

### Career Paths of Physics Degree Holders

Craig Group (He,Him,His) University of Virginia APS Career Mentoring Fellow



Slide from APS Careers

- Robert Craig Group born 1977, Columbia, SC
- Undergrad: BA, Erskine College, SC
   → Only 1 physics professor!
- MS Florida State
  - → "Bridge"...
- Ph.D. U. Florida
- Post-doc Fermi National Lab
- Faculty U. Virginia



- Undergrad: BA, Erskine College, SC
- MS Florida State
- Ph.D. U. Florida
- Post-doc Fermi National Lab
- Faculty U. Virginia
- Next????



- Undergrad: BA, Erskine College, SC
- MS Florida State
- Ph.D. U. Florida
- Post-doc Fermi National Lab
- Faculty U. Virginia
- Next????
  - → Still not clear what I will do when I grow up!



• Most important:



• Most important: I'm a human being!



- Most important: I'm a human being!
- I have family, friends, past times, emotions, challenges, health issues, failures, success, ...
- My career has to accommodate me as a person, not just a physicist.
- We are all unique, and luckily, there are many career options for physicists!



• As a professor, I teach classes, conduct research in experimental particle physics, and ...



 As a professor, I teach classes, conduct research in experimental particle physics, and mentor students and young(er) scientists.



- As a professor, I teach classes, conduct research in experimental particle physics, and mentor students and young(er) scientists.
- This last one, embarrassingly, caught me by surprise!
- Over the years, I've realized that it might be the most important part (to me).
- So, I applied to the **APS Career Mentoring Fellow** program to try and improve my skills.



### **Career Mentoring Fellows**

- Receive implicit bias training.
- Receive mentor training.
- Gain expertise about physics careers and learn about <u>APS Career Resources</u>.

That is why am here with you right now!

OK, let's talk about physics careers....



Academic Path

University/college

We all start here.







### **UVA Graduate Program**

#### **UVa Physics Department**



Nuclear

**Physics** 

#### • 39 department faculty

- +7 affiliated faculty (can also take students, in Engineering and Medical Physics)
- 20 research and postdoctoral scholars
- \$10.5M annual research funding

Medical

**Physics** 



Particle Physics Atomic, Optical, Quantum Information

Condensed Matter Astrophysics Gravity Cosmology





#### www.aps.org/careers

Slide from APS Careers

### UVA Graduate Program

#### UVa Physics Graduate Studies Program Overview

- About 110 graduate students (98% PhD)
- Incoming class typically 18
- All doctoral students are receive full financial support
  - Living stipend, tuition, fees, (single) health insurance fully paid
  - Academic year through research, teaching, and fellowships
  - Summer support through research
  - After 4th semester, most supported by research
- First year: typically core courses. Research starts in the summer!







Slide from APS Careers











www.aps.org/careers

Slide from APS Careers





www.aps.org/careers

Slide from APS Careers



## How many Physics Bachelor's are there?

Physics Bachelor's Degrees Awarded



#### >8500 Physics Bachelor's degrees are awarded annually

You are elite!

AIP Statistics



### How many MS holders are there?



\*These departments offer a master's as their highest physics degree.

http://www.aip.org/statistics

Additionally, ~700 new Physics Master's holders, also look for jobs.

www.aps.org/careers

Slide from APS Careers



### How many PhDs are there?

Physics PhDs Conferred in the US, 1900 through 2019

The number of Physics PhDs granted in the U.S. has almost doubled over the last two decades!



Sources: ACE (1900-1919), NAS (1920-1961), AIP (1962-2019)

#### AIP Statistics



### How many PhDs are there?

#### 2015-2016 graduates: 1 year after PhD





www.aps.org/careers

Slide from APS Careers

### What are they doing (PhDs)?

#### 2015-2016 graduates: 1 year after PhD



6% of those in the U.S. were unemployed the winter after receiving their degrees. <1% of those in the U.S. were not employed and not seeking employment.





### What are they doing (PhDs)?





Source: NSF Survey of Doctoral Recipients, 2001 - 2013



Slide from APS Careers

### What are they doing (PhDs)?



Source: AIP Statistical Research Center Report Common Careers of Physics PhDs in the Private Sector, June 2015

Most still perform research in private sector jobs!



