the SPS Observer

Volume LVI, Issue 2

FALL 2022

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the SPS Observer

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Juniata College held its annual Physics Phun night in April 2022, designed to introduce elementary and middle school students to physics in an exciting way. Shown here, an SPS chapter member and a volunteer participate in a fiery physics demonstration. Photo by 707 Photos, Nathan Thompson, Juniata College class of 2005.

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Strengthening the SPS Community

by Katherine Zaunbrecher, Member-At-Large (2016–2022), SPS Executive Committee

Recently, I have felt incredibly grateful to be a part of the SPS and physics community. Community is essential to me. The relationships that we establish in our communities are important ones. This has been especially true over the past two and a half years. Dealing with isolation, disruption, and so many other challenges has meant relying on others to help us through those struggles. As we transition into a more normal state, whatever that looks like, it is important that we foster these relationships and continue building new ones.

It is time to rekindle traditions, rebuild culture, and recruit new members into our physics and astronomy family. This year, SPS is extending a special "welcome" to our astronomy members and clubs. I say "welcome" because they have always been an integral part of SPS, but the language in our constitution has recently changed to reflect that. So use this time to strengthen and revitalize your SPS chapter and physics and astronomy clubs. Ensure that our astronomy members feel welcome in the SPS family. Extend personal invitations to new students and those whose first years at college were disrupted by the pandemic. Doing these things will benefit everyone.

There are many ways to foster community. You can host study sessions in your lounge, resume pizza parties, hold interactive SPS meetings, and plan Sigma Pi Sigma inductions. If current circumstances make hosting events difficult right now, plan virtual meetups or outdoor events. This issue of *The SPS Observer* highlights several ideas for building community, and I encourage you to reach out to your advisor, the SPS National Council, and the SPS National Office for more ideas and support. You can also check out the SPS website for resources at spsnational.org/resources/chapters.

Hopefully, you and your classmates were able to attend the Sigma Pi Sigma Congress in October in Washington, DC, where hundreds of physics and astronomy students celebrated the 100th anniversary of the founding of Sigma Pi Sigma. If not, check out the online talks on the @SPSNational YouTube channel. I hope the energy of that event takes hold in your chapter. And encourage your chapter to start planning now to attend the 2025 Congress!

As I finish my term as at-large member of the SPS Executive Committee, I want to thank you. You are part of a great organization that offers support and opportunities to so many students (and advisors). It has been a privilege to serve you—and a very fun and memorable six years! //

ABOVE: Katherine Zaunbrecher. Photo courtesy of the author.

BELOW LEFT: The 2021–22 National Council at its fall meeting. Photo by SPS.

THE SPS NATIONAL COUNCIL

The SPS National Council is the governing body for the Society of Physics Students and Sigma Pi Sigma, the physics and astronomy honor society. SPS is organized into 18 geographic zones, and each one is represented by an elected faculty zone councilor and student associate zone councilor. The council also includes the elected presidents of SPS and Sigma Pi Sigma, the director of SPS and Sigma Pi Sigma, an appointed historian, appointed at-large member, AZC representative, and the CEO of AIP. Elections are held each spring. To meet the current council and get information on running for the 2023–24 council, visit spsnational.org/about/governance/national-council.

Internship Not What You Expected?

Thinking through a less than ideal research experience

ABOVE: Kristine Romich. Photo courtesy of the author.

by Kristine Romich, Chemistry Instructor, United States Air Force Academy

A summer internship at a university or other research institute is often a student's first exposure to formal scientific research. Research internships, also known as research experiences, offer a glimpse into the day-to-day life of a scientist. If you're aiming for a career as a physics professor or research physicist, some undergraduate research experience is expected. If you've recently completed your first research internship, congratulations! If you haven't done one yet, read on because you probably will at some point.

Ideally, every internship would be both educational and enjoyable, but what if you didn't enjoy yours as much as you thought you would? Maybe it even left you questioning whether you picked the right major. If that's the case, keep in mind that internships are meant to help you grow as a professional, and sometimes that means figuring out what you don't want to do. It may turn out that you'd be happier in a different field, but before you decide to change your major, take some time to reflect on what made your research experience less than ideal.

IF YOU DIDN'T ENJOY THE PROJECT

Physics is an extremely broad area of study. If you didn't enjoy your research project, that doesn't necessarily mean physics isn't for you. It might just mean that the topic you did your research on (or the method you used) wasn't a great fit for your skills or interests.

For example, if your work was primarily computational but you'd prefer something more hands-on, an experimental lab—where you spend a good deal of time working with instruments—might suit you better. If your project focused on theoretical concepts or basic research, you might feel more fulfilled working on something applied, like medical physics or renewable energy research. It could also be a matter of finding the right subfield. Astronomy, optics, biophysics, acoustics, and nuclear physics are quite different from one another, but they all fall under the physics umbrella.

If you can identify a new area you'd like to learn more about, read up on some recent work in the field to see if it interests you. If your school has faculty who specialize in this area, request to meet with them for an informational interview. Current grad students can also provide valuable insight. If there's no one at your home institution you can talk to, don't be afraid to reach out to faculty members at other schools. Those who host summer internships in your field of interest might be your best bet. The connections you form may even help you secure a new research experience for the future.

During your internship, you may have discovered that you don't like research in general—there's nothing wrong with that! If you enjoy learning physics and sharing your knowledge with others, there are plenty of ways to stay in the field that don't involve traditional research. Look into opportunities in science communication, education, outreach, or policy (SPS National offers summer internships in each of these). You might also consider the growing field of STEM education research, which seeks to identify best practices in teaching science at various levels. Physics majors often go into related fields, like data science and engineering, that may not have a research aspect.

IF IT'S A WORK STYLE MISMATCH

Your mentor's supervisory style may not have lined up with the way you work best. For example, maybe you'd have benefited from a daily check-in, but your mentor took a more hands-off approach. Different mentors have different styles, and if you've only experienced one, don't let that alone deter you from work you might otherwise enjoy.

Knowing how you work best is valuable because you can take that into consideration going forward. If a program or job you're applying to involves an interview process, ask your potential supervisor about their management style, how your performance will be assessed, what the department or organizational culture is like, and anything else that you now know is important to you. (This is something you should also plan on doing if you intend to apply to grad school.) You can also learn to adapt. For example, if your supervisor isn't available (or approachable), you can set your own daily goals and seek out others who can help you as needed.

IF YOU FOUND THE ASSIGNMENT TOO CHALLENGING

If you faced a daunting learning curve but still felt excited about the work you were doing, that's a sign that you're on the right track. Keep in mind that the people you think of as experts—your internship mentor, your professors, the authors of papers you've read—were beginners once, too! Take heart in that no one expects you to know everything right off the bat—but if your internship helped you pinpoint specific areas you'd like to improve in (like coding, for instance), find opportunities to practice these skills, either through formal coursework or self-directed study.

Whatever you ultimately decide to do, the key is to be honest with yourself. Don't feel obliged to stay on a path you're not happy with for fear of upsetting your mentor (or anyone else). A good mentor won't be offended if you choose not to follow in their footsteps. They might even point you toward opportunities that are a better fit. It's in your best interest to maintain good relationships with the folks you met during your internship—they can be references for you in the future, even if you end up changing fields.

If you do opt for a different route (either within physics or in something else altogether), don't undervalue the transferable skills you gained from your experience. Programming, troubleshooting equipment, giving presentations, and working on a team—to name just a few—are useful in a wide variety of environments.

Career progressions aren't always linear, and that's okay. I know this firsthand. Several years after completing my bachelor's degrees in communication and psychology, I went back to school with the goal of pursuing a PhD in astrophysics. After finishing my MS in physics and spending some time working in research, I decided to transition to a career in education and outreach. I've been able to combine my background in communication and social science with my research experience and technical knowledge to advise students, teach courses, and develop instructional materials.

Remember that you don't need to have everything figured out right now. Depending on your year in school, you may have time to complete two or three more internships before you graduate. Other experiences—such as on-campus research, job fairs, lab tours, or conferences—can also help shape your career goals. Use these opportunities to help you identify a path that's right for you. //

Learn more about the SPS Summer Internship Program at spsnational.org/programs/internships.

ABOUT THE AUTHOR

Kristine Romich interned at NASA's Goddard Space Flight Center through the SPS Summer Internship Program in 2017. After completing her MS in physics from California State University, Northridge, she was a support scientist for the space weather team within the National Oceanic and Atmospheric Administration's National Centers for Environmental Information. Prior to assuming her present role at the United States Air Force Academy, she taught physics at Red Rocks Community College near Denver, Colorado.

The SPS Peer Mentorship Initiative

by Nkeiru Ubadike, SPS Chapter Deputy Treasurer, Stony Brook University, with Sara Kurdi, SPS Chapter Executive Treasurer, Stony Brook University

"I would love to continue my journey in physics and astronomy, but I have found it so hard since I don't have a support system or peers to talk with about physics and astronomy resources." These words, from a first-generation and minority college student, pierced my heart like a dagger.

In response, our SPS chapter at Stony Brook University (SBU) channeled that anguish into action and created a peer mentorship program in fall 2021.

Targeted at students from underrepresented groups but open to all, the program kicked off with nine mentee–mentor pairs on a cold October night. The room was buzzing with conversation, and just like the presurvey data had suggested, the demographics were pleasantly balanced. Our mentee pool was 55% female, and 30% had identified as coming from a race underrepresented in physics.

The program requirements were simple: mentors and mentees were to meet monthly to discuss a given topic (for example, in March the topic was making connections in physics) and then note the meeting in a Google form. Yet for many of us it became about so much more than meeting the bare requirements. I frequently bumped into my mentee in the cafeteria, and our candid conversations warmed my day as we walked to the physics library together on bitterly windy mornings. Other pairs formed meaningful relationships too.

Daijon, a sophomore mentee who expressed an interest in research, was paired with Max, an experienced undergraduate researcher (and future Fulbright Award winner). Max encouraged Daijon to reach out to various research groups. Daijon eventually landed a research position and won a place in SBU's Exploration in STEM program, a summer program that provides funding for student-initiated research projects.

