

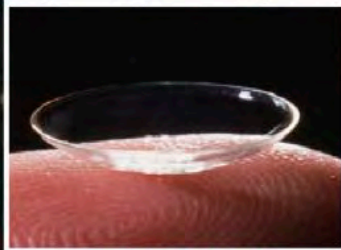
Prof. Marjorie Olmstead
ufaphys@uw.edu

WELCOME

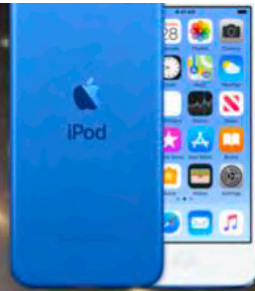
Assoc Chair for Undergraduates
Undergraduate Faculty Advisor

- Every one of you has the capability to graduate with a bachelor of science in physics.
- Every one of you is welcome, regardless of other identities you hold in addition to that of physics student.
- Every one of you may access campus resources to smooth your path through UW and help you transition to life beyond UW.





Contact Lens

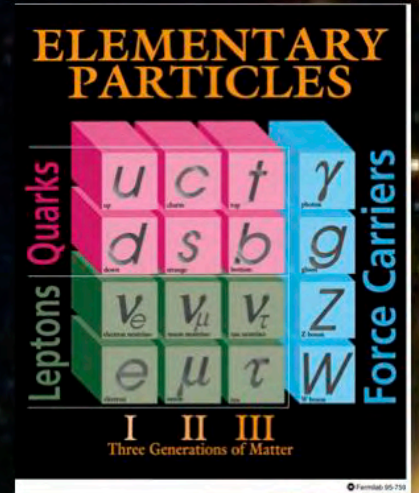


'Butterfly Wings on Every Eyelid' - L'Oreal

Physics explores how the universe works



Solar Power



MRI of Brain Cancer



Learning Physics at UW

- Largest undergraduate program in the country (expect 200 graduates this year)
Lectures are large, but have breakout sessions in 100- and 300-level courses and in all lab courses
- Most UG do some sort of research
140 students last year in physics department
80% of majors do research/project on campus
- Society of Physics Students provides community



Intro Tutorial



UG Collaborate on Research



Advanced Lab

SPS Annual Trip to LIGO



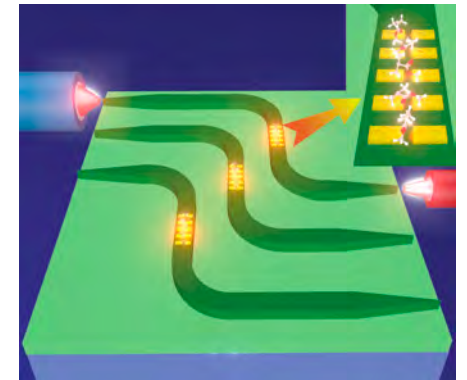
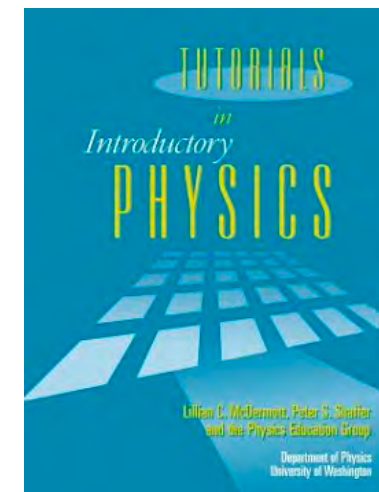
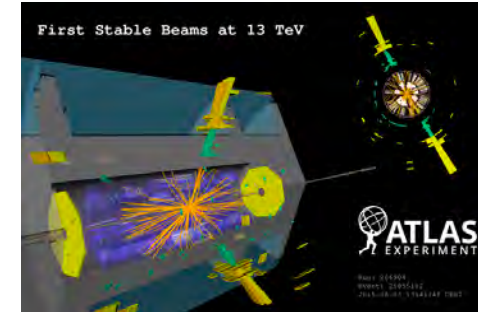
Getting Started – Pick the right 100-level route for you

PHYS 10x	Conceptual Physics	Algebra only.	Only starts in AUT
PHYS 11x	Physics for Life Sciences	Pre-calculus, algebra based	Starts every quarter
PHYS 12x	Physics for Physical Sci & Engr.	Calculus co-requisite	Starts every quarter
PHYS 14x	Honors Physics	Calculus I pre-requisite	Only starts in AUT

HS Physics	HS Pre-Calculus	AP Physics	AB Calculus	BC Calculus		AUTUMN	WINTER	SPRING
NO	NO	NO	NO	NO	No HS prep	PHYS 101 MATH 120	MATH 124	PHYS 121 MATH 125
NO YES	YES YES	NO NO	NO NO	NO NO	Calc Ready	MATH 124	PHYS 121 MATH 125	PHYS 122 MATH 126
YES NO	YES YES	EITHER NO	EITHER YES	NO NO	HS Phys	PHYS 121 MATH 124	PHYS 122 MATH 125	PHYS 123 MATH 126
NO YES	YES YES	NO EITHER	YES YES	EITHER EITHER	HS Calc	PHYS 121 MATH 125	PHYS 122 MATH 126	PHYS 123 MATH 3XX
NO YES YES	YES YES YES	NO NO YES	YES YES YES	EITHER EITHER EITHER	Honors	PHYS 141 MATH 134 or 125	PHYS 142 MATH 135 or 126	PHYS 143 MATH 136 or 126

UW Physics Degree 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, grad school in biophysics, biomed industry
 - 7 quarters of biology and chemistry in addition to physics core



<https://phys.washington.edu/declaring-major>

Why major in physics?

