Careers in Physics

TEACHER GUIDE

STEP UP

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NSF

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APS physics

AAPT PHYSICS EDUCATION

A&M COMMERCE

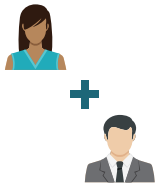
QUICK REFERENCE GUIDE

Help students **assess their personal values** in relation to a career in physics, **examine profiles** of professionals with physics degrees, and **envision themselves** in a physics career.

1. Students brainstorm careers that one can have with a physics degree.

2. Students complete a brief survey to determine areas of interest for their future careers.

3. Using data from their surveys and a matrix, students are matched to relevant physicist profiles to research and discuss.



4. Students discuss new careers in physics they learned about, and reflect on how their perceptions of careers in physics have changed.

5. **CRITICAL COMPONENT:** Students complete a personal career profile in which they envision themselves as a future physicist.

6. Students discuss data presented by the teacher on careers and salaries in physics.

Learn more at STEPUPphysics.org and register to access instructional support & FAQs.

CAREERS IN PHYSICS SUPPORTING RESEARCH

Lesson Topic: In this lesson, students will explore profiles of individuals with a degree in physics and identify goals that can be accomplished with a physics degree. They will also create their own future career profiles. The goal of the lesson is to help students realize the breadth of careers available with a physics degree and envision how a physics degree would help accomplish many goals.

Lesson Evidence: This lesson has been shown to improve students' future physics intentions (e.g. majoring in physics in college or intending physics-related careers) in classes across the US (N=823). Figure 1 shows that both female and non-female students have positive gains from the lesson. In addition, the overall gains from the lesson across all students are positive (Cheng et al., 2018). Additional research is forthcoming on a larger study (N = 1800 students) that confirms this positive effect.

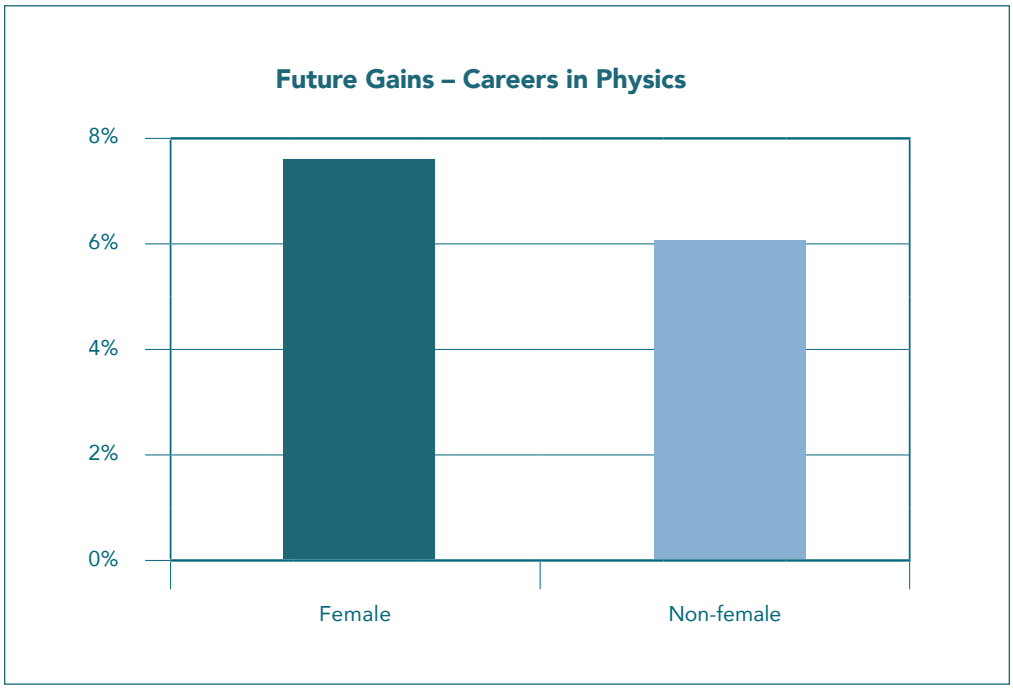


Figure 1. *Percentage gains in female and non-female students' future physics intentions (towards majoring/pursuing a career) due to the lesson.*

Teacher Motivations: Quotes about why physics teachers did the lesson.

- "Students don't realize all the things they can do with a physics degree."
- "It helps students see that physicists can help the world and work with others."
- "As a student, I wish I had the opportunity of envisioning my future with physics."
- "The posters students make as part of the lesson helps recognize students and who they are."

Implementation Timing: Physics teachers suggested the optimal timing for implementation is before college applications are due.

LESSON PLAN: *CAREERS IN PHYSICS*

CONTENT AREA(S): Physics		TITLE: Careers in Physics
GRADE LEVEL: 11-12	DATE(S): Beginning of the semester, prior to college applications	LESSON LENGTH: 60-90 minutes

OVERARCHING PURPOSE OF THE LESSON

In this lesson, students will assess their values in relation to their future education and career goals and match themselves with profiles of physicists who have pursued a variety of careers supported by their studies in physics. Students will examine the profiles to identify transferable traits and skills that can be obtained via a physics degree and then create their own career profiles with a focus on how earning a physics degree can help them achieve their career goals.

Standard(s) Alignment: This lesson addresses NGSS Appendix H – Understandings about Nature of Science

- **Science is a Human Endeavor**
  - Scientific knowledge is a result of human endeavor, imagination, and creativity.
  - Individuals and teams from many nations and cultures have contributed to science and to advances in engineering.
  - Science and engineering are influenced by society and society is influenced by science and engineering.
- **Scientific Investigations Use a Variety of Methods**
  - Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

Performance Objectives

- *Critical learning objective:* Students will identify ways that a degree in physics can support a variety of careers, including careers that benefit humans, society, and the Earth.
- Students will examine profiles of physicists and identify skills and traits developed by earning a degree in physics.
- Students will create a personal profile in which they identify how physics can help them meet their career goals.

Critical Lesson Components

- Ensure that students match physics careers to their own values and goals. (Body of the Lesson, Step 1)
- Ensure that students recognize that physicists work with others and benefit humans, society, and the Earth. (Body of the Lesson, Step 5)
- Ensure that students complete the Personal Career Profile, recognizing that physics can help them accomplish their career goals.(Body of the Lesson, Step 6)

Assessments (formative and summative)

- Students' responses during class discussions of physicists' profiles
- Students' responses to the **Career Goals Survey**
- **Rubric for Personal Career Profiles**

Materials/Resource List

- Sticky notes of different colors (6 per student - 3 notes in 2 different colors)
- **Career Goals Survey** and **Profile Matching Matrix** (Print 1 per student or use beta-site linked at STEPUPphysics.org/careers for an online option)
- **Personal Career Profile** (1 per student)
- Devices with internet access to look up physicists' profiles or **Physicist Career Profiles** can be printed in advance of the lesson (2–3 copies of each profile is recommended). Versions that are "clickable" & modifiable (via Word) are available at STEPUPphysics.org/careers.
- Devices with internet access to research career choices, or further examples printed out from recommended resource pages (see Bibliography).
- Class whiteboard, projector, computer (for teacher use in discussion and presentation of **Physics Careers and Salaries Presentation**. Full presentation available at STEPUPphysics.org/careers).

