4. PhD Program

The following information is for full-time students. Part-time students should refer to Section 6 for modifications to the regulations.

4.1 Course Requirements

The university has no requirements except for 12 credits of PhD thesis research (ASTR 899). All other requirements for courses are determined by the department.

A minimum of eight 3 or 4 credit graduate courses are required. During the first two years, full time students must take at least six of the nine ASTR 600 level courses routinely offered by the department, or show that they have already had equivalent courses. Representative syllabi of the astronomy courses are given in Appendix A. A research project, taken as ASTR 699 or 898, is required during the second year. You are also expected to take a 1-credit seminar, ASTR 695 - Introduction to Research, during one or both semesters of the first year. This seminar is intended to introduce you to the range of research being carried out in the department and to help you to choose a second-year research project (and subsequently a thesis). See the department website for detailed information about course registration.

Additional graduate coursework beyond the 6 above will vary with individual student interest, including physics courses, astronomy courses, and courses from other relevant departments (math, computer science, engineering, etc.). Courses beyond the required 8 are often necessary for advanced research. This will be assessed by the student's thesis committee. The minimum requirement of 8 courses must be completed by the end of the third year. The University requires that the total GPA in your graduate courses be at least 3.0.

It is expected that a student will have completed no less than 7 (of the required 8) courses before admission to the Ph.D. program. This corresponds to two 3 (or 4) credit courses in three of the four semesters of the first two years and at least one 3 (or 4) credit course in the other semester. Exceptions may be considered in unusual circumstances, such as illness.

Please note that these 7 (and 8) courses are normal graduate learning courses: courses connected in one way or another with research work (e.g. ASTR 695, ASTR 699, ASTR 799, ASTR 899) or undergraduate level classes do not count to either the 7 or the 8.

PUC students follow the requirements of their home department.

4.2 Stage 1 - From Admission to Graduate School to Admission to the PhD Program

Admission to the PhD program is a Department of Astronomy decision. It indicates an initial judgment by the faculty that the student is capable of doing independent research and is likely to be able to complete a PhD thesis. Search for a PhD research topic and an advisor does not occur until after admission to the PhD program. The decision is based on the student's course work, the performance on the Qualifying examination and the quality of the research project. The qualifying examination (see next section) is taken during the summer just prior to the start of the third year of graduate studies. The decision on admission to the PhD program is normally made in September, as soon as feasible after the Qualifier. During the first two years of graduate work, you should expect to concentrate on formal course work (see Section 4.1) and the second-year research project (see Section 4.2.1).

PUC students follow the requirements of their home department.
4.2.1 Second Year Research Project

A research project is required to be done by all PhD-seeking graduate students in their second year. This has the two-fold purpose of introducing the graduate students to the excitement of research and of allowing the faculty to evaluate the student's ability to carry out a research project, particularly including dealing with problems that arise in the course of such work. The seminar ASTR 695 – Introduction to Research consists of seminars by individual faculty members and postdoctoral researchers describing their research interests. Many presenters will discuss specific second-year projects they would be willing to supervise while others will discuss general areas in which they are working and would supervise projects. By the end of the first year, you should be familiar with what the faculty is doing. Equally important are the weekly Department Colloquia; you should regularly attend these to learn about other areas of research which may be suitable for a second year project. You are also strongly encouraged to discuss potential advisors and research projects with more senior graduate students.

By the end of your first year (May), you should choose a research area under an advisor on the full-time Graduate Faculty (see http://www.gradschool.umd.edu/catalog/grad_faculty_policies.htm). By the following September you will have chosen a research topic or else your advisor shall have assigned one. You should also have selected a second-year-project committee by this time. This committee should consist of three (or more) people with expertise relevant to the research project (including the advisor), at least two of whom are on the graduate faculty of the department. Students working on a project outside the department, e.g. at Goddard, will normally include their direct supervisor as a committee member. Most students begin at least the reading for the second-year project during the summer between first and second years and many begin the work for the project at that time. During the Fall semester, you should register for ASTR 699 – Independent Study (normally 1-3 credits) and start or continue work on the topic. No grade is given for this course – you should register for the S/U grading option. Most of the research should be done by the end of the Fall semester and the writing should be well under way by late January. A progress report on the status of the project must be submitted in writing to the committee by the end of the Fall semester.

During the Spring semester (registering for ASTR 699 or 898) a first draft must be submitted to your committee by c. March 1st; it will be returned with written comments in no more than two weeks. The completed paper should be submitted to your committee by early April. Your committee will make any last suggestions.

There is a single departmental Second-Year Examining Committee which will conduct a brief (typically one hour) oral examination of all second-year students. This committee must receive copies of the project report by c. Apr. 15. The exams will usually be scheduled prior to final exams for the spring semester. Your advisor is expected to be present for the exam. The exam is a miniature version of a thesis defense: you are expected to make a short (15 minutes) presentation summarizing the project and the committee will ask questions about the work done and about its implications. There is no pass or fail decision on the exam but the committee will prepare a written evaluation of your performance on the project itself and on the oral exam. You should typically receive a copy of this report within about two weeks.