- GOOD reasons
 - Because you REALLY want to know 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 explored several other options, and you like physics the best
- 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

UW offers over 200 undergraduate degree options, and that is before you start to mix and match

Physics is Capacity-Constrained

WHY?

- For the past 5 years, we have had the largest undergraduate program in the country
 - 200 undergraduates have already applied to graduate this year, a record
- Ten years ago
 - we graduated 57 physics bachelors in a single degree track.
 - we had 4.5 more tenure-track faculty FTE than we do now
 - we could fit our required 300-level courses in an 80-seat lecture hall
- Choice: limit the number of majors or decrease the requirements to graduate
 - Bottlenecks: Advanced Laboratory and Capstone Opportunities

GOING FORWARD

- We hope to admit to the major all students who truly want to be physics majors and who have the skill and knowledge base to succeed in the major.
- Prior to Winter 2020, the requirements were to earn ≥ 2.6 in recent physics and math classes. The median grade in the introductory sequence is typically 2.8.
- How competitive admission will be depends on the level of interest. We admitted 80% in winter.

What does it take to be a physics major?

- Interest –
 - Keen to learn about how and why matter interacts
 - Enjoy “mathematization” of events and processes, and using the results to predict the future
 - Proactive participation in your own learning
 - Desire to pursue a career that uses physics knowledge and skills
- Skills –
 - Time management and organization
 - Problem solving
 - Mathematical facility
- Knowledge base –
 - Algebra, Trigonometry, Calculus
 - Introductory physics series
(mechanics, electricity, magnetism, waves, optics, quanta, heat)

Typically apply Autumn or Spring of 2nd Year

What comes next?

- You can take any job where they want you to solve complex problems.
- You can attend any graduate program that builds on a physics base.

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 a third 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 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**.²
- One-third graduate with a **double major**, many in math.³
- One-tenth start at **two-year colleges**.⁴

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

~22% enroll in professional degree programs or attend graduate school NOT in physics or astronomy.⁵

- About half enter an **engineering** program; the rest enter programs in math, medicine, education, or another field.⁶
- As a group, physics majors score among the highest of all majors on medical school and law school admission tests (the MCAT and LSAT).⁶
- 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.⁷

~36% attend graduate school in physics or astronomy.⁸

- About 80% enroll in a **PhD program**; the remainder choose a master's degree program.⁸
- 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.⁹

Common employment sectors include:

Private sector⁷

- 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 \$90K.

Colleges or universities⁷

- 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 government⁷

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

Active military⁷

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

High school teaching⁷

The Statistical Research Center does not formally follow the career paths of these individuals, but we hear that they go on to successful careers in engineering, management, education, law, medicine, business, and a variety of other areas.



Add to the mix:

Foreign citizens coming to the United States for a graduate degree, students who earned bachelor's degrees in another field but want a graduate degree in physics, and students who earned a physics bachelor's degree in previous academic years.

~1 out of 6 US physics bachelor's receive a physics or astronomy PhD.¹⁰

- A doctorate in physics takes an average of 6–7 years.¹⁰
- Most PhD students are **fully supported** by teaching or research assistantships or fellowships.

Within one year of earning a physics PhD...

~2/3 accept a temporary position (e.g. a postdoc), primarily at a university or with the government.¹¹

~1/3 accept a potentially permanent position.¹¹

- 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.

The approximate breakdown by employment sector for all employed physics PhDs (not just new ones), is given below.¹¹

- 45–49% Private sector
- 29–33% Academic
- 14–17% Government
- 5–7% Other

~1 out of 12 US physics bachelor's receive an exiting physics or astronomy master's degree.⁴

Exiting 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**.⁸
- A master's degree in physics usually takes about **two years**.

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

~2/3 enter the workforce.⁹

- About half work in the **private sector**, overwhelmingly 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.

~1/3 continue with graduate studies.⁹

- 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.

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.

1. Starr Nicholson and Patrick J. Mulvey, *Roster of Physics Departments with Enrollment and Degree Data*, 2013, August 2014.
2. AIP Statistical Research Center, *AIP Physics Trends: Research Experiences of Physics Undergraduates*, Fall 2009.
3. AIP Statistical Research Center, *AIP Physics Trends: Physics Students Have Broad Interests*, Spring 2011.
4. Susan White and Raymond Chu, *Physics Enrollments in Two-Year Colleges*, April 2013.
5. Casey Langer Tesfaye and Patrick Mulvey, *Physics Bachelor's One Year After Degree*, September 2014.
6. Casey Langer Tesfaye and Patrick Mulvey, *MCAT, LSAT and Physics Bachelor's*, December 2013.
7. Casey Langer Tesfaye and Patrick Mulvey, *Physics Bachelor's Initial Employment*, September 2012.
8. Patrick J. Mulvey and Starr Nicholson, *Trends in Exiting Physics Master's*, March 2014.
9. Patrick Mulvey and Brandon Shindel, *Physics & Astronomy Master's Initial Employment*, April 2011.
10. Patrick J. Mulvey and Starr Nicholson, *Trends in Physics PhDs*, February 2014.
11. Garrett Anderson and Patrick Mulvey, *Physics Doctorates Initial*