#### www.aps.org/careers

Slide from APS Careers

### What are they doing (Master's)?

#### Employment Distribution of Exiting Physics Masters One Year After Degree, Classes of 2016, 2017, & 2018 Combined



Majority of Master's holders also go into the private sector

~20% find jobs at colleges or universities

Exiting masters are individuals who, upon receiving their master's degrees, leave their current physics departments. Figure includes US employed physics masters, including those who were employed part-time and not enrolled in a degree program and masters continuing in positions they held while pursuing their degrees. Other includes elementary and middle schools, health care facilities, and non-profit organizations. Figure based on responses from 349 individuals.

\*Active military excludes masters receiving their degrees from military academies.

**AIP** Statistics



### What are they doing (Bachelor's)?



### What are they doing (Bachelor's)?



#### Majority working in STEM jobs



www.aps.org/careers

Slide from APS Careers



Less than 8% of physics majors become professors at 4-yr universities. But, the vast majority have (more?) successful and fulfilling careers!



### Academic sector demand



About **~300** new tenure or tenure-track hires in 2016.

Recall: ~1600 PhDs looking for jobs yearly



#### www.aps.org/careers

### Academic sector demand



Position Status of New Faculty Members Hired, 2017-18 Academic Year

Faculty position types vary widely by institution.

Total of 556 new faculty hires (including all position types).

#### **AIP** Statistics

aip.org/statistics

Given that we are graduating over 1,600 PhDs/yr, with half of them going into postdocs with an intention of continuing as physics faculty, supply will continue to outweigh demand for the academic career path.

APS

www.aps.org/careers

Slide from APS Careers

### Industry demand



170/

Percentage of Physics PhDs\* Employed in the Private Sector <sup>15+ years</sup>



\*Data includes PhDs employed in potentially permanent positions only. Data excludes PhDs not in the labor force. Average unemployment is 3%.

Source: NSF Survey of Doctoral Recipients, 2001 - 2013

9%

1%

8%

Industry has been the largest employment base for Physics PhDs for decades.



Slide from APS Careers

31%

5%

### **Example: Data Science**

Physicists need data science skills, and so does industry!





### Examples of Successful Physicists' Careers aps.org/careers/physicists/profiles







#### Thomas Hefner, BS High School Physics Teacher

Combining his passion to give back to society with his love for physics, Thomas became a high school teacher. When teaching, he finds the physics material to be just as useful as the critical thinking skills taught in science courses.

Advice for students: Take different types of science courses and build communication skills through outreach activities.

Learn more: aps.org/careers/physicists/profiles/hefner.cfm







#### Paul Markoff-Johnson, MS Director of Product Development

Paul gained an appreciation for physics when he saw its connection with math.

He switched majors from engineering to physics due to the broader scope, variety of career options, and the invaluable skill of using basic principles to solve problems.

Currently, Paul is the Director of Product Development at a company specializing in thin film technology.

Learn more: aps.org/careers/physicists/profiles/markoff.cfm







Julia Scherschligt, MS Thermodynamic Metrology Scientist

Julia found a job at the National Institute of Standards and Technology (NIST) through her network.

After working in different areas at NIST, she now leads a group responsible for the fundamental measurements of temperature and pressure.

Advice for students: Talk to the grad students before applying to a school and take skills-based classes.

Learn more: aps.org/careers/physicists/profiles/scherschligt.cfm



### Academic on Industry?

- Most of us will not end of with a permanent career in academia.
- Should I give up on science?



### Academic on Industry?

- Most of us will not end of with a permanent career in academia.
- Should I give up on science?
- --> NO!
- I advice my students who what to do academic research to stay on that route as long is they are enjoying it **and it is treating them well!**
- It is <u>NOT</u> "settling" or "failure" to decide that industry or some other direction is a better fit for you!
- There are interesting and important and fun problems to solve everywhere, and your physics training can make you very useful!



