

A guide to job hunting for Australian Astronomy Ph.D. students

V1.0 14/12/11

Among the most difficult decisions during your Ph.D. is deciding what to do when you're finished. Your Ph.D. is in many ways only the first step in this journey towards becoming an Astronomer, or perhaps turning your skills to some other field.

As you move toward the last months of your Ph.D., you should consider the full range of employment options. Evaluating all the options is a lot of work, so allow time to do it properly and start well in advance. The application process for a job in astronomy typically takes several months so you should start evaluating your options up to 12 months before you submit.

Your education puts you in a position to find a job that not only pays the bills but also provides satisfaction. To discover what type of job will do the trick, analyse what you most enjoyed while working as a Ph.D. student. Was it working in a team of enthusiastic young people exploring unknown (scientific) territories or working to solve a tough problem? Or perhaps you were most excited by the challenge of mastering particular technical skills, learning the multidisciplinary aspects of your project, or teaching. At first glance, you may conclude that your particular research topic makes you want to get out of bed in the morning. But after more careful consideration, you're likely to realise that narrower aspects of your project are more important than the topic itself. Ask close friends and associates what they see as your strengths; friends can often see what you were best at and what gave you the most satisfaction, even when you can't see it yourself.

What types of jobs are available to astronomy Ph.D. graduates?

First and foremost, it must be said that the number of successful Astronomy Ph.D. graduates internationally in any year is greater than the number of jobs available, so securing a job after your Ph.D. is competitive. There are some demographics on Australian astronomy to be found on the ASA's Women in Astronomy web site (<http://asawomeninastronomy.org/statistics/national/>).

Most people who want to stay in astronomy go overseas for their first 'postdoc'. You will learn a lot about the world of astronomy beyond the relatively small community in Australia – and hopefully have a great time too! Generally about 70% of Ph.D. students secure their first postdoctoral position, with far fewer eventually going on to a permanent position. This document is mainly about finding that first postdoc.

However, an astronomy Ph.D. can also qualify you for many other positions in other fields not necessarily related to astronomy. A Ph.D. enables you to develop many skills which are transferrable to other fields and which are held in great esteem by employers. Many astronomy graduates end up in careers like computing, engineering, scientific research in areas outside astronomy, communications, journalism and teaching, to name but a few.

There are four career paths *in astronomy* that may typically be pursued by Ph.D. graduates:

1. Faculty position

It is extremely rare to land a permanent Faculty position at a University straight out of a Ph.D.. These positions are more typically seen as the end goal after a number of post-doctoral positions. Usually, a Faculty position includes both teaching and administrative duties. Perhaps 40% of the time

is spent on each of teaching and research, with the remainder for administrative duties. Greater proportions of research time (including 100%) do occur as well. One possible way this can occur is by securing a research grant that effectively buys you out of teaching. This may not be an option at all Institutions.

2. Fellowship

A fellowship is a paid position, which is usually between 2 and 5 years in duration. In this type of position you may set your own research agenda. This gives you the most flexibility as you can devote 100% of your time to research of your choosing. These positions are highly competitive. The application process normally involves submitting a research project outline, so you need to have thought this out and have developed some good ideas before applying. Also the application procedure for some Fellowships (e.g. the ARC) can take a year to be assessed, so you really need to plan ahead!

3. Standard postdoc

A standard post doc is typically a 2 to 5 year contract that pays you to work on a research project designed by your supervisor. You may find that you will have anywhere from 0-60% of the time for your own research projects, though it is usually closer to 0% than 60%.

4. Observatory positions

A job at an observatory may involve the support of a particular telescope or instrument. Again, some time may be available for your own research. The job may consist of conducting observations (service observing) for other astronomers, or being the local on-site person to help observers use the telescope. It may involve living in a remote location, close to the telescope or being prepared to travel there on a regular basis.

Other positions that Ph.D. graduates may find themselves in are in an instrument science, engineering or computing development or a support role. Since modern telescopes rely heavily on engineering and information technology, there is demand for people who have some experience in designing, developing or building instrumentation or developing computer software and techniques. With the rise of multi-processor computing and supercomputing centres there is a demand for those with skills in these newer areas of software development.

What should I be doing during my Ph.D. to better my chances?

1. Publications

For most astronomy-related jobs, be it a Faculty position, Fellowship or postdoc, the bread and butter of success is publications in refereed journals. It is important to keep publishing papers during your Ph.D.. 3-4 first author publications is typical, but is not always enough to land you a Fellowship, for example. Largely, success is based on the number of publications (including both first author and co-authored), but is also dependant on the number of citations, with the H-index being a popular but simplistic measure of an astronomer's publication power (H-index = X, where X is the number of publications an astronomer has with X or more citations each).

