Careers in Astronomy and Astrophysics

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Do I Need an Advanced Degree to Get a Job in Astronomy?

• If you want to do original research, yes, you do.
  – Our undergraduate major program and our graduate program are designed to prepare students for this most demanding career path.
  – Students often find that their interests or ambitions change with time: fortunately there are good “off-ramp” opportunities for astronomy students.
  – Unemployment rate for people with B.S. in Astronomy and Astrophysics is essentially 0.
What Kind of Careers Are Available to Astronomers?

- Ph.D. level jobs:
  - Professor at a College or University (~55%)
    - Research universities (PhD program)
      - Local examples: Ohio State, Case Western Reserve, Ohio U, Cincinnati
    - Teaching universities (Terminal BS or MS)
      - Local examples: Miami, Kenyon, Oberlin, Denison, Otterbein, Ohio Wesleyan
• The number of professorial jobs in astronomy and astrophysics at major research universities is limited.
  
  – About 35 US universities offer Ph.D.s in astronomy and astrophysics and many of these are actually in physics departments.

![Astrophysics and Astronomy](chart.png)
What Kind of Careers Are Available to Astronomers?

• Ph.D. level jobs:
  – Researcher or Support Scientist at a Government-funded observatory, institute, or laboratory (~33%)
    • Carnegie Observatories
    • National Optical Astronomy Observatories
    • National Radio Astronomy Observatory
    • National Solar Observatory
    • Space Telescope Science Institute
    • International Gemini Observatory
    • NASA Goddard Space Flight Center
    • NASA Ames Research Center
    • Jet Propulsion Laboratory
What Kind of Careers Are Available to Astronomers?

• Ph.D. level jobs:
  – Private industry (~10%)
    • Southwest Research Institute
    • Space Science Institute
    • Aerospace Corporation
    • Ball Aerospace
  – Planetaria, science museums, etc. (~2%)
    • American Museum of Natural History
Jobs You Can Get With a Bachelor of Science in Astronomy

- Data technician/analyst
- Science educator
- Science librarian
- Science writer
- Planetarium/museum director
- Instrument technician
- Telescope operator/night assistant
Jobs Held by Former OSU B.S. Students (a few of my former students who left astronomy)

- *International Space Station* payload director
- Science writer
- High-school science teacher
- Attorney
- Graduate student, nuclear engineering
# Path for an Academic Career

<table>
<thead>
<tr>
<th>Career Stage</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>Learn fundamentals of physical science, begin to develop research skills, earn B.S. degree, gain admission to graduate school.</td>
</tr>
<tr>
<td>Graduate</td>
<td>Learn to carry out original research, develop research skills, earn Ph.D. (and title “Doctor”), obtain a good temporary postdoctoral (“postdoc”) position.</td>
</tr>
<tr>
<td>Postdoc</td>
<td>Broaden experience and skills, build research reputation, carry out original research, obtain a permanent or “tenure-track” position.</td>
</tr>
<tr>
<td>Faculty</td>
<td>As an “assistant professor” (probationary), establish yourself as a leader in research in your field. Obtain grants, carry out research, publish research results, obtain tenure and promotion to “associate professor”.</td>
</tr>
</tbody>
</table>

Note on titles: “Doctor” is someone who has earned a Ph.D. degree. “Professor” is a job title: assistant, associate, and “full” professors are simply addressed as “Professor.” Nearly all professors are also doctors.
“Typical” Academic Career Path for Research Astronomers

• Undergraduate (4 years → Bachelor of Science)
  – Major in Astronomy and Astrophysics or Physics
    • Less often: Chemistry, Math, Engineering
• Graduate (~5 years → Doctor of Philosophy [Ph.D.])
  – Astronomy or Physics
  – Sometimes earn Master of Science along the way
  – Typically 2 years of classes + research, followed by original research leading to a dissertation
  – Graduate students receive tuition waivers and stipends
    • GTAs, GRAs, and Fellows
    • Current stipend for OSU Astronomy is $2038/month.
“Typical” Academic Career Path for Research Astronomers