INSTRUCTIONAL PROCEDURES

INTRODUCTION: Reveal students' prior conceptions about the types of careers people who earn a bachelor's in physics can have and have students make a visual representation that can be revisited by the end of the lesson. (est. time = 10 minutes)

What the Teacher Does *Day of lesson, in class*	**Anticipated Behaviors/Responses from Students** *In class*
1. Give each student 3 sticky notes (of the same color). Ask students to write down a response to the following prompt: "On each sticky note, name a career you can have with a physics bachelor's degree."	**1.** Students will record their responses on the sticky notes. Possible answers: • *Scientist, physicist, engineer, lab technician, physics teacher, researcher, doctor, etc.*
2. Have students post their sticky notes in a designated section of the room grouping them by common careers listed (i.e., medicine/health, laboratory/research, business/finance, education/academia). Make note of trends.	**2.** Students will post sticky notes in a designated section of the room sorting them by common careers.
3. Open the lesson with a discussion of what physicists do (Note: definition of a physicist for this lesson is a person with a bachelor's degree or higher in physics): "We're going to define a physicist as someone with a bachelor's degree in physics. With that in mind… **A.** Who do you think physicists work with? **B.** Who is helped by or benefits from the work of physicists? **C.** What societal outcomes do physicists address in their careers? **D.** What traits/skills do you think physicists have that they apply in their careers? Now we're going to look at profiles of physicists to see how getting a bachelor's degree in physics helped them in their careers."	**3.** Students will contribute to discussion - consider using randomized calling methods such as rolling dice, popsicle sticks or playing cards. Accept all responses to get at students' prior conceptions. Possible answers to prompts: **A.** *Physicists work with other scientists/engineers/physicists. Some work on their own. Some work with students (educators). Some work with nonscientists.* **B.** *Physics helps everyone. Other scientists benefit by getting new knowledge. No one benefits because they work on topics that aren't practical/applicable to real-life.* **C.** *Their work helps engineers and eventually it gets to help society at large.* **D.** *Physicists have the following traits/skills: smart/logical, good at math, good at solving problems, good at using instruments/machines, ability to communicate, ability to work with others, and creativity.*

BODY OF THE LESSON: In this part of the lesson students will examine physicists' career profiles to learn about the skills that can be gained through a physics degree. They will learn about the wide variety of possible careers and skills to be gained from a physics degree through discussion with a peer and then the whole class. They will revisit the sticky note activity to explore how their conceptions have changed after reviewing the profiles. They will then be assigned to make their own profiles of themselves in the future after having earned a physics degree. (est. time = 40 minutes)

What the Teacher Does	**Anticipated Behaviors/Responses from Students**
1. **CRITICAL LESSON COMPONENT:** Hand out the **Career Goals Survey** and have students complete it. When they are finished (about 2 min), hand students the **Profile Matching Matrix** and have each find their matching profile(s). This needs to be ready before commencing the bulk of the lesson.	**1.** Students will complete the **Career Goals Survey** and find their matching profiles.

2. Distribute copies of **Physicist Career Profiles** to students or direct them to the profiles they need to explore on the profile website/handouts. They can also search the internet for more information about the profiled physicist. If students are not interested in the profile they are matched with, allow them to choose another one that interests them. Direct students to pick up another profile if their first choice runs out. Have students read the profile and consider the following questions while reading their profile: • What is the career of the physicist in your profile? • What does your physicist personally value about his/her degree/career? • Who benefits from the work your physicist does? How does this physicist's work contribute to society? • What skills did your physicist gain from earning their degree in physics? How did these skills help your physicist in achieving their career?	**2.** Students will read the profile on the **Physicist Career Profiles** sheet that matches their survey responses and can research that profile on the internet for further information. Students will answer questions with respect to the profile. For possible student responses, see responses to discussion prompts below.
3. After students review their assigned profile, ask them to pair with another student in the class to share their profile and their responses to the questions.	**3.** Students will discuss their profiles in pairs.
4. Distribute new sticky notes (3 per student in a different color). In a whole class discussion, have students share their chosen examples. Ask them to write 3 new careers on the sticky notes that they hear about or share with the class themselves during the discussion. Facilitate a discussion on goals and career outcomes that a physics education achieves. As each student shares, focus on having new information shared with the class. Prompts: **A.** What new careers emerged from researching the physicist profiles? Write them on your sticky notes Have students ready to respond to 3 of the following: **B.** What surprised you about your profile? **C.** What values and goals do you believe drive these physicists in their careers? **D.** How do you think these physicists contribute to society and help the world? **E.** Who do you think benefits from the work of these physicists? **F.** Can you infer what skills allowed them to accomplish what they did in their career?	**4.** Students will share with the whole class and answer the question prompts. Students may need guidance to read between the lines of the profiles to answer the questions; the answers are not always obvious. Possible answers to prompts include the following: **A.** *A person with a physics degree can be a film producer, actuary, science writer, YouTuber, cardiologist, policy analyst, medical physicist, biophysics technician, laser scientist, teacher, etc.* **B.** *It surprised me how normal the physicist was; most physicists are not like the Big Bang Theory physicists.* **C.** *Values: Physicists are driven by being able to contribute to larger causes/pursuits, being able to help others, being able to work with others, independence/freedom/flexibility to pursue interests/passions, being able to work in a wide variety of areas, being able to work on challenging problems.* **D.** *Contributions: Physicists address many societal goals like educating the public about science, protecting the environment, protecting human health, entertaining, and building the economy.* **E.** *Beneficiaries: Physicists can benefit everyone, other scientists, the companies physicists work for, and the specific group they serve in their career (ex: patients for those in medical field).* **F.** *Possible skills/traits: Physicists use skills like scientific reasoning; problem solving; creative, critical, analytical, and quantitative thinking; and have the ability to collaborate with others, communicate through writing and speaking, and do mathematical modeling.*

5. Allow students to post the new sticky notes in the designated location (grouping them by common careers). This should provide a visual representation of the breadth of careers pursued by individuals with a bachelor's in physics. Compare and contrast with the sticky notes from the start of class. **CRITICAL LESSON COMPONENT: Emphasize that careers in physics include professions that benefit humans, society, and the Earth.**	**5.** Students will post the new sticky notes in the designated location (grouping them by common careers). Possible responses: • *Anticipate that responses will be expanded to include the careers profiled in the lesson, but they may still include the original examples (ex: scientist).*
6. **CRITICAL LESSON COMPONENT:** *creating* ***Personal Career Profiles***. Ask students to identify a career that they have an interest in. Challenge them to incorporate a physics degree into the pathway to their chosen career. What would their profile look like? The students will be creatively imagining their futures with a physics degree. This may be somewhat contrived, but this is an essential component of the lesson. It allows students to consider the possibility of a physics degree in a more serious way. If there is a high likelihood that it will not be completed at home, then it is recommended that you set aside class time for this activity. **The students will be creatively imagining their futures with a physics degree. This may be somewhat contrived, but this is an essential component of the lesson, especially Part 2 of the profile. It allows students to consider the possibility of a physics degree in a more serious way. If there is a high likelihood that it will not be completed at home, then it is recommended that you set aside class time for this activity.**	**6.** Students will imagine their own careers and think of ways a physics degree can help. It is recommended that students type out their **Personal Career Profiles** (prior work has found that students will write more in-depth profiles when they type them out.)
7. Distribute the **Personal Career Profile** exercise sheets. Page 1 can be used as scaffolding to the final profile if helpful to students as they prepare. The final profile can be completed at home, but should be posted in class. Students should make it professional and presentable. You may want to make a profile of yourself to share with the class as well.	**7.** Students will create their **Personal Career Profile** (this can also be done at home). It is expected that not all students will have a clear idea of pathways to their chosen career. Suggested websites for students to use in their career exploration are listed in the bibliography.
8. When students have completed their career profile, ask them to share their profiles with a peer. After collecting the profiles, post them in the classroom. Students can make their profile on cardstock or poster board to make it sturdier for display, or digitally created profiles can be printed and mounted.	**8.** Students will share their profiles in pairs.

LESSON CLOSURE: In this part of the lesson the teacher will present information about the advantages of pursuing a physics degree at the bachelor's level and how it benefits career prospects in a variety of ways. They will then reflect on any surprising aspects of the lesson through a brief writing exercise. (est. time = 10–15 minutes)

What the Teacher Does	Anticipated Behaviors/Responses from Students
1. Give a brief presentation on **Physics Careers and Salaries Presentation** (slides available for download at STEPUPphysics.org/careers).	**1.** Students will listen to the presentation and respond to any embedded questions in the presentation.
2. Have students complete an exit slip reflection at the end of the presentation (last slide).	**2.** Students will write their responses to the exit ticket questions at the end of the presentation.

ACCOMMODATIONS & EXTENSIONS

Accommodations

- English Language Learners: Allow extra time for ELL students to complete written responses to prompts, allow extra time for ELL students to formulate their responses prior and during discussions, pair them with a student who knows their native language and/or is willing to help, allow the usage of a device for them to translate.
- Students with Disabilities: Depending on the disability, limit the need to move around the classroom during the sticky note activity, situate students where they can clearly see/hear slides and discussions, and allow extra time as necessary.

Potential tech enhancements to activities

- spsedtech.wordpress.com/2013/08/24/socrative-and-wordle-on-day-one-getting-to-know-your-students/ - This article describes how to use Socrative and Wordle to make a word cloud, which could be used in place of the sticky note activities in the lesson
- polleverywhere.com - Poll Everywhere can automatically make word cloud from open-ended questions, which can be used in place of the sticky note activities in the lesson.