Note that only papers you've done at the time you submit your job application (12 months before you graduate) are helpful; if your thesis is going to produce a whole lot of good papers but only right at the end, this may be a concern.

You should be aware that conference proceedings are not equivalent to a refereed journal paper. It is unwise to base your publication record solely on a large number of conference proceedings.

Many people list "submitted" or "about to be submitted" papers to pad out their publication list on their job applications that can be code for "haven't written this paper yet". Try to avoid listing more than 1-2 submitted or 'in prep' papers, restricting them to only papers that really have been

submitted or will be shortly, and to papers that are central to your job application and accomplishments.

2. Gain experience for specific jobs.

During a Ph.D., you will undoubtedly gain much experience in doing research. But if you wish to end up with a Faculty position, then it is worth spending some of your time gaining some teaching experience, through tutoring and lab assistant work, which you may find offered through your Institution.

If you wish to pursue a Fellowship then it is important to have experience in writing grant applications. Writing a telescope observing proposal is a good start to this experience, but do not stop there! Grant applications are much more involved and probably more competitive, so much more attention to detail, as well as salesmanship is required. You need to market your application better than all the other applicants.

If you wish to pursue a career at a specific telescope, then offer to help out there when you can. Gain experience in operating the telescope, as well as the instrumentation attached to it. Identify your niche or interest area – what do you enjoy the most? Take every opportunity to gain skills and meet the people doing similar roles. If you find you don't enjoy a task or role, then mark it up to experience and keep looking.

3. Advertise yourself /Network

Your network is a great asset in the job search, but do you even have a network? You may not think you have but you certainly do. Your lecturers, fellow students, post docs in your institution and alumni all are usually happy to help you, if you are prepared to ask. But be clear what you are seeking to know.

Many people make the mistake of thinking that conferences are places just to present the subject of your current research. But they are also an excellent place to meet future employers. It is a law of nature that an employer is much more likely to pick someone they have met than someone they have not. Conferences are also great places to meet future collaborators who may be able to offer new insight into your work.

Many Ph.D. students have graduated from your institute in the past, and your supervisor and other staff members will most likely know how to find them. These people will usually be happy to discuss their current and past employment and answer your questions

If you hear someone interesting at a conference or colloquium and find you are interested in their field of research, then contact them and introduce yourself. Most people in our field are happy to talk to others of like mind and you are making a positive impact by making contact. When it comes later to applying for a position, they should remember you.

4. Develop your communication skills

There are many aspects to this, including writing journal papers, telescope proposals, presenting at conferences (both oral and poster), communicating with collaborators, your supervisor and communicating with the general public. In each of these, it is important to keep in mind who your target audience is and what the message is you are trying to get across.

A separate ASA document on *Conference Presentations and Telescope Time Applications* gives some useful suggestions on effectively communicating in these situations.

Some links to excellent resources on scientific writing include:

- *The science of scientific writing* (<http://www.unc.edu/~haipeng/teaching/sci.pdf>)
This is a link to a well known paper that describes how to write sentences that mesh well with the reader's expectation.
- *Scientific writing = Thinking in words* (<http://www.publish.csiro.au/pid/6529.htm>)
This very short book describes how to structure a good scientific paper. It argues for a holistic view of a scientific project: i.e. thinking carefully about paper and especially the hypothesis before performing the experiment. This view can help with the design of better experiments, and makes the paper writing easier.
- *How to Write a Paper in Scientific Journal Style and Format*
(<http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtoc.html>)
A good description of the sections of a scientific paper and how to approach writing one.
- *Trees, Maps, and Theorems* (<http://www.treesmapsandtheorems.com/>)
Check out this book to learn about the presentation of graphical data.
- *The Visual Display of Quantitative Information*
(http://www.edwardtufte.com/tufte/books_vdqi)
This classic work by Edward Tufte is another great resource on the theme of graphical data.

When is it time to apply for a job after your Ph.D.?

As suggested earlier, it is a good idea to start thinking about applying for a job at least a year before you submit – i.e. in the second year of your Ph.D.. One day you might see an advertisement for a position, which has a closing date in a few months. It can then take anywhere from one to three months for the employer to assess the applications and conduct interviews, if necessary. Then an offer goes out to you and there are a few more months before finally starting the position. All this can easily add up to a whole year so you should start writing applications at least one year before you intend to start.

There is a job cycle which peaks around September, when many advertisements go out. Note that the American Astronomical Society (AAS) has a rule to prevent poaching of applicants: no one can give offers for jobs listed after September before 15th of February.

How do you find a job?

