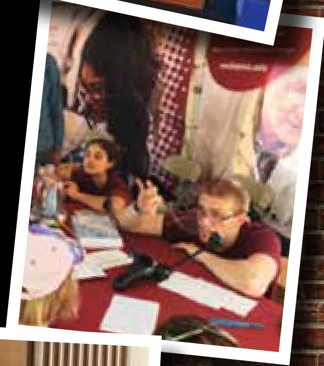
the SPS Observer

Volume LII, Issue 1

SPRING 2018



Communicating Science

+ Physics in the News

+ Snapshots from Conference for Undergraduate Women in Physics (CUWiP)

+ A Year in an SPS Chapter

the SPS Observer

SOCIETY OF PHYSICS STUDENTS

1 Physics Ellipse
College Park, MD 20740

301.209.3007 (tel)
301.209.0839 (fax)
sps@aip.org
www.spsnational.org

Find SPS on:

TABLE OF CONTENTS

SPRING 2018 ▪ VOLUME LII, ISSUE 1

FEATURES

ON THE COVER
Representing all the ways SPS members communicate science through outreach advocacy, and science policy.

DEPARTMENTS

The SPS Observer (ISSN 2160-1305) is the magazine of the Society of Physics Students, published quarterly by the American Institute of Physics. Printed in the USA. Standard postage paid at Freeport, OH. POSTMASTER: Send address changes to The SPS Observer, One Physics Ellipse, College Park, MD 20740-3841.

The American Institute of Physics is a federation of scientific societies in the physical sciences, representing scientists, engineers, educators, and students. AIP offers authoritative information, services, and expertise in physics education and student programs, science communication, government relations, career services, statistical research in physics employment and education, industrial outreach, and history of the physical sciences. AIP publishes *Physics Today*, the most closely followed magazine of the physical sciences community, and is also home to the Society of Physics Students and the Niels Bohr Library and Archives. AIP owns AIP Publishing LLC, a scholarly publisher in the physical and related sciences. www.aip.org

AIP Member Societies:
American Association of Physicists in Medicine
American Association of Physics Teachers
American Astronomical Society
American Crystallographic Association
American Meteorological Society
American Physical Society
Acoustical Society of America
AVS: Science & Technology of Materials, Interfaces, and Processing
The Optical Society
The Society of Rheology

Other Member Organizations:
Sigma Pi Sigma physics honor society
Society of Physics Students
Corporate Associates

AIP | American Institute of Physics

Indistinguishable from Magic: Communicating Science

by Brad R. Conrad, Director of SPS and Sigma Pi Sigma

Photo courtesy of Hyun-Joo Kim.

In college I didn't get to read as much as I wanted to, but one quote stuck with me, especially when I took my first electronics course:

"Any sufficiently advanced technology is indistinguishable from magic." - **Arthur C. Clarke**

For me, this still speaks volumes about what it's like to communicate physics. Physics problems are seemingly either impossible or straightforward, depending on if I understand them. The learning curve can be quite sharp and, if you've ever tutored before, I'm sure you've seen this same feeling manifest in those working on their introductory physics homework problems. One of the most common phrases I've heard is that the student knew the material, but the problems were impossible.

To be fair, I've felt that way more times than I can count. If you showed me the solution to an impossible problem, I could explain every step, but struggled to get there by myself… it's frustrating to feel like you know what's going on but also feel hopelessly lost, all at the same time. And then, after hours of not understanding anything at all—with a frustration level to match—the problem would click into place. Not because I looked up the solution in a textbook, but because I asked lots of questions, debated every step, and made every mistake possible, in concert with my colleagues and friends. This kind of thoughtful, earnest communication is one of the hardest things to learn, but possibly the most important skill a physicist can have in their repertoire.

It is through communicating science to others, in all of the available forms, that we truly learn a topic and remember the reasons many of us became scientists: the excitement of discovery and the desire to know why. Science is meant to be shared, discussed, and debated… together. Yet, scientific discovery is messy, difficult, and seemingly impossible most of the time.

Sometimes, after I had solved a problem, having looked at it from every viewpoint, answered every question someone could pose about the assumptions, established boundary conditions, and considered every limiting case, I felt as if I was holding the problem in my mind and could truly appreciate its different facets. This deep knowledge is hard to come by, but one way to make it easier is to explain the topic to others. Even after having taught a course for many years, I could be showing a demonstration and someone else's fresh perspective could make me feel like I'd never looked at the problem in the right way. A new facet. This is how discoveries are made and true experts in a topic emerge. We are better researchers and scientists when we communicate with and, more appropriately, teach each other.

Fresh perspectives have led to complete changes within the field. This can take the form of making extensions that have never been made, such as de Broglie's theory of electron waves,[1] or proposing an idea so outside the normal mode of thinking that it seems like magic—Einstein's quantum theory of light.[2] It can also be the incremental, but monumental little ventures in reasoning

> "The only way of discovering the limits of the possible is to venture a little way past them into the impossible." A. C. Clarke

that enable entire new fields; quantum mechanics is an excellent example. We learn as a community: the act of communicating science has led to breakthroughs. Not only do we make our understanding of our field more complete, but we get a little bit closer to the amazing breakthroughs yet to come. //

1. de Broglie, Louis, On the Theory of Quanta: Recherches Sur La the´ Orie Des Quanta, Ann. de Phys., 10e serie, ´ t. III (Janvier-Fevrier, 1925).

2. Rigden, John S., *Einstein 1905, The Standard of Greatness* (Harvard University Press, 2005).

Let's Talk Science

by Zoey Rosen, MS Public Communication and Technology student, Colorado State University

Photo courtesy of Zoey Rosen.

When I would walk into my SPS student chapter meetings as an undergrad, the first question I would address the room with was, "Are you Navier-Stoked to be here?" In my circle of atmospheric scientists and those interested in fluid dynamics, this pun on the Navier-Stokes equation slayed. However, when I repeated this line when I began teaching professional and technical writing, the humor did not affect the room like I expected. This was an issue of jargon—my students from across different scientific majors did not understand my reference and had their own sets of terminology. Even though I was teaching scientists, my audience had changed and I would need to adapt my communication style in order to be the most effective instructor I could be.

At Colorado State, I am studying science communication at the theoretical level. You probably have put some thought into science communication at a practical level. You know, for example, that better lab reports are those that are concise and easy to understand.

Our understanding of difficult subjects like quantum mechanics and thermodynamics can depend entirely on the readability of our textbooks and how well our professors communicate. However, I'm studying the theory of science communication. One aspect of communication theory to take into account when you share your research is audience.

Audience is arguably the single most important consideration when communicating science. There is often a disconnect between scientists and the public when it comes to communication. Scientists typically communicate research by beginning with a general background and supporting details, and coming to a focus with narrowed results and conclusions as depicted in Fig.1.

In contrast, science communicators often communicate using an "inverted pyramid" structure. This means they begin with their conclusion, then follow up with supporting details as depicted in Fig.2. Typically, the public wants to "get to the point" as soon as possible.

As you can see, these approaches are essentially complete opposites. It's important to remember that each approach is effective in the right place, but they are not universally effective. If you know your audience is going to be more general than simply those in your field, then you may want to consider using the inverted pyramid approach when discussing your work. Adjusting how you share is as important as the findings themselves—what good can your research do if no one understands its implications?

Becoming a better communicator and steward for your scientific work takes practice. If you are nervous about how your work comes across, take an interdisciplinary approach and talk with your college to see about forming communication groups across departments to practice sharing your work with audiences outside of your respective field. Open a dialogue about what you did well and where you could have been more clear, and return the favor to others who may want to do the same! Effective science communication is becoming more crucial in the physical sciences and deserves your time and effort. //

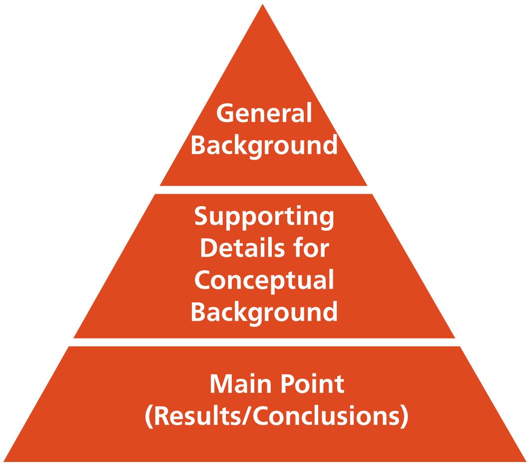


Figure 1. Typical Scientist Communication

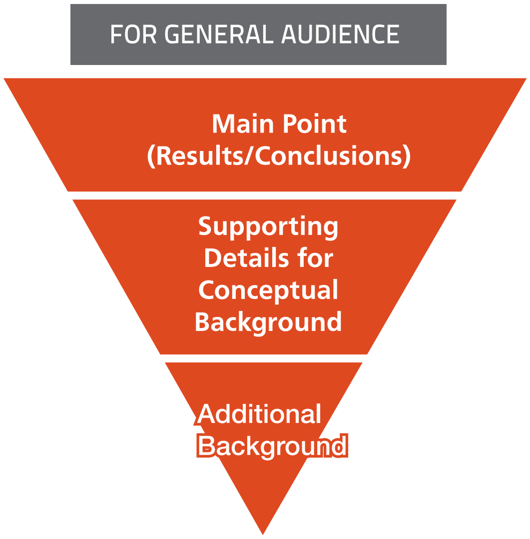


Figure 2. Typical Science Communication

Elizabeth Hook

BS Physics, Rhodes College

What she does:
Hook works as a contractor for NASA Applied Sciences in the Applied Remote Sensing Training Program (ARSET). ARSET provides training to professionals who may not have a science background (such as firefighters, journalists, and air quality and health professionals), instructing them on how to use satellite data and imagery and incorporate this data into their work. At NASA, Hook's role is to manage training logistics, edit and write informational materials and reports about ARSET, and coordinate the process of translating materials into Spanish. She also promotes the ARSET training programs.

How she got the job:
Hook earned her bachelor's degree in physics at Rhodes College and gained communications experience as a communications specialist at both the SPS National Office and the American Physical Society (APS). She attributes much of her success in the science communication field to these early positions and found them to be valuable in discerning her future career path.

Best part of her job:
"I love that we get to help other people use data in their everyday lives. It's an interesting mix between informal and formal education, and I like that we get to help people use NASA data and Earth observations to solve problems."

Most challenging part about her job:
ARSET typically holds 15 training sessions every year, serving around 4,000 attendees. Hook and her colleagues produce a lot of materials for the sessions, and there are a lot of logistical moving parts. Though it can be a challenge to manage, it has helped Hook to develop strong attention to detail and understanding of how things can best work together.

What advice does she offer to undergrads interested in science communication?
"Something I still struggle with, but is so critical to learn, is how to give and take good feedback. Most people are trying to do their best and create the best thing they can—do the best research, reach the most people. And it can be really difficult to separate feedback and criticism from self-worth. If you can use that feedback to grow, you'll become better at what you do and your job. And if you can learn how to give good feedback, that's so invaluable to working in a team environment."

