So you’re thinking of going to Graduate School?

Prof. Marjorie Olmstead

Associate Chair for Undergraduate Affairs
UW Department of Physics
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
Why Go to Grad School?

Deeper understanding of a subject
Better/different job prospects
Participate in the excitement of the intellectual frontier

DON’T
- Assume automatic faculty position
- Drift into graduate school
Get a PhD and Become ...

- A scientist
- A communicator
- A visionary
- A problem solver
- A politician
- The smartest househusband on the block
- ....
Where to Go? What Field?

What Subject for your Advanced Degree?

- Medicine
- Law
- Chemistry
- Engineering (Electrical, Materials, Chemical, ...)
- Physics
- Astronomy

### 2009 MCAT

<table>
<thead>
<tr>
<th>Major</th>
<th>Phys Sci</th>
<th>Bio Sci</th>
<th>Verbal</th>
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<td>OVERALL</td>
<td>9.2</td>
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### 2009 LSAT

<table>
<thead>
<tr>
<th>Major</th>
<th>Mean</th>
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<tbody>
<tr>
<td>Physics</td>
<td>161.5</td>
<td>180</td>
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<tr>
<td>Political Sci</td>
<td>153.0</td>
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<td>Pre-Law</td>
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<tr>
<td>OVERALL</td>
<td>152.6</td>
<td>81,530</td>
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</tbody>
</table>
What do Physics Bachelor’s do after graduation?

Trends in initial outcomes of physics bachelor’s Classes of 1995 to 2010 (1 year post degree)

- 37%: Get a Job
- 37% Physics/Astro GS
- 23% Other Grad School
- 5% Unemployed

http://www.aip.org/statistics
Last year’s UW class …

From “Apply to Graduate” survey:
- Other Work: 45%
- Other School: 23%
- Teach: 7%
- Other/ not sure: 6%
- Phys/Astro: 19%
- Grad School: 19%

From June Survey of Graduates:
- Employed: 54%
- Not yet sure: 19%
- School: 27%
- Not yet started: Looking
- Other/ not sure: 6%
- Other: 45%
Who hires physics bachelor’s?

Some employers in Washington that recently hired new physics bachelor recipients

- Absolute Aviation Services
- Astronics AES
- Battelle
- Blue Box Group
- Boeing
- Bruker Elemental
- Cascade Gasket, Inc.
- CleanScapes
- Device Inside, Inc.
- DNV
- ExtraHop Networks
- Financial Partners, Inc.
- Intentional Software
- Microsoft
- Octapharma Plasma, Inc.
- Pacific Northwest National Lab
- Puget Sound Naval Shipyard
- Radiant Zemax, LLC
- Schneider Electric
- Schweitzer Engineering Labs, Inc.
- Speakeasy, Inc.
- Stardust Materials
- Telect, Inc.
- Washington State Department of Health
- Washington River Protection Solutions
- Zulily


http://www.aip.org/statistics/trends/states/state.html
Initial BS Salary Relative to Other Fields

2012 Data

Business
Communications
Computer Science
Education
Engineering
Health Sciences
Humanities & Social Sciences
Math & Science

www.naceweb.org
UW Physics is growing

Year

UW Physics BS Degrees


Yearly Degrees

- NIM
- IntM
- PIM
- NM
- BM
- HM
- AM
- WM
- NIF
- IntF
- NF
- HF
- AF
- WF
UW Produces ~ 1% of US Physics BS

National Data / 100
How many people get a PhD?

PhD’s—2009 data:
- US: ~50% of 1237 degrees to US Citizens
- Germany: 1570
- France: 491
- UK: 415
- Japan: 374
- Next 5: 674
- Next 10: 345
How many people get a PhD?

PhD’s– 2009 data:

- US: ~ 50% of 1237 degrees to US Citizens
- Germany: 1570
- France: 491
- UK: 415
- Japan: 374
- Next 5: 674
- Next 10: 345

Bachelors scaled by 30%
How many people get a PhD?

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- US: ~50% of 1237 degrees to US Citizens
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- France: 491
- UK: 415
- Japan: 374
- Next 5: 674
- Next 10: 345
PhD Career Salaries

Salary 25% to 75% (k$)

- Academic
- University 9-10
- University 11-12
- 4-yr College 9-10
- Non-Academic
- Hospital, Med Services
- Government
- FFR&D
- Industry
- UARI
- Non-profit

Median Age

- 49
- 48
- 47
- 49
- 50
- 53
- 49
- 49
- 47

http://www.aip.org/statistics

2009 Median ~ $110k

2006-07 data
Physics Pays Well Relative to other STEM Fields


- Natural sciences managers
- Engineering managers
- Computer and information systems managers
- Petroleum engineers
- Physicists
- All STEM occupations
- Environmental science and protection technicians
- All occupations
- Biological technicians
- Surveying and mapping technicians
- Agricultural and food science technicians
- Forest and conservation technicians

