



Physics Careers: the Myths, the Data, and Tips for Success

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A little bit about me...

- UCLA – undergraduate degree
- University of Michigan – PhD in Physics
 - Student org involvement
 - Student government involvement
 - APS Volunteer
- Got my current job at APS through networking!

A little bit about you?

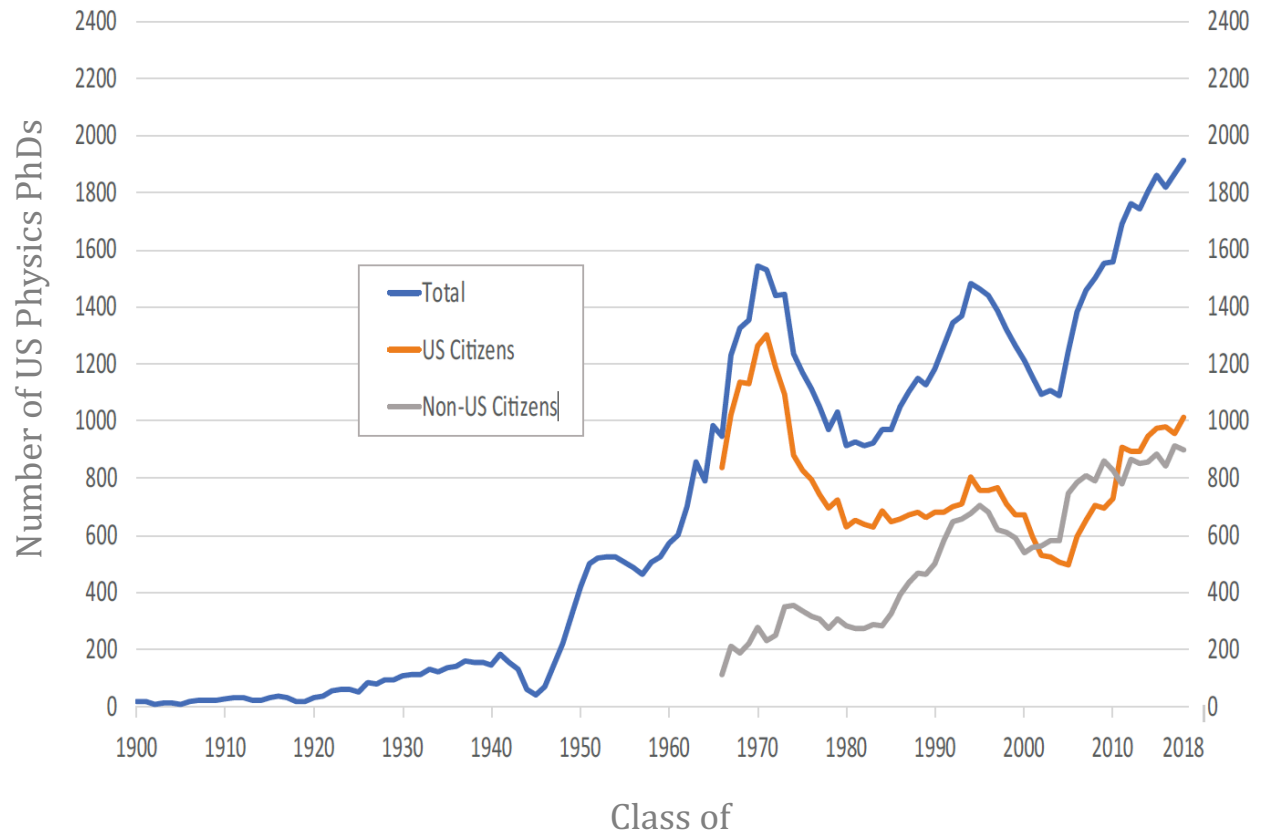
- How many are
 - Undergraduates?
 - Graduate Students?
 - Postdocs?
 - Faculty?
 - Other?

Outline of Talk

- Some Statistics
 - Number of physics degree holders
 - Career paths of degree holders
 - Academic careers outlook
 - Industry careers outlook
- What you can do to prepare (Students/Early Career)
- How can you help (Faculty/Mentors)
- Questions

How many PhDs are there?

The number of Physics PhDs granted in the U.S. has almost doubled over the last two decades!



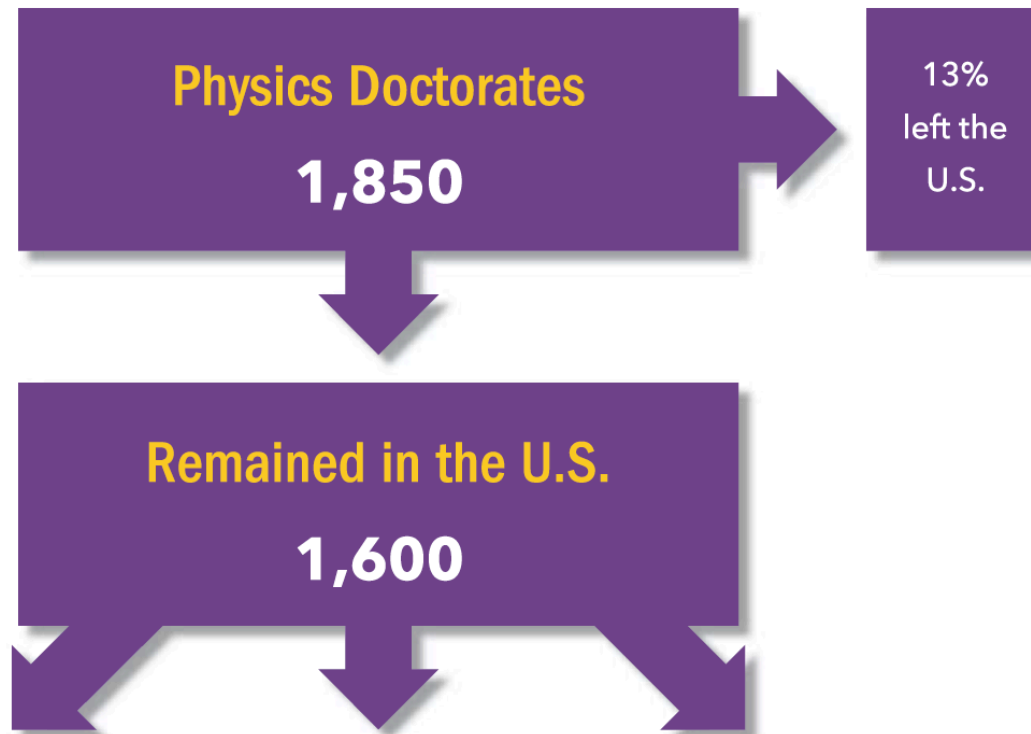
Sources: ACE (1900-1919), NAS (1920-1961), AIP (1962-2018)

AIP | Statistics

aip.org/statistics

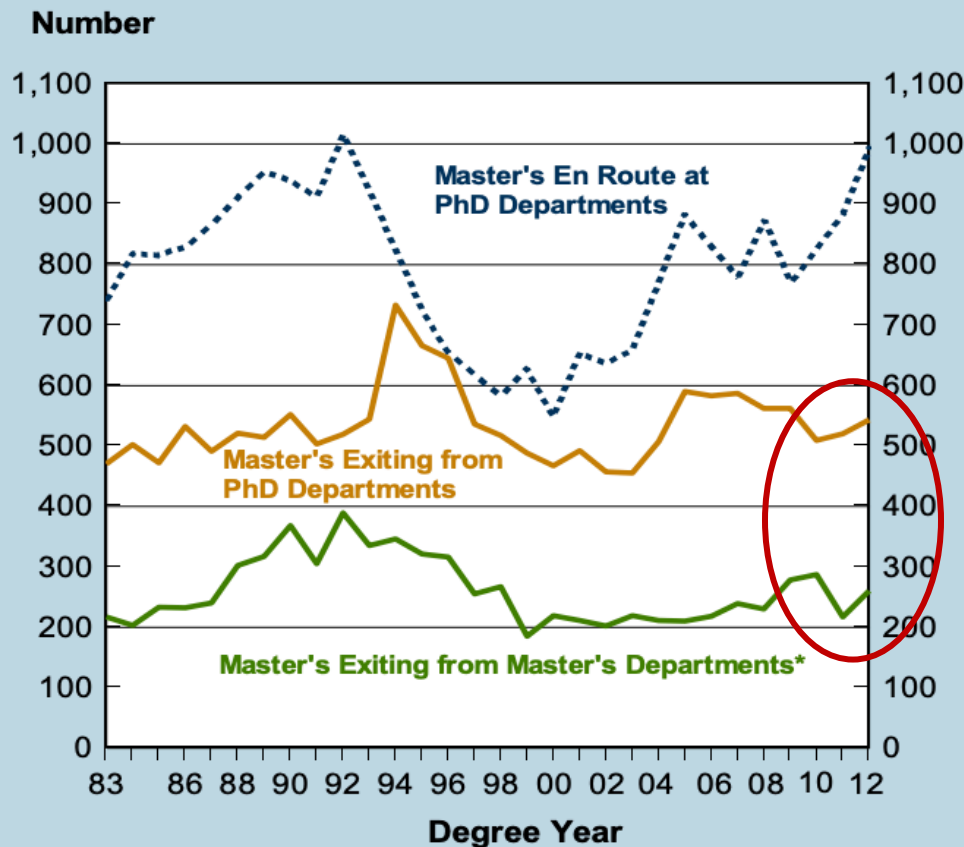
How many PhDs are there?