The first-generation college student quoted at the start of the article was welcomed into the astronomy community by her peer mentor. He planned a fun and informative meetup for mentees with astronomy majors and their peer mentors, during which we played games to get to know each other and discussed astronomy course requirements.

Continued on next page.

Feeling part of a wider physics community was crucial to my persistence in physics, and I wanted to help foster that feeling in our mentees and mentors. Therefore, the kickoff wasn't the only event that brought the peer mentoring participants together. On the weekend after spring break, we took a trip to an aviation museum, with discounted tickets thanks to an SPS Future Faces of Physics Award. The award also covered food at our closing event, where we played a game of Would You Rather and exchanged gifts and thank you cards.

In postprogram surveys, mentees reported that having a physics or astronomy mentor during their transition into the field was either "very helpful" or "extremely helpful." Seventy-five percent of mentees reported that they enjoyed working with their mentors "a great deal." Most mentees said their favorite thing about being a mentee was having someone who could answer their questions. Mentors mirrored this sentiment in their survey responses, with many saying they loved giving advice or seeing their mentee progress.

Following the success of the mentorship program, several participants were elected to our SPS chapter's Executive Board, and they have expressed interest in continuing the program in the future.

If you're thinking about creating a peer-led mentorship program, I'll leave you with some advice. In the beginning, be sure to interview mentees and mentors so that you can gauge their needs and commitment level. Additionally, create opportunities for participants to engage in the wider mentorship community, whether it's through field trips, game nights, or even a Discord channel. But be warned: soon you and your program participants won't be able to walk around your department without seeing a familiar face! //

TOP: Participants in SBU's physics and astronomy mentoring program visit a local aviation museum. Photos by Sara Kurdi.

ABOVE: Participants gather during the closing event of SBU's physics and astronomy mentoring program.

What's in a Name

JWST prompts a discussion about diversity and inclusion in physics

by Rajib Chowdhury, SPS Chapter President, University of Central Florida

"So who was the JWST actually named after?" This question came up after an SPS chapter meeting at the University of Central Florida (UCF) during which we talked about developments in high-energy physics and cosmology. Many of our eager, astronomy-oriented undergraduates were buzzing about the James Webb Space Telescope's (JWST's) recent launch and the fascinating science it would reveal. I had asked this same question a while ago, and unbeknownst to most of our chapter members, it had already become the basis for a future event—an event that would turn out to be one of the most popular and meaningful activities of the year.

After asking myself who James Webb was, I had come to learn that there was a fair bit of controversy surrounding him and the naming of the telescope. Webb was the administrator of NASA during much of the 1960s and has been accused of deliberately letting go of NASA employees because of their sexual orientation. This aligned with similar governmental directives spanning the federal workforce, which historians have labeled the Lavender Scare (see https://en.wikipedia.org/wiki/James_E._Webb).

This information prompted our SPS chapter leadership to plan an event. We didn't want to limit the topic to the naming of the JWST. Instead, we hoped to spark a larger discussion about physics academia and its disinclination toward tackling issues of discrimination. We also wanted to address the lack of diversity within our department and physics student cohort. We also wanted to initiate actionable goals for our own physics department. We decided that the best way to accomplish these goals was through an interactive panel where such concerns could be easily expressed. We applied for and received a Future Faces of Physics Award from SPS National to support honorariums for the panelists, marketing materials, and refreshments for attendees.

We sought to incorporate a variety of voices on the panel, keeping with our theme of diversity and inclusion. Our panel ultimately consisted of Kate Storey-Fisher, a PhD candidate in the Center for Cosmology and Particle Physics at New York University and a NASA FINESST fellow; Adam LaMee, a physics content expert on the Florida Department of Education's teacher certification exams and PhysTEC teacher-in-residence for the UCF physics department; and Dr. Talat Rahman, a leader in computational physics and nanoscience and a physics professor at UCF.

We knew that the audience would have different backgrounds, and we wanted to make sure everyone could get something out of the event. This prompted us to provide some historical context during the panel, including current and past federal government policy and legal history regarding LGBTQ+ issues.

ABOVE: Inspired by the controversy surrounding the name of the James Webb Space Telescope, the UCF's SPS chapter hosted a panel on diversity in physics. Images courtesy of the UCF SPS chapter.

RIGHT: UCF's SPS chapter leaders take time out for a quick photo.

Attendees were engaged throughout the event, asking many questions and contributing their own thoughts. We discussed ways in which we thought the larger academic community should change in areas such as access to laboratory resources and computing power, as well as how we as individuals can make change through our SPS chapter events. We decided to develop an end-of-year report compiled by students and edited by SPS officers that offers advice to our department on outreach events to reduce gender and racial inequities.

The Future Faces of Physics panel was an excellent introduction to the power of physics outreach for many of our attendees. Our goal was to bring awareness to the controversy regarding the naming of the JWST and why the topic is relevant to all of us, regardless of whether we are directly impacted by the choice of name. Given the success of this event, we plan to hold similar events over the next academic year aimed at increasing awareness of issues related to diversity and inclusion and increasing participation in physics. //

GET MONEY FOR YOUR CHAPTER EVENT OR PROGRAM!

Future Faces of Physics Awards of up to $500 are available for chapter programs or events that promote physics across cultures. Learn more at spsnational.org/awards/future-faces.

ABOVE: A behind-the-scenes view of the panel.

Postpandemic Outreach Builds New Bonds

by Patrick Herron, SPS Chapter President, Andrew Scherer, Past SPS Chapter President (2021–22), and Kiril Streletzky, SPS Chapter Advisor, Cleveland State University

We might remember 2022 as the year when life started returning to something we might call normal. With the world opening back up, our SPS chapter at Cleveland State University (CSU) had doing outreach at the top of our to-do list. Outreach has always been a priority for our chapter, and after an almost two-year hiatus, it was time to get back to doing what we love.

The grade school we had previously partnered with still didn't allow visitors, but CSU alumna and former SPS outreach coordinator Janna Mino is a science teacher at the nearby Bio-Med Science Academy in Rootstown, Ohio. Last February she invited us to work with more than 80 seventh-grade students at the academy. This gave us a chance to get back into the swing of outreach while building meaningful connections with a new school. Thanks to a Marsh White Award from SPS National, we were able to update our equipment to keep lessons engaging and interactive.

Our visit focused on wave mechanics and optics and included large-group demonstrations, as well as more focused, interactive discussions with smaller groups. During the latter, students explored dispersion using prisms and plastic

TOP: SPS members demonstrate a wave for students.

ABOVE: Students prescribe a corrective lens for a 3D model of a human eye presented by CSU's then SPS president Andrew Scherer. Photos by Janna Mino.

spectrometers, polarization using different gadgets, geometrical optics using a lens kit, interference using different slit arrangements, and a 3D model of the human eye. At the end of the lesson, we encouraged students to ask physics-related questions. These ranged from "What color is the sky?" to "What would happen if the moon blew up?" We also talked to students about their interests and plans for transitioning into high school.

After our successful visit with the seventh graders, we invited the high school freshmen at Bio-Med Science Academy to tour CSU and our physics department. This was a special event—all of our SPS officers and several faculty members were on hand to ensure that they had the best experience possible. Our afternoon began with tours of CSU's optics lab, scanning tunneling microscopy (STM) and atomic force microscopy (AFM) lab, and scanning electron microscopy (SEM) lab. CSU's strong pedigree in optics and soft matter research provided a fantastic opportunity for the Bio-Med students to see applications of physics that most aren't exposed to prior to college.

After the lab tours, the high school students came together for more than 15 interactive demonstrations. The wide-ranging demos included testing the conservation of angular momentum on a spinning stool and feeling the strength of atmospheric pressure by trying to pull apart Magdeburg spheres, along with visually appealing demonstrations such as Jacob's ladder and a display of electrical levitation that uses metallic paint on a ping-pong ball. Afterward, the students enjoyed a pizza lunch featuring liquid nitrogen ice cream made right before their eyes by SPS! During lunch, students had the opportunity to talk informally with SPS officers and physics faculty about what pursuing physics is all about. A few of the students even skipped sitting with their friends so they could talk to us about what we do, which was really cool!

The pandemic has made it difficult for people to connect with each other, and we've all felt this in the physics community. Now that places are opening back up, our chapter is working hard to encourage precollege students and show them the physics we all know and love. It was good for our chapter to get back to outreach, and we hope that our new connection to Bio-Med Science Academy will lead to a long partnership. //

GET MONEY FOR YOUR CHAPTER OUTREACH EVENT OR PROGRAM!

Marsh White Awards of up to $500 are available for chapter programs or events that promote an interest in physics or astronomy among students or the general public. Learn more at spsnational.org/awards/marsh-white.

Maura Shapiro

BS in Physics, BA in Communication and Rhetoric, University of Pittsburgh

ABOVE: Maura Shapiro. Photo courtesy of the author.

What she does

I cocreate and cohost *Initial Conditions: A Physics History Podcast*, which shares underreported and unconventional stories from physics history. For most of my physics education, all I knew about physics history was the names in textbooks that modified equations, laws, and models. Very few of those physicists are women or people of color, and this limited view of history propagates the notion that science advancements are the result of a few brilliant scientists.

In the podcast we dive into the overlooked stories behind physical discoveries. We challenge the conventional narrative of what it means to be a physicist. To do this, I read A LOT. Not just books and journal articles, but also primary sources and archival materials. After all the research is finished comes the fun part: shaping the information into a story and sharing it on the podcast!

How she got there

Growing up, I loved history, science, politics, and podcasts, but it never occurred to me that there was a way to combine them. Though seemingly different fields, all my interests are grounded in storytelling—even physics, which tells the story of the universe! I took public speaking and communication courses to learn how to be an effective storyteller and understand meaningful ways to convey a message. Early on in my physics career, I realized that I preferred communicating physics to a general audience over doing physics research. I also knew that science communication was a niche but vital field and was excited that it spoke directly to my skill set.