Learn more at the Careers Toolbox
www.spsnational.org/career

gradschoolshopper.com

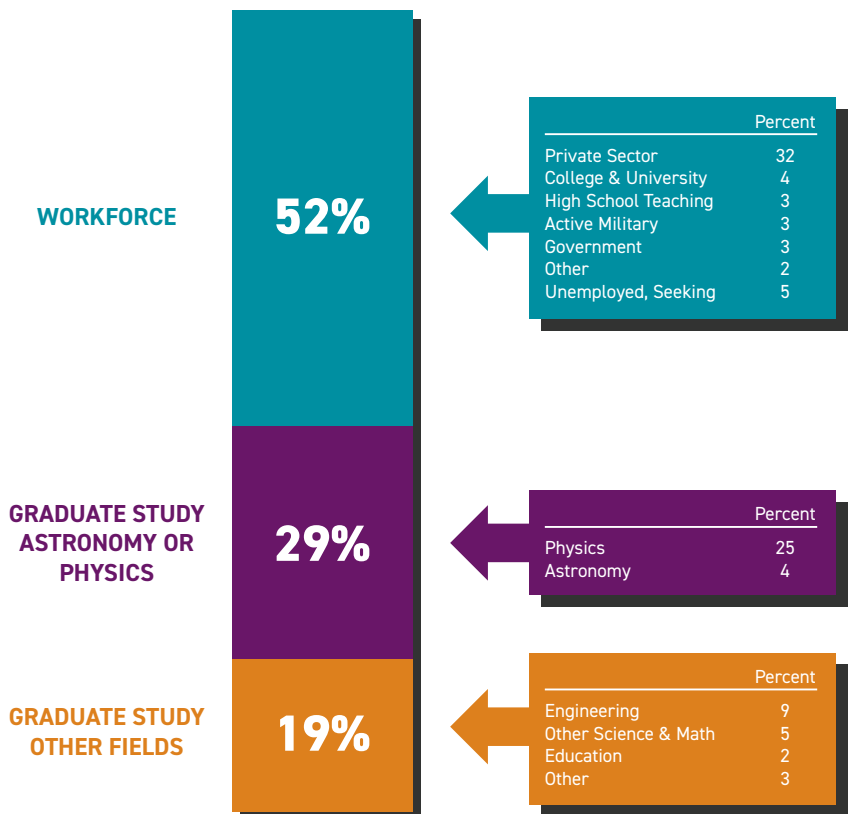
www.spsnational.org/careerstoolbox

Immediate Plans After Physics B.S. ...

- National Data: 1 year post graduation
from [aip.org/statistics](https://www.aip.org/statistics)

Physics Bachelors 1 Year Later

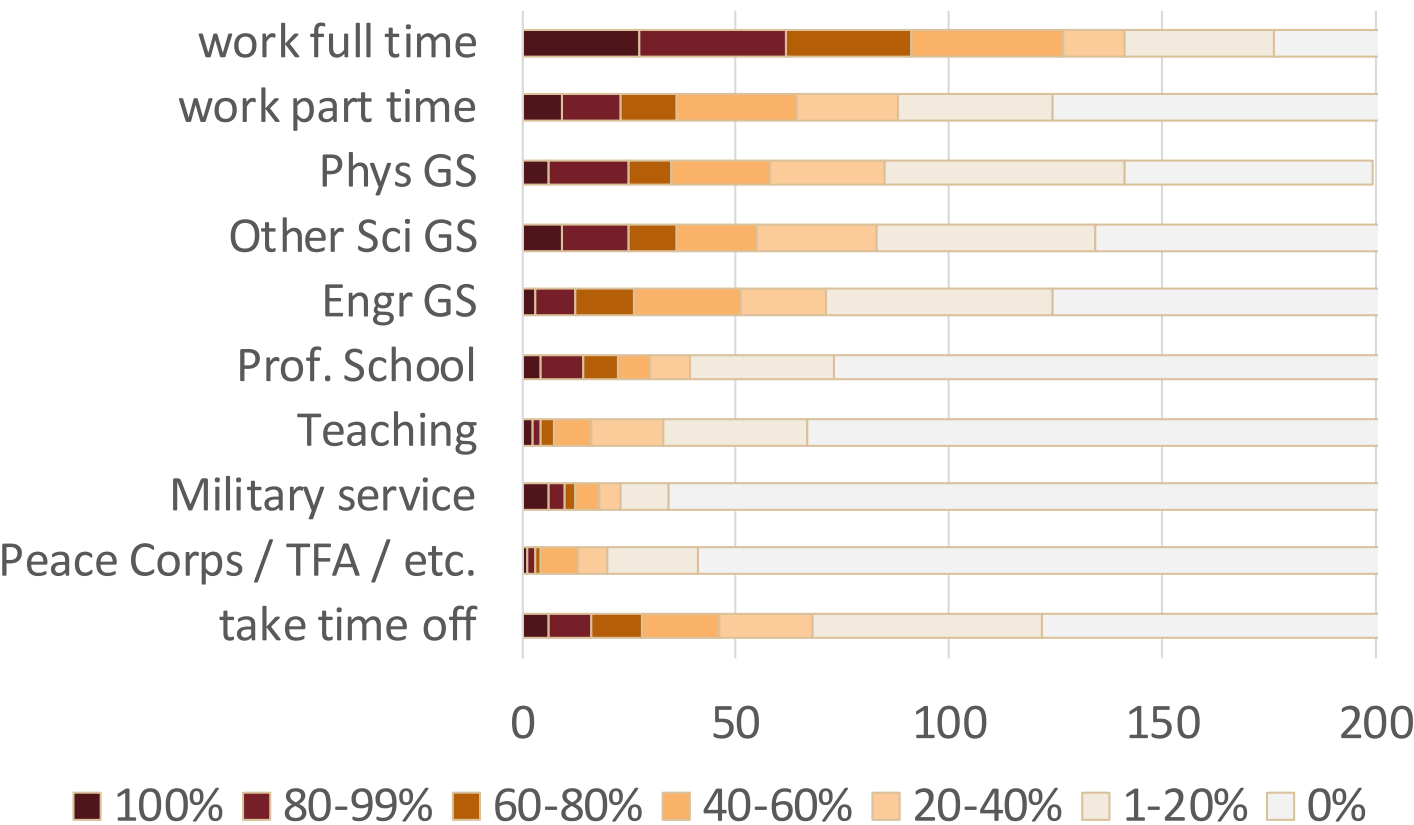
8,800 Recent Degree Recipients



Classes of 2017 and 2018 combined

- UW Data: Pre-graduation 2020 (200 students)