• Postdoctoral Research (total ~2 to 6 years → permanent position)
  – Real, full-time job, but fixed term (usually 2-3 years)
  – Usually full-time research
  – Two principal categories
    • Fellowship : free to work on projects of your own choosing
    • Research Assistant: hired to work on a specific project or program
“Typical” Academic Career Path for Research Astronomers

• Assistant Professor/Assistant Astronomer
  – Permanent position, but probationary
  – In no later than sixth year, a tenure† review takes place
    • Successful: promotion to Associate Professor with Tenure at the beginning of next year.
    • Unsuccessful: termination of position at the end of the following year.
      – Typically final outcome is a faculty position at a lower-tier university

†“Tenure” refers to a guarantee of a position until retirement. Can be revoked for cause or if unit is dissolved or institution is insolvent.
### “Typical” Academic Career Path for Research Astronomers

<table>
<thead>
<tr>
<th>Position</th>
<th>Undergrad</th>
<th>Grad</th>
<th>Postdoc</th>
<th>Asst Prof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>N/A</td>
<td>~$24k</td>
<td>$40-75k</td>
<td>$50-90k</td>
</tr>
<tr>
<td>Time</td>
<td>4 yrs</td>
<td>5-6 yrs</td>
<td>2-6 yrs</td>
<td>&lt; 7 yrs</td>
</tr>
<tr>
<td>Cumulative Time</td>
<td>4 yrs</td>
<td>9-10 yrs</td>
<td>11-16 yrs</td>
<td>13-22 yrs</td>
</tr>
</tbody>
</table>

Later career salaries (major research universities):
- Associate Professors: $75-100k
- Professors: $90->200k
What Should I Be Doing as an Undergraduate Astronomy Major?

• Join the OSU Astronomical Society
  – Get networked with more senior students!

• Position yourself for graduate school
  – Strong academic preparation in physics and math
  – Obtain research experience if you can
    • End of SECOND year is a good time to start.
    • Spend your FIRST and SECOND years concentrating on mastering calculus and physics.
  – Computer programming experience
    • Take every opportunity to learn new, marketable skills
  – Don’t neglect development of good writing skills
What Should I Be Doing as an Undergraduate Astronomy Major?

• Preparation for applying to graduate school should begin your third year
  – Which grad school you attend is in most cases the most important factor in your future career
  – Consider your strengths and weaknesses
    • Be honest with yourself
      – Most graduate schools will not consider your application if your GPA is lower than ~3.0
    • Set realistic goals and expectations
      – (e.g., if your GPA is 3.2 you won’t be admitted to Berkeley or Princeton so get over it)
What Should I Be Doing as an Undergraduate Astronomy Major?

• Preparation for applying to graduate school should begin your third year
  – Develop relationships with professors who can write letters of recommendation for you
  – Take the GRE aptitude test early and separately from the Advanced Physics test
  – Leave plenty of time for graduate school applications in autumn of your final year
How Can I Get Research Experience As An Undergraduate?

• Many observatories and universities have summer programs ("Research Experiences for Undergraduates" [REU])
  – Check the website of the American Astronomical Society
  – Seek advice from astronomy faculty and more senior students regarding specific programs
How Can I Get Research Experience As An Undergraduate?

• Apply to our Summer Undergraduate Research Program (SURP) in January
  – 10 weeks of full-time summer employment working with an Ohio State professor on research
  – Introductory seminars/labs on basic research tools
  – Possibility of extension into academic year
  – Expectation: presentation at NMS Undergraduate Research Forum and Denman Forum in spring
  – Many projects result in senior honors thesis (graduation with Distinction in Astronomy and Astrophysics)
Balance Sheet on Astronomy as a Career

• **Upsides**
  – Most astronomers love their jobs
  – Most astronomers choose what they work on
  – Interesting experiences and world travel
  – You will never be bored
  – Gratification of making a lasting contribution to science

• **Downsides**
  – Few options as to where you’ll live
  – “Deferred compensation” (good salaries come late)
  – Highly competitive nature of field demands long hours of hard work, dedication, sacrifice, and patience without much personal recognition
  – Research is risky business