

the SPS Observer

Volume LVII, Issue 3

WINTER 2024

THE CHAPTER SPOTLIGHT ISSUE

- + CUWiP 2023
- + Undergraduate Research Takes Center Stage
- + Legos, Metrology, and Planck's Constant
- + The International Physicists' Tournament
- + Building Community Online and Off
- + A Model Outreach Event

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ON THE COVER

Hundreds of visitors enjoy Lewis University’s annual Haunted Night in the Lab, hosted by Professor Jason Keleher and his research group in collaboration with the SPS chapter. Photo by Amy Mlynarski.



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AIP Member Societies:

American Association of Physicists in Medicine
American Association of Physics Teachers
American Astronomical Society
ACA: The Structural Science Society
American Meteorological Society

American Physical Society
Acoustical Society of America
AVS: Science & Technology of Materials, Interfaces, and Processing
Optica (formerly OSA)
The Society of Rheology

Other Member Organizations:

Sigma Pi Sigma physics and astronomy honor society
Society of Physics Students

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, 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 & Archives. AIP owns AIP Publishing LLC, a scholarly publisher in the physical and related sciences. For details visit www.aip.org.

Achieving Dreams— Together

by Rachel Nere, Associate Zone Councilor Representative, SPS Executive Committee 2023–24, and Graduate Student, Georgia Tech

During my childhood on this pale blue dot in space, a passion was ignited within me to understand and advance our knowledge of the cosmos and to communicate science in a way that can be understood by anyone.

I aim to be the first in my family to achieve a doctoral degree and to impact my community as a successful researcher, educator, and mentor. To get to this point, my first year of grad school, I have persevered through multiple transfers, long commutes, and a seven-year journey to my bachelor's degree. I paid for the majority of my education on my own terms, eventually gaining acceptance to graduate school and proving to my parents—and perhaps, more importantly, to myself—that I was capable of achieving the dreams I have had since I was six years old.

My drive to succeed has been fueled by a desire to honor my parents' sacrifices, even though they doubted my ability to achieve my dream, and live up to the values they instilled in me. However, my journey is not just about overcoming the hurdles of a first-generation college experience; it is deeply intertwined with my identity as a Black woman in STEM. This added another layer of complexity and challenge, as I have often had to navigate spaces where no one looked like me.

As of 2020, fewer than 100 Black women had ever earned PhDs in physics in the United States, and only 22 Black women had received PhDs in an astronomy-related field.¹ As a Black woman working toward a physics PhD with a focus on astrophysics, and as one who has faced numerous adversities throughout my nonlinear path to education, I find these statistics harrowing. But I have worked to take proactive control of my experiences and encourage fellow underrepresented students in STEM to do the same.

Through my tumultuous college journey, I learned firsthand how crucial community is for nontraditional students, marginalized people, first-generation Americans, and immigrants alike. The first four years of my undergraduate journey were spent at a state institution and a community college where I did not feel at home. During those years, I was actively discouraged from pursuing



ABOVE: Rachel Nere.

a career in physics by professors, peers, and even loved ones. As immigrants from a developing country, my parents wanted me to pursue a different kind of career. I could never see myself as a nurse, teacher, or medical doctor, so I persisted with my undying love for physics and astronomy. I continuously pushed against the barriers that were stacked against me time and time again, even when I had to commute five hours a day for school. After four long years, I transferred again, this time to the University of Massachusetts Boston (UMass Boston), which I was fortunate to call my academic home for the last three years of my undergraduate career.

A large part of the community that I found at UMass Boston was through SPS. My former thermodynamics professor and research advisor at the time, Professor Mohamed Amine Gharbi, insisted that I help revive the chapter at school, and so I did. I first became chapter vice president in 2021, then president from 2021 to 2023. SPS became a place of community and safety not only for me, but for other students as well. That was part of why I joined

the club—to help make it a place where others could connect, understand each other, empathize with each other, and help each other, regardless of the capacity of their needs. This journey started to flourish as time went on.

That community has since expanded. I met former SPS director Brad Conrad during my time at UMass Boston, which forever transformed my life for the better. He invited me to attend the American Institute of Physics Board Meeting in June 2023, where several other students and I spoke about our experiences. Another impactful experience was attending the 2022 Physics Congress—witnessing the bonds of other SPS chapters inspired me to want to further impact the physics and astronomy community. Through SPS, I was introduced to the scholarship that helped me afford to finish school—I became one of the inaugural recipients of the TEAM-UP Together Scholarship, which is a joint effort between several physics societies, including SPS. These experiences inspired me and showed me that more can be done to support underrepresented students in STEM. I want to be a part of that work.

Last spring I was elected as the SPS associate zone councilor for Zone 1, and this fall I was elected as the associate zone councilor representative to the SPS Executive Committee. I do not take these opportunities for granted and am extremely grateful for them. It is the students, leaders, professors, and those who have come before me who inspire me with their passion to give back, do better, and be more involved in something bigger than myself.

Physics is for everyone, regardless of journey or background. SPS is a place filled with people who hear you, see you, and allow you to cultivate what physics means to you. You matter, and so do your experiences and the path you have taken to get here. You are valued—physicists come in every form, not just one. My position on the SPS Council means so much to me because SPS is bigger than us as individuals. I am grateful to be working with you to make physics a more equitable space by giving back to the community and cultivating a family that includes each person, chapter, and zone in the organization. //

References

1. See “#BlackInAstro: Black Women in Astronomy and Physics” by Kate Storey-Fisher at astrobit.es.org/2020/06/25/blackinastro-black-women-in-astronomy-and-physics.

Meet the 2023 SPS Outstanding Chapter Advisor: Chad Kishimoto

by Kendra Redmond, 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 the chapter. For his leadership and guidance of the SPS chapter at the University of San Diego, Chad Kishimoto is the 2022–23 SPS Outstanding Chapter Advisor.

It’s hard to convince Chad Kishimoto that he’s an outstanding SPS advisor. He credits his students and the University of San Diego’s immediate past SPS chapter president and executive board for the active, vibrant group—and for this award. They make me “look better as an advisor,” he says. But it was these students who nominated Kishimoto for the SPS Outstanding Advisor Award.

Kishimoto came to physics through astronomy. “As long as I can remember, I’ve been a math and science kind of a person,” he says. A college astronomy class introduced him to astrophysics, and the more physics he saw, the more fun he had. Kishimoto kept on taking classes in the field, eventually completing all of the work for both an astronomy and physics major and heading to graduate school.

At the University of California, San Diego, Kishimoto earned a PhD in physics doing theoretical neutrino astrophysics research. After a postdoc, he became an adjunct professor at several Southern California institutions—a so-called “freeway flyer.” The nickname reflects how adjuncts in the area “literally fly along the freeway from class to class,” he explains.

When Kishimoto landed at the University of San Diego in 2014, an SPS chapter existed—but only on paper. He took the wheel. “I’m not sure how I first heard of SPS or that it was a thing, but it seemed like a valuable



TOP: Chad Kishimoto (center) and his research group hang out with then SPS director Brad Conrad (left) at the 2023 APS April Meeting. Photos courtesy of Kishimoto.

ABOVE: Chad Kishimoto (center) and his 2022–23 SPS executive board attend a Zone 18 meeting in February 2023.

umbrella for building life in a department,” he says. And it was.

As the SPS chapter took hold, the department became more closely knit, Kishimoto says. Today, the department and SPS are so integrated that the line between them isn’t always clear. “In a way, my role is to blur that line,” Kishimoto says. That means creating an environment where the department supports what the students want to do and vice versa, he says. “Our doors are open, and students feel free and welcome to come in and talk about classes, about research, about life, the universe, anything.”

Kishimoto also sees his role as connecting students to opportunities—which often means finding money. “I don’t ever want [funding] to be the issue—why we can’t do things that are engaging for all our members,” he says. In 2022, 15 of his students traveled 3,000 miles from San Diego to Washington, DC, for the Physics Congress. The chapter covered all expenses—primarily through Kishimoto’s fundraising efforts.

“I’ve had a lot of excellent SPS student leaders who were able to corral their colleagues, their peers, to do things,” Kishimoto says. “When we have a really successful year, my role is just to connect [students] to those resources.”

When students are less engaged, Kishimoto may plan some SPS events, invite students, and “yell into the void,” but he doesn’t sweat it. “The students who have interest in doing these things, they ebb and flow. I’ve never stressed about it when the ebbing part happens.”

Kishimoto’s approach to advising is helping students find their passion in physics and supporting them in what *they* want to do. It’s one of the things he finds most rewarding. That means that each SPS cohort sets its own agenda based on what the current students are passionate about. But they don’t have to reinvent the wheel—the chapter’s strong legacy of activity, relationships, and community carries on.

“Dr. Chad Kishimoto, or simply Chad to most of us, is the best chapter advisor and mentor I could have hoped for,” one student wrote in Kishimoto’s nomination package for this award. “Through Dr. Kishimoto, the rest of the faculty in the department have become very supportive and accustomed to our SPS chapter, which has resulted in more collaborative events, more funding, and more exposure. SPS has truly become our little family, and this is largely thanks to him.” //



1



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1

Emory University SPS members show off their club T-shirts.

2

University of Tampa SPS members enjoy their annual community-building trip to NASA's Kennedy Space Center.

3

Clemson University SPS members and friends de-stress by playing with puppies during an SPS event.

4

"Physics families" in the College of William & Mary's SPS chapter show off their physics-themed pumpkins during a Halloween competition. The losers must freeze their pumpkin with liquid nitrogen and drop it from the physics department balcony.

5

Incoming and outgoing SPS officers at the University of Louisville recreate an SPS officer photo they found taken more than 20 years ago.

All photos courtesy of the SPS chapter's 2022–23 annual report.

Building Community ONLINE AND OFF

by Deedee Jansen, SPS Chapter President, with Demi Held, SPS Chapter Secretary, and Justus Fagan, Former SPS Chapter President, Austin College

Butcher paper rips, staplers sing, paintbrushes swipe. As a new school year begins, the first SPS bulletin board takes shape, communicating our chapter's plans for the semester. But these hands-on tools aren't the only ones at play. In addition to creating artistic bulletin board displays, our SPS chapter recently embarked on a mission to enhance our online presence through engaging Instagram content. In combining these efforts, our physics-loving circle discovered the power of community building through meaningful communication.