2015-2016 graduates: 1 year after PhD



~1600 Physics PhDs go into the job market every year

How many Physics Masters are there?



Additionally, of
~700 new Physics
Master's holders,
>300 also look for
jobs (or continue
employment)
every year

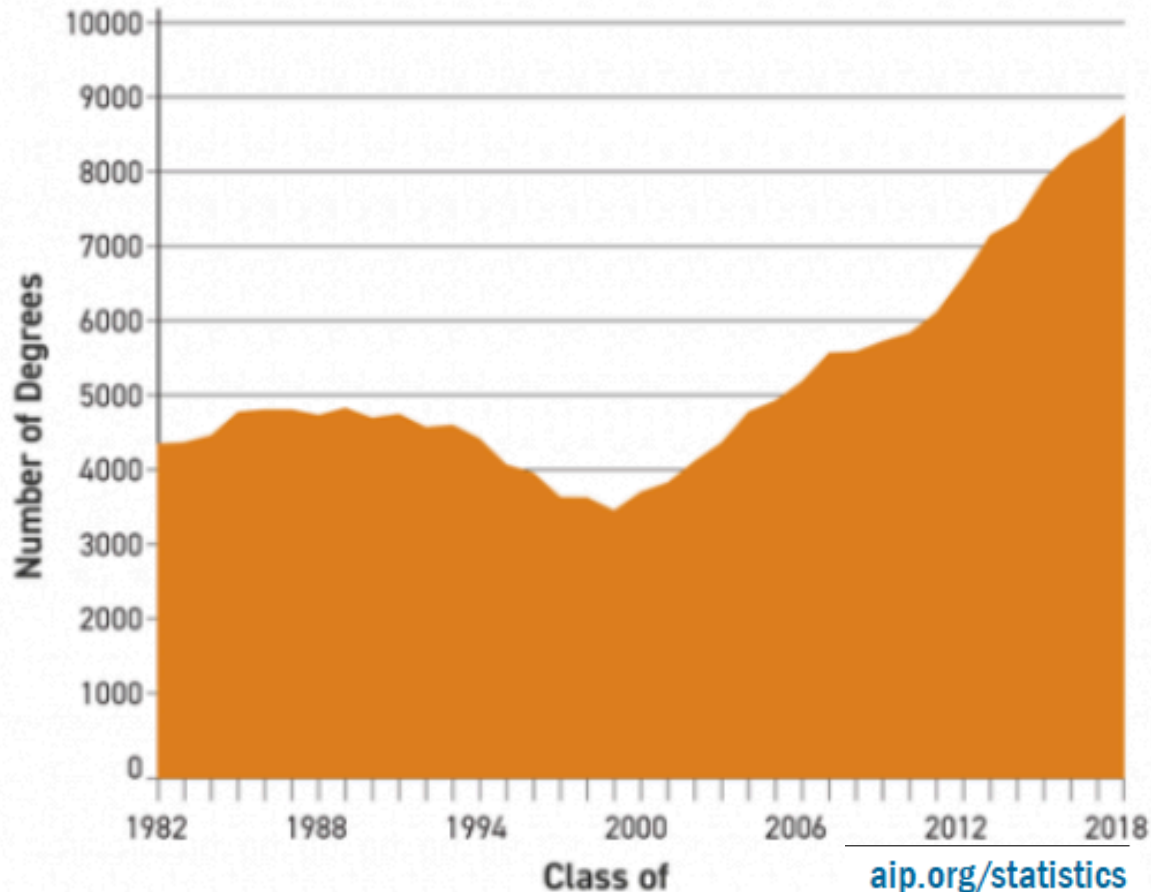
*These departments offer a master's as their highest physics degree.

<http://www.aip.org/statistics>

How many physics Bachelor's Degrees are earned each year?

>8500 Physics Bachelor's degrees are awarded annually

About half go straight into the workforce



Supply

~1600 Physics PhDs

~300 Physics Masters

~4250 Physics Bachelors

→ All entering work force

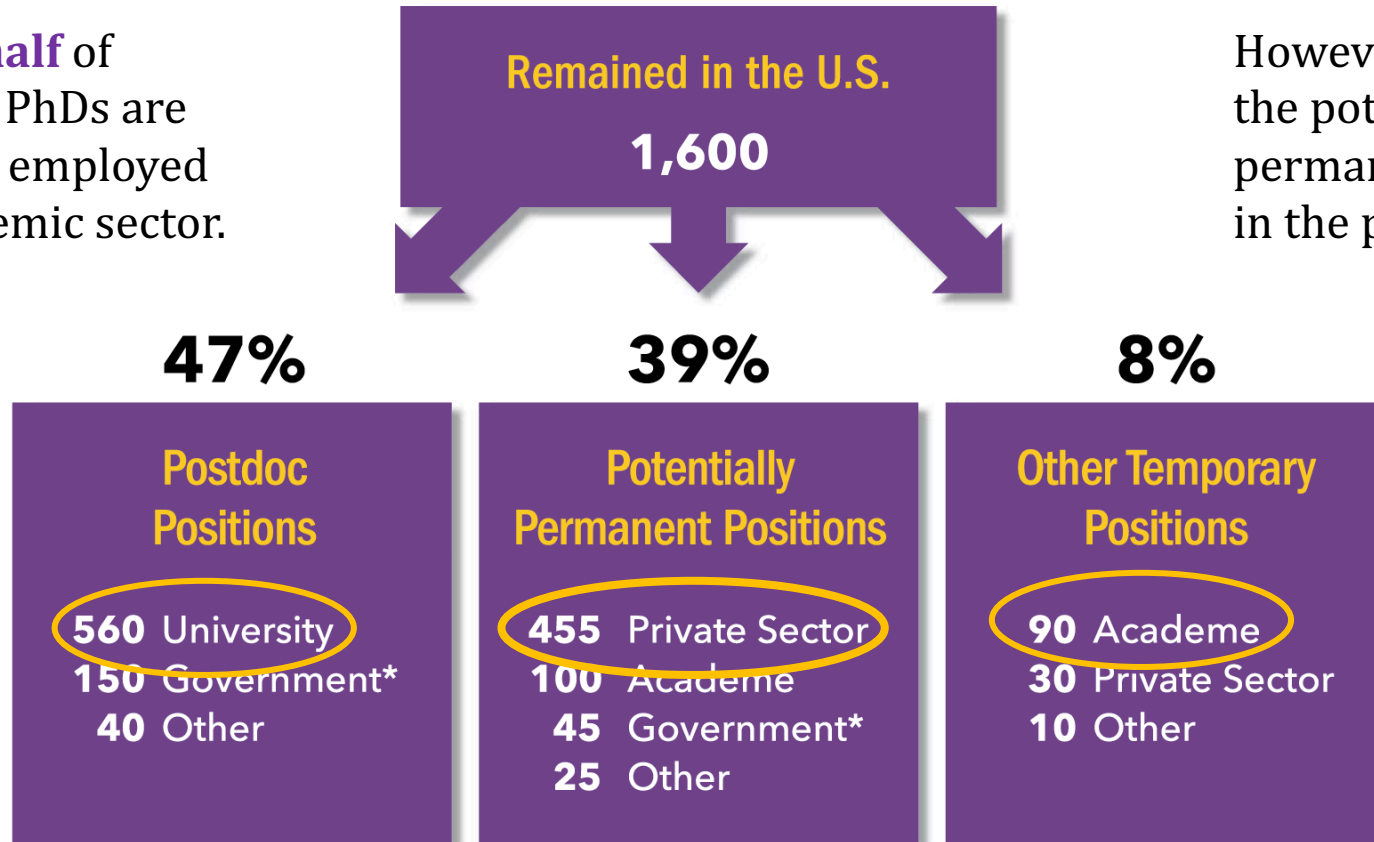
What is the demand?
Where is the demand?

What are they doing (PhDs)?

2015-2016 graduates: 1 year after PhD

About **half** of Physics PhDs are initially employed in academic sector.

However, ~**73%** of the potentially permanent jobs were in the private sector.



6% of those in the U.S. were unemployed the winter after receiving their degrees.
<1% of those in the U.S. were not employed and not seeking employment.

What are they doing (PhDs)?



