculty members must write proposals every one to three years; this involves a large amount of effort, and must be done 8 months to 1 year in advance. The actual cost of an RA to a grant is approximately twice what the student receives in salary, because it includes University overhead and fringe benefit costs for health care, tuition, etc. Funding is very competitive (oversubscription can be as high as 10 to 1), and RA support for students must be justified to the funding agencies upon their real scientific value to the proposed research.

#### **5.4. Advising**

Initially, the DGS, or another faculty member assigned to you, will serve as your adviser. At any time, you are welcome to informally seek advice from other faculty members. You may also have another faculty member officially designated as your adviser at any time. The supervisor of your Second Year Project may serve as your official academic adviser or not, by mutual agreement. All changes in adviser must be done officially through the DGS.

Before beginning your Ph.D. thesis work, you must obtain a "thesis adviser" who will supervise your thesis work and serve as your official academic adviser. Early in the year you should identify a faculty member with whom you wish to work and through discussions and/or a "work study project" identify a suitable thesis topic. It is not necessary for your PhD adviser to be the same faculty member as your second year project adviser.

#### **5.5. Travel Support**

MfA graduate students can access travel funding available to the School of Physics and Astronomy. The lump-sum award will be approximately half of the estimated total travel costs, subject to a maximum of \$750 per trip and a \$1500 career total. After the trip, if the actual expenses are less than what was estimated, the award will be reduced accordingly. This fund can be used as many times as you want as long as the career total of \$1500 is not exceeded.

Travel awards will be given as lump-sum travel fellowships. Students must submit a formal request BEFORE travel begins. To apply for travel funds, complete the Travel Grant request form found in the Graduate Program section of MyPhys. If approved, the student will receive a fellowship not to exceed \$750 or half of the total estimated cost of the trip, whichever is less.

The Graduate School offers national and international thesis research travel grants. To apply, visit [this link](#).

If the conditions allow it, Block Grant funds may be used for students accepted as speakers at a conference; students should contact the DGS if no other support is available.

## 5.7. Public Outreach Programs

Part of the mission of the Minnesota Institute of Astrophysics is to serve the citizens of Minnesota through various public outreach programs. All professional members of the department — faculty, post-docs, graduate students — are expected to participate in these activities. Some of these responsibilities are also folded into the Teaching Assistant positions.

Current activities in outreach include:

- Minnesota Starwatch - a newsletter about the night sky and other interesting facts
- Departmental web site
- Classroom visits to local schools for presentations
- Public evenings at the telescope
- Visits from Girl Scouts and other groups
- Talks to other local organizations as requested
- Mentoring programs with local school children
- Joint projects with the Minnesota Astronomical Society, the Planetarium, the Science Museum of Minnesota, etc

## 5.8. When Problems Arise

Graduate student life should be both challenging and enjoyable, in varying combinations. If either of these elements is missing for an extended period of time, it's time to talk to your adviser or the DGS.

It is not uncommon for stresses, academic, personal, financial, etc., to reach a level where they affect a student's work. It is very important that you do not let such problems reach a critical stage — instead, you should address them promptly when they are easiest to deal with. You may feel embarrassed or uncomfortable raising these issues; please be assured that you are not alone — many other students have dealt with difficult problems, and we can help with discretion and confidentiality. It is in the interests of the Department and University to have its students be successful, so please ask for help when you need it.

Your first contact in case of academic problems should be your adviser. Other faculty members, the DGS, and the Director may also be useful to you. On personal issues, it may be useful for you to talk with the DGS, who can refer you to other services. Or, you can go directly to such services yourself.

Crowded offices may be a source of conflicts with your fellow graduate students. Keep in mind some simple rules (see below) and if problems cannot be resolved, come and talk to the DGS. Most important is that you should be respectful of people and of other people's space. Talk with each other! Conflicts rarely resolve by themselves. Finally, [here](#) you can find 15 rules of etiquette for the cubicle, make sure to follow them.

### 5.8.1. Personal problems

Here are some places to start:

- ◆ [UCCS](#) (University Consulting and counseling Service) This service handles personal as well as interpersonal problems including study skills, thesis writing support groups and dealing with difficult teachers and advisers.
- ◆ [Disability Services](#) This is a resource for current and prospective students with physical and mental disabilities. They handle screening and official documentation of disabilities as well as help with classroom and program modifications.
- ◆ [Boynton Mental Health Clinic](#) This clinic will help with urgent and long term personal problems such as anxiety or depression.

