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# APS NEWS

A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY

INTERNATIONAL AFFAIRS

## Serving APS International Members and Physicists Worldwide: A Crucial Endeavor of APS

BY TAWANDA W. JOHNSON

APS is committed to serving the world's physicists through its meetings, publications, and many programs and initiatives. More than 23% of APS members live outside the United States in more than 100 countries, and physicists often cross continents to attend APS meetings.

For example, about 30% of 2019 APS March Meeting attendees traveled from outside the United States. Additionally, with some APS meetings going virtual due to COVID-19, international physicists have unprecedented access to APS meetings. In fact, the 2020 APS Virtual April Meeting attracted more than 1,800 physicists from outside the United States, accounting for more than 25% of attendees—up from an average of 6% during previous April Meetings.

Along with international participation in APS meetings, more than 70% of articles published in APS

journals are co-authored by scientists outside of the United States. Still, some physicists have asked: Why would a non-US physicist join the American Physical Society? In a 2017 survey, APS members, regardless of their nationality, stated they value being "part of a larger physics community" as the primary reason for joining APS [1]. This data point underscores APS's role as a "global hub" where physicists throughout the world connect with one another.

Toward that end, in 2017, APS CEO Kate Kirby launched the APS Task Force on Expanding International Engagement to examine how the Society could better serve its international

INTERNATIONAL CONTINUED ON PAGE 7

GOVERNANCE

## Departing APS CEO Kate Kirby Looks Back

Over the past twelve years, Kate Kirby has been with APS as Executive Officer (2009-2014), and then following reorganization of the Society's governance structure, as the first Chief Executive Officer (2015–2020). Kirby will step down as CEO at the end of 2020 as her replacement, Jonathan Bagger of the TRIUMF Laboratory in Canada, prepares to assume the role in January.

Before joining the staff of APS in 2009, Kirby was Director of the Institute for Theoretical Atomic, Molecular and Optical Physics at Harvard-Smithsonian Center for Astrophysics. She earned her bachelor's degree in chemistry and physics from Harvard/Radcliffe College and her PhD from the University of Chicago. From 1988 to 2001, she served as an Associate Director at the Harvard-Smithsonian Center for Astrophysics, heading the Atomic and Molecular Physics Division. Her research interests lie in theoretical

Kate Kirby

atomic and molecular physics. Kirby is a fellow of both APS and AAAS.

*APS News* talked with Kirby about her time at APS. The interview has been edited for length and clarity.

**How did you come to be Executive Officer at APS?**

When APS was looking for

KIRBY CONTINUED ON PAGE 6

EDUCATION

## The National Mentoring Community Launches New Ways to Connect Members

BY LEAH POFFENBERGER

For some physics students, particularly those who are from marginalized racial or ethnic groups, taking physics classes or joining physics departments can be a daunting and solitary experience. Students of color often don't see themselves reflected in the culture of their physics departments, leading to feelings of isolation and an increase in the chance they might decide physics isn't the field for them.

The APS National Mentoring Community (NMC) was formed to reverse the trend of African American, Hispanic American, and Native American students leaving their physics programs by matching students with mentors who can provide guidance, support, and resources. In an age of online school and meetings, the NMC has launched a number of virtual options to continue to support

Simone Hyater-Adams

students and build mentor-mentee relationships, ranging from a brand new NMC Slack workspace to holding the annual NMC conference online.

The new NMC Slack workspace is designed as a hub for members of the NMC to connect with each other and to access resources.

"NMC typically sends out e-mail

NMC CONTINUED ON PAGE 5

MEMBERSHIP UNITS

## The APS Division of Laser Science

BY ABIGAIL DOVE

With 1,250 members, the Division of Laser Science (DLS) is a home for physicists engaged in research and development of new lasers and associated laser technologies. This encompasses the physics of lasers, light propagation and control, and the development of advanced lasers, single photon light sources, as well as wide-ranging new applications of lasers and laser light.

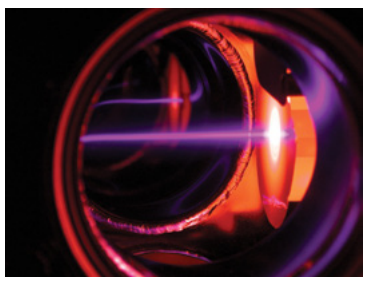
Beyond this, DLS chair Rick Averitt (UCSD) noted that DLS welcomes "all researchers who use lasers in any way, shape, or form in their research." This is quite a large group: Lasers are ubiquitous in numerous areas of research inside and outside physics, including but not limited to metrology, metamaterials, optical microscopy and nanoscopy, control of light in complex systems, the use of light for complex control, quantum materials, vibrational dynamics in molecules and biological materials, and quantum computing, computing, and sensing.

Laser science also has wide-ranging practical applications. In medicine, lasers are a key component in cancer diagnosis and therapy and are frequently used for eye and other soft tissue surgeries. Lasers are also fundamental to modern biomedical imaging: The advent of super-resolved fluorescence microscopy has opened a new world of visualizing the molecules of life. In industry, lasers are used to cut, weld, and engrave hard materials, and have enabled 3-D printing and scanning. In information technology, lasers form the basis of photolithography for modern semiconductor manufacturing and are fundamental to the fiber-optic devices that have ushered in modern communications and the Internet.

Researchers in laser science are themselves as diversified as this array of topics—pursuing both experimental and applied work and spanning academia, industry, and national labs.

A particular point of pride for DLS is its involvement in two major conferences on laser science: CLEO (Conference on Lasers and Electro-Optics) and the Laser Science conference.

CLEO—co-sponsored by DLS, the Optical Society (OSA), and the Photonics Society of the Institute for Electrical and Electronics Engineers (IEEE)—is focused on advances in research and technology in the laser science industry. With a regular attendance of over 5,000 people, CLEO typically draws 1,300 contributed talks, 400 posters, and 20 invited talks across categories like Applications & Technology (e.g. laser-based manufacturing and nanoprinting, advances in semiconductor technology, and biomedical applications),



Lasers are ubiquitous in physics. Here, a purple laser beam slows erbium atoms emerging from an oven at 1300°C, in preparation for trapping and cooling.

IMAGE: NIST

Fundamental Science (e.g. quantum optics of atoms, molecules, and solids, quantum information and communication, and metamaterials and complex media), and Science & Innovations (e.g. micro- and nano-photonic devices, quantum and atomic devices and instrumentation, and semiconductor lasers). After a successful virtual meeting this spring, the next CLEO meeting is tentatively slated for May 9-14, 2021 in San Jose, California.

Laser Science, the division's annual meeting, is held jointly with OSA's annual meeting, Frontiers in Optics, in an event called FiO+LS. Drawing over 2,000 people from across the APS and OSA communities, FiO+LS features around 500 contributed talks, 70 invited talks, and 250 posters spanning

LASER SCIENCE CONTINUED ON PAGE 6

EDUCATION

# Two New Bridge Program Graduates Share Their Stories and Advice

BY LEAH POFFENBERGER

The APS Bridge Program launched in 2013 with support from the National Science Foundation to increase the number of PhDs in physics awarded to underrepresented minority students, particularly African American, Hispanic American, and Native American students. A significant gap exists between the number of underrepresented minority students who receive bachelor's degrees in physics and the number of PhDs awarded. The Bridge Program works to fill this gap with a one- to two-year post-baccalaureate program, designed to give students experience and increased preparation for entering PhD programs.

Brian Casas

Manuel Bonilla Lopez

In May 2019, the first PhDs were awarded to Bridge students Tommy Boykin and Kevin Galiano. Now, they are joined by two new Bridge alumni who have recently received PhDs: Brian Casas (University of California, Irvine, UCI) and Manuel Bonilla Lopez (University of Southern Florida, USF). Casas and Bonilla both took time away from new positions—Casas is a postdoctoral researcher at the National High Magnetic Field Laboratory, and Bonilla is an engineer at Intel—to share their stories of success and advice for other students hoping to launch careers in physics.

Casas, who studies exotic materials, pinpoints the beginning of his interest in physics to a childhood fascination with crystals after various field trips to museums. While he initially began his undergraduate career at Rutgers University as a chemistry major, he quickly switched to physics and eventually found his way into condensed matter research.

"For a large chunk of my undergraduate career, I didn't know other physics majors and I didn't know how to navigate that space with academia until I found other older students to be mentors," says Casas. "I joined a research lab as a senior [studying] condensed matter—I worried about it being my first research experience, but I really enjoyed getting to study in a different way."

Inspired to continue his physics career, Casas applied to two graduate programs, but after being rejected from both, he applied to the Bridge program at USF, headed up at the time by Bridge Program Director Casey Miller. At the USF, Casas found a supportive community and a launching point for his research endeavors.

