INDUSTRY

APS is Committed to Helping Entrepreneurs Thrive in the Business World

BY TAWANDA W. JOHNSON

Many physicists do not follow an academic path after graduation, with a significant number instead choosing careers in industry, including starting their own businesses. APS remains committed to helping these entrepreneurs by providing access to technical findings in its scientific journals and reports; hosting conferences that encourage the sharing of ideas; providing guidance and support through its career and professional development programs; and advocating for robust research budgets for key federal science agencies.

Adam Steele, owner of ZerokNanoTech, a business based in Gaithersburg, Maryland, that develops and commercializes new technologies that utilize laser-cooled focused ion beams for nanomachining, said Physical Review Letters played an integral role in helping him start his business.

“It helped answer the question of how many atoms could we capture from a background vapor and extract into a slow beam,” recalled Steele, who added that technical findings in Physical Review Letters and Physical Review A were instrumental in guiding him as he launched his business.

APS Publisher Matthew Salter said he was pleased that Steele found the Society’s journals useful. “The Physical Review journals publish some of the most impactful and important research in physics and physics-related research, serving a wide range of user communities ranging from theoretical and experimental physics through to topics of interest to applied physicists in academia and industry,” explained Salter.

“We are proud of the role that the Physical Review journals play in supporting all researchers and entrepreneurs who are inspired to pursue a science-based career,” says Bailey. “Eighteen employers participated, and most of them said they’d participate in a similar event again,” says Crystal Bailey, Head of Careers Programs at APS. “The employers also said they were able to chat with potential candidates and get the word out about new programs...and the event attracted very good applicants.”

Creating spaces for networking and building personal connections at virtual meetings has been challenging but employing a platform such as GatherTown—which users have avatars they can use to walk around a space and initiate conversations—has its upsides.

“Gather is the best tool I’ve seen to partially recreate these environments. It’s not perfect, but there are ways it’s actually better, like finding people quickly or chatting across distances, which is not something you can do in an exhibit hall,” says Bailey. “A lot of people are going to be drawn

BUSINESS CONTINUED ON PAGE 4

MEMBERSHIP UNITS

The APS Topical Group on Physics Education Research

BY ABBIGAIL DIVE

The APS Topical Group on Physics Education Research (GPER) is a home for members interested in research on the learning and teaching of physics—a broad, multidisciplinary area encompassing everything from institutional practices to neural and cognitive processes to the social and contextual components of physics educational practices.

Physics education research (PER) falls within the purview of the emerging area of discipline-based education research, a field that focuses on the comprehensive study of learning and teaching in particular academic disciplines, most often (but not exclusively) at the university level.

Researchers in the GPER community are also focused on wider aspects of the teaching, learning, and practice of physics that extend beyond physics content itself. “For example, we need to ensure that students’ attitudes and habits of mind in physics classes are strengthened by our courses,” explained GPER chair-elect Mila Kryjevskaia (North Dakota State University). “We also need to ensure that our instructional efforts support all students rather than a subpopulation of students. Do we provide adequate support for those students who need it most?

EDUCATION CONTINUED ON PAGE 7

CAREERS

Giving Online Job Searching a Personal Touch

BY LEAH POFFENBERGER

For students or early career APS members, career fairs at APS Meetings have provided a crucial opportunity to build connections with potential employers. At the 2021 March Meeting, which took place entirely online, the APS Careers team rolled out a virtual career fair to reproduce a traditional job fair as closely as possible. Following the success of that event, another online job fair—the 2021 APS Virtual Career Fair—will be held for the first time from September 13 to 15.

The career fair at the March Meeting was held across three days, drawing around 300 attendees over the course of the event to a virtual space on GatherTown, which was set up to mimic the usual conference environment with customized booths for each employer. For the first time, the March Career Fair was open to all early career, undergraduate, or graduate student members of APS, regardless of whether they were attending the rest of the meeting.

“Eighteen employers participated, and most of them said they’d participate in a similar event again,” says Crystal Bailey, Head of Careers Programs at APS. “The employers also said they were able to chat with potential candidates and get the word out about new programs...and the event attracted very good applicants.”