As I was developing my communication skills and progressing in my physics degree, I discovered my love of learning about the people behind the physics. Through my observational astronomy research at the historic Allegheny Observatory, I learned about the Pittsburgh lensmaker John Brashear. Despite very little education, he became one of the most important figures in early modern astronomy. (You can learn more about him in Episode 9 of *Initial Conditions*!) I also worked in the university library, organizing the records of a past physics professor. I sorted through boxes of his records, notes, and correspondence and became immersed in his life. I had never done this kind of research before and found learning about the history of physics in this deeply personal way to be incredibly rewarding.

After I graduated, I was an SPS summer intern for the Niels Bohr Library & Archives and Center for History of Physics at the American Institute of Physics. I created teaching guides about women and people from underrepresented groups in physics and felt all my interests click into place. I was learning about history, physics, and how to combine them to tell a story. More importantly, I was advocating for the representation of women and people of color in physics education. After two months doing the most fun and meaningful work I could imagine, I struggled to envision myself doing anything else. I am grateful that today, as a physics history podcaster, I am always learning new things and growing a deeper appreciation for physics.

Advice to physics students

- Explore all your interests—even if there is no obvious "professional" application. Developing and nurturing a broad set of interests brings balance to your life, diversifies your skills, and enables you to see problems in different ways.
- Practice public speaking and performing! Speaking in front of a crowd develops confidence and presentation skills, which are helpful in every field.
- Reach out to people doing things you're interested in and ask for an informational interview! The worst thing that could happen is they say no or do not respond. In that case, you're no worse off than when you started! If they do accept, make sure you prepare by reading about their career and coming to the meeting prepped with questions and your own elevator pitch.
- Remember that your value is not defined by grades, clubs, research, internships, or whatever. You are the only person who can decide what success means to you.
- Surround yourself with people who inspire you and support you! I would not have a degree in physics without the people who encouraged me! //

LEARN MORE ABOUT...

- **SPS Internships at spsnational.org/programs/internships**
- **The Niels Bohr Library & Archives and Center for History of Physics at aip.org/history-programs**

INITIAL CONDITIONS: A PHYSICS HISTORY PODCAST

Initial conditions provide the context in which physics happens. Likewise, in *Initial Conditions: a Physics History Podcast*, we provide the context in which physical discoveries happened. We dive into the collections of the Niels Bohr Library & Archives at the American Institute of Physics to uncover the unexpected stories behind the physics we know. Through these stories, we hope to challenge the conventional narrative of what it means to be a physicist. Check it out at aip.org/initialconditions or wherever you get your podcasts.

Victoria DiTomasso

BA in Physics, CUNY Macaulay Honors College, Hunter College
and MA in Astronomy, Harvard University

What she does

I'm a PhD candidate at Harvard University and work at the Center for Astrophysics | Harvard & Smithsonian, which is a collaboration between Harvard Astronomy and the Smithsonian Astrophysical Observatory.

In my research I search for exoplanets and measure their masses. Today, most exoplanets are discovered using the transit method, which involves monitoring a star's brightness over time and looking for periodic dimming. This dimming is caused by an exoplanet passing in front of the star, blocking some of its light, and effectively casting a shadow on our telescopes. My research uses the radial velocity method to confirm such detections and measure exoplanet masses. We always say that planets orbit around their stars, but really stars and planets orbit around their shared center of mass, which is slightly offset from the center of the star. This means that a planet induces a small wobble in the movement of the star it orbits. We can measure the movement, or more specifically, the radial velocity, of a star over time and look for this wobble. From this we can determine the gravitational effect of the planet orbiting around that star and measure the planet's mass.

Currently, I'm finishing a project in which I confirm another team's detection of a planet around one of the stars in a binary system. Radial velocity measurements require data that has been collected over long periods of time, sometimes many years. Because of this, astronomers often collaborate on gathering data. Right now there are just a few collaborations around the world doing the high-precision radial velocity work needed to find planets in the size range I study—larger than Earth but smaller than Neptune.

My first paper was recently accepted for publication, and I am working on my PhD thesis. I'm also active in science outreach. For example, I made a video about my research for Virtual Scientist in a Classroom, a program through the Harvard Museum of Natural History that's aimed at a middle school audience. So far I've participated in more than five virtual Q&A sessions with middle school classes.

How she got there

I first became interested in physics, and in science, during my junior year of high school. I had a summer internship at the American Museum of Natural History (AMNH), during which I did hands-on activities and demonstrations for visitors and summer camps in the museum halls. I really enjoyed that experience. As part of the program we were introduced to a lot of museum scientists. I realized that doing science—and science education—is a job, and I started thinking about studying physics in college. I thought education and teaching were the main science careers, so when I started college, I wanted to be a high school physics teacher or work at a museum.

During my freshman year at the City University of New York (CUNY) Hunter College, I learned about an astronomy research fellowship called AstroCom NYC, a collaboration between CUNY and AMNH. I had never thought about space before. In fact, I like to joke that growing up in New York, I never saw the stars. I loved the museum and pictured myself being a lifer there. This fellowship was a great opportunity to stay involved at AMNH, and that's how I started doing astronomy research. Later, as an SPS intern, I was exposed to even more science-related fields.

Best part of her job

Prepandemic, my favorite thing about research was travel. Going to conferences and observatories, working with collaborators, attending workshops—all those things are amazing. I also like the variety of things that I'm doing: research, coding, writing, and reading papers. Then there's teaching and taking classes and doing outreach. I really love being involved in so many different tasks.

Most challenging part of her job

The flip side of having so much variety—and a lot of freedom to change projects—is the number of times that I encounter steep learning curves. As an undergrad and grad student, I've changed my research focus a few times, just to explore, to find out what I like best. At times I feel like I'm starting from zero, but I'm developing additional skills and expertise and building my network, which will benefit me in the long run.

ABOVE: Victoria DiTomasso. Photo courtesy of the author.

Advice to physics students

Try to focus on what interests and excites you, whether that's research, outreach, or industry, and make note of situations that aren't exciting or energizing so you know what to avoid in the future. You may not start out with a lot of control over your research topics or colleagues, but knowing what you like and don't can be helpful later, when you have more choices.

Also, be cautious of putting things off until certain milestones have passed. As an undergrad I would say to myself, "Okay, this is finals week—I'm not going to take care of myself or do anything fun until it's over." It can be easy to fall into that kind of thinking, but there is always going to be another milestone. Don't put off your happiness until X, because you may get caught in a cycle and never get there. //

2022 Individual Award and Scholarship Recipients

The Society of Physics Students congratulates this year's recipients and thanks the generous ΣΠΣ and SPS donors whose support makes these awards possible.

SCHOLARSHIPS

Multiple awards are given by SPS and ΣΠΣ each year, ranging in value from $2,500 to $6,000, to individuals showing excellence in academics, SPS participation, and additional criteria. Learn more and see photos and bios of the recipients at spsnational.org/awards/scholarships.

SPS Outstanding Leadership Scholarship

Sylphrena Kleinsasser
Lycoming College

NEW! Jack Hehn SPS Leadership Scholarships

Dan Fauni
University of the Sciences (merged with Saint Joseph's University)

Aidan Keaveney
Appalachian State University

SPS Leadership Scholarships

Mackenzie Gibbs
Rhodes College

Ameya Kunder
University of California Berkeley

Cielo Medina
Central Michigan University

Jaelyn Roth
Denison University

Annika Stare
Juniata College

LLNL-AIP Leadership Scholarships - Sponsored by Lawrence Livermore National Laboratory*

Marta Celebic
Juniata College

Allison Helferty
Juniata College

Olivia Kaufmann
Rhodes College

Natalie Lam
University of California San Diego

SPS Future Teacher Scholarship

Ian Carter
University of Wisconsin - River Falls

Peggy Dixon Two-Year Scholarship

Patrick Herron
Cleveland State University

Herbert Levy Memorial Scholarship

Priktish Rao Suntoo
Lycoming College

AWIS Kirsten R. Lorentzen Award

Kate Pletcher
University of Denver

Aysen Tunca Memorial Scholarship

Kayla Dickert
University of the Sciences (merged with Saint Joseph's University)

Science Systems and Applications, Inc. (SSAI) Academic Scholarship

Ronan Hix
University of Maryland, College Park

Science Systems and Applications, Inc. (SSAI) Underrepresented Student Scholarship

Alexander Pantoja
Texas Lutheran University

*Lawrence Livermore National Laboratory (LLNL) is a federally funded national laboratory research facility located in Livermore, California. LLNL graciously sponsors these awards to encourage the study of physics and the pursuit of high scholarship.

SPS AWARD FOR OUTSTANDING UNDERGRADUATE RESEARCH

Awards are made to individuals for outstanding research conducted as an undergraduate. Winners are awarded $1,800 to present their research at an AIP Member Society meeting and receive $500 for themselves and $500 for their SPS chapter. Learn more at spsnational.org/awards/outstanding-undergraduate-research.

Winners

Ameya Kunder
University of California Berkeley

Hurum Tohfa
Bryn Mawr College

THE SPS SUMMER INTERNS

The SPS summer internship program offers ten-week positions for undergraduate physics students in science research, education, outreach, and policy with organizations in the greater Washington, DC, area. Students are placed in organizations that use the interns' energy and viewpoints to engage with the community and promote the advancement of physics and astronomy. The 2022 interns were able to be in-person this session, making for an extra eventful summer! Learn more at spsnational.org/programs/internships.

