Career Options for Physicists

ATTENTION PHYSICS STUDENTS: You Have Options

Q: What can you do with a physics degree?
A: Get a PhD and become a physics professor OR …

What comes after the “or” is not widely known in many physics departments, even though data show that only about 3% of physics bachelor’s degree recipients enroll in a physics or astronomy graduate program within one year of graduating. People with undergraduate degrees in physics pursue a variety of fascinating, fulfilling, and well-paying careers. This is evidenced by decades of data collected by the Statistics Research Center at the American Institute of Physics. Illustrated below are the common paths of physics bachelor’s degree recipients based on the most recent data. Unless otherwise indicated, all data are for graduates of US physics programs who remain in the United States.

Over 7,300 physics bachelor’s degrees were awarded in the class of 2012–13.

A record high! Typically…

- Three-fourths of those who earn physics bachelor’s degrees have research experience.
- One-third graduate with a double major, many in math.
- One-tenth start a two-year college.

Within one year of earning a physics bachelor’s degree...

- 22% enroll in professional degree programs, NOT in physics or astronomy.
- About half enter an engineering program; the rest enter programs in math, medicine, education, or another field.
- As a group, physics majors score among the highest of all majors on medical school and law school admission tests (the MCAT and LSAT).
- Students in professional degree programs are more likely to be self-funded than students in research-based graduate programs, who usually have teaching assistantships, research assistantships, or fellowships.

- 36% attend graduate school in physics or astronomy.
- About 80% enroll in a PhD program and the remainder choose a master’s degree program.
- Most are fully supported by teaching assistantships, research assistantships, or fellowships.

Of those who start graduate school in physics or astronomy...

- 42% enter the workforce.

Common employment sectors include:

Private sector
- Typically, half of those who enter the workforce take jobs in the private sector.
- Of those that enter the private sector, the majority hold science, technology, engineering, and math (STEM) positions.
- Those in private-sector STEM positions are well compensated, with a median starting salary of about $50K.

Colleges or universities
- More than half of the students in these positions initially work at the same institution they graduated from. Many work in research or IT.

Civilian government
- The civilian government sector includes national labs. The vast majority of these positions are in STEM fields, many related to defense or energy.

Active military
- Physics bachelor’s work across all branches of the armed forces. Many work in aviation or nuclear power.

High school teaching

The average starting salary for physics PhD recipients entering the workforce is ~$50K.

- 2/3 enter the workforce.

- About half work in the private sector overwhelming in STEM fields.
- The largest portion of exiting master’s working in the private sector are employed in the field of engineering.
- Other common employment sectors for exiting master’s include colleges and universities, high schools, civilian government, and the military.

The approximate breakdown by employment sector for all employed physics PhDs (not just new ones), is given below.

- ~45–49% Private sector.
- ~29–33% Academe.
- ~14–17% Government.
- ~7–11% Other.

- 1 out of 6 US physics bachelor’s receive a physics or astronomy master’s degree.

Earning master’s degree recipients are individuals who leave their current department upon receiving a master’s degree. Many other students earn an en route master’s degree, continuing on to a physics PhD in the same department.

- About two-thirds of those who earn exiting master’s degrees do so with a specific research focus.
- A master’s degree in physics usually takes about two years.

For US citizens, within one year of earning an exiting master’s degree...

- 1/3 continue with graduate studies.

- Some transfer to other institutions to earn a physics PhD.

- Many others transfer to programs in related fields such as medical physics, atmospheric science, and materials science.

- ~2/3 accept a temporary position.

(e.g. a postdoc), primarily at a university or with the government.

- ~1/3 accept a potentially permanent position.

The majority of new PhDs accepting potentially permanent positions are employed in the private sector.

- The highest-paid positions for new PhDs are in the private sector and at government labs, with median starting salaries of about $90K and $85K respectively.

Learn more at the Careers Toolbox website:
www.spsnational.org/careerstoolbox

References and Notes

The following reports were published by the Statistical Research Center of the American Institute of Physics and are available online at www.aip.org/statistics.


*Estimate provided by the AIP Statistical Research Center, Fall 2014.
Should I major in physics? If so, what do I do next?
So you think you want to major in physics ...

Did you ever seriously consider majoring in engineering?

