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

Prof. Marjorie Olmstead
Associate Chair for Undergraduate Affairs
Undergraduate Faculty Advisor
UW Seattle Department of Physics

ufaphys@uw.edu
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

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  Overview of National Statistics on Physics BS/PhD

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  Panel of current UW Grad Students

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What is a PhD?

- Take some piece of knowledge about the universe from \((\text{frontier} - \varepsilon)\) to \((\text{frontier} + \varepsilon)\)

- 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)

Status of Physics Bachelors One Year After Degree, Classes of 1996 through 2018

2017/18
- 48% job
- 28% P/A grad
- 19% other grad
- 5% seeking

Field of Employment

- Engr.
- Phys/Astr
- Tech
- Non-STEM
- CS/Info.

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**

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

**Occupation of Physical Science Degree Holders**

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

- S & E Manager
- S & E Manager
- K-12 Teachers
- Health Life Sci
- Engineers
- CS/IT/Math
- Teach/Other Phys Sci
- Phys/Astr
- ESS
- Arts & Hum. Sales
- Business/Soc. Sci
- Non S&E Manager
- Other non-S&E
What might I earn?

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

- **Sector of Employment**: Private Sector non-STEM, Solves Technical Problems
- **Salary Ranges**: $20k - $40k - $60k - $80k - $100k

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

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<th>2008</th>
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<tr>
<td>PhD</td>
<td>189</td>
<td>198</td>
<td>201</td>
</tr>
<tr>
<td>Total</td>
<td>762</td>
<td>752</td>
<td>761</td>
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What else can I do with a PhD?

- 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

- 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

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
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

UW’s current US News ranking is about 20
What do they know about me?

- GRADES
- Letter of Rec 1
- Letter of Rec 2
- Letter of Rec 3
- Personal Statement + Cover Letter

- GRE
  - Physics + General

Study for the GRE!
- Very different from classroom exams
- Balance Speed vs. Silly Mistakes
- Get the book “Conquering the Physics GRE”
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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“Standard Path” to the Ph.D.

1. Take Classes
2. Read other people’s ideas, get trained
3. Dream New Ideas
4. Take Data/Calculate
5. Analyze Results
6. Present work
7. Publish results
8. GRADUATE
“Standard Path” to the Ph.D.

Take Classes

Read other people’s ideas, get trained

Dream New Ideas

Take Data

Analyze Data

Present work

GRADUATE

Publish results

2-3 years

2-4 years
Time to Degree

Average = 6.2 years
16% reported 8 or more years.
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.

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

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

Roommates
Used Car, New Computer

* NSF deadline is late October
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Look at papers you find interesting

- Where is the work being done?
- Where (and when) did the authors get their PhD?

Talk to physicists you trust

- What do they think are good fits for you?
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.
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,