Additional activities/extensions

- classtools.net - This site has simulators that can be used to enhance the lesson such as a headline generator, Facebook profiles (Facebook mimic), Twister (Twitter mimic), SMS generator (mimic text message exchange), that could be used to extend the personal profile creation component or enhance the lesson.
- Remote adaptations available at STEPUPphysics.org/careers, including a prototype website to do the matching exercise for the students.
- Teachers have also shared their adaptations at the STEP UP online community. Register at STEPUPphysics.org to join the conversation.

Career exploration websites & more scientist profiles

- American Physical Society Careers Site: aps.org/careers
- Compadre: careersinphysics.org/facts.cfm
- Society of Physics Students Careers Toolbox: spsnational.org/careerstoolbox
- American Association of Physics Teachers HerStories: aapt.org/resources/Herstories.cfm
- Institute of Physics Careers Site: www.physics.org/careers.asp?contentid=381
- U.S. Department of Labor Explore Careers: careeronestop.org/ExploreCareers/explore-careers.aspx
- National Career Development Association Resources: ncda.org/aws/NCDA/pt/sp/resources
- lgbt+physicists: lgbtphysicists.org
- 500 Women Scientists - Women in STEM database: 500womenscientists.org/request-a-scientist
- Adopt-a-Physicist: adoptaphysicist.org
- I am a Scientist Project: iamascientist.info

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Career Goals Survey

Q1. Mark the **three** most important factors for your future career satisfaction:

- ❑ **a**. Making money
- ❑ **b.** Helping other people
- ❑ **c.** Having job security
- ❑ **d.** Working with people
- ❑ **e.** Having lots of family time
- ❑ **f.** Having an exciting job
- ❑ **g.** Making use of my talents/abilities

Q2. Mark **two** areas you are most interested in:

- ❑ **a.** Medicine/Health
- ❑ **b.** Biology
- ❑ **c.** Chemistry
- ❑ **d.** Physics
- ❑ **e.** Astronomy
- ❑ **f.** Engineering
- ❑ **g.** English/Writing
- ❑ **h.** Finance/Business/Consultancy
- ❑ **i.** Administration/Management
- ❑ **j.** Arts/Media
- ❑ **k.** Academia/Education
- ❑ **l.** Technology/Computer Science
- ❑ **m.** Law

Profile Matching Matrix

After completing the **Career Goals Survey**, find which career profiles best fit your response using the table below. See next page for instructions.

Q2	PROFILES	Q1						
		a	b	c	d	e	f	g
a	Stacey Benson - Managing Health Scientist	✔	✔	✔	-	-	✔	-
a	Albin Gonzalez - Medical Physicist	✔	✔	✔	✔	-	-	✔
a	Urszula Tajchman - Pediatric Cardiologist	✔	✔	✔	✔	-	✔	-
a	Alison Binkowski - Health Policy Analyst	✔	✔	-		✔	-	✔
b	Allison Porter - Biophysics Technician	-	✔	-	✔	✔	✔	✔
c	Alice White - Materials Scientist	✔	-	✔	✔	-	✔	-
d	Jax Sanders - Professor, Interferometers & Gravitational Waves	✔	-	✔	✔	-	-	-
d	Lynett Rock - Physics & Math Professor, Math & Science Division Chair / Instructor	-	✔	-	-	✔	✔	✔
d	Nadya Mason - Materials Physics Professor	-	-	✔	✔	-	✔	✔
e	Kelle Cruz - Astrophysicist	-	✔	-	✔	✔	-	✔
e	Gabriela Gonzalez - Astrophysicist	✔	✔	✔	✔	-	✔	-
e	Jessica Mink - Astronomical Software Developer	-	-	✔	✔	-	✔	✔
f	Jessica Barrios - Structural Engineer	✔	-	✔	-	✔	✔	✔
f	Paul Davis - Applications Engineer	✔	-	✔	✔	-	-	✔
f	Sarah Ostrander - Senior Process Engineer	-	✔	✔	-	-	-	✔
f	David Sullivan - Engineer	✔	✔	✔	✔	✔	-	✔
g	Mark Alpert - Magazine Editor	-	-	-	✔	✔	-	✔
g	Liz Kruesi - Freelance Science Writer	-	✔	-	-	-	✔	✔
g	Kate McAlpine - Freelance Writer/YouTube	-	-	-	✔	-	✔	✔
g	Natalie Wolchover - Senior Writer and Editor at Quanta Magazine	-	-	-	✔	✔	✔	-
h	Deborah Berebichez - Financial Risk Analyst	✔	-	✔	-	-	-	✔
h	Amanda Joy McDonald - Actuary	✔	-	✔	-	✔	-	✔
h	Deborah Moore - Environmental Consultant	-	✔	-	-	✔	✔	✔
h	Maggie Seeds - Associate Consultant	✔	✔	✔	✔	-	✔	✔
i	Ginger Kerrick - NASA Flight Director	✔	-	-	✔	-	✔	✔
j	Dianna Cowern - YouTuber	✔	✔	-	✔	✔	✔	✔
j	Laura Kasian - Production Technician/Software Engineer	✔	-	✔	-	✔	✔	✔
k	Jacqueline Benitez - Distance Learning Educator	-	✔	-	✔	✔	✔	✔
k	Evelynn Hammonds - History of Science Professor	✔	✔	✔	✔	-	✔	✔
k	Yung Tae Kim - Skateboarding Physicist & Educator	-	✔	-	✔	-	✔	✔
k	Mary Lee McJimsey - High School Physics Teacher	-	✔	-	-	✔	✔	✔
k	Marta Dark McNeese - Laser Science Professor	-	-	✔	✔	-	✔	✔
k	Carlane Pittman - Director for Outreach	✔	✔	✔	✔	-	-	✔
l	December Martin - Senior Project Manager in Biomedical Technology	✔	✔	-	-	✔	-	✔
l	Cortney Weinbaum - Senior Management Scientist	✔	-	✔	-	-	✔	✔
m	Amy Ziegler - Intellectual Property Attorney	✔	-	✔	✔	-	✔	-

Profile Matching Matrix Instructions

HELPFUL TIPS ON HOW TO USE THE MATRIX

Step One

Look at responses to Question 2 (**Q2**, left-most column) and mark the rows that match your response. (Note - you can reverse the instructions and start with Q1 if you prefer).

EXAMPLE: *Sally chooses **e** (Astronomy) and **j** (Arts/Media) for **Q2**. She then goes to the table and sees three choices for **Q2e** and two for **Q2j**. Once she highlights/circles the responses she moves on to the next step.*

Q2	PROFILES	Q1						
		a	b	c	d	e	f	g
e	Kelle Cruz - Astrophysicist	-	✔	-	✔	✔	-	✔
e	Gabriela Gonzalez - Astrophysicist	✔	✔	✔	✔	-	✔	-
e	Jessica Mink - Astronomical Software Developer	-	-	✔	✔	-	✔	✔
j	Dianna Cowern - YouTuber	✔	✔	-	✔	✔	✔	✔
j	Laura Kasian - Production Technician/Software Engineer	✔	-	✔	-	✔	✔	✔

Step Two

From the groups marked in Step One, mark the columns noting the answers chosen for Question 1 (**Q1**, columns on the right) noting that ✔ indicates recommended profiles to read and " - " denotes a less relevant profile to read.

EXAMPLE: *For **Q1**, Sally picks **b** (helping other people), **d** (working with people), and **e** (having lots of family time). She then goes to the table and highlights or circles down the column matching her responses, taking note of every one that has a ✔.*

Q2	PROFILES	Q1						
		a	b	c	d	e	f	g
e	Kelle Cruz - Astrophysicist	-	✔	-	✔	✔	-	✔
e	Gabriela Gonzalez - Astrophysicist	✔	✔	✔	✔	-	✔	-
e	Jessica Mink - Astronomical Software Developer	-	-	✔	✔	-	✔	✔
j	Dianna Cowern - YouTuber	✔	✔	-	✔	✔	✔	✔
j	Laura Kasian - Production Technician/Software Engineer	✔	-	✔	-	✔	✔	✔

Step Three

Once all the responses have been marked, tally up all the ✔ marks for each profile (across the row). The one which has the highest number of ✔ marks is the profile that is most recommended to read. If there are tied highest results, you may choose between any of those profiles to read.