Why is it important for scientists to be good communicators?
"I think scientists have a responsibility to study the world and attempt to make it a better place. A big component of that is that people understand what you're doing. If you can't articulate why your research is important, no one will want to fund it. If you aren't good at explaining your research, people just won't be interested. Especially at a time when so many people don't believe in the scientific process and there's so much misinformation around, being able to relate to people and speak to them where they're at is so very important." //

Cortney Weinbaum

BS Physics, University of Michigan

What she does:
Weinbaum is a national security researcher at RAND Corporation, a nonprofit, nonpartisan think tank. In her role, she helps intelligence and defense agencies tackle difficult intelligence topics, identify new emerging technologies to invest in, and craft cyber strategies and approaches.

How she got there:
Weinbaum was deeply passionate about physics throughout her undergraduate career, but like many physics students, she was unsure of her career path. When the US was attacked on September 11, 2001, she was in her junior year. She immediately applied for and received a summer internship at the Defense Intelligence Agency, which led to a full-time position postgraduation in 2003. In this role, Weinbaum designed new intelligence collection systems and focused on radio frequency electromagnetic systems.

Weinbaum branched out from physics and spent 10 years as a consultant helping defense and intelligence agencies improve their analytic tradecraft, strategic planning, and operations. Eventually, she realized that she most enjoyed future-focused projects, so she moved to a think tank to help national security agencies improve for the future.

Best part of her job:
"My goal is to do no harm and to leave the intelligence community stronger and better than it was when I entered. I am deeply motivated by the need to make a difference, to keep the US and the world safe, and to try to move the world's hardest security topics in the right direction."

Most challenging part about her job:
Weinbaum acknowledges that there are many challenges in her work, the first being that national security workers must understand that no single person will save the world or create world peace. "One person alone can start a war, but we all have to work together for peace and security." Accepting these limitations, Weinbaum admits, is a challenge for someone who is goal oriented and results driven.

She was attracted to physics because of its elegant theories and laws. "But there are no elegant laws of nature for national security. Instead, the world is filled with billions of individuals, groups, organizations, and nation-states, all vying to achieve power and control and reach their own goals."

Why is it important for scientists to be good communicators?
"We each have to be our own advocates. You might discover the theory of everything, but if you can't explain it to anyone, then no one will know about it. At every stage in your career you will need funding for projects, you will want to get promoted to the next level, or you will want to share the importance of your discoveries. Often the audiences who will make these decisions are not physicists. They are policymakers, government leaders, executives, and others, and the language they speak is not the language of scientific journals. And then, if they are going to advocate for your cause, they will need to recommunicate it to their stakeholders, their constituents, their board of directors, and others who have even less understanding of physics and interest in your issue. I am constantly asking myself why my audience should care about a topic and what they will find compelling about the issue." //

Fall 2017 Chapter Awards

Congratulations to the following winners of the Fall 2017 Chapter Awards. These awards are made possible in part by generous contributions from SPS and Sigma Pi Sigma alumni. For examples of past award-winning projects, visit www.spsnational.org/awards/chapter-awards. The next round of awards will be accepted in Fall 2018.

FUTURE FACES OF PHYSICS

Future Faces of Physics Awards are made to SPS chapters to support projects designed to promote physics across cultures. The goal of the Future Faces of Physics Award is to promote the recruitment and retention of people from groups historically underrepresented in physics.

Adelphi University
Labs for Kids
James St. John (Leader)
Matthew Wright (Advisor)

California State University – San Marcos
CSUSM's Aim for Diversity in Physics
Jesus Perez (Leader)
Justin Perron (Advisor)

Coe College
G5: Girls are the 5th FUNdamental Force
Annie Ruckman (Leader)
Firdevs Duru (Advisor)

University at Buffalo
Women in Physics
Samuel Powers (Leader)
Salvatore Rappoccio (Advisor)

University of Southern Mississippi
Promoting Physics in Mississippi
Megan Payne (Leader)
Michael Vera (Advisor)

University of the Sciences
Strange Science: Unmasking the Weirdness of the Quantum Realm
Brett Conti (Leader)
Roberto Ramos (Advisor)

Utah State University
PhysX: High School Girls Exploring Opportunities in Physics
Vanessa Chambers (Leader)
David Peak (Advisor)

SPS CHAPTER RESEARCH

The SPS Chapter Research Award program provides calendar-year grants to support local chapter activities that are deemed imaginative and likely to contribute to the strengthening of the SPS program.

Florida Polytechnic University
Feasibility Studies of Dolomites from Phosphatic Pebble for Thermochemical Energy Storage and CO_2 Sequestration
Wyatt Liptak (Leader)
Sesha Srinivasan (Advisor)

Ithaca College
The Naked Eye Observatory
Adam Rabayda (Leader)
Michael Rogers (Advisor)

Purdue University – West Lafayette
Quantitative Evaluation of Pedestrian Movement Models: A Real Many-Body Problem
Adam Kline (Leader)
Rafael Lang (Advisor)

Suffolk University
Neutron Production and Detection Techniques Around a 15 MeV Medical LINAC
John Thomas (Leader)
Prashant Sharma (Advisor)

University of Central Florida
Cavendish Experiment
Brian Ferrari (Leader)
Costas Efthimiou (Advisor)

University of Maryland
Constructing a Watt Balance to Redefine the Kilogram
Siddhartha Harmalkar (Leader)
Donna Hammer (Advisor)

MARSH W. WHITE

Marsh W. White Awards are made to SPS chapters to support projects designed to promote interest in physics among students and the general public. The Marsh W. White Award dates back to 1975 and is named in honor of Dr. Marsh W. White for his long years of service to Sigma Pi Sigma.

Cleveland State University
Lunchtime Physics Club for True Inquirers
Samantha Tietjen (Leader)
Kiril Streletzky (Advisor)

Florida Polytechnic University
STEM Day Outreach at Florida Polytech
Wyatt Liptak (Leader)
Sesha Srinivasan (Advisor)

Hamline University
Renewable Energy in Units Anyone Can Understand
Zachary Pearson (Leader)
Lifeng Dong (Advisor)

Henderson State University
Science Olympics
Jackson Baber (Leader)
Shannon Clardy (Advisor)

Ithaca College
Phun with Physics
Adam Rabayda (Leader)
Michael Rogers (Advisor)

University of Alaska Fairbanks
Solarpalooza: A Solar Viewing Experience
Riley Troyer (Leader)
David Newman (Advisor)

University of Maine
Renewing Physics Demos for Community Outreach
Graham Van Goffrier (Leader)
Charles Hess (Advisor)

University of Rochester
Physics Pentathlon
Adina Ripin (Leader)
Frank Wolfs (Advisor)

University of Southern Mississippi
Promotion of Physics in the Hattiesburg Community
Megan Payne (Leader)
Michael Vera (Advisor)

University of the Sciences
Renewable Energy: Sustainable and Attainable
Austin Vantrease (Leader)
Roberto Ramos (Advisor)

Utah State University
Sucking Life Back into Physics Demos
Benjamin Lovelady (Leader)
David Peak (Advisor)

SIGMA PI SIGMA CHAPTER PROJECT

The Sigma Pi Sigma Chapter Project Award provides funding of up to $500 for chapter inductions and events.

Adelphi University
Alumni Dinner
James St. John (Leader)
Matthew Wright (Advisor)

Cleveland State University
Reviving the Sigma Pi Sigma Chapter at Cleveland State
Samantha Tietjen (Leader)
Kiril Streletzky (Advisor)

Colorado School of Mines
Physics for the People: Community Lecture Series
Emily Atkinson (Leader)
Timothy Ohno (Advisor)

St. John's University
Science for Humanity
Rachel Tyo (Leader)
Charles Fortmann (Advisor)

University of Maine
The Sigma Pi Sigma Induction & Awards Banquet
Samuel Borer (Leader)
Patricia Byard (Advisor)

University of Maryland
Sigma Pi Sigma Induction Ceremony & Banquet Dinner with Physics Alumni
Siddhartha Harmalkar (Leader)
Donna Hammer (Advisor)

University of the Sciences
Sigma Pi Sigma: Celebrating Diversity in Physics
Alyssa Petroski (Leader)
Roberto Ramos (Advisor)

Suffolk University SPS chapter members at Massachusetts General Hospital where they collect data for their SPS chapter research project. Photo courtesy of Suffolk University SPS chapter.

Making Space for Discovery

by Korena Di Roma Howley, Contributing Editor

While teaching her experimental lab, Mount Holyoke College physics professor and department chair Katherine Aidala noticed something: Many of her students were uncomfortable using basic tools to handle lab equipment, and they often had very little experience working with their hands. "It's somewhat universal," Aidala says. "There's an urban/rural divide, often, [and] there's certainly a male/female divide."

One solution? Embrace the maker movement, which has swept campuses, downtowns, and Instagram hashtags [with its marriage of the latest technology and traditional craft.] The movement celebrates open-source learning and independent innovation, and a wide range of skills falls under its umbrella, including coding, woodworking, robotics, circuitry, and sewing. It seems like the logical next step for a society that places high value on both creativity and tech savvy. But for those students who lack hands-on experience, whether with tech or handicrafts, maker know-how might seem like an unattainable ticket to the modern era.

Hoping to both increase STEM literacy and spark interest in it among students at the Massachusetts women's college, Aidala and her colleagues founded Mount Holyoke's first makerspace—a term used to describe a collaborative environment in which like-minded makers hash out ideas and bring projects to life, both physically and conceptually. Mount Holyoke's take (called, appropriately enough, Makerspace) comprises both a physical location and programs that further the broader mission: lowering the barriers of entry to technology by incorporating tech into traditional coursework and encouraging interdisciplinary collaboration. An American foreign policy class, for instance, assembles simple rover drones to simulate a humanitarian aid mission, and art students join a robotics course to create interactive sculpture.

Among the facilities in the physical space are 3-D printers, soldering stations, sewing machines, a vacuum former, and a laser cutter. But more than the technology that's being used, Aidala says the key is to create a welcoming environment. "It's about how you provide support for people who don't have experience" with new technology and hands-on production, she says. At Mount Holyoke, Makerspace's student workers serve as role models for peers who might otherwise be reluctant to undertake what have traditionally been male-dominated activities.

In addition, extracurricular workshops that are open to everyone—students, faculty, and staff—offer activities such as laser-cutter prototyping and paper modeling that appeal to a range of skill levels. In one popular lab, students discover how physics can help them successfully temper chocolate. They then create original molds using the thermal vacuum former.

According to Aidala, the machines encourage students to become more fluent with technology and help to expose them to new skills, perspectives, and possibly even academic interests. Often, students will walk away with tangible evidence of their journey outside the box. And the hope, she says, is that they'll soon return. "It's incredibly empowering to be able to make something from scratch."//

TOP: Mount Holyoke College's Makerspace provides a welcoming environment for hands-on technical experimentation and coursework.

