

**Is grad school right for me?
If so, how do I get there?**

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CAVEAT

This talk will focus on doctoral study in physics (or astro)

A masters in physics is generally:

- acquired en route to a PhD, especially if you change schools or drop out
- acquired by someone who did not major in physics as an undergrad
- something that does not add many career opportunities to a physics BS

A masters in various flavors of Engineering, Data or Computer Science, Business, etc., is a common path for physics bachelors. You should check with those departments on what they recommend as preparation.

Plan for this afternoon

➤ Why go to grad school? Who goes to grad school?

Overview of National Statistics on Physics BS/PhD

➤ What is Grad School Like? What should an UG do to prepare?

Panel of current UW Grad Students

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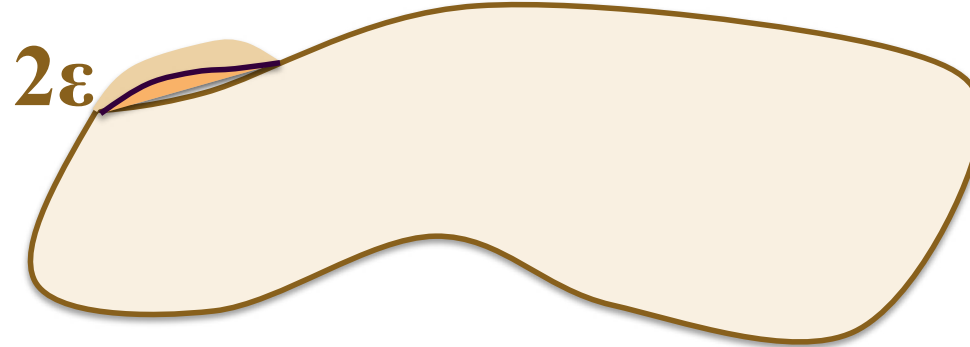
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What is a PhD?

- Take some piece of knowledge about the universe from (frontier $- \epsilon$) to (frontier $+ \epsilon$)



- Start out knowing nothing about a topic, and four years later you are the world expert
- “License to think” – allows you to direct research projects, teach @ college/univ, write grants

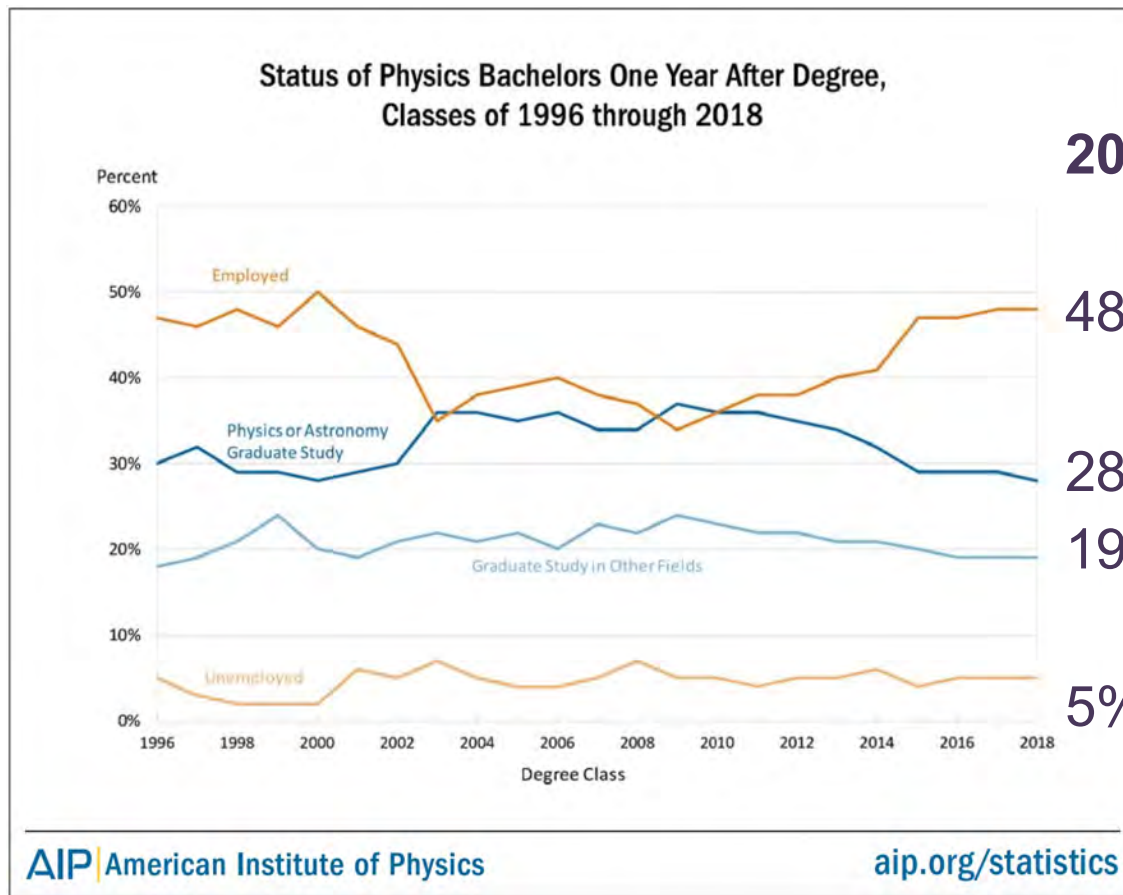
Why Go to Grad School?



