

ASTR/PHYS PROFESSIONAL DEVELOPMENT

*Join faculty and graduate students
from APS and Physics for a discussion on*

GRAD SCHOOL:

*Should I go?
Where should I go?
How do I apply?
How do I get in?*

starts at 4:45-6PM

Monday, October 9th 2023

Duane G130

plus FREE PIZZA!

Kevin Stenson, PHYS faculty
kevin.stenson@colorado.edu

Claire Savard, PHYS grad student
claire.savard @colorado.edu

Paul Hayne, APS faculty
nick.schneider@lasp.colorado.edu

Autumn Stephens, APS grad student
autumn.stephens@lasp.colorado.edu

Slides posted on APS and PHYS websites
Recording available [here](https://cu-classcapture.colorado.edu/Mediasite/Channel/ed48e1f92334c73bb0433354716ec555f/browse/null/most-recent/null/0/null)

<https://cu-classcapture.colorado.edu/Mediasite/Channel/ed48e1f92334c73bb0433354716ec555f/browse/null/most-recent/null/0/null>

Contact us with questions:
nick.schneider@lasp.colorado.edu
mike.dubson@colorado.edu

2023-2024 Events – ASTR/PHYS Professional Development

Fall '23 planned events:

- 9 Oct: Grad School
- 30 Oct: Getting involved in UG research (PHYS emphasis)
- 13 Nov: Careers in Heliophysics
- 5 Dec: Getting involved in UG research (ASTR emphasis)

Spring '24 events under consideration

- Careers in Education and Outreach
- Careers in Telescopes/Observatories
- Careers in Industry, Aerospace
- Careers in Startups
- Applying for Jobs
- Your requests here!

Grad School Discussion - Agenda

- [5 m] Welcome & Overview: Nick Schneider
- [10-15 m] Grad School in Physics: Kevin Stenson
- [5 m] Perspectives from a Physics grad student: Claire Savard
- [5 m] Q&A
- [10-15 m] Grad School in Astrophysics & Planetary Science: Paul Hayne
- [5 m] Perspectives from an Astro/Planetary grad student: Autumn Stephens
- [5 m] Closing comments: Nick Schneider & Mike Dubson
- [10 m] Q&A

6pm Adjourn

Who's here tonight...

- Physics Majors?
 - Engineering Physics
 - Astrophysical & Planetary Sciences?
 - Astrophysics track
 - General Astronomy track
 - Other?
-
- Graduating this year?
 - Next year?
 - Later?
 - Any grad students?
-
- Wants to do research as a career?
 - Join a research group?
 - Lead a research group?

Interested in these career paths??

- Observatory staff (e.g., Apache Point, HST, JWST)
- Mission outreach, communication (LASP, JPL)
- Planetarium & Museum staff (anywhere), animation (e.g., Fiske; Disney)
- Mission systems engineer (e.g., Ball, Lockheed Martin)
- Satellite operations, Earth remote sensing (e.g., LASP, SwRI, Digital Globe)
- Science data analyst, scientific visualization
- Mission proposal development (e.g., Ball, Lockheed Martin)
- Mission hardware development & test, operations

Interested in these career paths??

- Observatory staff (e.g., Apache Point, HST, JWST)
- Mission outreach, communication (LASP, JPL)
- Planetarium & Museum staff (anywhere), animation (e.g., Fiske; Disney)
- Mission systems engineer (e.g., Ball, Lockheed Martin)
- Satellite operations, Earth remote sensing (e.g., LASP, SwRI, Digital Globe)
- Science data analyst, scientific visualization
- Mission proposal development (e.g., Ball, Lockheed Martin)
- Mission hardware development & test, operations

➤ No PhD required!

Astrophysical & Planetary Sciences

COLLEGE OF ARTS AND SCIENCES

[Home](#) [Our Department](#) [Events](#) [Research](#) [Graduate Studies](#) **Undergraduate Studies** [People](#) [Funding](#)

[Home](#) > [Undergraduate Studies](#) > Professional Development

Professional Development

This website is designed to offer resources and advice that will help you succeed in your career after graduating CU Boulder. Navigate with the following main sections:

Previous Events/Resources

Recordings and presentations of past events. Check out this page if you want to see the presentation from an event you missed!

Undergraduate Opportunities

Opportunities to build your career while you are pursuing your undergraduate degree at CU, including research, teaching, and campus programs.