"It was a great experience because I [started] doing graduate course work, and with other Bridge Fellows there at the time, it had the largest population of Latinos I've seen in a physics department," says Casas. "The culture was extremely supportive, and I had a sense [that] I could maybe succeed in this realm."

For his PhD, Casas transferred to UCI to pursue his research interests in topologically non-trivial matter. "These are phases of matter that are fairly new, next-gen electronic materials. I'm not so interested in

BRIDGE CONTINUED ON PAGE 5

THIS MONTH IN

# Physics History

## December 1934: Discovery of Cherenkov radiation

Science builds on all the knowledge that came before, and the story of Cherenkov radiation is no exception. In this case, it arguably begins with Oliver Heaviside, an English electrical engineer, mathematician, and physicist, even though the phenomenon is named after the Soviet physicist Pavel Cherenkov.

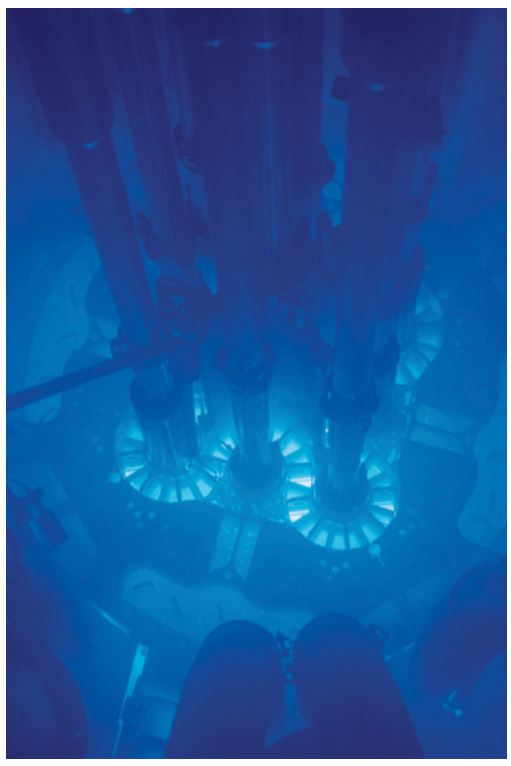
A product of the London slums that also produced Charles Dickens, the red-haired, diminutive Heaviside fell ill with scarlet fever as a child, which left him partially deaf. He was socially awkward and didn't get along with the other children at school in Camden Town, although he was a top student in every subject save geometry. Heaviside dropped out at 16 to continue his schooling at home. His uncle was Sir Charles Wheatstone, who co-invented the telegraph in the 1830s and was a recognized expert in the new field of electromagnetism.

Within two years, young Oliver found himself working as a telegraph operator, quickly advancing to chief operator. Heaviside discovered John Clerk Maxwell's seminal treatise in 1873 and was so enthralled by the work that he quit his job the following year to study it full-time, moving back into his parents' home in London. Once he'd grasped the essential points, "I set Maxwell aside and followed my own course," Heaviside later recalled. In the end, he reduced Maxwell's equations from 20 down to four vector equations and built upon that work to develop vector calculus.

In 1888, Heaviside published a paper in The Electrician, in which he explored the electromagnetic effects of a charge moving through a dielectric. "If the speed of the motion exceeds that of light, the disturbances are wholly left behind the charge, and are confined within a cone," he wrote. Unfortunately, nobody paid much attention to Heaviside's work in this area—he was an eccentric recluse later in life. His contribution wasn't uncovered until 1974, revealed in a one-page letter to Nature by physicist Tom Kaiser.

A 1904 paper by Arnold Sommerfeld theoretically predicting Cherenkov radiation also failed to gain traction within the scientific community. And in 1910, Marie Curie notably referenced an observation of a strange blue light during her research into a highly concentrated radium solution. "Nor was this the end of the wonders of radium," she wrote. "It also gave phosphorescence to a large number of bodies incapable of emitting light by their own means." Neither Marie nor her husband Pierre followed up on the observation, but their French colleague, Leon Mallett, began studying the phenomenon in earnest in 1922.

Pavel Cherenkov
IMAGE: WIKIMEDIA COMMONS



Radiation from a nuclear reactor submerged in water causes the blue glow of Cherenkov radiation.
IMAGE: ARGONNE NATIONAL LABORATORY

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OBITUARY

# Robert Park 1931–2020

BY LEAH POFFENBERGER

Robert L. Park, founder of the APS Office of Government Affairs, University of Maryland (UMD) professor, and relentless defender of scientific decision-making, died on April 29, 2020. He was 89.

Park came to APS in 1983 to open an office in Washington, DC, dividing his time between UMD and his work at APS. He was originally asked to report to the APS Board on what was happening in Washington regarding science policy, and while he was not engaged in today's version of science advocacy work, Park was a strong voice for science. His report-out to the APS Board evolved into a widely read (in Washington and elsewhere) publication titled *What's New*, a weekly one-page summary of policy news, peppered with Park's honest, unapologetic, and often hilarious commentary.

In his weekly chronicles of policymaking in DC, Park earned a reputation as a staunch advocate for using science—and common sense—to direct policy, and as an adversary for would-be peddlers of pseudoscience. Politicians, policy-makers, and quacks alike were held accountable on topics from manned missions to Mars to false claims of perpetual motion machines. Often on topics like missile defense, Park consulted General Persiflage and Puff Panegyric—his fictional sources at the Missile Defense Agency—to bring a humorous note to his sharp commentary.

"I think everybody who read What's New had to confront the truth of the science. Regardless of what the political issue was, [Park] was making it clear to all his readers what common sense has to say about the issue. And then we'd all have to confront that in our own way," said Francis Slakey, Chief External Affairs Officer at APS. "He brought some common-sense perspective to all the lobbyists in Washington. He had such an enormous readership in DC that I'd say it forced all of his readers to reflect on what the science was telling us about the issues."

Park's no-nonsense approach to science-based decision making brought him many fans, among them APS President Phil Bucksbaum, but also a number of detractors, who Park again managed with humor.

"Like many APS members, I was a devoted fan of Bob Park's weekly *What's New* column, with its irreverent wit about Washington, pseudoscience, and anything on his mind that fit his own description, [summarized as] 'Opinions are the author's and are not necessarily shared by the APS, but they should be,'" said Bucksbaum. "The column had a progressive bent, to say the least, and so it also had some detractors. I once saw Bob during the time that he was recovering from an injury from a tree falling on him. Bob was laid up for many months but had finally got to the point where he could attend our meeting of the *Physics Today* Advisory Committee. Bob thanked us for all the get-well wishes. He also said that he received a few notes from his column's detractors about how the tree was God's punishment.

**Robert Park**
IMAGE: UNIVERSITY OF MARYLAND

We were kind of shocked, but Bob followed up with a twinkle in his eye, 'You know, I cherished those comments.'"

Bucksbaum adds, "Bob's greater legacy was to give APS members a voice on public policy. As APS Director of Public Information, he established our Washington Office. This has become one of the most important services that we perform for our members, and for the field of physics."

Park, who was born in Kansas City, Missouri, decided to pursue a career in physics after serving as an electronics officer in the Air Force during the Korean War. He attended the University of Texas, receiving a BS in Physics with High Honors in 1958 and a MA in Physics in 1960. He then attended Brown University as an Edgar Lewis Marston Fellow, earning his PhD in 1964. For the next decade, he worked at Sandia National Laboratories until 1974, when he became a professor at UMD. From 1978 to 1982, Park served as Chair of the Department of Physics at UMD before joining APS to launch its Washington office. He stepped down as the Director of Public Information for APS in 2006 and retired from UMD in 2008. He was followed as Director by Michael Lubell, Professor of Physics at the City University of New York.

Park received the 1998 Joseph A. Burton Award from APS for informing the public about physics and the 2008 Philip J. Klass Award of the National Capital Skeptics for promoting critical thinking. He was also a Fellow of APS, the American Association for the Advancement of Science, and the American Vacuum Society.

In addition to his weekly production of *What's New*, Park also wrote two books, *Voodoo Science: the Road from Foolishness to Fraud* published in 2000 and *Superstition: Belief in the Age of Science* published in 2008. *Voodoo Science* has been translated into nine languages, broadening the reach of Park's mission to promote science-based decision making. He also contributed features to *The New York Times*, *The Washington Post*, and *US News and World Report*.