Education

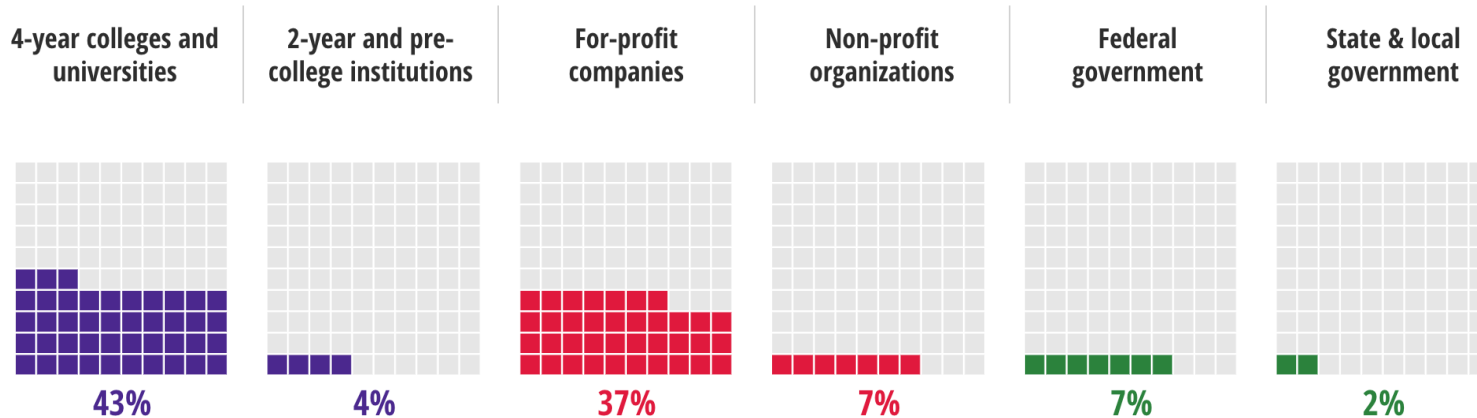


Business

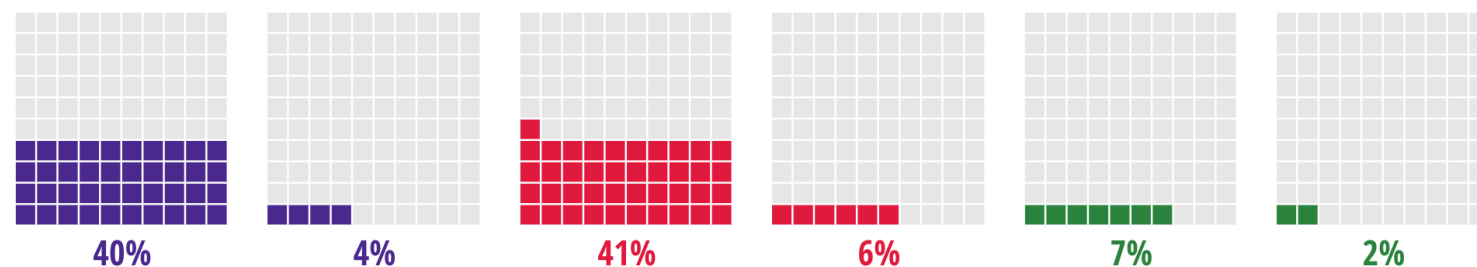


Government

10 - 14 years
since receiving degree



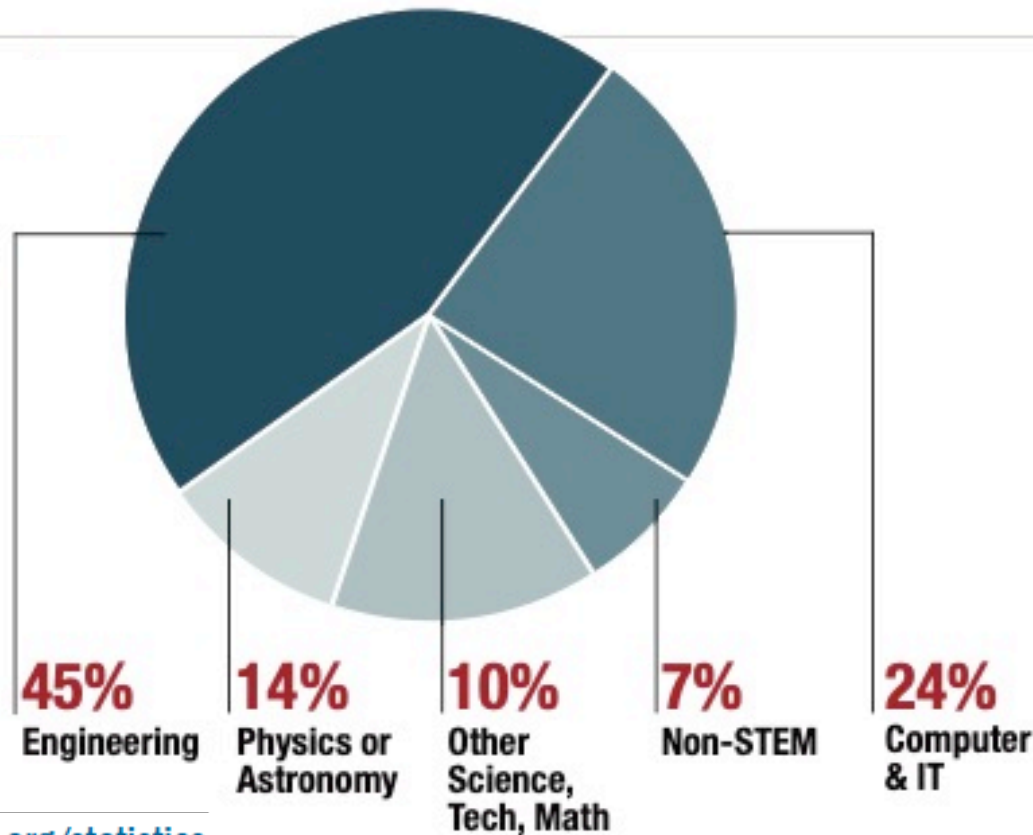
15+ years
since receiving degree



Source: NSF Survey of Doctoral Recipients, 2001 - 2013

What are they doing (Master's)?

Employer Distribution of Exiting Masters One Year After Degree, Classes of 2012, 2013, & 2014 Combined

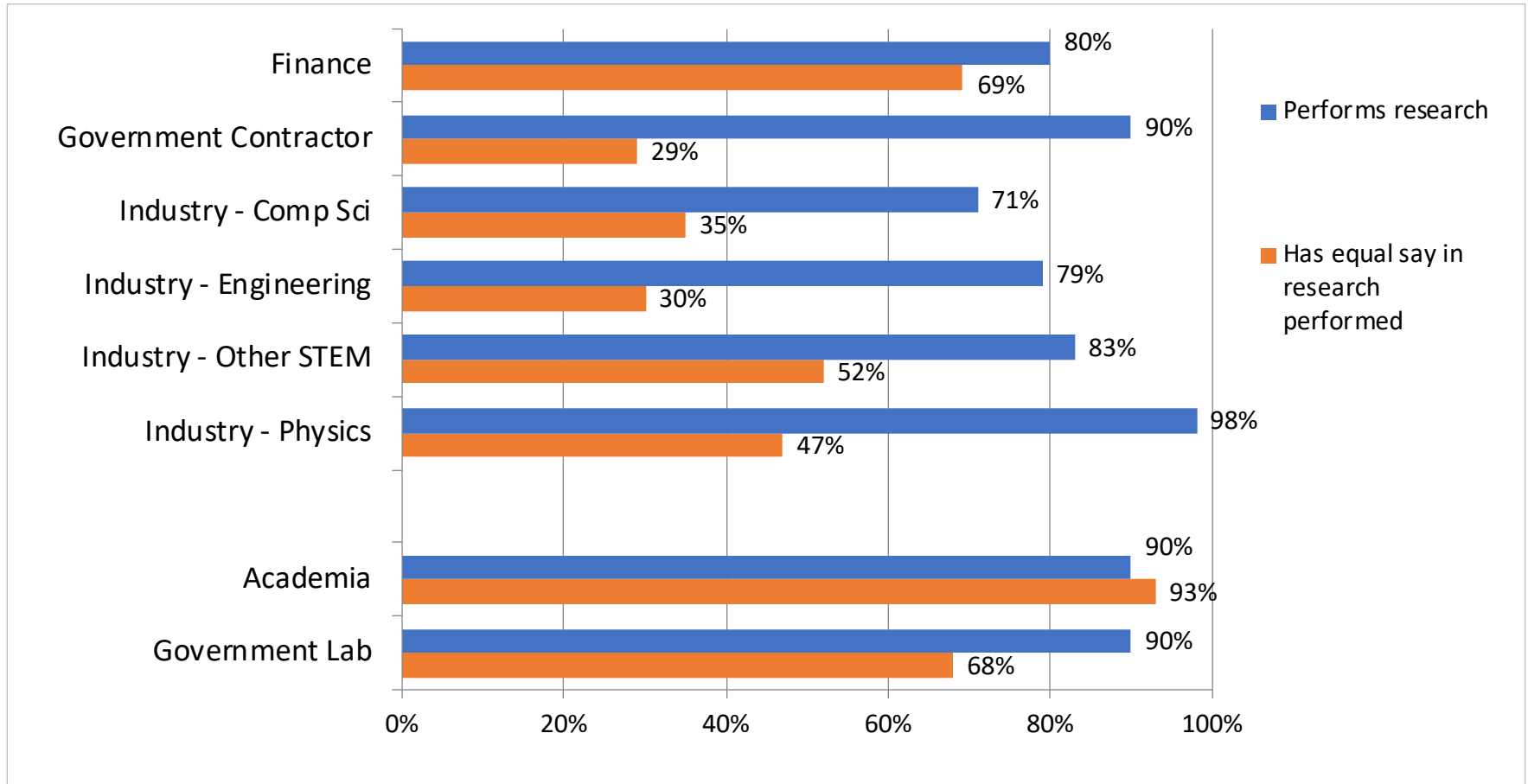


aip.org/statistics

The majority of Master's students also go in the private sector. Only **~19%** find jobs in academia.

A physics Master's opens doors to a variety of different career paths.

What are they (PhD and MS) doing?



Source: AIP Statistical Research Center Report Common Careers of Physics PhDs in the Private Sector, June 2015



RESEARCH!