#### **Common Job Titles of Physics Bachelors**

#### Engineering

Systems Engineer **Electrical Engineer Design Engineer Mechanical Engineer Project Engineer Optical Engineer** Manufacturing Technician **Associate Engineer Application Engineer Development Engineer** Process Engineer / Technician **Product Engineer Product Manager Research Engineer Quality / Test Engineer Technical Services Engineer Integration Engineer Accelerator Operator** 

#### **Computer Hardware/Software**

Software Engineer / Developer Programmer IT Consultant Systems Analyst Technical Support Staff Data Analyst / Scientist

#### **Business/Finance**

Business Analyst Consultant Project Manager Investment Associate / Trader

#### **Research and Technical**

Research Assistant Research Associate Research Technician Lab Technician / Assistant Scientist

#### Education

High School Physics Teacher High School Science Teacher Middle School Science Teacher Instructor Tutor

Source: AIP Follow-Up Survey of Physics Bachelors, Classes of 2017 and 2018.



www.aps.org/



### Typical Starting Salaries of New Physics PhDs



represented by the lines extending to each side of the box. The box represents the middle 50% (25th to 75th percentile) of the salaries. The vertical line within the box represents the median starting salary for the sector. The dots outside of the bars are statistical outliers. Government Lab includes federally funded research and development centers, e.g., Los Alamos National Laboratory. UARI is university affiliated research institute. The data for PhDs holding potentially permanent positions in academia include salaries based on 9-10 and 11-12 month commitments and have not been adjusted. Data are based on respondents holding potentially permanent positions in the private sector (192) and in universities and 4-year colleges (37), postdocs in government labs (101) and universities and UARIs (277), and "other temporary positions" in universities and 4-year colleges (17).

www.aps.org/careers



### Job Satisfaction of Physics PhDs

Subjective Aspects of Initial Employment for Physics PhDs Holding Potentially Permanent Positions by Sector, Classes of 2015 & 2016 Combined

	Sector of Employment		
Percent who felt:	Academic	Private Sector	Government
	(%)	(%)	(%)
A physics PhD is an			
appropriate background for	87	83	81
this position.			
This position is professionally	85	83	86
L consider myself			
underemployed in this	26	19	29
position.			
Overall, I am satisfied with this position.	89	87	86

The percentages represent the two positive responses on a four point scale such as Very appropriate, Appropriate, Not very appropriate, and Not at all appropriate. Data only include US-educated physics PhDs who remained in the US after earning their degrees.





www.aps.org/careers

### So...

- PhDs in industry are equally satisfied and earn more money than those who stay in academia.
- More proof that going into industry can be a rewarding choice.

(not "settling" for less or a failure)



#### Look Inwards/Reflect



#### Perform a detailed self-assessment

- Includes what you are good at doing and what you enjoy doing. Values are important!
- Reflect on your working style: collaborative, independent, goal-oriented?

#### Keep a Career Notebook/Doc

- Track insights, skills, and contacts
- Note when you're happiest and when you are the *least* happy.
- What is important to you?
  - Work-life balance? Money? Location?
  - Flexible schedule? Control over research?

#### **Document Skills**

 Record your skills – technical and nontechnical. These will be the building blocks of every resume you'll write.



#### **Use Resources**

#### APS Careers 2022 Guide

- Breadth of opportunities for physics graduates
- Advice from professionals
- List of companies hiring physicists
- Ex. Webinar: Why You Should Consider an Industry Career
   <u>Watch video</u>

go.aps.org/careersguide

#### SPS Careers Toolbox

- Lists common job titles
- Effective job searching tips
- Resume, cover letter help
- Tips for interviewing

#### spsnational.org/sites/all/careerstoolbox





#### **APS Careers Website**

- APS Job Board
- Professional Guidebook
- Physicist Profiles
- Common Careers Paths

#### aps.org/careers



#### **Use Resources**



#### **APS Webinars**

Free webinars on topics like: professional development during COVID, science policy careers, effective communication, and more:

- Success in Industry
- Career Exploration
- Public Engagement
- Professional Development for International Physicists in the U.S.

#### View Webinars & Sign up:

#### aps.org/webinars



#### **Build Your Network**

- Join LinkedIn
- Attend alumni mixers, career fairs, conferences, etc.
- Volunteer or Find internship



Industry Mentoring for Physicists

#### **Attend Informational Interviews**

- Reach out to contacts and ask for a 20-minute chat
- Here, *you* get to ask the questions!
  - Ask about their career path, their typical work day
  - Ask what aspects of work they like or dislike
- Don't ask for a job!