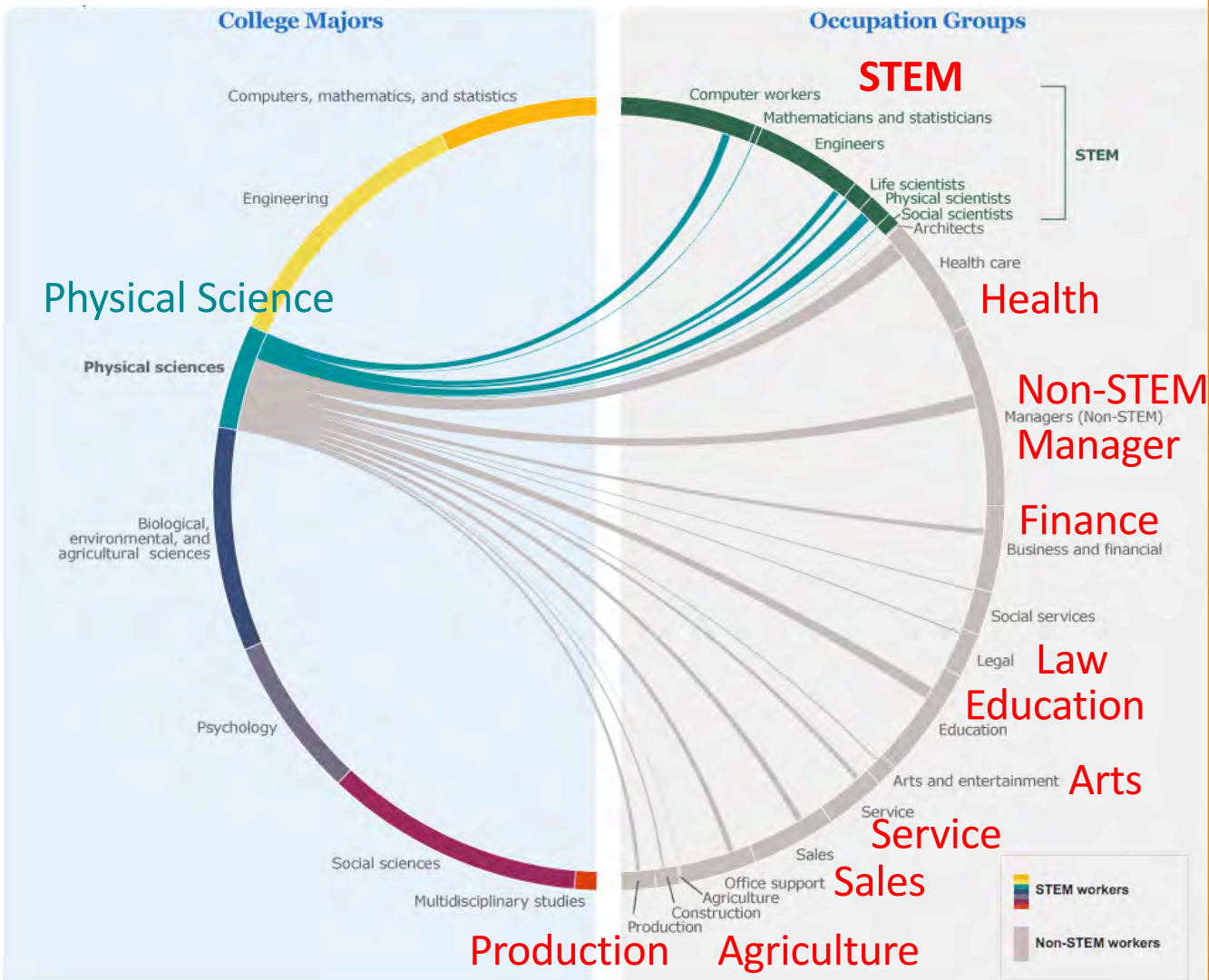
Estimated Probability I will ...



