A Message from the APS CEO and the APS President

We face a time of extraordinary challenges. We know, however, that our physics community will be resilient and resourceful in the face of crisis as the world confronts the coronavirus pandemic. We saw this in Denver following the sudden cancellation of the March Meeting, as many members stepped forward to schedule and conduct online sessions to ensure the continuity of scientific exchange. APS staff worked tirelessly to support, encourage, and enable these sessions, but the drive to push so much online so fast came from the March meeting physicists. This spirit is also seen in physics departments and labs worldwide, where physicists have suspended research with almost no prior warning, and students and staff have dispersed. Now and in the coming weeks, we will all be called upon to do what we can to keep our communities healthy, keep our research and education missions alive, and prepare for an uncertain future.

As a result of the coronavirus, APS—like most other professional societies around the world—has canceled conferences and requires staff to work from home. APS has prepared for this, and thus far the staff have maintained most core activities as usual. Research meetings have been affected profoundly, however. APS meetings are essential to our worldwide physics community, and so we have taken several steps:

- The APS Board Executive Committee agreed that the April Meeting, originally to be held in Washington, DC, is canceled as an in-person meeting, but will be held online to the greatest extent possible. The April Program Committee and APS IT support are working together to implement a robust virtual meeting.
- All spring section meetings have been canceled.
- DMOP leadership will make a decision about their June meeting.
- APS is supporting several community-driven efforts to continue to place many of the planned March Meeting sessions online. We are all exploring new ways to disseminate scientific information and interact with our colleagues. You can read more about this on the March Meeting website.

The APS’s Office of Government Affairs (OGA) has focused on ensuring that our graduate students and postdocs continue to receive support, despite the shutdown of labs and universities across the country. Through a grassroots-driven partnership with the Forum on Graduate Student Affairs, APS OGA is urging federal agencies to continue to provide salaries and benefits. In addition, in preparation for any future phase of federal economic stimulus to respond to COVID-19, OGA has prepared a proposal for including scientific infrastructure in the funding package.

We acknowledge the stress so many in our community are experiencing as they close down research experiments and laboratories and pivot to teaching all courses online and hold office hours in cyberspace. The April APS News Back Page article contains some suggestions regarding successful transitioning to online teaching. In addition, we must especially look for ways to help our early career and student members, whose lives have been upended as institutes are shuttered and campuses are closed. Other actions, both large and small, are taking place throughout our community to address critical needs resulting from the pandemic. Physics labs across the country are donating much-needed personal protective equipment to local hospitals. Several groups engaged in biological and medical physics are busier than ever, racing to develop knowledge that could lead to effective treatment. Although many national laboratories are temporarily shut down, some beamlines at synchrotrons such as SLSL at SLAC remain open for important research related to the COVID-19 virus.

Like other global threats our society has faced, from world wars to national disasters (both natural and man-made), this current situation is an existential challenge, which can accelerate positive change, spur innovation, and make us stronger and more resilient. APS exists to serve its members, the physics community, and society broadly. Learn more about our efforts on our COVID-19 response page. If there are additional actions you think we should be taking at this time, please let us know (exec-office@aps.org).

We send all best wishes to you and your families, and hope that you are able to stay healthy and strong.

Sincerely,

Kate P. Kirby
APS CEO
Philip H. Bucksbaum
APS President

Resources for Online Physics Instruction

Any physics departments have quickly moved their courses online in response to the COVID-19 pandemic. Some leading resources include:

- **PhysPort (physport.org)** - APS Fellow Sam McKagan is founder and director of this user-friendly web portal hosted by AAPT that supports physics faculty in implementing research-based teaching practices. The Expert Recommendations tab has a well-developed page titled "I suddenly have to move my face-to-face physics/astrology course online! What should I do?" Sourced from dozens of experts, this vetted page includes ideas and links from how to structure your class, to group work online, to online teaching resources.
- **PRET Simulations (phys.colorado.edu)** - Winner of the 2018 APS Excellence in Education Award, this website hosts over 100 interactive simulations of physics phenomena. Most simulations can be run on the web and all can be downloaded. Curricular materials are available for most sims, which can be used to supplement or substitute for hands-on laboratory exercises.

**Virtual Chairs Meeting** - APS and AAPT jointly organize the Physics Department Chairs Meeting and will be holding a shortened version of this meeting online, likely on June 19. Chairs and other department leaders are welcome to attend and discuss lessons learned from the unexpected experiment with online education, among other topics. Look for announcements on the APS Education Programs page (aps.org/programs/education) to stay in the loop.