Applying to Grad School

Resources for choosing graduate programs, writing entrance essays, taking standardized tests, conducting interviews and visits, and finding funding through fellowships/scholarships.

Careers

Advice and resources for using your APS/Physics degree to find a career.

Background

APS/PHYS Professional Development (previously "Beyond Boulder") was started in Fall 2008 by [Makenzie Lystrup](#) with support from a National Science Foundation Astronomy & Astrophysics Postdoctoral Research Fellowship. She ran the program through Spring 2011. [Emily Levesque](#) led the program from 2011-2014, and [Mikki Osterloo](#) of CU/LASP from 2014-2016, and [Nick Schneider](#) of APS from 2016-2020. [Meredith MacGregor](#) has been the coordinator since Fall 2020.

About

APS/PHYS Professional Development is a resource for undergrads in fields related to physics and astronomy at CU Boulder. This website includes resources and information designed to help undergraduates in APS/Physics develop successful longterm careers.

[Home](#) > [Undergraduate Studies](#) > [Professional Development](#) > Applying to Grad School

Applying to Grad School

Should I apply to graduate school?

Earning a graduate degree can open up many opportunities that would not be available with just a bachelor's degree, especially if you would like to pursue a career in research. That being said, depending on your career goals, it may make the most financial sense not to attend graduate school. A Master's degree can be expensive, and while PhD's are funded, they entail years of work at a barebones salary, which presents a severe financial opportunity cost. PhD's in particular also require a 5-6 year time commitment that typically includes taking additional courses, working on one research project for years, and writing/defending a thesis about your research.

When making this decision, you should consider your career goals and financial goals. It can be helpful to look up some of your dream positions, and see what the education/experience requirements are. For example, if your dream job is to be a Senior Project Engineer at Boeing on the Laser and Electro-Optical Systems team, you will need 10+ years of engineering experience and 5+ years of leadership experience- but only a Bachelor's degree. In that listing, even the "preferred qualifications" section included laser-optics experience and security clearance- but no graduate degree.

When deciding whether to pursue graduate school, you should consider personal factors (like whether you enjoy research and your reasons for considering graduate school) in addition to financial and career goals. Dr. Ijeoma Kola has written two helpful blog posts: [6 Bad Reasons to Get a PhD](#) and [3 Good Reasons to Get a PhD](#) (note that her point about teaching does not apply to APS/Physics, but the rest of the advice applies). Reading through these blog posts and other first-hand accounts from people with graduate degrees may help you get a sense of whether you will enjoy graduate school.

Many students who want to ultimately earn a graduate degree choose to join the workforce for 1-3 years to gain experience and perspective before applying to grad school. Check out [GoGrad's blog post](#) for some pros/cons of this option.

Applying to Grad School

In this section of the website, we have resources and advice about various steps in the graduate school application process:

Finding Programs

How to choose what type of graduate program to apply to and how to pick specific graduate programs to apply to.

Entrance Exams

Information and study tips for the entrance examinations (Physics GRE and General GRE), and what tests you need to take for APS/Physics programs.

Essays

Advice and resources for writing Personal Statements and Statements of Purpose.

Curriculum Vitae

Resources and ideas for things to add to your Curriculum Vitae (CV).

Interviews and Visits

Questions to ask and ways to prepare for in person graduate school visits and interviews.

Funding

Fellowship/Scholarship sources and information about their deadlines, requirements, etc.

Advice for APS students

Mike Shull, former APS Professor & Graduate Admissions Chair, prepared some answers to the question of what types of

<https://www.colorado.edu/aps/undergraduate-studies/professional-development>

Nick's Closing Comments

- Think through whether your goals really require a PhD and if this is how you wish to spend the next 5+ years of your life.
 - Remember that applying after an interval of being in the “real world” is an option.
- Apply to many schools (10-12?) including a bunch that are less competitive
 - If you don't get into your top choices, would you rather not go to grad school?
 - The best “safety school” is a smaller program with 1-2 researchers you've contacted
- Identify your recommendation letters writers early and establish relationships
 - Show them through your actions that you're ready for grad school; seek their advice
 - Given them a concise list of schools with deadlines easy, a month in advance if possible
- Your personal statement should emphasize skills, projects, verbs, readiness
- If you're applying next year, do everything possible to get research experience
 - Come to our next event on Tuesday, 5 December to hear many internship offers

Things to know about physics graduate school

Kevin Stenson

I am the Associate Chair for Graduate Studies for CU Physics. This also makes me the chair of the committee responsible for admitting students to the graduate program. What follows are my personal opinions on the topic. You should not take what I'm saying as the ultimate truth. I encourage you to talk to other professors, post-docs, graduate students, etc. before making your own decisions on graduate school. If you have any questions, feel free to send me email: kevin.stenson@colorado.edu

What is graduate school in physics like?