"The topics [Park] would write about in *What's New* are the topics he wrote about in Voodoo Science. He was trying to bring common sense,

ROBERT PARK CONTINUED ON PAGE 6

EDUCATION

# New Faculty Workshop Explores Techniques for Teaching Online

BY LEAH POFFENBERGER

Since 1996, the New Faculty Workshop, a partnership between APS, the American Association of Physics Teachers (AAPT), and the American Astronomical Society (AAS) with support from the National Science Foundation (NSF), has been providing early career faculty with best practices in physics education. Typically, the New Faculty Workshop is held twice a year at the American Center for Physics, but this year's Fall workshop made a successful pivot online, allowing attendees to experiment with new tools for online teaching.

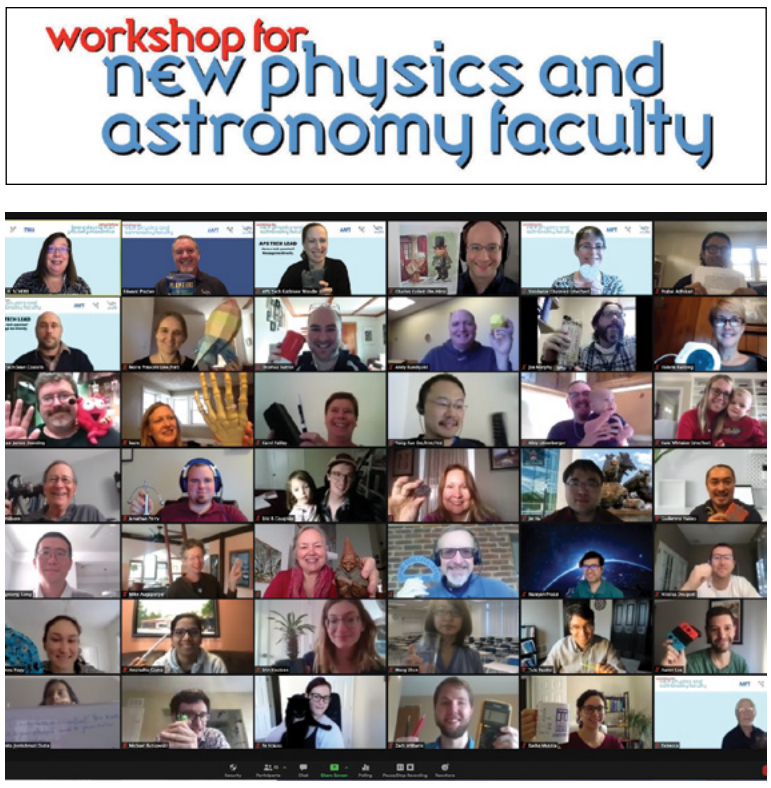
The ongoing mission of New Faculty Workshops is to help faculty members who are new to teaching hone their skills with effective strategies from the latest educational research. The latest New Faculty Workshop focused on strategies to promote active learning while navigating an online teaching environment. The Workshop ran from October 15 to 17 and drew over 130 attendees—roughly double the usual number of participants.

"This past workshop was open to anybody—we had tenure track faculty, lecturers, even a couple of post-docs," says Kathryne Woodle, Project Development Senior Program Manager at APS. "Participation in the fall workshop included about 30 percent women, which is above the national average of female participation in physics, and having the workshop online enabled a lot of people from smaller or underfunded departments to participate in ways they haven't been able to before."

The New Faculty Workshop was originally slated to be held in person, but aside from being online instead of in-person, the workshop was able to go on mostly as planned. The organizing team was able to work with presenters to bring their talks online through Zoom to cover their original topics—which happened to include a number of new online teaching techniques.

"Part of what the New Faculty Workshop does is demonstrate active learning—then new faculty can use it and then demonstrate it in the classroom. How do we do this online?" says Woodle. "We worked with using Zoom breakout rooms to facilitate those kinds of discussions and helping faculty think about what is possible. A lot of people are getting experience online, but there's a lot of interest in evolving their teaching."

Among the highlights of the conference were: demonstrations on how to use online teaching tools like Jamboard, Padlet, and Mentimeter, a well-attended session led by NSF program officers, and a vibrant and active Slack channel for all participants. Attendees were also given a new way to get the most out their New Faculty Workshop with the help of a "Participant Planning, Development and Reflection Document." Participants were encouraged to fill out their documents with aspects of teaching or learning they were hoping to develop during the workshop, culminating in a plan for future teaching implementing what they learned.




New Faculty Workshop Participants

Much of the New Faculty Workshop content was organized by AAPT, but this year APS took the lead on the technical aspects of moving the conference online. Woodle attributes some of the success to participants now being familiar with a lot of the technology. Several attendees expressed their opinions over the Slack channel, including one who called the workshop "the smoothest, most well put together large gathering I've done online ever."

Based on the success of this year's online workshop, more New Faculty Workshops will likely go online in the future, even when the option to meet in person is available again.

"We were also pleased enough with the online workshop that our plan is to do an online workshop every other year," says Robert Hilborn, Principal Investigator for the New Faculty Workshop and Associate Executive Officer at AAPT. "It seems that a fair number of participants indicated that the online workshop was easier to attend because there was no travel involved. Some colleges and universities don't have the funds to support travel and registration for people at the workshop—having online workshops enables us to serve a broader audience."

Online workshops are a key part of a new NSF grant proposal to keep the New Faculty Workshops up and running, along with adding a new focus to the program.

"We're making it our focus to show participants that we're working with them in a holistic fashion. We know faculty members have different expectations of them—some colleges might expect more teaching or more research.... How do you balance that?" says Hilborn. "We're bringing that out as more of a theme of our future workshops—we really haven't given the participants a coherent way of thinking about all those different expectations."

Whether online or in-person, New Faculty Workshops will continue twice yearly with their mission to reach faculty members in their first, second, or third year of teaching and give them effective tools to teach the next generation of physics students. So far, the program has already served over 2600 early career faculty members.

"New faculty workshops are run with support from NSF, but the fact that AAPT, APS, and AAS are all backers of the workshops gives it credibility in the physics and astronomy communities," says Hilborn. "This is an important role for professional societies to play—we're thinking about educating the next generation of physics and astronomy teachers who will go on to do on all kinds of important and interesting work."

*For more about New Faculty Workshops and to see topics from previous workshops, visit* aapt.org/Conferences/newfaculty/nfw.cfm.

HISTORY CONTINUED FROM PAGE 2

Enter Cherenkov. Born in July 1904 in a small village called Novaya Chigla, he graduated from Voronezh State University in 1928 and became a senior research in the Lebedev Physical Institute. In 1934, Cherenkov began conducting his own experiments on this strange form of radiation, working with his institute colleague Sergei Vavilov. (In fact, it was termed "Vavilov-Cherenkov radiation" in the Soviet Union.) He noted that same emission of blue light when bombarding a bottle of water with radiation.

Today, Cherenkov radiation is a critical element in numerous applications. The Cherenkov detector is now standard in particle research and one was even installed on Sputnik III. Astrophysicists rely on the effect to monitor cosmic rays hitting Earth's atmosphere and to detect neutrinos in such facilities as the Sudbury Neutrino Observatory, Super-Kamiokande, and IceCube.

In particle physics, Cherenkov radiation is used to distinguish the lighter particles from the heavier ones. An advanced detector that employs Cherenkov radiation is the Ring-Imaging Cherenkov Detector (RICH), one of which is currently being built for the ALICE collaboration at the Large Hadron Collider.

As for more practical applications, the glow from Cherenkov radiation is a good way to monitor nuclear reactors. It continues even after the chain reaction stops, dimming gradually as the more short-lived products of fission decay. It can also be an indication of how much spent nuclear fuel is still present in fuel pools. In medicine and biology, Cherenkov radiation is used to detect biomolecules doped with radioactive atoms like phosphorous-32 to characterize their interactions. In the medical realm, Cherenkov light can be used to detect radiation in the body. And external beam radiotherapy produces Cherenkov light in treated tissue, which can be detected at the entry and exit points.

As for Cherenkov, after being promoted to section leader, he was awarded a doctorate in 1940. By 1953 he was a professor of experimental physics, taking over the institute's photo-meso processes laboratory in 1959. He shared the 1958 Nobel Prize in Physics with Ilya Frank and Igor Tamm, who together developed the theory behind the phenomenon Cherenkov reported. Cherenkov went on to help develop and build electron accelerators, among other notable accomplishments.

Cherenkov died in Moscow on January 6, 1990. Among his other claims to fame, the character of Pavel Chekov on *Star Trek* is named in Cherenkov's honor, and the spaceships in the 1997 science fiction film *Starship Troopers* use a "Cherenkov drive" to travel faster than the speed of light.

