Breaking the Myth of the “Non-Traditional” Physicist

The Real Story About Employment for Physics PhDs

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American Physical Society

www.aps.org/careers
Who is a Physicist?
Anyone with a Physics Degree

• BS
• BA
• MS
• PhD, etc.

Why?

• Definition is consistent with other disciplines (e.g. Chemistry)
  • Defines a common set of experiences (and texts)
  • Inclusive view is better for survival of discipline

What makes them Physicists?

Shared experiences creates familiarity—not only with the same Physics concepts, but also with the culture of the discipline.

However, most importantly, even a basic Physics training imparts essential problem solving skills—“how to think”—which is the hallmark of a physicist.
Where do Physicists Work?

Not where you think!

What is a “traditional physicist”? A physics professor? A PhD researcher? The “most common” career path?

The AIP Statistical Research Center estimates that 1 in 7 physics bachelors will choose to finish a Physics PhD.

So ~14% of all Physics Degree holders will actually become Physics PhDs—and by extension “traditional physicists.”
PhD Job Force: Supply

In 2008, there was a 38% increase in the number of Physics PhDs produced compared to four years earlier.

At the time of the 2008 report, the AIP Statistical Research center estimated that the number of PhDs conferred should level off by 2012...

...at close to the highest number/year produced in the past century (it turned out to be higher than predicted: now 1600/year).

Bottom line: the US can expect to continue putting large numbers of Physics PhDs into the workforce.
The largest percentage of Physics PhDs found initial employment in Postdoctoral and other temporary positions…

…but a significant number of graduates went straight into potentially permanent employment in the private sector.
PhD Job Force: Demand

The majority (74%) of graduates who initially become postdocs are in academic settings. The remainder are at national laboratories (22%). Most postdocs go into their positions in the hopes of moving toward permanent employment.

In fact, research shows that at PhD granting universities, previous experience as a postdoc (or as faculty) is a strong indicator of the likelihood of becoming a faculty hire.

At the same time, becoming a new faculty hire with only a graduate degree is extremely unlikely—even at Bachelor’s granting universities.
However the number of departures of tenured and tenure-track faculty has changed little since 2003.

“While there were about 350 departures by tenured and tenure-track faculty during the 2006-2007 academic year…there were 475 recruitments for the same time frame, with 342 tenured and tenure-track faculty members hired in 2007-2008; this… is consistent with what we have seen in prior years.”

--Focus on the Faculty Job Market in Physics and Astronomy Departments, AIP Statistical Research Center
Not all faculty positions are created alike.

- The type of faculty position varies widely according to institution
- Many individuals who do get new faculty positions will spend time waiting for a desired situation to open up, or for tenure.

Bottom Line: the job market for faculty in universities and other institutions is very stable.

“Stable” means that overall, not many jobs are being lost. At the same time, not many are being created, either.

Given that we are graduating more than 1600 PhDs/yr, and with more than half of them going into postdocs with an intention of continuing as physics faculty, supply will continue to outweigh demand for the tenure-track academic career path.
PhD Employment in the Private Sector

Recall that the majority (57%) of graduates who initially went into permanent employment positions were in the private sector.

According to the NSF Survey of Doctoral Recipients, in 2010 the private sector was the largest single employment base of Physics PhDs: about 47% (the next highest was 4 year colleges, at 38%).

This was also true in 2001, when the private sector employed 46% of Physics PhDs¹…

…and was also true in 1993, when the private sector again employed 46% of Physics PhDs².

In fact, the same data has shown consistent support for Physics PhDs in the private sector since 1971.

Industry has been the largest employment base for Physics PhDs for decades.

¹NSF Survey of Doctoral Recipients, 2001
²NSF Integrated Survey Data, 1993
Not only does the private sector provide the largest number of jobs for physics PhDs, it also provides the highest-paying jobs, with a starting salary of $90K.

