### **ANYONE can do Physics!!**

At the University of Washington, we believe we are at our most excellent when we cultivate a diverse and equitable academic community. We strive to create welcoming and respectful learning and working environments, with access and opportunity for all.



# So you think you want to take physics ...

**Helpful Hints** 

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### **Major and Career Not Same Thing**



### What do Career Physicists Do?



NSF Survey of College Graduates 2013 https://ncsesdata.nsf.gov/us-workforce/2013/index.html Tables 3.2, 3.3, 3.4

### **Post-Graduation Physics BS**



UW Physics 2016-17 Grads Pre-graduation Plans [On Grad Application (N=172)] National Data 2013-14 Grads One year past graduation (aip.org/statistics)

### Typical Job Titles 1 yr Post B.S.

#### Engineering

Systems Engineer	Application Engineer
Electrical Engineer	Development Engineer
Design Engineer	Engineering Techniciar
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

### Who hires physics bachelors in Washington?

#### American Institute of Physics

- Some employers in Washington that recently hired new physics bachelor recipients
- Amazon
- Astronics AES
- Bainbridge Parks & Recreation
- Battelle
- Best in Class Education Center
- Blue Box Group
- Boeing
- Bombsheller
- Bruker Elemental
- Cascade Gasket, Inc.
- Corvus and Columba LLC
- David Evans and Associates, Inc.
- Det Norske Veritas
- Device Inside, Inc.
- Eagle Harbor Technologies, Inc.
- Exotic Metals Forming Company
- ExtraHop Networks

- Financial Partners, Inc.
- Flexasoft
- Google
- Gravity Jack, Inc.
- Intentional Software
- L&S Engineering.
- Lockheed Martin
- Logos Bible Software
- Marchex, Inc.
- Micro Encoder, Inc.
- Microsoft
- NAVSEA
- NW Medical Physics Ctr
- Octapharma Plasma, Inc.
- PNNL
- Procure Treatment Centers
- PSC Biotech

- Puget Sound Naval Shipyard
- Radiant Zemax, LLC
- RAFI USA
- Randstad
- Red Head Steering Gears
- Schneider Electric
- Schweitzer Engineering Labs.
- Seattle Children's Research Inst.
- Stardust Materials
- Tableau Software
- TecAce Software Limited
- Telect, Inc.
- University of Washington
- Washington State University
- Woodruff Scientific Computing
- X2 Biosystems
- Zulily

#### https://www.aip.org/statistics/washington

Source: AIP Statistical Reasearch Center, Initial Employment Surveys, classes 2010 thru 2014.

### UW is largest undergrad physics in US





# Welcome to Elite University!



(UW data from SAT web site)

Percent of UW		
92%		
98%		
100%		

### Top 10% of Introductory Physics: 10%

✤GPA	HS	Phys 121 (1 <sup>st</sup> qtr intro)
≻ GPA > 3.75	67%	15%
≻ GPA > 3.50	91%	28%
≻ GPA > 3.00	98%	45%

Freshmen returning for sophomore year: 94% Six year graduation rate: 84%

### HS GPA doesn't predict Phys 121 GPA



- **Current Status** 
  - Grad Phys
  - Grad Other
  - Enroll Phys
  - Enroll Other
  - Left Phys
  - Left Other

first time taking Physics 121 at UW for students who took Phys 227 A11 to A15

## **Your First Physics Midterm**

# Average grade: usually 60-70% WHY?

• 80% of the points on 80% of the questions = Solid Citizen B

MT1 Phys 122 Au 13



### What does it feel like?

- Gut "I don't fit" Reaction:
  - You are conditioned to believe that 60% is failing.
  - The person next to you got a 95% -- ARGH
  - > No one you see or talk to has your cultural background
  - You wander off and don't come back

### Better "I belong here" Reaction:

- > A 60% on a physics midterm is a "solid citizen" result
- The probability that the person sitting next to you will win the Nobel Prize is finite.
- > The Prof. will likely remember you
- You persevere, work on your study habits, learn from your mistakes, get some extra help and you thrive.

# **Confidence in your Education**

#### Life without Confidence

- You doubt yourself
- You get stopped by small tasks
- You get walked on
- You are miserable
- ≻ You quit

### Life with Confidence

- You believe in yourself
- You overcome barriers and accomplish tasks
- ➤ You are respected
- > You are happy
- You persevere and succeed

### **Confidence vs Time at UW**

Figure 2. Academic Self-Confidence Measures for Women who Remained in Science and Engineering vs. Women who Switched to Another Major



S. Brainard et al, UW Center for Workforce Development

# **Physics 12x Structure**

- No physics makes sense until you have seen it 3 times
- Each of you learns in a different way

### Opportunities

- ➢ PART OF YOUR GRADE
  - Tests (2/3 of total)
  - Tutorial
  - Tutorial Pretests
  - Tutorial Homework
  - Laboratory Pre-lab
  - Laboratory Reports
  - Lecture Homework
  - Class-Response Questions
  - Pre-lecture Questions

