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

- “license to think” – allows you to write grants, direct research projects, teach at college/university
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 homemaker on the block
- ....
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>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>BioMedEng</td>
<td>10.9</td>
<td>10.7</td>
<td>9.6</td>
<td>1005</td>
</tr>
<tr>
<td>Physics</td>
<td>11.1</td>
<td>10.3</td>
<td>9.6</td>
<td>207</td>
</tr>
<tr>
<td>Biology</td>
<td>8.7</td>
<td>9.5</td>
<td>8.7</td>
<td>12,705</td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td><strong>9.2</strong></td>
<td><strong>9.8</strong></td>
<td><strong>9.0</strong></td>
<td><strong>41,487</strong></td>
</tr>
</tbody>
</table>

**2009 LSAT**

<table>
<thead>
<tr>
<th>Major</th>
<th>Mean</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>161.5</td>
<td>180</td>
</tr>
<tr>
<td>Political Sci</td>
<td>153.0</td>
<td>14,964</td>
</tr>
<tr>
<td>Pre-Law</td>
<td>148.3</td>
<td>1,078</td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td><strong>152.6</strong></td>
<td><strong>81,530</strong></td>
</tr>
</tbody>
</table>
What do Physics Bachelor’s do after graduation?

Trends in initial outcomes of physics bachelor’s Classes of 1995 to 2012 (1 year post degree)

- 38%: Get a Job
- 36% Physics/Astro GS
- 22% Other Grad School
- 4% Unemployed

http://www.aip.org/statistics
UW Physics class of 2013 & 2014

From “Apply to Graduate” survey

- Other / Unsure: 5%
- Other Work: 48%
- Teach: 5%
- Other Schooling: 22%
- Phys/Astro Grad School: 20%
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
PhD vs Bachelor Starting Salaries

Salary 25% to 75% (k$)

Typical Starting Salaries for Physics Bachelor's Classes of 2009 & 2010 Combined

Employer
- Private Sector STEM
- Civilian Govt. incl. Nat'l Labs
- Private Sector non-STEM
- Active Military
- High School Teachers
- College or University

Typical Salaries (in thousands of dollars)

Starting Bachelors

http://www.aip.org/statistics

Starting PhD

2009-10 data

http://www.aip.org/statistics
UW Physics is growing
UW Produces \(\geq 1\%\) 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?

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
What might you expect?

- If grad programs don’t expand, it could be harder to be accepted to grad school.
- If they do, it might be harder to find a job when you are done.
Availability of Faculty Jobs

Current Positions of New Faculty Members, 2007-08

Highest Degree at Institution

Total TT = 302
Total Inst/Temp = 138

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

2008 Hire /2004 PhD = 40%
2010 Hire /2006 PhD = 26%
Satisfaction is generally quite high.

Initial Employment classes of 2009 & 2010

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

- Potentially Permanent  
- Postdoc

Ph.D. Class of 2009 & 2010. (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

Dream New Ideas

Analyze Data

Take Data

Present work

Read other people’s ideas, get trained

Publish results

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
- 2-3 years
- 2-4 years
- Publish results
Years to PhD

AIP Statistics

UW Statistics

Classes of 2007-2008

Number of PhD Students

Pre-qual Pre-General Post-General Ph.D. Left

Physics graduate program status october 2013

Year Entering Program

5th yr 6th yr 7th yr 8th yr
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 Types of Financial Support for Physics Bachelor's One Year After Degree, Classes of 2011 & 2012 Combined

<table>
<thead>
<tr>
<th>Degree Program Enrolled</th>
<th>Master's (N=216)</th>
<th>PhD (N=727)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graduate Study in Physics or Astronomy</strong></td>
<td>37</td>
<td>53</td>
</tr>
<tr>
<td><strong>Graduate Study in Engineering</strong></td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td><strong>Graduate Study in Other Fields</strong>*</td>
<td>26</td>
<td>51</td>
</tr>
</tbody>
</table>

*Does not include professional degree fields such as law and medicine.

### Primary Type of Support for Physics Doctoral Students

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70%</td>
</tr>
<tr>
<td>2</td>
<td>60%</td>
</tr>
<tr>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>40%</td>
</tr>
<tr>
<td>5</td>
<td>30%</td>
</tr>
<tr>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td>7</td>
<td>10%</td>
</tr>
<tr>
<td>8+</td>
<td>5%</td>
</tr>
</tbody>
</table>

*Source: AIP Graduate Student Survey, 2006*

2013 Data: [http://www.aip.org/statistics](http://www.aip.org/statistics)

2006 Data
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
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
Universities averaging > 15 PhD/Year

<table>
<thead>
<tr>
<th>University</th>
<th>Annual Average</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massachusetts Inst of Tech</td>
<td>38</td>
<td>U of California, Los Angeles</td>
</tr>
<tr>
<td>U of California, Berkeley</td>
<td>35</td>
<td>U of California, Davis</td>
</tr>
<tr>
<td>Harvard U (MA)</td>
<td>29</td>
<td>U of California, San Diego</td>
</tr>
<tr>
<td>U of Maryland, College Park</td>
<td>29</td>
<td>U of Michigan, Ann Arbor</td>
</tr>
<tr>
<td>U of Colorado, Boulder</td>
<td>28</td>
<td>U of Minnesota, Minneapolis</td>
</tr>
<tr>
<td>SUNY, Stony Brook U (NY)</td>
<td>26</td>
<td>U of Washington</td>
</tr>
<tr>
<td>Stanford U (CA)</td>
<td>26</td>
<td>Brown U (RI)</td>
</tr>
<tr>
<td>Ohio State U</td>
<td>24</td>
<td>Georgia Inst of Technology</td>
</tr>
<tr>
<td>U of Wisconsin, Madison</td>
<td>24</td>
<td>Yale U (CT)</td>
</tr>
<tr>
<td>Cornell U (NY)</td>
<td>23</td>
<td>Arizona State U</td>
</tr>
<tr>
<td>Stanford U-Applied (CA)</td>
<td>23</td>
<td>Florida State U</td>
</tr>
<tr>
<td>U of California, Santa Barbara</td>
<td>22</td>
<td>Pennsylvania State U</td>
</tr>
<tr>
<td>U of Florida</td>
<td>21</td>
<td>Purdue U, West Lafayette (IN)</td>
</tr>
<tr>
<td>California Inst. of Technology</td>
<td>20</td>
<td>U of Chicago (IL)</td>
</tr>
<tr>
<td>U of California, Irvine</td>
<td>20</td>
<td>Washington U (MO)</td>
</tr>
<tr>
<td>Princeton U</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

Note: List includes departments that averaged 15 or more physics PhDs, classes of 2010, 2011 & 2012 combined. List includes only those departments who contributed degree data for all three years.

http://www.aip.org/statistics
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

- GRADES
- GRE
  Physics + General
- Letters of Recommendation
- Your Essay + Cover Letter
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
GRE’s

- 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)
Letters of Recommendation

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
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....?

Graduate Secretary

Grees
Letters

Your application (Arrive first!!)

Transcripts

Complete Files

Chair, Grad Admissions

Fantastic
Admit

Awful
Deny

Rare events

Normal

2-3 Readers
Rank Applicant

Admit
Wait and See
Deny

Incomplete Files
Selection Criteria

Probable success depends on traits such as:

- Commitment
- Creativity
- Maturity
- Leadership
- 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.
- If it is what you want, then GO FOR IT!