Justin Andre Avendaño
Stevens Institute of Technology
Society of Rheology/Soft Matter Kitchen Intern

Divyansh Chamria
Colgate University
NIST Research Intern

Taylor Colaizzi
Washington and Lee University
NIST Research Intern

Lucy Corthell
Juniata College
APS Education & Diversity Intern

Gizem Doğan
Bowdoin College
Physics Today Science Writing Intern

Kate Futrowsky
University of Maryland, College Park
AIP Mather Public Policy Intern

Emma Goulet
Saint Anselm College
AIP Center for History of Physics/Niels Bohr Library & Archives Intern

Benjamin Johnson
University of Virginia
Potomac LLC Machine Learning Intern

Aidan Keaveney
Appalachian State University
AIP Mather Public Policy Intern

Nicole Leung
Wellesley College
NASA Goddard Space Center Intern

Matangi Melpakkam
Bryn Mawr College
AIP FYI Science Policy Communications Intern

Anthony Olguin
University of Maryland, College Park
Space Telescope Science Institute Intern

Taylor Overcast
Union University
AAPT Teacher Professional Development Intern

Saksham Prajapati
University of Missouri - St. Louis
APS Public Engagement Intern

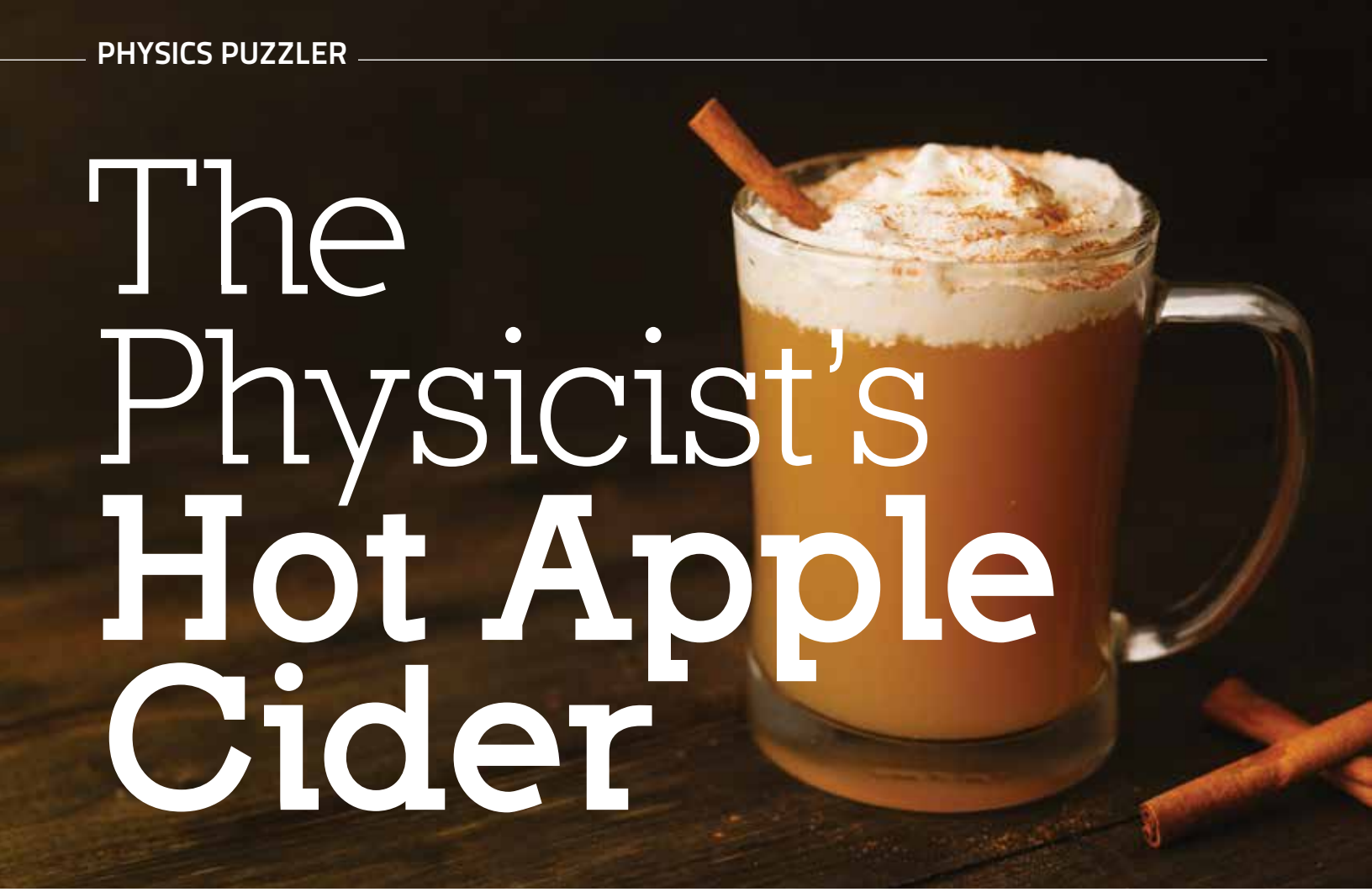
Janessa Slone
Embry-Riddle Aeronautical University, Prescott
SPS Science Outreach Catalyst Kit (SOCK) Intern

Valeria Viteri-Pflucker
Illinois Wesleyan University
NIST Research Intern

TEAM-UP TOGETHER SCHOLARSHIP

The TEAM-UP Together Scholarship Program (TUTSP), developed by the TEAM-UP Together Lead Partners and administered by SPS, supports African American students in the pursuit and attainment of a bachelor's degree in physics or astronomy. These awards of up to $10,000 per year aim to reduce the financial barriers that prevent Black students from completing their undergraduate degree programs in physics and astronomy. For eligibility requirements and deadline information, please visit spsnational.org/scholarships/teamup.

The Physicist's Hot Apple Cider

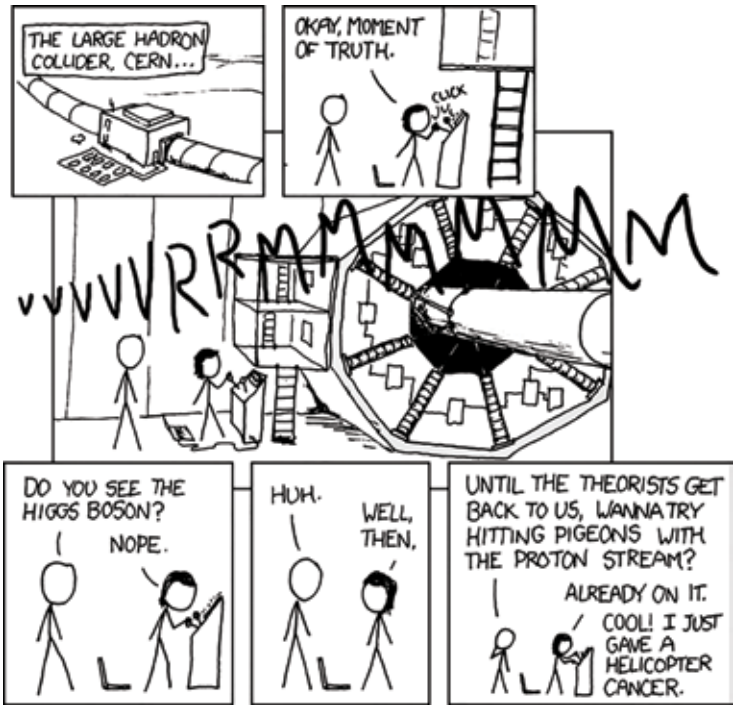


by Brad Conrad, Director, SPS and Sigma Pi Sigma

As leaves start to turn and things begin to cool off in the Northern Hemisphere (or be not quite as warm as you might prefer in the Southern), you might be craving a cup of hot, cinnamony apple cider. As a physicist, you might wonder about the best way to heat up your drink. SPS is here to help! In fact, we can turn this seemingly simple question into an amazing physics conundrum that pulls together all kinds of physics you might know (or want to know).

Would it be faster to heat up a cup of apple cider with a standard microwave, the sound power of a jet engine, or a particle beam from the LHC?

First, some background information. What is an *LHC*?!? As you might know from modern physics, particle physicists accelerate and smash together atoms or particles to learn how matter and the universe are put together. (Sidenote: That approach doesn't usually work with electronic devices.) The world's biggest particle accelerator is currently the Large Hadron Collider (LHC). It's also



TOP: Photo by Patrick Fore on Unsplash.

RIGHT: Image courtesy of XKCD, xkcd.com/401/.

the world's most powerful accelerator, boosting particles up to energies as high as 6.5 TeV (tera electron volts) and colliding particles at a rate of about 10^9 times per second. As a reminder, an electron volt is the energy equal to the work done on an electron in accelerating it through a potential difference of one volt. The LHC is famous for discovering the Higgs boson, an elementary particle that gives some particles mass.[1,2]

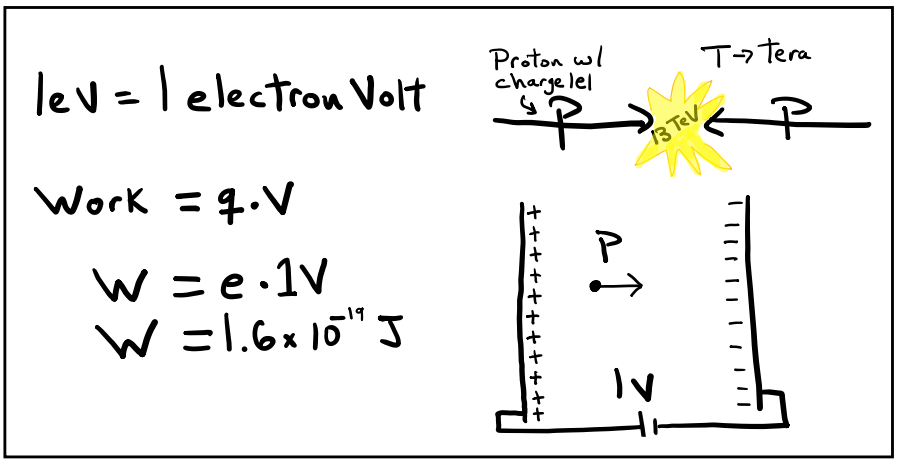


Figure 1. An explanation of an electron volt. Images by the author unless otherwise noted.