- Yes, I applied multiple times to engineering but did not get in. 30%
- Yes, but I did not have the grades or pre-reqs to apply to engineering. 6%
- No 42%
- Yes, but I was not accepted into the engineering major of my choice 19%
- Yes, but I never applied to engineering -- I decided I liked physics better (or I got in and then switched) 3%

Since 2011:
- 49% PreSci
- 37% PreEngr
- 12% Other

Cohort: Physics majors who applied to graduate in 2016-17
Why major in physics?

Reasons that tend not to work out well ...

- Because you decided to do so in middle school
- Because engineering turned you down
- Because mom and dad said to

GOOD reasons

- Because you REALLY want to WHY the world works
- Because the list of courses you REALLY want to take at UW gets you a physics degree (or at least close to one)
- Because you checked out a number of other options, and you like physics the best

UW offers 606 degree options across 314 programs
Annual Salary Distribution
2016 – Bureau of Labor Statistics

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<th>Fraction of Incomes</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>75</th>
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<tr>
<td>Chem Tech</td>
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http://www.bls.gov

Post-Graduation Physics BS

UW Physics 2016-17 Grads
[On Grad Application (N=169)]

National Data 2013-14 Grads
(aip.org/statistics)
Where do Physics B.S. end up?

NSF Table 3-2. Broad occupation category of employed U.S. scientists and engineers with a bachelor's as the highest degree, by field of highest degree: 2013

- STEM: 42%
- STEM-related: 19%
- Non-STEM: 38%
Engineeering B.S. Career Paths

NSF Table 3-2. Broad occupation category of employed U.S. scientists and engineers with a bachelor's as the highest degree, by field of highest degree: 2013

Physics B.S.

- Life Science: 0%
- CS/Math: 31%
- Physical Sci: 14%
- Social Sci: 0%
- Engineering: 30%
- Health: 1%
- Non STEM: 22%
- STEM Manager: 5%
- STEM Teacher: 0%
- Technician: 11%

STEM: 61%
STEM-related: 17%
Non-STEM: 22%
Physics jobs span the economy

Note: 47% of new physics bachelors were employed in the winter following the year in which they received their degree.

29% Phys/Astro grad school
10% Engineering grad school
10% other schooling
4% Unemployed

Figure 2. Initial employment of physics's bachelor’s degree recipients for the combined classes of 2015 & 2016
Private Sector Job Areas – 1 Yr Post B.S.

Field of Employment for New Physics Bachelors Employed in the Private Sector, Classes of 2015 & 2016 Combined

- Physics or Astronomy: 4%
- Other STEM: 12%
- Non-STEM, Rarely or Never Solves Technical Problems: 7%
- Non-STEM, Regularly Solves Technical Problems: 15%
- Computer or Information Systems: 27%
- Engineering: 35%

Figure 3. Employment data for physics bachelor’s degree recipients in the private sector. Note that Engineering and Computer Systems comprise 62% of the employment fields for bachelor’s working in the private sector.

STEM refers to natural science, technology, engineering and mathematics. Regularly solving technical problems refers to respondents who selected “Daily”, “Weekly”, or “Monthly” on a four-point scale that also included “Rarely or Never”.
Typical Job Skills Utilized

Knowledge and Skills Regularly Used by New Physics Bachelors Employed in the Private Sector, Classes of 2015 & 2016 Combined

- Work on a Team
- Solve Technical Problems
- Technical Writing
- Design & Development
- Perform Quality Control
- Use Specialized Equip.
- Programming
- Manage Projects
- Knowledge of Phys. or Ast.
- Simulation or Modeling
- Advanced Math
- Work with Customers
- Manage People
- Manage Budgets

Employment in Engineering

Employment in Computer Science or Information Technology

Percent regularly using knowledge or skill
Why Go to Grad School?

You are here → Grad School → GOALS

- 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
Grad School FAQ

- **How long?**
  - 5 – 7 yr to PhD; 2 yr to M.S.

- **Cost?**
  - You get paid (and your tuition does, too)

- **Requirements?**
  - Comprehensive track PLUS more electives
  - Physics GPA >~3.5
    - UW Physics PhD Admits: average = 3.85; none below 3.4
  - 3 Excellent letters of recommendation
  - Research experience
What can I do with a PhD other than Profess?