The final version of the paper, in a format suitable for publication, shall be submitted by the end of the spring semester. Copies of the final report must go both into your file in the departmental office and into the Uco van Wijk Memorial Library.

Throughout both semesters you should meet with your entire committee as a group often enough to keep the committee appraised of progress. This is particularly important for projects with an off-campus advisor. It is the responsibility of both the student and the
advisor to be sure these meetings occur. Table 3 lists typical second year project deadlines for both students and committees.

It is important to stress that, while the second year project should be of publishable quality, its primary purpose is not to be published but to allow students to understand the kinds of problems and solutions routinely encountered in doing research, to allow students to think critically about their research, and to allow the faculty to evaluate how well students approach research. Not all research projects will result in a published paper. You are strongly encouraged to also write a cover letter of a few pages both to describe the aspects of the research project which were not appropriate to a journal format but which were nonetheless significant aspects of the learning and to describe your own role vis the role of other collaborators in the project.

<table>
<thead>
<tr>
<th>Date</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept-May</td>
<td>1st</td>
<td>Attend ASTR 695 and Departmental Colloquia</td>
</tr>
<tr>
<td>Sept 1st</td>
<td>2nd</td>
<td>Choose research topic; form advisory committee</td>
</tr>
<tr>
<td>Last day of Fall classes</td>
<td>2nd</td>
<td>Progress report to committee before end of semester</td>
</tr>
<tr>
<td>March 1st</td>
<td>2nd</td>
<td>First draft of paper to committee</td>
</tr>
<tr>
<td>March 15th</td>
<td>2nd</td>
<td>Committee members return first draft with written comments</td>
</tr>
<tr>
<td>Apr. 15th</td>
<td>2nd</td>
<td>Final report to Second-Year Examining Committee</td>
</tr>
<tr>
<td>May 30th</td>
<td>2nd</td>
<td>Final report to Uco van Wijk Memorial Library and departmental file</td>
</tr>
</tbody>
</table>

4.2.2 The Qualifier

You are required to take this exam in the summer just prior to the start of your third year of studies. The closed book exam consists of two sections, each of four hours duration and given on successive days.

The qualifying exam will cover the material in the principal courses offered by the department. The exam is structured so that a student who has completed six of the nine principal Astronomy courses will be capable of writing a complete exam. There will only be one try at passing the exam. More specific information on this is circulated several months before the Qualifier. Copies of Qualifiers for the past several years are available in the main Astronomy office.

Shortly after the exam is taken, the Graduate Faculty will meet to discuss the results of the qualifier. Although there is no a priori set score for passing the qualifier, scores below 50% are considered poor. Qualifier results will be used by the faculty in their decision on admission to the PhD program (see Section 4.2.3). You will be informed of the decisions of the Graduate Faculty as soon as possible.

4.2.3 Admission to the PhD Program

This is decided by the graduate faculty on the basis of your coursework, your research project and your performance on the qualifier. The decision would normally be made soon after the qualifier, typically by mid-September. The decisions which can be reached are:
1. Admission to the PhD program.
2. Conditional admission. The conditions will be specified but normally consist of revision to the research paper or additional coursework.
3. Rejection from the PhD program. In this case you may petition the faculty for reconsideration.

You may also go on for a MS degree if the requirements can be fulfilled. (See Section 5.) You will be informed in writing of the faculty’s decision.

4.3 Joint PhD with PUC (optional)

After admission to the Ph.D. program, University of Maryland (UM) or Pontificia Universidad Católica de Chile (PUC) students who are interested in pursuing a joint doctoral degree must identify a Chilean and a U.S. co-advisor among the professorial faculty at both institutions. Each student then applies to the partner institution (PUC or the UM Graduate School). Each student also prepares an application for the Joint Doctoral Program Committee. The latter application package should contain 1) a transcript of courses and grades; 2) a copy of the completed research projects; 3) a two-page description of the intended thesis project, the observations and/or simulations necessary and how they will be obtained, and the expected stays at both institutions; and 4) letters from both co-advisors supporting the application and describing how the student will be funded throughout his or her thesis work.

The Joint Doctoral Program Committee will rank the candidates based on their submitted application materials. The chairpersons at UM and PUC will then recommend a number of the candidates thus ranked for acceptance into the joint doctoral program. They will then become registered as students at both institutions. Students that are not admitted into the joint doctoral program option are free to pursue the standard doctoral program at their home institutions.