Please contact us at education@aps.org if APS staff can be of assistance regarding questions with online education. Also see the APS News Back Page article by Chandrakheka Singh in this issue for additional links.

The author is APS Director of Programs.
Astromonomer Annie Jump Cannon was a rare creature for her time, when most women did not receive higher education, and were expected to pursue traditional domestic priorities. She defied those societal expectations and gave us a star classification system still in use today.

Born in December 1863, Cannon’s father was a shipbuilder in Delaware and a former state senator. Cannon recalled being fascinated by the glass prismatic spectacles in the family candylalbe, detaching them occasionally to catch sunbeams and play with the light. It was her mother, Mary Jump, who encouraged young Annie’s interest in the stars, obtaining them from the family attic. She learned about the constellations with the help of an old astronomy textbook. “Stars and planets!” Cannon later said. “How prophetic was this baby amusement of the profession which was destined to fill my life.”

Cannon’s mother also pushed her to study math and sciences at what is now woman’s College. Her mentor was Sarah Frances Whiting, a rare woman physicist in the US at the time. Cannon excelled academically and graduated with a degree in physics in 1884, serving as valedictorian of her graduating class.

Cannon did not immediately pursue a career in science. While helping Wellsley return to her Delaware home instead, where she worked as a tutor in math and history. She also developed a great skill in photographing, travelling throughout Europe taking pictures with a box camera. She published a pamphlet of her photographs from Spain in 1893, which was distributed at the Chicago World’s Columbian Exposition that year.

Starting during these years, Cannon had survived a bout with scarlet fever, but the illness left her mostly deaf. Then her mother died in 1904, and Cannon found herself at loose ends and despairing. She wrote to W. W. Waring about a job opening, and her former mentor hired her as a junior physics teacher. This also enabled Cannon to pursue graduate studies in physics and astronomy, and began to learn about spectroscopy. Eventually she enrolled at Radcliffe College, with the aim of gaining access to a better telescope, as well as the Harvard College Observatory.

In 1896, the director of the observatory, Edward Pickering, hired Cannon to join his “Harvard Computers,” thanks to her academic background and considerable experience with telescopes. Their job was to complete the Henry Draper Catalog and to map and define every star in the sky at the observatory, recording all the tiny fluctuations in the brightness of various stars, as well as synthesizing data from citizen scientists making their own observations around the globe. But she particularly excelled at classification, able to list the spectra in as little as three seconds. She would place each plate on a stand, and a mirror at the base would catch the sunlight to illuminate the holographic spectral bands on the plate. Then she used a microscope to determine the spectral patterns and verbally communicate the classification to an assistant.

Two of Cannon’s fellow computers, Williamina Fleming and Antonia Maury, had devised competition classifying schemes. Fleming’s system divided stars into 15 spectral categories, depending on how strong their hydrogen lines were. There were 22 categories in Maury’s more complicated system, based on the helium line in the same star.

Cannon devised her own compromise classification scheme that is still used today, preserving some elements of both, which (we now know) are essentially ranked stars in terms of temperature, from hottest to coldest. She based her scheme on a Balmier absorption lines which divided each star, dividing them into the spectral classes.

CANNON CONTINUED ON PAGE 7

MEMBERSHIP
APS Student Ambassadors Engage with Units
BY LEAH POFENZER

The APS Annual Leadership Meeting (ALM) was held in Washington, DC, held at the end of January is an important venue for connecting leaders of APS membership units to APS staff and leadership, and this year it also acted as a training ground for a new leadership cadre: the APS Student Ambassadors. APS Student Ambassadors are undergraduate and graduate students who have committed to acting as APS representatives for their fellow students and the larger APS community.

The Student Ambassador program was first launched in Spring of 2016, and now has 20 ambassadors at 18 institutions who inform their peers about APS and its resources. Ambassadors are provided with materials about APS programs and support from APS staff to act as a valuable bridge between students and APS.

“APS is almost 50% students, and APS is definitely making a big push to help support students and early career scientists more—[the Student Ambassadors Program] is part of that,” says Sarah Monk, University of Pennsylvania, Coordinator of Student Ambassadors at APS. “The Student Ambassadors serve as representatives of APS at their institutions, so if students have questions about APS, they can go to that representative who can answer their questions or point them in touch with a person at APS who can help them.”

As part of the program, student ambassadors are given free APS memberships, as well as unique opportunities for career growth. Seven student ambassadors representative five institutions attended ALM, and participated in all APS has to offer, from being a part of Congressional Visits Day (see p. 4) to ramping up their skills at a special professional development workshop.