EXAMPLE: *Sally highlights/circles her choices in yellow and sees that two profiles have the same number of ✔ marks. She then reads the job title of the profiles that have tied with the highest number of ✔ marks and chooses the one she finds most interesting.*

Q2	PROFILES	Q1						
		a	b	c	d	e	f	g
e	Kelle Cruz - Astrophysicist	-	✔	-	✔	✔	-	✔
e	Gabriela Gonzalez - Astrophysicist	✔	✔	✔	✔	-	✔	-
e	Jessica Mink - Astronomical Software Developer	-	-	✔	✔	-	✔	✔
j	Dianna Cowern - YouTuber	✔	✔	-	✔	✔	✔	✔
j	Laura Kasian - Production Technician/Software Engineer	✔	-	✔	-	✔	✔	✔

Physicist Career Profiles

Mark Alpert - Magazine Editor

Mark Alpert, a lifelong science geek, majored in astrophysics at Princeton University and wrote his undergraduate thesis on the application of the theory of relativity to Flatland, a hypothetical universe with only two spatial dimensions. (The resulting paper was published in the journal *General Relativity and Gravitation* and has been cited in more than 100 scholarly articles.) After Princeton, Alpert entered the creative writing program at Columbia University, where he earned an M.F.A. in poetry in 1984. He started his journalism career as a small-town reporter for the Claremont (N.H.) Eagle Times, then moved on to the Montgomery (Ala.) Advertiser. Having lots of family time, Alpert is very close to his wife and two non-robotic teenagers. He's a proud member of Scientific American's softball team, the Big Bangers.

markalpert.com/author.php

Jessica Barrios - Structural Engineer

Jessica Barrios was inspired to pursue engineering by her father, who is a professional petroleum engineer. "For as long as I can remember, I've enjoyed science, problem solving and building structures out of any material available," she says. Authentic and hardworking, Jessica enjoys tackling the different challenges unique to each project, "challenges that keep you on your toes no matter how much experience you have." She also likes seeing each project go "from drawings on paper to a tangible structure everyone can see, and seeing it safely used for its purpose." She was attracted to CE Solutions in 2016 because the growing company allows her to grow, too, within its distinctive culture. Jessica is a self-proclaimed "sports junkie," whether it's practicing, watching or simply talking about athletics. She also likes to watch movies, cook, and spend time with family.

cesolutionsinc.com/jessica-barrios-1

Jacqueline Benitez - Distance Learning Educator

Jacqueline ("Jacque") Benitez loved astronomy as a young girl, but struggled with physics throughout high school and college. Instead of quitting, however, Jacque decided to try one more physics class in college. "It was all about just wanting more knowledge about the world around me and about astronomy," Jacque says. This time, the physics finally started to click, and Jacque realized the difference that a skilled and dedicated physics educator could make to students learning the subject.

After college, she worked at a coffee shop to pay the bills, then later accepted two part time jobs to teach astronomy and teach students remotely. She turned the latter into a full time position and is now a distance learning education specialist. She spends most of her mornings during the school year facilitating science learning experiences over Zoom - perhaps starting with a class in California, taking a ten minute break, and then connecting with another class in South Carolina. "I can jump from talking about penguins with kindergarteners to talking about asteroids, comets, and meteors in our solar system with fifth graders," Jacque says. Specifically, using her physics training, she has developed interesting engineering techniques and hands-on experiences for her classroom. Jacque finds her students to be the most exciting part of her job. "For me, it's all about giving [students] a taste of what it's like to be a scientist," she says. She also enjoys hearing and learning from her students' perspectives.

www.aps.org/careers/physicists/profiles/benitez.cfm

Stacey Benson - Managing Health Scientist

Stacey Benson worked as a teaching assistant and physics laboratory technician while earning her bachelor's degree in physics. After her undergraduate work, she directed a physics lab for a five-week summer program and then decided to pursue a Master's degree in Exercise Physiology. She was then employed at the National Personal Protective Technology Laboratory where she applied her skills in technical writing, data analysis, and computer modeling to improve respirator designs for civilian workers in the U.S. and China. In addition, Dr. Benson's role also included recruiting hundreds of participants for participation in several research studies.

She went on to complete her doctorate in Environmental Epidemiology and now works as a Health Scientist for a company called Cardno ChemRisk where she provides expert advice to lawyers, specifically around worker exposure to chemicals such as asbestos, diesel exhaust and benzene.

go.aps.org/3gJLylo

Deborah Berebichez - Financial Risk Analyst

Deborah ("Debbie") Berebichez, while growing up in Mexico City, Mexico, was filled with a natural curiosity about the world and dreamed of being an astronaut. Unfortunately, she grew up in a conservative community that strongly discouraged girls from pursuing careers in science. So, Debbie let go of dreams of science and focused on more socially acceptable pursuits, such as theatre and writing. Debbie continued to work hard in school however and received a scholarship to study philosophy in the US at Brandeis University. Part of her coursework included an intro-level astronomy course, which she immediately fell in love with. She successfully caught up with the needed physics coursework and was able to finish her physics degree before her scholarship ended.

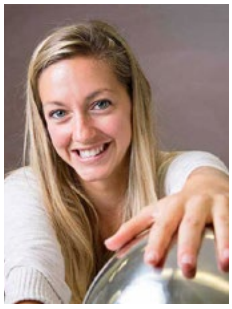
After becoming the first Mexican woman to graduate from Stanford University with a physics Ph.D., and completing two postdoctoral research positions, Debbie decided that she wanted a life outside of academia and research. She took her smarts to Wall Street and became a quantitative risk analyst. Now, as Vice President of Risk Analytics at Morgan Stanley, Debbie uses math models and quantitative analysis, like in statistics, to determine and manage the financial risk of investments. She trains her clients to use these math models, customizing solutions for their needs, creating mathematical models that will assess the risk of investments worth millions.

aps.org/careers/physicists/profiles/berebichez.cfm

Alison Binkowski - Health Policy Analyst

Alison Binkowski has had what many people would consider a "non-traditional" physics career. Her passion always drew her toward international health care issues, and some of her personal experiences helped form her concern. "I thought I wanted to work in... international health, " she says, "but after a summer in Senegal and Mali with the UN where I ended up being hospitalized in Mali for a week, making use of my talents/abilities I became more cognizant of the advantages of working on domestic health issues." Alison believes that her background in physics and computer science has served her well throughout her work. "Many fields – including international development and health policy – need more people with strong analytic backgrounds." For this reason, her training was considered an asset by her academic institutions. "My analytic training was noted as a primary reason why I was offered a partial academic scholarship in graduate school, and what helped me stand out from other candidates to get my current job at the [Government Accountability Office]." Alison says that she was drawn to physics because she "was always interested in how the world worked: from why objects fall to what was at the 'edge' of the universe. I also found the fact that phenomena could be captured and explained by mathematical formulas elegant, appealing, and even a bit spiritual."

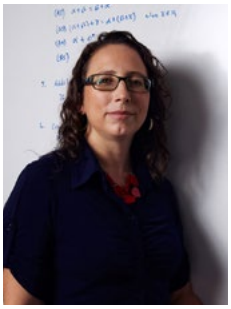
careersinphysics.org/physicists/Detail.cfm?id=2855



Dianna Cowern - YouTuber

Dianna Cowern is the creator of the award-winning YouTube channel Physics Girl, an educational series with PBS Digital Studios. She has reached over one million subscribers with 130+ videos on topics like, "How to create a vortex in your pool," and "Why is the universe flat?" Through Physics Girl, public talks, and private workshops for teachers across the nation, Dianna explains exciting science topics, inspires kids—especially young girls—to pursue an interest in science, and rallies the general public to think critically through the wonder of science. Surprise cameos from Bill Nye, skateboard legend Rodney Mullen, and Anne Wojcicki (23andMe) have helped the channel receive over 78 million views. Before starting Physics Girl, this Hawaii-raised MIT physics alumna completed a post-baccalaureate fellowship in astrophysics at Harvard, then worked as a software engineer at General Electric, and as UCSD's physics outreach coordinator. Physics Girl has been featured on the Huffington Post, Slate Magazine, Scientific American blogs, and Popular Science.

sciencemag.org/news/2017/03/meet-physics-girl-youtuber-who-makes-living-explaining-science