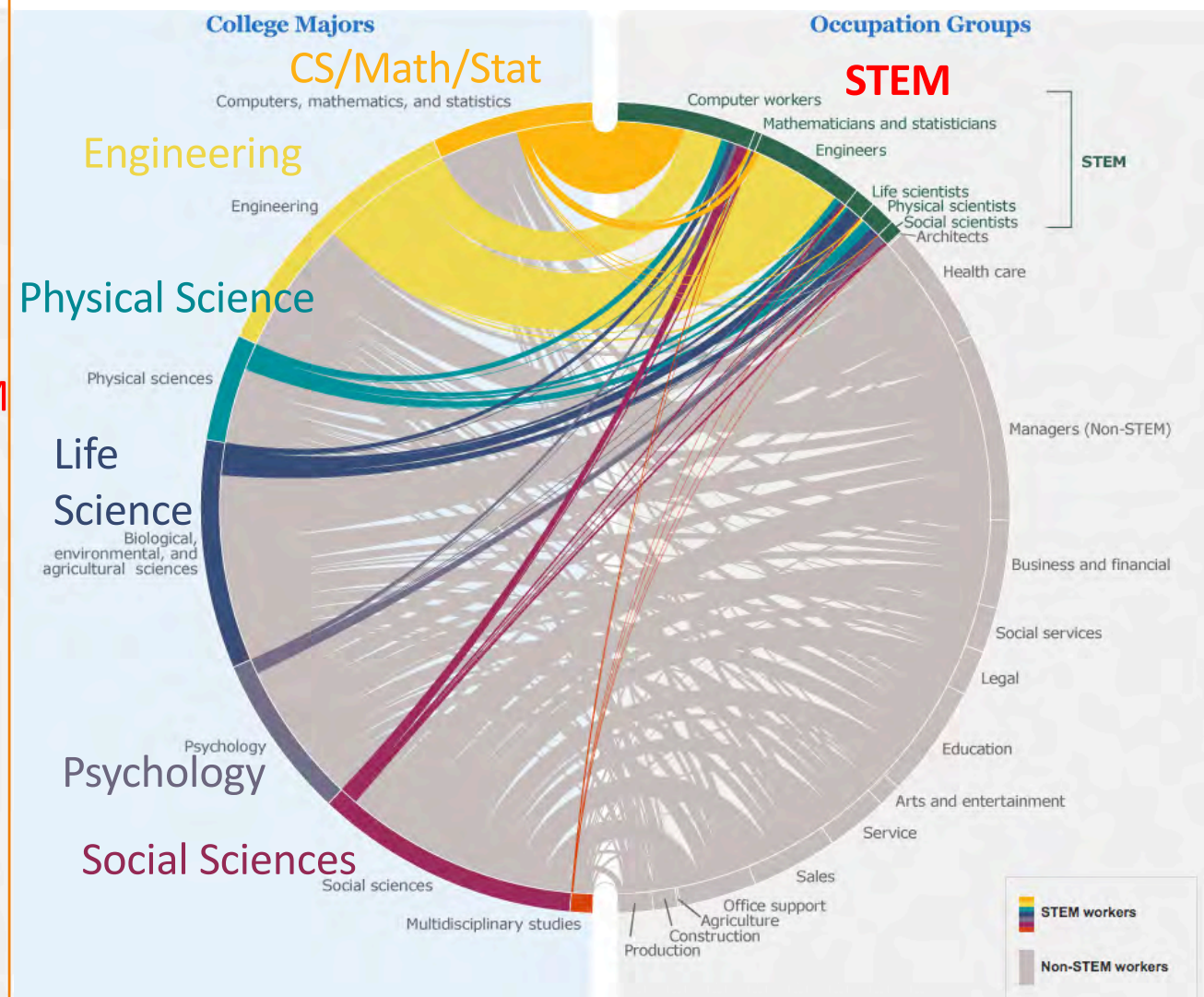
Occupation vs. College Degree – you have OPTIONS

<https://www.census.gov/dataviz/visualizations/stem/stem-html/>

In which careers do Physical Science BA/BS end up?



Which STEM BA/BS end up with STEM job?



Typical Job Titles/Salaries 1 yr Post B.S.

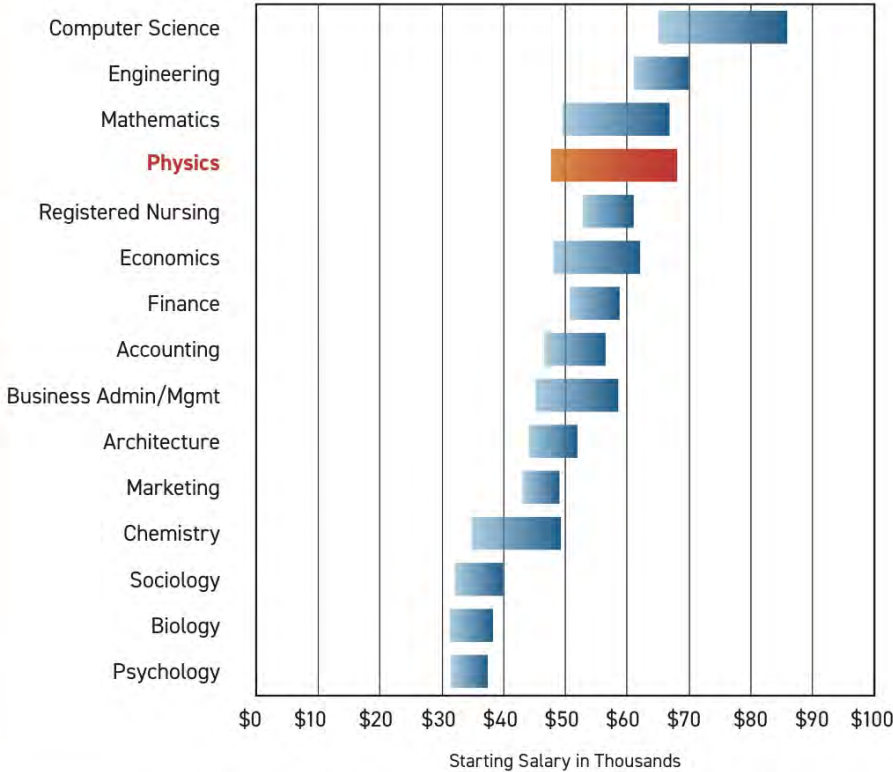
Engineering	
Systems Engineer	Application Engineer
Electrical Engineer	Development Engineer
Design Engineer	Engineering Technician
Mechanical Engineer	Field Engineer
Project Engineer	Process Engineer
Optical Engineer	Process Technician
Manufacturing Engineer	Product Engineer
Manufacturing Technician	Product Manager
Laser Engineer	Research Engineer
Associate Engineer	Test Engineer
Technical Services Engineer	General Engineer

Education
High School Physics Teacher
High School Science Teacher
Middle School Science Teacher
Substitute Science Teacher

Research & Technical
Research Assistant
Research Associate
Research Technician
Lab Technician
Lab Assistant
Accelerator Operator
Physical Sciences Technician

Computer Hardware / Software
Software Engineer
Programmer
Web Developer
IT Consultant
Systems Analyst
Technical Support Staff
Analyst

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.