“Part of the Ambassador program is providing professional development and networking opportunities for these ambassadors, and we thought ALM would be a really great opportunity for them to learn more about APS,” says Monk. “At the ALM, we paired each of these students with a staff unit leader as their mentor for the whole meeting, so they had that unit leader to answer questions for them to help their career path, whatever they needed.”

In a student-ambassadors-only session at ALM, the ambassadors were given resources, both for their own career growth and their work as representatives for APS. A workshop titled “Finding Your Voice: On Campus and Off!” helped give the students tools to better communicate about themselves, their research, and as APS representatives. Crystal Bailey, Head of Career Programs at APS, headed up a careers roundtable, sharing the resources APS has for students and early-career scientists, and Monica Plisch, APS Director of Programs, provided information on Society efforts dedicated to education, diversity, and inclusion. Monk led a training session, ensuring the ambassadors had all the tools they need to be successful representatives to fellow students.

“It was very useful to have a semi-interactive presentation of all the resources APS has to offer,” says Huey Sears, a graduate student at Ohio University and one of the Student Ambassadors who attended ALM. “I know that joining APS allows students to present at APS conferences for an affordable price, but I’ve struggled in finding reasons to join APS for students who maybe aren’t ready to present yet. This presentation gave me that information, and I now feel prepared to encourage all graduate students to join APS.”

Both undergraduate and graduate students can become Ambassadors upon nomination from the chair of their physics department or from other faculty members. Students will also be able to apply to be an Ambassador online starting August 1, 2020.

CANNON CONTINUED ON PAGE 7
The Division of Atomic, Molecular, and Optical Physics (DAMOP) is a home for physicists engaged in fundamental research on atomic, molecular, and optical physics, and on related fields. DAMOP has a unique mission to help ensure the success of the physics enterprise by promoting public understanding of and support for physics, and by increasing the diversity of the physics workforce.

The Division of Atomic, Molecular, and Optical Physics (DAMOP) was created in 1950 with the merger of the two oldest divisions of the American Physical Society (APS), the Division of Nuclear Physics and the Division of Atomic Physics. DAMOP has played a central role in the development of modern atomic, molecular, and optical physics.

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GOVERNMENT AFFAIRS

APS Members Take to Capitol Hill to Make Case for Science Policy Issues

BY TAWANDA W. JOHNSON

Nearly 70 APS members recently advocated for the Society’s policy priorities on Capitol Hill during APS’s annual Congressional Visits Day (CVD), and based on their feedback, the experience was positive and productive. The event was held just before the start of the APS Annual Leadership Meeting at the end of January.

Representing 36 states across the country, groups of those volunteers participated in nearly 100 meetings to make the case for science policy priorities determined by APS members and leadership. During the meetings, APS volunteers requested that members of Congress: support the Combating Sexual Harassment in Science Act; co-sponsor the Keep STEM Talent Act; preserve methane emissions regulations for oil and gas industry; introduce legislation to keep the Federal Helium Reserve open and create a robust helium recycling program; and include funding increases of at least 4 percent real growth for key science agencies during the fiscal year 2021 appropriations process.

During the Capitol Hill meetings, leaders of APS membership units shared personal stories related to these science policy issues and explained to the lawmakers how those stories affected their communities.

Almost 70 APS members from 26 states in the US visited Capitol Hill during APS Congressional Visits Day.

Shannon Swilley Greco, a science education senior program leader at Princeton Plasma Laboratory, said she appreciated the opportunity to be “civically engaged,” adding, “I think I am a good ambassador for these issues, and I’d like to think I’m effective. And the experience helped me hone my communication skills.”

Leslie Atkins Elliott, professor of curriculum, instruction, and foundation studies at Boise State University, said she was drawn to APS's policy issues. “This is a great way for us as researchers to really come together and make the case for science policy,” she said.

An R&D spending surge could be on the horizon, as senior Democrats and Republicans follow through with proposals to channel billions of dollars into fields they deem critical to national interests. The proposals circulating on Capitol Hill differ widely, but all cite either climate change or competition with China—or both—as justification for turbocharged funding.

In January, Republican members of the House Science Committee introduced the Securing America’s Leadership in Science and Technology Act, a sweeping policy bill that recommends roughly doubling the budgets of select science agencies over ten years. Among those included are the Department of Energy Office of Science, the National Science Foundation, and the National Institute of Standards and Technology.

Committee Ranking Member Frank Lucas (R–OK) has said he hopes the bill will “start a bipartisan legislation Democrats hope to introduce later this year.

In the Senate, interest has led tochanneled billions of dollars into five “Industries of the Future” the White House has identified on Capitol Hill differ widely, but all cite either climate change or competition with China—or both—as justification for turbocharged funding.

