

## Unsolicited advice for graduate students

This document<sup>1</sup> contains some advice about how to make the most of your time in graduate school. It is mainly intended for grad students interested in working in my group, but may also be useful to others, and some aspects may also be relevant to postdocs or undergrads. There is more than one way to be successful; the ideas here are based on my own (limited) experiences. I want you to succeed and am happy to discuss in person or offer more personalized feedback.

**Overarching principle:** It is important to remember that no one will care about your career and future as much as you do. I will work hard to create opportunities, but you need to be your own strongest advocate. The goal of a PhD is that by the time you finish, you will be an independent scientist with a productive research program that you know more about than I do. This requires you to take initiative.

Some concrete suggestions are below, organized roughly from the big picture to nitty gritty.

- **Plan and take ownership of your research program.** There are typically calls for telescope (and computing) proposals every 6 months or 12 months. When you get these emails, you should think about proposals you could write to further your interests or explore something new. I am happy to consult and advise, but see *overarching principle*. In general, I expect you to become more independent over time. It is normal for me to be suggesting projects during your first couple of years, but the balance should shift over time.
- **Read papers.** Lots of them, and critically. There is no substitute. I in general expect you to look through the latest arxiv/astro-ph posting daily. This does not mean you need to read every paper – you should skim to find what is relevant to you (I spend about 90 seconds on this), and then you read any papers that are close to your research carefully. At the same time, you should become familiar with the classic papers in your subfield.
- **Find conferences relevant to your research and apply for them.** [Here](#) is a near-comprehensive list of astronomy meetings and conferences that will happen in the next year or two. In most cases I will be happy to support your travel (but we should discuss before you register).
- **Finish your projects.** The basic currency of the field is papers. As far as the rest of the world is concerned, if you work on a research project and never write up the results, the research did not happen. This doesn't necessarily mean the project wasn't useful – you may have had fun with it, or learned skills that carry over to other work – but when you graduate and apply for jobs (at least in academia), the papers you write will be the key metric through which you are judged. It is therefore essential to finish and write up your projects before (or in parallel with) starting new ones. This is particularly true early on: after you have some papers under your belt, you'll be in a better position to drop some in favor of others that are more exciting.

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<sup>1</sup> Inspired by a similar document written by Charlie Conroy, with whom I worked as a postdoc at the CfA.

Of course, some projects do end up not being worth the effort. Early in graduate school, it is the responsibility of your advisor and mentors to let you know if they think this applies.

- **Be present.** Department events, group meetings, presentations by visitors, etc., are not just about getting information you need to do your research. They are also about creating a friendly and supportive community. That will not happen if you mostly work from home or hole up in your office.

Attend talks regularly. At minimum, I expect you to attend the astronomy colloquium and at least one other talk per week (e.g. TAPIR seminar, tea talks, physics colloquium, other informal seminars scheduled for visitors). More is better. Ask questions. I also strongly encourage you to enroll in AY 141 (journal club) and participate actively to get experience giving talks.

You may think that a particular week's talk is too far removed from your research area and that your time is better spent doing research. This is a mistake. Your goal in graduate school is to become an independent and well-rounded scientist, and a key step is to understand what your colleagues in other areas of astrophysics are talking about.

Sign up to meet with visitors. Perhaps the single greatest advantage of being in a cutting-edge department like Caltech is the steady flux of visitors passing through. Take advantage.

- **Be on top of your funding situation.** My default expectation for students in astronomy is that you will be supported by a department fellowship in year 1 and by teaching in year 2. Students in physics might have to teach some in year 1. If I have committed to being your advisor, I will try hard to raise funds to support you after your 2nd year (the alternative is having to TA, which is not necessarily bad, but does take time). It is important to recognize that funding in astronomy is usually awarded in blocks of three years or less, so faculty are rarely in a position to confidently predict their funding situation 5 years in the future. I strongly encourage you to minimize uncertainty by applying for your own funding through programs like NSF GRFP and NASA FINESST. I will be happy to help you with such applications, which will also be excellent preparation for most permanent astronomy jobs.
- **Seek out collaborators.** This includes contacting people when you read their papers, approaching them at conferences, signing up to meet with visitors, etc. Astronomy is a small field, and if you stick with it for 5+ years, you will get to know a large fraction of the community, especially people working in your subfield. Getting to know people (and getting known yourself) is a sum of many low-SNR events: it doesn't matter a whole lot if you attend any one event or not, but the signal builds over 5-6 years.
- **Find multiple mentors.** By the time you graduate, you should have multiple senior people with whom you collaborate and from whom you feel comfortable asking for advice. No one's judgement is perfect, and you will find that opinions are often divided about the most promising path toward tackling a scientific problem, or the next thing you should work on, or the correct interpretation of some data, etc. You can partially insure against bad advice by gathering multiple opinions and having several collaborators. This

will also be useful when you apply for jobs and need 3-4 people to write letters on your behalf.

- **Come to meetings prepared**, ideally with a few plots or slides to discuss. Remember that I have not been inside your head for the last week, so I'll need some context before you dive into code.

Relatedly, **be on time**. Our schedules are all segmented into 30-minute chunks. If you come 10 minutes late to a meeting, it either cuts the meeting short or makes other people late to their next meeting. So be respectful of other people's time.

- **Give talks and take them seriously**. Talks are the most effective way to spread the word about your work and get external feedback. A typical conference talk or seminar might have an audience of 50-100 scientists. 50-100 hours of scientist work time is a significant investment. If you phone it in after spending an hour preparing, that is not a good exchange rate. I am always happy to practice with you.
- **Help with observing**. Our group uses a fair amount of data obtained through our own observations, and everyone is asked to help out. In general, you are expected to do the observing for your own science programs, but trades are often fine and can make scheduling easier. Students just starting out may be working on data from someone else's observations in a previous semester. Some paying-it-forward is required for this to be sustainable.
- **Collaborate with other group members**. Since we are all working on overlapping topics and often are using the same datasets, your fellow group members should be the first people you ask when you have a question. And if you get help from another group member, be generous in including them in the paper.
- **Improve your writing**. Scientific writing is a learned skill. The best way to improve is to read papers. See also the how-to-guide at the end of this document. Proof-read your papers carefully before sending them out for comments. Form is content, and it is hard to judge the scientific results of a paper if they are buried in unclear prose.
- **Communicate**. Please keep me informed about challenges you are facing that limit your happiness, productivity, or self-realization. I am happy to listen and want to ensure our group is a welcoming environment for everyone.

Finally, here are three excellent how-to guides written by Nadia Zakamska. I endorse all her advice:

[Paper Writing](#)

[Making Figures](#)

[Asking Questions](#)