During a laughter-filled evening, we danced to music as we set up, painted, and designed that first bulletin board. With a keen eye for layouts, chapter vice president and art major Mari Wisner led the charge. Cailey Varnell, a talented sophomore, took on lettering, while treasurer Deedee Jansen channeled her inner resident assistant to create captivating borders and interactive elements.

In the morning, as classes gathered, students were greeted by a visually appealing board showcasing the month's events, promising free food, and even offering some bubble wrap to pop. Our vibrant monthly displays in an otherwise uninteresting hallway became a means to reach and engage with students on their way to class. They told stories about our community, showed off our achievements, and reminded us of the power of tangible, visually appealing communication in an increasingly digital world.

Simultaneously, one of our first-year students took on the daunting task of building an online presence for our SPS

chapter. Starting from scratch, Demi Held crafted an engaging and dynamic Instagram account. Through interactive stories, aesthetically pleasing posts, and captivating graphics, she transformed the account into a hub for resources and news on our activities. The grid layout seamlessly transitions from one picture to the next, inviting followers into a world of physics-related celebrations. The platform became a virtual community, with students sharing their presentations, conference experiences, class projects, and even news appearances. Tagged and frequently shared, the Instagram posts fostered connections among physics enthusiasts, bridging the gap between online and offline interactions. The Instagram account has been a gateway to digital community, opening doors to shared experiences and encouraging engagement and exploration.

Although these two modes of communication may seem distinct, both optimize the creativity and artistic talent within our SPS chapter. They cater to somewhat different audiences but share a common goal: bringing individuals together through a love of physics, STEM, and each other's company. Both platforms have contributed to the overall success of our chapter's communication efforts, sparking conversations, celebrations, and collaborations. As we continue to enhance our communication strategies, we remain committed to nurturing our community and spreading our love of physics and STEM. //



Connect with SPS on
Instagram @spsnational



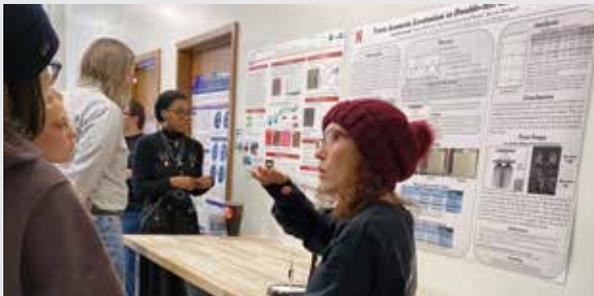
TOP: SPS members pose with their bulletin board. All images courtesy of the Austin College SPS chapter.

ABOVE: Check out @roosphysics on Instagram for ideas on how to advertise your next event!

ZONE 11

Fosters Connections in Fargo

by Jacob Hubbard and Sigurd Saude, SPS Members, and Alan Denton, SPS Chapter Advisor, North Dakota State University



TOP: SPS students participate in the poster session at the Zone 11 meeting. Photos courtesy of the North Dakota State University SPS chapter.

ABOVE: SPS students attend a talk during the Zone 11 meeting.

On a dark and stormy spring night in Fargo, North Dakota, we anxiously awaited the arrival of our SPS colleagues, intrepid physics students who were traveling from across the Upper Great Plains to attend the annual SPS Zone 11 meeting, held this time at North Dakota State University (NDSU). We were excited to host our largest event yet, but we were also nervous. We had spent many hours planning, learning, and preparing for this amazing opportunity. In the end, the effort and wait were definitely worthwhile.

Planning had started months ago during weekly chapter meetings. Organizing food, activities, lodging, and a guest speaker presented many logistical puzzles. Our advisor, Professor Alan Denton, was very helpful throughout the process. After numerous meetings and countless texts and emails, we finally made it to the weekend of the big event.

The meeting kicked off Friday night with a hot chocolate gathering. Once all of the students had arrived—some after driving nearly seven hours—we could finally put faces to the names of those we'd been in touch with over the previous months. On Saturday morning, after getting better acquainted over coffee and donuts, a caravan of students headed to NDSU's Research and Technology Park for a series of lab tours hosted by researchers from the Department of Physics and the Department of Coatings and Polymeric Materials.

We got to view many instruments up close during the tours, and learned about topics ranging from the folding and wrinkling of materials to disease prevention! At NDSU's high-performance computing center, which supports computational researchers, we even went inside the machine room. It was surprisingly loud because of the powerful industrial fans required to cool thousands of CPU cores.

Our afternoon session featured guest speaker Wayne Barkhouse, a professor of physics and astronomy at the University of North Dakota. Barkhouse gave an engaging presentation on his astrophysics research—the specific frequency of globular clusters. We learned that astronomers have observed oddities in the frequencies of these clusters in different types of galaxies, and how the James Webb Space Telescope is providing more detailed images and deeper views into our observable universe than ever before.

Later Saturday afternoon, we held a poster session that gave attendees the opportunity to mingle and show off their hard work in research. Then, on Sunday, the meeting wrapped up with a fun and friendly egg drop competition.

Throughout these activities we enjoyed bonding with students in our SPS zone whom we may not have met otherwise. We built valuable friendships and new relationships that will help us grow as individuals, as a chapter, and as a zone. We look forward to staying in contact with the attendees and can't wait to reunite with them at the next meeting! //

SPS ZONE MEETINGS

Zone meetings bring together students from SPS chapters within a geographic region. They're fun and effective ways for undergraduate physics and astronomy majors to meet other students, present their research, and interact with practicing scientists. SPS has 18 zones, and most hold at least one zone meeting per year. To see which zone you're in and find a list of upcoming zone meetings, visit spnsnational.org/meetings/zone-meetings.



An Out-of-This-World EXPERIENCE

by Myles Pope, SPS Chapter President,
and Prabhakar Misra, SPS Chapter
Advisor, Howard University

Students and faculty at Howard University recently had an out-of-this-world experience when our SPS chapter hosted a visit from Jessica Watkins on March 31, 2023. She is the first Black woman to participate in an extended mission on the International Space Station (ISS) and a PhD geologist. This was a significant event all around, as it was our first meeting with Watkins and her first time visiting Howard University.

During her visit, Watkins gave a presentation about her journey to and experience aboard the ISS. She spoke about her path to becoming an astronaut, from her childhood to her undergraduate and graduate years and beginnings at NASA. She emphasized the importance of pursuing what you're passionate about, even if that pursuit is against the norm. She then showed us a video about preparing for spaceflight and an extended mission aboard the ISS. The movie captivated the diverse audience, which included people from many different fields of study and levels of education.

Immediately following the presentation and a question-and-answer session, Watkins received service awards from the American Institute of Physics and Sigma Pi Sigma, the physics and astronomy honor society, and was inducted into the society. Then she presented a montage to Howard University on behalf of the ISS and its crew for supporting her visit.

During the remainder of her visit, Watkins toured many of the research laboratories at Howard — most tours were led by research students. We showed her STEM labs in the Interdisciplinary Research Building as well as labs in the Department of Physics and Astronomy. She viewed student demos in laser spectroscopy and saw an active, working environment in our computational physics lab.



TOP: Miles Phillips, an undergraduate mechanical engineering major at Howard who works in the Laser Spectroscopy Laboratory, demonstrates standoff Raman spectroscopy for Jessica Watkins (right) during a lab tour. All photos credit NASA/Aubrey Gemignani.

ABOVE: Howard University SPS chapter advisor Prabhakar Misra (left) and department chair Quinton Williams (right) receive a montage on behalf of the department and Howard University from astronaut Jessica Watkins (center). The montage is a thank you from the ISS crew for the university's efforts to support her visit.

This visit, one of the most memorable events our chapter hosted this year, was a truly historic one for our university and proved that there's strength in pursuing science through your own unique lens. //

The authors acknowledge the support of Quinton Williams and Karen Wright in organizing the event. For advertising and logistics, we thank Laurynette Griffin, Khouri Williams, Raul Garcia-Sanchez, Crawford Taylor, Dezerine Wallen, and Fred Kepner. We are grateful for funding provided by NASA M-STAR grant no. 80NSSC21M0301.

Community Shows Up in Drove for ASTRONOMY LECTURE

by Lori Porter, Former SPS Chapter President, University of Louisville

On a fall day in 2022, our SPS chapter was working hard on last-minute preparations for the annual Bullitt Lecture in Astronomy—the University of Louisville’s largest annual astronomy event and one of the best opportunities for our chapter to fundraise and share science with the community. This year’s event was particularly important. It was the second in-person Bullitt lecture since COVID-19 closures, and attendance at the first one had been lower than normal. We were determined to bring it back in full force, advertising in local newspapers, at schools, and elsewhere.

Still uncertain if our efforts would pay off, SPS volunteers set up the planetarium and prepared T-shirts and 3D-printed items for sale. Minutes later, we were beyond shocked to see people stream into the planetarium ready to hear the lecture, stopping to buy our merchandise on the way. The line of people waiting to sign our guest book extended all the way to the street!

When it was time for the lecture to begin, we gazed around the planetarium. The room was packed, and some attendees were standing. We had nearly reached capacity with more than one hundred people!

The lecture was given by Karan Jani, a Vanderbilt University professor who works on LIGO (the Laser Interferometer Gravitational-Wave Observatory). The talk covered gravitational waves, their discovery, and their importance to physics and astronomy. Attendees were filled with wonder, and we enjoyed hearing their thoughtful whispers when new images appeared on the planetarium’s dome.

One of my favorite parts of the evening was when a large group of students from a nearby high school approached Professor Jani after his lecture. The students identified themselves as Indian, like Professor Jani, and flooded him with questions about what it was like to succeed in the field. Later, one of the students told us that they rarely meet physicists who look like them in Kentucky. Connecting the students with a scientist they related to in this way was a fantastic experience.

Overall, the 2022 Bullitt Lecture in Astronomy at the University of Louisville (UofL), partly funded and hosted by the Society of Physics Students, was a huge success. We raised over \$200 by selling merchandise at the event and had a record-breaking attendance. It was an experience we will carry with us—a reminder of the importance of outreach, science, and hard work! //



TOP: The University of Louisville SPS chapter poses for a photo. Photos courtesy of the UofL SPS chapter.

ABOVE: Some of the 3D-printed merch created by the UofL SPS chapter.

NEED SPEAKERS FOR AN EVENT?

Check out the SPS Alumni Engagement Program—a database of participants willing to be speakers, panelists, tour guides, and mentors for SPS chapters. Learn more at spsnational.org/programs/alumni-engagement.