In January, a bipartisan group of senators led by Commerce, Science, and Transportation Committee Chair Roger Wicker (R–MS) introduced the Industries of the Future Act, which would direct the White House to sketch out its vision for these areas. It also would require the administration to develop plans for doubling civilian agencies’ annual spending on QIS and AI over the next two years and for scaling up their investments across emerging technology areas to $1 billion annually by 2021.

Senior Minority Leader Chuck Schumer (D–NY) has floated a separate proposal to channel $5 billion over five years into “basic research” in areas such as AI, quantum computing, robotics, and QIS. Schumer has not yet introduced legislation for the proposal, but he reiterated his interest in the idea in a recent letter to the White House encouraging it to significantly increase funding for NSF and NIST in its latest budget request. The administration ultimately proposed steep cuts to both entities. Although it did propose ramping up spending on QIS and AI.

Proposals for bolstering R&D spending to address climate change have likewise proliferated in Congress. The House Republican bill is part of that party’s new effort to develop an innovation–centered climate policy, but a similar idea was articulated a year ago by Sen. Lamar Alexander (R–TN), who called for doubling energy research funding over five years as part of a “New Manhattan Project for Clean Energy.”

Although his proposal has not been embodied in legislation, from his position as chair of the Senate appropriations subcommittee...
Meeting Technologies That Are Putting Self-driving Cars on the Road, such as laser sensors and multi-spectral cameras, are now enabling a different type of autonomous vehicle: self-flying drones. Researchers like Pratap Tokekar, an assistant professor at the Maryland Robotics Center at the University of Maryland, are developing small, unmanned aerial vehicles (UAVs) that can be deployed as tools to improve agriculture, inspect infrastructure, and monitor the environment.

Tokekar described his research at the September 2019 Frontiers in Optical/Laser Science meeting, organized by the Optical Society and the APS Division of Laser Science. His work was done while at Virginia Tech. “The goal of UAVs is really to do any task that is dull, dirty, and dangerous,” says Tokekar. “In terms of what we have here are certainly a lot of tasks that are dull, such as going and taking images of all the plants on your farm. This is something that is easily automated with robots that can help us improve the efficiency of our farming in general, using data-driven technologies.”

Tokekar’s use of UAVs for agricultural monitoring was made possible about eight years ago, thanks to advances in battery life and improved GPS technologies. Since farms are relatively free of aerial obstacles, vehicles equipped with onboard GPS and inertial measurement units for navigation can be deployed to begin collecting data with relative ease.

For instance, if you have a constrained platform, you have, says Tokekar. “This is, in some sense, good for us as robotics researchers because now we have a constrained platform. Instead of just flying everywhere in the environment, now it is upon us to find the most interesting locations in the environment to collect samples from.”

To meet the challenge of short battery life in aerial vehicles, Tokekar’s team has been working on algorithms that can combine teams of vehicles, both aerial and ground, to maximize the amount of push each UAV platform can spend in the most interesting locations. Unmanned ground vehicles (UGVs), which have much longer battery lifetimes, can be used to transport UAVs to areas of interest and act as charging stations, where a depleted UAV could land and recharge before completing its mission.

“If you have one vehicle that has only 10 minutes, then the solution is to have multiple vehicles that can all operate simultaneously: you can have a swarm or collection of aerial vehicles all going and doing data collection, but that introduces new challenges now because you need these vehicles to coordinate with each other,” says Tokekar. “Then the questions become: How do you coordinate the actions between these aerial and ground vehicles? How do you get few ground vehicles to support a larger fleet of aerial vehicles? That’s something that we’ve actually been working on.”

Coordination between different types of vehicles is also important for UAV applications in aquatic environments where UAVs and robotic boats can be deployed together in response to oil spills or other pollutants in a body of water.

“We’ve been working on developing algorithms to use a team of aerial robots with aerial sensors that can quickly disperse in the environment and map the extent of a pollutant, find the source of a pollutant, and then coordinate with a robotic boat that can go and collect physical samples,” says Tokekar. As autonomous vehicles like UAVs improve and become more widespread, robotics researchers like Tokekar recognize the potential for such technologies to impact the workforce. Tokekar has been involved with a research project, as part of the National Science Foundation’s Future of Work program, to study the intersection between UAV technology and workers. One focus was on how using UAVs will impact infrastructure.

“We are not only improving the technology [for infrastructure inspection], but also working with stakeholders: This includes government agencies as well as inspection companies, and economists too, to see what the workforce [requires] would look like if such a technology would become feasible in the near future,” says Tokekar. “How would training requirements change, would inspectors need to also be pilots and so on and so forth? It’s an interesting program, but I think this is something that can have a tangible impact.”