What are they (BS & BA) doing?

Physics Bachelors One Year Later

8,800 Recent Degree
Recipients
(2017 & 2018)

About **half** go
straight into
the workforce

Workforce

52%

	Percent
Private Sector	32
College & University	4
High School Teaching	3
Active Military	3
Government	3
Other	2
Unemployed, Seeking	5

Graduate Study
Astronomy or
Physics

29%

	Percent
Physics	25
Astronomy	4

Graduate Study
Other Fields

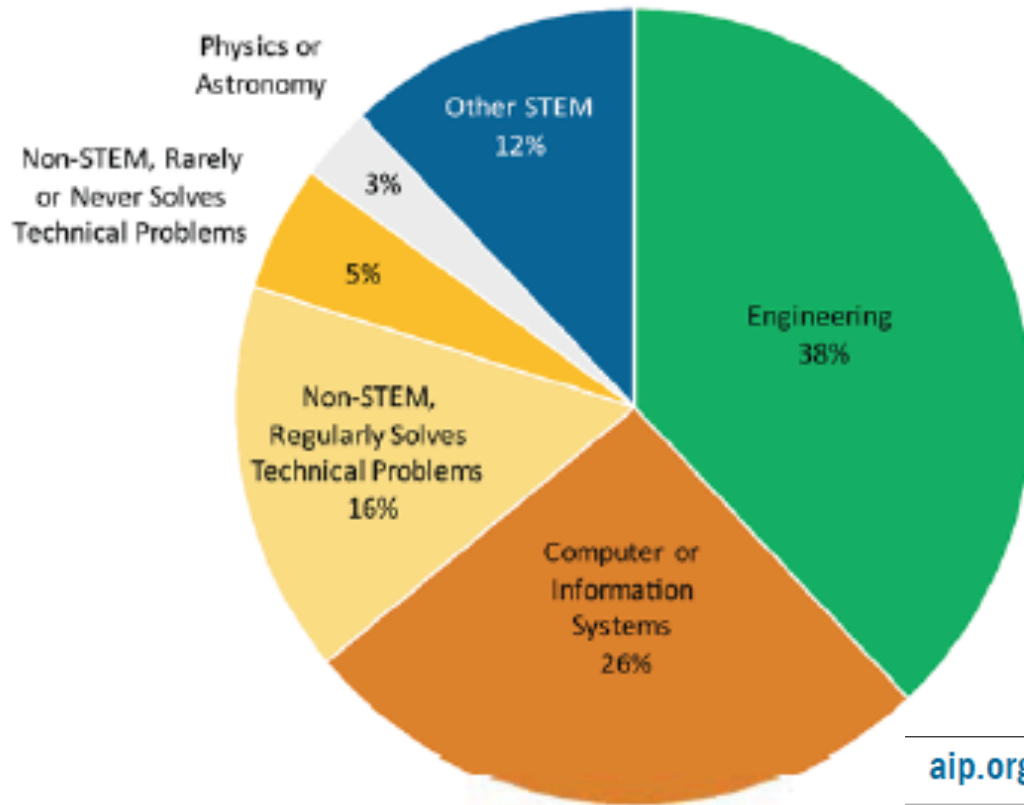
19%

	Percent
Engineering	9
Other Science & Math	5
Education	2
Other	3

aip.org/statistics

What are they (BS & BA) doing?

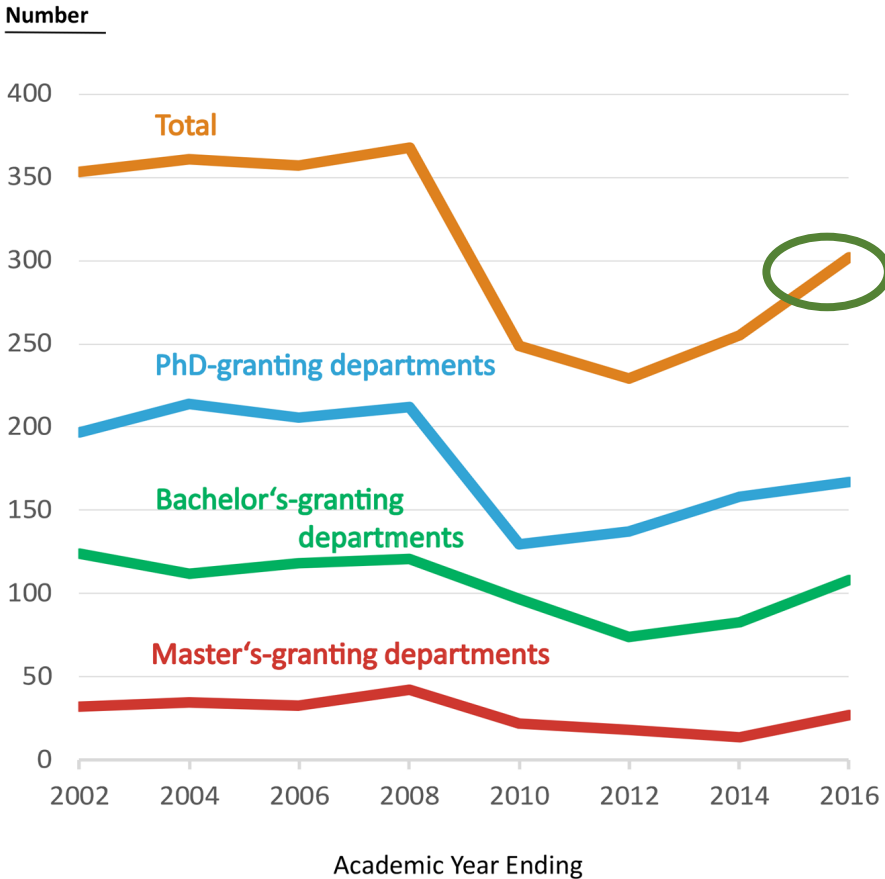
Field of Employment for New Physics Bachelors in the Private Sector,
Classes of 2017 & 2018 Combined



Majority
working in
STEM or
related fields

Number of Faculty Hired by Physics Departments

Tenured and Tenure-Track Positions Only



• The noticeable drop from 2008 to 2010 is likely due to the 2008 recession.

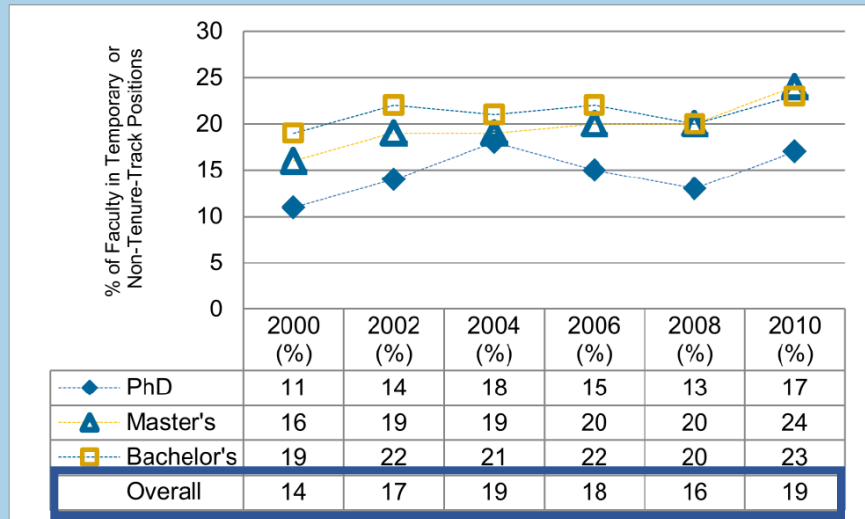
Typically, **~19%** of faculty positions were temporary or non-tenure-track.

Academic sector demand

About **~300** new hires (2016 data)

Recall: **~1600** PhDs looking for jobs every year

Percent of Full-Time Equivalent Physics Faculty Members Employed in Temporary or Non-Tenure-Track Positions By Highest Degree Awarded