## 5.8.2. Interpersonal Problems and Grievances

### MifA and SPA Resources

- ◆ Grad Phi: An organization that coordinates social events and disseminates information useful for graduate students. email: [gradphi@physics.umn.edu](mailto:gradphi@physics.umn.edu)
- ◆ WIPA Women in Physics and Astronomy. email: [wipa@physics.umn.edu](mailto:wipa@physics.umn.edu)
- ◆ DGS Director of Graduate Studies. email: [mscarlat@umn.edu](mailto:mscarlat@umn.edu)
- ◆ MifA director. email: [skill001@umn.edu](mailto:skill001@umn.edu)
- ◆ Grievance Committee: (You can make an appointment for a confidential and informal discussion)
  - Chuck Campbell
  - Vuk Mandic (MifA member, email: [mandic@physics.umn.edu](mailto:mandic@physics.umn.edu) )
  - Tom Walsh

### University Resources

#### Student Conflict Resolution Center (SCRC)

Ombudsman (SCRC)

Email: [sos@umn.edu](mailto:sos@umn.edu)

Jane Morse (Director)

(612) 624-7272

Minneapolis: 254 Appleby Hall (East Bank)

The Student Conflict Resolution Center assists students in resolving campus-based problems and concerns through coaching, intervention and mediation by Ombudsman and Advocacy staff. They can help you bring a formal grievance as well as help resolve a problem before it reaches the formal grievance stage. They also have advice for organizing effective research teams for conflict-avoidance.

#### University Counseling and Consulting Services (UCCS)

UCCS

Email: [uccs@umn.edu](mailto:uccs@umn.edu)

(612)-624-3323

Minneapolis: 340 Appleby Hall (East Bank)

St. Paul: 199 Coffey Hall

This service offers counseling, consultation, instruction, and testing services to the Minnesota educational community. Services include individual, career and personal counseling and Student Academic Success Services.

#### Office for Conflict Resolution (OCR)

OCR

Email: [ocr@umn.edu](mailto:ocr@umn.edu)

Minneapolis: 662 Heller Hall (West Bank)

(612) 624-1030

This office offers four informal options: consultation, ombuds services, facilitated dialogue, and mediation with a neutral third party.

### Formal Grievance Resources



- ◆ School of Physics and Astronomy Grievance Committee:
  - Chuck Campbell
  - Vuk Mandic (MfA member, email: [mandic@physics.umn.edu](mailto:mandic@physics.umn.edu) )
  - Tom Walsh Graduate School Grievance Procedures
- ◆ Graduate School Grievance procedure
- ◆ Office for Conflict Resolution This office provides peer hearings, final University decisions, and binding arbitration. You should have first exhausted your other options either with SCRC or OCR's informal grievance services.

### **5.8.3. Equal Opportunity Statement**

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation. In adhering to this policy the University abides by the requirements of Title IX of the Education Amendments of 1972, by Sections 503 and 504 of the Rehabilitation Act of 1973, by Executive Order 11246, as amended: 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

### **5.8.4. Sexual Harassment Policy (May, 1984)**

Sexual harassment in any situation is reprehensible. It subverts the mission of the University, and threatens the careers of students, faculty, and staff. It is viewed as a violation of Title VII of the 1964 Civil Rights Act. Sexual harassment will not be tolerated in this University. For purposes of this policy, sexual harassment is defined as follows: "Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic advancement, (2) submission to or rejection of such conduct by an individual is used as the basis for employment decisions or academic decisions affecting such individual, (3) such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment."

A copy of the full policy and guidelines may be obtained from the Office of Equal Opportunity and Affirmative Action.