By comparison, average typical starting salaries at Universities and 4-year colleges is around $50K…

…and a University postdoc position typically offers between $40K and $50K.

So, the private sector also offers well-paying employment to Physics PhDs.
Source: NSF Integrated Survey Data, 2010

- 2-year college median salary (post secondary and pre-college teachers): $53 K, 1,528
- 4-year college median salary (research scientists and professors): $74 K, 23,558
- Government (research scientists, engineers, and management): $105 K, 5,864
- Business/Industry (engineers, top- and mid- level managers, non-science): $120K, 25,568
But Won’t I Lose My Soul if I Go Into Industry?

NO!

Types of Positions Accepted by Private Sector Hires, 2009-2010

- 42%: Physics Research, Different Subfield then Dissertation
- 31%: Physics Research, Same Subfield as Dissertation
- 27%: Different Field than Physics


Less than half of graduating PhDs found employment in fields such as Engineering, Business and Finance, Education, or Medical Services.

But the majority of physics PhDs who accepted employment in the private sector were doing physics research, either in or out of their dissertation subfield.

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PhD Workforce: Summary

- The US produces about ~1600 physics PhDs a year—and is likely to continue producing physicists at this rate over the next several years—while there are only ~350 new faculty hires per year.
- Faculty positions are NOT the most common career path for physicists!
- Industry is the largest employment base for Physics PhDs…
  …and for Physics Masters
  ….and Physics Bachelors.

Your career path most likely will not be a straight line…

…BUT! Smart planning requires being aware of—and prepared for—all possibilities.

There is a lot of great science to be done—and opportunities to be found—in a lot of places!
What about the non-PhD physicists?

According to the AIP Statistical Research Center, 86% of physics bachelors will not earn a Physics PhD.

- Roughly one-third to one-half of Physics Bachelors will go straight into the workforce, mostly in STEM fields.
- Another third will go into graduate study in Physics and Astronomy.
- And the remainder will go into graduate study in other fields—including finance, law, and Medical Physics.

What types of employment are possible for these degree paths?
Master’s Degrees

Between 2006-2008, 64% of physics masters recipients entered or remained in the workforce.

- High School teachers taught Physics, Chemistry and Math
- Salaries for those continuing employment after earning their MS were $13,000 more than new hires.

- Typical titles include lab coordinator, instructor, and lecturer.
- Median Starting Salary: $35,000

- Positions mostly at National Labs, Armed Service Branches, or Trademark Office
- Median Starting Salary: $57,000

- Almost entirely STEM occupations
- Mostly management-level positions
- Median Starting Salary: $62,400

Private Sector 49%
College/University 21%
High School 13%
Civilian Government 9%
Other 9%
Not surprisingly, physics master’s degree holders also earn more than physics bachelor’s:

A physics master’s degree will open the door to more advanced positions in a variety of technical fields, with higher salaries.
Elon Musk, Physics MS
Founder and CEO
Tesla Motors, Space-X – Hawthorne, CA

Educational Background
BS – Physics, University of Pennsylvania
MS – Applied Physics/Materials Science, Stanford

As founder and CEO of Space-X, a company pioneering private, commercial space flight, Elon has definitely put his physics training to good use.

On 25 May 2012, the SpaceX Dragon vehicle docked with the International Space Station, ushering in a new era of exploration, travel, and private enterprise in space.

Ginger Kerrick, Physics MS
Flight Director
NASA Johnson Space Center – Houston, TX

Educational Background
BS – Physics, Texas Tech University
MS – Physics, Texas Tech University

Though her original goal was either to become an astronaut or a basketball player, various life circumstances sent her down a different path.

As flight director for NASA, Ginger uses her Physics training every day to solve problems creatively and quickly, to help get astronauts home safely.
Bachelor’s Degree

Between 1995 and 2007, about one-third to one-half of Bachelor’s degree recipients went directly into the workforce.

The remainder went on to graduate school:
• Mostly in Physics and Astronomy
• A significant proportion went to graduate school in other fields.