<http://www.aip.org/statistics>

Industry demand



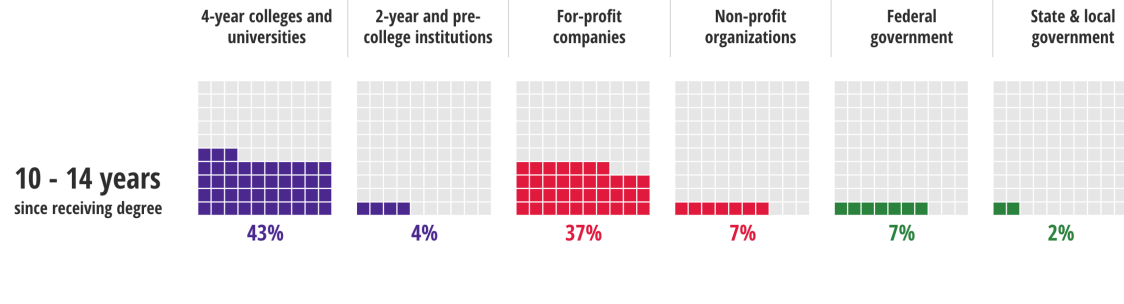
Education



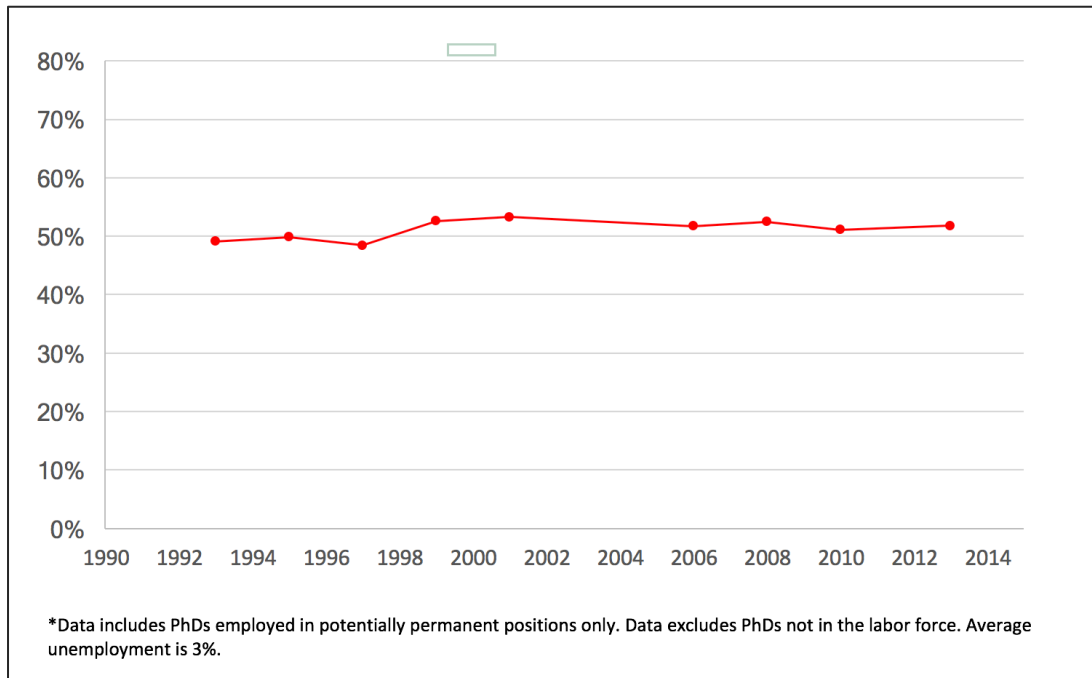
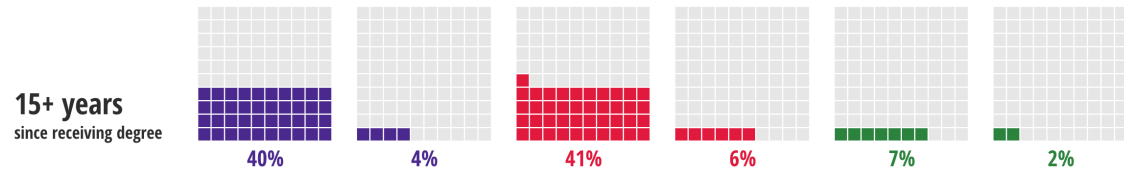
Business



Government



Percentage of Physics PhDs* Employed in the Private Sector



Source: NSF Survey of Doctoral Recipients, 2001 - 2013

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

Industry Demand

Employers in STEM fields value physics graduates in their companies as members of interdisciplinary teams

Over 80% of surveyed employers¹ agreed that physics majors:

- Could easily grasp new knowledge and concepts
- Were able to identify, formulate, and solve problems
- Were able to successfully analyze and interpret data
- Could engage in *continued* learning and problem solving

¹ABET Survey of applied and engineering physics graduates, Kettering University

Industry Demand

What else do STEM employers say?

That physics graduates are also missing important training and experience:

- Designing a system, component or process to meet a specific need⁵
- Working on multi-disciplinary teams^{2,3}
- Recognizing value of diverse relationships (customers, supervisors, etc.)⁵
- Leadership Skills⁵
- Communication skills (oral and written) – especially how to tailor message to audience⁵
- Real-world experience in companies before graduation⁶

²ABET survey of applied and engineering physics graduates, Kettering University

³APS Workshop on Nat'l. Issues in Industrial Physics

Bottom Line

Majority of physics degree holders at all levels (Bachelors, Masters, and PhD's) find jobs in industry.

Good news: The private sector has a **high demand** for physics degree holders.

Less good (but still good) news: However, there are some things you can do to **better prepare** for your career.

How can you start preparing?

Look Inwards/Reflect



Perform a detailed self-assessment

- Includes what you are good at doing *and what you enjoy doing*. **Values are important!**
- Where do I want to be in 1 year? 5 years?

Keep a Career Journal

- Track insights, **contacts**, skills.
- **What is important to you?**
 - Work-life balance? Money? Location?
 - Flexible schedule? Control over research?

Document Skills

- Record your skills – technical and non-technical. These will be the **building blocks of every resume** you'll write.
- Identify missing skills and make a plan for acquiring them.

How can you start preparing?

Use Resources

APS Online Professional Guidebook

- Detailed advice on key aspects of career development.
- Features 5-minute “webinette” clips from the top APS careers webinars
- Topics include self-assessment, networking, interviewing and negotiation strategies, and more.

go.aps.org/physicspdguide

APS Careers Website

- APS Job Board
- Physicist Profiles and Common Career Paths
- New Professional Development Webinar Series (coming this summer!)

www.aps.org/careers

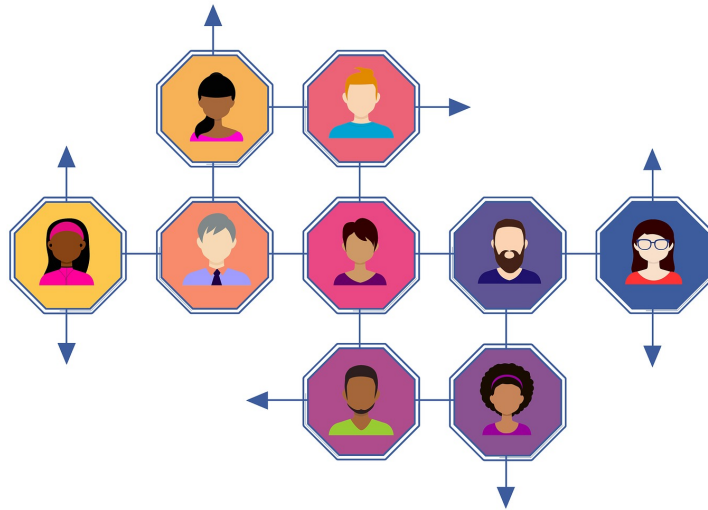


How can you start preparing?

Expand your career contacts

Build Your Network

- Join LinkedIn
 - Your network will grow automatically!
- Attend events
 - Alumni mixers, career fairs, conferences
- Volunteer or Job Shadow



Find Career Mentors

- Join the APS IMPACT program
- Some mentors are **ADVOCATES**
 - Know you personally
 - Sounding board and mentor
 - Likely family/friend
- Some mentors are **CONNECTORS**
 - Has various professional contacts
 - Willing to connect you
 - Likely alumni or advisors
- Some mentors are **EXPERTS**
 - Have experience in specific industry
 - Can give advice relevant to their area

How can you start preparing?

Expand your career contacts

Attend Informational Interviews

- Reach out to contacts and ask for a 20-minute phone chat
- Here, *you* get to ask the questions!
 - Ask about their career path
 - Ask about their typical work day
 - Ask aspects of job they like or dislike
 - Ask how you can get involved
- Don't ask for a job!



Develop a Pitch

- Short introduction to you
 - 30 sec to 1 minute
 - Make it a conversation, don't list facts
- Use present, past, future format
 - I am _____. I have worked on _____. I'm looking for opportunities to _____.
- Be prepared to answer questions, such as:
 - Why are you passionate about?
 - Why do you want to learn more about?
 - Why do you feel you are good at....?

What Can Faculty/Mentors Do?

Broaden Your Students' Career Focus

- Invite speakers from private sector, national labs (high school physics teachers, medical physicists, data scientists...)
- **Normalize industrial careers** – the vast majority of your students will have them!

Encourage More Industry Contact/Mentorship

- APS IMPact Program – industry mentoring for physicists: **impact.aps.org**
- LinkedIn®
Connect with your students now, and you'll be connected with industrial physicists in the future!

Evolve physics teaching to incorporate more workforce-relevant experiences/knowledge!

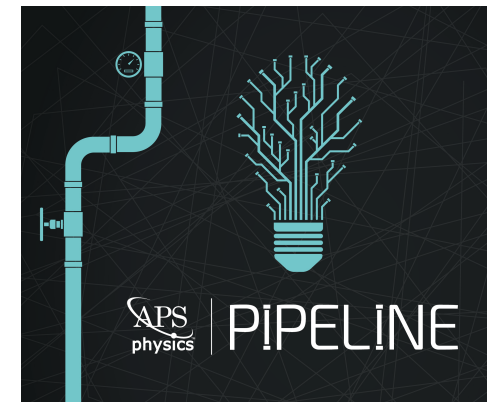
Experiences, courses, and research opportunities which:

- Explicitly **connect physics concepts with their real world applications**.
- Utilize physics principles to **create innovative solutions** to real world problems.
- Include **content relevant for careers in the private sector**, such as communicating to audience, intellectual property, private and public funding sources, business models, budgeting, etc.