#### **Find Career Mentors**

- Join the APS IMPact program to find industry mentors: impact.aps.org
- Ask faculty mentors to connect you to industry professionals/past students
- Career Mentors are critical!!! (first half of workshop)





### LinkedIn Basics

# Meghan Anzelc · 1st Head of Data & Analytics at Spencer Stuart | Public Speaker

ater Chicago Area · Contact info

#### Headline

- Subheading under your name, 120 characters
- Job title/company by default, but can be modified:
  - Materials scientist with expertise in quantum optics
  - Data Scientist | Machine Learning Expert | Problem-Solver
- Used in LinkedIn Search Algorithm

#### Photo

- Extremely important for forming connections
- Should cover >60% of the frame
- High resolution
- Should look like you
- No one else should be in it

#### **Profile Summary**

- What combination of skills help you achieve results?
- What motivates you?
- Include skills and accomplishments
- Good place to explain any gaps or why you're switching fields



### Tips on Resume Writing

#### Resume vs. CV

#### Resume

- 1-2 pages,
- Specifically tailored to job posting,
- Only lists relevant skills and experiences
- More common in industry

#### CV

- Several pages,
- Can be used for multiple applications,
- Lists all experiences
- More common in academia

#### Writing a Resume

- Carefully read the job description and highlight required skills
- Organize resume into sections based on each prominent skill (rather than organizing by job title/experience)
- Use bullet points to describe experiences and accomplishments relevant to each section

#### Name, Contact Info

#### Skill Area #1 – e.g. "Data Analysis Skills"

- Bulleted Skill (Title, Organization, Year)
- Bulleted Skill (Title, Organization, Year)
- Etc....

#### Skill Area #2 – e.g. "Leadership Skills"

- Bulleted Skill (Title, Organization, Year)
- Bulleted Skill (Title, Organization, Year)
- Etc....





### **Interviewing Process**

#### Typical Interview Trajectory at a Company

- Phone interview with HR usually to determine if you meet basic requirements
- In person (or virtual) interviews with specific department and team members
- Presentation to department on your research or other work relevant to the position (sometimes required)

#### **Preparing for Interviews**

- Review job description be able to provide examples of how you qualify for specific requirements
- Practice answering common questions
  - "Tell me about yourself" "Why are you interested in this position?"
  - "Tell us about a time when you..."
    - Dealt with a conflict, worked with someone difficult, etc.
- Test out any technical issues for video calls beforehand



### Summary

- Hundreds of physics degree holders enter the job market every year
- Majority find careers in the private sector, applying their physics knowledge and training
- You can start preparing now by expanding your network find mentors and collaborators!
- The world is full of important and interesting problems to solve!
- You are a unique human, you have unique and marketable skills!
- Figure out what you love and how to put your skills to work to find a satisfying career. APS resources can help!!!



### Thank you!

Survey: tinyurl.com/APS-CareerTalk22



### Back up slides



### What about non-US Citizens

Recent US policies hindering international physicists' employment in the US APS Government Affairs is advocating for better policies

Important Resources

APS International Affairs Website aps.org/programs/international/

APS Office of Government Affairs Website aps.org/policy/

APS IMPact Program – Effort to add more mentors from non-US backgrounds impact.aps.org

APS Webinar Series on Career Development for International Physicists aps.org/webinars

Employment Resources for International Members aps.org/careers/guidance/international/index.cfm





Slide from APS Careers

### What are they doing (Master's)?

#### Scientific and Technical Knowledge and Skills Used by Exiting Physics Masters, Classes of 2016, 2017, & 2018 Combined





### What are they doing (Master's)?

#### Interpersonal and Management Skills Used by Exiting Physics Masters, Classes of 2016, 2017, & 2018 Combined





### Typical Starting Salaries of New Physics PhDs



represented by the lines extending to each side of the box. The box represents the middle 50% (25th to 75th percentile) of the salaries. The vertical line within the box represents the median starting salary for the sector. The dots outside of the bars are statistical outliers. Government Lab includes federally funded research and development centers, e.g., Los Alamos National Laboratory. UARI is university affiliated research institute. The data for PhDs holding potentially permanent positions in academia include salaries based on 9-10 and 11-12 month commitments and have not been adjusted. Data are based on respondents holding potentially permanent positions in the private sector (192) and in universities and 4-year colleges (37), postdocs in government labs (101) and universities and UARIs (277), and "other temporary positions" in universities and 4-year colleges (17).

www.aps.org/careers



### How much do physics Master's earn?





The full starting salary range is represented by the lines extending to each side of the box. The box represents the middle 50% (25th to 75th percentile) of the salaries. The vertical line within the box represents the median starting salary for the sector. Figure does not include salaries for masters holding part-time positions or salaries for respondents who reported starting their employment more than a year prior to earning their master's degree. The College or University category includes two-year colleges, four-year colleges, universities, and university affiliated research institutes. Data are based on 80 private sector salaries and 20 college and university salaries.