Second, it would be really helpful to know how much energy is in a jet engine's roar. A jet engine can reach up to 150 dB at a safe 30 meters away.[3] dB is the abbreviation for decibel, which is a relative measurement of sound intensity with units of power per unit area. Most sound intensity measurements are relative to a generally accepted threshold of hearing I_o. Let's start by assuming 150 dB:

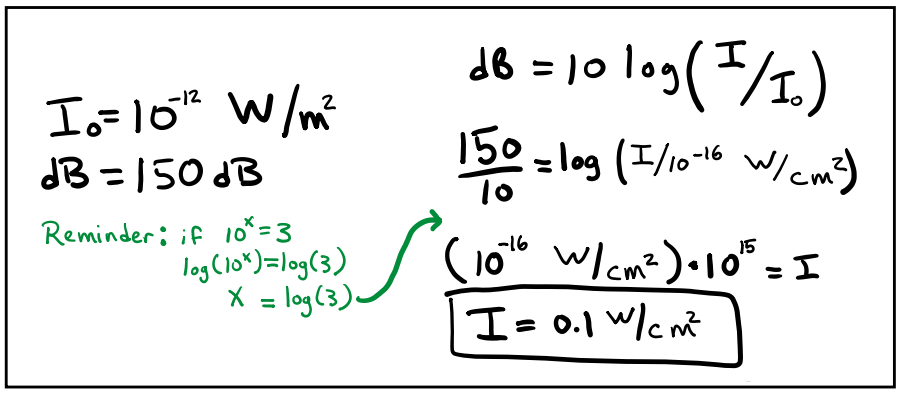


Figure 2. Finding the intensity of a jet engine roar.

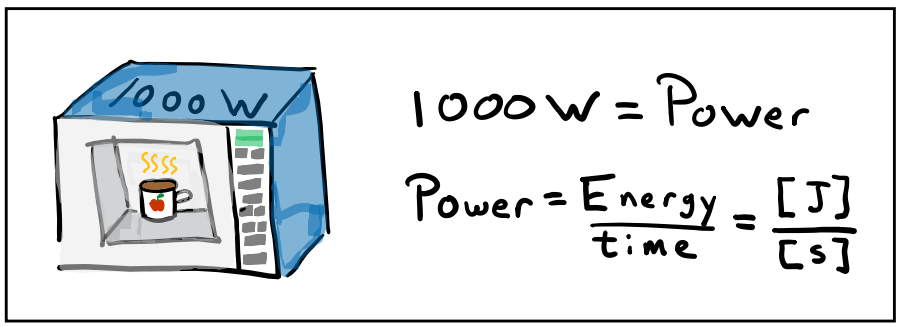


Figure 3. An illustration of power.

Third, we need to know the power of a standard microwave. You can look inside the one closest to your dorm/apartment/home, but most are about 1,000 watts (which is pretty powerful). Here, it's helpful to remember the definition of power, *P*, see Fig. 3.

Now I'll hand off the puzzle to you.

If you had a mug of apple cider at room temperature and wanted it hot but not quite boiling, how long would you need to wait if your heat source was an LHC particle beam? The sound of a jet engine? A microwave? //

References

1. M. Riordan, "CERN's Higgs Boson Discovery," *Phys. Today* (June 2022), physicstoday.scitation.org/do/10.1063/PT.6.4.20220630a/full/.
2. See the minutephysics YouTube video, "The Higgs Boson, Part 1," at youtube.com/watch?v=9Uh5mTxRQcg.
3. K. L. Gee, T. B. Neilsen, and A. T. Wall, "The 'Sound of Freedom': Characterizing jet noise from high-performance military aircraft," *Acoust. Today* (July 2013), acousticstoday.org/sound-freedom-characterizing-jet-noise-high-performance-military-aircraft/.

The Goop Project

by Bianca Caminada, SPS Member, Purdue University, with the rest of the Goop Project Team: Matt Schulz, Albert Xu, Ben Hayward, Alan Wright, Andrew Gustafson, David Lamey, Ethan Pinarski, and Will Messman

If you had walked into Purdue University's SPS lounge around March 2020, you would have seen a group of students enthusiastically passing around and turning over a cylindrical hourglasslike container partially filled with green goop.

We were fascinated by how the goop fell from one end of the container to the other when it was flipped upside down. A thin strand of goop pulled away from the whole and, like one end of a rope, fell to the bottom of the cylinder and began forming circular patterns. This coiling behavior continued until the last of the green goop fell to the bottom.

"What if we studied it?" asked our then SPS chapter secretary Matt Schulz, who had watched a YouTube video on the phenomenon, known as the liquid rope coiling effect. This behavior occurs with many viscous liquids, including honey and maple syrup.

And that's how it would have begun—if not for the onset of the COVID-19 pandemic the following week. School shut down and most of us went home, not knowing when we would all be back together. However, the Purdue SPS leadership was determined to maintain our community, even if we had to switch to online methods of interaction.

In the fall of 2020, Schulz, now chapter vice president, suggested we study the effect even though we couldn't all be in the lab together. Over a Discord call, he and other chapter members introduced eager first-year students to the liquid rope coiling effect, and our SPS chapter research project finally began. What better way to bond future scientists than with physics, experimental data, and discussions of the best ratio of syrup-to-pancake?

What started as entertainment quickly evolved into a proper scientific investigation. In late 2020 our chapter received a Chapter Project Award from SPS National, and we started designing the experiment. We had moved on from the early days of studying a fluid trapped in a jar to building a chamber for studying liquids of different viscosities. With this, we would analyze how the polymerization and viscosity of fluids affect their liquid rope coiling behavior.

ABOVE: Project members observe the behavior of goop made with a new recipe, which turned out to be too non-Newtonian to coil. Photos courtesy of Ben Hayward.

After multiple designs, we settled on using a long PVC tube with a cube reservoir at the top. One to two liters of polymer solution (our homemade "goop") poured in the top would slowly fall through the tube while the pressure at the bottom of the apparatus stayed roughly constant.

Underneath the tube sat a watch glass–covered graduated cylinder. When the goop fell onto this surface, we captured the coiling effects on camera. We placed the whole apparatus on an adjustable-height workbench so that we could change the height from which the goop fell.

After a multitude of (failed) attempts to design our desired fluids, we settled for comparing two polymer fluids with different concentrations of polymer lengths. We were trying to create two fluids with very different viscosities, like those of thick maple syrup and ketchup. As it turned out, we ended up with two solutions that physically resembled each other but demonstrated different coiling behaviors.

We collected footage of the coiling behavior of both fluids as they fell from various heights. From the video, we extracted data on where the liquid rope touched the surface (its position) as a function of time. Then we used a fast Fourier transform to extract the frequency of the coiling for that specific run—that is, how many times per second the goop coiled. You can think of this as the number of oscillations per second of the falling fluid or its frequency.

When we increased the fall height past a certain threshold we saw more frequency peaks, which is consistent with the literature. Before this threshold, the coil was in what's known as the gravitational regime. Beyond the threshold it was in the inertio-gravitational regime. We saw this behavior in both fluids, but we would need further investigation to find and compare the bifurcation height that separates the two regimes in each fluid. We did observe an inverse dependency between frequency and viscosity in the gravitational regime for both fluids, which is consistent with a 2006 paper by N. M. Ribe, M. Habibi, and D. Bonn on the stability of liquid rope coiling.[1]

Like most investigations, the scope of our project evolved as we found out what worked and what didn't. We spent a lot of time constructing and optimizing the setup, which included making and finding the right parts. And as we did, we plowed through the difficulties presented by COVID-19 limitations.

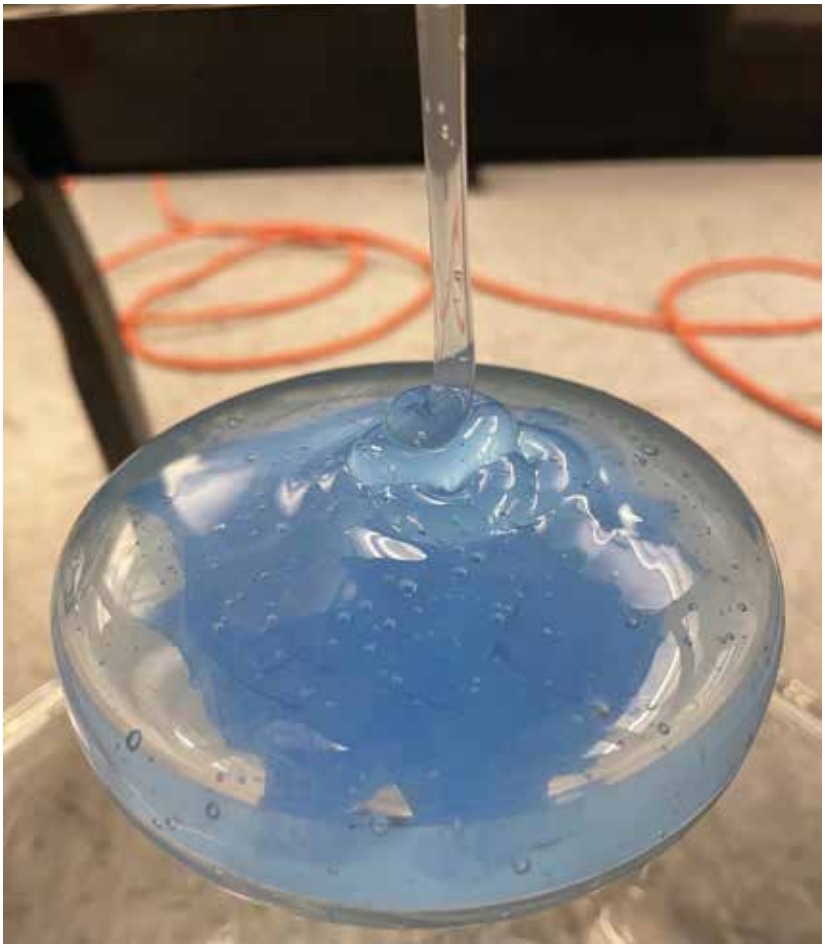
To our chapter the goop project became more than just a fulfillment of curiosity; it kept us connected. We worked together, even though we had to be physically separated much of the time. The following year, when we were trying to settle back into campus life in its new format, the project served as a way to rope in new members and give them something tangible to work on. The goop was a silent friend that tied our chapter together during these challenging times. //

References

1. N. M. Ribe, M. Habibi, and D. Bonn, "Stability of Liquid Rope Coiling," *Phys. Fluids* 18, 084102 (2006), doi.org/10.1063/1.2336803.