There are a few websites around that advertise astronomy positions. The main one is the "AAS Job Register" (<http://jobregister.aas.org/>), where jobs from all around the world (including Australia) are advertised. There is also the "RAS JobsList" (<http://www.ras.org.uk/education-and-careers>). It is also a good idea to look through websites of institutions you are interested in, which may occasionally advertise only locally. In Australia, the Observatories, CSIRO and Universities which have astronomy departments often advertise their positions through the ASA email exploder and on their websites. It is worth making yourself a list of bookmarks and checking regularly. Other positions may be offered on Seek.com.au so it is worthwhile to register there to receive job emails relating to the field or employers in whom you are interested in working.

Finally, it is also a very good idea to talk to as many people as possible, to let them know you are looking for something and see if they know about a job that is just coming up.

What to put in your CV and cover letter?

For any application, the first thing to do is prepare your CV, which is a generic background document on yourself. Once you have the CV together, it is much easier to apply for multiple positions by

tailoring a cover letter. Your institution should be able to provide you with help in preparing a CV - if not within your own school, then within the University postgrad or research support group.

Publications are the most important part of your CV. List them in reverse chronological order (latest papers first), with your name in bold. You can add a single sentence to each paper if you want, describing the paper. Separate out refereed papers from conference papers. It is OK to include 1-2 papers in preparation, but be prepared to hand copies to your potential employer.

Include dot points of your key skills – e.g. computational and observational skills – elaborate if you have special skills such as GPU or parallel processing, particular software language expertise. If you have won, awards or prizes, list them. Be careful about including information on hobbies – depending what they are, they may make you sound like a well-rounded individual or a bit of a nerd.

The cover letter needs to stand out quickly to the reader, so start off with a summary of the most salient points. There will usually be selection criteria given for the job, so make sure you have a clear statement on each, even if they are covered in more detail in an application form. The cover letter is there to sell yourself to your potential employer so explain why you are the right person for the job and what skills you can bring to it.

How do you choose referees?

Generally speaking you need to pick the biggest names you can for referees. You will need typically 3 of them. Your supervisor is normally one of your referees. You can also ask thesis/paper examiners, who have a good knowledge of your work. Try and choose referees from a diverse range of backgrounds as you can. Be careful when approaching a potential referee. Allow them to say no by asking if they are in a position to write a report, or similar. Normally most people will say yes to being a referee even if they do not feel that they will write a good report on you.

How do you prepare for an interview?

You should think about how you will answer likely questions you will be asked, such as “describe your current research” and “what are your future research plans?” Explain why this job is interesting for you and what skills you have previously acquired make you well suited. If you get the opportunity, explain some of the interesting aspects of your previous work – what has given you passion in the past? You may be asked about other positions you are applying for and when you can start.

Also, think about the questions you want to ask, such as relocation expenses, living costs, what funding is provided for computers/travel/page charges and what is the preferred start date.

Come prepared to the interview. You need to know yourself - your strengths, weaknesses and accomplishments. A job interview is not the time to wing it!

It may seem obvious, but think about the appearance you want to convey when you go the interview. Be neat, clean and tidy. Pay attention to personal hygiene. Overdress a little rather than underdress.

Arrive 15 to 20 minutes early. Punctuality is a subtle clue about attitude and behaviour. Tardiness, no matter the excuse, is a major blunder. Check out in advance what your parking options are and allow plenty of time.

First impressions, positive or negative, dramatically affect the ultimate evaluation. You can make or break a job interview within the first five minutes. Be confident. High self-esteem and self-confidence are the hallmarks of the successful individual. With confidence, be able to demonstrate how you have overcome obstacles. There’s nothing wrong with feeling good about yourself.

Be prepared to support statements about yourself with specific examples. These will provide legitimacy to your claims. Without them, the interviewer may not accept them as valid.

By the conclusion of the interview, state that you are definitely interested in the position and would like to know when the next step will take place. It's best to demonstrate this interest throughout the session, but be careful not to go overboard. Another thing to consider is that these days, initial interviews may be over video link – you need to take as much care in your appearance as in person and be careful not to have too many distractions. If you are unsuccessful – then ask for feedback so that you learn from the experience and improve for the next interview.

Once you have an offer

You may be able to negotiate the salary (but only if you ask). If you have more than one offer, then explain this as you may be able to negotiate a better salary and/or conditions. If you do wish to negotiate, think about how you explain why you're justified in the salary increase, based on additional skills etc. Don't plead poverty as it won't help you get a better salary. If you accept a position, you should not continue negotiations elsewhere and you should consider the decision final.

Once you have a postdoc

Now is not the time to put your feet up (you have to wait for retirement for that). You need to make a good impression in your first postdoc, particularly with publications, in order to have a good chance of landing a permanent position in the future.

Make sure you stay focussed on your research. Postdocs are an important time to be involved in many projects but you need to pay attention to your core research primarily, otherwise you may end up after a couple of postdocs without anything to show as your own work. However, postdocs are a great time to build collaborations (and friendships), particularly if you go overseas for the postdoc and are immersed in a different culture. Balance is the key.

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