

Resources for Graduate Students in the CU Boulder Department of Astrophysical and Planetary Sciences (APS): A Guide for Success

APS GCCC, Academic Year 2022-2023

1. Introduction

The intent of this document is to provide 'one stop shopping' for many of the topics of practical importance as students navigate the APS graduate program. The current document was built from the ground up by the AY21-22 Graduate Curriculum and Concerns Committee (GCCC), replacing the previous "Survival Guide" which was last updated in 2010. This new survival guide attempts to find a balance between providing verbose explanations and covering a range of topics that are important to the graduate community. A few considerations when reading this guide:

1. It was written during the Fall 2021 and Spring 2022 semesters (with minor updates made in Fall 2022). While the general topics will remain relevant, details may evolve on timescales of an academic year.
2. This document was reviewed to be accurate and up-to-date with respect to academic topics such as credit hours, Comps guidelines, CU grievance processes, etc. Often faculty and students have only part of the story on these topics, but the goal for this guide was to clear up often conflicting information from various sources. In an attempt to keep this document as up to date as possible, links to full policy pages are referenced throughout.
3. The APS grad student community maintains a wiki of additional day-to-day resources for students; we recommend that interested parties consult with the student representatives on the GCCC.

This guide first discusses academic topics going from core coursework through Ph.D. defense ([Section 2](#)). [Section 3](#) describes the numerous avenues for APS graduate students to find help with a range of issues and file formal grievances. [Section 4](#) includes links to information about graduate student compensation and [Section 5](#) contains a summary of CU and APS values and climate expectations. Career building and professional skills are discussed in [Section 6](#).

2. Graduate School & Departmental Regulations

2.1. [APS Core and Elective Courses, Seminars](#)

Out of the 37 required credit hours of graduate-level (ASTR-5000 level) coursework, 15 of those credits are associated with the five APS core courses. The usual (but not mandatory) sequence of taking these courses is as follows:

- **Year 1, Fall:** Atomic and Molecular Physics (ASTR-5110) and Mathematical Methods (ASTR-5540).
- **Year 1, Spring:** Introduction to Fluid Dynamics (ASTR-5400) and Observations, Data Analysis, and Statistics (ASTR-5550).
- **Year 2, Fall:** Radiative and Dynamical Processes (ASTR-5120).

The five core courses must be taken by all graduate students, unless a student's preparation prior to starting the program (e.g., a Master's degree) was adequate to receive a waiver on some/all of the core courses (recommendations for course waivers are generated by the Admissions Committee and are approved by the Department Chair; [see this page](#) for more details).

In addition to having to take the core courses, students are also required to take 6 electives and 4 one-credit seminars (i.e., ASTR-6000 and/or ASTR-5835). The usual combination is the core (15 credits) + 6 electives (18 credits) + 4 seminars (4 credits), but other combinations of 1, 2, and 3 credit electives are allowed. If a student reaches a total of 37 credits having taken only 3 one-credit seminars, approval from the Grad Associate Chair is required.

Most of the APS three-credit elective courses are offered on a two-year cycle. The most up-to-date schedule is shown here:

Two-year Graduate Teaching Cycle. GCCC, AY22-23				
	Fall 2021	Spring 2022	Fall 2022	Spring 2023
APS Core	5110 - Atomic & Molecular Processes (1st yr) 5120 - Radiative & Dynamical Processes (2nd yr) 5540 - Mathematical Methods (1st yr)	5400 - Fluid Dynamics (1st yr) 5550 - Observations & Statistics (1st yr)	5110 - Atomic & Molecular Processes (1st yr) 5120 - Radiative & Dynamical Processes (2nd yr) 5540 - Mathematical Methods (1st yr)	5400 - Fluid Dynamics (1st yr) 5550 - Observations & Statistics (1st yr)
Astro Electives	5780 - Space Mission Development (w/AES) 5770 - Cosmology	5700 - Stellar Astrophysics	5720 - Galaxies	5710 - High-energy Astrophysics 5760 - Astronomical Instrumentation
Planetary Electives	5800 - Planetary Surfaces & Interiors	5810 - Planetary Atmospheres	5820 - Orig/Evol of Planetary Systems	5830 - Topics in Planetary Science
Solar/Space Phys.	5140 - Space Plasmas	5150 - Plasma Physics (often led by Physics) TBD - Topics in Solar Physics (COLLAGE)	5410 - Fluids II	5300 - Planetary Magnetospheres TBD - Topics in Solar Physics (COLLAGE)

