

A Survival Guide for Graduate Studies in Astrophysical and Planetary Sciences

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Abstract

This "Survival Guide has been put together to aid you in your Graduate studies in the Department of Astrophysical and Planetary Sciences, APS. It contains brief summaries of the graduate rules of both the University and the Department, tips on how to survive (and even flourish) in the graduate atmosphere, and brief descriptions of faculty interests. Keep it in a safe, but accessible, place.

1 Preliminary Remarks

This is the fifth revision of the "Survival Guide". It appears after recent updates to the Core Curriculum and Comprehensive Exam.

2 Introduction

We have found that a familiar complaint from graduate students is the lack of a compact summary of rules and pertinent data concerning the University and the Department. This “Survival Guide” is meant to serve, at least partially, that purpose. Before proceeding, however, you must be made aware of four important points.

- No institution is static. Therefore rules change (sometimes with bewildering rapidity); you must keep up with those changes and you are ultimately responsible for what you do. The most recent Survival Guide is posted on the APS website under Local Access. The APS Graduate Program Assistant can give you the username and password so you can access the document.
- No Guide can be complete. We provide here a summary of what you need. If at any time you are puzzled or think you need more detail, speak to the Graduate Program Assistant, your APS advisor, or contact the Graduate School.
- You may be tempted to ask your favorite faculty member to amplify, adjudicate, or otherwise explain something you read here or in more formal publications of the University. You are perfectly free to do so, and we always encourage you to talk to faculty. But be aware: faculty is often as confused by rules and events as any graduate student. Again, go to the source.
- Final note: This Guide is *not* a replacement for official University publications. The latter *always* take precedence, where applicable.

3 Graduate School & Departmental Regulations

The Graduate School Rules for the current academic year, along with other information, can be found on the Graduate School website:
<http://www.Colorado.EDU/GraduateSchool>

We summarize only the pertinent material here, with comments.

3.1 Academic Standards

We quote from the University of Colorado Catalog:

A student is required to maintain a *B* (3.00) average in all work attempted while enrolled in the Graduate School, and must have at least a 3.00 cumulative average to receive a graduate degree.

For the Ph.D., a course mark below *B-* is unsatisfactory and does not count toward fulfilling the minimum requirements for the degree. For a Master's degree, a course mark below *C* is unsatisfactory and does not count toward fulfilling the minimum requirements for the degree.

A student who fails to maintain a 3.00 grade point average (GPA) or to make adequate progress toward completing a degree will be subject to suspension from the Graduate School upon consultation with the major department. The final decision on suspension will be made by the Dean of the Graduate School.

You can survive graduate school by barely satisfying these requirements, but the practice is not recommended. Most APS graduate courses are graded A/B, for students in good standing. For Master's degree students not doing a thesis, a potential employer does pay attention to grades, not having much else to go on besides interviews and letters of recommendation. However, *all* students, at one stage or another, must take either a Comprehensive exam (Ph.D. students) or some version of a Comprehensive-Final exam. (See 3.2-3.3). Grades do figure in here when the faculty is deciding on passage for those whose performance is marginal on these exams. A question much beloved of faculty is "What do this student's grades look like?"

Sections 3.2-3.3 below list separately the requirements for the Master's and Ph.D. degrees. They have some elements in common. One of these is a preliminary evaluation of the student when s/he arrives at CU. In our department, this involves an interview by several faculty and assignment of an academic (faculty) advisor. The purpose of the interview is to evaluate the student's background (beyond what is found in college transcripts) and to give advice on what courses to take the first year.

The academic advisor at this time (who may be the research supervisor) will help guide the student during the first year or two. Regular meetings with that advisor are required.

Another feature common to the Master's and Ph.D. programs in our department is that we do not require a foreign language, although we believe this is a desirable part of a general education.

All students in the department are required to set up a Progress Review Committee after their first year, to review the progress of the student and to make suggestions regarding the student's graduate career. See 3.4 for details.

3.2 Master's Degree Requirements

There are two tracks leading to a Master of Science degree at CU. These are called Plans I and II. Plan I requires a thesis, whereas Plan II does not. In either track, a student who wishes to become a "candidate" for a Master's degree must file an application with the Graduate School no later than 10 weeks prior to the completion of the comprehensive-final examination (see below, and see the Graduate Program Assistant).