# Appendices

## A. Typical Yearly Academic Goals

Ph.D.	
First Year	Second Year
<input type="checkbox"/> Complete PHYS 5011-5012	<input type="checkbox"/> Complete course requirements
<input type="checkbox"/> Complete AST 4001-4002 & AST 5012-5022	<input type="checkbox"/> Complete second year project
<input type="checkbox"/> Work on small research projects	<input type="checkbox"/> Pass Astrophysics Written Exam
<input type="checkbox"/> Begin second year project by summer	<input type="checkbox"/> Identify thesis adviser and topic
Third Year	Fourth Year and Onward
<input type="checkbox"/> Take preliminary oral exam	<input type="checkbox"/> Complete thesis and related research
<input type="checkbox"/> File thesis title and description	<input type="checkbox"/> Write thesis and papers for publication
<input type="checkbox"/> Work on thesis and related research	<input type="checkbox"/> Take final oral exam

## B. Checklist for Preliminary Oral Exam

The preliminary oral exam is to be taken in the Fall of the third year of study or earlier. In preparation for this exam, you must appoint a committee, provide a write-up of your Second Year Project, and complete a series of steps with the Graduate Student Services and Progress (GSSP) office.

The GSSP office:  
160 Williamson Hall,  
gssp@umn.edu  
612-625-0168

All forms and general information regarding the Ph.D. program can be found on the [doctoral forms](#) page.

### Confirm Adviser on file

Check with Terry T. that your correct adviser is on file. All incoming students are assigned the DGS as an adviser until Terry T. hears otherwise.

### Complete the Graduate Degree Plan

- Download the [Graduate Degree Plan form](#)
- When filling out your coursework, classify your out-of-department class (e.g. Stats or EE course) as "Other".
- You'll need signatures from:
  - Your adviser
  - The DGS
  - The Associate Dean for Research and Planning for the College of Science and Engineering: Jill Johnson in 105 Walter will accept your form and return it after it has been reviewed.
- Turn the form into the GSSP office, 160 Williamson Hall.

□ **Complete the Preliminary Written Exam**

Confirm that your results were sent to GSSP

□ **Assign members to your preliminary oral exam committee**

You must appoint four faculty members to your committee, one of whom must be from outside the Astrophysics graduate faculty.

The necessary form and a "Quick Start Guide" can be found at the link for general forms listed above.

Or go directly [here](#). Launch this form only after you've finalized your committee member selections and at a MINIMUM ONE MONTH prior to your exam date.

□ **Schedule your oral exam**

Again, see the link for general forms or go directly [here](#). Submit this form as soon as a date is set, but NO LATER THAN ONE WEEK prior to the exam.

□ **Submit your paper to your committee**

Submit your write-up of your Second Year Project to your committee at least two weeks prior to the exam.

## C. Annual Self-Evaluation

We have a self-evaluation questionnaire annually in the Spring. It is important to the faculty to see what our students have accomplished, how they perceive their progress, and what they expect to do in the future.

- i. Please briefly describe the research projects in which you participated. Indicate your most satisfying accomplishments, as well as any serious bumps in the road you may have experienced.
- ii. List the papers you have submitted and any presentations at a professional meeting.
- iii. List your Journal Club presentations, any assigned teaching in the last 12 months, and your outreach activities.
- iv. Make a self-evaluation of your progress over the past year.
- v. State your objectives for the next year and sketch out a time-line for working towards your degree.
- vi. Anything else you would like to communicate to the faculty.

## D. Formal Requirements for the Masters Degrees

You have been specifically admitted to the Ph.D. program. To change programs (e.g., add an M.S. before obtaining a Ph.D.) you must make formal application for transfer through the Graduate School. If you are thinking of obtaining an M.S. degree on the way to a Ph.D., please talk to the DGS as early as possible.

There are two possibilities to obtain your M.S. that require a different kind of work. Plan A requires a thesis, while Plan B doesn't. You are required to file the Degree Program including a list of courses and a thesis title (for Plan A) by the end of your first year in the program. You must take a total of at least 30 credits. You have to take one semester of classical Physics (Phys 5011). For Plan A, the credits are divided as follows: 14

credits in astrophysics, 6 credits in a related field (e.g., Physics or Mathematics), and 10 Master's thesis credits. Plan B requires 30 course credits.

The Graduate School requires a minimum GPA of 2.8 on all course work in the program.

### **5.1. Plan A Master's Degree (Thesis)**

In the M.S. Plan A program you will be required to submit a research title with your Degree Program. Minor changes in the thesis title are acceptable without subsequent re-approval. Requires 10 Master's thesis credits.

The M.S. thesis topic should be something of scientific merit which is suitable for publication in a serious scientific journal. The Second Year Project may also be used as a Plan A Master's Thesis, upon agreement of the student and supervisor. When your adviser agrees that your thesis is ready for review and defense, you must acquire a "readers report form" from the Graduate School, which must be signed by all three members of your final examining committee. This certifies that you are ready for final examination. Then you may obtain the examination report form from the Graduate School. You must arrange a time and place for the exam. All members of the committee must agree that you have passed the exam.