**Further Reading:**

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GOVERNMENT AFFAIRS

## With New Report, APS Fights Trump Administration's Plans to Restrict Visa Categories

BY TAWANDA W. JOHNSON

Pushing back against the Trump Administration's plans to restrict certain visa categories that are crucial to science and economic competitiveness, the APS Office of Government Affairs (APS OGA) released a new report titled "How International Students and Researchers Benefit the United States: Their Experiences, Their Stories."

The report highlights the importance of the Optional Practical Training (OPT) and J-1 visa programs—both viewed as vulnerable under the Trump Administration—through stories about talented international students and scholars who chose to study and work in the United States.

The OPT program enables highly skilled international students who completed their studies in the United States to gain work experience for a period of time and is used as a recruiting tool by high-tech companies. Businesses such as Amazon, Microsoft, and Intel are among numerous tech firms that annually employ thousands of recently graduated international scientists and engineers under the OPT program. J-1 visa holders are typically researchers, students, and professors who participate in work- or study-related programs in the United States.

Despite their benefit to the United States, the future of these programs is uncertain following the release of a series of executive actions targeting key visa programs. For example, in June, the White House issued a proclamation that included suspending entry to the United States for international workers in certain J-1 categories.

Although STEM categories for the J-1 visa were spared any negative impact—due in part to the overwhelming response of APS members in a grassroots campaign—the opposite was true for the H-1B program, which enables colleges and businesses to hire highly skilled international workers. The proclamation suspends entry to the United States of anyone who seeks to enter using an H-1B visa, but does not currently have a valid visa.

Further, a recent White House action will create a disincentive to the current and future employment of international workers on H-1B visas. Companies, associations and universities are fighting the H-1B rules with lawsuits. Meanwhile, the science community remains concerned that OPT and STEM categories for J-1 could be curtailed.

The APS OGA report states how important international students and scholars are to the US scientific enterprise.


"The benefit these international students and researchers provide to the United States is clear and measurable. As of 2018, immigrants had founded more than half (50 of 91) of the privately-held billion-dollar startup companies in the United States, and 21 of these 91 companies had a founder who first came to the United States as an international student," the document notes.

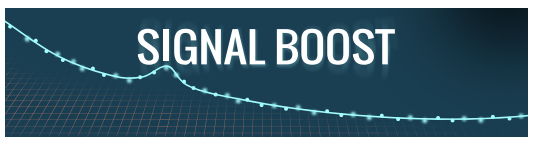
The highlight of the report, as previously noted, is the more than 100 compelling stories from APS members about the positive impact OPT and J-1 visa programs have had on their or peers' careers. The following are general themes and highlights from those stories:

**OPT and J-1 visas can attract the world's top talent**

"In 1973, Michael Kosterlitz came to the United States from the United Kingdom for a postdoctoral position at Cornell University on a

VISA CONTINUED ON PAGE 5






Signal Boost is a monthly email video newsletter alerting APS members to policy issues and identifying opportunities to get involved. Past issues are available at go.aps.org/2nr298D. **Join Our Mailing List: visit the sign-up page at go.aps.org/2nqGtJP.**

FYI: SCIENCE POLICY NEWS FROM AIP

## Science Policy Outlook for the Biden Administration

BY MITCH AMBROSE

Following a campaign in which he pledged to "choose science over fiction," President-elect Joe Biden is expected to place an early emphasis on science policy in his administration.

In his victory speech on November 7, Biden said his first priority will be to address the COVID-19 pandemic through a plan that is "built on a bedrock of science," and in his first major announcement as president-elect, he named a 13 member pandemic advisory panel. On taking office, he also plans to reinstate routine public pandemic briefings that are run by non-political officials and reverse President Trump's withdrawal from the World Health Organization.

Alongside addressing COVID-19, Biden's transition team website lists economic recovery, racial equity, and climate change as top priorities. Biden has said one of his first moves as president will be to rejoin the Paris Agreement, through which countries around the world have committed to curb greenhouse gas emissions.

Biden's climate plan sets a target for the US to reach net-zero emissions no later than 2050 through a combination of R&D investments, efficiency measures, and regulations. On energy innovation, the transition website states Biden will pursue "dramatic cost reductions in critical clean energy technologies, including battery storage, negative emissions technologies, the next generation of building materials, renewable hydrogen, and advanced nuclear."

During the campaign, Biden also pledged to propose the "largest-ever investment in clean energy research and innovation," with a spending target of $400 billion over 10 years. In parallel, he proposed $300 billion in R&D spending over four years on a "Made in All of America" initiative to foster new manufacturing jobs.

Such proposals are likely to face strong headwinds in Congress, especially if Republicans retain control of the Senate following two runoff elections in Georgia on January 5. However, an R&D spending surge is not completely out of the question, as prominent lawmakers from both parties have recently backed the idea in principle, citing climate change and strategic competition with China as key motivators.


US–China tensions are likely to remain a significant factor in science policy during the Biden administration. Rolling out his "Made in All of America" initiative this summer, Biden remarked, "The Chinese are spending multiple billions of dollars trying to own the technology of the future while we sit with our thumb in our ear."

Elements of Biden's science policy apparatus may quickly fall in place, assuming he follows the approach of President Obama, who named several high-level science officials before Inauguration Day. Details of Biden's R&D spending priorities may come in his first budget request, which is due shortly after he takes office.

Beyond his ambitions for climate change and the pandemic, Biden will work to change the country's

FYI CONTINUED ON PAGE 7

BRIDGE CONTINUED FROM PAGE 2

applications, but in fundamental research in material discovery," says Casas. "I'd ultimately like to transition into a faculty position to focus on teaching and mentorship."

Casas has been involved with mentoring undergraduate students at UCI, stressing the importance of fostering a feeling of belonging for students from underrepresented groups looking to continue their physics careers.

"There's a general lack of support for underrepresented students in a lot of physics departments—many departments want to increase diversity without the resources or follow-through to make sure students succeed," says Casas. "I'm lucky to be involved in mentorship programs, and the first students I mentored were at USF…I tried to find a way to distill whatever harsh realities I had faced into lessons to help others avoid pitfalls…Looking back, my undergraduate experience may have been different with more mentorship."

For those looking to follow his footsteps toward a PhD, Casas reminds students to consider the long-term commitment in graduate school when selecting an advisor.

"Realize that your relationship with your advisor can last five to seven years—be deliberate about who you decide to work with," says Casas. "It's not just about the physics you're interested in… consider the day to day interactions with an emphasis on your mental health."

Like Casas, Bonilla's interest in physics started before college and blossomed into a career in materials science research. Bonilla credits his high school physics teacher with setting him on his career path by fostering an interest in physics and acting as a mentor.

"I come from a small town in Puerto Rico and I was raised on a farm, so I didn't know many professionals, but I had a good physics teacher," says Bonilla. His teacher became a role model and an inspiration, as Bonilla made it a goal to study hard to have an opportunity to "become smarter than [his] teacher."

Bonilla studied physics at the University of Puerto Rico, diving into research at a materials science lab during his second year at school. During his senior year, Bonilla was contacted directly by Miller, the Bridge Program Director, who asked him to apply to USF as part of the Bridge Program. "I was so busy at the time with tests and other responsibilities that I hadn't had time to apply to other programs. The timing was really perfect," says Bonilla.

Bonilla spent two years at USF in the Bridge program before applying to a PhD program, also at USF. While completing research in two-dimensional materials for his PhD, Bonilla recognized that the long hours of academic research didn't appeal to him as a future career, so he began searching for careers in industry. He stresses that students should keep an open mind when trying to decide on a career path in physics—and remember that careers exist outside of academia.

"Plan to be flexible in choosing a career…Work hard, but don't [believe that] all of your opportunities [are] in one place," says Bonilla. "People tend to make you think you have to go to plan A or you're a failure, but it's your career, and your life—don't let your boss or a professor dictate what you do."

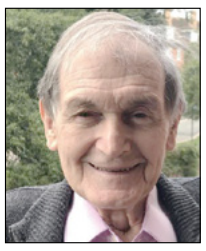
He also emphasizes staying true to oneself, both while selecting a career or navigating academia, especially as a minority student.

"Go into a field that makes you feel comfortable—especially [if you are a minority not well] represented in physics," says Bonilla. "You have to understand that the things that represent you will be seen as outside of the normal… try to be true to yourself, don't try to be just like your professors to be successful in academia. Be different, be the first one—do it as yourself."

*For more information about the APS Bridge Program or to apply, visit* aps.org/programs/minorities/bridge/.

**Correction**

Owing to a late production error not caught by the Editor during proofreading, the names of two of the 2020 Nobel Prize in Physics laureates were misspelled in the November print edition of *APS News*. The correct names are given below.