There is also a recommended sequence of “planetary core” courses for students interested in planetary science research, and there is a list of other non-APS electives that have been pre-approved for APS grad students. Additional details are available on the APS Department's [Course Information](#) page, as well as on the typical [Yearly Timeline](#).

Several other notes about courses include:

- Please be aware of CU's [add/drop calendar](#). The last days to add or drop a course "without penalty" are typically only 2 or 3 weeks into the semester. If you drop a course after those **early** deadlines (even if it is prior to the much-later "last day to drop a class") you may be subject to thousands of dollars of tuition payments that cannot be paid for by TA or RA positions.
- Please do not officially "Audit" courses at CU. Similar tuition penalties as above may apply. If you wish to sit in on a class and not receive a grade, please feel free to discuss a purely informal arrangement with the instructor.

2.2. Academic Standards and the APS Core

The APS department follows the graduate school requirements for accruing credit hours and [conducting the Comprehensive Examination](#). This section outlines the grade requirements for receiving credit for graduate coursework and fulfilling the preliminary exams requirements through completion of the core courses. Credit hour and [Comps requirements](#) are expanded on in subsequent subsections.

Students are required to earn a B– or higher in order to receive credit for a graduate course. The core course requirements are satisfied by successfully completing the five core courses with grades of B– or higher, meeting the [Preliminary Exam requirements](#) (following Graduate School rules) of the department. A class grade lower than B– triggers a mandatory retake of the core course. In this case, the department will initiate the following actions to support the student's successful completion of said course:

1. The student will be assigned a faculty mentor (not the core course instructor) who has previously taught the core material and who has the time to work closely with the student to help in mastering the core material.
2. The student may elect to either retake the course or to request the creation of an independent study replacement for the course. The independent study option is intended to address significant individual student difficulties with the core course lecture format. Students are discouraged from using the independent study option out of concerns regarding an individual core course instructor, core course instruction level or quality, or grading policy. These latter issues should instead be addressed and resolved through the department's grievance policy (outlined below). To elect the independent study option the student must:
 - a) find a faculty member in the department who has previously taught the core material to serve as the independent study instructor. The independent study instructor can be the same person as either the assigned mentor or a faculty core course instructor.
 - b) define and design an independent course of study in close consultation with the faculty mentor, the previous core course instructor, and the anticipated faculty independent study instructor.

- c) obtain the approval of the Examinations Committee of the planned independent study course syllabus and final exam (requirements following those outlined in administration items a and b above).

2.3. Master's Degree Requirements and the Comprehensive Examination

Before attempting the comprehensive exam, all students must pass the five Core Courses with a grade of B– or better, unless the student has received a course waiver (See above). See [this page](#) for more info.

The Graduate School recognizes both “Plan I - thesis option” and “Plan II - course work option” to complete the requirement for a Master's degree. However, the APS Department only recognizes Plan II because the Comprehensive Examination presentation is also an oral exam (see [Section 2.3.1](#); note that a Comprehensive Exam paper is not a “Master's Thesis”). The Comprehensive Exam serves as both the exam to advance to doctoral candidacy as well as the final exam to earn a Master's degree (*Note: there are two graduate school forms that are signed following a comprehensive exam, one for the Master's exam and one for the advancement to candidacy*). **A student must pass Comps at the Master's level in order to receive a Master's degree.** It is possible to pass Comps at the Master's level but not advance to candidacy. **It is not possible** to receive a Master's by completing the required coursework but not passing the comprehensive exam at the Master's level. For more details about the timeline of applying for the Master's degree, see the APS web page that describes the [relevant steps and deadlines](#).