GET MONEY FOR CHAPTER RESEARCH

SPS Chapter Research Awards provide up to $2,000 for physics research projects that are deemed imaginative and likely to contribute to the strengthening of the SPS program. For details, visit spsnational.org/awards/chapter-research.



TOP RIGHT: The experimental setup.

RIGHT: An up-close view of goop falling and coiling (circling) around the surface.

FEATURE

Bringing Students Together

AFTER REMOTE LEARNING, AND BEYOND

by Michael "Bodhi" Rodgers, SPS Faculty Zone Councilor for Zone 14 and SPS Chapter Advisor, University of Colorado Denver

On February 29, 2020, the physics community received news that the APS March Meeting was canceled due to the then mysterious new coronavirus. The meeting was to begin on March 2, and many attendees had already arrived in the host city of Denver, Colorado. The University of Colorado Denver (UC Denver) and Metropolitan State University of Denver Society of Physics Students chapters quickly established opportunities for folks already in town to present their research at our joint campus.

Then, on March 11, UC Denver faculty received notice that we'd be testing remote course delivery over the next few weeks for a full transition to remote mode on Monday, March 30. But that wasn't the end of the breaking news. On Monday, March 16, we were notified that campus was shutting down at 6 pm the next day and all work was moved to remote mode. All university buildings would be closed. They stayed closed until the beginning of summer 2021.

That summer our campus slowly began seeing activity. Classes were mostly remote, but research began to return. The fall semester was to bring a return to in-person classes with some hybrid and remote options, but we had a last-minute pivot (are you as tired of the word "pivot" as I am?). Two weeks of fully remote instruction jarred all of us eager to return to campus.

Despite the bumpy start, our department used a variety of methods to "restart" our in-person community and help physics students get to know one another better. To complement our SPS chapter, increase the variety of events in the department, attract new members, provide more leadership and ownership opportunities, and access more campus resources, in the fall of 2021 our physics majors created four affiliated clubs: Physics Club, Astronomy Club, Physics Identity & Expression Club, and PSI*, the Physics Student Innovators (*and alumni) Club. The leaders of each club met early in the semester to discuss how to set goals that worked together instead of overlapping. For example, the Astronomy Club might be very active in running observing nights as part of community connections, while the Physics Club might work on inviting speakers.

As the advisor to our SPS chapter (and some of the clubs), I meet periodically with the leadership for check-ins. We use the SPS chapter report template and rubric to set goals, and our check-ins focus on progress toward those goals and filling in areas for the chapter report; otherwise I stay out of the leaders' way and let them do their thing. If I'm needed, the students will ask, and if I see something not happening, I step in to encourage and nudge.

Our UC Denver physics program also debuted three new one-credit professional development seminars (ProDev) in the fall of 2021. I created these seminars as a professor at Ithaca College and ported them to UC Denver.

Our advising team automatically enrolls all new physics majors in ProDev-I, so I have all of the new physics students each fall. This gives me the opportunity to have our SPS chapter leaders meet with the new students and talk about the role of SPS and the various clubs. Every other week our physics faculty give research talks. During the nontalk weeks, we discuss physics career pathways, read through sections of *The Careers Toolbox*, and discuss what it means to engage in undergraduate research.

ProDev-II is for students midway through their undergraduate physics career, and we look at opportunities to build resumes. This connects to SPS through leadership opportunities, presentations, and publication opportunities. I invite alumni to discuss their career arc from being an undergraduate physics major to their present position, and I reserve lots of time for students to ask questions. We also review many of the American Institute of Physics statistical data sheets, read through graduate school letters of reference, engage in a "translating the transcript" activity, and develop individualized plans on how to have a solid resume by graduation.

I've subtitled ProDev-III "Oh crap, I'm graduating." We discuss how to apply to graduate school, find an appropriate graduate program, find jobs, write cover letters, request letters of recommendation, interview, and negotiate a job contract. This is not a drill. By this point many of the students will have already engaged with SPS and the clubs, but if not, they still have time to add some things to their resume.

While these seminars are always filled with productive discussions, they were especially helpful during our return to campus. They helped our new and returning physics majors explore and

develop their identity as a physics person in a low-stakes environment with high rewards. Each seminar meets weekly for 50 minutes, with lots of classroom discussion and whiteboard brainstorming, so they helped our physics students get to know each other better. Many students in ProDev-II had only met each other through Zoom classes. The seminars also helped our SPS chapter recruit new members.

This particular year our clubs are working with our Office of Development to do a crowd-funding effort to raise money for the 2022 Physics Congress. We are also reaching out to alumni, applying for student travel funds available through various campus offices, and requesting support from our student government association with the aspirational goal of sending 16 fully funded students to the congress.

Our department had 25 new physics majors start the fall of 2021. Our ProDev-I seminar put these new students in contact with our SPS chapter student leaders early in the semester, the department provided free membership in SPS and a simple mechanism to complete the membership form, and we hosted a variety of club events to appeal to various interests. Together, these curricular and cocurricular activities create opportunities for physics majors to develop their physics identity, to connect as a community, to build resilience for future "pivots," and to find their role in supporting the mission of the Society of Physics Students. All of these approaches were especially helpful after 14 months of remote-mode and Zoom fatigue, but they're also a great way to build community as a regular practice. //

To learn more, reach out to Bodhi Rogers at Michael.B.Rogers@UCDenver.edu.

TOP AND ABOVE: UC Denver SPS members assist kids with building traffic light circuits. Photos by Alya Sharbaugh.

PHYSICS AND ASTRONOMY BY THE NUMBERS

The American Institute of Physics Statistical Research Center is your source for data on education, careers, and diversity in physics, astronomy, and other physical sciences. aip.org/statistics

THE CAREERS TOOLBOX

The Careers Toolbox for Undergraduate Physics Students is an in-depth resource for undergraduate physics students entering the workforce after graduation. Many of the tools can also be applied to finding internships, research positions, or even entrance into graduate programs. spsnational.org/sites/all/careerstoolbox

FEATURE

SPS 101: (Re) Starting Your SPS CHAPTER

by Kayla Stephens, Assistant Director, SPS and Mikayla Cleaver, Programs Coordinator, SPS

Since the spring of 2020, the dynamic of many SPS chapters has changed—some chapters are trying to rebuild the community they once had, while others don't have an active chapter at all anymore. As physics students reconvene on campus this fall, it's time to connect with SPS Headquarters, find that new normal, and (re) establish your physics and astronomy club. Whether you're looking to revitalize your SPS chapter or create one, here are some steps to guide you in the right direction. It's time to get involved, be creative, and (re) start something amazing!

STEP 1: FIND OUT IF YOU HAVE AN SPS CHAPTER—IF YOU DON'T, CHARTER ONE!

If you have a chapter, it's time to get involved, recruit members, and plan some engaging events! If you don't know whether you have an official SPS chapter, reach out to SPS Headquarters at sps@aip.org and your physics department. You may have an official chapter that has gone quiet. In that case, take on a leadership role and revive it by following the steps below. If you don't have an official chapter, you can charter one this semester. Visit spsnational.org/about/governance/chapters/starting-new-chapter for information on how to submit a petition and create chapter bylaws.

STEP 2: RECRUIT MEMBERS

A tried-and-true way to garner interest in your chapter is to sign up for your school's activity or club fair. This is also a great way to engage students who may not be physics or astronomy majors! Other ways to grow interest in SPS include holding tutoring events, movie nights, or pizza parties in your physics and astronomy student lounge, doing cool science demos on campus, and visiting intro physics and astronomy classes to meet first-year students. Be sure to add everyone's email address to your club's listserv, and keep people up to date on chapter meetings and events throughout the semester!

STEP 3: CONNECT WITH YOUR AZC, ZC, AND ZONE

SPS chapters are divided into 18 geographic regions, also known as zones. To make the most of SPS, know which zone your chapter resides in and connect with your zone representatives. Each zone has an elected student associate zone councilor (AZC) and faculty member zone councilor (ZC) on the SPS National Council. They represent the voice of physics and astronomy students, faculty, and departments in your zone. They also serve as a resource for you regarding SPS scholarships, awards, internship opportunities and deadlines, and much more. Find your zone at spsnational.org/about/governance/zones, and learn who your AZC and ZC reps are at spsnational.org/about/governance/national-council—invite them to speak at a chapter meeting or event!

Each zone traditionally holds one or two annual meetings. Make plans now to attend yours! These meetings bring together SPS chapters within a geographic region for professional development and community building among like-minded physics students. They are a fun and effective way for undergraduates to meet other students, present their research, and interact with practicing scientists. For a list of upcoming zone meetings, visit spsnational.org/meetings/2022-23-zone-meetings.

STEP 4: PLAN AND HOST EVENTS

Now that you've been in contact with your AZC and ZC and with SPS Headquarters, it's time to plan some fun events! What kind of events? A great place to start is with informal gatherings for your school's physics and astronomy students. Movie nights, game nights, and pizza dinners are the perfect environment for your chapter members to get to know one another, connect with newer physics majors, and just have fun together! If you're hosting a game night, consider Physics

Jeopardy!—available on SPS's website at spsnational.org/programs/outreach/physics-jeopardy.

If your chapter is ready to host a larger function, consider a community outreach event. Pumpkin drops and launches are fun fall activities—you can even have teams decorate their pumpkin. Want to travel to a conference or lab? Host a fundraiser by selling donuts or slices of pizza in the student union to raise money for chapter travel. You might also consider inviting SPS or Sigma Pi Sigma alumni to give virtual or in-person talks on careers, life, or anything of interest to your members. To get contact information for your school's Sigma Pi Sigma alumni, talk to your advisor or email sigmapisigma@aip.org.

STEP 5: SUBMIT A CHAPTER REPORT

The end of the academic year is the time to reflect on your chapter's accomplishments and showcase them in a report for SPS Headquarters. No matter how big or small your events were, it all matters. Submitting a chapter report gives SPS Headquarters an opportunity to learn about you and how we can better support you. Additionally, this is a great opportunity to share your best practices with other chapters, provide guidance for future SPS members in your chapter, determine strengths and areas for improvement, receive feedback from the SPS National Council, qualify for SPS Outstanding Chapter Awards, and much more! //

For chapter report templates, visit spsnational.org/resources/chapters/annual-chapter-reports.