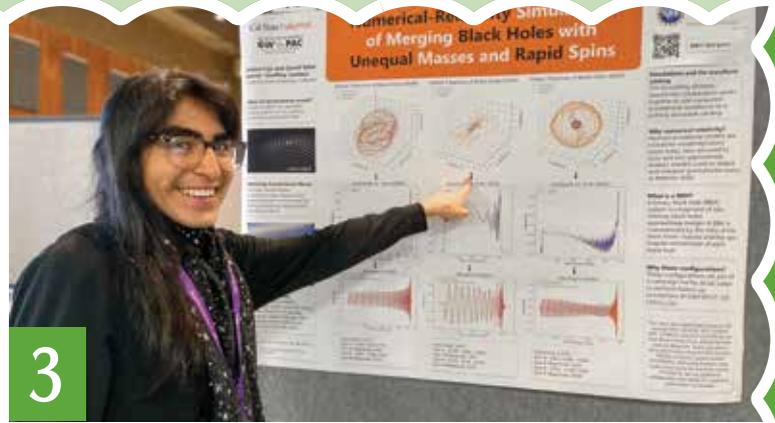
GET MONEY FOR CHAPTER OUTREACH EVENTS

Marsh White Awards of up to \$600 are available for chapter programs or events that promote an interest in physics or astronomy among students or the general public. Applications are due November 15 each year.

Learn more at spsnational.org/awards/marsh-white.

SPS CHAPTERS ON

PROFESSIONAL DEVELOPMENT



1 Emmanuella Goe and Zoe Vetter, Sigma Pi Sigma inductees at Truman State University, celebrate joining the physics and astronomy society.

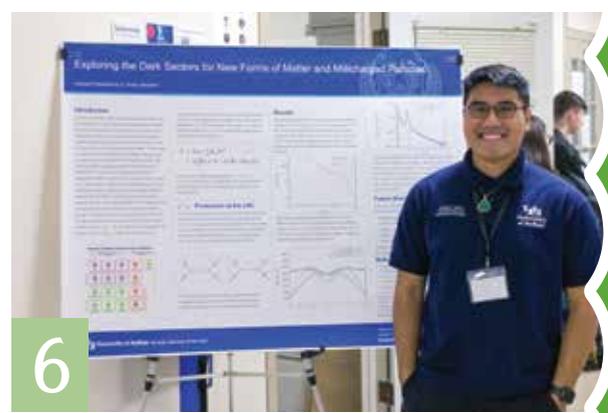
2 Dillard University SPS chapter president Rachel Jackson celebrates graduation with SPS chapter vice president Zachary Bastian.

3 SPS member Daniel Tellez from California State University, Fullerton, presents a research poster at a LIGO-Virgo-KAGRA collaboration meeting.

4 Attendees at the Spring 2023 SPS Zone 5 Meeting pose with guest speaker Deborah Ross (front, second from left), US House Representative for North Carolina's Second Congressional District, at Duke University.

5 SPS students from West Chester University of Pennsylvania tour the Singh Center for Nanotechnology at the University of Pennsylvania.

6 SPS member Keopasith Phaphanthong, from SUNY Buffalo, presents a research poster at the 41st Rochester Symposium for Physics Students.



All photos courtesy of the SPS chapter's 2022–23 annual report.

CUWiP 2023:

A Conference Deferred but Not Denied

by Rajib Chowdhury, SPS Member,
University of Central Florida

In recent years, the University of Central Florida (UCF) has been eager to host a Conference for Undergraduate Women in Physics (CUWiP). Several CUWiPs are held each year, all on the same January weekend but in different geographical regions. We had hoped to host one a few years ago, but that was postponed due to COVID-19. Finally, in January 2023 we were able to host an in-person meeting for our region. As the conference kicked off, the stage was set for a weekend full of research talks, poster presentations, and panel discussions.

Among the sciences, physics usually ranks last in the percentage of women enrolled in degree-granting programs, with doctoral, master's, and undergraduate percentages hovering in the twenties for the past two decades. The CUWiPs have been instrumental in building community among physics students who are women and from other groups underrepresented in physics. The meetings aim to support, connect, and empower those who may otherwise feel discouraged from continuing in the field.

Our CUWiP had an incredible array of speakers, including Jami Valentine Miller of the US Patent and Trade Office and Rose LeJiste, founder of RL Engineering and Tech Solutions. They shared great anecdotes about physics careers that don't follow the traditional path of undergraduate to graduate student to professor. LeJiste spoke about starting her own company and applying lessons from her work in physics spaces, such as the Kennedy Space Center, to her own business. Miller explained how her physics background helps her define the scope of patents for new devices. In addition, both speakers touched on how being a woman

in a male-dominated field has impacted them.

One of the highlights of the UCF CUWiP was a nighttime excursion to the Robinson Observatory, our in-house astronomical telescope and viewing station used to study binary asteroids, the dust production of comets, variable stars, and exoplanets. Here, under the darkness, attendees viewed stellar objects with small, portable telescopes. They looked at many of the planets in our solar system through our Meade LX90s, equipped with eight-inch mirrors and rotational motors, and checked out the systems required to control our 20-inch Ritchey-Chretien telescope, which was then under repair.

Another highlight was the simulcast plenary talk that brought together all of the CUWiP sites. The 2023 Millie Dresselhaus CUWiP Keynote Lecture was given by Nadya Mason, a professor at the University of Illinois Urbana-Champaign. She works on flexible graphene devices in the context of condensed-matter experiments. Her work lies at the intersection of well-understood classical bulk physics and microscopic quantum phenomena. She gave a fascinating history of graphene, including her graduate work on the properties of graphene and how they change under strain. Professor Mason explained how small developments, such as learning how tears in graphene affect its resistance, were instrumental in developing a



ABOVE: Physics students from the College of Wooster attend the January 2023 Conference of Undergraduate Women in Physics at Pennsylvania State University. Photo courtesy of the College of Wooster SPS chapter.

method to control the material's conductance using nanospheres.

After the research portion of the talk, Professor Mason chronicled her path into physics and her career. She spoke about her struggles while pursuing a physics major, which were incredibly relevant to me and the majority of attendees. She also suggested that we think about research opportunities as tools for honing in on what kind of research career to pursue, if any.

Many of our UCF SPS members helped to coordinate and execute the event, and it took a Herculean effort to produce the finished product: a three-day-long intense aggregation of some of the brightest minds in physics and astronomy focused on building community and discussing issues instrumental to success in these fields.

The conference drew more than 200 undergraduates and dozens of faculty members from all over the southeast, including Georgia, Florida, and Puerto Rico. Our SPS chapter is proud to have helped make CUWiP@UCF possible! //

WOMEN IN PHYSICS AND ASTRONOMY

The American Institute of Physics Statistical Research Center is your source for data on women in physics and astronomy. See the numbers at aip.org/statistics/women.

LEARN MORE ABOUT CUWiPs

Find out more about the APS Conferences for Undergraduate Women in Physics (CUWiP) at aps.org/programs/women/cuwip.

Undergraduate Research TAKES CENTER STAGE

by Evan Trommer, Former SPS Chapter President, Stony Brook University

For an undergraduate, tracking down and talking to a professor at the top of their field can be both difficult and intimidating. In fact, students in our SPS chapter have often expressed feeling disconnected from faculty members, which may limit the research they're exposed to in our physics and astronomy department.

Research experience is highly encouraged for physics majors, yet for students there are few professional avenues for discussing the groundbreaking work that physicists do. In addition, a sizable portion of the undergraduate population in our department is involved in research in some manner, but there are only a handful of events where we can present our work on campus.

To address these challenges, our chapter recently organized and hosted our department's inaugural Undergraduate Research Day, an environment for open, engaging conversation between Stony Brook University undergraduates and physics and astronomy professors. Through this event, students gained experience presenting their scientific work in a conference-style setting and demonstrated to department members just how active we are in research.

First, in a series of six talks, professors discussed departmental research in dark matter, quantum entanglement, exotic states of matter, ferroelectric materials, and physics beyond the standard model. Then five professors in various research areas and at different stages of their careers participated in a panel, answering questions from students and providing invaluable insight into topics such as obtaining



TOP: Attendees circulate during the undergraduate poster symposium. Photo courtesy of the Stony Brook University SPS chapter.

ABOVE: Stony Brook undergraduate Tobias Weiss gives a talk during the Undergraduate Colloquium. Photo by Will Daniels.

SPS AWARD FOR OUTSTANDING UNDERGRADUATE RESEARCH

These monetary awards recognize individuals for exceptional physics or astronomy research conducted as an undergraduate. Applications are due March 15 each year. Learn more at spsnational.org/awards/outstanding-undergraduate-research.

research experience, improving diversity in physics, and achieving work-life balance.

During the final event of Undergraduate Research Day, 19 undergraduates presented posters on their research during a three-hour symposium. More than 50 undergraduate students and 10 professors attended, including the physics and astronomy undergraduate program director and the director of Stony Brook's Undergraduate Research and Creative Activities program. Many students took the opportunity to ask professors about their work. Four faculty judges voted on the best posters, and those students were invited to give 10-minute presentations at the department's first Undergraduate Colloquium, attended by a sizable number of undergraduates, graduate students, and faculty members.

In the lead-up to this event, our chapter's executive board collaborated with many people across the department and the university. We arranged for event space, food and drinks for attendees, and print services and supplies for the poster symposium. We even held a meeting to teach symposium participants how to make and present a professional-level poster.