LEFT & RIGHT: Students in Mount Holyoke's Engineering Robotics Systems class test their SumoBots by attempting to push other bots out of a circular arena. Photos courtesy of Katherine Aidala.

A Stellar SPS Chapter

by Rachel Kaufman, Editor

The SPS Outstanding Chapter Advisor Award is the most prestigious award given by SPS, bestowed annually on the basis of the leadership, student leadership development, support, and encouragement the advisor has provided to his or her chapter.

For his leadership and guidance of Ithaca College's SPS chapter, Dr. Michael "Bodhi" Rogers, a professor of physics, an archaeologist, and the coordinator of the science teaching certification program at Ithaca College, is SPS's 2017 Outstanding Chapter Advisor.

Rogers has been nominated a stunning 14 years in a row. This is his first year winning.

"The students kept saying, 'Is this going to be the year?' I told them that with my role on the SPS National Council I get to see how many amazing chapters and chapter advisors are out there....Knowing the group that I'm now part of is pretty humbling."

"Dr. Rogers is a great part of our chapter, and without him we would not be as prosperous of a chapter as we are now," wrote Amy Parker, Ithaca College SPS president, in her nomination letter.

Rogers has a wide and varied set of research interests. In addition to a PhD in physics, he also has a master's in archaeology and is active in education research. During the first two-decades of his career he used tools such as ground-penetrating radar and magnetometry to look beneath the ground without digging at archaeology sites, but most recently has been using ground-based LiDAR to digitally preserve historic architecture. "I was fortunate to find a way of combining my passion for archaeology and my passion for physics," he says. He has laser-scanned historic homes, historic landmarks, and even an entire castle in Ireland, taking students along. "I love doing research with students," he says. "I enjoy having physics students conduct research outside of the traditional laboratory....We've gotten to do some amazing projects in amazing places."

During Rogers's time at Ithaca, he has helped the physics department grow from 20 majors 15 years ago to around 75 today, an increase that has required bringing on three new full-time faculty.

"We put a lot of effort into that," he says. The SPS chapter has also grown under Rogers's leadership—to 40 active members, all of whom are working on at least one project.

These projects include building a 3-D printer that prints in clay (to complement the department's other 3-D printers, including PancakeBot, a 3-D printer that uses pancake batter), collaborating with occupational therapy students to develop adaptive devices, fundraising for PhysCon, and building "The Naked Eye Observatory," a project that was recently funded through the SPS Chapter Research Award (see pp. 8-9). The Naked Eye Observatory, led by student Adam Rabayda, will be an outdoor "modern Stonehenge," where observers can see astronomical phenomena without telescopes or other equipment. "We've proposed this project to the Ithaca College administration to have it centrally located on campus. We are hopeful that we will receive administrative approval and financial support in the near future to make this exciting project come to life." Rogers says.

He says he feels comfortable stepping back and letting students take the lead. "Watching the students become more experienced, passing knowledge on, and mentoring each other… has been really exciting. My role is, when they need or want help, I step in and give advice." A change to the chapter structure helped. Now the chapter's secretary and treasurer automatically become president and vice president the next year, leads to chapter leadership that can train incoming board members.

"The greatest reward is watching students grow professionally and personally. Undergraduates arrive at college at the top of their high-school game, but they have so much yet to learn. In just four years they leave college as emerging professionals." //

TOP: Professor Rogers and physics major Chidi Anyata using a Leica C10 3-D laser scanner to digitally preserve the Keep at Trim Castle in Ireland. Trim Castle is the largest Anglo-Norman castle in Ireland, and the Ithaca College team conducted two month-long summer expeditions to take positional readings every 5 mm inside and outside of the Keep, the Barbican Gate, the Curtain Wall, and the surrounding medieval landscape.
Photo courtesy of Professor Rogers.

LEFT: Ithaca College physics major Ryan Bouricius demonstrating a 3-D printed prosthetic hand at Ithaca College's Educational Technology Day. Ryan's senior physics thesis focused on modifying a design obtained from eNable to give the thumb and fingers additional orientations to make the hand more functional. Educational Technology Day at Ithaca College is a free regional event that attracts 1,600 educators and technology specialists to learn about the latest trends in educational technology. Professor Rogers and the Ithaca College SPS chapter share their 3-D laser scanning and printing educational efforts at this event each year.
Photo by teacher-in-residence Marty Alderman.

Chapter Report

Submission Deadline: **June 15**

Why Chapter Reports Are Important:

- Maintain chapter health, success, and growth by reflecting on the year's events
- Provide guiding template for your chapter's future SPS members
- Determine chapter's strengths and weaknesses
- Share your chapter's best practices with other SPS chapters
- Gain national recognition for your hard work

What to Include in Chapter Reports:

- Name and email of your SPS chapter advisor
- Names and emails of incoming SPS chapter leadership
- Chapter's participation in SPS National Office programs and use of National Office resources (scholarships, internships, chapter and individual awards, Careers Toolbox, GSS, demo and outreach tools)
- Attendance at zone, regional, and national meetings
- Interactions within your chapter
  - Examples of activities include: bad physics movie nights, liquid nitrogen ice cream socials, alumni career panels, colloquia
- Interactions with other SPS chapters, campus clubs/societies, or your local community
  - Examples of events include: 'Pi a Professor' day, Harry Potter Family Fun Nights with your Library and Chem Club, Outreach events at local museums
- Your chapter's Sigma Pi Sigma inductions and activity
- Blake Lilly Prize application
- Pictures, news clippings, links to the chapter's social media accounts

For Information regarding Chapter Reports visit: **spsnational.org/chapter-reports**

The Society of Physics Students
One Physics Ellipse, College Park, MD 20740 | Tel: 301-209-3007 | Email: sps@aip.org

AIP American Institute of Physics

FEATURE

To the Ramparts: Defending Science!

by Don Lincoln, Senior Scientist, Fermilab

Photo by Fermilab/R. Hahn

There is a cultural war going on for the soul of America, and you are a soldier.

That might seem to be an overly martial metaphor, but bear with me. On the one side, there are the voices of reason and science, guided by logic and with a deep respect for the interplay between mathematics, modeling, and empiricism. On the other side are those who reject the tools that have advanced our understanding of the universe. They are the antivaxxers and flat-earthers, the homeopaths and climate-change deniers. Influential people talk about alternative facts as if they were a real thing. There's astrology, creation science, and zero-point energy. The list of topics with antiscientific supporters is depressingly long.

Is this a problem? After all, we've always had nutty people on the corner, standing on their soapboxes, yelling to all who will listen (and even to those who won't) that the end is near. Is this anything new?

Well, yes and no. The forces of pseudoscience have always been among us. But the internet has given them a larger voice than before and allowed them to grow their communities. With increased voice comes increased influence. Should their voices carry the day, this has real consequences for you and for future generations. In the US, the rate of people contracting measles has doubled between 2001 and 2015, with the majority occurring among the unvaccinated population. And the dangers of climate change cannot be overstated. As ragingly liberal an institution as the US Department of Defense has identified climate change as a nonpartisan military threat to the nation. Climate-caused social instability will arise; indeed, it already has. Forget the polar bears, climate change will cause vast migration and wars and unimaginable human suffering.

So what can you do? The first thing is to get engaged. Find a way to have a voice. Write an op-ed or start a local science café. If you have the inclination, make videos or write books or magazine articles. Engage science skeptics online. If politics are your thing, contact members of Congress or representatives of government agencies at all levels. If you don't speak up, the only voices that will be heard are the ones that espouse pseudoscience. And it is crucial to remember that, when you speak, your audience isn't comprised of the purveyors of nonsense but the silent readers. They're the ones you're talking to. You won't convince the zealots, but the neutral spectators can be persuaded.

If you feel uncomfortable doing this alone, there are organizations that can help, including the Society of Physics Students, the American Physical Society, and the American Association for the Advancement of Science. Talk to people who are already doing it and learn from them. Then go forth and do likewise. The features that follow provide helpful tips, best practices, and valuable resources to help effectively communicate science.

The struggle for the soul of America will not be won in a single conversation. It will take all of us, and each must do their part.

To the ramparts! I'll meet you there.//

FEATURE

Communicating Science - Collective Experiences from Everyday Physicists

SPEAKING PHYSICS

by Julia Majors, Project Manager, AIP

In studying physics and learning about the universe, you learn to speak "Physicist." It's a unique language, descended from the more classical tongue "Scientist," and delightfully embellished by mathematicians' names and colorful portmanteaus like "qubit" and "heterostructure." Dialects do vary between the numerous niche disciplines within physics, but all originate from the same core axioms.

Those who speak "Physicist" and "Scientist" are increasingly valuable, not just for their problem-solving skillset, but for their ability to translate and make accessible the cornucopia of emerging scientific discoveries. The field of science communication has evolved to earn a number of its own advanced degree programs, like UC Santa Barbara's Master's in Science Journalism, and even its own hashtag (#SciComm).

The demand for skilled, effective science communicators is at an all-time high. In fact, the endurance of scientific advancement has arguably never depended on it more than it does today. The ability to effectively communicate new findings is precisely what drives further progress.

But while most scientists who have publicly presented their research will agree that "good communication skills" have been valuable in their career, it is usually in the context of a community that already speaks their language (or dialect). Communicators who can explain science to a general audience are rare, and this has left science, and physics in particular, isolated from much of the general public.

Thankfully, the tide is starting to turn. There is more attention on the need for broader science communication, leading to training and outreach programs at major research conferences. There is now an ever-expanding array of opportunities to carve your own career or enhance the path you're already traveling.

At its essence, the art of science communication is a unique form of storytelling that reveals secrets of the universe and new mysteries. These stories can be told in all sorts of ways, to all sorts of audiences.

After a lucky introduction through a professional society, while working on my dissertation research I was offered funding to attend a conference in exchange for writing daily news reports of presentations. This was my first experience writing physics stories for a large audience—in print no less—and I never would have guessed how much I would enjoy it. Four years and many, many more stories later, I have also discovered just how many facets of science communication exist.

Today, science communication takes myriad forms beyond traditional science journalism. Technical writers compose educational coursework and industrial white papers. Science editors help academics and professionals alike shape complex information for different audiences. And social media has led to an explosion of new demands for science content, creating the first podcast and YouTube stars with millions of fans.

> "Imagine you're a crime reporter writing a story about a shooting at a nightclub. Now imagine that none of your readers know what a gun is."
>
> - Carl Zimmer, NYT Science Columnist

If you are just as interested in how physics is discussed as the physics itself, you're not alone. Whether you aspire to follow in the footsteps of Carl Sagan or are just looking for new ways to explore your love for physics, science communication offers a plethora of paths worth traveling. The stories below are just a few of the paths you could take.

Julia Majors is a Project Manager at the American Institute of Physics. She has a PhD in Physics from University of California, Irvine. You can contact her at jmajors@aip.org.