- Generally take core courses (QM1+2, EM1+2, Classical Mechanics, Statistical Mechanics) plus some elective courses (mostly in physics).
- Core courses are much more difficult than undergraduate courses. 2–3 courses is the normal load, with 10+ hours of homework/week.
- You also need to balance course work with either TA or RA responsibilities (~20 hours/week for TA; RA could be more or less).
- By the end of your first year, should be doing research, along with classes.
- By the end of your second year, should be done with classes.
- A physics Ph.D. generally takes 6–6.5 years in total.
- The pay is pretty low: around \$40,000 per year. But tuition is covered, so if you live frugally and are not supporting anyone else, you shouldn't need to accumulate much debt (and any existing student loans are deferred while in grad school).
- **Grad school is tough!**

Is graduate school right for you?

- Are you truly passionate about physics?
- Are you happy to work long hours on physics?
- Are you willing to take another 2 years of very difficult classes?
- Are you OK getting paid very little for the next 6 or so years?
- Are you getting very good grades in your physics and math courses?
- Are you interested in becoming a professor, doing original research, and/or leading a research team?

If you answered yes to all of these questions, then physics graduate school may be for you.

What graduate school is best for you?

- The program size and quality are somewhat correlated, so large schools are generally high quality and have a diverse range of research areas.
- Smaller schools may admit a broader range of students but may not have as many research activities.
- To start your school evaluations, can look at U.S. News & World Report: www.usnews.com/best-graduate-schools/search?program=top-physics-schools or gradschoolshopper: <https://gradschoolshopper.com>
- While overall ranking is useful, the quality of your education and your future success depend much more on you and your research advisor. If you have a good idea of what physics you want to do, you should make sure the university is doing good, original research in that area.

How applications are evaluated at CU

- We basically ask two questions:
 - Does the student have the academic preparation and skills to pass the graduate coursework?
 - Does the student have the skills and temperament to pursue an independent research project through to completion of a Ph.D. dissertation?
- The academic preparation is generally evaluated by the applicant's GPA and physics grades in upper division classes.
- The research aptitude is evaluated by recommendation letters (mainly) and the applicant's personal statement.

Academic evaluation

- Having a high GPA is important. If there are extenuating circumstances that lowered your GPA, these should be addressed in the personal statement. You should have taken the full breadth of physics courses and math courses.
- Just a few years ago, the General and Physics GRE tests were required nearly everywhere. That is changing and I'm not sure of the best advice. Check the requirements of the programs you plan to apply to:
 - General test can be taken ~anytime by computer at testing center or at home. Shouldn't need to study; just do 1–2 practice tests so you know what to expect.
 - Subject test is computerized and can be taken during three two-week periods (two in fall, one in spring) at testing centers or at home.
 - You should study for this test, at least by taking practice tests so you know what to expect. It is very easy to run out of time.
 - Should generally take this late so that you have had as many physics courses as possible. However, you may want to take it early in the fall so that if there is a problem, you can retake it later in the fall and still get it submitted in time.

Research aptitude evaluation

- CU requires a personal statement. This is your chance to talk about the research you have done and what fields of physics you are interested in.
 - Your past research description should be factually correct, describe your contributions, and show that you took initiative and were involved intellectually.
 - Your plans for future physics should be well thought out and if there are professors you are interested in working for, you should mention them and what you want to do.
- CU requires 3 recommendation letters. These should be from physics professors who know you well. You can submit more than 3 but you should only do so if they will be good additional letters.
 - The best letters are from professors (preferably physics) who supervised your research (or know you well from discussions, lab courses, etc.).
 - The less useful letters are from professors who only taught courses you were in. Generally, there is not much they can say that we don't know from the transcript. If you had lots of deep physics discussions with them during office hours, that can be helpful.
 - The least useful letters are from coaches or supervisors at non-physics jobs as they don't really know what is required for a physics Ph.D.