- 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
Physics PhD Job Categories

Employment fields for new physics PhD recipients in potentially permanent positions, classes of 2009 through 2014

Hover over field names to see more employment information

- Physics (23%)
- Education (Physics) (14%)
- Education (non-Physics) (6%)
- Computer Hardware (5%)
- Computer Software (10%)
- Business (8%)
- Non-STEM Other (6%)
- Other STEM (5%)
- Medicine (3%)
Resources for More Information

https://www.spsnational.org/career-resources

https://www.aip.org/career-resources
**UW Physics Major Options**

- **Comprehensive**
  - Graduate school in physics or astronomy
  - Full range of physics and math

- **Applied**
  - Technical job at B.S. level or M.S. in engineering
  - More flexibility in electives

- **Teaching**
  - Communicate science to HS or general audience
  - Physics by Inquiry sequence

- **Biological**
  - Medical school or grad school in biophysics
  - 7 quarters of biology and chemistry in addition to physics core
UW Physics Majors are Satisfied

(-2 = very dissatisfied, +2 = very satisfied)

How satisfied are you with your choice of physics as a major?

-2 -1 0 1 2

Everyone (N=137)
Teach (N=3)
Bio (N=14)
Appl (n=53)
Comp (N=59)
Old (N=8)

2016: 1.19 ± 0.91
2017: 1.25 ± 0.85
2018: 1.25 ± 0.85

Please grade the Physics Dept. on the following items.

Content and Quality of the overall program
Quality of Instruction
Instructors' Concern for Students
Welcoming Atmosphere

 Poor Fair Good Very Good Excellent
**Physics Student Services Resources**

**Declaring a Major**
- Background for change
- Transcript-based admission
- Petition-based admission

**Choosing a Degree Option**
- Applied, Comprehensive, Teaching, Biological

**Degree requirements**

**Send email to uwspsofficers@uw.edu**
Physics Student Services: C139/C141

- **Staff Advisors**
  - Margot Nims
    - All undergraduate issues
  - Catherine Provost
    - All graduate issues
    - Grad school-related UG issues

- **Faculty Advisor**
  - Prof. Marjorie Olmstead
    - advice from a faculty member
    - petition admission to major
    - waivers and substitutions; transfer credit equivalency

- **Program Assistant**
  - Paula Newcomer
Declaring a Physics Major

- **Transcript-Based Admission**
  - Minimum criteria
  - Not competitive
  - No cap on number of majors

- **Petition-Based Admission**
  - Route if do not meet minimum criteria

- **Goal of admissions criteria**
  - Students are prepared for major
  - Students actively choose major
  - Fewer students who leave UW without a degree
How to Declare a Major

www.phys.washington.edu

Declaring a Physics Major

Declaring a Major in Physics

Physics at UW Seattle is a "minimum requirement" major, and the number of majors, nor is admission competitive. The minimum requirements may be found via the link.

Students may be admitted to the physics major at the University of Washington, Seattle, either through transcript-based petition or the Undergraduate Program of Interest. Students who meet the requirements for the (details below) may be admitted to the physics major by the Undergraduate Program of Interest, Margot Nims. In brief, students must be enrolled in a UW-Seattle core course and have completed at least one additional core physics or math class with a grade of 3.0 or higher during the previous two quarters (three, if you took a course at the University of Washington, Seattle, either through transcript-based petition or the Undergraduate Program of Interest). Students wishing to major in physics who do not meet these requirements may file a petition to the Undergraduate Program of Interest at the University of Washington, Seattle.
During the qualifying quarters, a student must have received a grade of at least 2.6 in both one qualifying course from List 1 and at least one additional qualifying course from either List 1 or List 2. A student must also either be enrolled in a List 1 course at UW Seattle during the quarter in which the application is submitted, or have completed a List 1 class at UW Seattle during the previous quarter.

Students must prepare a quarter-by-quarter, realistic course schedule that will result in a physics degree in their chosen degree option (Applied, Comprehensive, Biological or Teaching) in a reasonable period of time. Students will discuss their graduation plan with the Undergraduate Advisor when declaring a physics major.