Creating spaces for networking and building personal connections at virtual meetings has been challenging but employing a platform such as GatherTown—where users have avatars they can use to walk around a space and initiate conversations—it’s upsides.

“Gather is the best tool I’ve seen to partially recreate these environments. It’s not perfect, but there are ways it’s actually better, like finding people quickly or chatting across distances, which is not something you can do in an exhibit hall,” says Bailey. “A lot of people are going to be drawn

JOBS CONTINUED ON PAGE 2
to go back to the old way of doing things, but the important thing that Gather has allowed is a lowered barrier to participation. You don’t have to find money to come to an event or negotiate visas."

The 2021 APS Virtual Career Fair is looking to capitalize on the success of the March Meeting by launching a similar event, this time combined with a grad school fair. The three-day event will welcome students and early career scientists on a network with employers in industry, national labs, and academia, as well as graduate programs.

“This event will be very similar to March, with tables, literature, promo videos, and private conversation rooms,” says Bailey. “We’re also combining the best mechanisms for posting jobs or advertising specific jobs,” says Bailey. “We’re also combining the career fair with a grad school fair. A downside of grad fairs at March Meeting is that a lot of students have already decided where they’re going, but September is an ideal time to recruit.”

According to Bailey, following a slight dip in hiring last year due to the pandemic, hiring activity in physics-related jobs has bounced back. “Things are looking great,” she says. Still, job seekers worried about job hunting in a virtual setting, Bailey suggests seeking guidance from APS Webinars for tips and tricks on navigating career exploration. For- would-be attendees of the September virtual career fair, Bailey offered more advice. “Have an agenda—do some research, look at who is there, understand what they’re looking for,” says Bailey. “Think of this as an opportunity where you have access to people. Plan out who to visit, and what questions you want to ask. Be intentional, and use the resources on the APS Careers website, which has a lot of great information to prepare job seekers.”

To learn more about the Virtual Career Fair, or to register as a recruiter or attendee, visit go.aps.org/CareerFair.

Meet with representatives from graduate schools, and companies currently hiring!

Attendees, graduate schools, and employers all must register by August 27.

goad.aps.org/CareerFair

THIS MONTH IN

Physics History

July 19, 1921: Birth of Rosalyn Sussman Yalow

By Leah Poffenberger

edical physicist Rosalyn Sussman Yalow became the first American-born woman to receive the Nobel Prize in Physiology or Medicine in 1977. She was one half of a -year scientific partnership with physician Solomon Berson that resulted in the development of the radioimmunoassay (RIA) technique. The creation of RIA, which allows for the detection of small quantities of substances such as insulin or enzymes in blood, was influential in opening doors for the field of endocrinology.

Yalow was born on July 19, 1921, in the Bronx, New York, to Clara (née Zipper) and Simon Sussman, and was the youngest of their two children. Neither Clara, who immigrated to New York at the age of four, nor Simon, who was born on the Lower East Side, had high school educations, but they expected both of their children to attend college. Yalow, in her Nobel biography, described herself as a “stubborn, determined child,” with a fondness for reading and a dedication to mathematics, which developed by seventh grade. By the age of eight, she had aspirations of being a scientist. She attended high school at Walton High School, at the time an all-girls institution, where she became interested in chemistry.

After high school, Yalow attended Hunter College, an all-female, tuition-free school, where her family hoped she would study to become a teacher. Instead, Yalow was drawn to physics, in part by the excitement surrounding the field of nuclear physics in the late 1930s. Eve Curie’s biography of her mother, Marie Curie, was a source of inspiration for Yalow. Her professors at Hunter College encouraged her to pursue a career in physics, despite Yalow’s worry that good graduate schools would not offer a woman in physics a position of financial support. In September 1940, during her senior year, one of her professors secured her role as a secretary for a leading biochemist at Columbia University, which was supposed to allow her the ability to take graduate courses. The only catch was that she had to commit to taking stenography. However, in February 1941, Yalow received an offer of a teaching assistantship in physics at the University of Illinois Urbana-Champaign, the most prestigious school she had applied to. In September 1941, Yalow entered the University of Illinois, becoming the only woman among the 400-member faculty of the College of Engineering, and the first woman there since 1917, according to the Dean of Faculty at the time. In her Nobel biography, Yalow notes that the draft of college-aged men into the armed forces leading up to World War II likely opened up space for her to attend graduate school. Her first year was difficult: since Hunter College had not offered many physics courses, Yalow had to sign up for two undergraduate courses without credit in addition to taking three graduate courses and working as an assistant teaching freshman physics. Yalow would receive straight As in both of her courses, except in an optics laboratory course, where she received an A-, prompting the chair of the physics department, “That A- confirms that women do not do well at laboratory work.”