#### ➢ HIGHLY RECOMMENDED

- Lecture
- Textbook
- Study Center
- Professor's Office Hours
- Chat Room
- Study with Peers
- Supplemental Homework

### Use what works for you!!

NOTE: Keeping track of all this is one of your biggest tasks in Physics 12x

## 12x Grading

### Exams:

66%

Best 3 of MT1,MT2, final/2, final/2

> 2/3 from lecture, 1/6 lab, 1/6 tutorial

➢ 55% multiple choice MT; 100% on final

Lab (pre-Lab, in-class): 10%

### Tutorial

- (HW, Pretest, Attend) 8%
- Lecture HW
  8%
- Pre-lecture4%
- In-class response

For more detail, see

https://phys.washington.edu/12x-series-grading-allocation

4%

### Should I take calculus first?



- Grad Other
- Enroll Physics
- Enroll Other
- Left Physics
- Left Other

First UW Phys 121 vs Concurrent Math Class N = 594

Grad Physics

# What about HS Physics?

#### First 6-7 weeks of 121 covered well in HS

#### Last 3 weeks are not!

#### If you did have good HS Physics:

Leave time in your schedule for later in the

quarter when new material is introduced

Use the time to explore in greater depth

#### If you DIDN' T have good HS Physics:

- Don't panic. You will catch up soon.
- Develop good study habits early.



### Come to Class!!!

Strongest correlation I could find:



### Resources

- Your Classmates
- Your Teaching Assistants
- Your Professors
- Physics Advisor (Margot)
- Physics Study Center
- Physics 104 Group study for Phys 121
- C. L. U. E. (Mary Gates Hall)
- WISE, Engineering Academic Center
- OMA/D Instructional Center
- Disability Resources for Students

# Why Stay in STEM?

- It's fascinating!
- Lots of career options
- Intellectually engaging
- Meet and work with interesting people
- Solve interesting problems
- Gain the potential to change the world

# Why do people leave SME?

#### Female top 6:

- Non-SME major offers better education
- Turned off of science
- Rejection of SME career and lifestyle
- Poor teaching by SME faculty
- Inadequate advising
- Curriculum overload / fast pace

#### Male Top 6:

- Turned off of science
- Curriculum overload / fast pace
- Poor teaching by SME faculty
- SME Career rewards not worth the effort
- Non-SME major offers better education
- > Discouraged/lost confidence due to low grades in early years

# **Physics Major and Minor**

- Physics Minor 30-36 credits:
  - > 15 credits already engineering requirements
  - Add thermodymanics, quantum mechanics I or new class
  - Plus choose from:
    - Teaching preparation 407-8-9
    - Three advanced labs
    - Mathematical physics + E&M or QM
- Physics Major
  - Comprehensive
  - > Applied
  - Teaching
  - Biophysics

### Reasons Physics Grads took >4 yrs

#### Out of 179 graduating 17-18



I have changed majors or chosen a major late

Health or other personal problems slowed my progress I have been delayed by inability to enroll in physics classes that I need

There are too few credits given per required core physics course

I am pursuing two or more majors/degrees

I took fewer courses each quarter so that I could get better grades

I have been delayed by inability to enroll in non-physics classes that I need

There were not enough physics classes offered at the institution I attended before UW

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

☑ Of minor importance
☑ Somewhat important

## **Physics Core Courses**

Core Classes (55/6 cr)	
Phys: 121, 122, 123	Mechanics, Elect. & Mag., Waves,
224, 225	Thermo, Modern I
294	Intro to Research
Math 124, 125, 126 1 from math menu: Math 307, 308, 309, 324, 326; Amath 351, 352, 353, 401	Differential, Integral, Multivar. Calc 1 from: Linear Alg., Diff. Eq., Vector Calc, Complex Anal, Partial Diff. Eq.
227	Math Phys
321, 322	Electromagnetism II&III
334	Electronics Laboratory

## **Physics Option Requirements**

	Comprehensive (+38-41 cr)	Applied (+34-39 cr)	Teaching (+38-41 cr)	Biological (+51-552 cr)
Math	Phys 228 (Math Phys) + 1 MM	AMATH 301 (MatLab) +2 of {Phys 228 +MM}	Phys 228 + 1 MM	Phys 228
32x	226, 324 (Part; QM2) Three junior level E&M, QM, Astro, Mechanics, Statistical	One from 226, 323, 324, 328, 329 (Part., E&M3, QM2, Statistical, Classical)	226, 324 (Part; QM2) One from E&M, QM, Mechanics	324 (QM2) 328 (Statistical) One from 226, 323, 329
Lab	Two advanced labs	231 (intermediate lab) Two advanced labs	One advanced lab	(in bio/chem)
Res/ Sem	3 cr Research or Sem	3 cr Research or Sem	3 cr teaching/PER	3 cr in bio-related research
UD Elect	2 additional Phys/Cognate Class	3 additional 32x, Phys/Cognate (may include 1 lab; 1 intro sci)	407-8-9 (physics for future teachers)	429 (Biophysics)
Other Sci				3 chem classes 2 bio 2 additional bio/chem



### What have Physicists Brought Society?