- Participate in the excitement of the intellectual frontier
- Deeper understanding of a subject
- Better/different job prospects
- DON'T Drift into graduate school
- DON'T go to grad school just for a student visa

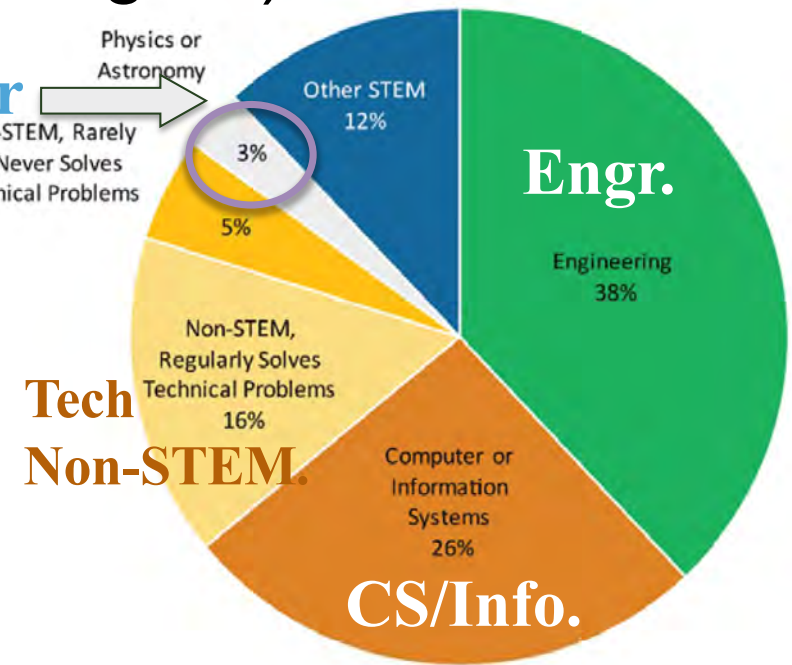
What else could I do?

Trends in initial outcomes of physics bachelor's Classes of 1996 to 2018 (1 year post degree)