Plan I: A summary of the minimum requirements for Plan I follows (for the details, consult the University of Colorado Catalog):

- A total of 30 semester hours, including a thesis for 6 credit hours plus 24 credit hours of graduate course work, at least 12 of which must be APS courses, must be at the 5000 level or above.
- Completion of a Master of Science thesis and oral examination based upon this thesis. The examination is to be conducted by at least three departmental faculty members who have been approved by the Graduate School (note that the Catalog calls this a Comprehensive-Final Examination). In APS, as in other departments, the questions will not exclusively be confined to thesis material. The examination may only be retaken once if the student fails.
- The copy of the thesis presented to the Graduate School must conform in general appearance to the rules given in the *University of Colorado Graduate School Thesis and Dissertation Specifications* (available from the Graduate School or online at :

http://www.Colorado.EDU/GraduateSchool/Academics/Master_Graduation_Packet_Thesis.html

- Completion of *all* degree requirements within four years of commencing course work. The normal time for completion is two years for those students who enter the program without academic deficiencies.

- Master's degree residence requirements can be met only by residence on the Boulder campus for at least two semesters or at least three summer sessions.

The thesis is supervised by an advisor chosen by the student. According to the Catalog, it represents some 4-6 semester hours of effort, but it is more likely to require more work than that to do a respectable job.

Plan II: Plan II, which does not entail a thesis, minimally requires:

- A total of 30 credit hours of graduate courses, of which at least 16 credit hours must be APS courses completed at the 5000 level or above.
- A Comprehensive-Final Examination conducted by at least three departmental faculty members approved by the Graduate School after the course requirements are substantially completed. The examination may be oral, written, or both. The examination may only be retaken once. In most instances, our department has used the Ph.D. Comp 1 exam (see below) to satisfy this examination requirement.
- Completion of *all* degree requirements within four years of commencing course work. The normal time for completion is two years for those students who enter the program without academic deficiencies.
- Master's degree residence requirements can be met only by residence on the Boulder campus for at least two semesters or at least three summer sessions.

3.3 Marching Toward the Ph.D.

Most students who decide on the Ph.D. path opt to receive the M.S. degree beforehand (either with or without thesis-see above). In any case, a student entering the Ph.D. program should have the proficiency required of a holder of the M.S. given by the department. Note that a student must apply for "admission to candidacy" for the doctoral degree on forms supplied by the Graduate School at least two weeks before attempting the comprehensive

examination (see below). Before being admitted to candidacy, the student shall have earned at least four semesters of residence, and shall have passed the comprehensive exam. If you're not a "candidate", you cannot get the degree. Also, candidacy has an impact on Teaching and Research Assistant pay ("TA/RA"). Teaching and Research Assistants are entitled to an increase in pay **after** completion of 39 hours of coursework, and a pass of Comp 1 and a successful defense of Comp 2. See the Graduate Program Assistant for details.