LEFT AND BELOW:
Physics and astronomy students showcase their SPS chapter at the 2019 Physics Congress. Photos courtesy of SPS.

MORE SPS CHAPTER ACTIVITY IDEAS

Looking for other activities to do as an SPS chapter? You could:

- **Visit a lab, observatory, or grad school.**
- **Attend a professional physics or astronomy conference with funding from an SPS Reporter Award (spsnational.org/awards/reporter) or SPS Travel Award (spsnational.org/awards/travel).**
- **Do research together and present it at a poster session, or host a poster session to share individual research. SPS offers funding for chapter research projects. For details, see spsnational.org/awards/chapter-research.**
- **Reach out to your community. SPS offers funding for chapter outreach events and initiatives. For details, see spsnational.org/awards/chapter-awards.**
- **Write an article for *The SPS Observer* about a cool chapter event or research your members did together. Email SPS-programs@aip.org to share your idea!**

TIPS FOR A GREAT FIRST MEETING

- **Offer food and snacks—nobody can resist free pizza!**
- **Start with an interactive activity, like a bridge-building competition.**
- **Have an agenda going into the meeting and share it with those attending.**
- **Discuss the benefits of being an SPS member and being part of the chapter.**
- **Discuss potential goals for the chapter (include potential new members in the discussion and make sure everyone is heard).**
- **Get everyone's contact information, if you don't have it already!**
- **Discuss officer positions and elections, if you haven't had them yet.**

FEATURE

A Space for COMMUNITY

by Elizabeth Buchheim, SPS Chapter President, Colorado School of Mines

Nestled in the Front Range of the Rocky Mountains sits the Colorado School of Mines in Golden, Colorado. Golden is home to zesty adventures and flocking tourists, but it's also home to a rigorous applied science and engineering university. And within that university there's one place where physics and engineering physics students can always find respite: CoorsTek 188, or "the lounge."

The Mines physics lounge has two sides: one geared toward computer-based projects and extensive whiteboard work, the other for eating and relaxing between campus activities. The mood of the students on each side reflects its purpose, shifting from hard-core studying to simply enjoying each other's company.

SPS member Paul Slayback stated that "Physics majors are like pendulums. Once you get two or more together, it becomes chaotic." There's no better way to describe our group. At any point during the school week, you'll see 20 students crowded around a table gleefully shouting about an intense match of Uno while another group huddles around a whiteboard learning quantum mechanics. You'll see sketches of students and professors as friendly ghosts. You'll hear students quipping about difficult homework and how to build a personalized mechanical keyboard. You'll smell freshly brewed coffee and the assorted aromas of lunchtime. Most of all, you'll get the feeling that students are genuinely comfortable here.

Fostering engagement in our SPS chapter means creating a safe space that is an on-campus home for anyone with a curiosity for science. Last year, our chapter made it a goal to be consistently accessible in the physics lounge. This meant having professors host office hours in the lounge and having impromptu frisbee and hacky sack tournaments in the nearby field. A spring collaboration between the Society of Women in Physics (SWiP), SPS, and Sigma Pi Sigma created a weekly evening study environment. The study sessions were equipped with food and upper-level students, who taught skills such as LaTeX and Linux and helped others with introductory physics homework.

To further ensure that the lounge is a welcoming space, we plan to continue these study sessions and engage current and future members through small, yet perpetual efforts. During the fall, SPS members will visit introductory-level physics classrooms and personally invite students to join. We plan to foster appreciation through weekly member recognition emails and by adorning the lounge with cheerful photographs of chapter members. Most importantly, we are further developing an SPS mentorship program where upper-level students meet with first- and second-year students to establish a support network.

Step by step, we can build a chapter based upon tight relationships. Outreach events, campus volunteering, and social gatherings all mean so much more when we continuously encourage and inspire one another. Our chapter thrives when we all climb together. By forming connections at weekly meetings, in mentoring relationships, and during friendly discussions in the lounge, we create a space where students know that learning physics isn't a mile-high task because we're in it together. //

TOP: SPS members enjoy time outside the physics lounge while making cookies in an Easy-Bake Oven. Photos courtesy of Elizabeth Buchheim.

ABOVE: Mines SPS officers (L-R) Olivia Jackson, Elizabeth Buchheim, and Connor Hewson sport newly designed shirts in front of the "Physics at Mines" ghost sketch in the lounge.

BUILD COMMUNITY IN YOUR CHAPTER

For community-building ideas and resources, check out:

- **"(Re) Starting Your SPS Chapter" on page 20**
- **SPS resources for chapters at spsnational.org/resources/chapters**
- ***The SPS Observer*'s archive of Interactions stories at spsnational.org/the-sps-observer/sps-observer-departments/interactions-sps-chapters-action**

SPECIAL FEATURE

How to Welcome Astronomy

SPS aims to support all physics and astronomy clubs

by Brad R. Conrad, Director, SPS and Sigma Pi Sigma, and Andrew Zeidell, Assistant Director, Sigma Pi Sigma

On behalf of the SPS and Sigma Pi Sigma Executive Committee, the SPS Council, and the 846 chapters formed over a century of SPS and Sigma Pi Sigma, we're excited to welcome all those interested in astronomy and physics to SPS! While SPS and Sigma Pi Sigma have been composed of physicists and astronomers since the start, we changed our constitution and bylaws in 2021 to explicitly codify our focus on serving physics *and astronomy* students. Though this may not seem like a big change to some, it is an important acknowledgment in our journey to ensure that the organizations support all those interested in physics *and astronomy*.

We believe that student clubs should first and foremost serve undergraduates and the departments they occupy. To help achieve this goal, the SPS leadership wanted to offer some thoughts on what embracing astronomy could mean for SPS chapters, Sigma Pi Sigma chapters, and other physics and astronomy department clubs and groups.

Our overarching guidance is that SPS and Sigma Pi Sigma chapters should seek to welcome all students interested in physics and astronomy and strive to build an inclusive and equitable community. We suggest that local clubs and advisors consider making SPS an umbrella organization for all undergraduates in the department. There may be several student groups within a department, each with its own identity (for example, Physics Club, Women in Physics, Astronomy Club, etc.), and yet all may be part of the same overarching Society of Physics Students and Sigma Pi Sigma chapters. This organizational structure would give all clubs the rights, privileges, and responsibilities of being an officially recognized chapter of SPS.

To ensure that your chapter is inviting and fully welcoming astronomy students, we encourage you to take the following steps.

1. Extend the full range of SPS opportunities to students in your school's astronomy community. This will look different at each institution, as it depends on whether your school has a stand-alone astronomy department, a combined physics and astronomy department, or a department primarily focused on physics.
2. If you have an astronomy club on campus, reach out to its student leaders to see how you might partner.
3. If applicable, invite eligible astronomy students to be inducted into your Sigma Pi Sigma chapter. Also consider inducting astronomy alums who may have been overlooked, especially if your astronomy department has not been involved in Sigma Pi Sigma in the past.
4. Reexamine your chapter bylaws. Each SPS chapter has bylaws that govern membership, elections, officers, and responsibilities. Officers should examine these bylaws yearly and explain them to their members. Make sure your chapter supports physics *and astronomy* students, and consider codifying this in your bylaws. If you don't have access to your chapter bylaws, talk with your chapter advisor or the entity that authorizes campus clubs, or reach out to SPS Headquarters.
5. Post an SPS code of conduct and rules for common areas. Doing so is important for new and returning students, allowing members to hold each other accountable and support everyone in the department.
6. Explore physics *and astronomy* career options. AIP's Statistical Research Center shows that physics majors go into various disciplines, including astronomy and astrophysics, and astronomy majors often go into physics. Make sure astronomy is represented in your events and discussions. Examples could include hosting observing events and star parties or having astrophysicists speak to your club.
7. When designing outreach events for the coming year, help the public understand that physics and astronomy are strongly connected—AND SUPER COOL! One of the most important activities for many clubs is local outreach to potential majors and the general public. For many people who won't major in physics and astronomy, outreach events hosted by SPS are among their most memorable connections to the field.

You are SPS, and collectively we can have a huge impact on this world. Have questions about what your chapter can do to implement these changes? Reach out to sps@aip.org or your regional elected officials, and together we can make our community even more stellar. //

SPECIAL FEATURE

Finding Community in the Stars

by Brandon Sike, SPS Chapter President, University of Texas at Dallas, and Alex Obenza, SPS Chapter Treasurer, University of Texas at Dallas

ABOVE: Students gather during a fall star party cohosted by the UTD SPS chapter, GSP, and the Astronomy Club. Photo courtesy of Brandon Sike.

Astronomy and physics have always been closely aligned. In recognition of this, the University of Texas at Dallas (UTD) SPS chapter, in coordination with the Astronomy Club and Graduate Students in Physics (GSP), hosted an overnight observation of the near-total lunar eclipse on November 19, 2021. The event had an exceptional turnout, with more than 120 attendees.

Astronomy events are the most popular events hosted by our SPS chapter. They typically consist of star parties, but we also organize them around rare astronomical events such as eclipses or planetary transits. Astronomy-themed events are great outreach because they increase interest in both physics and astronomy.

The Astronomy Club isn't officially registered with the UTD student organization center. It's composed of astronomy enthusiasts and prospective astronomers, and jointly coordinated by our local chapters of SPS and GSP. Although the idea of spinning off the Astronomy Club into an independent organization has been floated occasionally, the club has remained tied to these two organizations. One reason is that the fields of astronomy and physics are so closely linked, and another is that their membership is so closely linked. We both benefit from working together.

For the eclipse event, our SPS chapter and the Astronomy Club set up telescopes for the duration of the eclipse. Students, many non-physics majors, dropped by to look at the eclipse. We also had fun socializing, despite the cold weather. Our other astronomy-themed events have included many star parties, an SPS Zone 13 Virtual Astronomy Night, a partial solar eclipse livestream, and an attempt to view the November 2019 Mercury transit, which was canceled due to weather.