- **List 1: Core Physics Lecture Classes**
  - Physics 121, 122, 123, 224, 225, 226, 227, 228
  - Physics 321, 322, 323, 324, 325, 328, 329 and Astronomy 321, 322, 323

- **List 2: Core Math Classes**
  - Math 124, 125, 126, 134, 135, 136, 307, 308, 309, 324
  - Applied Math 301, 351, 352, 353, 401

- **Qualifying quarters**: Admission will be based on the two quarters immediately preceding the student’s application to the major. If a student was not enrolled during one of those two quarters (e.g., summer, internship or study abroad), then it will be based on the three immediately preceding quarters. These courses need not have been at UW.
Catalyst Form for Admission

1. Name, Email, Student Number
2. Degree option and planned graduation date
3. List 1 physics course you are currently taking
4. Highest List 1 grade in prev. 2† qtrs
5. (Next) highest List 1/List 2 grade in prev 2† qtrs
6. Enter plan into MyPlan and go see Margot Nims

List 1 = Physics n2x
List 2 = Math/AMath requirement

If any of:
• 3 is blank
• 4 is < 2.6 or blank
• 5 is < 2.6 or blank

PETITION or WAIT (and come in for advising)

†3, if took qtr off
Petition-based Admission

- At least one List 1/2 course should have been completed at UW Seattle during a qualifying quarter. Proposed exceptions to this criterion (e.g., you are currently enrolled in, but have not completed, any qualifying courses) must be strongly supported in your personal statement.

- **Personal Statement.** Address goals and objectives, past academic performance, successes not on your transcript and support network.

- **Graduation Plan.** Complete a quarter-by-quarter, realistic course schedule that will result in a physics B.S in a reasonable period of time.

- **Interview.** Meet to discuss your Personal Statement and Graduation Plan with the Undergraduate Faculty Advisor

- Rejected students may reapply after passing an additional qualifying course.
Personal Statement

- **Goals and objectives:** Why do you want to major in physics?

- **Past academic performance:** What has gone well for you? What has not? What is your assessment of what makes a difference? Were you hampered by inadequate high school preparation? Did you have significant non-academic time commitments?

- **Successes not on your transcript:** What leadership, family, volunteer, or work accomplishments are you proud of?

- **Support network:** What academic and social resources will you use to support your future success in the physics major?

All of you should think about these items, whether or not you are petitioning!
Questions on Process?

Next: Navigating the Major
What do I have to do to graduate?

www.phys.washington.edu

UNDERGRADUATE

BS in Physics

Core

Comprehensive Applied Biological Teaching
<table>
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<tr>
<th>N</th>
<th>%</th>
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<td>100</td>
<td>Physics B.S. A10 to Sp15, 227 by A09</td>
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<tr>
<td>249</td>
<td>75</td>
<td>Completed Mechanics by end of 1st yr at UW</td>
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<tr>
<td>222</td>
<td>67</td>
<td>Took Full Intro sequence at UW</td>
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<td>146</td>
<td>44</td>
<td>Took Mechanics first year at UW</td>
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<td>97</td>
<td>29</td>
<td>Took Waves in first year at UW</td>
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<td>46</td>
<td>14</td>
<td>Took Mechanics first quarter at UW</td>
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<td>Mechanics 1st qtr, Waves 3rd Qtr at UW</td>
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<td>21</td>
<td>6</td>
<td>Then took MP-1 next Autumn</td>
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<tr>
<td>16</td>
<td>5</td>
<td>Took Thermal Phys that Aut &amp; QM-1 Winter *</td>
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<tr>
<td>11</td>
<td>3</td>
<td>Took E&amp;M 1 following Aut &amp; E&amp;M 2 Winter *</td>
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<tr>
<td>6</td>
<td>2</td>
<td>Graduated in 3.75 yrs (only 1 took Electronics in sequence)</td>
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<tr>
<td>2</td>
<td>&lt;1</td>
<td>Took at least 1 400-level (non-lab) physics elective</td>
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**Core Physics Lecture Requirements**

**Cohort:** Graduates A10 to Sp15 who completed Phys 227 by A09

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* The “&” here didn’t lose any students. These students also took MP-2 and QM-2
What delays students?