FROM THE BENCH TO THE PAGE:
One physicist's path to a career in science journalism

by Yuen Yiu, Staff Writer, AIP

My journey to becoming a science writer is one with a humble beginning and a humble ending, albeit a tad bit unconventional compared to others.

To begin with, English is not my native language, and I didn't study journalism in college. Growing up in Hong Kong, I was taught at a young age to be "practical." I chose computer engineering as my major as I rode on the tail end of the dot-com boom. But after a few years away from my parents, I became more "unhinged," and like many unsupervised college kids, I wildly switched my major to physics. Soon after, I got my BS. Then graduate school became the obvious choice, and off I went.

It wasn't until the fourth or fifth year into my doctoral studies that the thought of becoming a science writer took root. I was writing my first research paper, and my supervisor noted that my writing needed improving. He encouraged me to take some relevant classes to improve my science communication skills.

Since there weren't many classes that specifically taught scientists how to write papers, I combed through all the class descriptions until I found one that came close. Of the classes I ended up taking, "Writing About Science" was the one in which, after some training, I discovered my ability to explain complex scientific concepts to a lay audience—perhaps not as well as a professional journalist, but definitely better than my fellow labmates, even as the only international student in the class. In the end, I got an A.

A couple of years later, I was debating between applying for a second postdoc or venturing into private industry. One afternoon I spotted a job posting that began with something like, "If you love science but feel that a career at the bench isn't enough to sate your desire to learn more about the natural world, then a career in science writing might be good for you."

That evening, I started a new Word document and titled it, "YuenYiu_CV_ScienceWriter.doc." The rest is history!

Yuen Yiu is a Staff Writer at the American Institute of Physics. He has a PhD in physics from University of Tennessee and a bachelor's degree, also in physics, from University of Michigan.You can contact him at yyiu@aip.org.

SCIENCE COMMUNICATION IS EVERYWHERE

by Emilie Lorditch, Assistant News Director, AIP

While earning my undergraduate degree, I was interested in so many different topics that I found it impossible to commit to a specialty. I really enjoyed talking to researchers about their passions, but I never had a burning desire to pursue my own research projects. A science writing class taught by a working journalist really opened my eyes to a career in science writing. Once I was a working science writer, I found that having a science degree helped me ask thought-provoking questions and earn the respect of wary experts. I discovered there are all types of science writing, from long, in-depth feature articles to attention-grabbing science news tweets. When I had the opportunity to write for science videos, I learned that writing wasn't the only way to communicate science. For me, the perfect moments in our science videos are when the narration complements the animation on the screen, and the viewer gets it in just a few seconds. Whether it is a casual conversation with the person standing behind you in the checkout line, or a 30-minute presentation to your peers, it all counts as science communication.

After many years in a career focused on various forms of science communication, an important lesson I've learned is to know the technical level of your audience and choose your words carefully to make sure your message will be understood.

There are many ways to start developing your own science communication skills and prepare yourself for rewarding career opportunities: Take a writing class in your university's journalism department; look for opportunities to write for your university and/or your department; pitch an article or blog idea to your favorite online science news source; get involved with professional organizations in your field (like AIP!), and keep your eyes and ears open for writing opportunities related to their events and members.

Emilie Lorditch is the Assistant News Director at the American Institute of Physics. She has a degree in physical/environmental geography from The Pennsylvania State University. Emilie's articles have appeared in Scientific American and NBC News.com. You can contact her @EmilieLorditch or elorditc@aip.org.

ComSciCon

by Nathan Sanders, Vice President, Legendary Pictures

Ask any scientist in any field how they spend their time and what skills are most vital to their career success, and I'm confident most will agree that communication is at least as much a part of their job as experimentation and analysis. But consider how much of your formal education has addressed skills in communication and how many opportunities are presented to you as a student to grow and practice these skills. It's fairly easy to find students who feel significantly underserved in this way.

As a graduate student in astronomy at Harvard University in 2012, along with a number of my colleagues at MIT and the University of Colorado at Boulder, we recognized this gap in our own experience. We sought to create student-driven, entrepreneurial programs in science communication that would generate opportunities for students to communicate science.

My colleagues and I gained experience working on Astrobites (http://astrobites.org/) and Chembites (http://chembites.org/), graduate student writing collaboratives that produce daily digests of the research literature in astronomy and chemistry, respectively. Through these projects, we practiced synthesizing and interpreting research in our fields and adding context for undergraduates. We wanted to spur the creation of more opportunity-generating initiatives like these.

Our solution was to develop a workshop series on science communication, called ComSciCon, that would bring together young leaders in science communication from across the country. Over the course of our three-day ComSciCon workshops, we introduced these scientists to expert science communication professionals from a variety of fields, including journalism, education, media production, policymaking, and more—and to each other.

Through our "write-a-thon," panel discussions, storytelling workshops, and other interactive sessions, these students are exposed to a wide range of methods and domains for applying science communication. They leave reporting greater confidence in communicating to broad and diverse audiences, and an intent to engage in outreach and communication.

We work with sponsors like the American Astronomical Society to make registration free of charge and fund travel for students to attend our Boston-based national workshop. We support our alums in founding ComSciCon-region-specific franchises that provide these opportunities nationwide.

Together with the American Institute of Physics' Venture Partnership Fund program, we're working with more AIP Member Societies such as The Optical Society (OSA) to bring ComSciCon programming to professional society meetings and to make the digital content captured at our workshop available to members online.

If you go on to attend graduate school and want to further your own experience in science communication, we welcome you to apply to join us at a future ComSciCon event! You can find details about our regional franchise programs on our website (http://comscicon.com/). //

Nathan Sanders is the Vice President of quantitative analytics at Legendary Pictures and one of the founding members of Astrobites and ComSciCon. https://www.cfa.harvard.edu/~nsanders/

FEATURE

A Peek Into the World of Federal Funding

The questions Congress is asking and how you can help answer them

by Eleanor Hook, SPS Member, Rhodes College

Photo courtesy of Eleanor Hook.

All of us in the sciences have heard the complaint at one point or another: *The government just doesn't understand! When will they fund science properly?* How can I afford to do my research? The truth is that the public policy that forms the basis for science funding is an incredibly complex issue, one we could all stand to learn more about. This summer, as an AIP Mather Policy Intern, I gained a much broader perspective on the world of science policy and the debates that rage on Capitol Hill.

In 2017, the U.S. federal government spent nearly $150 billion on research and development.[1] Many of these projects have led to enormous advances in technology, medicine, and our fundamental understanding of the world. For example, research supported by the National Institutes of Health (NIH) and the NSF brought the now-ubiquitous MRI to hospitals across the United States. Federal funding is also partially responsible for Google (the NSF, NASA, and DARPA all helped support Larry Page and Sergey Brin in developing their new search algorithm), GPS (and the atomic clock that keeps it accurate), and the artificial intelligence and speech recognition that would eventually render Siri possible.[2]

That's not to say that government involvement in research isn't hotly debated. Federal funding for research and development has declined as a percentage of GDP, from 1.2 percent in 1976 to 0.75 percent in 2016, and there is no indication that this trend will reverse. One of the most common disagreements is about the role government should play in research funding, compared to private industry.

It's true that historically industry has been great at applying scientific advances quickly to make them commercially feasible, and some companies (like Tesla and Google) fund their own research operations. However, even those companies that do perform basic research operations rarely, if ever, fund research outside of what is directly applicable to their company and product line. The last large corporation to regularly fund a broad variety of research was Bell Labs — and that mostly ended after financial hardship in the 1980s.

Here's another important question: Given that the government has a fund set aside for researchers, how much of this should be dedicated to basic research (cellular structure, theoretical physics, astronomy) and how much should go to applied research (disease prevention, quantum computing, solar energy)? There are compelling arguments on either side: Why should the government use taxpayer dollars for projects that will not directly benefit them? Why spend billions of dollars exploring the outer reaches of the solar system when there are more than 500,000 homeless people[3] in the US?

On the other hand, many of the technological advances that we all benefit from stem from such "useless" projects. Without Einstein's exploration of relativity, we wouldn't be able to sync up our terrestrial clocks with satellites. Without studying quantum physics, we wouldn't have smartphones. Without the highly theoretical work on coherent light in the early 20th century, we wouldn't have CD players. The list goes on.

Finally, what percentage of our resources should be concentrated on incremental improvements on already-existing theories and technologies, and how much should go toward risky but potentially groundbreaking work? Many companies are willing to pour money into small projects or build upon advances made in government laboratories but are uncomfortable gambling large sums on research that may not pay off. How much should we allow industry to capitalize on taxpayer-funded research without taking on any of the risks? These are just a few of the countless questions asked by and of members of Congress every day.

1. https://www.aaas.org/sites/default/files/Agencies.jpg
2. http://www2.itif.org/2014-federally-supported-innovations.pdf
3. http://www.bbc.com/news/world-us-canada-42248999

What can we physics students do to enter this debate? The first is to follow it. Although many of us keep up with the daily headlines, how often do we see issues relating to research and development (barring the occasional outcry following a budget cut)? For more reliable updates, AIP's FYI newsletter is an excellent resource. When you see an issue that's important to you, call your representatives!

SPS also offers several summer internships in science policy each year. The AIP Mather Policy Internship places you on Capitol Hill, where you engage directly with the legislative process; your work will vary based on your placement, but I got to attend hearings and markups, perform research for legislation and speeches, and meet countless people who work in science policy. The AIP Science Policy News Internship also takes you to Capitol Hill, this time to report on important science topics, and gives you great experience writing and communicating professionally about science. SPS also offers an annual Congressional Visits Day (CVD) for chapter officers, where you'll learn how to advocate on various science policy issues.

Even if you don't want to devote your career to working on Capitol Hill, science outreach is still something you can use as part of your everyday work. Increasingly, studies show that while most Americans support research as a general concept, they have very little understanding of basic science or the scientific method. Many SPS chapters already perform some form of physics outreach; if yours doesn't, see if you can make it happen! To those publishing research, it's wonderful when you get accepted to that one journal that everyone in your field reads. But if the general community has no way to access or even understand your research, how much are you contributing to the world at large? Wherever you can, try to publish articles targeting the general public as well. By educating the public and getting voters excited about science and research, you'll help keep the dialogue flowing. //

TOP LEFT: Eleanor and fellow 2017 Mather Intern Riley Troyer met with astronaut Tracy Caldwell Dyson and heard about how her background in chemistry helped her on the ISS. Photo by Tracy Caldwell Dyson.

TOP RIGHT: Eleanor stands with Representative Dr. Bill Foster (IL) in front of the Capitol. Rep. Foster is the only physicist in Congress. Photo by Riley Troyer.

MIDDLE: Eleanor stands with Dr. John Mather in front of the Capitol. Dr. Mather sponsors the AIP Mather Internship. Photo by Riley Troyer.

BOTTOM: Eleanor stands on the Speaker's Balcony at the Capitol Building, with the Reflecting Pool and the National Mall in the background.
Photo by Aria Kovalovich.