Many physics bachelor’s degree recipients pursued advanced degrees in other areas...

...and less than 7% of them were unemployed!
Physics Bachelors in 2009-10 found initial employment in a variety of areas.

Over half of physics bachelor’s degree recipients in 2009-2010 found work in the private sector.

http://www.aip.org/statistics
Of these, many went into engineering or computer science.

A significant portion went into “non-STEM” fields.

Physics bachelors are highly employable, in a variety of career paths.

STEM refers to natural Science, Technology, Engineering, and Mathematics.

http://www.aip.org/statistics
In fact…

A physics bachelor’s degree now ranks higher in starting salary than many other technical fields (including mechanical engineering).

The typical starting salary for a physics bachelor degree has increased by nearly $10,000 since 2003.
Christina Barrow, Physics BS
Medical Physicist
Department of Veteran Affairs, Baton Rouge, LA

Educational Background
BS – Physics
MS – Medical Physics

At the Dept. of Veteran Affairs, Christina is responsible for quality assurance of radiation treatments for cancer patients. Her work allows VA medical personnel to have access to the latest techniques in patient care.

David X. Cohen, Physics BS
Writer and Executive Producer
Television show Futurama

Educational Background
BA – Physics, Harvard University
MS – Computer Science, UC Berkeley

David claims that his choice to study physics was a “pathetic form of rebellion” against his parents, who are both Biologists.

As a writer for the show Futurama, David says his physics training helps him incorporate an understanding of how the world actually works into the show, which is set in a fictional world.
Beyond the Bachelor’s Degree

Medical School

Physics majors out-performed many other majors (including pre-med) on all three sections on the MCAT.

Physics majors also account for less than 1% of individuals taking the exam...

These factors make Physics majors stand out compared to other med school applicants.

Average MCAT Scores by Selected Major*, 2012

<table>
<thead>
<tr>
<th>Major</th>
<th>Physical Science</th>
<th>Biological Science</th>
<th>Verbal Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>11.1</td>
<td>10.4</td>
<td>9.8</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>11.1</td>
<td>10.6</td>
<td>9.6</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10.6</td>
<td>10.4</td>
<td>9.3</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>10.9</td>
<td>10.1</td>
<td>9.4</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>10.1</td>
<td>10.6</td>
<td>9.5</td>
</tr>
<tr>
<td>English</td>
<td>9.6</td>
<td>10.1</td>
<td>10.2</td>
</tr>
<tr>
<td>Biochemistry</td>
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<td>10.1</td>
<td>9</td>
</tr>
<tr>
<td>Chemistry</td>
<td>9.5</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Psychology</td>
<td>9.1</td>
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<td>9.1</td>
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<tr>
<td>Biology</td>
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<td>9.7</td>
<td>8.7</td>
</tr>
<tr>
<td>Premed</td>
<td>8.3</td>
<td>8.9</td>
<td>8.1</td>
</tr>
</tbody>
</table>

* Based on test takers who applied to medical school, and based on applicants’ most recent MCAT scores. Source: AIP Statistical Research Center compiled from the Data Warehouse of the Association of American Medical Colleges.
Or Law School?

Physics majors also received the highest average LSAT scores compared to several other majors (including Pre Law).

Average LSAT Scores by Selected Major, 2012

<table>
<thead>
<tr>
<th>Major</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>162.2</td>
</tr>
<tr>
<td>Physics</td>
<td>162.1</td>
</tr>
<tr>
<td>Engineering</td>
<td>157.3</td>
</tr>
<tr>
<td>Chemistry</td>
<td>156.7</td>
</tr>
<tr>
<td>English</td>
<td>155.8</td>
</tr>
<tr>
<td>Biology</td>
<td>155.2</td>
</tr>
<tr>
<td>Political Science</td>
<td>154.3</td>
</tr>
<tr>
<td>Pre-Law</td>
<td>149</td>
</tr>
<tr>
<td>Criminal Justice</td>
<td>145.3</td>
</tr>
</tbody>
</table>

Source: Compiled by the Statistical Research Center based on data collected from the Law School Admission Council.