Decide Early

- I have changed majors or chosen a major late.
- There are too few credits given per required core physics course.
- I am pursuing two or more majors/degrees
- I have been delayed by inability to enroll in physics classes that I need.
- I took fewer courses each quarter so that I could get better grades.
- Health or other personal problems slowed my progress.
- I have been delayed by inability to enroll in non-physics classes that I need.
- I have been unable to take full course loads due to financial needs.
- I took some time off for travel or other non-work opportunities.
- There were not enough physics classes offered at the institution I attended before UW.
- Something else (please describe below)

Check your MyPlan

Get help early

Number of Students Reporting
(of 137 total; 88 checking at least one box)

- of minor importance
- somewhat important
- reasonably important
- very important
# Physics Core Courses

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<th>Core Classes (55 cr)</th>
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<td>Math 307, 308, 309, 324;</td>
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<tr>
<td>Amath 351, 352, 353, 401</td>
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<tr>
<td>227 321, 322 334</td>
<td>Mathematical Physics Electricity and Magnetism I&amp;II Electronics Laboratory</td>
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</table>
UW Physics Major Options

- **Comprehensive**
  - Graduate school in physics or astronomy
  - Full range of physics and math

- **Applied**
  - Technical job at B.S. level or M.S. in engineering
  - More flexibility in electives

- **Teaching**
  - Communicate science to HS or general audience
  - Physics by Inquiry sequence

- **Biological**
  - Medical school or grad school in biophysics
  - 7 quarters of biology and chemistry in addition to physics core
# Physics Option Requirements

<table>
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<th>Applied (+34-39 cr)</th>
<th>Teaching (+38-41 cr)</th>
<th>Biological (+51-55 cr)</th>
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<td><strong>Math</strong></td>
<td>Phys 228 (Math Phys) + 1 MM</td>
<td>AMATH 301 (MatLab) +2 of {Phys 228 +MM}</td>
<td>Phys 228 + 1 MM</td>
<td>Phys 228</td>
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<td><strong>32x</strong></td>
<td>226, 324 (Part; QM2) 3 of junior level E&amp;M, QM, Astro, Classical Mech, Stat Mech</td>
<td>One from 226, 323, 324, 328, 329 (Part., E&amp;M3, QM2, Stat Mech, Classical)</td>
<td>226, 324 (Part; QM2) One from E&amp;M, QM, Mechanics</td>
<td>324 (QM2) 328 (Statistical) One from 226, 323, 325, 329</td>
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<tr>
<td><strong>Lab</strong></td>
<td>Two advanced labs</td>
<td>231 (intermediate lab) Two advanced labs</td>
<td>One advanced lab</td>
<td>(in bio/chem)</td>
</tr>
<tr>
<td><strong>Capstone</strong></td>
<td>3 cr Research or Sem</td>
<td>3 cr Research or Sem</td>
<td>3 cr teaching/PER</td>
<td>3 cr in bio-related research</td>
</tr>
<tr>
<td><strong>UD Elect</strong></td>
<td>2 additional Phys/Cognate Class</td>
<td>3 additional 32x, Phys/Cognate (≥ 1 UD lecture; may include 1 lab; 1 intro sci)</td>
<td>407-8-9 (physics for future teachers)</td>
<td>429 (Biophysics)</td>
</tr>
<tr>
<td><strong>Other Sci</strong></td>
<td>3 chem classes 2 bio 2 additional bio/chem</td>
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</tbody>
</table>
# Physics Minor

<table>
<thead>
<tr>
<th>Core</th>
<th>Mechanics, Elect. &amp; Mag., Waves, Thermo, Quantum I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phys: 121, 122, 123 224, 225 (or 248)</td>
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<tr>
<th>Specialization (Pick 1)</th>
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<tbody>
<tr>
<td>Physics Education</td>
<td>Physics by Inquiry Series Phys 407-408-409</td>
</tr>
<tr>
<td>Experimental Physics</td>
<td>Intro Laboratory Analysis: Phys 231 Electronics: Phys 334 Additional Advanced Lab</td>
</tr>
<tr>
<td>Mathematical Physics</td>
<td>Math Physics I and II: Phys 227, 228 Either Electricity &amp; Magnetism (321) or Quantum Mechanics (324)</td>
</tr>
</tbody>
</table>
To find these slides (in a day or two) and info about the physics major, go to www.phys.washington.edu & click on “UNDERGRADUATE”.

Prof. Marjorie Olmstead
ufaphys@uw.edu
PAT C141

So now do you think you want to major in physics ...?

Spring Quarter Office Hours
PAT C141
Tues: 12:00 pm – 2:00 pm
Wed: 10:30 am – 12:30 pm
Thu: 8:30 am – 10:30 am
Fri: 3:00 pm – 5:00 pm