Phys/Astr

Physics or
Astronomy
 Non-STEM, Rarely
or Never Solves
Technical Problems



Field of Employment

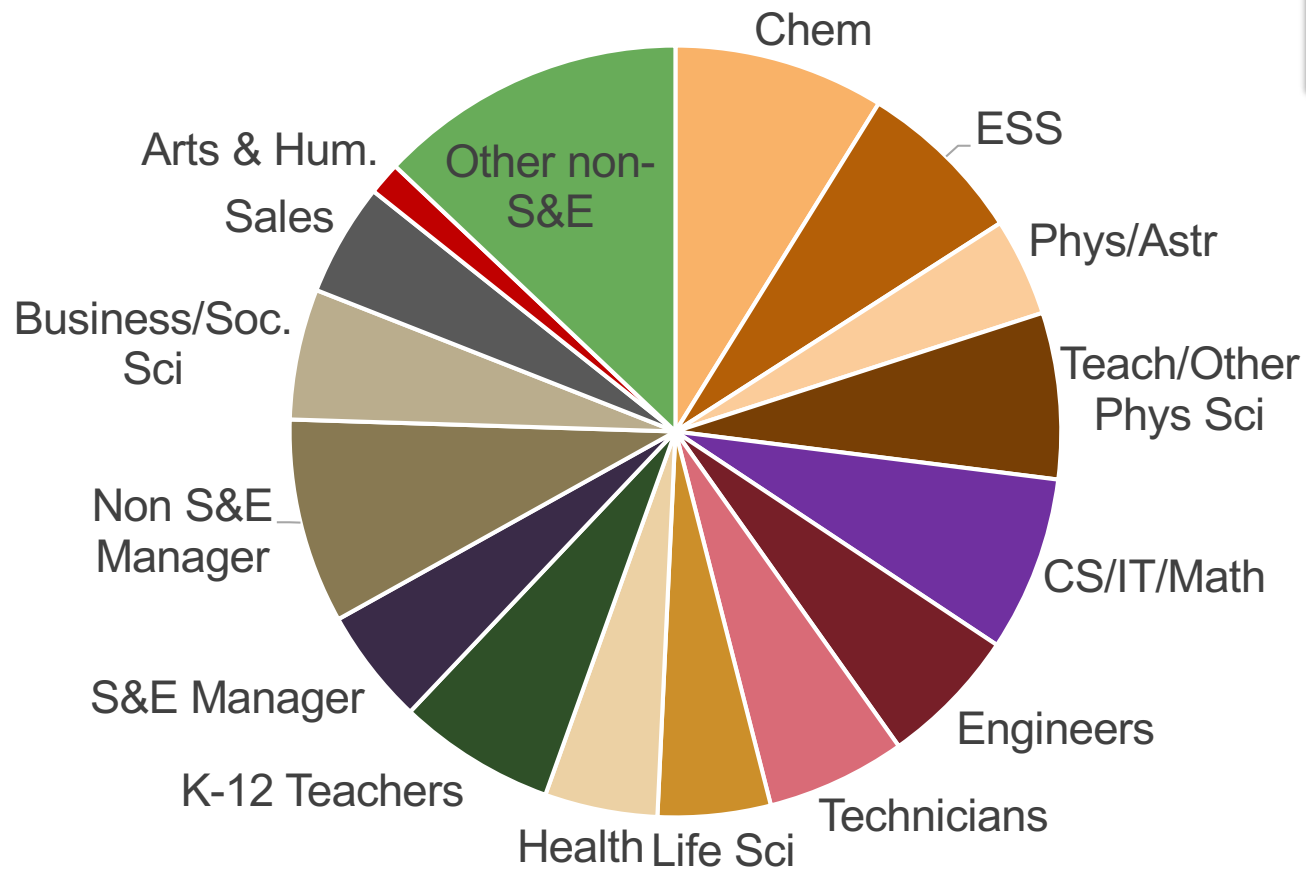
2017/18 data

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

NSF Data on Phys Sci B.S. Careers

NSF Table S3-2. Scientists and engineers, by occupation and degree field: 2017

Occupation of Physical Science Degree Holders



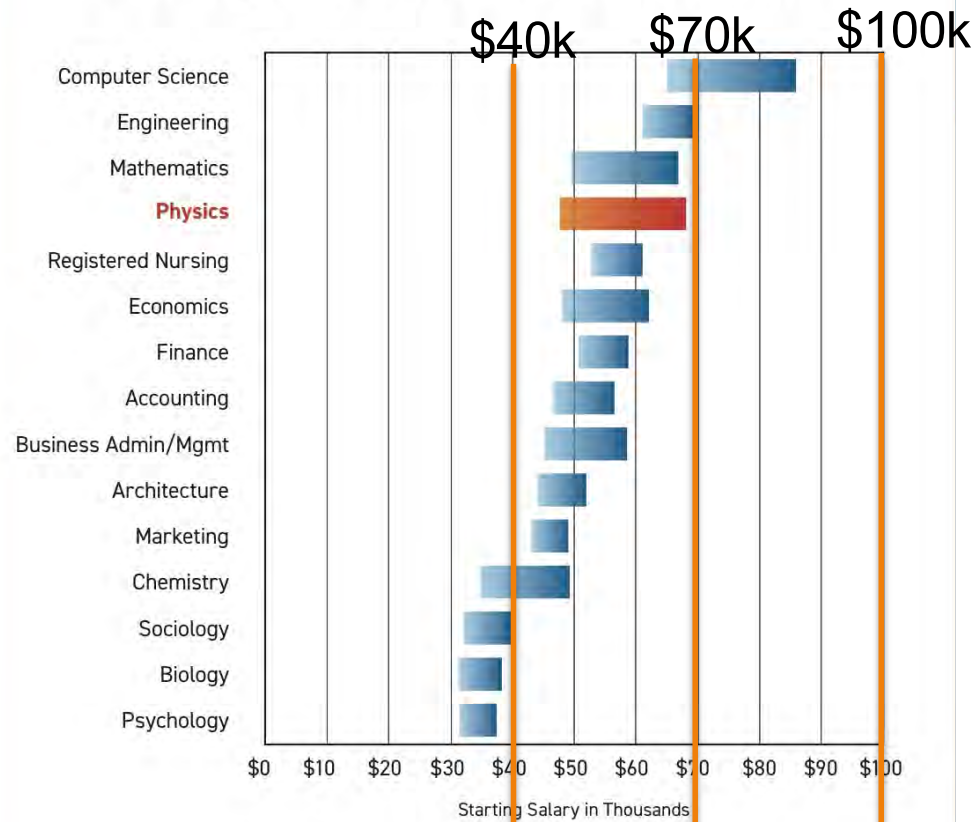
STEM: 45%
STEM-related: 20%
Non-STEM: 35%

Chemists, except biochemists
 Earth scientists, geologists,
 and oceanographers
 Physicists and astronomers
 Other physical and related
 scientists

What might I earn?

What Do New Bachelors Earn?

Starting Salaries for the Class of 2018



Bars represent the middle 50% of salaries, i.e. between the 25th and the 75th percentiles.

Reprinted from the Summer 2019 Salary Survey, with permission of the National Association of Colleges and Employers, copyright holder.