#### **5.1.1. GS Plan A Master's Degree Requirements**

- i. After completion of about 10 credits, file a Degree Program form.
- ii. Once the Degree Program has been approved by the Graduate School and the thesis is ready to go to the reviewers, request a graduation packet on-line or by visiting 316 Johnston Hall. The Thesis Reviewers Report form will be issued at that time. Remember to allow your committee at least 2 weeks to read the thesis.
- iii. Submit the Application for Degree to 200 Fraser or 130 Coffey by the first working day of the intended month of graduation.
- iv. Submit the signed Thesis Reviewer's Report form to 316 Johnston Hall. The Final Examination Report Form will be given to you at that time. You must have the Final Exam Form before you report for the exam.
- v. Return the Final Examination Report form by the last working day of the intended month of graduation.
- vi. Submit two unbound copies of your thesis, both signed by your adviser(s), by the last working day of the intended month of graduation.

### **5.2. Plan B Master's Degree (Non-Thesis)**

Requires 30 semester credits of coursework.

The Plan B Master's degree requires completion of from one to three papers written in connection with three courses in your program. These three courses must total at least nine credits and each course must be designated by an asterisk in the Graduate School Bulletin. At least two of these courses must be in astrophysics. The official expectation is that about 120 working hours are necessary in preparing your Plan B papers. A paper may be written for each course separately, or you may combine courses. You should clear your topic(s) with the instructors in the specified courses and with the DGS and get their approval of the final result. Although there is no formal mechanism for this approval, you do not want to wait until the final oral to find out whether or not the topics were acceptable.

You must pass a final oral examination, primarily based on your Plan B papers. The examination committee is chosen by the DGS, with your help, and approved by the Graduate School. Copies of your Plan B papers must be made available to the committee members at least 7-10 days before your exam. You are responsible for arranging the time and place for the examination. All committee members must agree that you have passed the exam.

The plan B option for the Master’s degree is normally chosen when a graduate student has decided not to pursue a Ph.D. in Astrophysics, has completed the required course work, but has not made significant progress on original research. For example, in the past, graduate students that have transferred into other graduate programs have found the plan B option desirable, as it allows them to show tangible credit for their accomplishments, while not requiring the extra effort of writing a Master’s thesis.

### 5.2.1. GS Plan B Master’s Degree Requirements

- i. After completion of about 10 credits, file a Degree Program form.
- ii. Once the Degree Program has been approved by the Graduate School, pick up the Final Examination Report for and the graduation packet before your final oral examination.
- iii. Submit an Application for Degree to 200 Fraser or 130 Coffey by the first working day of the intended month of graduation.
- iv. Return the Final Examination Report form by the last working day of the intended month of graduation.

<b>M.S. Plan B</b>	
<b>First Year</b>	<b>Second Year</b>
<input type="checkbox"/> Complete PHYS 5011	<input type="checkbox"/> Complete course requirements
<input type="checkbox"/> Complete AST 4001-4002 or AST 5012-5022	<input type="checkbox"/> Write Plan B papers
<input type="checkbox"/> Identify topics for Plan B papers, file degree plan	<input type="checkbox"/> Take final oral exam

<b>M.S. Plan A</b>	
<b>First Year</b>	<b>Second Year</b>
<input type="checkbox"/> Complete PHYS 5011-5012	<input type="checkbox"/> Complete course requirements
<input type="checkbox"/> Complete AST 4001-4002 or AST 5012-5022	<input type="checkbox"/> Write thesis
<input type="checkbox"/> Obtain a thesis adviser, file degree plan	<input type="checkbox"/> Take final oral exam

## E. Useful links

### [Graduate Student Services & Progress \(GSSP\)](#)

Your first stop for all information regarding degree requirements, examinations, and all University policies and procedures.

The GSSP office:  
160 Williamson Hall,  
gssp @ umn.edu  
612-625-0168

[Graduate School Catalog](#)

Describes current graduate degree programs and their requirements

Summaries of Degree Completion Steps for:

[Ph.D.](#)

[Master's Plan A](#)

[Master's Plans B](#)

[Forms for Doctoral Students](#)

[Forms for Master's Students](#)