**Roger Penrose**
IMAGE: OXFORD UNIVERSITY

**Reinhard Genzel**
IMAGE: MPG

**Andrea Ghez**
IMAGE: UCLA

NMC CONTINUED FROM PAGE 1

prompts for mentor/mentee discussions—questions that mentors and mentees can talk about—and sends resources like [information about] scholarships or other APS-related information. We're hoping to do these things via the new Slack workspace," says Simone Hyater-Adams, Education and Diversity Programs Manager. "We're also offering other new things through Slack, like lots of online meetup events, [so that] program participants have a space to interact and chat about their experiences at their institutions and in life."

One vital type of virtual event the NMC plans to introduce will help students find mentors based on their interests, even if that mentor serves at a different institution. These events will revamp the matching process, which currently requires mentors and mentees to navigate a database in search of a possible match.

"A lot of people have joined the NMC but might not be matched with a mentor or mentee yet," says Hyater-Adams. "In lieu of a tricky database, we can create events for mentors/mentees to meet face to face and chat about what types of experience each person has to help create a match. We're making this somewhat like a speed-dating set up—folks will register, and we'll create Zoom rooms organized by topics of interest."

While the NMC encourages students to find a mentor at their institution, these events may help students find additional mentors who may be able to offer additional resources or perspectives. "Mentees often have more than one mentor, depending on interests the student might have," says Hyater-Adams.

The annual NMC Conference, which is organized in partnership with the National Society for Black Physicists and the National Society for Hispanic Physicists, is also going online. On February 18 to 21, participants will gather virtually for an exciting weekend with resources for mentors and mentees alike, ranging from plenary talks on mentoring and research to career workshops and networking opportunities. Registration is currently open, as are submissions for Student Presentation Abstracts. In addition to scientific talks and poster presentations, students are also encouraged to submit ideas for sessions that will help create community connections.

"This year, the NMC Conference Program Committee is leaving open slots for student-organized community-building sessions," says Hyater-Adams. "These could be things like a Virtual Game Night, a Hobby Chat, a Murder Mystery, or any other topic that you think will be beneficial for conference goers. Students will get support from the committee in organizing this."

This year's NMC conference will be partially funded by a donation from Kenton and Amy Brown. In November, they gifted the NMC with a $50,000 donation, largely to support one of the NMC's hallmark resources, the NMC Bringing Emergency Aid to Mentees (BEAM) fund as well as an emergency fund for the APS Bridge Program and to support the 2021 NMC Conference. The BEAM fund provides small grants between $100 to $1500 to NMC mentees who are experiencing a sudden financial emergency in order to remove barriers or stress and help students continue their physics studies.

Joining the NMC is free for both mentors and mentees and does not require membership in APS. For more on the NMC or to join, visit aps.org/programs/minorities/nmc/.



VISA CONTINUED FROM PAGE 4

J-1 visa. This experience started a long career in the United States, as he became a physics professor at Brown University and a US citizen. He was awarded the Nobel Prize in Physics in 2016 and one year later was elected to the US National Academy of Sciences. As he puts it, 'This would not have happened without my getting a J-1 visa in 1973, so I owe my success to the J-1 visa and (the) USA owes the J-1 visa program for yet another Nobel Prize to an American citizen.'"

### OPT and J-1 visas produce strong and positive outcomes for the United States

"Forty-three years ago, James Myra came to the United States from Canada to pursue a PhD in plasma and fusion physics. After completing his doctorate, Myra was able to transition to a career in the United States through OPT and eventually became a US citizen. 'It has been a career in which I could apply my research skills to the benefit of the American people and indeed the world." His contributions to US economic and scientific competitiveness include: starting a business in Colorado; hiring US citizens; and publishing research publications that have been cited by other scientists around the world an astonishing 6,800+ times."

### OPT and J-1 visas generate critical contributions far beyond academia

"Jennifer Ross is chair of the Physics Department at Syracuse University, and her high-impact work focuses on the physics of cells. She highlighted the contributions that foreign-born scholars have made in her lab, especially one of her former postdoctoral researchers who came to the United States on a J-1 visa from Mexico: 'He taught everyone in the lab about molecular biology, protein purification (and) microscopy. He wrote our first paper that came exclusively from my lab. I probably wouldn't have tenure without his work.' This same postdoctoral fellow, after leaving her lab, contributed to the private sector: 'He worked on a start-up company focused on using local RNA delivery to boost wound healing. It has major ramifications for basic science and applications for medical research. In particular, it should be of interest to the military—to help our wounded soldiers to heal faster without scar tissue.'"

### Diverse perspectives greatly benefit the US R&D communities

"Laurel Anderson is currently a physics PhD student at Harvard University advancing our understanding of nanomaterials. 'Although I am a US citizen, I have benefited immensely from the knowledge, expertise and mentorship of J-1 visa recipients. My research lab has postdoctoral researchers from Israel, Finland, Turkey, Brazil, South Korea and other countries. They bring a wealth of specialized skills and scientific insight about our field to help our lab perform cutting-edge experiments. There are very few people in the world with these skills, and losing these postdocs due to visa difficulties would set our research back years… Their advice and support have been truly invaluable to me. They bring so much to our country beyond just their expertise.'"

In concluding, the report lays out several themes:

- A small but critical number of programs attract top international talent to the United States, including OPT and the J-1 visa program.
- International students and scholars want to come to the United States to study and pursue their careers, but to do that, they must overcome challenges to acquiring a visa, the growing perception that the United States is becoming increasingly unwelcome to international talent, and uncertainties with being able to stay and have a long-term career in the United States.
- The stories highlighted illustrate a broad range of measurable benefits: from Nobel Prizes to patents, from attracting more international talent to guiding domestic talent, from starting companies and hiring US citizens to establishing research dominance in areas of critical US need. In short, they enable US economic competitiveness, national security, and global scientific leadership.

Francis Slakey, Chief External Affairs Officer for APS, said the Society looks forward to using the report as part of a roadmap toward keeping the "United States as the destination of choice for the world's best and brightest."

He added, "These stories have been shared with staffers at the US State Department, and the goal is to have them use the information to preserve OPT and the J-1 visa program."

*The author is Senior Press Secretary in the Office of External Affairs.*

LASER SCIENCE CONTINUED FROM PAGE 1

a broad range of topics in optics and photonics. On the LS side, this year's virtual meeting in September featured topics ranging from quantum information and quantum optics, optical lattices and atomic clocks, and biophysical and ultrafast and high-field laser science.

The participation of DLS in the APS March Meeting is also growing. "As lasers and photonics technology are becoming increasingly important in condensed matter physics, materials science, and other areas that are heavily represented at the APS March Meeting," Averitt explained, "We are actively seeking to grow our presence there."

Indeed, the natural synergy between laser science and other areas of physics provides ample opportunity for collaboration and cross-talk with several other APS units, including the Divisions of Condensed Matter Physics (DCMP; see *APS News* April 2019), Quantum Information (DQI; see *APS News* December 2019), and Atomic, Molecular, and Optical Physics (DAMOP; see *APS News* April 2020), and the Topical Group on Precision Measurement and Fundamental Constants (GPMFC; see *APS News* May 2020).

Notably, at around 40%, DLS ranks among the top APS membership units in terms of student involvement—an indicator of the vibrancy of this rapidly advancing field. To this end, DLS makes several efforts to engage younger scientists, including offering student travel grants to enable conference attendance, undergraduate symposia at at CLEO and FiO+LS, and the Carl E. Anderson Dissertation Award to recognize exceptional doctoral work in laser science.

For more senior researchers, DLS nominates members for APS Fellowship and recognizes outstanding contributions to basic laser science research with the Arthur L. Schawlow Prize in Laser Science.

Looking forward, the DLS executive committee has two main goals for the division: (1) to increase the division's membership, and (2) to enhance its ability to represent those members and highlight the importance of lasers in education, fundamental and applied research, and industry. "Given the increasing importance of lasers and photonics in the 21st century, it is imperative to promote and communicate this to key decision makers," explained Averitt. "DLS hopes to play an important role in accomplishing this to the benefit of our members, and more generally, society."

Overall, DLS stands out as an ambitious and energetic division within APS, promoting research and exchange of ideas at the forefront of one of the most buzzing and interdisciplinary areas of physics. More information on this unit can be found on the DLS website: aps.org/units/dls/.

ROBERT PARK CONTINUED FROM PAGE 3

science-based decision making to the public," said Slakey. "Don't be fooled by homeopathy, don't be fooled by that perpetual motion scam... the things he was writing about were things that try to use science to pretend that they're legitimate, but if you follow the science, you'd end up drawing a reverse conclusion."