The top candidate will be a qualified scientific leader with knowledge of the U.S. legislative process, science policy, and global scientific collaboration. The new CEO will have experience with the needs of diverse, multidisciplinary audiences and appreciate the intricacies of working with member-elected governing bodies. They will manage, lead, and inspire a staff and members to accelerate organizational change and resilience.

Jackie Eder-Van Hook, PhD, President, Transition Management Consulting, Inc. is conducting this search for APS. Interested candidates should read the Organizational and Candidate Profile at TransitionCEO.com/careers and submit their cover letter, resume, and salary expectations as soon as possible, but not later than Thursday, April 30, 2020. Questions should be mailed to APS2020@SearchBC.com.
tor’s office, and the discussion on immigration policies for physics graduates at North Carolina State University was a great chance to share our thoughts.”

James Vary, physics professor at Iowa State University; Klaus Bartschat, physics professor at Drake University; and Wayne Polyzou, physics professor at the University of Iowa, attended meetings with staff in the offices of US Sens. Joni Ernst and Chuck Grassely concerning the Keep STEM Talent Act.

Vary also wrote an op-ed in the Cedar Rapids Gazette about the Keep STEM Talent Act. In his piece, he stated, “Our nation’s role as a global leader in innovation, however, remains in jeopardy as the number of international students applying for physics PhDs at essential US institutions [is] experiencing a major decline...Fortunately, our US Sens. Joni Ernst and Chuck Grassley are in a position to help by co-sponsoring the Keep STEM Talent Act, which would enable high-skilled international graduate students to both study at US universities and [would] provide a path to a green card if they secure job offers from US employers after graduation.”

Bartschat said he was pleased to be among the 5 Sigma Physicists awardees.

“When I looked at the list of awardees from recent years, I recognized some of them, and I am very happy to be in such distinguished company,” he said. “I am certainly determined to keep doing what I can, and I hope that more of my colleagues will devote some energy to support the efforts of APS.”

Added Polyzou, “Today, with tight budgets, and some public skepticism about science, it is important for all scientists to try to educate the public, and in particular, lawmakers about the impact that science and science policy has on society.”

Raju Ghimire, a PhD student focused on nanoscience and microsystem engineering at the University of New Mexico (UNM) and a visiting PhD student at the University of Texas at Austin (UT Austin), pointed out, “As scientists, we have the knowledge and expertise to serve as crucial advisers to lawmakers to ensure that their policies are supported by sound, scientific data.” Ghimire helped design and implement a survey of international physics graduate students on their experiences with US visa processes and their perceptions of the US as a destination to study and work. He said his advocacy work would not have been possible without the support of his advisors Mehran Tehranl (UT Austin) and Yu-Lin Shen (UNM).

Sophia Hayes, chemistry professor at Washington University in St. Louis, said she was “both honored and humbled” to receive the distinction. Hayes used her expertise on helium during a Capitol Hill hearing. She was also widely quoted in media articles on the topic.

“We scientists often have specialized, detailed knowledge at times, and if that can be put to good use outside the lab for the betterment of society, then it’s a tremendous opportunity,” she said. Joseph DiVerdi, chemistry professor at Colorado State University, published an op-ed in The New York Times about keeping the Federal Helium Reserve beyond its 2023 closure date and creating a helium recycling program modeled after one sponsored by the National Science Foundation.

“Advocating for and helping to shape science policy assists the current generation of scientists to further and deepen our understanding of ourselves, our world and our universe. It also contributes to the process of mentoring the next generation of scientists, so that we will not be the last,” said DiVerdi.

Dany Waller said “wow” after receiving word that she had been selected for the award. She wrote an op-ed in The Louisville Courier Journal that asked congressional leaders to lift budgetary caps to promote investment in scientific research and STEM job growth. “I’m so honored to be recognized for my work. Collaborating on an op-ed really spurred me to stay involved at a local and national level at a time when I was considering disengaging from advocacy entirely,” said Waller, former president of the University of Kentucky’s Association of Women in Mathematics and Physics. “We can’t expect the public and policymakers to support our work if we are not putting in the effort to convince them of its importance.”

Francis Slakey, APS Chief Government Affairs Officer, said the 5 Sigma Physicists awardees represent the best of the best in science policy advocacy.

“APS greatly appreciates the time and effort these volunteers committed to advocacy initiatives that benefit not only the physics community but society as a whole. They set the standard for outstanding advocacy, and we look forward to working with them and many other APS members who are determined to let their voices be heard on crucial science policy issues,” he said.