Kelle Cruz - Astrophysicist

Kelle Cruz studies a kind of celestial body called brown dwarfs to better understand planets outside our solar system. She is an assistant professor at Hunter College in New York, where she continues her work on brown dwarfs. Kelle loves the independence that her degree in physics has given her. She gets to pick her activities based on personal choice and interests. She enjoys the freedom of essentially being her own boss and having a lot of free rein in her work. "I decided early on that I never wanted to make money by making other people money and my physics degree has enabled me to accomplish that goal," she says. She is currently serving on the Board of the American Astronomical Society. Prior to being elected to the Board, she served as the Chair of the Committee on Employment from 2010-2017. She is the founder and Editor-in-Chief of the AstroBetter blog and wiki and is on the Coordination Committee of the Astropy Project where she promotes information-sharing practices among astronomers. She also started ScienceBetter Consulting, a small business dedicated to serving the needs of the scientific community.

aps.org/careers/physicists/profiles/cruz.cfm

Paul Davis - Applications Engineer

Paul Davis earned his BS in Physics at Howard University. He is employed through Corning, Inc and works on a team of engineers who support a major customer that uses Corning optical fiber to manufacture fiber optic cable. This industrial job allows him to contribute to the development of important products for the company and their clients. Paul's advice for students looking to follow on a similar path is to build a network with other students and professionals as "this can open doors." He also encourages asking lots of questions of this network and the world to stay curious and constantly learning. Paul also suggests that aspiring engineers join technical organizations and to make sure you "don't stay in a job that isn't meeting your needs."

spsnational.org/career-resources/physicist-profiles/paul-davis

Albin Gonzalez - Medical Physicist

Albin Gonzalez thinks of himself as a "problem solver." One of the problems Albin solves nearly every day is how to position patients during radiation treatments for the most efficient and least painful access. He also routinely solves difficulties with the technology itself. Albin checks treatment plans and monitors the machines to make sure they're working properly and that their output is within an acceptable range. Together with doctors, dosimetrists, radiation therapists and nurses, Albin treats around 40 patients per day with extremely high doses of radiation. Physics allows Albin to work in a fast-paced environment that's constantly adapting to the latest technology. Right now, his department is lucky enough to use "a fantastic treatment planning system that is the latest in the market," he says. It makes treatment plans much more efficient, which is good news for cancer patients!

aps.org/careers/physicists/profiles/agonzalez.cfm

Gabriela Gonzalez - Astrophysicist

When asked about her love for physics, Gabriela Gonzalez said, "I was amazed at how we could 'explain' the world with physics and we could predict what objects would do. When I found out this also applied to stars and the universe, and that there were unknown phenomena waiting to be discovered, I decided I couldn't do anything else!" She is currently a professor in the physics and astronomy department at Louisiana State University (LSU). In addition to teaching, she works with the nearby Laser Interferometer Gravitational-Wave Observatory (LIGO) in Livingston, Louisiana.

aps.org/careers/physicists/profiles/ggonzalez.cfm

Evelynn Hammonds - History of Science Professor

Professor Evelynn Hammonds is the Barbara Gutmann Rosenkrantz Professor of the History of Science and Professor of African and African American Studies and current chair of the Department of the History of Science at Harvard University. From 2008–2013 she served as Dean of Harvard College. Professor Hammonds' areas of research include the histories of science, medicine and public health in the United States; race and gender in science studies; feminist theory and African American history. She has published articles on the history of disease, race and science, African American feminism, African-American women and the epidemic of HIV/AIDS and analyses of gender and race in science and medicine. Her current work focuses on the intersection of scientific, medical and socio-political concepts of race in the United States. Professor Hammonds earned a Ph.D. in the history of science from Harvard University, a S.M. in physics from the Massachusetts Institute of Technology (MIT), a B.E.E. in electrical engineering from the Georgia Institute of Technology, and a B.S. in physics from Spelman College. In 2010 she was appointed to President Barack Obama's Board of Advisors on Historically Black Colleges and Universities and in 2014 to the President's Advisory Committee on Excellence in Higher Education for African Americans. She is currently director of the Project on Race & Gender in Science & Medicine at the Hutchins Center for African and African American Research at Harvard.

aps.org/careers/physicists/profiles/hammonds.cfm

Laura Kasian - Production Technician/Software Engineer

Laura Kasian is a physicist who puts her analytical skills to use in visual effects at Sony Pictures Imageworks in Vancouver, Canada. It may seem an unexpected place to find someone with a Ph.D. in astronomy, but Laura has .worked on everything from the gritty Suicide Squad to the animated movie Spider-Man: Into the Spider-Verse. Laura operates behind the scenes to smooth out the many technical elements that go into creating the movies we love. Her unusual career path demonstrates that physics is about learning skills instead of facts. She completed her bachelor's in physics at the University of Winnipeg, then pursued a graduate degree in astronomy at the University of British Columbia. She overlapped the last year of her doctorate with her first year of law school, earning her Ph.D. in 2012 and her law degree in 2013.

physicstoday.scitation.org/do/10.1063/PT.5.9093/full/

Ginger Kerrick - NASA Flight Director

Ginger Kerrick uses physics every day to quickly change plans to account for weather changes and ensure that the astronauts can safely return home. Her job as a flight director can even be seen as more important than that of an astronaut because of the amount of time and skill that she has to use to think of every single scenario that could occur while the astronauts are in space. Even though Ginger could not become an astronaut, she became one of the key people who plans everything for the astronauts and gives them the instructions on how to complete their tasks. More importantly, her experience and willingness to learn new skills gave her the opportunity to work in space exploration as a NASA flight director. The setbacks that Ginger has experienced have never stopped her from pursuing a career in space exploration.

aps.org/careers/physicists/profiles/kerrick.cfm

Yung Tae Kim - Skateboarding Physicist & Educator

Yung Tae Kim grew up in Atlanta, Georgia, with an early love for skateboarding. Tae describes his dive into physics as a stroke of luck citing a high school math teacher who "even worked with me outside of class so I could study more advanced math…he was a real mentor," Tae says. In college, Tae stumbled upon a physics class that changed the course of his academic studies, and led him to major in physics. "This [physics] class was special - it was an honors section that only 8 students bothered to sign up for," Tae says.

After graduating and teaching as a visiting physics professor at several universities in the Chicago area, Tae took his talents and physics know-how to the video game industry, becoming a consultant and controls engineer for two games in the popular Tony Hawk skateboarding game series. Tae provided game developers with the physics behind skating tricks, allowing them to more accurately simulate them in the game. As an engineer, he revamped the game's new interactive skateboard controller, which players stand on and move to produce on-screen tricks. In his next career move, Tae created an educational web series called "The Physics of Skateboarding with Dr. Tae" targeting skaters to get them to think scientifically about the sport. He also serves on the advisory board for the Puget Sound Community School in Seattle, Washington.

aps.org/careers/physicists/profiles/kim.cfm

Liz Kruesi - Freelance Science Writer

Liz Kruesi studied physics and astrophysics in college and graduate school, and soon found herself leaving behind mathematical equations to focus instead on the words and stories describing astronomical concepts. As a science journalist, she has been able to explore everything from dark matter and black holes to the outer planets and future telescopes. She loves diving into difficult topics — how did the universe evolve, where do the highest-energy particles come from, and what definitive proof do scientists need to declare life on another planet? She has written dozens of feature articles and hundreds of news stories covering all aspects of astronomical science. She translates complex scientific concepts, discoveries, and their stories into language that not only is understandable to anyone, but also captures the topic's excitement and importance.

lizkruesi.com/about

December Martin - Senior Project Manager in Biomedical Technology

December Martin was born and raised in the Philippines, and worked diligently in grade school and performed well; however, she had not yet discovered her love for science. December calls her start in physics a "happy accident" - in high school she became enthralled by the energy of physics and the excitement of solving problems. She worked part-time while pursuing an undergraduate degree in the U.S., and found a lot of strength from working with a physics study group. At a networking event during college, she met employees from a startup biotechnology company. A conversation with a scientist from that company landed her an interview, and her first industry job.

Years later, December moved into hardware engineering, where she helped to design and launch a medical device for monitoring HIV/AIDS in resource-limited countries. She loved being able to help people, and she was invigorated by the scientific community. "You're surrounded by a group of people who are very accepting of integrating difficult concepts… [Scientists and engineers] never say 'when am I ever going to use this?'... Even if you never use [these concepts] in your career, as long as you're training yourself to think critically, it's not a waste of time," December says. "This mentality is one I love and know I share with people in science." Outside of work, December is an avid surfer, volunteer, and a member of the speech contest group 'Toastmasters International.'

aps.org/careers/physicists/profiles/martin.cfm

Nadya Mason – Materials Physics Professor

Nadya Mason says that the best thing about having a degree in physics is that she gets to work in a fun and stimulating profession. She also gets to choose her schedule, focus on research and teaching that appeal to her, and travel and meet interesting people from around the world. Nadya's main strategy for success is to make sure that she enjoys the work that she does. "Most physics-related jobs involve research and problem-solving, so they're likely to be interesting and even fun," she says.