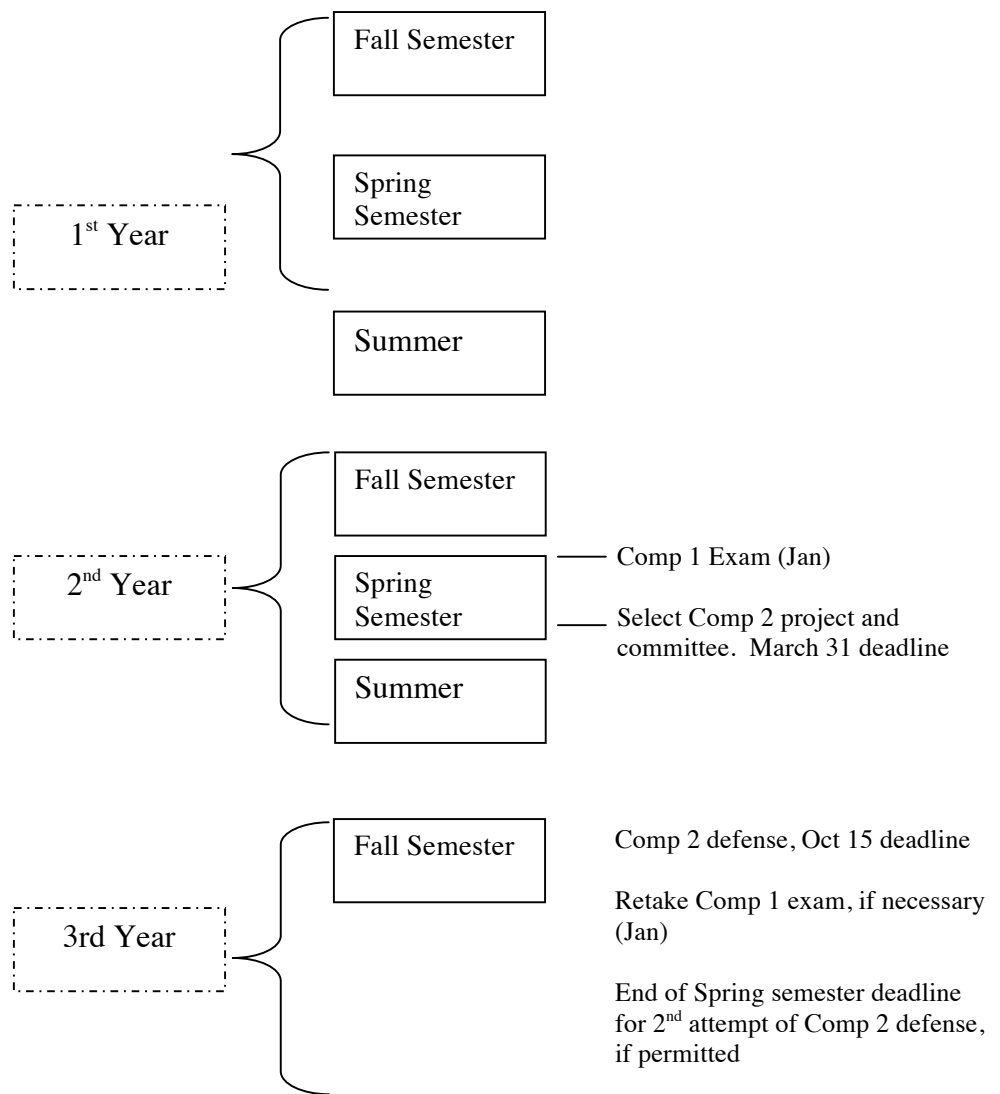
The requirements for a Ph.D. degree include the following:

- In APS, 39 credit hours for courses numbered 5000 or above (including 4 of our one-hour graduate seminars) are required with at least a cumulative GPA of 3.0. The number of courses taken usually exceeds these minima. In addition, 30 hours of dissertation credit are required, with not more than ten of these hours taken in any one semester (none of these hours count toward the 39 credit hours in courses). No more than 10 of these dissertation hours may be accrued before the student takes the Comp 2 (see below), but 10 hours are allowed in the semester that the student *passes* that exam. A student must be registered for a minimum of 5 thesis hours to be considered a full time student after passing the Comp 2 exam. This includes the semester they defend their Ph.D. dissertation. Your Graduate Program Assistant will be helpful in tracking all of this!
- The minimum residence requirement is six semesters beyond the attainment of an acceptable bachelor's degree. Two semesters of residence credit may be allowed for a Master's degree from another institution of approved standing; however, at least four semesters of residence credit, two of which must be consecutive in one academic year, must be earned for work taken at CU-Boulder.
- All degree requirements must be satisfied within a period of six years. For some students, especially those doing dissertations involving experimental or observational work, this may prove to be a burden. In such cases, the Graduate School may be petitioned for a time extension. The reasons should be very good, however, because the extension is not guaranteed.
- A student is required to register continuously (fall and spring) beginning with the semester following the passage of their Comp 2.

Students have four years from the conclusion of the semester in which they pass their Comp 2 to complete all requirements for the degree. Extensions are permitted only after a successful petition to the Graduate School.

- A student must formally apply to the Graduate School for admission to candidacy at least two weeks before attempting the Comp 2 exam.

Figure 1. Ph.D. Candidacy Schedule



3.3.1 The Comprehensive Examination

At the present time, the comprehensive exam in APS consists of two parts, called Comps 1 and Comps 2. Both must be passed before the student may be admitted to candidacy. Comps 1 tests a student's preparation in formal coursework, while Comps 2 examines the student's ability to carry out independent research. More details can be found on the APS website: <http://aps.colorado.edu>.

Comp 1: Comp 1 is presently a one-day exam given each January and it is taken by all students about to begin their fourth semester in the graduate program. Exceptions to this policy may be granted only after a successful petition to the Department. The exam is closed book, is typically six hours in duration, and contains five questions, on topics covered in the APS core courses. Precise ground rules for this exam vary from year to year and these will be announced well before the exam is given.