At the University of Illinois, Yalow would also meet her future husband, Aaron Yalow, who was also a graduate student in physics, the first day of school. They would marry in 1943, with some delay caused by anti-nepotism rules that prevented married couples from being employed by the same university. In January 1945, Yalow received her PhD in nuclear physics and moved back to New York City without her husband (he would join her later that year) to work as an engineer at the Federal Telecommunications Laboratory. In 1946, she returned to Hunter College to teach physics, whose student body included returning veterans. While teaching at Hunter College, Yalow influenced a young Mildred Dresselhaus to pursue a career in physics instead of becoming a primary school teacher. Although she would continue teaching at Hunter College until 1950, Yalow began consulting at the Bronx Veterans Association Hospital in 1947 as part of a research program to explore the medical uses of radioactive substances. It was there she would meet Solomon Berson who would become her chief collaborator for the
The Frontiers of Physics (FOP), a US-based collaborative program, held the First US-Bangladesh Physics Conference on Physics in partnership with University of Dhaka and the Bangladesh Physical Society (BPS) in Dhaka, Bangladesh on February 5 and 6, 2021. FOP was founded to support the pursuit of advancing science and education in Bangladesh by Charles Clark (Rutgers University, Materials Science and Technology), and the author (The Ohio State University). Clark’s interest in promoting science in Bangladesh was inspired by his collaborator, well-known Bangladeshi American neutron spectrometrist Mohammad Alip, who passed away recently. Clark provided the start-up funds for FOP and I am the FOP liaison to Bangladeshi institutions. BPS covered the expenses for the conference.

The inaugural conference year of 2021 was chosen to coincide with the centennial anniversary of the University of Dhaka and Satyendra Nath Bose, an Indian physicist and the founder of the Bose-Einstein condensate. The first intercontinental quantum-end-to-end videocall—keeping a kosher home. Yalow held a particular expertise for women in science was Cartilage, introduced a new concept of particles with integer spin, now known as bosons. This concept led to the development of Bose-Einstein condensates and the prediction of Bose-Einstein condensates.

Chao-Yang Lu, who has been dubbed China’s “father of quantum” and is co-leader of the APS journal Physical Review Research. After meeting Pan at USTC, where he earned a master’s degree before moving to the University of Cambridge for his Ph.D. In 2011, he returned to his alma mater as a professor. In less than two decades, Lu has witnessed the field of quantum technology grow from a small academic community to an international arena involving billions of dollars in investment. Still, experts anticipate that it will take decades of development before they build a fault-tolerant quantum computer—a device that can correct its own errors. Lu spoke to APS News about his career and his perspective on the race to build a useful quantum computer.

APS NEWS

THE FIRST US-BANGLADESH PHYSICS CONFERENCE

By Sultana N. Nahar

T

he Physics Department Chairs Conference, organized by APS and the American Association of Physics Teachers (AAPT), brings chairs together from departments across the country. Connecting chairs from a variety of types of institutions provides an important opportunity for both new and existing chairs to discuss challenges, share solutions, and build a network of resources. On June 3 and 4, around 150 chairs participated in the two-day event, which drew on feedback from the first virtual conference in 2020 to create a vibrant online experience. The 2021 Conference explored topics from improving departmental culture through diversity, equity, and inclusion to managing departmental threats to in order to build a thriving department. Each session was highly interactive, generating lively discussion from attendees.

"Much of the feedback from last year’s virtual event was around the need for networking and informal ‘happy hour’ conversations," said Farah Dawood, a member of the conference organizing committee at APS. "This year we did not have any sessions that were fully pre-conference—every session was a short intro, and then we had participants go into breakouts to have small-group discussions."