4.4 Stage 2 – Thesis Committee and Advancing to PhD Candidacy

After admission to the PhD program, all students, whether following the standard or joint Ph.D. options, should concentrate on selecting and beginning work on a research project which will eventually become their Ph.D. thesis. A research advisory committee will be constituted to reflect the student’s research interests. As per UM requirements, the advisor(s) must be a member of the Graduate Faculty of the University of Maryland. The Department of Astronomy further requires that a member of the Graduate Faculty within Astronomy unofficially look after the student if the primary advisor of the thesis is outside the department. In the case of a joint Ph.D. student, the research advisory committee members may be from either institution but will always include at least one member from each (the co-advisors). PUC faculty will be established as Special Members of the Graduate Faculty as necessary.

Students are required to hold annual meetings with their committee (see Sect. 3.1). See the department website for detailed information about course registration.

Once a thesis topic is selected, the student should present his or her topic in a meeting of the research advisory committee. At this meeting, the student will give a brief presentation followed by questions. The role of the research advisory committee is to judge in detail the viability and suitability of the thesis plan and topic, and to advise changes whenever necessary. The entire graduate faculty of the department is to be informed of this meeting and invited to attend.

In the case of a joint Ph.D. student, the meeting is advertised and open to both departments. The presentation is expected to take place at the home institution of the student and will be transmitted by videoconference to the partner institution.
Once the thesis topic is approved and all other departmental requirements have been met, the student may apply to the Graduate School for Admission to Candidacy.

4.4.1 Regulations

University – The official forms for filing for candidacy are available online and in the Astronomy departmental office. It is the student's responsibility to file these forms in a timely manner.

Department of Astronomy – Admission to Candidacy must occur within four years of admission to the Graduate School. All the departmental requirements for admission to the PhD program must, of course, have been fulfilled. In addition, all incompletes must have been removed except for those in research courses where the work is part of the PhD research. All departmental course requirements must have been satisfied.

4.5 Stage 3 – From Candidacy to Completion of the PhD

During this period, you should concentrate on completing the PhD research work and on writing the dissertation. Students are required to continue their annual meetings with their committee (see Sect. 3.1). The thesis must involve significant, original, and independent research, performed under the supervision of the advisor. The thesis must be of the quality normally required for publication in recognized research journals. It is usual that several drafts are gone through before the final thesis is produced. The Department will normally bear the cost of reproducing the final draft of the thesis. There are University regulations as to the format of the thesis and the mechanics of submitting it to the Graduate School (See the Graduate School's website at www.gradschool.umd.edu).

4.5.1 Regulations

University – A minimum of one and a maximum of four years is allowed between admission to candidacy and completion of the PhD, of which at least one year must be spent at the University of Maryland. During this time you must be continuously registered each semester (not including summer semesters). This is true even if you are not in residence; in this case you must fill out the Continuous Registration Form and pay a nominal fee each semester. When filing for the degree, all Incompletes in the courses being used for the PhD must be completed and a minimum grade point average of 3.0 must be obtained. There are specific deadlines each semester for applying for a degree and for submitting the final dissertation. (See the Graduate School's website at www.gradschool.umd.edu/).

Department – A complete draft of the thesis must be submitted to the examining committee two weeks before the final defense. It is your responsibility and that of your advisor to see that the entire Graduate faculty is informed of the examination date and time at least two weeks in advance. You must also have a copy of the thesis available for examination by any other faculty who might wish to attend the defense. You are responsible for seeing that the final thesis reaches the Graduate School.

4.5.2 Dissertation Defense (Standard PhD Option)

Once the dissertation is completed, it is defended in front of a committee consisting of members of the Department of Astronomy, members of the University faculty who are not members of the Department of Astronomy (e.g. the Dean's Representative), and external examiners from other universities who have been made members of the University of Maryland's Graduate Faculty. A discussion of the guidelines for the Ph.D. oral can be found on the Graduate School's website at www.gradschool.umd.edu/. Once the committee has
approved the dissertation, it can be submitted to the Graduate School. More details can be found in Appendix B.

4.5.3 Dissertation Defense (Joint PhD Option)

Once the dissertation is completed, it will be defended in front of a dissertation review committee. The committee membership will consist of members of both Departments of Astronomy, members of each university's faculty from other departments (including official representatives such as the University of Maryland's Dean's Representative), and external examiners from other universities. Both the latter and all PUC faculty must be established as members of the University of Maryland's Graduate Faculty in order to serve on the committee.

The defense will physically take place at one of the partner institutions, and be transmitted by videoconference to the other. Physical presence of the student's co-advisor from the partner institution is required; physical presence of the partner institutions' other committee members will not be required. The examination date and time will be advertised to the entire Graduate Faculty of both institutions.

More details can be found in Appendix B, with the modifications noted in this section.

Final drafts of the thesis, written in English and incorporating the recommendations from the dissertation review committee, should be submitted by the candidate to the Graduate Schools of both institutions compliant with their required formats. Acceptance of the dissertation by both schools will complete the Ph.D.