The author is APS Senior Press Secretary.

Stephen Albright  
Klaus Bartschat  
Joseph DiVerdi  
Midhat Farooq

Nadia Fomin  
Raju Ghimire  
Sophia Hayes  
Amber Lauer

Wayne Polyzou  
Elizabeth Mae Scott  
James Vary  
Dany Waller

Christine Nattrass  
Tiffany Nichols  
Kevin Nuckolls  
Saeed Pegahan

Tucson, Arizona.

The author is a freelance writer in Tucson, Arizona.
CANNON CONTINUED FROM PAGE 2
O, B, A, F, G, K, and M. Astronomy the National Academy of Science’s of science from Oxford University, to receive an honorary doctorate the first part of which was published the Henry Draper Extension Charts, six volumes. She also contributed to over the oversight for the remaining Pickering died in 1919, Cannon took photographing stars in the Southern International Astronomical to remember the classifications: Cannon was the first woman Ladies of the Harvard Observatory Scholar American

CANNON CONTINUED FROM PAGE 2
with other divisions and units in APS” and to “increase the diver- sity of the DAMOP membership” (current) or her. Cannon took over the oversight for the remaining six volumes. She also contributed to the Henry Draper Extension Charts, the first part of which was published in 1937. The full extension charts were published in 1949. Cannon was the first woman to receive an honorary doctorate of science from Oxford University, and the first woman to receive the National Academy of Science’s Henry Draper Medal, thanks to a nomination by Pickering’s suc- cessor, Harlow Shapley. She also established the American Astronomy’s Astronomy Prize, Cannon Prize. Astronomer Cecilia Payne-Gaposchkin, who used Cannon’s data to prove that stars were mostly made up of hydrogen and helium, was the first honoree, and received a gold pin in the shape of a spiral galaxy. “Isn’t it the first universe ever made by a woman?” Cannon remarked when she saw the pin. Prize-winners still receive a handcrafted piece of jewelry to this day. In 1938, Cannon became the William C. Bond Astronomer and Curator of Astronomical Photographs, a position she held until her death on April 13, 1941, at the age of 77. She catalogued some 350,000 stars in her lifetime, discovering over 300 variable stars, five novas, and one spectroscopic binary star in the process. Further Reading: Getiche, Carole. Annie Jump Cannon, Astrono- mer, Guilder, L.A. Pelican, 2011. Greenwood, George. (1993). “The Ladies of the Observatory Hill.” American Scholar 62(3): 437-446. Sobel, David. The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars. New York: Penguin, 2016.

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The APS CVD because she “knew very little about how groups like APS help shape policy decisions.” Elliott continued, “I enjoyed the insights into that process and thinking about how science isn’t serendipity, but the outcome of deliberate actions by scientists and lawmakers.” The APS CVD experience was “quite positive,” said Pushpa Bhat, senior scientist at Fermi National Accelerator Laboratory. She noted that congressional staffers were “susceptible of attracting the best and brightest” students to study and work in the US — a primary goal of the CVD STEM Talent Act. “It doesn’t make sense to have these students trained here and then have them leave,” she explained. Much to the delight of Jason Fry, assistant professor of physics and astronomy at Eastern Kentucky University, he received great news during his meetings. “US Rep. Tim Burchett (TN-2nd) and US Rep. Andy Barr (KY-6th) both said they would like to co-sponsor it,” he said, excitedly. “Everyone we talked to said it sounds like a good idea.” APS CVD continues to be a high- light event for APS members and the Society’s advocacy efforts, said Callie Pruett, Senior Strategist for Grassroots Advocacy in the APS Office of Government Affairs (APS OGA). “We equipped nearly 70 APS members to confidently go into meetings and speak on five key issues. And we strengthened our coalition of APS members who have already taken an active role in advo- cating for the future of science,” she said. APS members provided good feedback about their meetings on Capitol Hill, added Pruet. “There are new avenues now open with congressional offices to help advance the Keep STEM Talent Act and the Combating Sexual Harassment in Science Act, address the helium crisis, counter the rollback on climate emissions, and increase the federal research and development budget,” she explained. “Our teams were well-prepared, organized, and on their A-game, and the feedback from the offices reflected that.” Following the CVD, Pruet said US Sen. Chris Van Hollen (MD) and US Sen. Dianne Feinstein (CA) signed on as co-sponsors the Combating Sexual Harassment in Science Act in the Senate. Additionally, US Rep. Himes (CT-4th) and Van Hollen have both added co-sponsorships the Keep STEM Talent Act in the House and Senate, respectively. “These legislative developments have a direct connection to APS’s advocacy efforts. As follow-up and communication continues, we aim to see more results and co-spon- sors,” said Pruet. “CVD is a great example of APS staff across departments and regions working together to provide a unique opportunity for APS members,” said Mark Elsesser, Associate Director of Government Affairs in APS OGA. “The day continues to be a success because of the strong coordination between several APS departments, including OGA, Communications, and Membership,” he said. Keeping members engaged on important science policy issues is a key goal of APS OGA, explained Francis Slaney, Chief Government Affairs Officer. “We want to make sure our members are fully equipped to take advantage of as many and as many as possible to make their voices heard on crucial science policy issues that impact the physics community and scientific enterprise,” he said.