Nadya teaches at the University of Illinois at Urbana-Champaign. Her work focuses on the way electrons behave and interact in "low dimensional" materials such as carbon nanotubes and graphene. These materials are made up of extremely thin layers of carbon, sometimes no thicker than a single carbon atom. This means that a stack of 7 million sheets would be only a millimeter thick! When dimensions are so low, electrons interact in ways that create new phenomena, which Nadya aims to explore. "The research that I do explores the fundamental science that may form the basis of the next generation of technology," she says. For example, carbon nanotubes might play an important role in the next generation of nano-scale computers, leading to super-powerful quantum computers that could be significantly faster than the computers we use today.

aps.org/careers/physicists/profiles/mason.cfm

Kate McAlpine - Freelance Writer

Kate McAlpine received her bachelor's degree from Michigan State University, where she was studying both physics and writing. "I planned the science communicator part while still in college, but I didn't plan rap as an aspect of my career," says Kate. Having an exciting job is definitely one of the goals she had in mind. Kate is planning on finishing a nuclear physics rap soon, and is also working on a rap about black holes.

"I'm a freelance writer and sometimes rapper, specializing in physics," says Kate. She adds, "as a science communicator, my job is to explain research. Sometimes it's documenting the progress of a long-term project, like my current work with the ATLAS e-News, for the ATLAS experiment on CERN's Large Hadron Collider (LHC). Sometimes it's reporting about a recent advance, as in the articles for New Scientist magazine." On her work surrounding the LHC, Kate often faced challenges around defending the value of scientific research or explaining complex scientific concepts to reassure citizens about the safety of large experiments like the LHC.

cnet.com/news/when-rap-physics-and-fame-collide/

Amanda Joy McDonald – Actuary

Amanda Joy McDonald earned a BS in physics from Southern Nazarene University (SNU, in Bethany, OK) in 1989, where she published a paper in the Journal of Undergraduate Research in Physics. She was elected into Sigma Pi Sigma in the SNU chapter when it was chartered in 1994. Joy began her career as an actuary before graduation by taking the first actuarial exam in November 1988. Then life intervened. Needing lots of family time, she took several years off from Fellowship studies to raise children while still working as an actuary for American Fidelity. In 2006, realizing she was approaching the twentieth anniversary of starting the Fellows program, Joy set a goal to achieve the FSA before that anniversary. That goal was realized a few months early when Joy completed the final requirement in July 2008. Joy concentrated her actuarial studies in Group and Health Insurance.

Joy has remained a highly visible "hidden physicist" throughout her actuarial career. She presents talks to university math clubs and chapters of the Society of Physics Students, describing how a background in physics prepares one well for actuarial studies.

careersinphysics.org/physicists/Detail.cfm?id=2845

Mary Lee McJimsey - High School Physics Teacher

Mary Lee McJimsey decided to become a teacher while she was an undergraduate physics major at Cal Poly in San Luis Obispo. She was doing physics research at the time and remembers, "everyday I came in and did exactly the same thing." Mary Lee found herself inspired to pursue a career in teaching – a goal which could provide variety and excitement in her career. This proved to be true. Responding to a question of why she loves teaching, Mary Lee says, "I understand how much this job is doing to change my community. I can help a student choose to go to college, and maybe even become one of the next engineers or physicists who's going to change the world. Also, every single day is different…I see many teachers, every day, who come to me to have me help them solve a problem. I plan, but I never know what to expect."

Mary Lee is now the proud mom to two boys, and recently spent a year as elementary science specialist, teaching science to students from grades K–3. She most recently worked as a physics teacher at a small school focused entirely on problem-based learning (PBL). She is temporarily out of the classroom caring for her newest family member but hopes to return to high school teaching soon.

knowlesteachers.org/bios/mary-lee-mcjimsey

Marta Dark McNeese - Laser Science Professor

Marta Dark McNeese teaches undergraduate students of all levels and backgrounds, from humanities students to physics majors, at Spelman College. "I enjoy interacting with my students most, but I also love having to continually learn new things," she says. Marta gets ample opportunities to learn new things while she works on her latest research projects. The focus of her research has shifted from knee cartilage to light-emitting materials. Marta's main project deals with synthesizing molecules that can give off light when they're hit with light or when voltage is applied. She's interested in these so-called "electroluminescence properties" and improving them. Marta's lab is experimenting with adding metals to the molecule of interest, in hopes that this will improve the electroluminescence of the molecule. Her work has applications in light-emitting devices, diodes for displays, and even flexible light-emitting materials.

aps.org/careers/physicists/profiles/mcneese.cfm

Jessica Mink - Astronomical Software Developer

Jessica Mink is a positional astronomer and software developer at the Smithsonian Astrophysical Observatory. After getting Bachelor's and Master's degrees from MIT, she took some "enforced time off from astronomy due to a lack of jobs," in her words, and worked in the private sector developing financial software. She then got a job working in a planetary science laboratory at Cornell where she co-discovered the rings of Uranus. When her research group moved back to MIT, she contributed to the discovery of Neptune's rings and detection of the extent of Pluto's atmosphere. Moving to SAO, she developed some key softwares for analyzing data from a Space Shuttle Telescope and from ground-based spectrographs. These are used to study everything from exoplanets to Large Scale Structure of the universe! Along the way, she wrote astronomical software packages that are widely-used to work with spatial positions on scales from the solar system to nearby stars to the Milky Way galaxy to the positions of other galaxies in space.

tdc-www.harvard.edu/mink/

Deborah Moore - Environmental Consultant

Deborah Moore is an award-winning scientist, advocate, changemaker, mother, and nature lover. While she may not be a household name to you, her work has touched millions of lives and thousands of square miles of nature around the world. She has led winning campaigns across a wide range of issues, from river restoration and Indian water rights agreements in the western U.S. to fighting destructive dams around the world, and from establishing green and healthy school programs that get schools to go solar and kids out in nature to advancing the human rights of indigenous peoples. Throughout her varied career, Deborah has held roles as a research scientist, environmental advocate, non-profit director, educator, foundation consultant, and coalition builder, from small start-ups to large global initiatives. "I am an award-winning changemaker, advocate, scientist, and social entrepreneur for the environment and human rights with experience advancing sustainability, social equity, and youth engagement in the U.S. and internationally. I produce tangible results with lasting value by bringing together people with diverse perspectives to forge broadly supported solutions. My passions are climate change, water, and children - all are fundamental to a healthy future!"

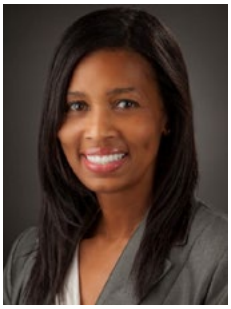
compadre.org/careers/physicists/Detail.cfm?id=2313

Sarah Ostrander - Senior Process Engineer

Sarah Ostrander's path to her current career might have seemed pretty inevitable from the outside looking in. She put an incredible amount of effort into the things she cared about, and the two most prominent things on that list were her volunteer and professional work as an EMT and her physics and engineering courses. The fusion of the two disciplines was clearly the niche she was meant for, and she has chased her dream to contribute to this arena.