Starting Salaries for New Physics Bachelors, Classes of 2017 & 2018 Combined

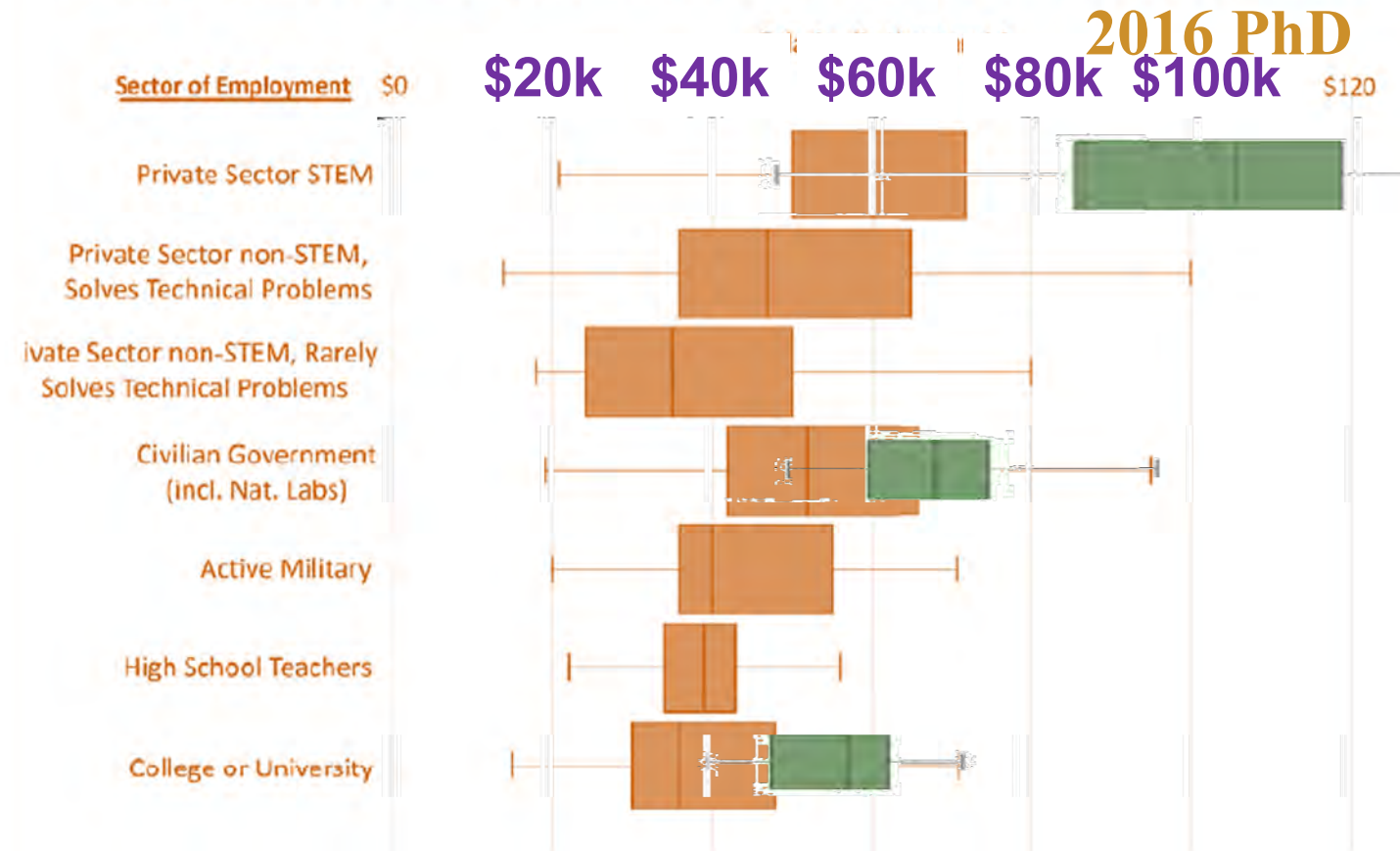
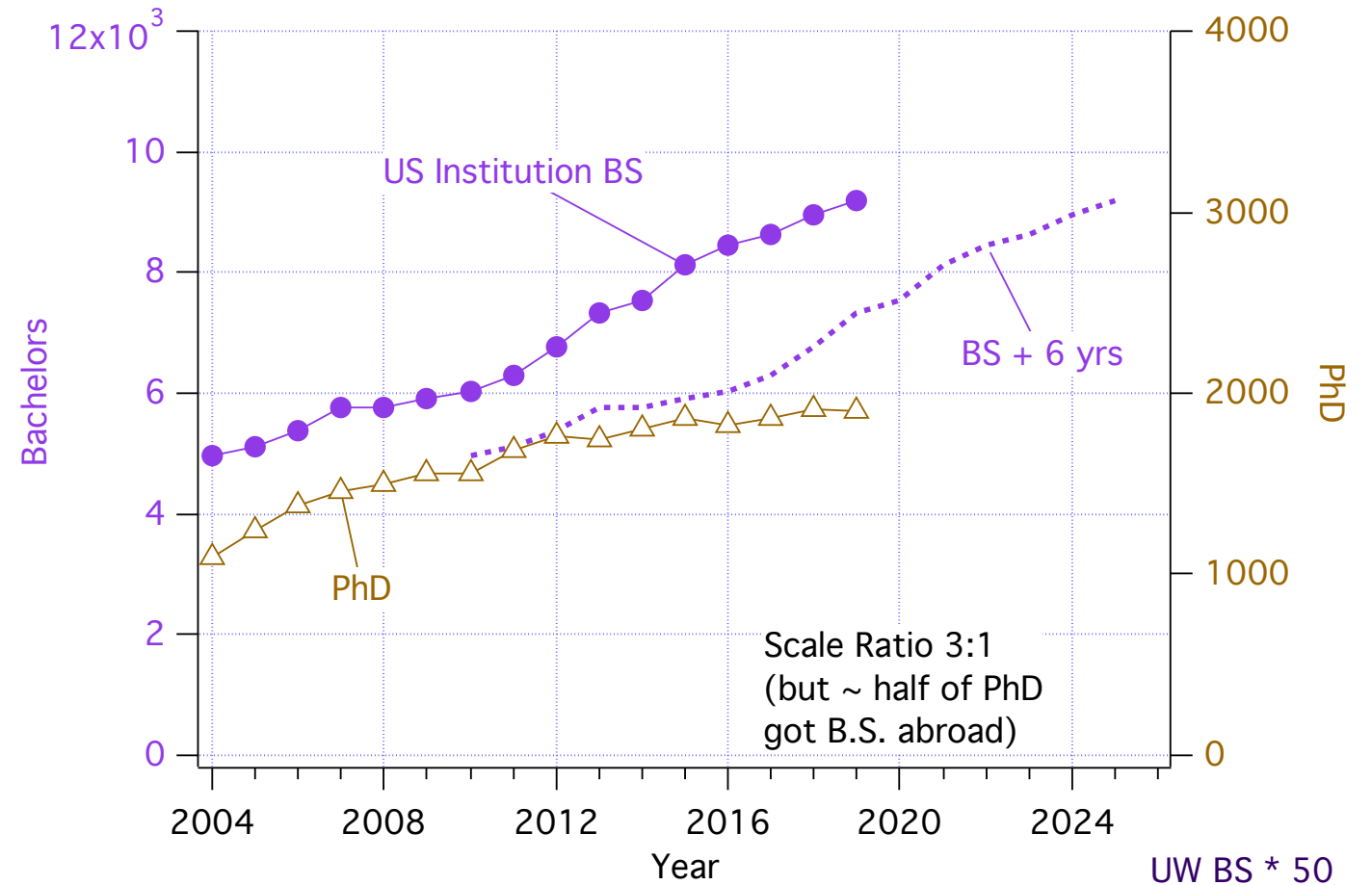


Figure only includes bachelors in full-time, newly accepted positions. The full starting salary range is represented by the lines extending to each side of the box. The box represents the middle 50% (25th to 75th percentile) of the salaries. The vertical line within the box represents the median starting salary for the sector. Solves technical problems refers to respondents who selected "Daily", "Weekly", or "Monthly" on a four-point scale that also included "Rarely or Never" when asked how frequently they solved technical problems in their position.

Who gets a physics PhD?