= “Physics Innovation and Entrepreneurship Education (PIE)”

APS PIPELINE Program*

- APS PIPELINE Program (Loyola University Maryland, Rochester Institute of Technology, Wright State University, UC Denver, and George Washington University).
- Advised by experts from established physics entrepreneurship programs (e.g. Carthage College, Case Western, Kettering University)
- Goals are to develop curricula, best practices, and research instruments for teaching physics innovation and entrepreneurship (PIE).



*Support for this work provided by the National Science Foundation's Improving Undergraduate STEM Education (IUSE) program under Award No. 1624882

Approaches under development include:

- Experiential learning/“maker” spaces (e.g. the *Innovation Hyperlab*)
- Enhanced co-op or internship programs
- New technical entrepreneurship courses, modified existing physics courses
- Pop-up courses
- New courses on communication, IP, business structures, etc.

<http://www.aps.org/programs/education/innovation/>

Summary

- Many physics degree holders enter the job market every year
- Majority find careers in private sector
- You can start preparing now by expanding your network and using APS Resources

Thank you!

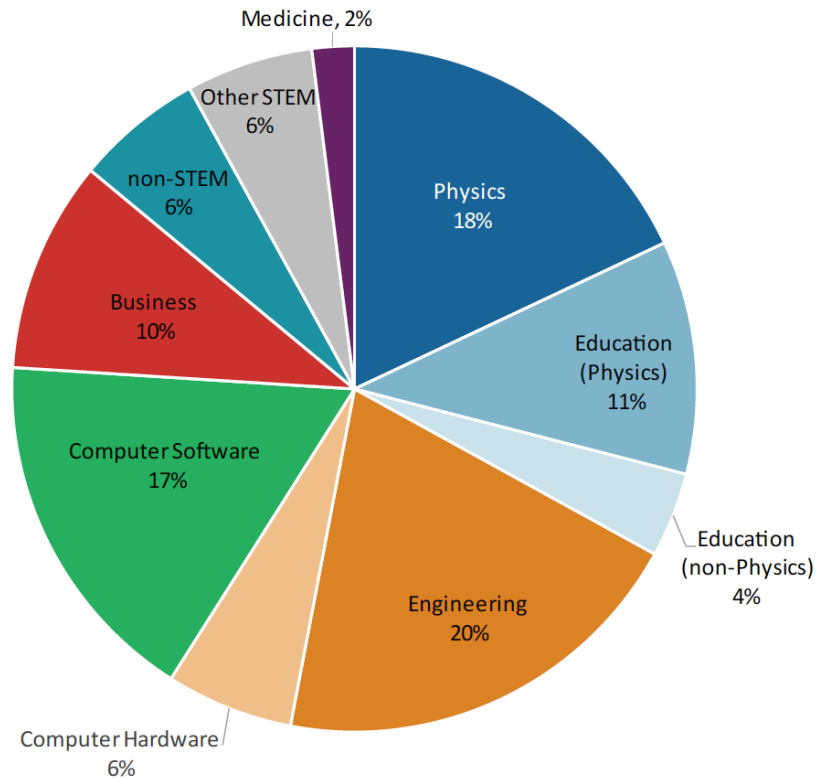
Questions? Comments?

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BACK UP

Who employs physics PhD's?

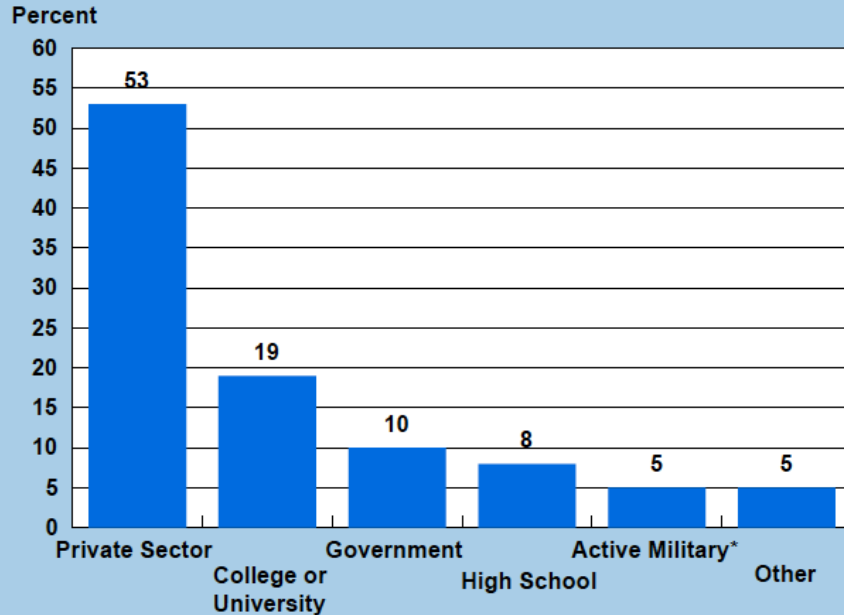
Employment Fields for New Physics PhDs in Potentially Permanent Positions, Classes of 2011 through 2016



Source: AIP Statistical Research Center, Initial Employment Survey, Classes of 2011 through 2016.

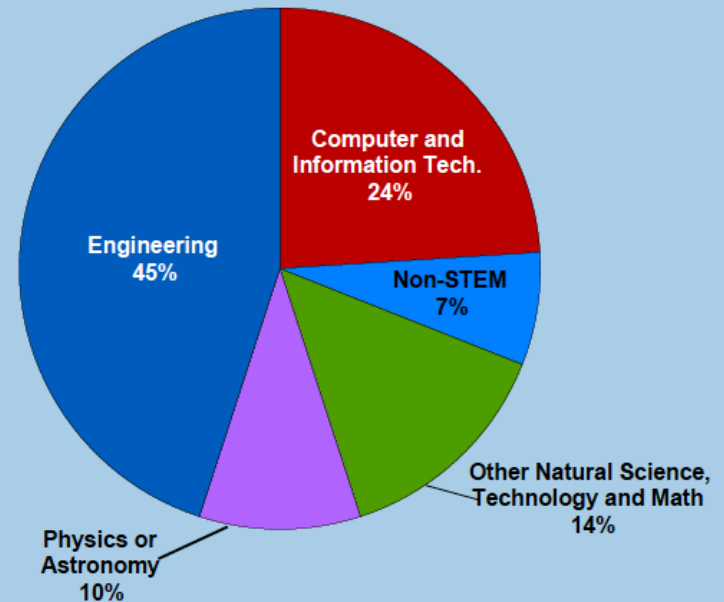
What are they doing (Master's)?

Employer Distribution of Exiting Physics Masters One Year After Degree, Classes of 2012, 2013, & 2014 Combined.



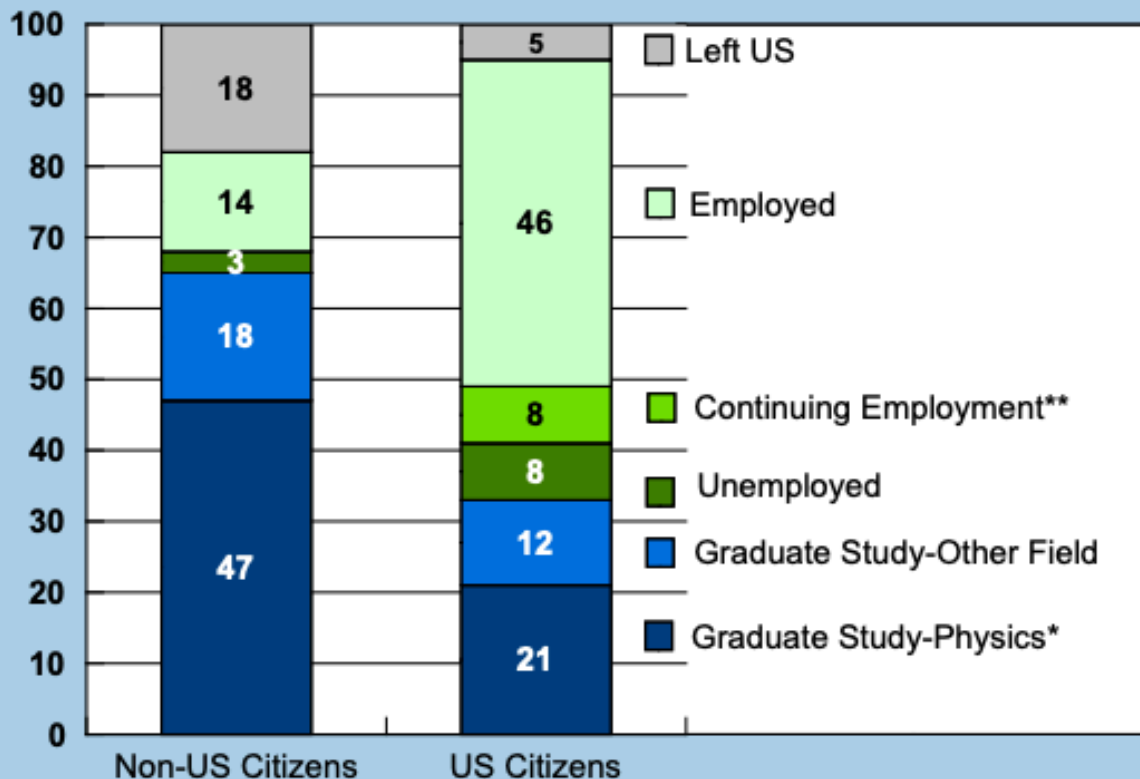
A physics Master's opens doors to a variety of different career paths.