In addition to passing Comps at the ‘advancement to candidacy’ level, the second requirement for successful advancement to candidacy is the credit hour requirement. **30 non-dissertation credits** are required to receive the Master's degree and advance to candidacy. Students are encouraged to complete this credit hour requirement by the end of the semester that they take Comps (typically the end of the student's fifth semester in the APS program), however, the formal deadline to complete 30 non-dissertation credits is the end of a student's fourth year in the program. This milestone also makes you eligible to receive the pay raise (and fee reduction) that come with the change of status (i.e., the “post-comps bump”). If a student has completed all of the required credit hours but does not pass the ‘advancement to candidacy’ component of the Comps exam, they have a chance to retake Comps prior to the end of their fourth year in the APS program.

2.3.1. *What is the Comprehensive Examination, who should be on my committee, and when should all of this happen?* We refer the reader to the most up-to-date version of the [Comprehensive Exam Guidelines](#) on the APS web site. Note that Comps Exams must be held during academic semesters (i.e., not over the summer or winter break).

2.4. Marching Toward the Ph.D.

2.4.1. *Credit Hour Requirements:* **Pre-comps, students need to maintain at least 5 course credits** (or at least 1 doctoral dissertation hour) in each of the Fall and Spring semesters in order to be considered full-time students. 37 credit hours of coursework (including at least 4 graduate seminars) in courses numbered 5000 or above (from the [list of APS electives](#) or as approved by the Associate Chair for Graduate Studies) are required for completion of a Ph.D. This is typically distributed as five core courses, six electives, and four seminars over the course of a student's tenure in APS. Students may take extra courses as desired, subject to funding (more classes mean more tuition that must be covered by your advisor or grant). **Post-comps, students must maintain at least 5 dissertation hours** (but not more than 10) per semester, and are welcome to take other classes as well. It should be noted that there must be 5 dissertation hours post-comps; different combinations totaling to 5 hours (e.g., 2 dissertation hours and a 3 credit course) *does not* fulfill the requirement. Dissertation hours are entered as ASTR-8990. Please be sure to select the correct section for your dissertation advisor. If your advisor isn't listed, please contact the Graduate Program Coordinator (GPC).

2.4.2. *Annual Post-Comps Progress Reviews:* Following the Comprehensive Examination, APS students must complete [mandatory post-comps annual progress reviews](#), which include opportunities for both students and advisors to bring issues up with an impartial committee to identify and mitigate potential challenges before they become significant enough to delay a student's graduation from the APS program.

2.4.3. *The Ph.D. Dissertation and Dissertation Committee.* We refer the reader to the Graduate School's [Thesis Specifications, including the official LaTeX template](#). As described in the CU graduate school documentation, "The defense committee is comprised of a minimum of 5 members who must have current graduate faculty appointments. Three of the members must be Boulder campus resident faculty. The chair and outside member should both have a regular or tenured appointment. The other 3 members can have either a regular or special appointment. To pass the defense the student must have the affirmative vote of at least four of the committee members." In practice, a student, in consultation with their research and/or academic advisor, selects a committee that meets the above criteria. That committee is then subject to approval by the APS Chair. Additional guidelines on the committee makeup can be found [here](#).

2.4.4. *Deadlines:* University rules require students to complete their Ph.D. by the graduation deadline in the Fall semester of a student's 7th year. After this time, students require approval from their advisor, the APS Associate Chair for Graduate Studies (GAC), and the graduate school to continue into subsequent years.

2.5. Student Mentoring and Progress Reviews

Starting in AY18-19, APS has been revising examination and mentoring policies, with the goal of incorporating improved faculty, peer, and professional mentoring practices to help graduate students navigate the program and defend their dissertations in a 6-year timeframe with minimal stress and disruption to their primary research activities.