#### **AIP** Statistics



### How much do physics Bachelor's earn?





### What are they doing (PhDs)? 2015-2016 graduates: 1 year after PhD

Type of Employment of Physics by Employment Sector, One Year After Degree, Classes of 2015 & 2016 Combined

About half of physics PhDs are initially employed in the academic sector.

However, ~70% of the potentially permanent jobs are in the private sector.

Initial Employment Type				
Sector of Employment	Postdoc %	Potentially Permanent %	Other Temporary %	Overall %
Academic	75	16	70	49
Private	1	73	22	34
Government	20	7	5	14
Other	4	4	3	3
	100%	100%	100%	100%

Note: Data only includes US-educated physics PhDs who remained in the US after earning their degrees. Data are based on the responses of 593 postdocs, 514 individuals working in potentially permanent positions and 93 individuals working in "other temporary positions".

#### www.aps.org/careers

#### **AIP** Statistics

### What are they doing (PhDs)? 2019-2020 graduates: 1 year after PhD

Type of Employment of New Physics PhDs by Employment Sector, Classes of 2019 & 2020 Combined

About half of physics PhDs are initially employed in the academic sector.

However, ~70% of the potentially permanent jobs are in the private sector.

Initial Employment Type				
Sector of Employment	Postdoc	Potentially Permanent	Other Temporary	Overall
	%	%	%	%
Academic	73	18	62	49
Private	1	70	30	32
Government	23	8	3	15
Other	3	4	5	4
	100%	100%	100%	100%

Note: Data includes only US-educated physics PhDs who remained in the US after earning their degrees. Data are based on the responses of 809 postdocs, 650 individuals working in potentially permanent positions, and 99 individuals working in "other temporary positions."



ŝ

### **Academic Sector Demand**

2016-2017 saw 371 total faculty departures. In 2018-2019, there were 571 recruitments, of which 369 were tenured/tenure-track.

Compared to the supply of ~1600 PhD's each year, this is still relatively low.

	Highest Physics Degree Offered			
	PhD	Master's	Bachelor's	Overall
Number of Departures	202	31	138	371
Percent of Departures Among Faculty Members	3.4%	3.5%	3.8%	3.5%
Percent of Departments with Departures	61%	31%	25%	35%
Percent of Departing Faculty Members that Left Without Tenure	10%	15%	24%	16%
Total Headcount of Faculty Members	6,015	870	3,615	10,500

Estimated Number of Faculty Departures in Physics Departments, 2016–17 Academic Year

Note: The total headcount of faculty members is for the academic year of 2017-18. The total number of faculty members in this report differs from the total number reported in "The Number of Faculty Members in Physics Departments", which reported full-time equivalent (FTE) faculty totals, not headcount totals.





Job Satisfaction of Physics Bachelors In Private Sector STEM Positions (2013 & 2014)





#### Job Satisfaction of Exiting Physics Masters in Potentially Permanent Positions, Classes of 2016, 2017, & 2018 Combined



Exiting masters are individuals who, upon receiving their master's degrees, leave their current physics departments. Percentages represent the physics masters who chose "very satisfied" or "somewhat satisfied" on a four-point scale that also included "somewhat dissatisfied" and "very dissatisfied." Figure is based on the responses of 91 individuals in the private sector and 29 individuals in the academic sector.





### Job Satisfaction of Physics PhDs

Subjective Aspects of Initial Employment for Physics PhDs Holding Potentially Permanent Positions by Sector, Classes of 2015 & 2016 Combined

	Sector of Employment		
Percent who felt:	Academic	Private Sector	Government
	(%)	(%)	(%)
A physics PhD is an			
appropriate background for	87	83	81
this position.			
This position is professionally	85	83	86
L consider myself			
underemployed in this	26	19	29
position.			
Overall, I am satisfied with this position.	89	87	86

The percentages represent the two positive responses on a four point scale such as Very appropriate, Appropriate, Not very appropriate, and Not at all appropriate. Data only include US-educated physics PhDs who remained in the US after earning their degrees.