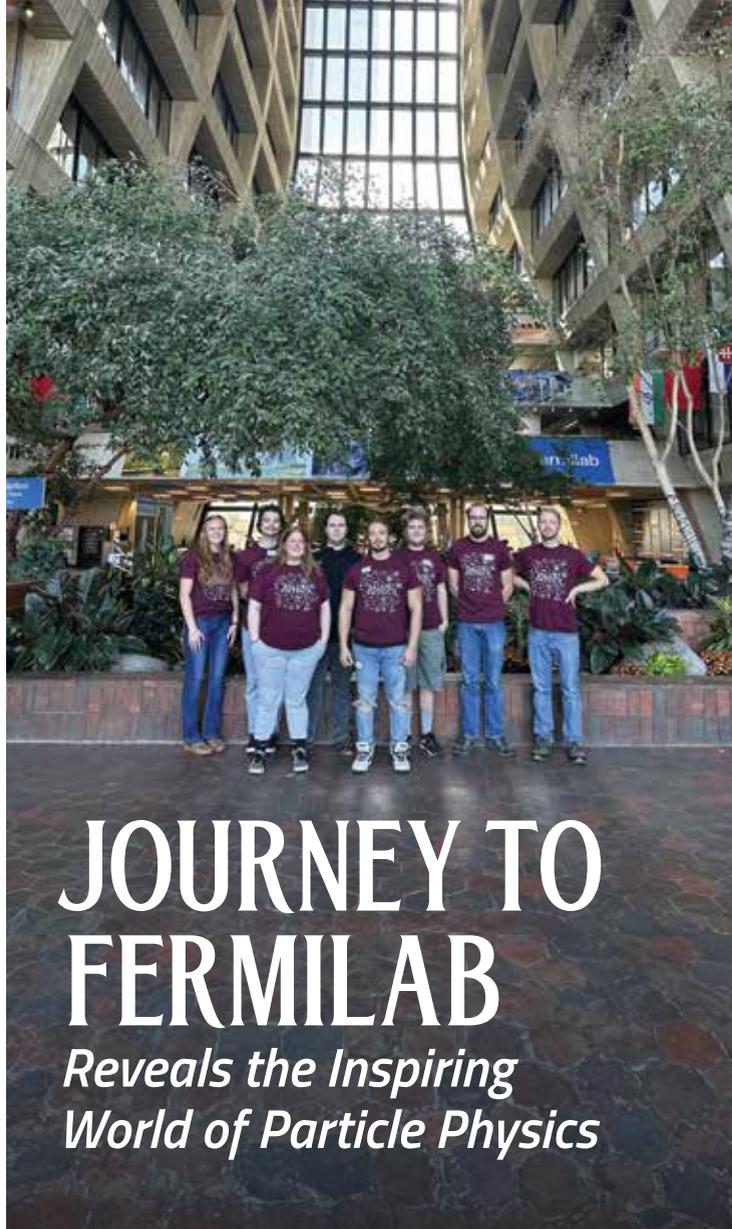
The event was a resounding success, and our chapter received lots of positive feedback and compliments from participants. Professor Jan Bernauer, a presenter during the morning talk, said he genuinely enjoyed the whole day. "It was eye-opening and a delight to see the strong participation of the students," he said. "I have rarely seen a poster session so well attended, and the level of posters was definitely above what you see at many conferences."

Professor Chang Kee Jung, chair of the physics and astronomy department, called the event "a great success," adding, "The positive engagement, enthusiasm, and energy, along with high scientific content, were wonderful to see."

Given the large turnout and positive feedback, our chapter plans to make this an annual event, and the department has agreed to host an annual Undergraduate Colloquium in conjunction. We plan to build upon the successes and hope to include more graduate and faculty members in future planning. Also, the experience inspired us to plan a Physics Town Hall, a fall event to welcome new students by showcasing research from graduate students, postdocs, and faculty members, opening first-year students' eyes to the possibilities ahead. //

PUBLISH YOUR UNDERGRADUATE RESEARCH

The *Journal of Undergraduate Research in Physics and Astronomy* (JURPA) is a peer-reviewed SPS publication that consists of papers by undergraduate physics and astronomy researchers. Manuscripts must be submitted by March 15 each year for print consideration. Learn more at spsnational.org/jurpa.



JOURNEY TO FERMILAB

Reveals the Inspiring World of Particle Physics

by Thayne Dean, SPS Chapter President,
Southern Illinois University Carbondale

In October 2022, the Southern Illinois University Carbondale SPS chapter embarked on an exhilarating journey to Fermi National Accelerator Laboratory (Fermilab), one of the world's leading centers for particle physics research. This unforgettable experience reinforced the lab's significance and greatly impacted our passion for physics.

Nestled in Batavia, Illinois, near Chicago, Fermilab is about six hours from Carbondale. That meant we'd need to stay overnight. This was the first trip our SPS board had planned, and it was a great success! After preparing a detailed budget and itinerary, we secured funding from our Undergraduate Student Government as well as the Graduate Professional Student Council. Despite the cold weather, we camped to reduce

costs, which ended up being tons of fun. Eight members attended—an impressive turnout for our small chapter.

During our tour of Fermilab, we visited research facilities that left us awestruck. One of the highlights was exploring the main control room, where scientists monitor and control the intricate operations of particle accelerators. The high-tech infrastructure and intricate web of detectors we viewed underscored the meticulous precision required for such experiments.

We were also fortunate to engage with some of the brightest minds in particle physics as Fermilab scientists and researchers generously shared their knowledge, passion, and experiences with us. They introduced us to cutting-edge experiments involving the properties of neutrinos and the search for new particles beyond the standard model. We learned about the significance of the Higgs boson—which earned François Englert and Peter Higgs the 2013 Nobel Prize in Physics—and marveled at ongoing efforts to uncover the nature of dark matter and the existence of additional dimensions.

Fermilab's mission to unravel the mysteries of the universe through particle physics research opened our eyes to the immense possibilities that exist in this field of study. Our visit was both an opportunity to witness groundbreaking science and a catalyst for our personal growth. Interacting with scientists who demonstrated a collaborative spirit and passion for their work ignited our curiosity, instilled a sense of purpose, and solidified our commitment to the pursuit of scientific knowledge. We left inspired, ready to continue our exploration of the frontiers of science and contribute to the remarkable legacy of scientific discovery at Fermilab. //



LEFT: The group gathers for a tour of Fermilab. Photo courtesy of the Southern Illinois University (SIU) Carbondale SPS chapter.

TOP: The Muon g-2 (pronounced “gee minus two”) storage ring at Fermilab. Scientists working on the Muon g-2 experiment use accelerators to explore how muons interact with a strong magnetic field in “empty” space. Photo by Ryan Postel, Fermilab.

ABOVE: Bison play on the grounds of Fermilab. A herd of bison has been a fixture there since 1969. Photo courtesy of the SIU Carbondale SPS chapter.

THE SPS OBSERVER WANTS TO SHOWCASE YOUR CHAPTER

Invest in the future of your chapter and let SPS know what you've been up to by submitting your SPS chapter report this spring, using the latest template. Select chapters will be invited to share their activities with SPS broadly. For details visit spsnational.org/resources/chapters/annual-chapter-reports.

HOSTING A CONFERENCE

Brought Our Chapter Together

by Alexandria Watrous, SPS Chapter Vice President, University of Mississippi

Our school, the University of Mississippi, hosted the Fall 2022 Meeting of the Southeastern Section of the American Physical Society (SESAPS). The American Physical Society is a professional organization for physicists, and SESAPS includes the APS members in that region of the United States. SEASAPS meetings include plenary talks, research presentations, and networking opportunities, and undergraduates are especially encouraged to attend. Our SPS chapter provided a lot of the hands-on meeting support that made the 2022 Fall Meeting a success!

This was the first SESAPS meeting in Mississippi in 22 years and the largest scientific meeting ever hosted at the University of Mississippi. We had more than 325 attendees—200 of which were students—and nearly 250 presentations (talks and posters)!

Our SPS chapter played a major role in meeting preparations. One SPS member engaged in the planning meetings that determined where to have the poster session, transportation logistics, the conference website, and the program of events. Another SPS member organized an oral presentation session. Our SPS chapter made packets inviting physics departments in the region to attend SESAPS. SPS students, as well as other student volunteers, put together welcome bags for conference participants.

Helping to prepare for the conference was a great way for us to advertise the meeting on campus and encourage fellow undergraduate physics students to attend. Our physics department even covered the registration fee for University of Mississippi undergraduate students.

During the conference, SPS members worked hard to ensure everything ran smoothly. We worked registration shifts and AV, staffed the help desk, and even walked attendees around campus. We hosted an SPS event where undergraduate attendees could visit our physics department, compete in Physics Jeopardy!, and play card and board games. We also invited University of Mississippi graduate students so that undergraduate attendees could ask them about physics graduate school.

SESAPS was an excellent way to see how conferences work behind the scenes and volunteer in a professional setting. Our SPS chapter enjoyed working and attending together, and the activities helped bring our members closer. //



TOP: Undergraduates gather for Physics Jeopardy! during SESAPS. Photo courtesy of the University of Mississippi SPS chapter.

MIDDLE: SPS members help SEASAPS attendees check in and find their way around the meeting. Photo by Cecille Labuda.

ABOVE: SEASAPS attendees prepare for a session. Photo by Cecille Labuda.

ATTEND AN APS MEETING

To learn more about SEASAPS meetings and other APS meetings that may be coming up near you, visit aps.org/meetings.

GET FUNDING FOR CONFERENCE TRAVEL

SPS Travel Awards offer partial travel support for SPS members to attend and present their research at a national meeting of an AIP Member Society. Applications are accepted on a rolling basis. Learn more at spsnational.org/awards/travel.

SPS Reporter Awards offer partial travel support for SPS chapters or individual members to attend and report on professional physics and astronomy meetings for SPS publications. Applications are accepted on a rolling basis. Learn more at spsnational.org/awards/chapter-awards.

Classic SPS



THE HAMMOCK ZONE

by Alison Spadaro, SPS Chapter President, University of Texas at Dallas

Physics students and faculty at the **University of Texas at Dallas** enjoyed our department picnic last year. Attendees spread out in four areas: the food table, a “kids” table (where the undergrads hung out), a games area where small children and a fashionably dressed dog spent most of their time, and the hammock zone, which consisted solely of our then SPS chapter president, Brandon Sike, and the hammock he brought. Determined to have a relaxing break from finals season, he aimed to set up the hammock between two trees at the edge of the games area. After a fearsome battle—and to the surprise of the many onlookers—he finally succeeded. One can’t help but think of this as a metaphor for the struggles our department faced during the height of COVID-19. Although for two years we felt as though we had lost both our picnic and the community it stood for, just like Brandon’s battle with the hammock, we were ultimately successful.

¡Bien Hecho!

2022 DÍA DE LA FÍSICA

by the SPS Chapter Officers, University of Puerto Rico, Río Piedras

In October 2022, the **University of Puerto Rico, Río Piedras** (UPR-RP) campus hosted the National Society of Hispanic Physicists (NSHP) Annual Meeting. As part of this meeting, we helped put on the standout event of our academic year, the 2022 Día de la Física, organized by NSHP. This activity is a significant focal point for Hispanic physicists and scientists. It was a privilege for UPR-RP to help with the event and share our cutting-edge research with more than a hundred Hispanic students, teachers, and professors. This event holds a special place in our hearts, as it is a testament to the presence and impactful contributions of Hispanics in physics, whose work has improved society.