FEATURE

Science Communication & Outreach

by Stanley Micklavzina,
Department of Physics,
University of Oregon

Outreach inspires scientific literacy while promoting public understanding of the benefits of physics education and research. Community and educational partnerships also foster curiosity and passion in the next generation. These activities enrich the experience of the participating undergraduate students as ambassadors of science by promoting a deeper commitment to their discipline. **– SPS National Council outreach statement, adopted 2013**

Science outreach is a form of science communication that serves to:

- inspire young minds in schools and public venues,
- communicate to the public an understanding of the importance of science education and research,
- promote the science program offered at a college or university,
- and deepen the understanding of the presented science for the presenter.

While outreach and demonstrations can be challenging to make work in front of an audience, it's one of the most important things you can do for both the audience and yourself. You are able to hone your knowledge of physics, practice presentation skills, field (sometimes difficult) questions you might have never thought of, and support the next generation of physicists and astronomers. **A win for all involved!**

Before you begin, consider the following steps to make sure you make the impact you are hoping for:

1. Identify your audience.
2. Determine the goal of the event.
3. Select the physics concepts you want the audience to consider.
4. Don't rush through the presentation, as thinking takes time.
5. Repeat the important concepts multiple times, but in different ways.
6. Relate the physics principles to their daily lives.
7. Locate volunteers, identify the right venue, and double–check your setup.

I classify three primary ways to facilitate outreach to the community. Each method has different goals and outcomes, so think about what resources you have available and what outcomes you are looking for.

TOP: Stanley Micklavzina and undergraduate physics major Yohan Walter from the University of Oregon recently presented physics demonstrations in a stage production entitled "Tesla: Sound, Light, Color." Photo by Stanley Micklavzina.

1 THE STAGE

My personal preference is to focus on an interesting and entertaining theme, keeping the presentation from being scattered. The idea is to capture the audience's interest by enhancing demonstrations with descriptions that stimulate and broaden understanding of the science or concepts. Usually, I pick a theme, build up the demonstrations around it, and end with an exciting grand finale. For example, the Physics of Rock 'n Roll show is a string of electricity and magnetism (E&M) demonstrations which build up to show how speakers, microphones, and guitar pickups work. By adding in light, an E&M wave, with a fog machine, the grand finale is a Rock 'n Roll laser light show! Ideally, the demonstrations keep the younger audience captivated while the explanations engage the older students and parents.

Audience participation also enhances the show experience. Keeping the show moving along and well timed is extremely important. All the demonstrations should be laid out in advance, and train volunteers to help with the setup and show presentation. Have an outline of the demonstration order, including lighting or sound cues, for all the stage volunteers. Putting the actual order number on the demonstrations can also help the show run more smoothly, cutting the time you spend looking for parts on a demonstration table.

Suggestions for a stage-type presentation:

- If possible, investigate where you will be doing the presentation. Can lights be dimmed? Is there a sound system? How large is the venue?
- The demonstrations should be visible and organized and practiced well beforehand. Rehearsals are very important! Practice packing and setting up before and after a full rehearsal so you will not forget anything.
- Try to out-think Murphy's law!
- During a presentation, if something goes wrong, make it part of the show. State what is wrong and what you are doing to fix it, or what went wrong and why it went wrong. The physics is always there, and it actually always works!
- Have fun and engage with the audience.

LEFT: Table at a Science Open House. Building a speaker using wires, magnets, and a plastic yogurt tub and building the world's simplest motor. Photo by Brandy Todd.

2 PHYSICS AND PERFORMANCE

Physics and Performance has been a project I have been involved with over the years, developing a performance where the people come to be entertained while science is presented at various points within the show. The idea is to provide inspiration and science awareness to a set of people who might not usually attend a science presentation. Recently, I participated in a coordinated interdisciplinary production called "Tesla: Sound, Light, Color" where a tribute to Nikola Tesla involved ballet dancers, an original music score, a string octet, a 50-foot screen displaying computer graphics, and three segments of physics demonstrations showing the principles of E&M, as well as demonstrating a few of Tesla's inventions. Below is a list of demonstrations used for the performance to help guide you on how to develop a theme of your own.

Electricity: 600BC to 1860

- Electrostatic – Separate charges, repelling and attracting straws by rubbing with different materials
- Separating charges and creating sparks, Van de Graaff
- Battery – Chemicals separate charges using a hand battery
- Light a light bulb by connecting to a 12 V battery – Takes two wires to complete a circuit
- Repeat light connecting 12 V battery – Hanging coil near a strong magnet moves, electricity creates magnetism
- 1820 – Currents light things up but also create a magnetic field, Oersted discovery
- Coil repels or attracts magnet depending on current direction
- DC motor – Switch polarity and make the coil go back and forth

Can Magnets Create Electricity?

- Moving magnet in a coil lights an LED
- 1860 – James Clerk Maxwell publishes his mathematical theory of electromagnetic fields
- 1856 – Nicola Tesla is born, myth has it, at midnight during a lightning storm!

Alternating Current

- AC motor – Hanging coil and bulb with AC/DC current, pendulum
- Resonance – Maximum energy transfer
- Tesla – Transfer energy without wires!
- Small Tesla coil and fluorescent bulb
- Large Tesla coil lights neon signs and fluorescent tubes nearby

Communication: Transfer of Information Without Wires

- Wireless communication transmitter and receiver – Amplifier output to coil with a pickup coil connected to sound system
- Radio signals – Turn on a portable radio
- Tesla coil can make sound, or play music, acting like a speaker with current disturbing the air

3 SCHOOL OR SCIENCE CENTER ACTIVITY VISIT

This can be an assembly type of presentation, much like the stage, or visiting a particular grade or after-school program. We have visited grade schools with physics students where each student presents an interactive demonstration. The impact of college students interacting with the younger kids is very dramatic, better than the teacher or myself doing it! Young kids will relate more to you, seeing you as an older sibling explaining science rather than another older teacher! I suggest focusing the presentation around a narrow topic or technology: light and color, electricity, solar PV cells, sound and music, astronomy, or pressure and force. Be sure to have notes and a guide to maintain focus while the fun is happening. If working with a smaller group, make it interactive! For example, ask a set of students to work together and write down what they saw at each station and what they got out of the interaction. Leave students with something they can discuss with the whole class after the event, and also something to take home.

Interactive Presentation Table:

We have set up small tables or areas at special events, science fairs, at our local science center special events such as University Day, Halloween, or the Science Open House hosted on campus (along with a demo show!). If we are doing a demo show, we will also have tables set up in the lobby, or even in the auditorium, before the show so the public can interact with a demo and experience a principle up close, as some people respond well to individual communication. We have also done tables for summer outdoor festivals and county fairs. Again, having college students at these tables is a huge asset. Younger kids like it, and parents also like talking with college students about what they are learning and what they know. The posture of a presenter can make all the difference in the level of engagement, for example, for children, try coming to their physical level (lowering yourself) as you are showing a demonstration.

Communicate effectively. **Make it interactive, ask for feedback, and make them guess about what will happen before it happens.** As stated at the beginning, the payoffs are high. The people you interact with are appreciative, and the feeling of accomplishment lives long after the experience. Have fun!

Example of Building a Demo for the Stage or Table:

To facilitate the Nikola Tesla presentation, I had to build some new demonstrations. I needed a large display demonstrating that a current creates a magnetic field, so I made a 10-cm-diameter coil of coated wire with 30 turns and hung it from a rod, creating a coil pendulum about 12 cm long to the center of mass of the coil.

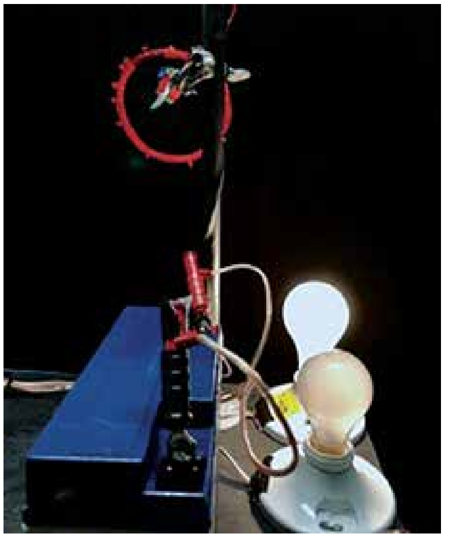
Near the center of the coil I placed a strong neodymium magnet. When a current goes through the coil it deflects, the direction depending on which way the current is flowing. This large demonstration can be seen from far away and is easily repeatable.

Also demonstrated is the concept of the AC motor, a Tesla invention. Connect an AC current at the pendulum frequency to the coil and it will oscillate. This is also a demonstration about resonance, since the amplitude becomes very small if you are not at the resonant frequency. You need a low-frequency signal generator that can produce signals at about 1–2 Hz and an audio amplifier that can work at low frequencies. I purchased 75 and 25 W, 12 V incandescent bulbs and connected a bulb in series with the coil so it's easy to observe when the current is flowing. (The 75 W bulb is in series with the 12 V battery connected to the coil, and the 25 W bulb is in series with the amplifier connected to the coil. A switch controls which source is connected to the circuit.) The audience can see that the coil moves when the bulb is lit, since the current flowing is creating the magnetic field.

We also built Tesla coils for the show using kits sold by oneTesla. Some electronic knowledge is helpful to assemble those kits, and safety precautions need to be understood when operating larger Tesla coils. Having a Tesla coil that can play music really made the show fun! //

Sources of Ideas:
https://www.spsnational.org/programs/outreach

For Tabletop and Classroom Visits:
Little Shop of Physics, Brian Jones, Colorado State University. http://www.lsop.colostate.edu/lesson-plans-guides/.



TOP: Hanging coil in series with light bulb and near a strong magnet.

BOTTOM LEFT: Hanging coil and strong magnet with no deflection.

BOTTOM RIGHT: Hanging coil and strong magnet with deflection. Great for a large room!

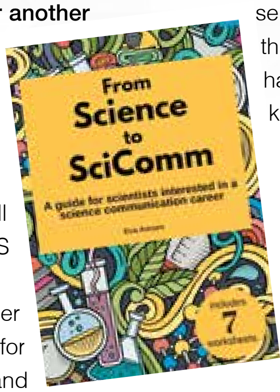
All photos by Stanley Micklavzina.

SPECIAL FEATURE

Five Tips for Communicating Science Like a Pro

by Rachel Kaufman, Editor

Whether you have your heart set on research, teaching, or another career after you graduate, every physicist needs to know how to communicate. Some physicists will even leave the lab entirely and instead spend their careers communicating science to others, whether as a writer, a lecturer, or something else.



Wherever your career takes you, communication skills will be crucial to your success as a professional. That's why SPS Observer reached out to Eva Amsen.

Amsen has a PhD in biochemistry but has spent her career outside of the traditional lab environment. She has worked for scientific publishers and as a freelance science journalist, and has managed communications for scientific organizations, among other jobs. At her blog, easternblot.net, she laid out a series of posts aimed at helping scientists—physicists included, of course—who want to improve their communication skills or pursue a job in science communication. She recently compiled those posts into an ebook (http://easternblot.net/2018/01/16/science-scicomm-workbook/) featuring a set of seven exercises that are meant to help you map out your career in science communication.