Past exams are available from the Graduate Program Assistant. The content of the questions, and their style, depend upon who poses the questions, where the "who" is usually a faculty member who has taught the relevant course in the recent past. Note that all questions are screened by the Examinations Committee, which includes post-comp APS graduate student representatives.

A passing grade for a question is set around 65% although, to be honest, questions and questioners have different standards. All of the questions are graded by two faculty members, and the compiled results for all students are discussed in a general faculty meeting shortly after the grading is complete. All students who took the exam are put into one of three categories: pass, marginal pass, and fail. A student who receives a marginal pass is, in effect, on probation awaiting the results of her/his Comp 2 (see below). A "High Pass" on Comp 2 means that the marginally passed student is now considered to have passed Comp 1 and is finished with the comprehensives. An ordinary pass is not sufficient. In the sad event that a student fails Comp 1 for the first time, the exam may be retaken the following January.

Hints for studying for Comp 1: First you should get hold of old exams and work the problems. Try to do each one in about an hour. If you have trouble working them out, work with your classmates and discuss conceptual difficulties, etc. It is also a good idea to talk to faculty who posed problems in the past and ask them how they approached a solution. You may get some unique insights that don't come up in the classroom.

Some of you say "I do not take exams well". If this is the case for you, then let the faculty know at an early stage in your career here. There are programs at the University of Colorado to help students deal with stress and exam taking. These can be very useful, and not just for the purpose of solving your immediate problem.

- **Note:** As mentioned before, the structure of Comp 1 has changed through the years and may well continue to do so in the future. We shall keep you up-to-date on the current format in later editions of this Guide.

Comp 2: Comp 2 is designed to examine a Ph.D. candidate's ability to carry out semi-independent research and to develop skills in written and oral communication and time management. The Comp 2 project is also meant to encourage students to become involved in research early in their graduate careers. These skills and experience are critical in the academic and industrial market. Comp 2 is an independent research project, which the student organizes, completes, and presents to a 5-person committee approved by the Chair (or delegated to the Associate Chair).

After taking Comp 1, the student selects a Comp 2 committee and a non-advocate chair, who is not his/her research advisor (see below for a more detailed description of committee membership). Early in the process, the student should obtain formal approval from the committee of a short research proposal that describes the scope of the research project. After 4-8 months of work, the student should submit a written research paper or its equivalent and make an oral presentation to the committee. Approval of the Comp 2 defense is made by the full APS faculty, upon recommendation of the student's committee. In the event that the student fails to pass the Comp 2, the student and committee will work out a plan to remedy the shortcomings.

The paper and presentation should demonstrate that the student has learned many of the professional skills needed to succeed as a scientist. The goal for the paper is that, after some further development, it could be publishable in a refereed journal or conference proceedings. The committee's judgment of the appropriate level of the project should be based on objective criteria. For example, the project should create new knowledge and utilize significant research skills. In the written and oral presentation, the student should demonstrate a well-defined contribution to the project and should be able to explain the scientific background and context of the research. A grade of "High Pass" will be awarded to students who exhibit strong mastery of these goals. Typically, 10 - 15% of APS students receive High-Pass.

A final written report shall contain the following:

- A definition of the research problem.

- A discussion of previously related work and the overall scientific context, and physical issues.
- A formulation of the specific research objectives.
- An outline of the techniques used.
- The results of the research.

This written report must be distributed to the committee (see below) at least one week prior to the oral exam. The latter will consist of a roughly 45 minute oral presentation of the research work followed by questions on the research topic and relevant fundamental concepts. These exams are usually open to the “public” (i.e., faculty and graduate students) but this is to be decided upon by the committee and candidate beforehand.

The form of the final written report is to be worked out by the student and the supervisor (see below). Many faculty insist on a final work that is publishable (at least in principle) in a refereed journal with the aim of further certifying the level of the work and to give the student practice in the important process of writing for, and dealing with, journals. Note that a copy of the final report is to be given to the Graduate Program Assistant who will place it in the student’s file.

The exam committee shall have five members, selected jointly by the project supervisor and the student, and approved by the APS Chair or Associate Chair. The project supervisor (also a member of the committee) must be a member of the APS faculty, adjunct/adjunct faculty, research faculty, or a Ph.D. research associate, and may be the student’s advisor and/or employer. The committee chair must be on the APS faculty, but may **not** be the student’s advisor, project supervisor, or employer. While this may seem a somewhat obscure and cumbersome requirement, the committee chair fills an impartial role, ensuring that the proposed Comp 2 project is neither too large nor small. The committee chair also monitors the student’s area of specialization. The Comp 2 exam committee does **not** require one faculty member from outside the APS Department (an outside member is required for a Ph.D. thesis committee).