Peter Zimmerman, Emeritus Professor of Science and Security at King's College, London, and Park met through the APS Panel on Public Affairs, before both moved to Washington and ended up with an opportunity to work closely together—Park, as the Public Affairs Officer for APS, and Zimmerman as Chief Scientist at the US Arms Control and Disarmament Agency.

"Bob was a great goad to all kinds of physicists to get involved and be involved, he was just absolutely hell on wheels against fraud in science, any kind of fraud or fakery," said Zimmerman. "That was fine because I felt very much the same way."

Park and Zimmerman disagreed on some finer points of science policy, such as manned space flight—which Park was opposed to—but they agreed on the importance of promoting science, especially physics.

"His biggest contribution was the Washington office of APS—having the idea, getting it set up and running it so long," said Zimmerman. "He was very effective on the Hill keeping people aware of physics and generating support for science and physics in particular—support that was political, societal, and in the only currency that counts—money. He was excellent at defending the interests of physics."

Over two decades with APS, Park helped develop the Washington Office from his one-man operation to a full-fledged, six-person professional advocacy office. But even as the office made a pivot towards direct engagement with Capitol Hill, a move that brought Slakey into the office, Park continued publishing *What's New* weekly, without fail.

"Bob realized he was saying something that people really wanted to hear. And so he turned it into this public newsletter that anybody could subscribe to. And then he came up with this formula, which is he's going to report it out every Friday afternoon, holidays be damned," said Slakey. "It wouldn't matter if it was New Year's Day or Christmas Day, he put that thing out, and he did it 52 times a year without fail. And, then typically by the time Monday morning rolled around, there'd be people in town talking about the wise cracks that he had put into it. If nothing else, he found a way to make discussions of science and policy entertaining and a must read."

After leaving APS in 2006, Park continued writing *What's New* as a blog until 2012, continuing his unwavering commitment to science, regardless of outside critiques and criticisms.

"He would say things, whether they were unpopular or unconventional, it didn't matter. If that's where the science took him, that's what he was going to say," said Slakey. "That's why he would take a position. And he did this on issue after issue after issue—he never let politics interfere with his judgement, he let the science take him where it would."

KIRBY CONTINUED FROM PAGE 1

someone to succeed Judy Franz as Executive Officer in 2008, I was asked by APS President Artie Bienenstock to chair the search committee. After an extensive search process over five months, our top candidate suddenly had to withdraw and the committee was back at square one. As committee chair, I was calling around and pursuing leads. Judy had, appropriately, stayed out of the search process but I decided I needed to get her input. I said "Judy, you know this community better than anyone. Whom should we be approaching about this position?" And she replied: "I'm looking at her." So, she spent the next hour and a half telling me what a great job it was. She is really the one who convinced me to step down from the committee and apply for the job.

**The governance structure at APS was quite different then. How did that change?**

When I became Executive Officer in 2009, it was as part of a triumvirate—three co-equal operating officers: Executive Officer, Editor in Chief of the journals, and Treasurer/Publisher. Gene Sprouse (Stony Brook University) was Editor in Chief and Joe Serene (Georgetown University) was Treasurer/Publisher. The three of us worked very well together.

But for a long time, the APS Presidential Line—the elected leadership of APS—had been concerned about this unusual structure in which no one person was responsible for everything. They recognized that the operating officers were getting along well, but they felt the leadership structure wasn't right.

In 2013, then-APS President Michael Turner and the rest of the Presidential Line initiated a process together with the Board and several consultants, which they called "corporate reform." This resulted not only in a CEO model for staff leadership, but also updated APS's Articles of Incorporation (to conform to DC laws) and clarified roles and responsibilities for the two APS governing bodies—the Council of Representatives and the Board of Directors.

**The reorganization into a new structure was voted on and approved by the membership in 2014, and you became the first CEO of APS in 2015.**

I was actually interviewed and offered the job in December 2014 and then started in January 2015. The Board charged me with transitioning the organization to this new leadership structure. My first challenge was to establish a senior executive team (aps.org/about/governance/leadership/staff-advisors.cfm) to work with me collectively to lead the staff at our three offices in College Park, MD, Ridge, NY, and Washington, DC.

As a result of the reorganization, we had established a separate role for an elected Treasurer who provides "the eyes of the Board" on the finances of the organization. APS publishing and finances had grown sufficiently large and complex that it was important to call on professionals outside the physics community to shepherd these critical areas. It was also important to combine and integrate the information technology across our offices.

**Apart from the governance reorganization, what are some of the biggest changes at APS during your time as CEO?**

Early on, I felt that we really needed someone from the industrial physics community on staff who could reach out to industrial members, find ways to engage them better, and give industrial physics more visibility in the Society. Our first Industrial Fellow Steven Lambert and his successor as Director of Industrial Engagement, Dan Pisano, have been doing that for APS.

Over the past ten years, we've built up our programs in education, diversity, and careers, thanks to the excellent work of Monica Plisch (Director of Programs) and Ted Hodapp (Director of Project Development) and their teams. APS was asked to support volunteer activities, such as the very successful Conferences for Undergraduate Women in Physics. The APS Bridge Program was started while I was Executive Officer and has been going now for over seven years. Its goal is to increase the number of underrepresented minorities who obtain a PhD degree (see article on p. 2). Supported by the National Science Foundation, we are now leading a coalition of other societies within the physical sciences to establish similar "bridging programs."

I am pleased that over the last ten years we have started new journals: *Physical Review X* (*PRX*), *Physical Review Applied*, *Physical Review Fluids*, *Physical Review Materials*, *Physical Review Research*, and *PRX Quantum*. These journals are increasing the publishing options that we provide for the physics community and expanding our footprint into new areas of physics.

**You were also involved in leading the creation of a new Strategic Plan for the entire organization.**

By the end of 2017, with a senior management team that was working well together across the whole organization, I decided, together with the Board, to undertake a strategic planning process focusing on the entire APS. That had never happened before. When you have a plan that spans the entire organization, it is easier to align all parts of the Society. With the involvement of the membership and APS staff, it was completed in a record time of 10 months and was approved by the Board and Council at the end of 2018. The *APS Strategic Plan: 2019* is a high-level document and succinct, only eight pages. It serves as a useful guide that also articulates our Mission, Vision and Values.

**How is APS coping with the coronavirus pandemic?**

I never anticipated that I'd be spending my last year at APS "zooming" from home in Cambridge, Massachusetts, or in London, England (where one of my daughters has just given birth to her first baby). I think APS staff, together with our elected leadership have done a fabulous job at responding. We are continuing operations, doing them differently, but still serving the community. We are continuing to put out our journals, pivoting to hosting our meetings virtually, pursuing our advocacy in support of physics and science generally, and offering a lot of additional programs and webinars in a totally virtual environment.

The Strategic Plan has proven to be helpful in identifying important priorities during COVID-19. One of those areas clearly has been serving our young people who have been badly affected in terms of their progression through graduate school and their postdoctoral training. Suddenly departments aren't hiring, students and postdocs aren't able to present research at in-person meetings, and opportunities seem to have dried up. It's been a rough time for our cohort of early career physicists and we've been trying to help by providing professional development resources and information. They are such an important part of APS, as they are our future.

Overall, APS is very fortunate. The Society has strong finances and we have great people involved in the organization. I am confident that we will be able to emerge from this unprecedented time in good shape.

**What are you most proud of as APS CEO?**

I'm really proud of the fact that we've been able to establish a great relationship and partnership between the elected leadership, the governing bodies of APS, and the Senior Management Team. This has enabled us to make some good decisions during a rough time. I was pleased that we were able to decide to cancel the March meeting during a critical time period. This was a joint decision of elected leadership and management. It would have been dangerous to do otherwise, as the meeting could have easily been a super-spreader event.

Another thing that I care deeply about is diversity, equity, and inclusion, which is woven into the fabric of our strategic plan. This is such an important issue for us as a physics organization, for us as a physics community, and for our society generally. It's going to take a lot of effort on the part of all of us to change physics to be more welcoming and inclusive. I'm proud of the things that we've started as an organization to try to address a number of these issues, but I think there's a lot more to do.

It has been a tremendous honor and a pleasure to serve in this position. I have so many people to thank because one can't do this alone: our members who devote so much time and effort to the work of the Society; and our APS staff who are terrific and whose commitment to excellence enable us to achieve so many of our goals. I feel very grateful for having had the opportunity to work with so many wonderful people.

INTERNATIONAL CONTINUED FROM PAGE 1

members and physicists worldwide. The task force reached out to all parts of the Society—APS leaders, units, members, editors, staff, as well as other national physics societies and international institutes. The task force issued a report and recommendations that were adopted by the APS Council of Representatives in November 2018.