Observer sat down with Amsen to learn how scientists can improve their communication skills, or even transition to a science communication career.

HERE'S WHAT WE LEARNED:

1. Know your "scicomm style." Are you interested in writing articles for the public? Interpreting exhibits at a science museum? Giving demos at an outreach event? These are all examples of science communication. What kind interests you the most? "It took me years to figure out my own style," Amsen says. If you're in the same boat, spend some time reflecting on what kind of communication you see yourself doing, and try lots of different things to see what you like best.

2. Read what you want to write. "I was a teaching assistant for a science writing course just after my PhD. The undergraduates in the course were writing essays that were supposed to be really general audience pieces, and they were writing these convoluted sentence structures that you'd only find in scientific papers. It's because that's what they'd been reading—you kind of absorb that language."

Instead, make sure you're absorbing more than academic language if you want to work outside academia. If you want to work in science journalism, read great science journalism. If you want to work in university communications—you can usually sign up to get your university's press releases to start to get a sense of what a press release sounds like. As a bonus, doing this will help you stay up to date on the exciting research happening at your school. Want to write science books for kids? Read as many as you can.

3. Make connections. As a scientist, it's important to meet other researchers in your field—they might become mentors or collaborators. As a science communicator, the same is true. Meet and talk with other writers or people who do work similar to the work you want to do. "It's a very welcoming community," Amsen says. "You get to find what jobs are out there, and maybe make some connections."

4. Just do it. You don't need a license or degree to start writing or speaking about science (although the degree does help if and when you want to start getting paid for your work). You can get valuable experience while still working on your degree. If your school has a student newspaper, write a science column for it.

"When I was doing my PhD, the editors of the university newspaper were not science students themselves, so they always needed people to write about science." Amsen adds. (And if you're an SPS member, get in touch with us about contributing to our pages!)

If you'd prefer to speak or give demos rather than write, look for events near you where scientists present their work to the public (some events with chapters around the country include Nerd Nite and Science Café, among others), find a local museum to volunteer at, or just get active with your SPS chapter's outreach events.

5. Track it. While you're "just doing it," keep track of how much time projects take. Unless and until you're getting paid for your outreach and communications work, it's important to know whether you're spending your time wisely—or getting sucked into a never-ending project. "I used to have a really bad habit of agreeing to do things that ended up taking way too much time, because I couldn't judge how long something would take," Amsen says. "[Time management] isn't generally taught as something you should be doing." If you do start to get paid for your work, knowing how long something takes will help you figure out how much to charge.

Science communication is a wide-open field with many possible specialties. Hopefully you will be inspired by the many options available to you in science communication. Best of luck on your career journey! //

SPECIAL FEATURE

Physics in the News

by Rachel Kaufman, Editor

SPACEX REACHES MILESTONE

Elon Musk's private spaceflight company SpaceX made history with the February 6 launch of the Falcon Heavy rocket, the most powerful rocket currently in operation. Not only did the Falcon Heavy successfully deliver its payload to space, but in another first, two of the rocket's boosters landed themselves at Cape Canaveral Air Force Station, to be reused in a future flight. SpaceX's strategy of reusing rocket parts has allowed it to offer launch services to NASA and the military at a cost significantly lower than competitors.

The payload on Falcon Heavy's maiden launch was also a little unconventional. Musk chose to launch his personal Tesla Roadster, complete with a "driver" (a mannequin wearing a spacesuit). The Roadster is currently heading into an orbit that takes it slightly beyond Mars, an orbit in which it will (most likely) remain for quite some time. NASA's Jet Propulsion Laboratory is tracking the car as it travels through the solar system, and you can follow the progress of "Starman," the mannequin "driver," at http://www.whereisroadster.com/.

ABOVE: The Falcon Heavy rocket takes off from pad 39A at the Kennedy Space Center in Florida. Photo courtesy of SpaceX.

NEW TRACTOR BEAM COULD (SOMEDAY) LEVITATE HUMANS

University of Bristol researchers have built an acoustic tractor beam that can capture objects much bigger than previous versions.

Acoustic tractor beams use sound waves to levitate small objects. This principle is fairly well understood (so much so, in fact, that you can build your own with about $75 in parts).[1]

Typically, these beams can only levitate or capture objects that are smaller than the wavelength of the sound in use, because the sound waves transfer spinning motion to the object until it spins out of control and flies out of the beam. The Bristol engineers solved this problem by creating what they call acoustic vortices—essentially tornadoes of sound—that stabilize the tractor beam. This let them use a 40 kHz sound, which is far outside the range of human hearing, to levitate a 2 cm ball.

The researchers believe that such a tractor beam could someday be used to guide drugs or microsurgical implements within the body, and if it were to be scaled up, could lift even bigger objects—possibly even a human.

Read the paper: **DOI: 10.1103/PhysRevLett.120.044301.**

1. http://www.instructables.com/id/Acoustic-Tractor-Beam/. This tutorial was designed by one of the engineers who developed the new tractor beam!

NEW METHOD PROPOSED TO STOP LIGHT IN ITS TRACKS

Even though light travels nearly 300,000 meters per second, physicists can "stop" it by trapping it inside crystals or inside a cloud of very cold atoms. Now, researchers have proposed a third method of trapping light that makes use of "exceptional points."

Exceptional points are points at which waves' resonant frequencies and resonant modes coincide. (Essentially, you "cancel out" one light wave with another.) Normally, most of the light is lost at these points. Researchers at Technion – Israel Institute of Technology and Brazil's National Institute of Pure and Applied Mathematics show that theoretically it should be possible to retain the light by using waveguides with PT symmetry.

A waveguide is much like it sounds—a physical structure that guides the movement of waves, in this case, light waves. A fiber-optic cable is an example of a waveguide.

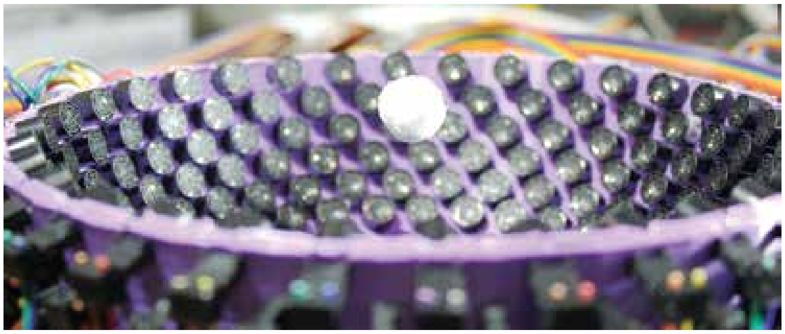
The scientists' work was purely theoretical, so up next is testing the theory. But already this theoretical technique may have advantages over existing light-stopping techniques. The technique could work with any wavelength of light, and in fact could even work with other types of waves, such as sound waves.

"Slow light" is thought to have applications in telecommunications and computing, but it's a ways off. Until then, read the new paper: **DOI: 10.1103/PhysRevLett.120.013901.** //

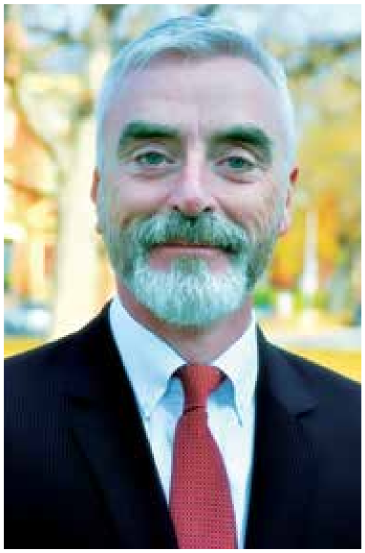
LEFT: Intertwined short vortices of opposite directions are emitted to trap and stabilize particles.

BELOW: A styrofoam particle of 1.6 cm (1.88 wavelengths of sound) trapped in the center of a 40 kHz ultrasonic generator of virtual vortices.

All photos courtesy of University of Bristol.



AIP Welcomes New CEO Michael H. Moloney



Experimental physicist Michael H. Moloney assumed the role of CEO on March 5, following unanimous approval by AIP's Board of Directors. Moloney becomes the ninth executive to lead AIP and will sit on the Executive Committee of the SPS and Sigma Pi Sigma National Council. He previously held the position of director for space and aeronautics at the Space Studies Board and the Aeronautics and Space Engineering Board of the US National Academies of Sciences, Engineering, and Medicine. He's a senior member of the American Institute of Aeronautics and Astronautics, an AIP-affiliated society, and was inducted into the International Academy of Astronautics in 2016 for his leadership in space policy.

Moloney says he's looking forward to embracing the great opportunities that AIP, its societies, the community in general, and humanity at large will face in the 21st century. "Science is rapidly changing and becoming more interdisciplinary," he says, "and the fields of physical science connect like never before."

Collisional Processes in Rubidium-Methane Gas Mixtures for Alkali Laser Development

by Philip Rich and Lucy Zimmerman, SPS Members, US Air Force Academy

A diode-pumped alkali laser is a new class of optically pumped lasers whose active medium is an alkali vapor such as potassium, rubidium, or cesium. This type of laser has the capability to deliver high output powers with excellent laser beam quality and therefore is desirable in a variety of applications of national security interest. A typical off-the-shelf laser pointer delivers about 1 mW of power, while an alkali laser has reportedly reached over 1 kW.

Our SPS chapter is working on understanding the physics behind the operation of these lasers with the ultimate goal of improving their performance. Specifically, we study collisional processes in alkali–buffer gas mixtures to determine the collisional excitation transfer and quenching cross sections.

The operation of an alkali laser relies on efficient excitation transfer between fine-structure levels of an alkali in the presence of a buffer gas. The rate at which these fine-structure changing collisions occur depends on the alkali–buffer gas combination, the buffer gas pressure, and the temperature. Quenching (decay without the emission of a photon) from these levels is also important, as this causes unwanted heating in the laser medium, which leads to a reduction in laser efficiency. Methane is often used as a buffer gas due to its favorable collisional excitation transfer cross section. However, the effects of quenching on the laser performance are not well understood, because very few measurements of the quenching cross section are reported in the literature, and these measurements are neither precise nor in agreement with each other.

Our measurements are performed in a room temperature vapor cell which is connected to a high-vacuum system containing rubidium and methane at variable pressures. A self-mode-locking Ti:sapphire laser generates ultrafast laser pulses at 780 nm, which excites the rubidium atoms from the 5S ground state to one 5P fine-structure state. The rubidium atoms collide with methane gas at a given pressure, thus facilitating a transition to the other 5P fine-structure state. As the rubidium atoms decay back to the ground state from this other 5P excited state, they emit fluorescence photons at 795 nm which are detected by a photomultiplier tube. We record these photons as a function of time by a time-to-digital converter interfacing with a computer via a LabView program.