THE ROCK

by William Greene, SPS Member, University of Tennessee

When Professor Lawrence Lee came to the **University of Tennessee** (UT) two years ago, he knew the importance of studying outside the classroom. Like many professors, he assigned out-of-class reading and required students to submit notes as proof of completion. But unlike others, Professor Lee made it abundantly clear that students could turn in notes however they pleased. So we submitted notes typed in Word documents, written on iPads, scrawled on scratch paper at the last second, formatted nicely with LaTeX, and during the Halloween season, painted on a pumpkin. But our outreach coordinator, Sarah Flavin, suggested we step things up.

The Rock is a nearly hundred-ton boulder that serves as an iconic landmark and outlet for student expression at UT. A symbol of the university community, the Rock has hosted political messages, football festivities, a marriage proposal—and now, our classical mechanics notes.



TOP LEFT: The well-earned hammock zone. Photo courtesy of Jason Slinker.

TOP RIGHT: SPS chapter members pose with the physics-homework-themed rock. Photo courtesy of Sarah Flavin.

ABOVE: Día de la Física participants pause for a group photo. Volunteers from the University of Puerto Rico, Río Piedras, are in red department shirts. Photo courtesy of the UPR-RP SPS chapter.

Chapter Highlights

SENSING FOCUS

by Ronald E. Kumon, SPS Chapter Advisor, Kettering University B

Our Department of Natural Sciences at **Kettering University** is considering initiating an interdisciplinary engineering degree program in sensors. In response, our Physics Club organized a series of sensor-themed meetings for the spring 2023 term. Physics Club president Wenchao Liu, a mechanical engineering student, kicked off the series with a presentation on sensors for autonomous vehicles. Other talks encompassed physics, engineering, mathematics, and computer programming, and brought students and faculty together to discuss the role sensors play in some important and emerging applications. The club hopes to get into some hands-on sensor projects soon!

A COLLECTIVE CRUSHING

by Kate Luerken, SPS Chapter Officer, with the other SPS Chapter Officers, University of Oregon

Steven van Enk is a physics professor at the **University of Oregon** and a national FIDE Master—the third-highest title a player can achieve from the International Chess Federation. Many of our students are avid chess players, so when one wanted to play Professor van Enk, SPS made it happen. We held an event where 10 SPS members played him at once! We didn't earn any bragging rights, though. Professor van Enk won all 10 games!

Why Didn't We Think of That?

WELCOMING THE NEXT CLASS

by Joyce Palmer-Fortune, SPS Chapter Advisor, Smith College

Ten students from the physics department at **Smith College** gathered in early April for an unusual SPS activity—writing letters. They congratulated and welcomed the 32 students who were newly accepted to Smith and had expressed interest in a physics major. Many SPS members reached out to students who shared a common interest or came from the same geographic area. Later that month, SPS members met with several of the students they had written to during campus visits to share more about physics at Smith.

NO FLUX GIVEN

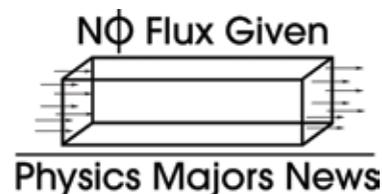
by Nathaniel O, SPS Chapter Vice President, Saint Joseph's University

The 2022 fall semester marked the first semester since **Saint Joseph's University** (SJU) officially merged with the University of the Sciences (USciences), bringing together two campuses, physics departments, SPS chapters, and student cohorts. To our chapter's delight, the number of physics students tripled. But managing this large, geographically divided department presented its own issues—issues that our preexisting structure wasn't prepared to handle.

In spring 2023 we replaced some of our regular informative meetings with a department newsletter called *No Flux Given* (NFG). As the semester developed, professors and students began sending content to include and suggestions for new sections, such as student and professor spotlights. One highlight is the weekly Hot Take, where we invite students and faculty to respond to fun prompts such as “Coke vs. Pepsi” or “Is water wet?” Answers are featured in the following edition of NFG and highlight the diverse personalities in our department. Interestingly, we've started engaging with our department's adjunct professors because of this. Many majors (including me) didn't even know we had adjuncts until we started seeing their Hot Take responses.

The effect of NFG on our in-person meetings became evident over the semester. Our two major meetings had much-improved attendance, a more relaxed environment, food, and group activities. Unlike the information-swamped SPS meetings often led by faculty, “The physics major meetings became more student-centered, as they should always be,” said Roberto Ramos, our SPS advisor. //

Chapter report excerpts have been edited for clarity and length.



THE NATIONAL SOCIETY OF HISPANIC PHYSICISTS (NSHP)

NSHP aims to promote the professional well-being and recognize the accomplishments of Hispanic physicists within the US scientific community and society. The society seeks to develop and support efforts to increase opportunities for Hispanics in physics and increase the number of practicing Hispanic physicists, particularly by encouraging Hispanic students to enter physics careers. Learn more at hispanicphysicists.org.

SPS CHAPTERS ON

HANDS-ON PROJECTS



1

After spending a month building hobby rockets, University of Northern Iowa SPS members launch them on campus.

2

SPS members at Northern Virginia Community College win the state championship in the computer science category of SkillsUSA, a competition held by industry professionals in many technical and vocational fields.

3

During Bethel University's SPS chapter Christmas party, a team prepares to build the tallest structure using one sleeve of graham crackers.

4

On Pi Day, Union University's SPS chapter hands out the 300 cupcakes they baked and iced with the first 300 digits of pi.

5

Southern Adventist University physics students take a break from building an ion beamline on campus.

6

Students at the Citadel show off their work during an end-of-term SPS project expo.

7

Lycoming College SPS members take a break from stargazing through telescopes to enjoy the campfire during a camping trip.

6

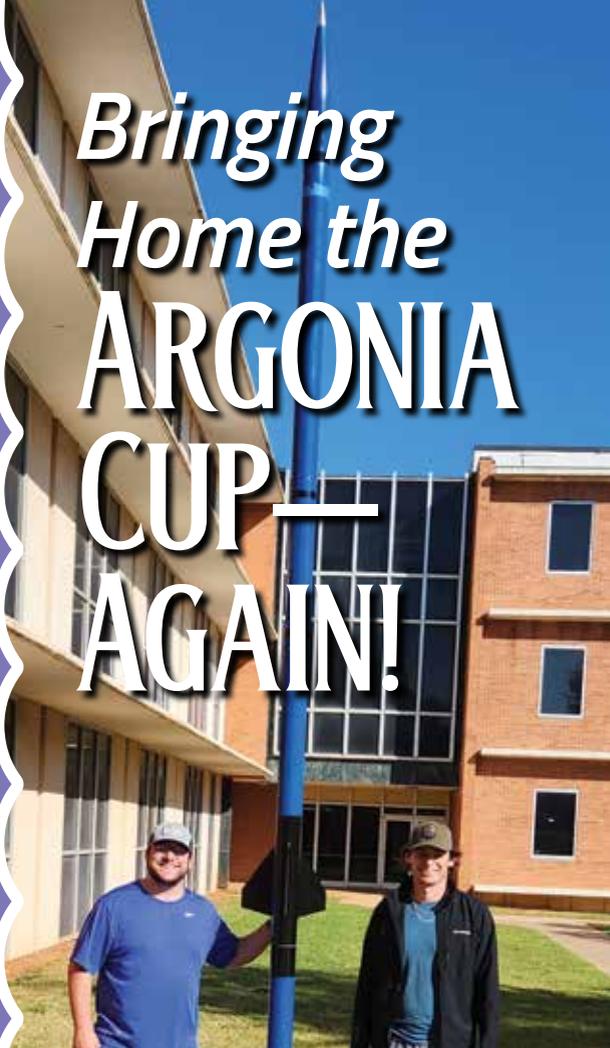


7



All photos courtesy of the SPS chapter's 2022–23 annual report.

Bringing Home the ARGONIA CUP— AGAIN!



TOP: Chris Svebek and Cody Conrady stand with the test rocket as they prepare for the 2024 Argonia Cup Rocketry Competition. Photos courtesy of the SWOSU SPS chapter.

ABOVE: The SWOSU Rocket Dawgs win the 2023 Argonia Cup!

by Chris Svebek and Jessica Massey, SPS Members, Southwestern Oklahoma State University

In March 2023 the Rocket Dawgs, the rocketry team from our Physics and Engineering Club at Southwestern Oklahoma State University (SWOSU), took home its second consecutive Argonia Cup title!

Run by the Kloudbusters Rocketry Club, the Argonia Cup is an annual rocketry competition held in Rocket Pasture, an actual pasture near Argonia, Kansas, just north of the Oklahoma border. During the two-day competition held each spring, university teams try to meet a challenge over three competitive launches (and unlimited practice launches). The rules of the competition can change from year to year, depending on whether teams successfully met the previous year's challenge. Because we nailed the challenge in 2022, there was a new challenge for 2023.

This year's challenge was to fly a two-stage rocket to a minimum altitude of 9,000 feet above ground level and then land the payload (a golf ball) as close as possible to an X on the ground. Scores were determined by the equation $A-20D$, where A is the highest altitude of the rocket, D is the distance between the golf ball and the X, and all distances are measured in feet.

We wanted to go higher than 9,000 feet, so we designed a rocket with a 2.6-inch diameter that could easily reach 10,000 feet and possibly up to 16,000 feet.

A successful two-stage launch, in which the stages fully separate in flight, is hard to achieve. The main challenge is getting the second motor to ignite properly in flight. To do this, we used redundant timer-based ignition systems that also have tilt limits. The tilt limits make sure the second stage doesn't ignite if the rocket is tilted by more than 20 degrees from vertical. Two-stage rockets also require twice as many electronics for recovery and deployment as single-stage rockets, and two-stage launches have more uncertainty. Further, the mechanical coupling between the two stages is full of opportunities for failure, including early and late release.

We planned to deliver the payload (the golf ball) to the X using a small quadcopter deployed by the rocket at its highest altitude. Using a rocket with a small diameter meant that we needed a small drone (quadcopter). We wanted a drone with 3-inch-diameter propellers that could hold a large battery yet fit into a 2.6-inch-diameter rocket (the propellers are linear and fit in the rocket tube lengthwise). So, we designed one. We ran into a few problems, but we were able to mitigate them.

At the Argonia Cup we were the only team to meet all the requirements of the competition: landing the golf ball and recovering all parts of the rocket in working condition. So, despite landing our golf ball 2.41 miles away from the X and a score of about -239,000 feet (yes, negative!), we still won the competition.