Data from American Institute of Physics (aip.org/statistics)

@AIPStatistics

aip.org/statistics

Who hires physics bachelor's in Washington State?

Washington Employers that recently hired new physics bachelor recipients (2014-2018 data)
<https://www.aip.org/statistics/washington>.

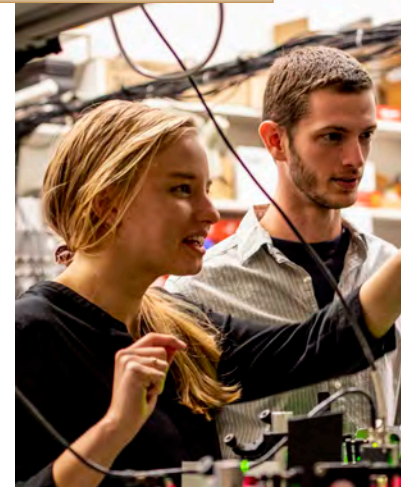
AbbVie
AeroTEC
Allen Institute for Brain Science
ALS Global
Amazon
Applied Motion Systems
Areva
Assemble Inc.
Battelle
Bluetooth SIG, Inc.
Boeing
BTownWeb
Carlisle IT - Tri Star
Casey Products
Chipton Ross
Corvus and Columba LLC
Dynetics, Inc.
Eagle Harbor Technologies, Inc.
Electroimpact, Inc.

Factset
Fidelity Investments
Fred Hutch Cancer Res Ctr
G.S. Builders
Google
HopeSource
HP Inc.
Inst. Defense Analyses
Inst. Environmental Health
Inst. Health Metrics & Eval.
Intellectual Ventures
Jacobs
Lease Crutcher Lewis
Leidos
Manufacturing Technology Inc.
Marchex, Inc.
Microsoft
Microvision
Mott MacDonald

Orbital ATK
Ozone International
Pacific Northwest National Laboratory
Pellego
Physio-Control Inc
Professional Credit Service
PSC Biotech
Puget Sound Energy
Radiant Vision Systems
RAFI USA
Raisbeck Engineering
Randstad
Scribe America
Seattle Children's Research Institute
Silicon Mechanics
Tableau Software
Tecplot Inc.
TigerStop
United States Navy
UT Austin
UW
UtiliQuest
Visiongate
VL Systems
WA State Dept of Transportation
Woodruff Sci. Computing

We look forward to your joining us!!

Graduation 2019

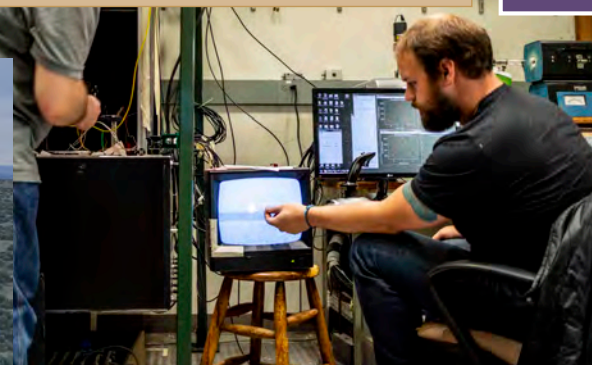


Intro Tutorial

To talk with us or get your questions answered during the COVID-19 shut-down:
<https://phys.washington.edu/advising-student-services-0>. physadvs@uw.edu

UG Collaborate on Research

SPS Annual Trip to LIGO



Advanced Lab



Details for the Interested Student

- Contact Information for Physics Student Services and Advising
- Major Requirements: Core + Degree Options
- Minor Requirements
- Major Application Procedure
- Satisfactory Progress Policy
- Selected Data from 2020 Pre-Graduation Survey
 - Career goals
 - Research participation
 - Factors that can delay graduation
 - Satisfaction with program
 - Preparation for program

Physics Student Services – PAT C139

- Director of Student Services
 - Catherine Provost (cuala@uw.edu)
 - All graduate issues
 - Grad school-related UG issues
- Staff Advisors
 - Margot Nims (sassy2@uw.edu) and Paula Newcomer (newcomer@uw.edu)
 - All undergraduate issues
- Introductory Sequence Program Coordinator
 - Susan Miller (susanh82@uw.edu)
 - 100-level course logistics
- Faculty Advisor
 - Prof. Marjorie Olmstead (ufaphys@uw.edu)
 - advice from a faculty member
 - waivers and substitutions
- Program Assistant
 - Amy Glenz (amyglenz@uw.edu)

If you aren't sure who should answer your email:
physadvs@uw.edu

To reach us during the COVID-19 shut-down:
<https://phys.washington.edu/advising-student-services-0>

Common Physics Core (55 cr) – taken by all majors

- 5-quarter overview of physics (21 cr)
 - Motion; Electricity & Magnetism; Oscillations & Waves; Thermal Physics; Quantum Physics
- Key tools for doing physics (8 cr)
 - Mathematical tools
 - Electronics lab
 - Overview of physics research
- Common sequence for applying those tools (8 cr)
 - Advanced Electricity and Magnetism
- At least 4 quarters of math (≥ 18 cr)
 - One year of Calculus
 - Selections from Linear Algebra, Differential Equations, Vector Calculus, Partial Diff. Eqn, Complex Analysis