Random tips on applying

- Don't be afraid to ask for advice (from professors, post-docs, grad students, etc. about where and how to apply). Have someone (ideally a professor) read your research statement.
- Apply before the deadline.
- Provide your letter writers with information about you to ensure they don't forget anything. You can send them information about research you have done, awards you have received, etc.
- Apply to a variety of universities so that you have choices.
- If you know what area(s) of physics interest you, include this information. If you are unsure, make it clear that you are exploring and not that you are aimlessly floating.
- Plan to visit at least 2 universities where you get admitted in the spring. They will usually have particular days set aside for visits and it is best to attend at those times (but they will welcome you at any time). You may want to avoid planning a big spring break trip to Cancun.
- During visits, find out if the current graduate students are happy and if there is a place for you doing the research you like with an advisor you like.

Some statistics on CU admissions

- Last year we received 1006 applications
- We admitted 206 students, with 53 accepting our offer.
- Of the students that were **admitted** last year, the average GPA was 3.86 with a standard deviation of 0.16
- Overall about 10% of students submitted GRE General and 10% submitted GRE Physics scores (same percentage for admitted students). But about 20% of admitted students in theory submitted GRE Physics scores (while only 10% all students in theory submitted GRE Physics scores).
- The AIP provides lots of useful information on physics graduate programs here: <https://www.gradschoolshopper.com/>

Grad School in the Astrophysical & Planetary Sciences

ASTR/PHYS Professional Development – Fall 2023

Paul Hayne (APS faculty)

Topics:

- What should I expect in astro/planetary grad school?
- How can I get into grad school?



What can I expect in astro/planetary grad school?

- APS offers PhD admission only (no “terminal” masters)
- Coursework: first 3 semesters mostly occupied with coursework and “learning the ropes”
- Finding a research mentor: during or before first year; requires initiative! (Nobody goes without a research mentor/project)
- Comprehensive exam:
 - Fall of third year
 - Research presentation and paper on short project relevant to subfield
 - Usually, but not necessarily related to eventual thesis
- Thesis research:
 - 2-3 years “post-comps”
 - Become the world expert in chosen subfield and topic of research
 - Learn to become an independent scientist and publish



How do grad programs in APS research areas differ?

- Astrophysics programs are most similar to physics programs, expecting similar preparation. Some programs are within PHYS depts.
 - <https://gradschoolshopper.com> from API
 - <https://aas.org/learn/college-departments-offering-astronomy-related-degrees>
 - Planetary programs are all different, occasionally “stand-alone” but often joint with astrophysics, earth science or atmospheric science. Sometimes not a “program”
 - <https://dps.aas.org/education/graduate-schools> for planetary programs
 - open positions at https://docs.google.com/spreadsheets/d/12yRS2c9-eW4DGLcb3cPgZU759gII_QZjnDk-ptlh3k4/
 - Solar & space physics programs are rare but worth checking out
 - <https://docs.google.com/spreadsheets/d/19cTA9vtAokPT9gIQdnyT3PsVdCdjeT-Xeuj696TAthA>
- “Terminal Masters” degrees in these fields are very rare and very expensive

How can I get into grad school?

- Application process starts in the late summer/early fall
 - Need to identify letter writers (faculty/research mentors) ASAP in fall
 - Start drafting the "personal statement" during the summer/early fall, give time to faculty mentors to read it and provide feedback
- Typical application deadline is around December 1 each year
- Acceptance rates range from ~1% to 25% depending on program and subfield
- Admissions process is done very differently depending on the program/departement

How can I get into grad school?

- Qualities sought in applicants/admits are those that signify likelihood of success in the PhD program:
 - Fundamental knowledge (and success in) physics, math, and related coursework
 - Ability to perform (independent) research
 - Creativity
 - Perseverance
 - Professionalism

How can I get into grad school?

- Fundamental knowledge (and success in) physics, math, and related coursework
 - Generally A's and B's in these subjects (a 'C' is not a deal-breaker, though)
 - Upward trend looks good
 - Explain any particularly poor performance in the personal statement as appropriate

How can I get into grad school?

- Ability to perform (independent) research
 - Summer REU or similar
 - Part-time research during academic year w/ faculty mentor
 - Honors thesis
 - Class project!
 - Intensive technically oriented hobbies

How can I get into grad school?

- Creativity & Perseverance
 - Personal statement should tell a story about these as appropriate
- Professionalism
 - Letters of recommendation should vouch for you
 - Personal statement should show clear commitment and understanding of what a PhD means for short- and long-term career plans/aspirations



What if I decide grad school isn't for me?

(And that's Ok!)