Sarah overcame challenges throughout her college career and continued to offer support to others. She got a job out of college working for a manufacturing company and has worked in the electrical and electronic manufacturing industry since, working on Medical Devices

STEPUPphysics.org/ostrander



Carlane Pittman - Director for Outreach

Carlane Pittman is responsible for student concerns and student advising at the College of William and Mary. She also coordinates and maintains the outreach efforts of the physics department to recruit and advise students. She enjoys seeing students benefit from my educational programs, and promoting science at the same time. Carlane's main focus for the past 21 years while at College of William and Mary has been in the area of college student development including classroom and out of classroom experiences. She received her B.S. in physics from Spelman College and then her M.A. in education from Hampton University.

spsnational.org/career-resources/physicist-profiles/carlane-pittman

Allison Porter - Biophysics Technician

Allison Porter had always been interested in the sciences, and had showed special interest in becoming a doctor, partially due to her aunt's fight with ovarian cancer. In high school, she had a physics class that she particularly enjoyed. In the class, she was introduced to astrophysics that allowed students to create a simulated solar system by determining objects masses and velocities. When going through her undergraduate years, she wanted to choose a major that gave some breadth to her education, and her good experience in her high school physics class helped steer her towards astrophysics. "Making use of my talents, I think a lot of it is from just a philosophical standpoint, studying things that are much larger than we can really comprehend, I was very interested in big bang cosmology, the origins of the universe." After graduating from Harvard, Porter entered the Miss America pageant, representing her state of Washington. She chose the pageant due to its goal to develop well-rounded women, and currently employs her role as Miss Washington to raise awareness of cancer prevention, treatment, and funding. She is currently in the MD Program at the University of Washington. Aside from her work, Allison Porter is helping other people by being involved in a wide range of community support activities. She has spent time in Mexico doing disease education, Calcutta working at a disabled children's orphanage, and Ecuador as a part of a mobile surgery unit.

physicscentral.com/explore/people/porter.cfm

Lynett Rock - Physics & Math Professor, Math & Science Division Chair / Instructor

Lynett grew up in a rural area of Oklahoma, between the Native American Cherokee and Creek nations. As a high school senior, Lynett wasn't planning on a career in physics—she thought she'd be an accountant or a math major, but after taking her first university physics class, "it was obvious that this was what I was supposed to do," Lynett says.

After getting a degree in engineering physics, Lynett continued on to graduate school, where she studied how electrons moved through glass with different properties. The goal of her project was to come up with the perfect glass for use in space shuttles. After getting her Master's degree in physics, Lynett began teaching high school physics. When a position opened at a junior college in her hometown Lynett took it, and she and her family moved into the house next door to her parents. She now teaches math and physics at the junior college and is the Division Chair of the Math and Science Department.

Lynett enjoys showing students that math and science are not only within their reach, but very enjoyable. Many of her students plan to become teachers, and she likes knowing she's preparing future teachers to educate students to come. "I believe teaching the next generation has a huge impact on the future," she says.

aps.org/careers/physicists/profiles/rock.cfm

Jax Sanders - Professor, Interferometers & Gravitational Waves

Jax Sanders was drawn to the notion of teaching and doing research as a professor since middle school. As an undergraduate studying physics and mathematics at Kalamazoo College, Jax became particularly interested in astrophysics. They sought out a summer experience in the field and were accepted to the Laser Interferometer Gravitational-Wave Observatory (LIGO) Summer Undergraduate Research Program (SURF). Jax credits this admission to their experience in theater as a set carpenter and metal worker. Experience in welding and soldering are attractive skills at LIGO!

Physics training involves learning to approach various complex problems, and Jax utilizes this crucial skill to find answers to their research questions. "A lot of [solving a problem] is trying to think laterally but knowing that there really are unifying principles underneath all these weird things that happen." Jax is currently an Assistant Professor of Physics at Marquette University in Milwaukee, Wisconsin. They are expanding the scope of gravitational wave astronomy by designing subsystems for gravitational wave interferometers while also designing new detectors. Jax also recognizes that, even for professors, physics requires constantly learning new things.

aps.org/careers/physicists/profiles/sanders.cfm

Maggie Seeds - Associate Consultant

Maggie Seeds was always a stargazer and wanted to pursue that passion in her undergraduate education. Maggie attended Appalachian State University where astronomy was a concentration available to physics majors. She felt that physics was a natural path of study for her, and found that she enjoyed the mathematical side of physics, working through difficult challenges and finally arriving at the answer to complicated problems. Today, Maggie is a consultant at Clarkston Consulting (N.C.), a management and technology consulting firm which focuses on consumer products and the life sciences industries. As a consultant, Maggie plays many different roles depending on a client's needs. She says these range "from technical to strategic, across supply chain and business process areas." The terms "supply chain" and "business process" refer to how raw materials make their way into a finished, marketable product.

Maggie says that one of the reasons she chose this career path was because she enjoyed having to be flexible and having to examine a problem from many different angles. She knew that she wanted to utilize the critical thinking skills she'd learned studying physics, but she also wanted to travel and take on a variety of complex problems. She says that consulting filled all of these needs, since every client is different and has a new, interesting problem.

aps.org/careers/physicists/profiles/seeds.cfm

David Sullivan - Engineer

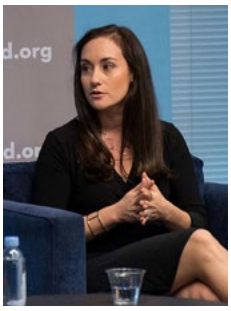
David Sullivan is involved in many ways at Raytheon. First of all, he is a principal system producibility engineer within the company. He also is very involved with recruiting university students for Raytheon, as well as working with middle and high schoolers, encouraging in them an interest in math and science. In addition to his various positions within Raytheon, David is an active member of the community. He is a member of the Decision Making Committee for the Townview Science and Engineering Magnet High School. David is an active member of his church, Friendship West Baptist, where he has been involved with the men's ministry and college groups. He has also been a coach for little league football. David's position requires his expertise in education, research, management, and government. His job utilizes his skills in complex problem solving, synthesizing information, knowledge of physics principles, communication, and teamwork.

careersinphysics.org/physicists/Detail.cfm?id=2332

Urszula Tajchman - Pediatric Cardiologist

In her job, Urszula Tajchman treats children with heart disease, as well as conducts research in molecular biology. Urszula received her medical training at the Johns Hopkins University. She then did her residency in pediatrics at the University of Colorado, and a fellowship in pediatric cardiology at the University of Iowa. She worked as a pediatric cardiologist at the University of South Dakota before becoming the first pediatric cardiologist in Central Oregon in 2002. Urszula is board certified in pediatrics and pediatric cardiology. She says that the best things about her job are caring for patients, teaching children and parents about their health, and studying therapies for disease.

careersinphysics.org/physicists/Detail.cfm?id=2321



Cortney Weinbaum - Senior Management Scientist

Cortney Weinbaum was studying physics in college and wasn't sure what to do after. She reached out to her university's alumni network in Washington and asked, "What can I do?" Her mentors said, "You have a physics degree? Send in a resume." Her summer internship with the Defense Intelligence Agency led to a job after college as an intelligence officer, designing advanced sensors for intelligence gathering.

She now conducts research and analysis on intelligence and cyber programs in the U.S. government to advise federal agencies how to improve their strategies, policies, and operations. Her research has helped the intelligence community improve its data collection and analysis and identify emerging technologies and their impact on operations. She's written that "as long as society has achieved technology advancements, people have sought ways to weaponize or militarize them. Democratic societies can make decisions that are representative of their citizens' values and stand up to public scrutiny."

As a woman with a physics degree, she works to be a mentor to younger students and recommends that students find a good role model. She says "you might not know any in your community, but there are people like you—whatever 'like you' means—who are doing really interesting science, and you should pursue it if you love it.

www.rand.org/about/people/w/weinbaum_cortney.html#overview

Alice White - Materials Scientist

Alice White first got into science in high school and went on to study chemistry at Middlebury College, a small liberal arts school in Vermont. Alice loved Middlebury's close-knit and supportive science department and one semester took an organic chemistry and physics course at the same time. She found she didn't like the messiness of her chemistry lab, but loved all the math used in physics. The experience led her to change her major and complete her degree in physics.

Alice is now a research scientist and works at the Boston University Department of Mechanical Engineering as Chair. Her technical background focuses on experimental solid-state physics and fabrication of optical components. She's received many awards and fellowships for her work, which has led to over 125 publications and 7 patents. She had a lot of support from her family and has had good mentors in her career. She strives to give back through mentorship, and outreach such as talks and physics demonstrations at local elementary schools. She says, "I really benefited...and it's something that I'm happy to give back."

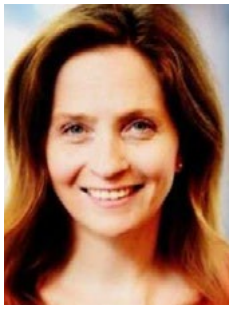
aps.org/careers/physicists/profiles/white.cfm

Natalie Wolchover - Senior Writer and Editor at Quanta Magazine

Natalie Wolchover grew up splitting her time between England and Texas where each of her parents lived. She always wanted to be a scientist, but she became interested in physics in particular at age thirteen when she read Stephen Hawking's *A Brief History of Time*. She decided to become a physicist and went on to study physics in college.