See <https://phys.washington.edu/major-requirements>

Physics Degree Option Requirements

	Comprehensive (+38-41 cr)	Applied (+33-36 cr)	Teaching (+38-41 cr)	Biological (+51-55 cr)
Math	Math Phys II + Another adv. math	Matlab or Python + +2 adv. math	Math Phys II + Another adv. math	Math Phys II
32x	Relativity & Particles, Quantum Mechanics; 3 of E&M, QM, Astro, Classical Mech, Stat Mech	One from “call me a physicist” list	Relativity & Particles, Quantum Mechanics; 1 more “call me a physicist”	Quantum Mechanics Statistical Physics 1 more “call me a physicist”
Lab	Two advanced labs	Data Analysis lab Two advanced labs	One advanced lab	(in bio/chem)
Capstone	Research or Seminar	Research, internship or Seminar	Teaching practicum	bio-related research
UD Elect	2 additional Phys/Cognate Class	3 additional Phys/Cognate (may include 1 lab; 1 intro sci)	Sequence for future teachers	Biophysics
Other Sci				1 year intro chemistry 2 qtrs. Intro biology 2 additional bio/chem

Physics Minor (30-36 cr, plus math*)

Core (21 cr)	https://phys.washington.edu/minor-physics
Motion, Electricity & Magnetism, Oscillations & Waves, Thermal Physics, Quantum Physics	
Specialization (Pick 1)	
Physics Education (15 cr)	Physics by Inquiry Series
Experimental Physics (9 cr)	Intro Laboratory Analysis Electronics Lab Additional Advanced Lab
Mathematical Physics (12 cr)	Math Physics I and II: Phys 227, 228 Either Electricity & Magnetism (321) or Quantum Mechanics (324)

*Note: Prerequisites for these classes includes 15 credits of calculus sequence, plus 6-7 credits of advanced math

Declaring a Physics Major

See <https://phys.washington.edu/declaring-major>

1. Complete PHYS 123 and MATH 126.
 2. Take a physics course within the previous two quarters and be enrolled in a physics course with number > 220.
 3. Develop a graduation plan and enter into UW MyPlan.
 4. Personal statement addressing reasons for choosing physics and strategies for success in the major.
- Apply online during first three weeks of Spring or Autumn quarter.*
 - Meeting minimum requirements does not guarantee admission. Admission is capacity constrained, based on holistic review of a student's record.
 - New majors must agree to the department [Code of Conduct](#) and have their graduation plan approved by Physics Student Services.
 - See department [website](#) for sample graduation plans

* Winter quarter for transfer students or extended premajors only

Criteria for Satisfactory Progress

- Students must take physics courses, courses from the menu of math classes, or electives in other departments that meet a requirement for the physics major. Exceptions (e.g. for double major, study abroad) should be pre-approved.
- Maintain a cumulative average GPA of at least 2.0 in all physics classes.
- Students must earn a numerical grade of at least a 2.0 in each course used to satisfy the requirements of the physics major.

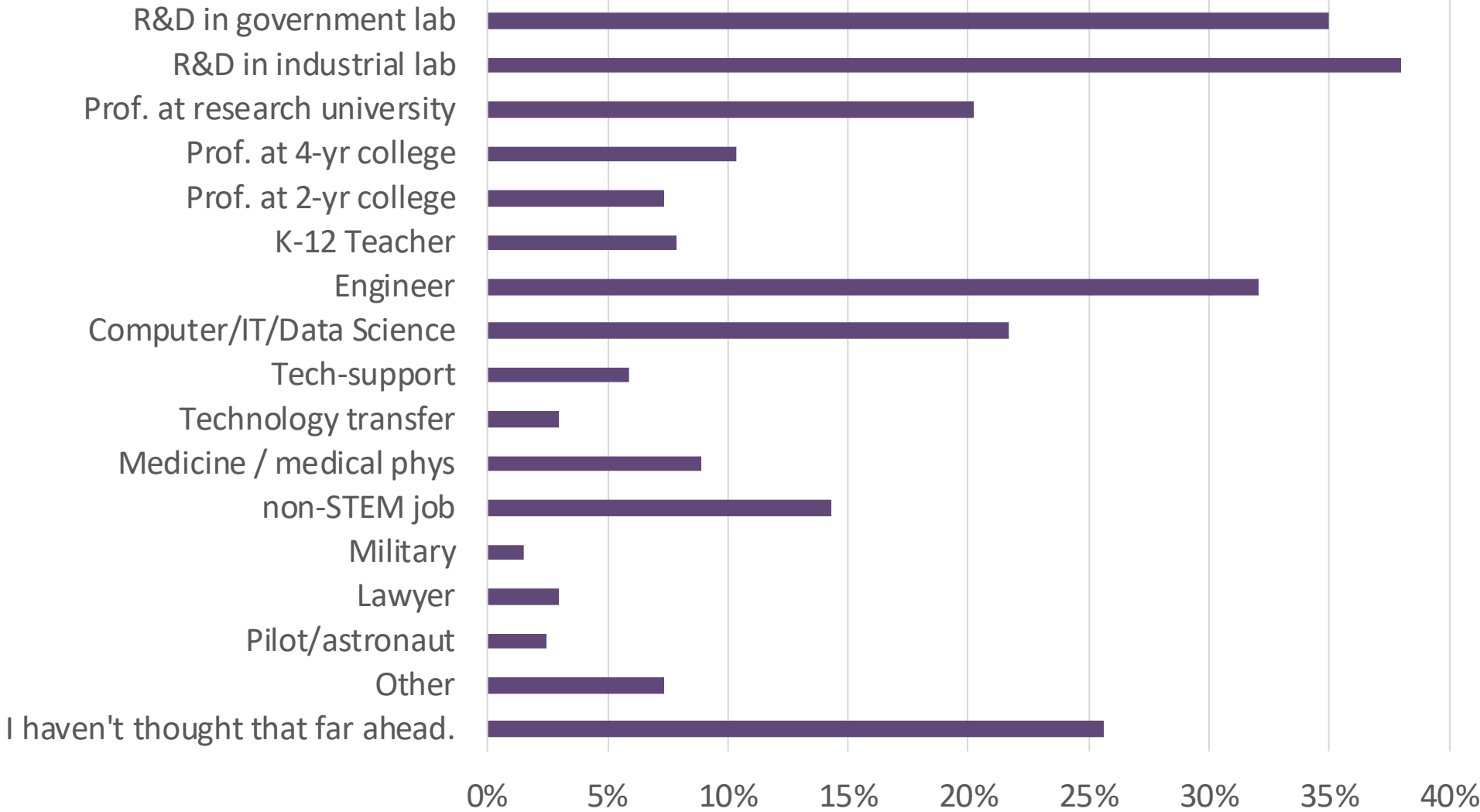
See <https://phys.washington.edu/uw-physics-major-continuation-policy>