Star parties have been invaluable for connecting our community, and the fall semester just wouldn't feel right without a star party kickoff. SPS, GSP, and the Astronomy Club set up telescopes on a parking structure, turn off the lights, and invite the campus to observe. We look at Jupiter's moons, Saturn's rings, and features on the moon's surface. This is the first introduction many students have to telescopes, so members of the Astronomy Club give microlectures on telescope operation and construction. Our star parties are a great astronomy introduction for the entire school community and the perfect opportunity for students to meet faculty and each other.

Our collaborations with the Astronomy Club are invaluable to our physics community. In addition to being great educational experiences, our joint astronomy events present an ideal environment in which to socialize and build community. We plan to continue this partnership tradition in the future, and we highly recommend that other SPS chapters start their own astronomy traditions! //

FUTURE OF PHYSICS DAYS

Lay the Groundwork for Your Future in Physics

Future of Physics Days (FPD) events help undergraduate students have valuable professional experiences at APS scientific meetings. Join us at an APS March or April Meeting to present your research, explore career options, and meet new colleagues.

APS physics

SPS

Submit an abstract for the March or April Meeting: march.aps.org or **april.aps.org**

Making a Magnetic Impact on the Field

by Korena Di Roma Howley, Contributing Editor

While growing up in Northern Virginia, Serena Eley came across a story about magnetic levitation trains in a children's newspaper supplement. The story noted the use of superconductors in various maglev train designs, so Eley turned to her family's *Encyclopedia Britannica* volumes to learn more about superconductors. But the *Britannica* entries only went so far in answering her questions, and she realized that it might take several years—if not a lifetime—to thoroughly understand the topic.

After further research, Eley understood the impact of superconductors on transportation and could infer their potential impact on power applications. Later, as a physics student, she came to realize that superconductors with specific properties could also be transformative for magnets and devices.

Today, Eley is a physics professor who studies superconductors, magnetic materials, and superconducting quantum circuits. Her research looks into how the microscopic defects within a material's structure influence its properties and how those influences can be minimized or harnessed.

"The general goal," she says, "is to learn how to optimize the material disorder landscape to improve properties for applications, which may enable, for example, superconducting magnets capable of higher magnetic fields and skyrmion-based spintronic devices."

Such spintronic devices have the potential for storing much more information than conventional electronics in a much smaller space and with less power.

"I really enjoy research, solving problems that have no known solution," Eley says. Even the day-to-day aspects of her career bring rewards. "I like the challenges of troubleshooting experiments and processes," she says. "I also love learning about the frontiers of research and hearing about clever approaches at conferences and workshops, as well as collaborating internationally."

In addition to research, Eley is passionate about mentorship and its importance in the field of physics. "We cannot solve the toughest, most compelling problems in a vacuum," she says. "Yet physics is not a welcoming field. It tends to have a bit of an elitist culture that not only serves as a deterrent for many who try to enter the field but also partially accounts for a fairly prevalent fear of physics among our nonphysicist friends."

In addition to helping students navigate these challenges, Eley says a good mentor can provide strategies for securing opportunities, as well as advice that directly results in measurable, career-improving accomplishments. Her own mentors paved the way for opportunities that led to her academic career. Now, as a teacher and mentor, Eley finds it particularly rewarding to see students apply what they've learned in her courses and research lab to real-world internship opportunities.

ABOVE: Serena Eley. Photo by Joe Del Nero, Digital Media and Communications Manager, Colorado School of Mines.

In recognition of her contributions to physics, Eley was named the recipient of the 2021 Joseph A. Johnson III Award for Excellence by the American Institute of Physics and the National Society of Black Physicists (NSBP). Now in its second year, the award is granted to early career scientists who exemplify the values of Joseph A. Johnson, a renowned experimental physicist, impactful mentor, and founder of NSBP.

With the award, Eley plans to continue her dedication to undergraduate research opportunities. After four years at the Colorado School of Mines, where she mentored 23 undergraduate researchers, in January 2023 Eley will begin a faculty position at the University of Washington.

Eley encourages undergraduates to take advantage of available opportunities, even if they don't feel ready yet. "A lot of early physics students fear that they don't have useful skills to secure an internship, and they wait until later in their undergraduate careers to apply," she says. "My advice is that it's never too early to apply and to participate in technical internships every summer. Use these opportunities to boost your resume, learn new skills, and help determine your career path, but don't forget to also prioritize contributing to the goals of a research program or industry position." She urges students to avoid overcommitting, however. "Accepting multiple research positions or research and teaching assistantships restricts your ability to take ownership of your commitments and fully contribute."

And, of course, Eley encourages mentorships. The best way to find a mentor, she says, is simply to schedule meetings with professors or other scientists to casually discuss their research and your career goals. "For experimentalists," she says, "just ask to see the lab. We love showing our labs. And when you find someone who seems truly interested and excited to provide advice to you, ask them to be your mentor." //

THE NATIONAL SOCIETY OF BLACK PHYSICISTS (NSBP)

The mission of NSPB is to promote the professional well-being of African American physicists and physics students within the international scientific community and within society at large. To learn more, visit the NSBP website at nsbp.org.

Student members of SPS are eligible for free membership in NSBP. For details, see spsnational.org/about/partnerships/nsbp.

Applications due
January 15

SPS SUMMER INTERNSHIPS

The SPS summer internship offers ten-week-long positions in:

- Science Policy
- Communication
- Research
- Education
- Outreach

All internships include paid housing, a competitive stipend, a commuting allowance, and transportation to and from Washington, DC.

For more information and to view the previous work and journal entries of SPS interns, please visit spsnational.org/programs/internships.

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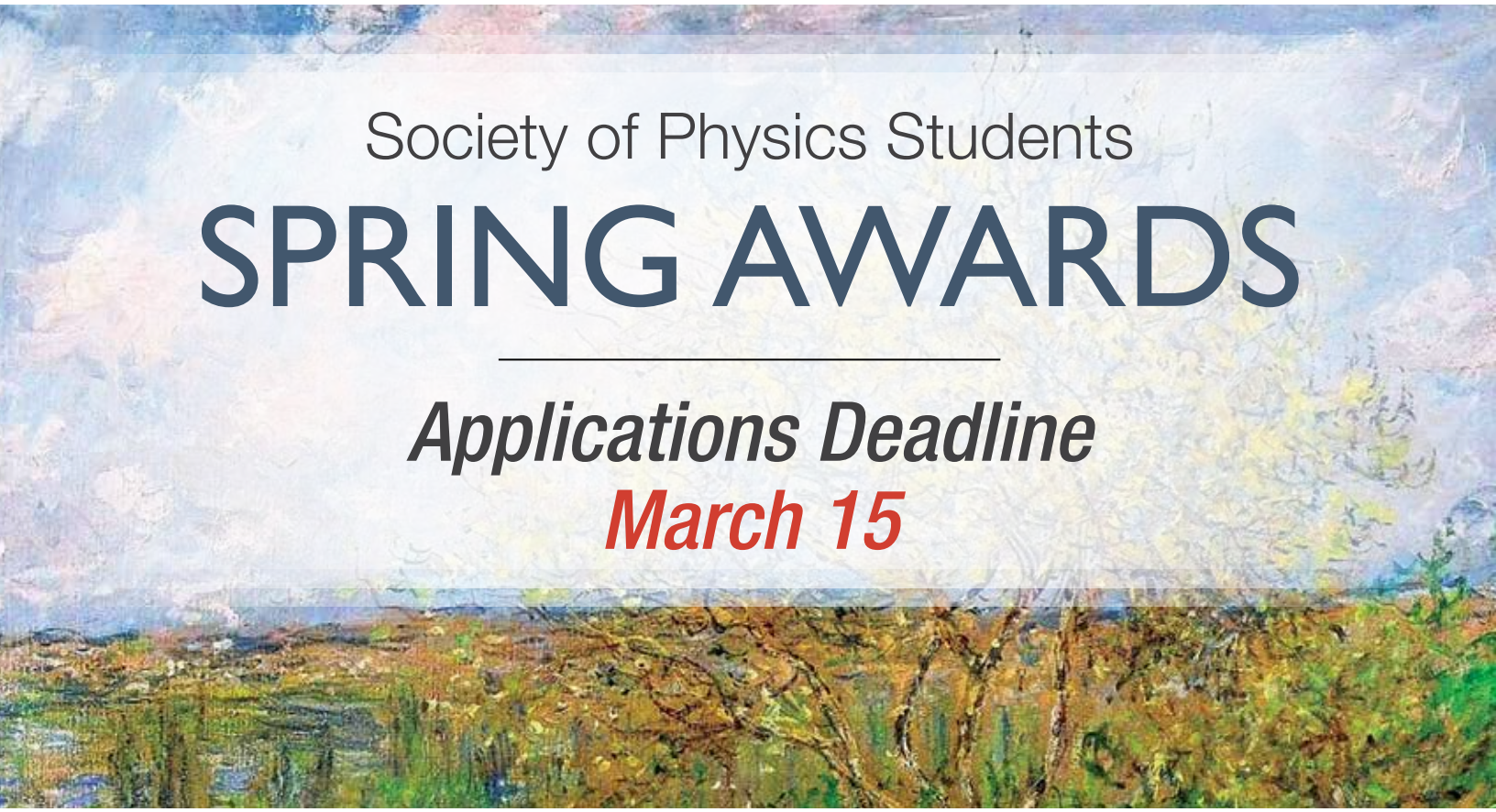

Society of Physics Students

SPRING AWARDS

Applications Deadline
March 15

Outstanding Chapter Advisor Award

Awarded on the basis of leadership, student leadership development, support, and encouragement the advisor has provided to the chapter. Must have received an Outstanding Chapter Award within the past two years.

SPS Award for Outstanding Undergraduate Research

Provided to students based on exceptional research achievement in any physics-related field.

SPS Scholarships

Awarded to undergraduate physics and astronomy students on the basis of scholarship, SPS participation, and additional criteria specific to each scholarship.

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