We're now preparing for the 2024 challenge, to get the highest score calculated by $A^*((N/10) + 1)$ with a two-stage rocket, where A is the height (in feet) of the upper stage (sustainer) at apogee, and N is the number of golf balls carried in the sustainer. The total impulse of the motors must be less than or equal to 5120 Newton-seconds. See you at the competition! //

The Rocket Dawgs are supported by Madeline Baugher and the Oklahoma NASA Space Grant Consortium, the SWOSU Department of Chemistry and Physics, SWOSU alums Sharon Hodges and Brock Mason, Daniel Gassen, and our amazing mentors John Yuthas, Dan Major, John Bolene, and Larry Ortega of the Tripoli Oklahoma Rocketry Club.

LEGOS, METROLOGY, AND PLANCK'S CONSTANT

Modeling an apparatus that helped redefine the kilogram

by Ivy Cartwright, Former SPS Chapter President, with Tatiana Allen, SPS Chapter Advisor, University of Tennessee at Chattanooga

After the COVID-19 lull, our SPS chapter at the University of Tennessee at Chattanooga sought a project to bring us together. We were lucky enough to find one that involved LEGOs! While we resumed pre-COVID routines and chapter activities in 2021, we wrote an SPS Chapter Research Award proposal requesting funding to construct a LEGO-based model of a Kibble balance, also known as a Watt balance.

A Kibble balance, named after its inventor, Bryan Kibble, measures the downward gravitational force on a mass by counteracting it with an upward electromagnetic force. The machine toggles between two measurement modes and indirectly equates electrical power and mechanical power, hence its other name, the Watt balance.

The balance is an integral part of a machine built by the National Institute of Standards and Technology (NIST) to redefine the kilogram, a base unit in the International System of Units (SI). The kilogram used to be defined as the mass of a specific metal cylinder kept under controlled conditions but is now based on a fundamental physical constant, the Planck constant. With this new method, the kilogram can be realized with an astonishing accuracy of about three-millionths of a percent. The complicated machine is kept under clean-room conditions, takes measurements at helium temperatures, and costs several millions of dollars.

In an effort to inspire interest in metrology and increase outreach opportunities for undergraduate students, NIST researchers built a LEGO-based model of the Kibble balance—a much simpler version of the real thing. Our goal was to construct a replica based on NIST's instructions.

Our chapter received a \$2,000 award from SPS to buy materials for the project. As we put it together, we learned more about many areas of

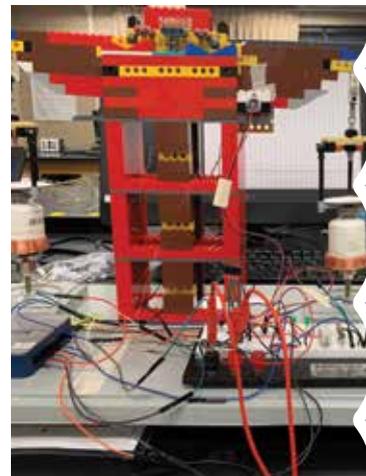
physics and metrology, improved our experimental skills, and grew stronger as a team. We have successfully used our new balance, controlled by LABVIEW software provided by NIST, in two ways—to measure a microscopic mass and to determine the value of Planck's constant.

The project was a wonderful learning experience and community-building activity for our chapter. After a period of remote learning, we were thrilled to meet in person regularly. We also benefited from working with several professors in our department—our chapter vice president even did summer research with a professor he met while completing this project.

Working on the Kibble balance also increased interest in and support for our SPS chapter. We more than doubled our membership, recruiting students from physics and other majors. The Department of Chemistry and Physics helped send SPS members to two conferences and our regional SPS zone meeting to present this project, and it gave us \$1,000 toward purchasing a more powerful computer to control the LEGO model.

The model continues to inspire our chapter. A former SPS member and physics alum helped us design 3D-printed parts that improved the appearance and accuracy of our Kibble balance considerably. We've also interacted with NIST scientists and other members of the professional community because of this project, experiences that have been invaluable for our members. And we're planning to use our LEGO model in physics outreach activities with local schools and our community.

We learned so much by constructing this LEGO-based model of a Kibble balance—the first one in the Southeast. We have truly grown as an SPS chapter and are actively looking for our next (possibly LEGO-based?) science project. //



TOP: The LEGO-based Kibble (Watt) balance. Photo courtesy of Ivy Cartwright.

ABOVE: Members of the University of Tennessee at Chattanooga's Kibble model team and friends pose with the LEGO model at the 2022 SEASAPS Meeting. Photo courtesy of Tatiana Allen.

GET MONEY FOR SPS CHAPTER RESEARCH PROJECTS

SPS Chapter Research Awards provide up to \$2,000 for physics research projects deemed imaginative and likely to contribute to the strengthening of the SPS program. Applications are due November 15 each year. For details, visit spsnational.org/awards/chapter-research.

THE INTERNATIONAL PHYSICISTS' TOURNAMENT:

A Unique and Unforgettable Experience



by Nathan Rago, SPS Chapter President,
Oklahoma State University

I was sleep deprived but determined to get my magnetic gear simulations to work. It was early morning, and the only sound piercing the silence of the night was the incessant buzzing of the fluorescent lights casting a harsh glare on my computer screen. In five short hours, the US team of six students and two team leaders from Oklahoma State University would leave for Paris, France, where seven long months of work by teams worldwide would come to a head at the 2023 International Physicists' Tournament (IPT).

The multileg red-eye that followed did little to calm my stress as I anticipated the competitive events, called physics fights, coming the next day. But that stress dissipated after we arrived at the hostel—which was nicer than most hotels I've stayed in! As teams from different countries arrived, the lobby filled with physics students and professors from all over the world. Instead of tension, the air was filled with jovial excitement as old friends reunited and new friends were made. It was our team's first time, but the IPT cohort welcomed us quickly, and the friendly conversation calmed our nerves.

The next day the competition began. I still remember the walk to the room where our first fight was held. It was a small classroom made for 20 people, but 50 squeezed in, each team and their advisors,

judges, and proctors. The room was hot, and participants were apprehensive but eager to begin. Over the past several months, each team had devised solutions to a set of challenging physics problems, and it was now time to present and defend our solutions against other teams in front of judges. With each event the teams became increasingly competitive, but the friendly nature remained.

During the first two days we competed against teams from Italy, Sweden, France, and Poland, and Team IPT, just to name a few. We saw unique and inspiring solutions to problems we had solved in our own way. Being exposed to all the different thought processes firsthand had a lasting positive impact on me and my team members, inspiring us to look at problems in a different light.

After that we had some time to relax. The semifinalists were announced, and many teams congregated to exchange stories and talk about their experiences in their home countries. Later in the week, teams France (Lyon) and Poland tied in an inspiring final round, after which participants enjoyed a community-building gala. Within a week our IPT experience had gone from an anxious beginning to an inspiring end.

Competing in IPT notably impacted us at Oklahoma State University. One of the

LEFT: The US IPT team takes one last picture, in front of the famous Arc de Triomphe de l'Étoile, before heading to the airport in Paris, France. Photos courtesy of the chapter.

TOP RIGHT: The US team midfight against teams from Poland and Italy.

ABOVE RIGHT: The US team poses for a photo between physics fights.

team leaders, Rosty Martinez, became the US representative for IPT. Team members who are now PhD candidates, and therefore unable to compete again, are looking into becoming team leaders. This past December, our school hosted a preliminary competition to determine the next US team—and won. We will be representing the US at IPT again in 2024, this time in Zurich, Switzerland. Participating in IPT was an invaluable experience that my teammates and I will carry with us into our future physics careers—a truly unforgettable experience. //

LEARN MORE

Find out more about the International Physics Tournament and how your institution can compete to represent your nation at the International Physicists' Tournament at iptnet.info. Only one team is allowed per nation.

Teaching Students to MAKE CAMERAS FROM SCRATCH

by AJ Messinger, SPS Chapter President, and Sean P. McBride, SPS Chapter Advisor, Marshall University

How do you make a pinhole camera out of cardboard tubes, aluminum foil, and tracing paper? That's what students from Davis Creek Elementary School and Highlawn Elementary School learned from members of our SPS chapter at Marshall University (MU), located in Huntington, West Virginia. We hosted two STEAM-centered (science, technology, engineering, art, and math) activities, one for each school, during which young participants built their very own pinhole cameras!

We helped students create their cameras from two cardboard tubes (of different lengths) and other household items. First, students covered one end of the longer cardboard tube with tracing paper. Then they attached the shorter cardboard tube to the longer one so that the tracing paper was in the middle. Finally, students covered the open end of the smaller cardboard tube with aluminum foil. At this point, we poked a small hole in the center of the aluminum foil to let in light. When students pointed this hole at an object and looked through the open end of the tube, they could see an inverted image of the object on the tracing paper!

When you place a screen in front of an object, you don't usually see an image of that object on the screen. That's because light reflecting off of the object interferes with other light in the room. However, a pinhole filters out most of the noise, allowing light from the desired object to travel through the tube without much interference. The images generated by pinhole cameras are sharp but very dim. The smaller the hole, the sharper the image.

After students finished their cameras, we encouraged them to find the most unique images they could. Excitedly, students viewed their school and its surroundings through their instruments. Playing with their simple devices brought them a lot of joy. The students loved doing their very own science experiments with everyday supplies. They were also excited to take their pinhole cameras home and show them off to family and friends.

Overall, both events were a success. SPS members AJ Messinger and Aidan Payton did an amazing job leading the Davis Creek and Highlawn workshops, respectively. Messinger is an alum of Davis Creek, making the event extra special. The schools told us how much their students loved the MU SPS workshop, and as a chapter, we enjoyed sharing our excitement about science with the younger generation. We hope to hold this workshop again, re-creating the excitement with new students and igniting a spark in them to learn more about the exciting field of physics and STEAM. //

Supplies for the pinhole cameras were sponsored by the MU SPS chapter through the endowed Society of Physics Students Fund.

EXPAND YOUR OUTREACH WITH AN SPS SOCK

Science Outreach Catalyst Kits (SOCKs) are free science outreach kits designed for SPS chapters. New SOCKs are created each summer by SPS interns. Request a SOCK for your chapter at spsnational.org/programs/outreach/science-outreach-catalyst-kits.



FIRST: MU SPS chapter president AJ Messinger helps a student build a camera. Photo by Victoria Maynor.