First- and second-year mentoring, including assignment of first year mentors and direct follow-up with mentors and students, is led by the Associate Chair for Graduate Studies. The first-year student mentoring program is an important way to integrate incoming students into the department, give them a secure place to ask questions and/or raise concerns, and provides an opportunity for the faculty to make sure the students are keeping their heads above water. First and second years are assigned a faculty advisor that is not their direct research advisor. Students are asked to contact their mentor to arrange a meeting prior to the end of the first week of classes, and then mentors are directed to set up these appointments if the student did not make contact by this time. During the meetings, faculty are encouraged to provide an open forum for the student to ask questions about coursework, research, or any aspect of APS-life that was not sufficiently addressed during the orientation presentations. Faculty may also provide their perspective on what areas of coursework and research that their own students have found beneficial. Students are encouraged to bring questions and concerns they have about the APS graduate program to their first-year mentor.

Outside of the mandatory progress reviews, faculty advisors, and research advisors, there are a variety of peer-mentoring programs. The Graduate School has a [mentoring program](#) where students can participate as mentees and then later as mentors. The APS Social Committee has put together a “Binary Stars” mentoring program pairing junior graduate students with senior graduate students within APS. There is also “AstroPals” that creates mentoring cohorts of 4 to 5 students and postdocs *“focused on fostering an inclusive culture and supportive community, reducing feelings of isolation felt most acutely by students transitioning from undergraduate to graduate school and students with marginalized identities, and elevating voices and concerns in order to affect positive change.”* Similarly, the Women and Gender Minorities Mentoring Circle creates a space for graduate students, post-docs, and faculty to engage in less formal peer-to-peer mentoring in a communal atmosphere through social events, shared experiences, and discussion.

2.6. How to find an advisor

APS does not require an incoming student to have a research advisor prior to being admitted. It is up to the student to secure a research project; this typically happens prior to the summer after their first year, if not sooner. You can (and are encouraged to!) begin talking with and emailing potential advisors at any point; it can be before you apply, after you are admitted, or once you get here for your first semester.

Where to look:

- Peruse the [APS directory](#).
 - Faculty, staff, and graduate students all have pages listing their research interests. Striking up a conversation with someone who is working in a similar area as you are interested in is a great first step.
- Check out the local research institutes.
 - We are lucky to have so many other science research institutes local to us in Boulder. Many students in APS conduct their research outside of the department. Institutes and centers within CU include [CASA](#), [JILA](#) and [LASP](#) which house many more researchers than just department faculty. Nearby are [HAO](#), NCAR, [NIST \(NIST at CU\)](#), [NSO](#), and [SwRI](#) which all take on CU students periodically. Reach out directly to those with similar interests to you.
- Attend faculty research talks
 - There is often a Fall seminar series where you can learn about what is happening in the department. These are normally separate from the Colloquium and sometimes feature speakers from other institutes. Many of the speakers are specifically looking to recruit graduate students.
- Most importantly - ASK!
 - Most, if not all, APS faculty have an open door policy; if the door is open, knock and chat with them. Send an inquiry email or introduce yourself in the hall. Even if a faculty member does not currently have an open project they may know others in the Boulder area who do.

2.6.1. *How to change advisors:* Switching advisors in the middle of grad school is not a thesis killer or even that uncommon. If you are interested in a new project for any reason there are ways to switch directions without delaying graduation. Students should always let the Graduate Program Coordinator know when switching advisors.

The most common times to switch projects are:

1. After your first summer
 - Started with lab work and now want to try theory? That's ok; make a change!
2. Post-Comps
 - The Comprehensive Exam is meant to be a self-contained project. Changing advisors following Comps is the most popular time to make a switch.
 - It is also possible to switch advisors just for the Comps Exam project and return to a previous project afterwards.
3. Hale Rotations
 - If you are on a CU/NSO Hale Fellowship, you have the option of choosing to do up to 3 short projects with different members of the local solar community. Each project is designed to fit into a single semester so you can dabble in

different areas of solar and space physics research. Email [Mark Rast](#) for the current list of available projects.

4. Collaborate
 - Having co-advisors who advise on different chapters of your thesis is always an option. This can be, for example, adding a physics education component or incorporating different techniques or data.
5. Later on
 - Later in your grad career, switching is still possible if not a bit more difficult. Talk with your [post-comps review committee](#) and the APS Associate Grad Chair to come up with a solution for your particular situation.