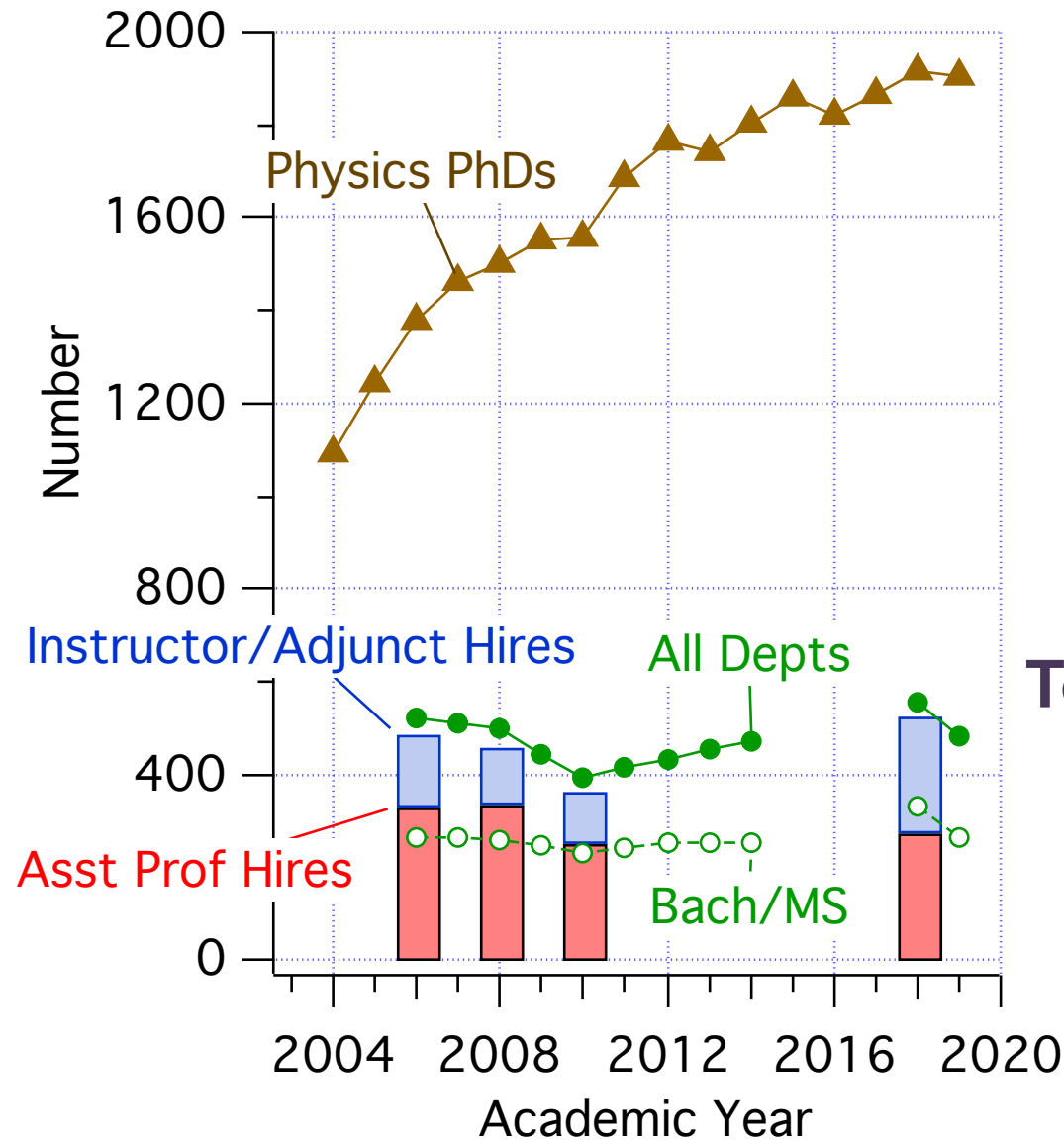
Physics PhD's– 2019 data (N=1903)

- 54% US Citizens
- 20% Female
- 16% of US citizens are non-white
- Median age 29.5 (8% > 35)



PhD curve level while BS still growing

Newly Hired Faculty Growth < PhD



2008 Hire /2004 PhD = 40%
 2010 Hire /2006 PhD = 26%
 2014 Hire /2010 PhD = 30%
 2018 Hire /2014 PhD = 31%

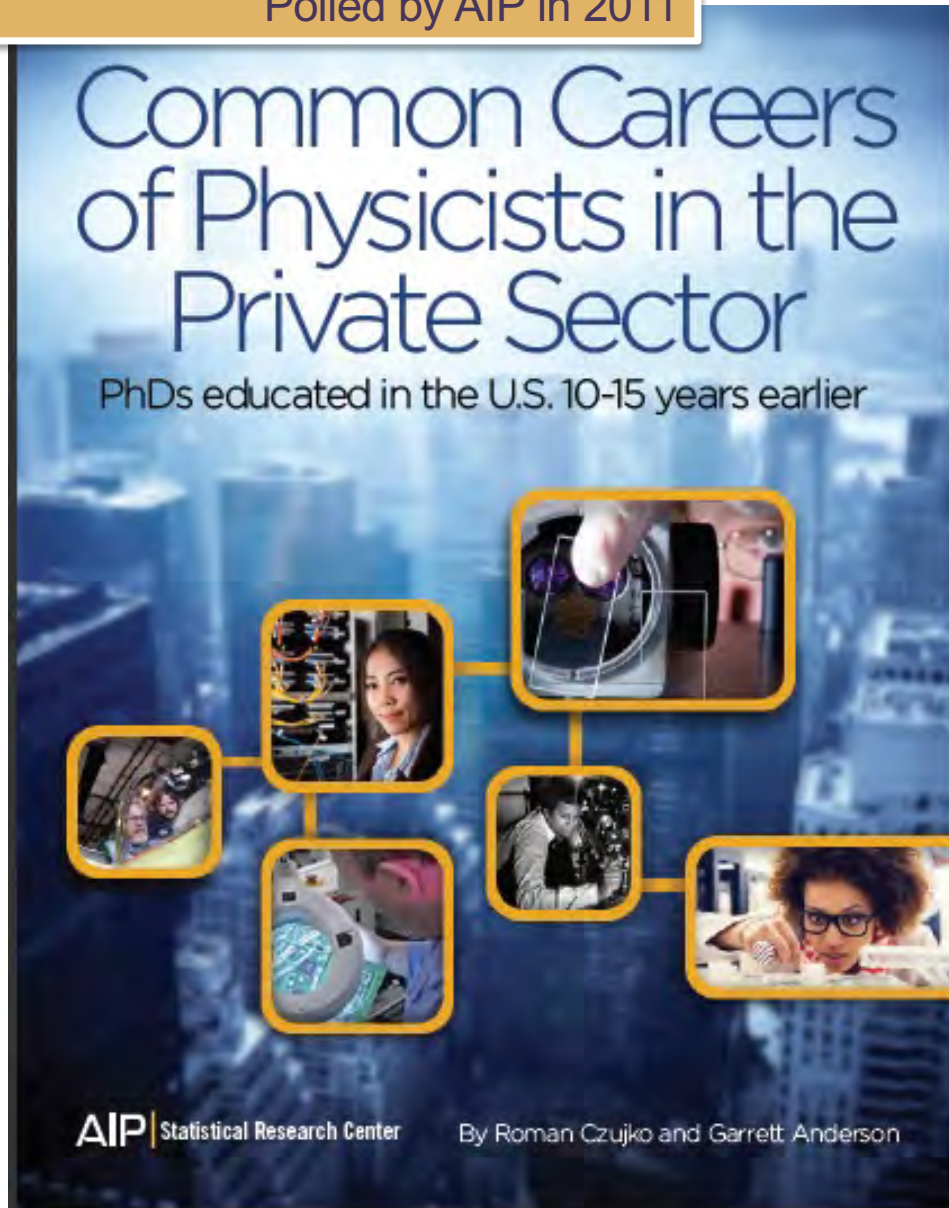
Jobs like mine: → <10%
 General Academic: ~ 30%

Total # Departments ~ Same

	2008	2013	2018
Bachelors	509	497	503
Masters	64	57	57
PhD	189	198	201
Total	762	752	761

What else can I do with a PhD?