SECOND: Elementary school students consider what happens when light enters a pinhole camera. Photo by Victoria Maynor.

THIRD: A student is amazed by the inverted image produced by the pinhole camera. Photo by Kolbey Walker.

FOURTH: Students build cameras during an SPS workshop. Photo by Kolbey Walker.



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1 An SPS volunteer from Florida A&M University performs science demonstrations for a high school science class during STEM Day, with the assistance of a visiting volunteer from the Princeton Plasma Physics Laboratory.

2 University of North Carolina Asheville SPS volunteers show off demos as they cohost a branch of the North Carolina Science Festival.

3 An SPS member from Las Positas College demonstrates spectroscopy during the Tri-Valley Innovation Fair.

4 Emory University SPS members blow smoke rings with a vortex cannon during Outreach Day, an event they hosted at Spread the Word Church in Atlanta, Georgia.

5 Brigham Young University's SPS chapter shares their passion for science with local elementary school students.

6 A University of Vermont SPS member talks magnetism with a visitor at the Echo Center, a science and nature museum, during a daylong SPS outreach event there.

All photos courtesy of the SPS chapter's 2022–23 annual report.

Exploring Space at the Intersection of IDENTITY AND EXPRESSION

by Stephanie Howell, SPS Associate Zone Councilor for Zone 14, University of Colorado Denver

On an unusually rainy summer Tuesday, the Physics Identity & Expression (PI&E) Club at the University of Colorado Denver transformed the ordinary event room of the Aurora Public Library into a journey into outer space, a place where elementary-aged children could learn, discover, and explore fascinating aspects of our solar system.

The purpose of PI&E Club, which falls under the umbrella of our SPS chapter, is to be a forum for physics students from a variety of backgrounds to socialize and discuss prevalent issues facing women and minorities in the field, and to foster interest in physics and STEM through outreach. The beauty of the PI&E Club is that it exists at the intersection between identity and expression, meaning that during outreach events, we have the potential to redefine what kids think a physicist looks like.

When I was elected vice president in the fall of last year, one of my goals was to help the club reach its full potential through outreach programs. I did this by first connecting with faculty member Kathryn Hamilton, who has a history of organizing and hosting outreach events. Over the next couple of months, the PI&E Club president, Boushrah Kassir, and I met with her regularly. Where would we host the event? What would the theme be? What supplies did we need? We took inspiration from the SPS Science Outreach Catalyst Kit (SOCK) and decided to host an event on space and the upcoming solar eclipse, which the library advertised in its summer newsletter.

The event opened with a brief slideshow introducing the planets in our solar system along with the Moon and Sun, how these celestial bodies move, and how this movement is responsible for different kinds of eclipses. We encouraged the children to ask lots of questions and share their thoughts throughout the presentation.

We ended the presentation by announcing when the next solar eclipse would be visible in Colorado and how to see it safely. Then we helped the kids act out planetary motion using inflatable planets. Each child had the opportunity to be either the stationary Sun or an orbiting planet. To close the program, each child created and decorated their own pinhole camera, made from a shoebox, to take home.

Through the hard work and dedication of many, the Aurora Public Library, which serves one of the most diverse areas in the state of Colorado, became a hub of learning and discovery during our outreach program. The attendees were engaged, and we showed them a more diverse picture of what physicists look like than is often portrayed. We look forward to future opportunities to share the wonders of science with our community through our commitment to fostering curiosity and education, ensuring that young minds everywhere understand that physics is for everyone! //



TOP: Boushrah Kassir and Stephanie Howell pause for a photo before the PI&E Club outreach event. Photos courtesy of the PI&E Club at the University of Colorado Denver.

MIDDLE: Young visitors to the Aurora Public Library enjoy learning about the solar system.

ABOVE: Kids create their own pinhole cameras for eclipse viewing.

GET MONEY FOR INCLUSIVE OUTREACH EVENTS

Future Faces of Physics Awards of up to \$600 are available for chapter programs or events that promote physics and astronomy across cultures. Applications are due November 15 each year. Learn more at spsnational.org/awards/future-faces.

ECLIPSE INFO

Learn more about the April 2024 eclipse from the American Astronomical Society at eclipse.aas.org and check out the SPS resources at sigmapisigma.org/sigmapisigma/eclipse.

How Outreach Changed MY CAREER PLANS

by Jason Bier, SPS Member, Adelphi University

*"The meaning of life is to find your gift. The purpose of life is to give it away."
— widely attributed to Pablo Picasso*

When I came to Adelphi University, I wanted to pursue a physics degree but was also dead set on becoming an engineer. Throughout my first few semesters, I began to question this career plan. I adored physics and its ability to explain the inner workings of the world and the grander universe around us. I also realized that I wanted to offer my knowledge and life experience to others—to open doors for the next generation of learners.

I started problem-solving my future. I searched for a career in which I could better see my effect on those around me, where I could satisfy my desire to serve others and hopefully make a direct impact on their lives. After participating in Adelphi's physics education outreach program, Lab4Kids, I realized that teaching physics was the perfect blend of all these factors.

The physics department at Adelphi, led by Professor Matthew Wright, our department chair, is eager to open its doors to all who are interested in learning about physics. Through Lab4Kids we host various events that involve either traveling to local high schools or inviting high school students to our department. Because Lab4Kids enjoys any opportunity to reach out to the community and share our knowledge and experience, we extend our impact far beyond campus. During events we engage the students in activities and experiments such as pumpkin drops and building miniature DC motors out of batteries. We show them how physics is ever present in their lives and explain some of the phenomena we experience on a daily basis.

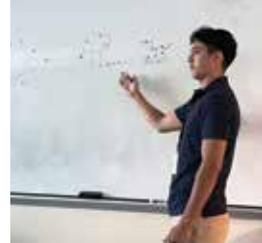
My experience with Lab4Kids culminated in an internship with a middle school

enrichment program last summer in which I designed curriculum based on the work we had done all year with Lab4Kids. Each week I created and implemented experiments and competitions ranging from an egg drop with straws and tape to bridge building with popsicle sticks and glue, visualizing magnetic fields with iron filings, creating holograms, and measuring the speed of sound.

The students I worked with enjoyed the interactive experiments and were eager to understand the science behind them. On some of the hottest days of our Long Island, New York, summer, I witnessed students excitedly inquiring about concepts like force and acceleration as they worked to protect their eggs during the egg drop. I saw them collaborating with classmates to build the strongest bridge and claim victory over their friends. It was a wonderful sight to see—kids engaged and having fun with physics.

I see attending college as a way to gain a better understanding of the world around me and access new opportunities. The impact Lab4Kids had on me during my time at Adelphi cannot be understated. Interacting with and inspiring the next generation of students gave me a glimpse of the kind of impact I could have on others in my future endeavors.

I'm now pursuing a career in physics education. Being part of the Adelphi physics program and Lab4Kids gave me both the confidence that I'm making the right choice for myself and hope for my future in teaching. I believe I can be a guiding force for students, helping to open new doors and reveal new opportunities through learning. //



TOP LEFT: Lab4Kids participants build mini DC motors out of batteries. Photos courtesy of Matthew Wright.

TOP RIGHT: Author Jason Bier sharpens his teaching skills during an outreach event.

ABOVE: Students sort through pumpkin drop data during a Lab4Kids event.

INTERESTED IN TEACHING PHYSICS?

Check out the American Association of Physics Teachers (AAPT) at aapt.org. Student members of SPS are eligible for free membership in AAPT. For details see spsnational.org/about/membership/free-ms-membership.

TEST DRIVE A CAREER AT SPS JOBS

Check out SPS Jobs for internship, research experience, and job postings in physics, astronomy, and related fields: jobs.spsnational.org.



LIGHTING IT UP: *Potato Batteries and STEM Outreach Day*



LEFT: SPS volunteer Lara Celik (right) and lab supervisor Erdinc Atilgan guide student teams in the making of a homemade potato battery. Photo by Bart Horn.

ABOVE: SPS volunteer Lara Celik demonstrates a homemade inductor coil. Photo by Sarah Rosen.

by Lara Celik, SPS Member, and Bart Horn, SPS Advisor, Manhattan College

Education is for all, and our SPS chapter at Manhattan College was proud to help bring the excitement of science to the next generation at Manhattan College's first annual STEM Outreach Day. Approximately 35 students from grades 6 to 12 and their teachers visited campus from three schools in the Bronx in New York City. Our challenge was to unite concepts and principles from electricity and magnetism in a clear, concise, and engaging manner for them during the physics station.

"STEM people change the world in so many different ways, and it's really important to get that excitement from a young age," event coordinator and SPS co-president Sarah Rosen told Spectrum NY1 News. "We wanted to run this event to give students the opportunity to be exposed to all the different things in STEM, and have the opportunity to explore and have a good time."

During the event students participated in small group activities in different STEM fields, including isolating DNA from strawberry puree (biology), designing popsicle stick bridges (civil engineering), coding games with Python (computer science), investigating acids and bases

in the kitchen (chemistry), and generating electricity (physics).

Education and diversity go hand in hand, and to reflect this in our activity, we combined visual, auditory, and hands-on modalities to engage students with different learning styles. We drew the schematics of the experiment on a whiteboard and wrote definitions, helping students understand the relationship between electric charge, voltage, and current, and interpret how electricity can be generated using batteries or inductor coils. We went through the steps of the activity using a visual projector. Students then collaborated in small groups to construct batteries out of potatoes, copper pennies, and zinc washers while SPS volunteers and faculty advisors answered questions. When students put physics to the test and connected their batteries together, both their eyes and our LED lights lit up!

Through trial and error, students figured out the differences between series and parallel connections, and all our teams were ultimately successful. One group began excitedly calculating how many potatoes they would need to charge a

phone. Although it was early on a Saturday morning, the students were actively engaged, and quite a few enthusiastically declared that the physics activity was their favorite.

For us, the event highlighted the importance of adaptability in teaching. While testing the experiment in advance, we were surprised to discover that potatoes worked as well as lemons! Then, on the day of the event, we had to adapt to meet the needs of the students who attended. The students had a range of ages, and one of the groups we taught spoke only Spanish. While some of us are bilingual, the nonpolyglots came up with creative ways to connect with the students. Visual demonstrations and hands-on learning, not to mention background music from Star Wars, helped us include everyone.