After graduating, Natalie planned to go to graduate school, but she was feeling burnt out from her intense undergraduate experience. She decided to take a break from school; for a year, she lived in a tent and worked on an organic farm in Texas. She found the time to be very rewarding. "[The gap year gave] me some much-needed perspective, and it was also very nice to be able to concentrate on studying for the exams and work on my applications and really think about what I wanted in grad school," Natalie says. Natalie went to graduate school for physics, but left during the first year to pursue physics writing. She has written for Popular Science, Seed, LiveScience, Make magazine and other publications. Now she is the Senior Writer and Editor at Quanta Magazine, and interviews physicists involved in LIGO and other major initiatives in physics. Some advice she offers to new science writers is to "Be bold, and to ask scientists for interviews even when they seem busy. They'll end up getting as much out of it as you do."

www.kitp.ucsb.edu/outreach/writer-in-residence/natalie-wolchover



Amy Ziegler - Intellectual Property Attorney

Amy Ziegler's interest in physics bloomed in high school as a result of an excellent physics teacher's efforts and participation in science fairs. After earning her Bachelor's degree, Amy did not feel ready to jump into graduate work. Instead, she began working at Argonne National Laboratory as a Particle Accelerator Operator. Her role involved keeping the beamline running and quickly solving any problems that arose to salvage research scientists' limited beam time.

As Amy weighed her long-term career options, she wanted a career with autonomy and variety, so decided to attend law school and became a patent attorney. She says that even though she "just sort of fell into that" job, it ended up being "a very lucrative, good job for people with a science and engineering background who go to law school." In this position, Amy worked with a variety of inventors to write their patent applications. Amy found the discipline and logical thinking skills learned through her physics background to be especially helpful when researching these highly specialized inventions. Amy then switched from working in patents to trademarks, a different branch of intellectual property law that deals with branding, counterfeiting, and marketing issues. She enjoys the fast pace and variety of issues covered. Amy also appreciates being able to incorporate technology into her firm's practice. "I like what I do, I like the legal work, but I also like applying technology to try to make our processes better and more efficient."

aps.org/careers/physicists/profiles/ziegler.cfm

Feel free to add additional career profiles!

Personal Career Profile (Planning Sheet)

Name: _____ **Date:** _____

PART 1: Use this sheet to plan your career profile.

I want to pursue a career in _____

In this career I will focus on:

What do you hope to contribute or accomplish through your career choice? (How will you help the world or contribute to society?)

I need the following skills (What skills or traits do you need to pursue this career?)

Based on what you learned from the physicist profiles, what are the ways you could achieve this career with a degree in physics? (How can a degree in physics lead you into this career or support your growth in this career?)

Personal Career Profile (Final)

Name: _____ **Date:** _____

PART 2: Using the information you documented in Part 1, create a profile of your *future self* that achieves your career goals with a *degree in physics*. Imagine that this profile will be read by students like you to illustrate that physics can help them achieve their goals. Use the template below (2 page maximum).

Name
Career Title

[Insert a picture of YOU that relates to your career]

WHO I AM

[Describe who you are and aspects of your background that are important to you].

WHY PHYSICS

[Give a brief personal background including how you became interested in physics, the degree(s) you earned, and the steps you took to reach your career through physics.]

USING PHYSICS

[Describe the skills and traits from your physics degree that you use in your career. Describe ways that you have contributed to your field, or ways your work benefits others, or interesting projects/accomplishments that have occurred in your career.]

ADVICE FOR STUDENTS

[Suggest ways for students to pursue their career goals using a physics degree, what they may not know about physics, etc.]

Rubric for Personal Career Pofiles

CATEGORY	TARGET (1 POINT)	UNACCEPTABLE (0 POINTS)	TOTAL
Picture	Student includes a picture of themselves, preferably illustrating their career.	Student picture is not included.	
Who I Am	Describes: (i) meaningful aspects of their background, (ii) what is important to them.	Missing one or both of the following: (i) aspects of their background, (ii) what is important to them.	
Why Physics	Incorporates: (i) how they became interested in physics, (ii) the degree(s) they earned, (iii) steps they took to reach their career using physics.	Missing multiple parts of the following: (i) how they became interested in physics, (ii) the degree(s) they earned, and (iii) steps they took to reach their career using physics	
Using Physics	Includes: (i) skills and traits from a physics degree that they use in their career, (ii) ways that they have contributed (e.g. to their field, to benefit others, interesting projects/accomplishments).	Missing one or both of the following: (i) skills and traits from a physics degree that they use in their career, (ii) ways that they have contributed	
Advice for Students	Describes: (i) ways for students to pursue their career goals using a physics degree, (ii) what they may not know about physics.	Missing one or both of the following: (i) ways for students to pursue their career goals using a physics degree, (ii) what they may not know about physics.	
Overall (Bonus)	Excellent descriptions and visual presentation of their profile. This is definitely one to post in class!	Descriptions or visual presentation need work.	
		TOTAL (OUT OF 5)	

SAMPLE CAREER PROFILE #1

Cami Monsalve
Sustainable Energy Innovator

WHO I AM

I am a Colombian woman, who moved to the United States when I was 8 years old. It is important for me to be passionate and motivated in my career.

WHY PHYSICS

I got inspired by my high school teacher, he helped me see my potential and strengths. At first, I completed a degree in biology because I wanted to be a medical doctor. All I wanted to do was help people and challenge myself while I was at it. Therefore, I went to complete my second bachelor's in physics, which taught me tenacity. I also participated in my university's StartUp Hub, which taught me how to be an entrepreneur.

USING PHYSICS

In my career I have focused on designing simple artifacts for sustainable power. For example, creating a water filter that uses solar energy. Designing this project took a team of scientists and engineers, who all collaborated. Simultaneously, I worked with environmentalist and social workers to determine exterior design that would be functional for the water filter. Programming helped in this project especially when designing the proper solar panel to harvest enough energy for the filter, which I thankfully learned in my physics degree.

ADVICE FOR STUDENTS

My advice for any student who is pursuing a physics degree is to become an active agent of your education and be comfortable with your own limits. Many times, the explanation of a professor is not enough for you, ask fearlessly until the concept makes sense to you. Also, there are times where you must review basic math concepts and skills to understand better either the concept or the math for physics.

SAMPLE CAREER PROFILE #2

Pseudonym Smith
Petroleum Engineer

WHO I AM

Hi, I'm a petroleum engineer. I grew up in a household that values education and financial success and stability, which in turn influenced how I think of the world and what job I want in the future. I decided that I wanted a high paying job at a very young age, I just didn't know what I wanted to do until I was introduced to this field of engineering of course.

WHY PHYSICS

Before I determined that this is what I wanted to do, my parents were pushing me to be a doctor or a lawyer or a surgeon due to the financial success and stability that come with those jobs, but quite frankly I was never really interested in those jobs, I found them rather dull and I like to have fun every now and then but those jobs require constant hard work, which my family also values a lot, and I wasn't really about that life. I was very confused about what I wanted to do later in life until I came across physics in high school. My teacher back then, had assigned us to do this project about a career that we can get into with a physics degree, and that's essentially when I fell in love with this career. The first step that I took to have a shot at a future in this career was to graduate high school with good grades, then the next step was to go to college and get a degree in both physics, and petroleum engineering. After doing all that, I went and looked for an internship at an oil company, which I did end up finding, and after the internship they ended up offering me a job there and ever since then my life has been great as petroleum engineering is a high paying and stable career to have.

USING PHYSICS

I have learned many skills while getting my physics degree that have helped me greatly in my career, such as critical thinking and problem-solving skills, which I use everyday when I'm at

SAMPLE CAREER PROFILE #2 CONTINUED

home. In fact, I even use these skills when I'm not home as well, I use those skills everywhere, they are very essential and wonderful skills to have. My career provides new opportunities to make everyday oil prices cheaper and cheaper as my job is to come up with new, cheaper, and more effective ways to extract oil. I am very proud to be a part of this career, and very happy of all the different ways in which I help make people's lives better, whether it be helping the company that I'm working for make more profit, which would make me more money as well, or help people save on gas prices.

ADVICE FOR STUDENTS

There are many different career paths that you can go for with a physics degree. The first thing that I would suggest that you do is to first research all of those careers, see which one of them interest you the most, then look up what degrees and qualifications that you need to be able to achieve those careers, then just go for it, and if you ever get scared of failure then just think of the following quote: "You miss 100% of the shots that you don't take." -Wayne Gretzky