Classes of 1996-7 and 2000-2001
Polled by AIP in 2011



- Self-employed
- Finance
- Gov't Contractors
- Health & Medicine
- Industry
 - Engineering
 - Computer Science
 - Physics
 - Other STEM
 - Non-STEM

Most Common Activities:

- solving complex problems
- managing projects
- writing for a technical audience

Keys to PhD Career Success

10 most common answers

- Hard work
- Problem-solving skills
- Interpersonal skills
- Persistence
- Education experience
- Supportive mentors
- Previous experience in certain fields
- Supportive colleagues and collaborations
- Flexibility in job fields, positions, or tasks
- Passion for work

Questions on Why go to Grad School?

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Graduate Student Panel

- **Rithi Anandwade** 1st year
University of Il Urbana-Champaign
- **Sam Borden** 2nd year
Yale University
- **Charles Cardot** 1st year
Georgia Institute of Technology
- **Ellis Thompson** 2nd year
Vassar College

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Selection Criteria

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- Probable success depends on traits such as:
 - *Commitment*
 - *Creativity*
 - *Maturity*
 - *Confidence*
 - *Leadership*
 - *Communication Skills*
- Good match between your goals and research in the department (and not too many in one area)
- Successful research (or independent) experience
- Your UG academic performance and GRE
- Meet all deadlines; essay spelling and grammar

Letters and Personal Statement

What are grad schools looking for?

- **Intellectual Potential**
- **Intellectual Depth**
- **Intellectual Independence**
- **Intellectual Curiosity**
- **Critical Thinking**
- **Analyze a Problem and Formulate a Solution**
- **Creativity and Imagination**
- **Academic Performance**
- **Research Aptitude & Potential**
- **Lab Skills & Techniques**
- **Potential for Teaching**
- **Potential for career advancement**
- **Motivation**
- **Maturity**
- **Self-confidence**
- **Resilience**
- **Concern for others**
- **Social Skills**
- **Ability to Work with Others**
- **Ethics and Integrity**
- **Facility with English Language**
- **Oral Communication**
- **Written Communication**
- **Planning and organization**

Checkboxes for your recommenders: Relative to other students at the same level, is this student:
Top 5%, 10%, 25%, above average, other, unable to judge.

What do I need to do before my senior year?

- **100- and 200-level courses**
 - Build a strong foundation
 - Get involved in the departmental community (SPS, office hours, etc.)
 - Start reading about Physics in places like Scientific American, Physics Today
 - Learn to program a useful language (e.g., Python)
- **“Junior” year (two years before you graduate)**
 - Take as many “core 32x” classes as you can do well in
 - Get to know faculty outside the classroom
 - Get involved in a research project
 - January: Apply for summer research experience
 - Stay involved in the departmental community
- **Summer before senior year**
 - Do research full time (at UW or elsewhere)
 - Study for the GRE (assuming it survives COVID) – register for the Sept or Oct test date
 - Research potential graduate schools

What do I need to do my senior year?

➤ **September/October**

- Take the GRE (if it survives)
- Figure out which schools to apply to, their deadlines, their specialties
- Ask faculty if they will write letters
- Write your personal statement
- Write your research statement
- Put together your CV/resume
- Apply for NSF/other fellowships
- Do well in your classes (don't overload!!)

➤ **November/December**

- Get feedback on your statements & give to recommenders
- Tailor your personal/research statements to each school
- Submit Applications (remember to OPEN the apps two weeks before for LOR)

➤ **Winter Quarter**

- Wait ... Get in to a subset of your schools
- Make a list of criteria you want in a school
- Visit schools

➤ **April**

- DECIDE

➤ **June**

- GRADUATE!!

UW Admission Statistics

➤ 700 Apply ⇒ 90 - 100 Admit ⇒ 25-30 Enroll

➤ Undergrad GPA:

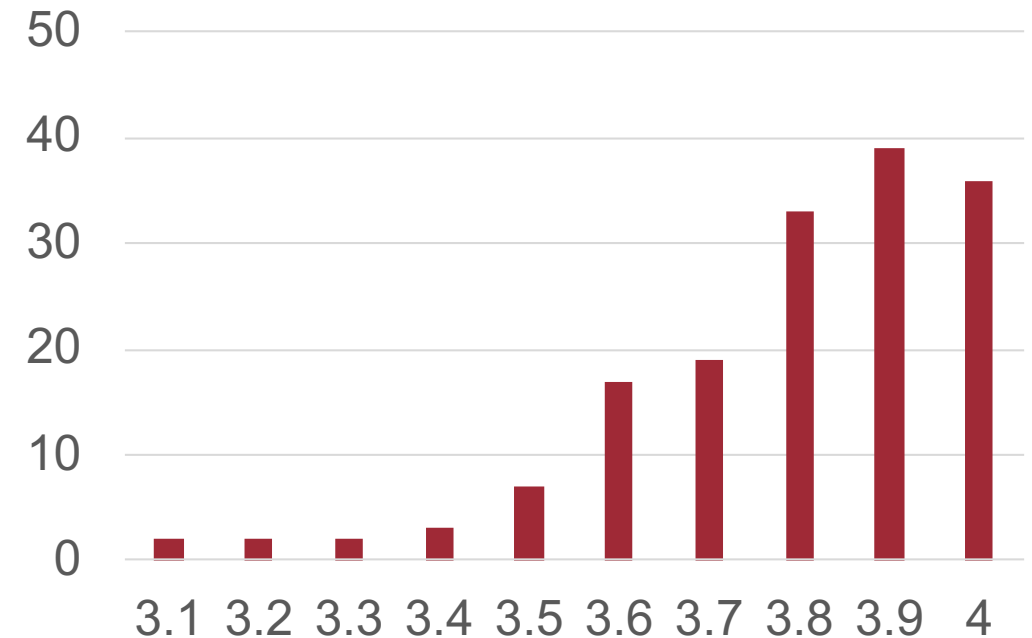
- Average GPA = 3.8

- Admission rare below ~ 3.5

- Research Experience

- Expected: Almost everyone has some

Undergrad GPA of Current UW Physics Grad Students



UW's current US News ranking is about 20

What do they know about me?