Congratulations to the 2021-2022 STEIN Advocates

Learn more at go.aps.org/Advocates21-22

HONORS

Quantum Scientist Wins APS Prize

By Sophia Chen

Chao-Yang Lu received the 2021 APS Rolf Landauer Award in Quantum Computing, for his work on the development of quantum technologies, such as optical quantum information sciences, especially on solid-state quantum computers, quantum teleportation, and optical quantum computing." Lu has worked on some of the flashiest projects in the development of quantum technology. A physicist at the University of Science and Technology of China (USTC) in Hefei, China, Lu is a member of the team that launched the world’s first known quantum satellite, Micius, which delivers information encoded in single photons to the ground from low Earth orbit. Using Micius in 2017, his team orchestrated the world’s first intercontinental quantum-encrypted videocall—for 75 minutes, with colleagues in Vienna. In 2020, Lu’s team published in Science that they had trapped a single quantum computer using 76 photons to execute an algorithm in 200 seconds that they estimated would take a conventional supercomputer 2.5 billion years: a demonstration of so-called quantum advantage. (Researchers point out that this algorithm, known as Gaussian boson sampling, could be useful for biology or business applications that involve graph theory, although they have not conclusively demonstrated any applications.)

Now 38, Lu began his career in 2003 as an undergraduate protégé of physicist Jian-Wei Pan, who has next 22 years, until his death on April 11, 1972. The first investigations Yalow and Berson undertook together were applying radioisotopes to blood volume determination, diagnosis of kidney diseases, and the kinetics of iodine metabolism. As their work progressed, they found that insulin levels could be employed to trace hormones, such as insulin. RIAs first used in 1959 to study insulin levels in people with diabetes but has been since applied to the detection of other hormones, vitamins, and enzymes to diagnose a number of endocrine-related diseases. Yalow and Berson would continue to collaborate until 1968, when Berson accepted the position of Chair of the Department of Medicine at the Mount Sinai School of Medicine. During this time period, Yalow also balanced her life as a wife and mother, raising two children and keeping a kosher home. Yalow held traditional views on her role in homemaking, telling The New York Times in 1978 that she believed it to be a wife’s responsibility. She expressed a belief that the low number of women in science was due to a lack of interest rather than lack of opportunities. While such views caused her to eschew organizations specifically promoting women in science, Yalow had a strong belief in the capabilities of women to succeed in the field. Her Nobel lecture included a call to other women in science: ”we must believe in ourselves or no one else will believe in us; we must match our aspirations with the competence, courage and determination to succeed, and we must feel a personal responsibility to ease the path for those who come after us.”

In 1972, Berson died of a heart attack while attending a medical meeting, leaving Yalow to continue their research alone. According to The New York Times, many people—including Yalow—began to doubt that she would ever receive a Nobel Prize for the pioneering work on RIA, especially after the loss of Berson, who some—erroneously—viewed as the leader of their collaboration. However, in 1979, Yalow received one half of the Nobel Prize, with the other half going to Roger Guillemin and Andrew Schally for work in other fields.

Yalow died May 30, 2011 in the Bronx, New York, and is survived by her two children and two grandchildren. Her scientific legacy also continues to live on through her contributions to medicine. In 2021, to commemorate 100 years since her birth, the University of Illinois honored her as a Nobel Prize in Women in STEM by creating the Rosalyn S. Yalow Professorship.

Additional Reading:


Prize Continued on Page 5

HISTORY CONTINUED FROM PAGE 2

2021 Chairs Conference Gathers Department Leadership to Share Solutions to Challenges

By Leah Pofdenberger

The US-Bangladesh Conference on Physics featured Nobel Laureate Eric Cornell as the public keynote lecturer. Cornell was awarded the 2001 Nobel Prize in Physics, along with Carl Wieman and Wolfgang Ketterle, for experimental verification of the existence of Bose-Einstein condensates. The conference also featured presentations by seven speakers from Princeton University, University of Florida, The Ohio State University (OSU), the Joint Institute for Laboratory Astrophysics (JILA), and NIST, and by seven of the most distinguished physicists in Bangladesh.