The majority of Master's students also go in the private sector. Only ~19% find jobs in academia.



Status of Exiting Physics Masters by Citizenship One Year After Degree, Classes of 2012, 2013, & 2014 Combined.

Percent



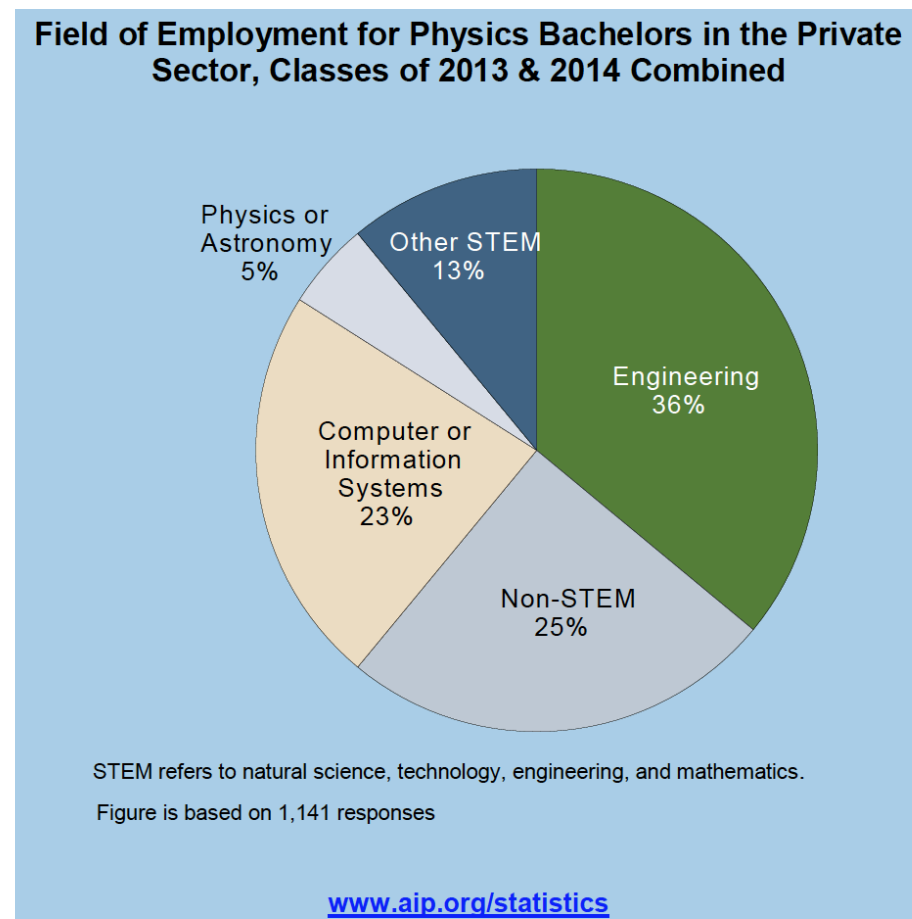
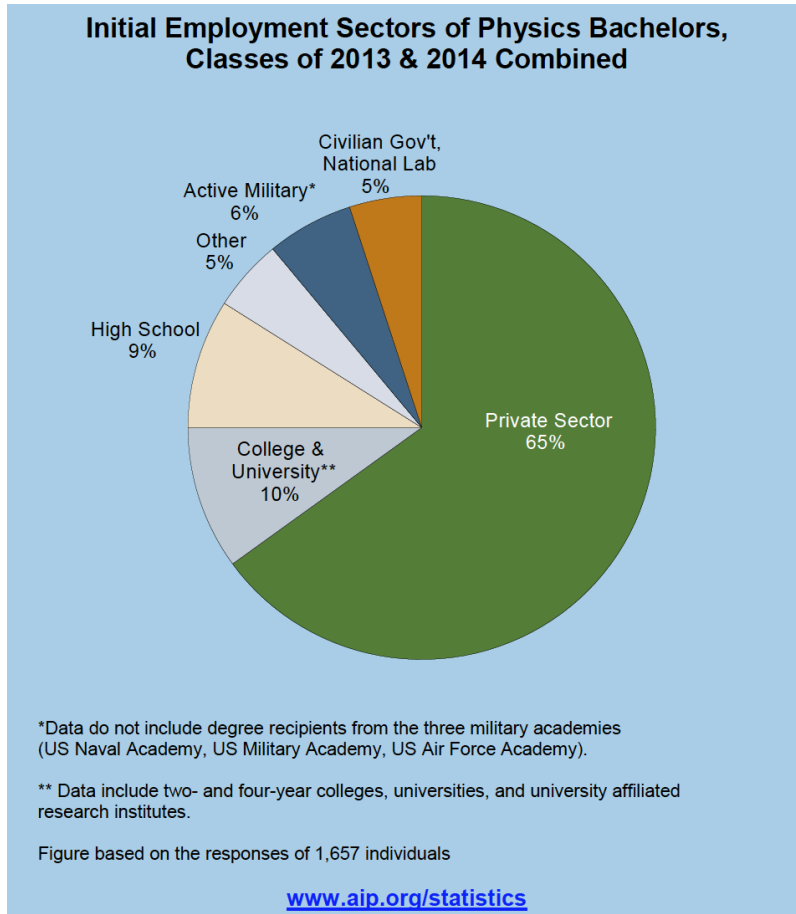
Exiting masters are individuals who, upon receiving their master's degrees, leave their current physics departments. This figure is based on the responses of 210 non-US citizens and 536 US citizens.

*Graduate study-physics: enrolled at a different institution than where master's degree was obtained.

**Continuing employment: individuals who were employed with the same employer for more than a year prior to earning their master's degrees.

What are they doing (Physics Bachelors)?

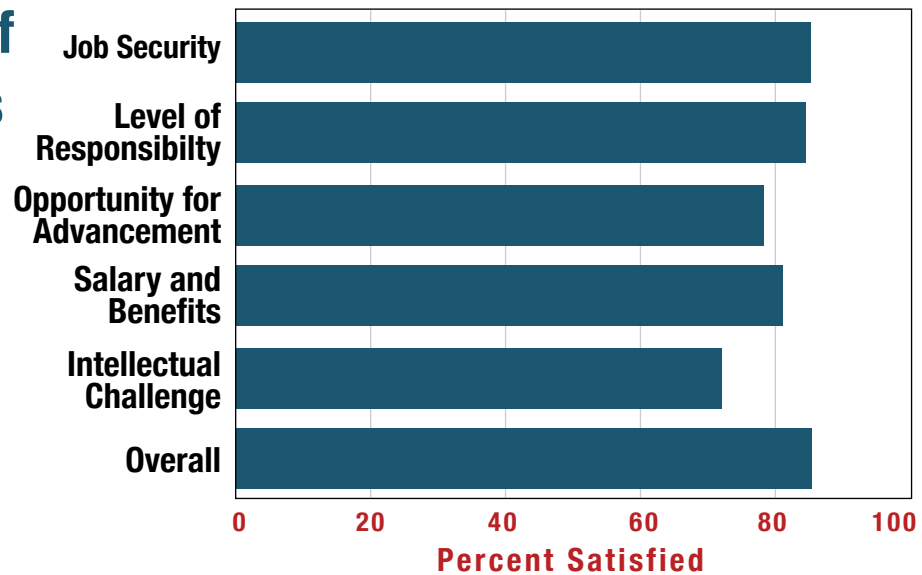
On average between 1995 and 2012, about 40% of physics bachelors went directly into the workforce after graduation.



Bottom line: at all degree paths, the largest initial employment sector for physics graduates is the private sector.

Job Satisfaction of Physics Bachelors In Private Sector STEM Positions (2013 & 2014)

aip.org/statistics



...and they tend to be happy

How much do physics PhDs earn?