CVD COVID-19 CONTINUED FROM PAGE 1

APSA MEE TS

The in-person APS March and April Meetings are being canceled. APS is supporting virtual access to March Meeting presentations and is working actively to provide a virtual April Meeting. Virtual content from the March Meeting. There have been a number of spontaneous initiatives by individuals and small groups of researchers aimed at enabling the sharing of research that would have been presented at the March Meeting. A number of March Meeting units and attendees have organized virtual March Meeting sessions. Check march.aps.org/about/sharing-your-research/regularly for updates.

Virtual April Meeting Confirmed. APS is excited to announce that the April Meeting will be the inaugural APS Virtual Meeting, taking place over the same dates (18-21 April 2020). APS staff have selected a third-party virtual meeting platform that supports live sessions, real-time audio and tech- nical support for live sessions, and pre-recorded talks. The platform also will allow small groups of participants to interact directly with each other and exhibitors. For the latest visit aps.org/covid-19.

Registration refunds. APS has processed the majority of the March Meeting registration refunds. Upon processing the refund, it will take up to three days for the credit to appear on the credit card from which the payment was initiated. In addition, each registrant should receive an email from meetings-refunds@aps.org that includes a copy of the refund invoice. It is each registrant’s responsibility to provide a copy of the refund invoice to the party who paid for their registration, as applicable. If you have not received an email from meetings-refunds@aps.org or do not see the credit on your statement, please check your APS account at my.aps.org under My Orders or feel free to contact meet- ings-refunds@aps.org and include the following information so we can investigate: Registrant Name Registrant ID number Credit Amount Expected Last four digits of credit card number (if known) APS has started processing meeting registration refunds for the April Meeting and will follow a similar process.

Note: Some funding agencies permit investigators to use grant funds to pay nonrefundable travel costs resulting from can- cellations. Among these are the DOE Office of Science and NSF. Visit the funding agency’s website for more information and check with your program manager or agency office if in doubt.

APS News and Physics Today

APS members will continue to receive print copies of APS News and Physics Today. If you currently receive them at your workplace, you may go to your my.aps.org profile to change your address to receive them at home. We would also like to remind everyone that they can read all the articles pub- lished by APS News free online: aps.org/apsnews. Membership

APS extends thanks to all members who continue to demon- strate support of the Society by renewing their membership. Processing of new memberships and renewals is functioning as usual. If you have any questions about your membership status, unit membership, or other details, you can contact APS Member Services at aps.org/membership.
Moving Physics Courses Online on Short Notice

BY CHANDRALEKHA SINGH

n the midst of the COVID-19 pandemic, many physics instructors have suddenly found themselves in an unprecedented situation: their institutions are immediately transitioning to a completely online format. Here are some strategies and resources that can help you and your colleagues navigate such a situation. Keep in mind that being compassionate and providing maximum flexibility to students is critical, particularly if they did not sign up for an online course and many of them may not have necessary resources, e.g., access to a computer with reliable internet connection or a quiet room at home or required to be due to caring for a sick family member in order to complete all of the requirements of your online course. Everyone is anxious and trying to do their very best, so whatever you and your students can accomplish is good. Communicating frequently and clearly with students is key.

There are many online resources, for example, Linda Strubbe has created an excellent cross-collaborated resources on PhysPort [3], which is no longer available so you should definitely go over it in its entirety. Below, I summarize several things to keep in mind while preparing for and executing your online physics courses, including labs:

1. Keep the focus on the learning goals and objectives of your course. For example, if your big picture goals are to help students learn to think like a physicist and help them become independent learners and excellent problem solvers, think carefully about strategies for how your online course will accomplish that [1–3]. Reduce the overall content coverage and instead focus on effective approaches to engaging students and assessing their learning.

2. For lecture-based courses, decide whether it is better to deliver your lectures synchronously or asynchronously. Synchronous approach involves streaming your lectures live. Discussions and peer interactions can occur as they would not in a brick and mortar classroom. You can record the streamed lectures and students can watch them at different times of the day so that students whose online internet connections do not reliably support video.