So, a physics bachelor’s degree provides excellent training for careers in medicine and in law.
A Bigger Picture…

Job Security

Unemployment rates in science and engineering fields have trended lower than that of all US workers for decades.

During the 2008 recession, they remained even lower, proportionally.
During the two years before the recession, S&E employment grew the fastest.

...and during the recession, S&E employment suffered the least.

Given that in the same timeframe, 58% of Physics Bachelors, 87% of Physics Masters, and 82% of Physics PhDs were employed in S&E fields, we can conclude that a physics training benefitted these students—and the US workforce—in palpable ways.
In Conclusion

• The US produces about ~1600 physics PhDs a year—and is likely to continue producing physicists at this rate over the next several years.
• At the same time, there are approximately ~350 new faculty hires per year.
• A faculty hire of a recent physics PhD graduate (without a postdoc or other prior teaching experience) is very small.
• Industry is the largest employment base for Physics PhDs…and for Physics Masters…
  …and for Physics Bachelors.
• Physics working in the private sector are:
  - Engineers
  - Computer Scientists
  - Project Managers
  - Research Scientists
  - Patent Lawyers
  - Wall Street Financiers…

Why call what most Physicists actually do “non-traditional”?
Other Ways APS Can Help

APS Job Board and Job Fairs

Shared database (Physics Today, IEEE Computing, AVS, and others) means that there are hundreds of jobs available on the site right now.

Job Seekers can:

• Search for jobs on the Job Center (totally free).
• Store your resume, cover letters, and other materials in your profile on the site.
• Apply for positions directly through the Job Center.

Panels and Networking Opportunities at APS Meetings

• Career Workshops
• Industrial Careers Workshop at APS March 2013 Meeting
• Graduate Student “Lunch with the Experts”
• Career Panel and Networking Reception
APS Webinars

APS webinars are designed to connect students with information on physics careers, educational programs, and professional development for students, working physicists, and educators.

Monthly broadcasts are free and open to the public.

Topics have included:

- Career Self-Advocacy: How I Got My Six-Figure Salary in the Private Sector (Meghan Anzelc, CNA Insurance)
- Putting your Science to Work (with celebrated career coach Peter Fiske)
- Choosing a Graduate School (with physics professor Peter Collings)
- Careers in Patent Law (with physicist and patent attorney Hey Yeung Cheung)

Visit: go.aps.org/apswebinars
APS Units and Committees You Should Know About

Forum on Graduate Student Affairs (FGSA)
FGSA is led by graduate students, who are amazingly proactive about advocating for graduate students in physics, including careers and professional development activities, information on science policy, and much more
http://www.aps.org/units/fgsa/

Forum on Industrial and Applied Physics (FIAP)
APS Forum representing the Industrial and Applied Physics Community. Also very engaged with FGSA and CCPD to bring more information on these career paths to students and early career physicists.
http://www.aps.org/units/fiap/

Committee on Careers and Professional Development (CCPD)
APS Committee dedicated to developing career information and professional development support to all APS Members and the general physics community.
http://www.aps.org/about/governance/committees/ccpd/
The APS Career Website is the gateway to physics career resources. Here you can find links to the APS Job Center, Webinars, information on upcoming workshops and meetings, career advice, and other career and job related resources.

www.aps.org/careers
Remember:

A limited number of faculty jobs does not translate to “a limited number of jobs.”

Success Means Planning Effectively by Broadening Your Focus…

– Examine your skills and interests, as well as your lifestyle goals.
– Learn as much as you can about different career paths.
– Build your network to maximize the effectiveness of your search.
– Seek out experiences that will give you marketable skills in your fields of interest.

…and by starting the process early!

Questions? Comments?
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