What do they know about me?

GRADES

Letter of Rec 1

Letter of Rec 2

Letter of Rec 3

GRE
Physics + General

Personal Statement +
Cover Letter

Study for the GRE!

- Very different from classroom exams
- Balance Speed vs. Silly Mistakes
- Get the book “Conquering the Physics GRE”

Personal Statement

Personal Statement

- Be honest and sincere
 - Show, don't tell
- Speak to your strengths and goals
 - OK not to know your specialty, but don't sound wishy-washy
- Tailor and connect to the target department
 - Mention specific research areas, faculty
- Address any irregularities in your record
 - OK for this to be in letters of reference
- EDIT for grammar, spelling, coherence
 - Have someone read your essay
- Give a copy to your references

Letters of Recommendation

- You need 3 letters from people **with a PhD** who **know you well** outside the classroom
 - Thank them if they say you should find someone else
- At least one should be from someone with whom you have done research (either at UW or elsewhere)
 - Summer REU, Local project with results by Autumn Sr Year
- Provide background information
 - Aspects you want them to cover in their letter
- Give plenty of time
 - Send email with a list, including deadlines and links
 - Gently verify/remind as deadline approaches

Questions on
What Grad Schools Want and
How You Can Give it to Them?

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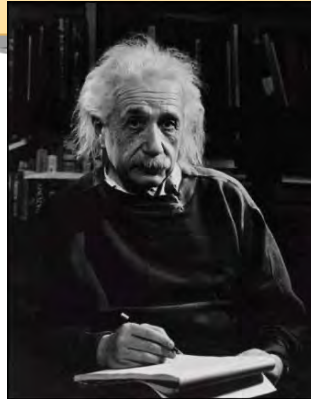
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“Standard Path” to the Ph.D.



Take Classes



Dream New Ideas



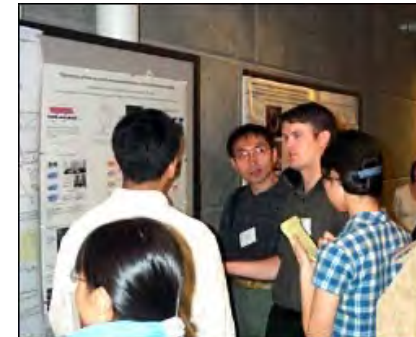
Analyze Results



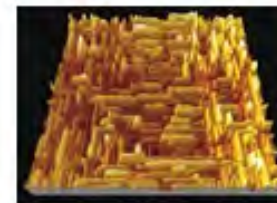
**Read other
people's ideas,
get trained**



Take Data/Calculate



Present work



Publish results



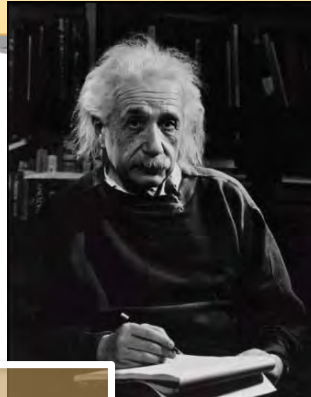
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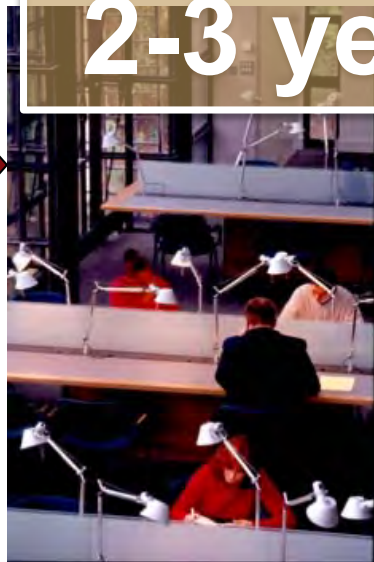
Dream New Ideas