3. Where Can I Go For Help?

1. Campus Resources ([OIEC](#), [Disability Services](#), [UCW](#), [ISSS](#), [CAPS](#), [Ombuds Office](#), etc.)
2. Department Resources
 - a. If you have general questions about grad student life/faculty expectations, need help finding research, or are having an issue with your advisor, your first/second year mentor is a great place to start. You are assigned a first-year mentor upon entering APS and they are intentionally someone you will not be doing research with based on your initial research interests.
 - b. If you have general questions about the department or Graduate School, registration questions, scheduling questions, questions about pay (TAs and Hale Fellows), or just generally don't know where to go, see the APS Graduate Program Coordinator. If they can't help, they likely know who can!
 - c. If you have questions about pay as an RA, contact the appropriate person [in your research institute](#) as listed on the compensation guide.
 - d. If you have questions about which classes to take or when to take them, anything related to your research project, fellowship applications, research/publication expectations in your field, preparing for Comps, or anything else, see your first-year mentor, advisor, or your post-comps review committee. They can point you in the right direction if they don't know. Your advisor and committee are there to support you through graduate school.
3. CU's Office of [International Student and Scholar Services](#) will be your most reliable resource for anything in which the international student experience differs from that of a domestic student.
 - a. The health care system in the U.S. can be rather complex and difficult to understand. There's a video primer and a link to more specific information at the bottom of [this page](#).

4. [Grievance Procedures](#) The Graduate School has provided this [flow chart](#) as a summary of the grievance process, and the full policy can be found in [Section III.D of the Graduate Student Grievance Process and Procedures document](#). A convenient summary of the grievance process for the CU graduate school is provided below:
 1. After all other possible informal avenues have been exhausted, the student submits a [GSG grievance form](#) to the department's Associate Chair for Graduate Studies. If the Associate Chair is named in the grievance, the form should instead be submitted to the Department Chair. The Graduate School should be copied on this email.
 2. The Associate Chair or/Chair must alert the College of Arts and Sciences' Associate Dean and the Dean of the Graduate School that a formal grievance has been received.
 3. The Associate Chair must next:
 - a. Deem the GSG form either complete or incomplete. If incomplete it must be *promptly* returned to the student with instructions for completion.
 - b. Determine if the grievance falls under the scope of the Graduate School's Grievance Process and Procedures policy or if it falls under another University policy and must be forwarded elsewhere (e.g., OIEC, SCRM, OSCCR).
 4. If the grievance falls under the scope of the Process and Procedures policy, the Associate Chair must form an Advisory Committee of 2 - 4 APS faculty with regular appointments in the graduate program. The Associate Chair shall serve as the non-deciding Advisory Committee Chair. The Associate Chair must then promptly distribute any materials associated with the submitted GSG form to the Advisory Committee.
 5. The Advisory Committee is to hold a hearing with the student and those named in the grievance. Full details for how this hearing must be run are in the Graduate School's Process and Procedures policy document under Section III.D.3.
 6. The Advisory Committee is then to discuss in private and respond to the grievance with recommendations. These can be direct remedies the grievant has sought and/or overall program improvement. The Advisory Committee cannot decide on any student or personnel sanctions or requirements; recommendations of such a nature should be forwarded to the appropriate appointing authority.
 7. The Associate Chair is to compile a report with specific recommendations the Advisory Committee has identified. *Within 10 business days*, the Associate Chair is to distribute the recommendations to the grievant and those named in the grievance.
 8. The time from official submission of the grievance to issuance of the report should be *no more than 60 calendar days*. Allowances that may

extend this timeline are outlined in the Process and Procedures document.

9. If unsatisfied with the grievance result, the student can appeal directly to the Graduate School. A similar process to the one described above is repeated with faculty from across the University involved on the Advisory Committee. The Graduate School's involvement is meant only to be an appeals process and can occur only after internal departmental action has taken place.

4. Graduate Student Funding

1. TAs, RAs, and Fellowships: We refer the reader to the [Graduate Compensation Overview](#) web page, which we endeavor to keep up-to-date. Additional resources regarding student housing, peer support, etc., are available to current students as part of the APS Graduate Student Wiki (password protected).
2. Residency: In order to receive tuition remission as an TA or RA, you must begin the process of establishing Colorado residency as soon as possible once you arrive. For more details, see the [APS web page about residency](#), and/or additional information from the [Registrar's Office](#).