Mean annual wage (in dollars)

2009 Data


http://www.bls.gov/opub/mlr/2011/05/art1full.pdf
Where might you work …

>13 % STEM Workforce:
Silicon Valley  Boulder  
Huntsville  Research Triangle  
Greater DC  Greater Boston  
Seattle (though mostly CS, not physics)

Average = 6%

Physics Low Unemployment relative to other STEM

Unemployment Rates 1-3 Years Post-PhD

NSF Science & Engineering Indicators 2010

Involuntary New Field

Total Unemployed
### Availability of Faculty Jobs

#### 2003 Total US PhD

<table>
<thead>
<tr>
<th></th>
<th>TT</th>
<th>Other</th>
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<tbody>
<tr>
<td>2007 BS Faculty Hires</td>
<td>103</td>
<td>156</td>
</tr>
<tr>
<td>2007 MS Faculty hires</td>
<td>39</td>
<td>23</td>
</tr>
<tr>
<td>2007 PhD Faculty hires</td>
<td>200</td>
<td>41</td>
</tr>
<tr>
<td>What’s left</td>
<td>538</td>
<td></td>
</tr>
</tbody>
</table>

#### Highest Degree at Institution

- PhD: 173, Tenured: 27, Tenure-track: 6, Non-tenured, perm.: 16, FT temporary: 33, PT & Other: 96
- Master’s: 33, Tenured: 16, Tenure-track: 7, Non-tenured, perm.: 6, FT temporary: 17, PT & Other: 52
- Bachelor’s: 19, Tenured: 16, Tenure-track: 6, Non-tenured, perm.: 52, PT & Other: 52

Jobs like mine: <20%
General Academic: ~50%
Job Satisfaction -- 1st Year

- Satisfaction is generally quite high.

Initial PhD Employment Classes of 2007-2008

- I consider myself underemployed in this position
- I am satisfied with this position
- This position is professionally challenging
- A Physics PhD is an appropriate background for this position

Ph.D. Class of 2007-08. (Those checking choices 3, 4 on 4 point scale)
So if I do go to grad school …

- What happens?
- How long does it take?
- How do I finance it?
- How do I figure out where to go?
- What are grad schools looking for?
“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
“Standard Path” to the Ph.D.

1. Take Classes
2-3 years

2. Read other people’s ideas, get trained

3. Dream New Ideas

4. Take Data

5. Analyze Data
2-4 years

6. Present work

7. Publish results

8. Graduate
Years to PhD

AIP Statistics

UW Statistics

Classes of 2007-2008

Number of PhD Students

Pre-qual Pre-General Post-General Ph.D. Left
So if I do go to grad school …

- What happens?
- How long does it take?
- How do I finance it?
- How do I figure out where to go?
- What are grad schools looking for?
You get **PAID** to go to grad school!!

**Primary Type of Support for Physics Doctoral Students**

- Self-supporting
- NSF, Hertz, University
- Grant support for your PhD research
- Teaching labs & Sections

(Source: AIP Graduate Student Survey, 2006)
It’s not much money, but it’s enough

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: $1600-$2000/month
Current NSF Fellowship: $2500/mo

Roommates
Used Car, New Computer
So if I do go to grad school …

- What happens?
- How long does it take?
- How do I finance it?
- How do I figure out where to go?
- What are grad schools looking for?
Information Available

- Description of University (tuition, etc.)
- Average GRE scores, GPA
- Information by subfield:
  - Number of grad students
  - Number of Ph.D.’s granted
  - Number of faculty
  - Research $$$
- Fraction TA/RA/Fellowship
- Requirements
  - e.g. Qualifying Exam, Foreign Language
<table>
<thead>
<tr>
<th>University</th>
<th>Annual Average</th>
<th>University</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT (MA)</td>
<td>37</td>
<td>Ohio State U</td>
<td>18</td>
</tr>
<tr>
<td>U of Illinois, Urbana-Champaign</td>
<td>36</td>
<td>Princeton U (NJ)</td>
<td>18</td>
</tr>
<tr>
<td>U of Texas, Austin</td>
<td>33</td>
<td>U of California, Los Angeles</td>
<td>18</td>
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<tr>
<td>U of Maryland, College Park</td>
<td>32</td>
<td>Michigan State U</td>
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<tr>
<td>U of California, Berkeley</td>
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<td>U of Minnesota, Minneapolis</td>
<td>17</td>
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<tr>
<td>Cornell U (NY)</td>
<td>27</td>
<td>Georgia Inst of Tech</td>
<td>16</td>
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<tr>
<td>Stanford U (CA)</td>
<td>25</td>
<td>Pennsylvania State U</td>
<td>16</td>
</tr>
<tr>
<td>SUNY Stony Brook U (NY)</td>
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<td>U of Washington</td>
<td>16</td>
</tr>
<tr>
<td>U of Colorado, Boulder</td>
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<tr>
<td>Caltech (CA)</td>
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<td>Florida State U</td>
<td>15</td>
</tr>
<tr>
<td>U of Chicago (IL)</td>
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<td>Purdue U, West Lafayette (IN)</td>
<td>15</td>
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<tr>
<td>U of Wisconsin, Madison</td>
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<td>Texas A&amp;M U, College Station</td>
<td>15</td>
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<tr>
<td>U of California, Santa Barbara</td>
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<td>U of Rochester (NY)</td>
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</tr>
<tr>
<td>U of Michigan, Ann Arbor</td>
<td>20</td>
<td>Washington U (MO)</td>
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<tr>
<td>Stanford U – Applied (CA)</td>
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<td>Yale U (CT)</td>
<td>15</td>
</tr>
<tr>
<td>U of Florida</td>
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</tr>
</tbody>
</table>