Based on enthusiastic feedback from students and volunteers, STEM Outreach Day was a great success, and both SPS and Manhattan College look forward to building on this initiative in years to come. Together we can help inspire and educate all students, and better yet, we can bring about change in the world. //

A Model OUTREACH EVENT

by Stephen Bardowell, Former
SPS Chapter President,
Tarleton State University

Tarleton State University is home to an optical research observatory that can be remotely operated from anywhere in the world. Despite the observatory's high quality, few locals know it exists. Our SPS chapter decided to host a space-themed outreach event for local students to raise awareness of the observatory.

The event kicked off bright and early on a fall morning in 2022. Volunteers arrived at the observatory at 8 a.m. to set up activities and prepare for the first group of students. By the time buses full of 7th to 12th graders arrived, we had roaring heaters and volunteers eager to guide small groups through five stations located inside and outside of the observatory—a wild round-robin of physics fun!

Small groups of students rotated through each station, but with the brisk winter air, they seemed to enjoy the heaters the most! The students huddled close to the warmth while waiting for their turn to build structures from toothpicks and marshmallows and walk through Tarleton's 32-inch Ritchey-Chretien research telescope.

By mid-morning, temperatures had risen enough that focus strayed from the heaters to the black hole simulators, where students enjoyed competing to see who could achieve the largest gravity assist. Using a neodymium magnet attached to the underside of a canvas painted to look like space, students rolled ball bearings ("spaceships") along the surface to discover the location of a hidden "black hole." Then, by carefully matching their incoming velocity to the bearing mass, students could slingshot their spaceship around the event horizon for a massive speed boost.

In the afternoon we hosted a second group, this time of 4th to 6th graders. These students particularly enjoyed firing "rockets" toward a target using nested straws attached to a balloon. By controlling the pressure in the balloon and creating wings and airfoils with tape, participants competed to see who could hit the targets from farthest away.



TOP: Students brave the cold to learn about physics and astronomy during Tarleton's outreach event. Photos courtesy of Tarleton University's SPS chapter.

ABOVE: Tarleton's SPS chapter relaxes in the lounge.

Our solar telescope received lots of attention from the afternoon group when the sun put on a display, showing a sudden uptick in prominences, stellar snakes, and even a solar flare. Back at the black hole station, one student got so good that he managed to slingshot his bearing around the black hole for two whole rotations before it rocketed off the canvas and got lost in the grass!

This event generated a lot of enthusiasm among the students and nearby schools, and showed off the observatory to many local students. We had so much positive feedback that we've decided to offer slots for future events through a lottery system. We also plan to make a few tweaks. Specifically, we plan to reduce the time students spend at each station so we can have a third group of students cycle through, and we'd also like to add a few more stations. With these changes, we should be able to accommodate even more students, introducing them to our observatory and having fun with physics and astronomy. //

BE AN SPS SUMMER INTERN

The SPS summer internship program offers 10-week, paid positions for undergraduate physics and astronomy students in science research, education, outreach, and policy. Interns are placed with organizations in the greater Washington, DC, area. Applications are due January 15 each year. Learn more at spsnational.org/programs/internships.

GET AN SPS SCHOLARSHIP

SPS and Sigma Pi Sigma award many scholarships each year to students who are active in SPS, demonstrate excellence in academics, and meet additional criteria as specified in the application. Applications are due March 15 each year. Learn more at spsnational.org/awards/scholarships.

FUTURE OF PHYSICS DAYS

Lay the Groundwork for Your Future in Physics

Future of Physics Days (FPD) events help undergraduate students gain valuable 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.

Learn how to attend March or April Meetings:
march.aps.org or april.aps.org



Outstanding Chapter Advisor & Outstanding Chapter Awards

2022–23 SPS OUTSTANDING CHAPTER ADVISOR AWARD

The SPS Outstanding Chapter Advisor Award is the most prestigious award given each year by SPS. The following SPS advisors were nominated by their students, colleagues, and departments in recognition of their dedication to furthering the mission of SPS. The winner receives a total of \$6,000 for themselves, their chapter, and their department. Learn more at spsnational.org/awards/outstanding-chapter-advisor. Nominations are due March 15 each year.

Winner:

Chad Kishimoto
University of San Diego

Runner-up:

Ronald (Mel) Blake
University of North Alabama

Nominees:

Caio Bragatto
Coe College

Tikhon Bykov
McMurry University

Ethan Deneault
University of Tampa

Luke Keller
Ithaca College

Steve Lindaas
Minnesota State University
Moorhead

Sean McBride
Marshall University

Irina Novikova
College of William & Mary

Jesus Rivera
Swarthmore College

Toni Sauncy
Texas Lutheran University

Glenn Spiczak
University of Wisconsin - River
Falls

2022–23 SPS OUTSTANDING CHAPTER AWARDS

The SPS Outstanding, Distinguished, and Notable Chapters are determined each year by the SPS Council through careful review of the SPS chapter reports. Designations are made based on chapter involvement in local, zone, and national SPS meetings, participation in SPS programs, outreach efforts, student recruitment, and interaction with their department and department alumni. To earn these designations, SPS chapters are encouraged to stay active and engaged by participating in an array of activities. Sample activities can be found in the SPS Information Handbook, available at spsnational.org/about/governance/sps-information-handbook. SPS chapter reports are due June 15 each year.

Outstanding Chapters

Zone 1

Massachusetts Institute of Technology
Mount Holyoke College
Suffolk University
University of Maine
University of Vermont
Yale University

Zone 2

Manhattan College
Rochester Institute of Technology
Saint John's University
Siena College
Stony Brook University

Zone 3

Juniata College
Lycoming College
Rowan University
Rutgers University
Saint Joseph's University
Stevens Institute of Technology
Swarthmore College

Zone 4

College of William & Mary
Howard University
Old Dominion University
Randolph College
University of Virginia - Charlottesville
Virginia Tech

Zone 5

Appalachian State University
Davidson College
Duke University
High Point University
University of North Carolina Asheville
University of North Carolina at Chapel Hill

Zone 6

Florida State University
University of Central Florida
University of Puerto Rico Rio Piedras

Zone 7

Cleveland State University
The College of Wooster
Kettering University A
Kettering University B
Lawrence Technological University
Marshall University
Wayne State University

Zone 8

Austin Peay State University
Tennessee Technological University
University of Louisville
University of Tennessee at Chattanooga
Western Illinois University

Zone 9

Augustana College
University of Wisconsin - River Falls

Zone 10

Rhodes College

Zone 11

Coe College
Minnesota State University Moorhead
North Dakota State University
South Dakota School of Mines & Technology

Zone 12

Southwestern Oklahoma State University
William Jewell College

Zone 13

Abilene Christian University
Angelo State University
Lamar University
McMurry University
Stephen F. Austin State University
Tarleton State University
Texas A&M University - Commerce
Texas Lutheran University
University of Texas at Dallas

Zone 14

Colorado School of Mines
University of Colorado Denver
US Air Force Academy

Zone 15

Brigham Young University
University of Utah

Zone 16

Embry-Riddle Aeronautical
University - Prescott

Zone 17

Lewis & Clark College
University of Washington

Zone 18

Ohlone College
University of California, Berkeley
University of San Diego

Distinguished Chapters

Zone 1

Brown University
Harvard University
Saint Anselm College
Worcester Polytechnic Institute

Zone 2

Adelphi University
Buffalo State College
City College of New York
Sarah Lawrence College
SUNY University at Buffalo
University of Rochester

Zone 3

Bryn Mawr College
Drew University
Drexel University
Gettysburg College
Moravian University
Pennsylvania State University
Ursinus College
West Chester University of
Pennsylvania

Zone 4

George Washington University
Georgetown University
Johns Hopkins University
Radford University
Randolph-Macon College
University of Mary Washington
University of Maryland, College
Park

Zone 5

Clemson University
Francis Marion University
Wofford College

Zone 6

Augusta University

Emory University
Florida A&M University
Florida Polytechnic University
Georgia Institute of Technology
University of Alabama
University of North Alabama
University of Puerto Rico,
Mayagüez
University of Tampa

Zone 7

Gannon University
Ohio University
Ohio Wesleyan University
University of Michigan, Ann Arbor
University of Pittsburgh
West Virginia University

Zone 8

Berea College
Southern Adventist University
Southern Illinois University
Carbondale
University of Kentucky
University of Tennessee Knoxville

Zone 9

Illinois Wesleyan University
Lawrence University
Lewis University
University of Wisconsin - Eau Claire
Wheaton College

Zone 10

Dillard University
University of Mississippi
University of Southern Mississippi

Zone 11

Augustana University
Bethel University
University of Northern Iowa

Zone 12

Oklahoma State University
Truman State University

Zone 13

Austin College
San Antonio College
Texas A&M University - College
Station
Texas Tech University
University of Houston
University of Houston - Clear Lake

Zone 14

University of Colorado at Boulder
University of Denver
University of Wyoming

Zone 15

Utah State University
Westminster University

Zone 17

University of Oregon
Washington State University

Zone 18

Cal Poly Pomona University
California Lutheran University
California State University, Fullerton
Las Positas College
Santa Clara University
University of California, San Diego

Notable Chapters

Zone 1

Fairfield University
Smith College

Zone 2

Hofstra University
Ithaca College
Rensselaer Polytechnic Institute
SUNY New Paltz

Zone 3

Millersville University
Saint Peter's University
Stockton University
Temple University

Zone 4

Longwood University
Northern Virginia Community
College
Salisbury University
Virginia Military Institute

Zone 5

The Citadel
Furman University
North Carolina State University

Zone 6

Wallace Community College

Zone 7

Allegheny College
Case Western Reserve University
Indiana University of Pennsylvania
John Carroll University
Kalamazoo College
Kenyon College
Washington & Jefferson College

Zone 8

Ball State University
Millikin University
Murray State University

Zone 9

Carthage College
Indiana University South Bend
University of Illinois Chicago
University of Wisconsin - Parkside

Zone 10

Louisiana Tech University
Union University
University of Louisiana at Lafayette

Zone 11

Nebraska Wesleyan University
University of Minnesota Twin Cities
University of Nebraska - Lincoln

Zone 12

Pittsburg State University

Zone 14

Colorado Mesa University
Fort Lewis College

Zone 18

California State University, Channel
Islands
California State University, Long
Beach
California State University,
Sacramento //

**UPCOMING SPS AWARD
APPLICATION DEADLINES**

March 15

- SPS Award for Outstanding Undergraduate Research
- SPS Outstanding Chapter Advisor Award
- SPS Scholarships

June 15

- SPS Outstanding Chapter Award (chapter reports are due)

For details on all SPS awards visit
spsnational.org/awards.

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