Potentially Permanent Positions

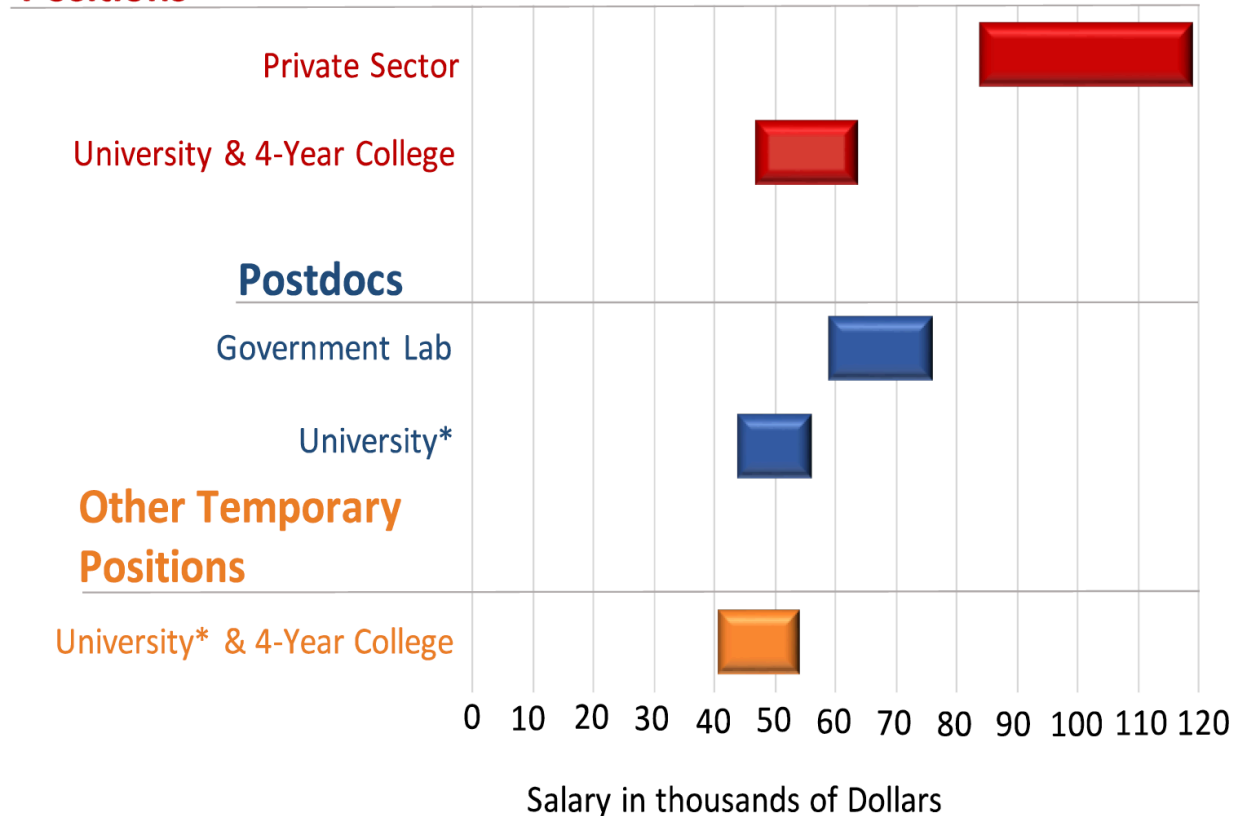
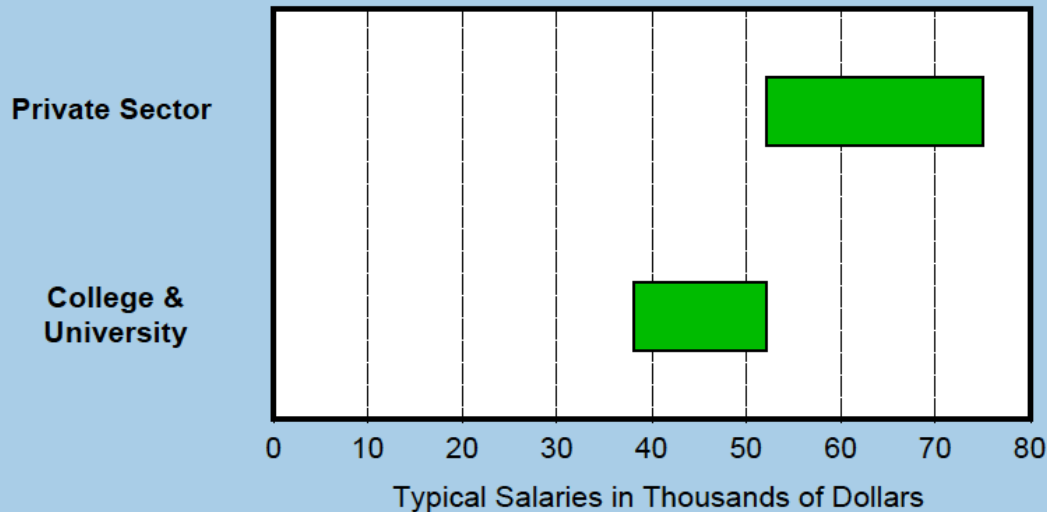


Figure includes only doctorates in full-time, newly accepted positions from the classes of 2015 and 2016 combined. Typical salaries are in the middle 50% i.e, between the 25th and 75th percentiles.

**Typical Starting Salaries of Exiting Physics Masters
One Year after Degree,
Classes 2012, 2013, & 2014 Combined.**

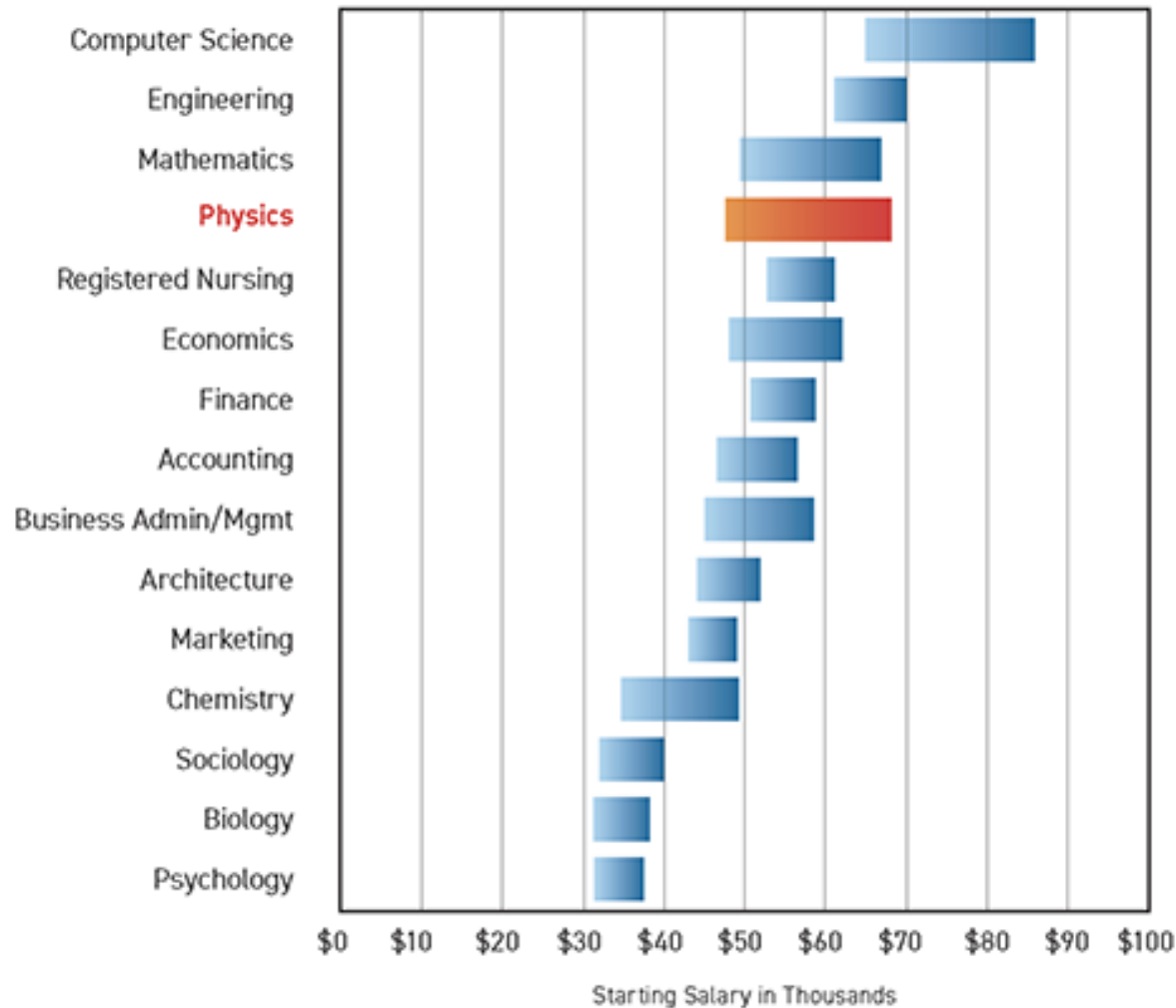


Exiting masters are individuals who, upon receiving their master's degrees, leave their current physics departments.

The graphic represents the middle 50% of reported salaries, i.e., between the 25th and 75th percentiles. Figure does not include salaries for masters holding part-time positions or salaries for respondents who reported starting their employment more than a year prior to earning their master's degree. The College & University category includes two-year colleges, four-year colleges, universities, and university affiliated research institutes. Data are based on 71 private sector salaries and 19 college and university salaries.

How much do physics Bachelor's earn?

Starting Salary for Class of 2018



Academic sector demand

Total Full-time Equivalent (FTE) Faculty Members in Physics
Departments by Highest Degree Awarded, 2012 - 2018.

Highest Physics Degree Offered	Year			
	2012	2014	2016	2018
PhD	5800 (195)	6000 (199)	6000 (202)	5700 (201)
Master's	800 (62)	700 (56)	800 (56)	800 (56)
Bachelor's	2900 (494)	3100 (496)	3100 (492)	2900 (493)
TOTAL	9400 (751)	9800 (751)	9900 (750)	9400 (750)

Number of faculty positions has remained more or less constant over last 7 years.

Between 2006-2008, the average retirement rate for physics faculty was **2.5%**.

Potentially **~380** open positions (06-08 data).

Estimated Retirements and Retirement Rates for Faculty in Physics Departments, 2006-07 and 2007-08 Combined

	Highest Degree Awarded			Overall
	PhD	Master's	Bachelor's	
Estimated Number of Retirements	226	38	114	378
Estimated Percent of Departments with Retirements	42%	26%	11%	20%
Estimated Annual Retirement Rate	2.4%	3.1%	2.4%	2.5%
Number of Faculty	5,400	800	2,900	9,100