Note: List includes only those departments who contributed degree data for all 3 years.

http://www.aip.org/statistics
Big vs. Small

Ranking:
- “Top12” hire each other’s grads
  - Hardest to get into
- Lower ranked departments often have pockets of top-ranked subfields

Size:
- Large comprehensive department lets you change sub-fields easily
- Small lets you be a bigger fish in a smaller pond
So if I do go to grad school …

- What happens?
- How long does it take?
- How do I finance it?
- How do I figure out where to go?
- What are grad schools looking for?
Application:

- Weighting Varies
- Deadlines IMPORTANT -- usually January
- Schools offer by 4/1; You decide by 4/15
- FOLLOW INSTRUCTIONS
- CHECK SPELLING and GRAMMAR
- TYPE YOUR ESSAY
Physics GRE of US Admits:
- Averages in the low 800’s (out of 990)
- Admission rare below the mid 600’s

Average GPA:
- Average 3.4-3.7
- Admission rare below ~ 3.2

ADVICE from our Admissions Chair
- Study for the GRE
- Get research experience
Study for them!!

- Can increase score >100 points
- Figure out your best balance of speed and accuracy

UW physics grad admissions averages:
- Verbal 606
- Quantitative 726
- Analytical 779
- Physics >800 (and RISING)
GET TO KNOW 3-4 FACULTY NOW!!

Choose people who KNOW you well

Ask if they’re willing to write you a “good letter”

Provide background information

Give plenty of time

Gently verify/remind as deadline approaches
Personal Statement

- Be honest
- Be sincere
- Connect to the target department
  - Mention specific research areas, faculty
  - Get letters from people known to that department (REUs are good for this)
- Speak to your strengths and goals
- Address any irregularities in your record
- EDIT for grammar, spelling, coherence
- Have a prof or friend read your essay
Research Experience

- VERY HELPFUL to your application
- The vast majority of accepted students have some research experience as undergrads
- It will be expected of someone from UW
  - OK here or via an REU elsewhere
  - OK during year (Phys 499) or summer
Finding a Research Home

- NSF REU site
- Talk to Margot
- Talk to your TAs
- Ask around at SPS
- Talk to your profs in physics and elsewhere
- Search Grad school part of our website
- Mary Gates
Enclosures

- **Don’t** weigh down your application
- **DO** include any published paper or its abstract/citation
Overall Advice

- Consider applying to about 10 places
- Don’t apply anywhere you aren’t willing to go, but remember to include a safety school
- Get applications in EARLY
- Stand out from the rest
  - Visit
  - Phone call/email someone appropriate
    - (but don’t bug them too much....)
- Check that file is complete
  - Contact Grad Assistant by email
  - Follow up on late letters, transcripts, etc.
What happens to it now....?

- GREs
- Letters
- Transcripts
- Graduate Secretary
- Incomplete Files
- Complete Files
- Chair, Grad Admissions
- 2-3 Readers
- Rank Applicant
- Admit
- Wait and See
- Deny
- Fantastic
- ADMIT
- Awful
- DENY
- Rare events

Your application (Arrive first!!)
Selection Criteria

➢ Probable success depends on traits such as:
  o Commitment
  o Creativity
  o Maturity
  o Leadership
  o Being able to communicate

➢ Good match between your goals and research in the department of interest

➢ Successful research experience

➢ Your UG academic performance

➢ Mixed interests (spread out over whole dept) for entering class
Summary

- UG preparation in physics is a solid foundation for a variety of post-graduate programs.
- Grad study in Physics/Astronomy can be a grand adventure.
- Grad school is an opportunity to acquire skills and perspective that are broadly applicable to many fields.
- GO FOR IT!