There are three levels of pass/fail for Comp 2. In all cases, the full faculty votes on the Comp 2 committee’s recommendation. A “Fail” is a flat -out failure. The committee will decide if a second attempt is warranted, and if the same research project may be attempted. This is one reason why the student should work closely with the project supervisor and maintain contact with other members of the committee; unpleasant surprises can usually be avoided (as in dissertation defenses!). A “High Pass” is a pat on the back for the student and, in the event of a marginal pass on Comp 1, is a lifesaver (as discussed earlier). A “Pass” is just that, and

congratulations. Students who successfully complete Comp 1 and Comp 2 are recommended to the Graduate School for advancement to Ph.D. candidacy.

Timetable for Comp 1 and Comp 2: The first, and hopefully final, attempt for Comp 1 is normally in January of the student's second year. Exceptions can be made for students who enter in a spring semester or those accepted under special provisions. These exceptions should be made clear early on.

For Comp 2, the student must have selected a project and a committee by March 31st of the second year after entering the program. This is a reasonable deadline, because the Comp 2 defense must take place before October 15th of the student's third year. The faculty regards this deadline as "hard" and only extenuating circumstances beyond the student's control will result in a successful petition to extend the deadline. This is particularly true for a Comp 2 student who has already failed Comp 1 once. The completion of Comp 2 prior to Comp 1 allows the faculty to have more information (hopefully positive) when making the final decision after a second attempt at Comp 1. If the first defense of Comp 2 is a failure, then a second try, if permitted, must take place by the end of the spring semester following that failure. Figure 1 on page 8 shows the sequence of deadlines, etc., in a compact form. The student is responsible for meeting these deadlines.

3.3.2 The Ph.D. Dissertation

Our graduate students typically publish several referred papers in academic journals during their 4-6 years at CU. The culmination of the Ph.D. student's graduate life is her/his defense of the dissertation. The dissertation itself is supervised by the dissertation advisor, who must be a regularly appointed member of the Graduate School faculty. The thrust and content of that work is, initially, between the student and the advisor. Good advice for the student is to choose an advisor who is not only respected in the field (which usually means she/he has grant money support-no trivial matter in itself) but also one who is sympathetic to the way the student works. Choose a tough advisor who can be firm when the need arises because, in most respects, the dissertation is the key to a successful career later on. All this implies close collaboration of an unusual sort.

The form of the dissertation is a matter of choice between the student and advisor, but the advisor usually has the last word. Some advisors permit the student to string together a series of papers published, or soon to be published, in journals or conference proceedings, with our introductory chapter that defines the overall theme, to make the dissertation hang together. Other advisors insist on a more coherent dissertation, which may, for example, contain detailed information that would not normally

appear in the published literature. On the other hand, the student's dissertation committee (see below) may also have its collective or individual view on the matter, and you don't want to antagonize them.

The *official* form of the dissertation, as presented to the University, is yet another matter. There are a host of rules regarding margins, spacing, figures, and so on, which must be followed. Check with the Graduate School to obtain these rules as laid out in the publication *The University of Colorado Graduate School Thesis and Dissertation Specifications* (also available online at:

http://www.colorado.edu/graduateschool/academics/Phd_Graduation_Packet_Thesis.htm.) Note also that pre-packaged formats are usually available in TEX, LATEX, or some word processing software. This can ease the pain somewhat.

The dissertation defense committee must be composed of at least five members, all of whom are regular or specially appointed faculty of the Graduate School. The committee chair **must** be a regularly appointed faculty member of the CU Boulder campus, who holds the rank of Professor, Associate Professor, Assistant Professor, or any Research Professor title. At least three of the members must be Boulder campus resident faculty and one **must** be from outside the student's department. It is normally the case that the student is responsible for rounding up the members of his/her committee, and this can sometimes be no easy task. Students should start working on this early, not only for timing, but because some committee members can make significant contributions to the dissertation itself. An early start is also desired, since serious questions may arise that no student wants to have put to him/her during the defense; surprises are not welcome at that late point.

The published Graduate School rules regarding when and how the dissertation is to be presented to the committee are quite strict (see the rules for yourself). However, the tradition in this department has been to allow some slack for the benefit of the student because the last stages of dissertation preparation are often painfully rushed. Our rule is that a basically final draft of the dissertation must be in the committee's hands two weeks before the defense. We strongly advise that you not abuse this relaxation of the rules!