Analyze Data

2-3 years

2-4 years



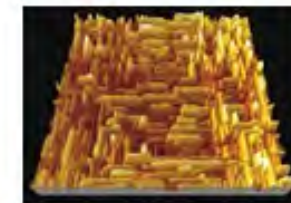
Read other people's ideas, get trained



Take Data



Present work



Publish results



GRADUATE

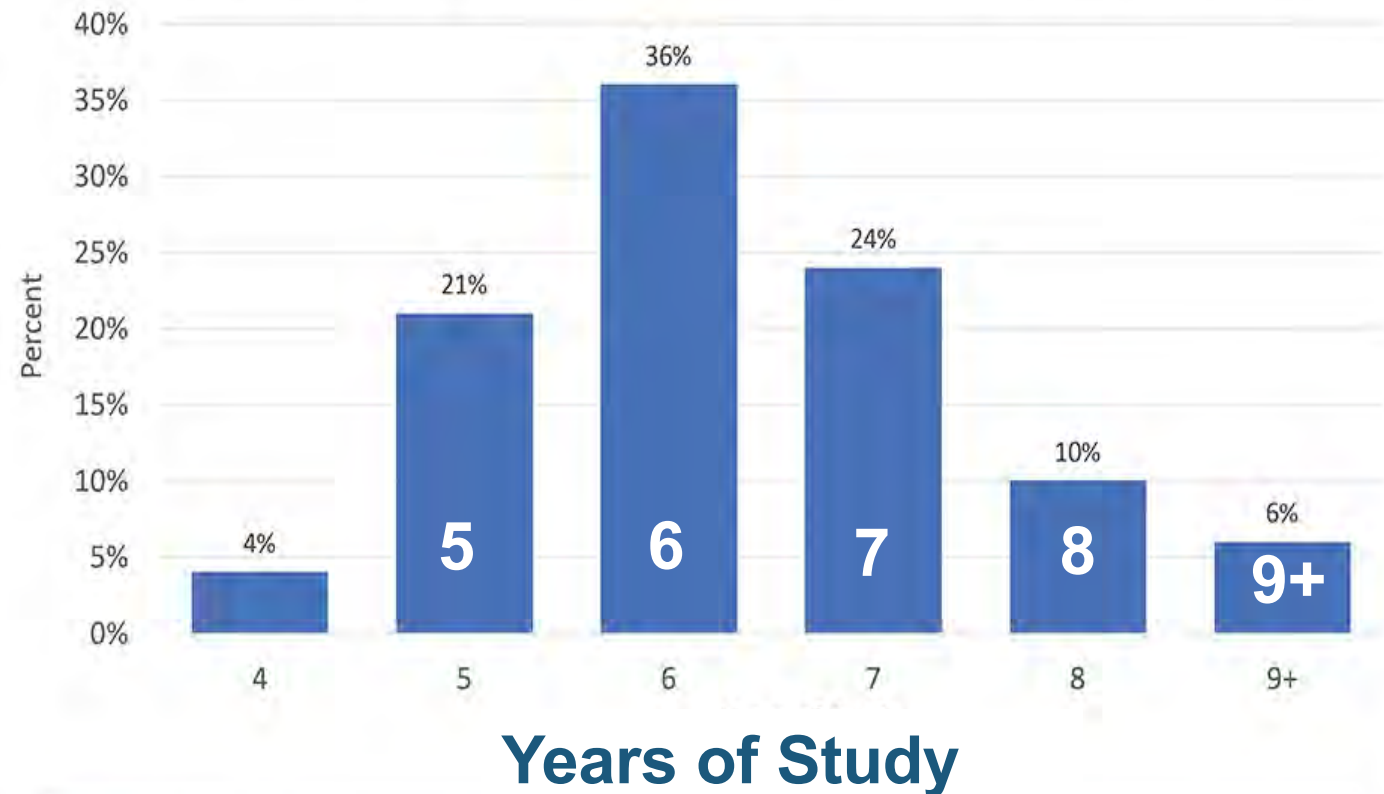


Time to Degree

Average = 6.2 years

16% reported 8 or more years.

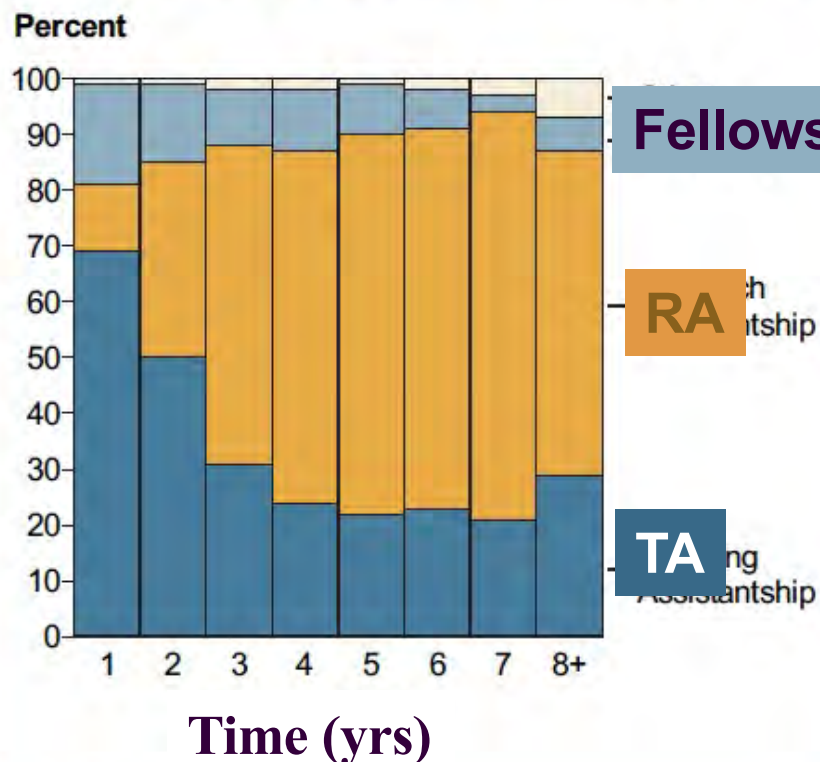
Years of Physics Graduate Study to Earn a PhD, Classes of 2017 and 2018 Combined



You get PAID to go to grad school!!

PLUS: Your tuition gets paid
& you don't have to pay off student loans until you graduate

Primary Type of Support for Physics Doctoral Students



Source: AIP Graduate Student Survey, 2006

You don't add to your savings, but you don't deplete them, either.

Fellowship*

Current UW Rates: \$29-34 k/yr
Current NSF Fellowship: \$34 k/yr

RA (Research Assistantship)

TA (Teaching Assistantship)

Roommates
Used Car, New Computer

* NSF deadline is late October

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GradSchoolShopper

presented by
AIP American Institute of Physics

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- Where (and when) did the authors get their PhD?

Talk to physicists you trust

- What do they think are good fits for you?

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Search by location

Search

Top Tier? Big? Close to home?

➤ Ranking

- Rankings are out of date – new hires make a big difference
- Top tier hire each other's grads
- Next tier = schools like UW
- Lower tiers often have pockets of top-ranked subfields

➤ Size

- Large comprehensive department lets you change sub-fields
- Small lets you be a bigger fish in a smaller pond
- Your professional network = your grad school contacts

➤ Interdisciplinary Connections

➤ Geography

➤ Department Climate – Visit!!

Overall Advice

- Connect with Faculty EARLY in your career
- Do research during academic year AND full time summer after junior year
- Take as many core 300-level physics courses as you can do well in
- Don't overload your schedule senior year
- Apply to 7-10 places
 - 2-3 "Reach", 2-3 "Safety"
 - Don't apply anywhere you aren't willing to go
- Stand out from the rest
 - Apply WELL BEFORE the deadline
 - Visit, call and/or email someone you want to work with
 - (but don't bug them too much....)
- Check that file is complete
 - Contact Grad Assistant by email
 - Follow up on late letters, transcripts, etc.

It's not for everyone, but ...

It's not for everyone, but ...

- Grad study in Physics can be a grand adventure.
- A Physics PhD prepares you for a wide variety of careers and life experiences.
- If this is what you want, and you are willing to work towards it at subsistence wages for 6 years,

GO FOR IT!