5. Graduate Values and Behavior

1. From the APS web page: The APS department recognizes our scientific and educational missions are strengthened by contributions from diverse perspectives. We aim to promote a fair, inclusive, and supportive environment for all. As a member organization of the American Astronomical Society, our department adheres to their [Code of Ethics](#) and encourages all our faculty, students, and staff to do the same. If you feel we have failed in this goal, or if there are any issues or areas of concern that the APS Executive Committee should be aware of, please use the [Anonymous Issue Form](#).
2. OIEC provides policies on Discrimination & Harassment, Sexual Misconduct, Intimate Partner Violence and Stalking, and Conflict of Interest in Cases of Amorous Relationships here: <https://www.colorado.edu/oiec/policies>
3. The department continues to stand by the following statement from June 2020:

Dear APS Community,

The recent killings of Ahmaud Arbery, Breonna Taylor and George Floyd and the ensuing events of this past week are a stark reminder of the long history of racial inequity in our country, and the injustice, oppression, and fear that black people in our country continue to face on a daily basis. They are a reminder that

we've seen no meaningful change in our country since the killings of Freddie Gray, Sandra Bland, Eric Gardner, Michael Brown, Tamir Rice, and countless others. They are a reminder that we have yet to break the chains of institutionalized racism woven into the birth of our country, when black people were property, and our economy and most venerated institutions were built using slave labor. Continued conversations about race are not enough. We must take action to create meaningful change.

First, to be crystal clear: we will not tolerate racism in our APS community. We are building a safe community in which we can productively engage in learning. Not only in the classroom and not only on scientific topics, but on issues like racism, equity, diversity, and inclusion which affect our learning community and promote, or inhibit, our best work as scientists and leading meaningful and productive lives as humans. We have made good progress as a community in understanding each other, revealing our biases, and embracing change for the better. But, we have much work yet to do.

As educators and students in an educational institution, we have an obligation to promote thinking critically about complex problems, cultivating compassion for others, embracing and grappling with uncomfortable truths, and creating solutions for our collective path forward. Our mission together now is more vital and critical than ever, given the uncertainties of living in a pandemic and feeling the fabric of our society coming apart in the face of failure to address continuing inequities.

We don't presume to have any easy answers here. But we will do our utmost to work with you to make APS and our society a better place in which to work and live. We know that many in our APS community are taking action individually. Today in our faculty meeting, we'll discuss actions we can take as a department, and we ask you to contribute your ideas. We can only succeed in our efforts if we work together and harness the collective wisdom and experience of our community.

Finally, we know many of you are feeling vulnerable during these uncertain times. Please reach out to us if you feel unsafe or need help. We will do what we can to direct you to needed resources, or just talk. Our doors are open.

*Nils, Dave, Kevin, John B., Ann-Marie, Steph, Troy, and Jose
The APS Executive Committee and Staff*

4. Some other useful CU-level policies: are described at:
<https://www.colorado.edu/compliance/policies>
5. The [APS Department supports the CU Honor Code.](#)

6. Graduate Student Career Building and Skills Emphasized by APS

Historically, APS graduate students have chosen different career paths upon completing their degrees, ranging from postdoc and faculty positions to jobs in the biomedical and aerospace industries, secret agents (details omitted!), and software engineering. Below is a non-exhaustive list of resources aimed at helping graduate students in developing skills that are important for succeeding in graduate school, as well as resources for long-term career navigation. This list should be approached as a starting point for one's career considerations.

1. [AstroBetter: tips and tricks for professional astronomers](#)
2. [AstroBites section on career navigation](#)
3. [Steve Cranmer's list of tips and tricks](#)
4. [Astronomy paper seminar participation guide & reading walkthrough](#)
5. [CU Career Services](#)
6. The Graduate School's [Endurance PhD](#)
7. List of APS alumni and their current positions (See APS Graduate Student Wiki)