### LinkedIn Basics

# Weghan Anzelc · 1st Head of Data & Analytics at Spencer Stuart | Public Speaker

ater Chicago Area · Contact info

#### Headline

- Subheading under your name, 120 characters
- Job title/company by default, but can be modified:
  - Materials scientist with expertise in quantum optics
  - Data Scientist | Machine Learning Expert | Problem-Solver
- Used in LinkedIn Search Algorithm

#### Photo

- Extremely important for forming connections
- Should cover >60% of the frame
- High resolution
- Should look like you
- No one else should be in it

#### **Profile Summary**

- What combination of skills help you achieve results?
- What motivates you?
- Include skills and accomplishments
- Good place to explain any gaps or why you're switching fields



### Using LinkedIn

#### LinkedIn Search Feature

- Order of connection:
  - 1st searches through your current connections,
  - 2nd connections of your connections, etc.
- Location, company (current or past!), school, industry, job title, etc.

#### **Inviting New Contacts**

- Tailor/personalize each invitation
- If you know them, good idea to remind them how
- Find something in common
- Be enthusiastic/give reason for why they would want to connect

Services All filters	
Filter only People - by	>
Connections	
1st	2nd
3rd+	
Connections of	
+ Add a connection	
Locations	
United States	Washington DC-Baltimore Area
India	California, United States
San Francisco Bay Area	+ Add a location
Current company	
Amazon	Booz Allen Hamilton
Microsoft	Facebook
Google	+ Add a company
Past company	

### Tips on Resume Writing

#### Resume vs. CV

#### Resume

- 1-2 pages,
- Specifically tailored to job posting,
- Only lists relevant skills and experiences
- More common in industry

#### CV

- Several pages,
- Can be used for multiple applications,
- Lists all experiences
- More common in academia

#### Writing a Resume

- Carefully read the job description and highlight required skills
- Organize resume into sections based on each prominent skill (rather than organizing by job title/experience)
- Use bullet points to describe experiences and accomplishments relevant to each section

#### Name, Contact Info

#### Skill Area #1 – e.g. "Data Analysis Skills"

- Bulleted Skill (Title, Organization, Year)
- Bulleted Skill (Title, Organization, Year)
- Etc....

#### Skill Area #2 – e.g. "Leadership Skills"

- Bulleted Skill (Title, Organization, Year)
- Bulleted Skill (Title, Organization, Year)
- Etc....





### **Interviewing Process**

#### Typical Interview Trajectory at a Company

- Phone interview with HR usually to determine if you meet basic requirements
- In person (or virtual) interviews with specific department and team members
- Presentation to department on your research or other work relevant to the position (sometimes required)

#### **Preparing for Interviews**

- Review job description be able to provide examples of how you qualify for specific requirements
- Practice answering common questions
  - "Tell me about yourself" "Why are you interested in this position?"
  - "Tell us about a time when you..."
    - Dealt with a conflict, worked with someone difficult, etc.
- Test out any technical issues for video calls beforehand



#### **Common Job Titles of Physics Bachelors**

#### Engineering

Systems Engineer **Electrical Engineer Design Engineer Mechanical Engineer Project Engineer Optical Engineer** Manufacturing Technician **Associate Engineer Application Engineer Development Engineer** Process Engineer / Technician **Product Engineer Product Manager Research Engineer Quality / Test Engineer Technical Services Engineer Integration Engineer Accelerator Operator** 

#### **Computer Hardware/Software**

Software Engineer / Developer Programmer IT Consultant Systems Analyst Technical Support Staff Data Analyst / Scientist

#### **Business/Finance**

Business Analyst Consultant Project Manager Investment Associate / Trader

#### **Research and Technical**

Research Assistant Research Associate Research Technician Lab Technician / Assistant Scientist

#### Education

High School Physics Teacher High School Science Teacher Middle School Science Teacher Instructor Tutor

Source: AIP Follow-Up Survey of Physics Bachelors, Classes of 2017 and 2018.



www.aps.org/