Some results from this year's survey of graduating seniors (filed 2 to 10 months prior to graduation)

- Career Goals
- Participation in Research
- Causes for delays in their graduation
- How well their previous institution prepared them for the physics major

Career Goals

**What type of job do you envision having in 10-15 years?
(check all that apply)**



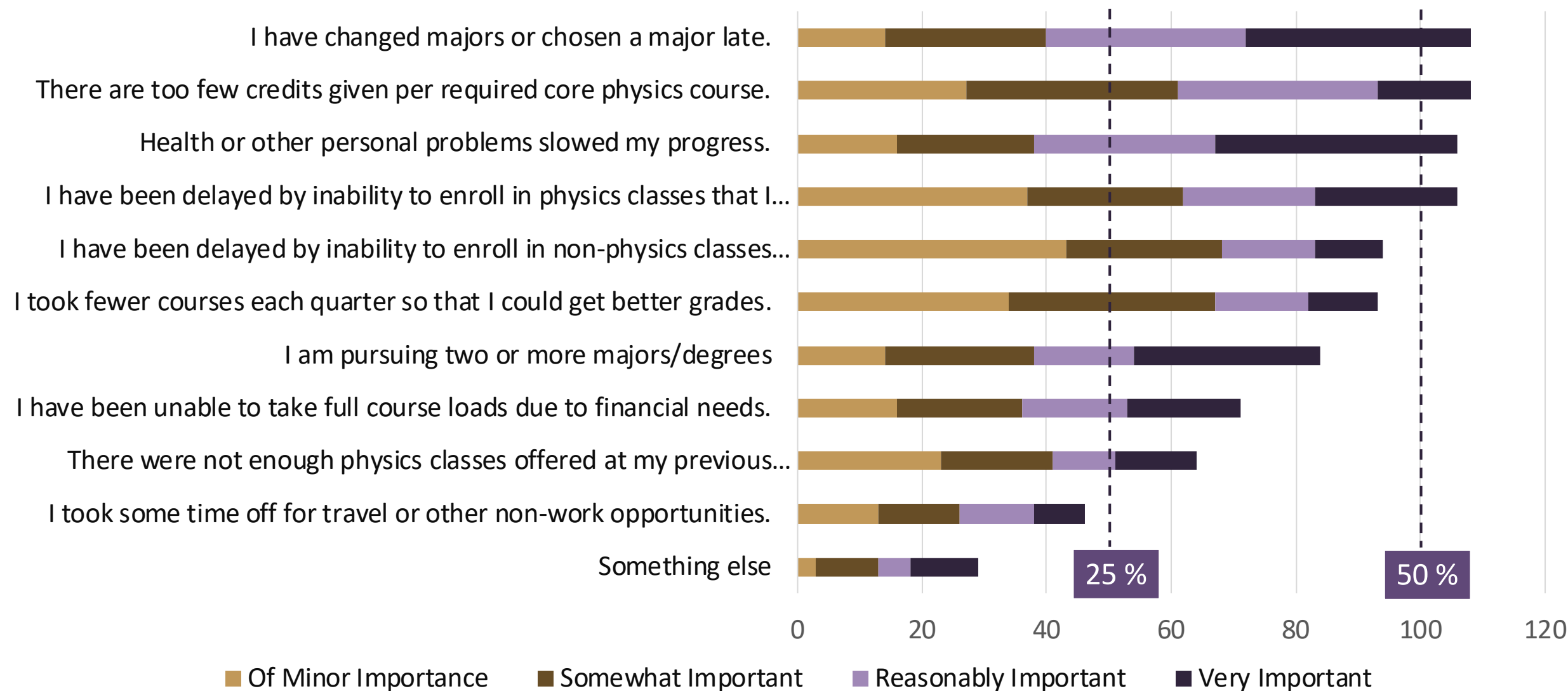
Participation in Research

- From 2019-20 Graduation Survey (filed 2 to 10 months before graduation)

Have completed research for credit	59%
Plan to do so before graduation	21%
No, I had difficulty finding project or fitting to my schedule	16%
Not interested in pursuing research	4%

- From Transcripts Aut 16 through Win 20
 - 302 distinct students received undergraduate credit for doing research with 43 distinct physics faculty, for a total of over 1200 credit hours
 - 80% of graduates received credit for doing research either in physics or elsewhere on campus

What factors impacted your ability to graduate in four years from starting college (at UW or elsewhere)?



Preparation for our program

How well did your educational experiences prior to UW prepare you for the skills and knowledge needed to succeed in your UW physics courses?