The first part of the dissertation defense is open to the public and is usually at least an hour long. The student should be prepared to answer questions at any time, although the format of the defense may be such that most (or all) questions are deferred until after the presentation. An open questioning period then takes place, after which the committee chair closes the meeting to the public and the committee takes over.

In the unlikely event that the committee rules the student has failed the defense, the student is allowed one more chance, and only one, to be reexamined after a period of time determined by the committee.

3.4 Progress Reviews

All graduate students must establish a Progress Review Committee whose role is to promote the student's continued progress in the appropriate degree program by allowing direct communication between faculty and student. The committee is to be composed of four faculty members, at least one of whom, and preferably more, are rostered members of the department. The APS Chair, or her/his designee, must approve all committee members. In most cases, the committee will form the nucleus of and evolve towards a thesis committee for those students in the Ph.D. or Plan I Master's track. The chair of the committee will be the student's major advisor (academic or thesis) and at least three members of the committee must be present at meetings of the committee with the student. Meetings may be convened by either the student or the advisor, and are to be scheduled at least once a year (preferably twice a year), according to the guidelines given below. The committee chair is responsible for a complete and concise report of each meeting. The report will evaluate the student's progress, which may include academic work, and pre-thesis or thesis work. This report will be placed in the student's file, with a copy to the student. To indicate the faculty's commitment, reports may be reviewed during one of their regular meetings.

Students in the Master's degree program who do not attempt Comps must hold their first meeting by March 31 of their fourth semester. We strongly advise that you do so well before this date because of the shorter time span of this program (versus the Ph.D.). For those who attempt Comps, the first meeting is by March 31 of that semester, or directly after passing Comp 2, whichever comes first.

4 Who Do I Go To for Help?!

Questions of all sorts inevitably arise when pursuing a graduate degree: it's a complicated pursuit. The following is a simple guide to Departmental and University resources:

- The Departmental Graduate Program Assistant usually has at her/his fingertips administrative information you will need. First, however, consult either this Survival Guide, material on the APS website, or the relevant University catalogs and bulletins.
- The Associate Chair of the Department is to be consulted for more serious matters such as petitions (or complaints), present and future

curriculum, and other matters pertaining to Comps. In her/his absence the Chair may be contacted.

- For perhaps more mundane matters your advisor (academic or dissertation) is the one to see. As we warned before, however, a deep knowledge of rules and regulations is usually not the faculty's strong suit.
- A good person to see is one of the two graduate student representatives to APS faculty meetings. In some cases he/she may be a good buffer if you would prefer to remain anonymous for some reason.
- The APS Department also has a host of committees, many of which pertain to graduate life. For questions about Comp 1 exams, for example, the Examinations Committee is the group to see. More general matters may be brought to the Graduate Student Concerns Committee. An e-mail to the chair of that committee is a graceful way to introduce yourself, or see one of your student representatives on that committee. Any staff member in the APS Office can give you the names of committee members.
- Individual problems of an academic or social nature: If you feel comfortable talking with your advisor about these issues, she/he is your best first step. If your advisor does not feel that she/he can provide appropriate help, try the Chair or Associate Chair. For other matters of a more delicate or personal nature, the members of the APS Diversity Committee serve as departmental ombudspersons (neutral referees). This committee includes faculty, staff and students. The names of these members are publicized each year.
- If some serious matter cannot be resolved by any of the above means, then it may be necessary to contact the office of the Associate Dean of the Graduate School.

5 A Question of Money

Graduate school is not an inexpensive undertaking. Some guidelines to follow are:

- Be sure to obtain Colorado (“in-state”) residency as soon as possible if you are a US citizen. This entails registering to vote, obtaining a driver’s license, and keeping records of the rental or purchase of a house or apartment. More information on this topic may be obtained from either the Graduate Program Assistant or the Tuition Classification Office: 303-492-6868 or <http://registrar.colorado.edu/Support/Residency/Residency.html> .
- Vigorously seek grant money support from a thesis advisor as early as possible.
- Teaching Assistant funds are often available and, in any case, the faculty strongly recommends teaching experience in the classroom at some point in your graduate career.
- The Graduate School keeps a listing of various grants available to graduate students; e.g. fellowships, travel grants, NASA grants, etc. The Graduate Program Assistant usually has this information at hand as well.