The shape of the fluorescence curve is that of a double exponential. The rising portion is because of collisional excitation transfer, and the decay portion is due to spontaneous decay and quenching. Quenching appears in the fluorescence curve as a faster decay to the ground state compared to the natural spontaneous decay. We observed no signs of collisional quenching at low methane pressures (less than 25 Torr), but quenching was present at high pressures. This observation allowed us to perform the study in two different pressure regimes. By fitting the fluorescence data using a nonlinear least-squares fitting routine in MATLAB, we determined either the collisional excitation transfer or the quenching rate at that particular pressure. Both the collisional excitation transfer and the quenching rates are directly proportional to their respective cross sections, the buffer gas number density, and the relative speed of the colliding partners. By varying the methane pressure and measuring either the collisional excitation transfer or the quenching rate we are able to determine the respective cross sections. Our measurement of the collisional excitation transfer cross section is in excellent agreement with previous measurements, while having an order of magnitude less uncertainty. Our measurement of the quenching cross section is the most precise measurement to date, and it also resolves a discrepancy in previous quenching measurements.

This project was performed in the Laser and Optics Research Center at US Air Force Academy under the supervision of Dr. Alina Gearba-Sell, the SPS faculty advisor, and Dr. Jerry Sell, a senior research scientist. It was funded in part by a SPS Chapter Research Award. Philip Rich, the current project leader, joined the research team last spring as a freshman physics major and aspires to become a special operations officer in the US Air Force upon graduation. Lucy Zimmerman is a sophomore physics major who plans on attending graduate school and serving in the US Air Force as a physicist. Jeremiah Wells, the former project leader, and Jared Wesemann worked on this project during the 2017 spring semester and graduated with a BS in physics. They are currently serving as second lieutenants in the US Air Force and attending pilot training.

The undergraduate students are co-authors of a manuscript they plan to submit to Physical Review A. Cadets Rich and Zimmerman presented their research findings at the 2018 Annual Directed Energy Science and Technology Symposium in Oxnard, California. //

LEFT: Cadets Philip Rich, Jared Wesemann, and Jeremiah Wells.

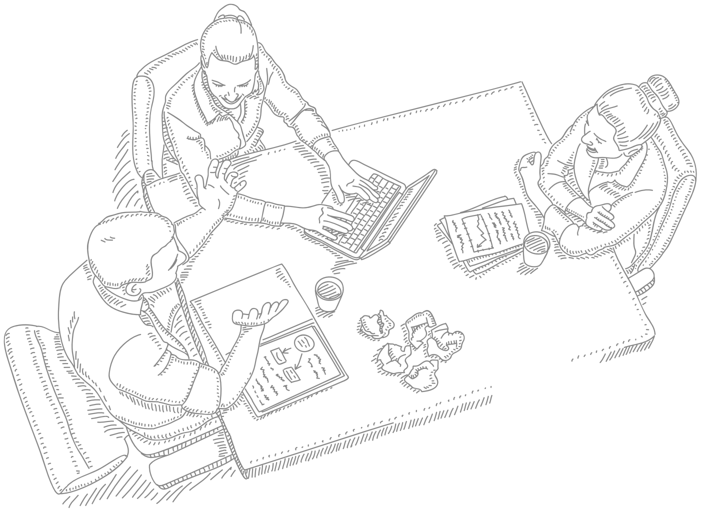
RIGHT: Cadets Lucy Zimmerman and Philip Rich posing in front of the vacuum system while adjusting the buffer gas pressure in preparation for collecting the fluorescence photons. All photos courtesy of Dr. Alina Gearba-Sell.

A Year in an SPS Chapter

by Kerry Kidwell-Slak, Associate Director, Society of Physics Students & Sigma Pi Sigma

With spring upon us, many SPS chapters are holding elections and considering who will lead the group into the next academic year. Whether you are interested in elected office or not, just being a member of your local chapter means you have the ability and even the responsibility to improve the health of your chapter and make it the best it can be. To do this effectively, it's helpful to understand the life cycle of a group—how groups coalesce and learn to thrive.

One helpful model for understanding chapter development is Tuckman and Jensen's model of group development.[1] Their assertion was that while every group will have its own personality, successes, and challenges, groups tend to follow similar patterns in how they learn to function and progress through a series of stages. They use the mnemonic of Forming – Storming – Norming – Performing – Adjourning to capture each of these points. How long each group spends in each stage can vary, but the progression generally stays consistent. Let's explore each one and how you might be able to implement activities for your chapter that take advantage of your stage. //



	Characteristics
Forming	• Typical of early in the school year • New people are checking out the group amid other orientation activities • Hopes for the year are high, and people have a positive outlook on group dynamics
Storming	• Conflict among members as differing priorities and expectations emerge • Dwindling membership as potential prospects and members shift their time and interests to classwork and other priorities • Lack of trust among members, officers, and possibly advisors
Norming	• Chapters "hit their stride" and figure out programs and activities that suit the time, interests, and talents of their group • Clear expectations and roles for officers • Advisors are available as resources, but students take the lead in planning and executing activities
Performing	• Group excels at identifying and solving problems • Individual members understand and adapt to various roles • New leaders begin to emerge • Energy and morale within the group are high
Adjourning	• Intentional transition as students graduate and new officers are elected • A time of closure and reflection on shared experiences

1. Tuckman, Bruce W., & Jensen, Mary Ann C. (1977). "Stages of small group development revisited," *Group and Organizational Studies,* 2, 419–427.

2. Adapted from "Group Development," (2015). A presentation by the Office of Student Activities and Involvement at James Madison University.

Suggested activities[2]	Keep in mind…
• Fun icebreakers/get-to-know-you games • Review of mission and purpose of the group with new members • Social activities with food (BBQs, pizza parties, etc.) • A splashy demo at a campus fair • Regular officer meetings to establish roles and expectations • Connect with AZC and ZC to get ideas and best practices from other chapters in your zone	Your chapter should have an intentional plan for welcoming newcomers. Avoid inside jokes and being cliquish to ensure that your chapter continues to grow.
• A workshop on communication skills or conflict resolution styles • Officer meetings to review and clarify roles • Remind everybody that this stage is a natural part of group development and that they will emerge stronger	Conflict and disagreements are healthy and normal! The Storming stage can be challenging, but try to stay engaged with it and put yourself in the shoes of those you find yourself in conflict with. If you find yourself stuck in the Storming stage for a long time, try seeking an outside mediator from your campus student organization office or seek guidance from SPS National.
• Strive for a variety of activities, including outreach/service, research, fellowship, and professional development • Design a t-shirt or button for chapter to advertise across campus • Consider starting a new tradition, like a design competition, demo show, or outreach event • Write a Marsh White or Chapter Research Award proposal	Take time for members to engage in social activities as well as programmatic tasks to strengthen interpersonal relationships and avoid regressing to the "Storming" stage.
• Begin to work on your Chapter Report to document what went well and what can be improved upon for the future • Take an active role in leading part of your zone meeting • Nominate your advisor for Outstanding Chapter Advisor Award • Encourage members to apply for internships and scholarships	This is a good time for graduating students to consciously step back and allow younger students to lead and excel.
• Organize your Sigma Pi Sigma induction ceremony as a special event for your department • Have a senior banquet or awards night to recognize the contributions of members who are graduating • Hold elections so new officers have the summer to plan, and have outgoing officers write transition reports to help their successors • Use your Chapter Report to reflect on what went well during the year and what you might do differently in the future • Contact SPS National to update contact information for officers and advisors	This can be an emotional time for chapter members or advisors who may be moving on. Be sure to celebrate and show appreciation for their contributions.

CUWiP 2018: Continuing the Tradition

FROM CUWIP, IOWA STATE UNIVERSITY

by Ariel Crego, SPS Member, Coe College

"If I do things other than physics, they won't think I'm serious about it. That's not true."

These words, spoken by Dr. Ágnes Mócsy, couldn't have better reflected my own attitude. My two areas of study—physics and creative writing—tend to elicit raised eyebrows. I was only able to combine them thanks to Coe College, where exploration of various fields of study is heavily encouraged. And while I know many students who pair science with mathematics, language, or cultural studies, there have been only a handful of science and writing majors before me.

Throughout the years I've had a back-and-forth with myself about the validity of my interests, and only recently have I been introduced to science communications as a career path, albeit one with no clear-cut road. This led me to apply for the 2018 Conference for Undergraduate Women in Physics (CUWiP) at Iowa State University in Ames. My first conference was a CUWiP, and it made me see that I could be a woman of science despite all my inhibitions and insecurities. It helped me gain the confidence to stay with physics, and I wanted to do any small part I could to help someone who might feel the same way.

During the first full day of the conference, about 200 physics students from various colleges and universities piled into the spacious Benton Auditorium. Murmurs and snippets of conversation bounced off the walls. There was lots of early morning chatter and people on their first cup of coffee for the day.

Dr. Ágnes Mócsy, professor of physics and astronomy at Pratt University, took the stage, and there was no one more fit to start the morning. Mócsy works with the building blocks of the universe, those particles that existed at the time of the big bang and those that still build everything around us. But it was the moment when she turned to the intersection of physics and art that I still hold onto.

Around me I saw people shifting forward, eyes lighting up and mouths opening in exclamations of awe. Mócsy showed photos of art created with physics in mind—hats modeled after the post–big bang explosion of particles, earrings shaped like gluons, beautiful paintings and sculpture modeled after cosmological structures studied around the world, dresses with "red-shift, blue-shift" detailing that shimmer and sparkle in the light.

In that moment, it began to come together for me—and for many others around the room. Any woman in science knows that one must not appear too feminine, lest male colleagues not take us seriously. Yet, here in front of us was a woman who is highly respected in the community, who has worked at Brookhaven, Yale, and the Niels Bohr Institute but is also a fashion designer and filmmaker. While art is not intrinsically a woman's field, there is the perception that art and science don't mix—and that's simply not true.

For the rest of the conference Mócsy was surrounded by people sharing stories of their own desires to create "artistic science." I had the opportunity to speak with many of them throughout the conference, and the hope they gave me for the future is immense.

LEFT: Attendees of the 2018 Iowa State CUWiP pose for a photo in the lobby of the Gateway Hotel in Ames.

TOP RIGHT: Dr. Ágnes Mócsy showcases a piece of art modeled with the splitting of a particle in mind.

BOTTOM RIGHT: On the first night of the conference, attendees engaged in an icebreaker challenge. Groups of five were tasked with building a pasta tower to support a marshmallow without breaking or falling.

All photos by Massimo Marengo.

There was even a pair of students from the same school, both majoring in physics and art, who had no idea the other existed until this conference. My takeaway: No one should feel that they must be purely science-oriented to be a successful physicist.

The conference also emphasized networking and connecting. When you're the only girl in the class, it's easy to forget about the hundreds of other women in the field. But suddenly being thrust into a room with so many of them can be daunting. Parallel sessions allowed us to make personal connections while also learning about combating bias, imposter syndrome, and taking on leadership positions.