As Director of International Affairs (INTAF) for APS, Amy Flatten is dedicated to working with APS colleagues to implement the task force's primary recommendation: "that APS deepen its international engagement across the full range of the Society's activities."

"With almost 25% of its members outside of the US, it's important that APS includes international members across all aspects of APS and infuses international elements into APS programs, especially those that may have been US-centric and less accessible to communities outside of the US," said Flatten, an APS Fellow.

To achieve the task force recommendation, INTAF initiated cross-organizational partnerships with various APS departments, programs, and initiatives to expand APS offerings beyond US stakeholders. The programs and activities described below provide a snapshot of the Society's efforts so far.

### APS Presidential Line: bringing together international physics leaders for summits & roundtable discussions

During the past year, the APS Presidential Line has convened international leaders to discuss shared interests and concerns of the international physics community. These include:

- **US-China Physics Roundtable**: These ongoing meetings include the APS Presidential Line, Nobel Laureates, and distinguished representatives from the Chinese Academy of Sciences to discuss opportunities and challenges for US-China physics cooperation, in areas such as high energy physics and astrophysics.
- **International Leadership Forum**: In January 2020, as part of the inaugural APS Annual Leadership Meeting, the Society held an international leadership roundtable with international science leaders to discuss balancing global science competitiveness with international scientific collaboration.
- **COVID-19 International Roundtable:** To address the impact of COVID-19 on the physics community, APS organized a virtual roundtable, attended by physics leaders in Europe, Africa, Asia, North America, and South America. The pandemic has led to severe reduction in research activity, including the shuttering (most likely temporary) of national laboratories.

"These interna.al roundtables are excellent examples of science diplomacy, with participants respecting national interests, while exploring possible international collaboration and approaches to shared concerns," explained Flatten.

### Industrial Physics: expanding IMPact mentoring platform to include new opportunities for international mentors and mentees

Dan Pisano, Director of APS Industrial Engagement, and INTAF have partnered to broaden the APS Industry Mentoring Program (IMPact) to include international students, as well as mentors.

Flatten is thrilled by the evolution of IMPact: "This platform recognizes that we're all interconnected. We hope that students from all parts of the world will be able to connect with a mentor in any country they wish to work. Likewise, those mentors who may also be seeking to hire can tap into a global pool of young physics talent."

Pisano explained that many early-career physicists and international students have limited exposure to industry during their academic years. "The IMPact mentoring site will give them an opportunity to connect with an experienced industrial physicist to secure answers to their questions. Further, international mentors will be able to connect with both undergraduate and graduate students globally to help fill their company's need for physics talent," he said.

### APS Editorial Office: partnering to offer webinars/seminars to young physicists on writing, reviewing, and publishing scientific journal articles

Warren Lin, APS Head of Editorial Development, along with colleagues in the APS Editorial Offices in Ridge, NY, partnered with the Chinese Physical Society (CPS) to host an APS-CPS Author-Referee Tutorial Webinar. The webinar covered different writing methods for peer-reviewed scientific papers and tips for improving writing skills. It also provided information about the submission and review process for APS's Physical Review Journals. More than 100,000 physicists participated in the session, said Flatten.

Added Serena Dalena, Associate Editor, *Physical Review Letters*, "The Physical Review journals are highly international, and for an editor it is extremely important to engage with the broader physics community. The great thing about being a scientist is the feeling of being a citizen of the world; your colleagues come from different countries, and everyone brings their own background, so these events are also a great opportunity to build communities and exchange ideas."

INTAF hopes to emulate that success by working with the Editorial Offices, the Indo-US Science and Technology Forum (IUSSTF) and the APS Committee on International Scientific Affairs to hold a similar webinar for young physicists in India. By partnering with IUSSTF, the audience for such a webinar could extend well beyond APS members living in India, reaching young physicists at institutions across that country. "India is recognized as an emerging scientific power, and by working with INTAF and its partners, we hope to strengthen our collaborations with many other physics societies," said Dalena.

### Communications: collaborating to promote APS's International Engagement Around the World Tool

One of the questions most frequently asked by international physicists is: What does APS do for physicists in my country?

INTAF answered that question through the development of the APS International Engagement Around the World tool (aps.org/programs/international/map/), a clickable map which enables any physicist—anywhere in the world—to learn how to participate in APS programs and how the Society serves their interests.

The challenge now is making sure that physicists know the tool exists, and INTAF will work to reach audiences outside the United States and even beyond the membership of APS, so that they are aware of APS's offerings.

### Membership: including international young physicists in the previously US-focused Student Ambassadors Program

INTAF wants to ensure that international students have an opportunity to participate in the Student Ambassadors Program, a leadership opportunity for students dedicated to representing APS at their home institutions.

Cortney Bougher, APS Director of Membership remarked about the program, "While one of the main goals of Student Ambassadors is the promotion of APS and APS membership; we also seek feedback and input from the students. Two-way communication is key, and APS values international students' perspectives."

### Careers: developing international messaging on the career platform

The APS Careers Program and INTAF are collaborating to include information about US visas, the Optional Practical Training Program (temporary employment related to an F-1 visa student's program of study), as well as contacts for international companies in the Career Program's online resources. APS appreciates the opportunity to provide young physicists with the resources necessary to be competitive and successful in their careers, whether they live in the US or another country.

"Physics is an international endeavor, and it is imperative that APS provide career resources that are relevant to our community worldwide," said Crystal Bailey, Head of Career Programs.

### STEP UP: piloting a new opportunity for International Ambassadors in 2020

APS STEP UP Ambassadors empower fellow teachers to inspire young women to pursue physics by changing cultural views about physicists through the use of evidence-based teaching resources designed to help young women see themselves as "physics people." This year, APS is piloting a new opportunity to include international STEP UP Ambassadors, and Flatten is thrilled.

"Expanding STEP UP to include International Ambassadors is a wonderful way for APS to broaden the reach of a very important and impactful program and will help inform STEP UP about how to translate these important classroom materials to new languages and cultures," said Anne Kornahrens, APS STEP UP Project Manager.

### CUWiP: working toward adding international pilot conference sites in 2022

APS Conferences for Undergraduate Women in Physics (CUWiP) aim to help undergraduate women continue in physics by providing them with the opportunity to experience a professional conference. Flatten said INTAF is working with the program administrators to add new, international sites for the conferences in 2022.

"In 2021, this pilot program is looking to open up slots for international attendees with the hope that additional CUWiP conferences may be held outside the US in 2022. This will strengthen APS partnerships internationally and help undergraduate physics students build connections to other women and gender minorities in physics with whom they can share experiences, advice, and ideas," said Renee Michelle Goertzen, Assistant Director of APS Programs.

### APS Chapters: collaborating with APS Project Development Department toward international chapters

INTAF and the APS Project Development Department are conferring with the APS Committee on International Scientific Affairs about eventually offering chapters outside the US. Chapters are a new type of membership structure to support graduate students, postdocs, and early-career scientists (see *APS News*, November 2020).

"It is exciting to have APS chapters launching across the United States this year. After the pilot program is further developed, we hope to eventually enable individuals outside the US to start chapters in their countries should they wish to do so," said Farah Dawood, APS Chapters Program Manager.

### Women in Physics: partnering with other national physical societies toward joint postings/offerings

APS is partnering with other national physical societies to highlight each Society's resources for women in physics on their respective websites.

"By working together, we can reach more female physicists and better strengthen the role of women in physics than we could by working alone," said Della Richardson, Women and Education Programs Coordinator.

### Office of Government Affairs: working together to prevent certain US government policies from hindering international collaboration, mobility and opportunities for students to study and work in the US

The APS Office of Government Affairs (APS OGA) has spearheaded numerous advocacy campaigns and several surveys, in conjunction with support from INTAF, to push back against policies and proclamations that harm international students. Results from the most recent survey of students and department chairs are being examined as this article went to press.

"INTAF appreciates the chance to work with APS OGA to provide policymakers with powerful messages from constituents, as well as compelling data about the impact of US government policies affecting our nation's ability to attract and retain global talent," said Flatten.

Francis Slakey, Chief External Affairs Officer for APS, summarized the overall goals of the APS international efforts, saying that "The Society recognizes that it serves a diverse community of members and physicists worldwide—not just US physicists. This global community makes large contributions to APS and the US physics community through its involvement in APS meetings, units, programmatic activities, various initiatives, and by publishing in the Society's journals."

He added, "We look forward to continuing to serve the Society's international members and the broader international physics community to address the interests and needs of all physicists globally."

*The author is Senior Press Secretary in the Office of External Affairs.*

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1. R. Chu and S. White; "2017 Survey of APS International Programs," Table 3, (American Institute of Physics, December 2017).