3. Consider establishing virtual office hours and have them at different times of the day so that students in different time zones can connect with you. Live one-on-one or few-on-one sessions will give your students an opportunity to ask questions. You will have had to reflect on the material and work on homework. A discussion board, e.g., Blackboard or Canvas, where students and you can discuss what students are finding challenging and there is a record of those discussions for all students can be invaluable. Also, using low-bandwidth methods like chat apps may be particularly helpful for students whose internet connections do not reliably support video.

4. Consider using pre-recorded lectures, created either by you or by others. This way you can use all of the synchronous time with students for interactions, discussions, and reflections. This approach is common in the “flipped mode” [4] of teaching in which most of the meeting time with students is devoted to activities in the spirit of “just-in-time teaching” [5,6]. Students interact with their peers and instructor after having gone over the pre-recorded lecture and can provide and receive peer-assessment tasks. Videoconferencing solutions such as Zoom have breakout rooms so that a smaller number of students can work with each other on the physics problems you assign. Then, students can go back into the same virtual room for a general discussion. In large classes, you may poll students by asking multiple-choice questions [7] that focus on your learning goals although it may be more difficult to engage students in peer interaction in this mode. Also, if you are pre-recording your own lectures (8), make sure that you break your lecture into roughly 10-minute sub-lectures and intersperse them with online assessments. This design is conducive to maintaining students’ attention and giving them an opportunity to assess their learning between different modules. Each of these pre-recorded sub-lectures can be, e.g., voice over power point or similar to Khan Academy offerings (9) you will need a laptop or iPad with ability to write on it. Try to incorporate good visuals and if possible lecture demonstrations especially for introductory physics. If you are using pre-recorded video lectures, you can use the existing resources for introductory physics [4], although it may cost money.

5. For lab courses, take advantage of interactive virtual labs, simulations, and journal articles. There are many such virtual labs (e.g., see [10–13], some of them are free while others may cost money beyond a 30-day trial period). Articles in the American Journal of Physics (AJP) and The Physics Teacher (TPT) can be great resources in online teaching not only in lecture-based courses but particularly for your lab courses at all levels. For example, there are many experiments that have been discussed in a pedagogical manner in AJP and TPT. In these articles, e.g., instructors have often shared insights about classic experiments, e.g., single-photon experiments for which video data are available [14], the Millikan oil drop experiment [15], muon decay [16], and many others. You could ask students to read about the experiments and then write about which aspects of those experimental set ups made them effective, how things evolved in that field and how trouble shooting was done, what the experimental errors were, and their implications to physics in general and various other issues based upon your goals. You can have a virtual discussion with the students about what they got out of those papers and assess them on their writings and discussions. If possible, combine these tasks with interactive simulations and data analysis. Similarly, for upper-level lecture classes, AJP and TPT articles often provide nice overview of a field including common student difficulties that can make it easier for students to understand the concepts. This can help students learn to read and reflect upon journal articles (good for becoming a lifelong learner) and enjoy the whole experience.

6. Remind yourself that these are extraordinary circumstances and feel free to change assessment approach and be considerate. It is ok to change assessment strategies as well as grading rubric and adjust the emphasis before and after going online. For example, it is ok for you to reduce the weight on the final exam or even eliminate the traditional final exam in favor of many low-stakes assessments, formative projects, and online peer evaluations (that can be pre-recorded or can be synchronous so that students can field questions from their peers and you). Student projects to reduce isolation (particularly because isolation can increase anxiety) and to benefit from interactions. You can come up with novel group projects that meet the goals of your course in lieu of the final exam especially for your upper-level courses that require students to work in groups but have some individual accountability built into the course (e.g., all students must contribute some part of their project individually and answer questions by peers and instructor). If you must give final exams that students will do at their own pace at home, use an honor code. Try to be especially considerate to students who may not have resources at home to take advantage of the full online learning environment. Be inclusive and think about whether it is appropriate and equitable to give students who cannot do the work due to constraints an incomplete so they can make up later or modify requirements for them commensurate with their constraints so that they can finish with everyone. Consider not giving a grade lower than what they would have gotten based upon their performance on the course thus far before going online.

7. Remember that technology is a tool and not the goal. Make sure the focus is always on your students and their learning based on your learning goals and personalize learning as much as possible in this online environment so that students who are already disadvantaged in many ways are not further disadvantaged. Share your ideas with your colleagues and help each other. We will learn a lot about online learning at the end of this challenging period!

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