On our drive back to Cedar Rapids, my peers and I chatted about ways to introduce new ideas and concepts to our professors, as well as events, activities, and collaborations that our campus Women in STEM organization could host. I can only imagine that the departure for many other attendees was similar, and I hope that anyone who may have been unsure of their place in physics left with a clearer idea of their own future.

FROM CUWIP, GEORGE WASHINGTON UNIVERSITY

by Sarah Monk, SPS Member, University of Maryland

The 2018 Conference for Undergraduate Women in Physics at George Washington University wasn't the first CUWiP that I've attended, but as a graduating senior, it will likely be my last. I was fortunate to experience my final CUWiP with an amazing group of women, including several from my home institution, the University of Maryland. It was the first CUWiP for most of them, and I was thrilled to see the enthusiasm and empowerment on their faces over the course of the weekend.

The conference kicked off with a tour of the NASA Goddard Space Flight Center before the official opening banquet. It was a wonderful dinner, with heartfelt welcomes from Evie Downie, representing the conference organizing committee, and representatives from GWU and APS. My table was lucky enough to be seated with after-dinner speaker Christine Jones of the Harvard-Smithsonian Center for Astrophysics. It was great to speak with her in a less formal setting and hear about some of her experiences. Those at our table studying astronomy even learned that she had developed the software used in their astronomy courses.

The next morning's plenary speaker, Dr. Kawtar Hafidi, was an experimental nuclear physicist currently serving as director of the Argonne National Labs Physics Division. We learned of her upbringing in Morocco, her travels around the world, and how she achieved her position through hard work, while also balancing her life as a wife and mother.

Our first panel discussion, "How to battle issues of diversity, bias, and intersectionality: Mentoring and building a diverse community," was for me one of the conference's most impactful. Hearing first hand from women who've overcome so many struggles to get where they are really stood out to me.

Next, we jumped right in to the poster session, later celebrating two fellow undergrads from UMD who won poster awards: Stephanie Williams took second place, and Junellie Gonzalez-Quiles took third.

Much of the rest of the afternoon was spent with parallel panels and workshops on career development. It was refreshing to see the wide range of careers that GW drew attention to and to know that, as physicists, we have many options. That afternoon, the APS keynote speaker, Dr. Patricia Burchat from Stanford, told the inspiring story of her path from first-generation high school graduate to the top of her field in experimental particle physics and cosmology.

Sessions wrapped up with an entertaining outreach fair led by GWU faculty member Gary White, who specializes in physics education, and the local Society of Physics Students chapter, which gave everyone the chance to unwind with physics demos and games. We closed the day with Physics Jeopardy before everyone headed back to the hotel, exhausted after a fun-filled day.

Our final day included plenary talks by Nancy Jo Nicholas from Los Alamos National Laboratory and Dr. Luz Martinez-Miranda from the UMD materials sciences department. The panels and workshops focused on life as a physicist, addressing graduate school life, work/life balance, LGBTQ+ experiences, and health and self-care. I was sorry not to be able to attend them all.

As our CUWiP came to a close, we all said our heartfelt goodbyes and thank yous. Attending these conferences has truly been a favorite event in my academic career. I hope that every young woman entering the field gets the chance to experience the camaraderie, solidarity, and empowerment that goes along with it. //

LEFT: UMD undergraduates at the GWU CUWiP, with conference organizer Evie Downie. From left: Melanie Rowland, Ruhi Perez, Stephanie Williams, Mackenzie Carlson, Evie Downie, Junellie Gonzalez-Quiles, Sophie Sarcano, and Sarah Monk. Photo by Sarah Monk.

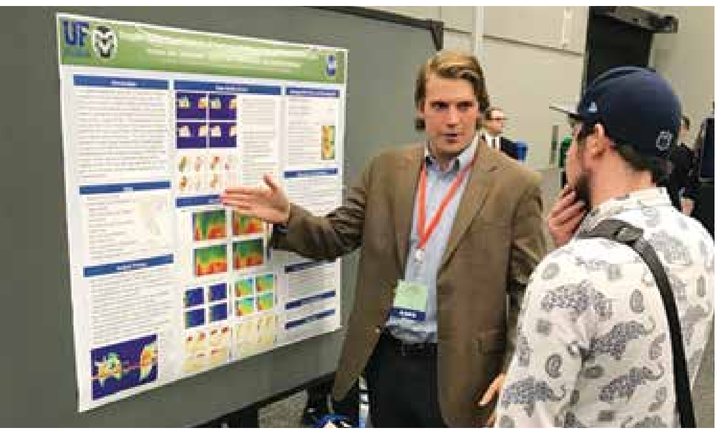
Students Take Austin by Storm

by Aaron Alexander, SPS Representative to the 2018 AMS Student Conference Planning Committee, University of California, Davis

Greetings from Austin, Texas, site of the 2018 American Meteorological Society (AMS) Student Conference. The AMS is a professional group for those interested in atmospheric sciences, and the student conference is held to inspire undergraduate and graduate students to pursue their professional passions. Despite its name, the conference isn't limited to meteorology students. Those interested in atmospheric chemistry or dynamics, climatology, space weather, and even communication also come together to meet other students from around the country, engage in professional development, and present research.

Professionals from institutions like the National Center for Atmospheric Research and the National Weather Service (NWS), as well as private weather forecasting companies, fielded questions from students on whether to attend graduate school before looking for a job, how to stand out in a pool of applicants, and how to find your professional passion. Students also got to talk with experts in various disciplines, such as researchers trying to understand severe weather or those who've sailed the open seas with the NOAA Corps.

For students looking toward graduate school, distinguished researchers from top-tier institutions and current graduate students answered questions about what makes a prospective graduate student competitive, what students should do to aid their transition, and even where to look for internships within their field of interest.



"I love the graduate student panel because it gives students the opportunity to ask questions that can't necessarily be answered by faculty and staff at schools," says Makenzie Krocak, a graduate student from the University of Oklahoma who has served on the panel for two years. "We keep it very informal, because the goal of the panel is really just to have a conversation with undergraduates about how to manage their stipend or how to transition from focusing on classes to focusing on work and research."

In addition to the panels, the conference offered a variety of interactive sessions. One of the most popular was the resume workshop, where students had their resumes reviewed by professionals in academia, government, and private research. Other sessions included reviews of aspiring broadcast meteorologists' audition tapes, a scientific writing workshop, and a session where students simulated a real-life emergency management scenario to understand how the NWS, local governments, and media interact during natural disasters.

The conference is a good opportunity to find out more about what meteorologists and atmospheric physicists do (spoiler alert: not everyone forecasts the weather), develop professional skills, and have one-on-one interactions with professionals in the scientific community. Next year's conference, in Phoenix, Arizona (January 5–6, 2019), promises to be even better—and I hope to see you there! //

Aaron Alexander is a first-year PhD student in water resource engineering at the University of California, Davis. His undergraduate degrees are in physics and atmospheric sciences, and he was heavily involved with his undergraduate SPS chapter at the University of Nevada, Reno.

LEFT: AMS Student Conference attendee presenting research at poster session. Photo by Aaron Alexander.

ABOVE LEFT: Students making connections from around the country as part of the AMS Student Conference. Photo by the AMS Nationals photographer.

ABOVE RIGHT: Attendees enjoy talking with Dr. Sunni Ivey about careers in academia during Conversations With Professionals. Photo by Aaron Alexander.

Listening In at
the Acoustical Society of America

by Phoebe Sharp, AZC & SPS Member, Rhodes College

When I decided to major in physics, I was surprised and excited to discover how broad and inclusive the discipline is. Not only have I studied the stars, but I've also researched the properties of sound in bone to diagnose osteoporosis, and after I graduate I hope to work in science policy.

My research using ultrasound to detect changes in the density of bone brought me to the Acoustical Society of America meeting in New Orleans, Louisiana, where I had the opportunity to hear other students from my research group give talks on bone density and imaging with ultrasound for biomedical purposes. We want to use the techniques that we're testing to help diagnose osteoporosis in high-risk locations, such as the hip or lower back, where most osteoporotic fractures take place. Techniques used today involve large instruments and expensive equipment. With osteoporosis affecting 54 million Americans, the impacts of the disease are not just physical but economical as well.

At the conference, most of the researchers involved in similar forms of biomedical ultrasound research were from Japan. I was especially interested to discover the connections between the research they're doing and the research I'm part of, along with the differences between our labs.

Acoustics is a massive field, and with good reason: We use sound all the time, and this conference was the place for researchers to talk about how they're using sound from a scientific perspective.

As a clarinet player, I thought one of the most interesting topics was a project looking at how sound varies when four different musicians play the same jazz piece on four different clarinets. Another group of researchers is looking at how language is produced from people diagnosed with ALS and Parkinson's. Others gave presentations on the best way to design an open office to combat distracting noises. Alongside these were countless other diverse projects that allowed researchers to look at and use sound to help our understanding of the world around us.

And because this was New Orleans, there was plenty of music. In lieu of an hour-long lecture, the Savoy Family Cajun Band treated us to a concert, with question-and-answer sessions between pieces. It was a great change of pace. The band would play an enthusiastic piece, and physicists would walk to the front of the banquet hall and dance! Afterward, people asked about how the accordion worked and how different keys impacted the sound of the different instruments used. I was happy to learn that this existed within the acoustics community—equal parts work and play.

The music continued with a jam session by acoustical physicists that's been a tradition for 10 years. I loved how cohesive the group was and how inclusive they were of younger players. This was one of many demonstrations of inclusiveness in the community at this conference. For people from many different research backgrounds and experiences to come together and not only share their research but also share their time and passions was fantastic to witness and great fun to be a part of.

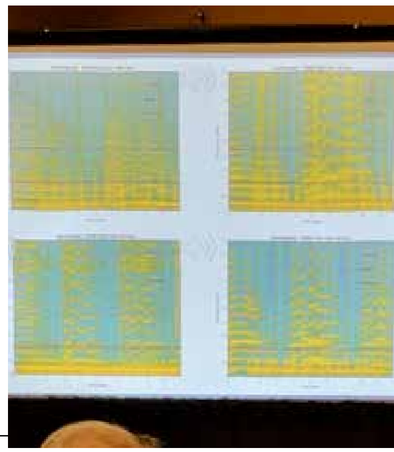
With so many different fields represented, this conference showed me just how different each acoustic physicist is. I'm grateful for my experience at this international gathering and aim to keep learning about the many different disciplines of physics that are still out there. //

LEFT: Abel Diaz, secretary of the Rhodes College chapter of SPS, presenting his research "Correlation of ultrasonic backscatter difference parameters with bone density in clinical ultrasound images."

MIDDLE: From left to right: Abel Diaz, Jordan Ankersen, Phoebe Sharp, and Joshua Moore.

RIGHT: An image from the presentation "Signal Analysis of New Orleans Jazz Clarinet Sound" by Joshua Veillon from the University of New Orleans.

All photos by Phoebe Sharp.



the SPS Observer
American Institute of Physics
1 Physics Ellipse
College Park, MD 20740-3841