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course on visa and immigration policy. Apart from its focus on immigration enforcement, the Trump administration has moved to restrict visa programs used by students and high-skilled workers, drawing criticism from universities and scientific societies.

Conversely, Biden's campaign platform stated that he will seek to increase the number of visas available for high-skilled workers and exempt recent doctoral graduates in STEM fields from caps on green cards. Such changes would require congressional cooperation.

The prospect of a new stance toward the admission of foreign students and researchers has already drawn praise within the scientific community. A letter from 81 Nobel Laureates endorsing his presidential bid cited, among other factors, "his understanding of the value of international collaboration in research, and his respect for the contribution that immigrants make to the intellectual life of our country."

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# THE BACK PAGE

## The Scientist as Artist

BY PHILIP H. BUCKSBAUM AND S. JAMES GATES, JR.

The 2020 Nobel Prize in physics was jointly awarded to Roger Penrose, "for the discovery that black hole formation is a robust prediction of the general theory of relativity" and to Reinhard Genzel and Andrea Ghez "for the discovery of a supermassive compact object at the center of our galaxy" [1]. We join the members of the American Physical Society in congratulating our colleagues for their epochal work and lasting contribution to humanity's understanding of the cosmos.

This achievement brings to mind a famous Albert Einstein quote: "After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are always artists as well" [2].

Nobel Prizes are not always of this sort. Sometimes they celebrate an unexpected but ground-breaking discovery, such as high-$T_c$ superconductivity; or the culmination of a huge team effort for a long-sought confirmation, such as the Higgs boson; or, a transformational technological advance, like blue LEDs. But this year the Swedish Royal Academy recognizes such a "coalescence of science and art:" a genius composer's masterpiece in the hands of virtuoso technical performers. Roger Penrose (youtube.com/watch?v=f7kW8xd8p4s) is the composer, while Ghez and Genzel are the virtuoso performers.

"The scientific theorist is not to be envied," Einstein also cautioned. "For Nature, or more precisely experiment, is an exorable and not very friendly judge of his work. It never says 'yes' to a theory. In the most favorable cases it says 'Maybe,' and in the great majority of cases simply 'No.' If an experiment agrees with a theory it means for the latter 'Maybe,' and if it does not agree it means 'No.' Probably every theory will some day experience its 'No'—most theories, soon after conception" [3]. Thus, theorists celebrate heartily that in this case Nature has not delivered a baleful glance to their lot.

Penrose used his mastery of topology (the part of mathematics that tells us that a donut and a coffee cup can be regarded as the same shape) to show that black holes can exist in the center of galaxies. Here the artist analogy is direct and obvious, since Penrose may be even more well-known for his artistic compositions of the Penrose stairs optical illusion [4], and his space-filling aperiodic 5-fold symmetric Penrose tiling [5]. The Penrose stairs are acknowledged as the direct inspiration to the Dutch artist M.C. Escher for his famous lithograph, "Ascending and Descending" in 1960 [6], while the Penrose tiling paved the way for the 2011 Chemistry Nobel Prize awarded to Dan Shechtman for quasicrystals. Science and art converge in the mind and work of Roger Penrose.

Ghez and Genzel are both master performers on some of the most sophisticated and beautiful instruments in optical physics: The Keck telescope in Hawaii, which was used by Ghez; and the ESO Very Large Telescope (VLT) in Chile, used by Genzel. These telescopes are spectacular to look at, but like fine race cars their real beauty is under the hood. Ghez and Genzel both used a succession of ever-improving technologies over decades to image the orbits of stars around what they thought might be our galaxy's central black hole. A real breakthrough was the development of phase-corrective adaptive optics, which use a nearby star or a small patch of sodium atoms in the upper atmosphere excited by a ground-based laser to measure the changing distortion of the intervening atmosphere, so that a deformable mirror can correct the image.

Thus equipped, these telescopes have unequalled vision. And like a Stradivarius, their potential for discovery and amazement is then limited only by the virtuosity of their users. Ghez and Genzel put these machines to great use, to peer through our turbulent atmosphere and the obscuring dust of the galaxy to track the orbits of stars near the galactic center.

This union of art and science also illustrates a concept proposed by philosopher Karl Popper, that progress in science requires a convergence of unbounded leaps of the imagination, coupled to rigorous observational examination.

The observations in this case have been carried out over decades by the competing groups of Ghez and Genzel, who have pushed each other to ever increasing precision. The antecedents of this work show how science favors creative leaps of imagination.

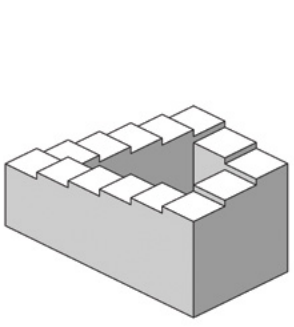
The stars that these astronomers studied orbit a bright radio source in the center of the galaxy known as Sagittarius A*, which was one of the first objects detected by Karl Jansky in the early 1930s, using a radio antenna at Bell Labs in Holmdel, NJ. Bell Labs' parent company, AT&T, was interested in the radio noise because its core business was telecommunication. Jansky's leap of imagination was to realize that the noise in his antennas was from localized regions among the stars, and thus he founded radio astronomy. (Arno Penzias and Bob Wilson, working at a nearby Bell Labs location in the 1960s, would earn a Nobel Prize by noting that the sky also radiates a nearly uniform source of 2.7K thermal background noise, a remnant of the Big Bang).

In the late 1970s Charles Townes, also a Nobelist for his invention of the laser, had a research group at Berkeley that was pioneering laser-based heterodyne infrared astrophysical Doppler shift measurements of atomic lines in the vicinity of the galactic center. Their Doppler measurements of atomic spectra showed high velocities that suggested that the Milky Way's center might contain four million solar-masses in a volume too small to resolve, possibly a black hole [7], a leap of imagination that steadily gained credence through painstaking observations over the ensuing decades. If so, then the close orbiting stars could be a laboratory for precision General Relativity—that is, if telescopes of sufficient resolving power could be developed. Reinhard Genzel was a postdoc in Townes' group and later a member of the Berkeley faculty who pursued that great goal.

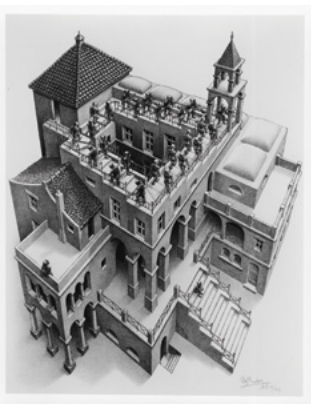
The adaptive optics technology that solved this problem was proposed only a few years later [8]. The concept of a laser guide star to tame the optical atmospheric distortions first appeared in classified reports for the 1980s US "Star Wars" program, inspired (and funded) for US national security. Soon after, the same concept was proposed independently within the astronomy community. The new generation of telescopes that would employ adaptive optics thus set the stage for the long and careful observations of Ghez and Genzel.

The progression in science from imaginative leap, to technical mastery, to detailed measurements, and ultimately to new discovery and future insights, is thus composed of collaborative efforts and creative singular advances by human networks of scientists that extend through time and across boundaries. Each step relies on contributions of many who cannot share the ultimate spotlight in Stockholm. Yet without them scientific achievements would be greatly impeded.

Thus decades of scientific accomplishments and insights and technological advance are celebrated in this year's Nobel prize along with the artistry of the three honored scientists. This path of progress should be familiar to many physicists reading this Back Page. For isn't that our quest as well? And we know why we persist: We love the intellectual and physical challenge, even when the larger goals we pursue are so difficult that few of us may ever succeed at such a level. But here we see that some do succeed, and it lifts us all. Well done!



**Drawing of the "impossible stairs" of Roger Penrose**
IMAGE: WIKIMEDIA COMMONS



**M. C. Escher's "Ascending and Descending"** (C) 2020 THE M. C. ESCHER COMPANY-THE NETHERLANDS. ALL RIGHTS RESERVED.

**The W. M. Keck Observatory uses a laser (yellow) to create an artificial guide star that allows images to be corrected for atmospheric blurring. Nobel Laureate Andrea Ghez and her team used the facility in her prize-winning research.**
IMAGE: KECK OBSERVATORY

**Nobel Laureate Reinhard Genzel and colleagues carried out their work at the ESO Very Large Telescope in Chile.**
IMAGE: ESO

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*S. J. Gates Jr. is APS President-Elect and will take office as APS President in 2021. He is currently the Ford Foundation Physics Professor, Affiliate Mathematics Professor at Brown University, and Watson Institute for International and Public Affairs Faculty Fellow.*

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