BANGLADESH CONTINUED ON PAGE 7

CHAIRS CONTINUED ON PAGE 6

APSNW

July/August 2021

2021 APS NEWS July/August 2021

Congratulations to the 2021-2022 STEIN Advocates

Learn more at go.aps.org/Advocates21-22
use their scientific talent to address global challenges."
Salter continued, "Although all of the Physical Review journals are world-leading in their fields, our core focused journals, Physical Review Applied, launched in 2014, as well as Physical Review Fluids and Physical Review Materials, launched in 2016 and 2017, respectively, are likely to be of particular interest to industrial researchers and entrepreneurs."

APs meetings and confer- ences offer additional avenues for entreprenuers to gain insight into launching new businesses, with the meetings representing opportun- ities to test new ideas as novel scientific results are shared and discussed among attendees.

Steelf first presented his inven- tion of a focused ion-beam system at the APS Division of Atomic, Molecular, and Optical Physics (DAMOP) meeting a few years ago. "I found the DAMOP meeting useful in the same way that I found the journals; it was a chance to learn about the latest scientific results in laser cooling," he said, adding that he thinks the meeting is also a great way to recruit future employees.

Similarly, entrepreneur Gil Travish, who developed field e-beam guns. Meeting in 2018. Travish discussed among attendees.

"We hope that this report helps [faculty members] build the case for what they are trying to do. We also hope that we can create a commu- nity of practice so that educators can share the approaches they are developing more broadly," added Bailey.

APS Government Affairs (GA) also does its part to support APS members on the entrepreneurial path by advocating for robust budgets for federal science agencies that support projects "across the R&D continuum, from foundational and use-inspired research to tech transfer and commercialization," said Mark Elsesser, GA Director.

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

GOVERNMENT AFFAIRS

Congress Seeks Compromise on Landmark Competitiveness Legislation

BY MITCH AMBROSE

This century’s biggest US science policy debate to date has reached a pivotal phase, with the House and Senate preparing to iron out differences between their distinct visions for expanding federal science agencies.

In June, the Senate passed the sprawling US Innovation and Competition Act (USICA), a 2,400-page legislative package that is primarily aimed at countering the Chinese government’s growing influence in the fields of technology and geopolitical clout. The package includes the Endless Frontier Act, which would add a directorate to NSF focused on technology-centric vision for expanding the agency.

The Senate, like the House, is unconvinced of the senators' tech- nological and geopolitical clout. The House Science Committee began developing the NSF bill soon after Senate Majority Leader Chuck Schumer (D-NY) first introduced the Endless Frontier Act last year with Sen. Todd Young (R-IN), and House Majority Leader Steny Hoyer (D-MD).

The House Science Committee began developing the NSF bill soon after Senate Majority Leader Chuck Schumer (D-NY) first introduced the Endless Frontier Act last year with Sen. Todd Young (R-IN), and House Majority Leader Steny Hoyer (D-MD).

Through an at-times chaotic amendment process, the Senate assigned the Department of Energy and Defense Advanced Research Projects Agency a major role in supporting the same set of tech- nology areas. It also added $52 billion for domestic semiconductor manufacturing incentives and R&D to implement the recently enacted CHIPS for America Act.

Rather than take up the USICA, the House passed the first pieces of its own legislative vision in June, starting with the NSF for the Future Act and the DOE Science for the Future Act. These and other bills will form the basis of negotiations with the Senate over a comprehensive package that will likely take months to complete.

The House Science Committee recently approved a reversal of the Trump Administration’s rollback of methane emissions regulations, following robust engagement by APS members to support the change.

The resolution, which was passed by the Senate in April, will now head to President Biden for his signature.

"We are extremely happy about this development, which will help reduce methane emissions from the oil and gas industry in a significant way. APS members have consis- tently ranked climate change as one of the issues most important to them, and they deserve credit for dedicating their time to reach out to their members of Congress to urge action on this matter," said Mark Elsesser, Director of APS Government Affairs.

In response to recent scientific results indicating that the negative environmental impacts of methane are significantly higher than previously estimated, the Society submitted a public comment to fall 2019 to the US Environmental Protection Agency (EPA), opposing the agency’s proposed policy amendment to curtail all regulations of greenhouse gas emissions. The amendments would have elimi- nated requirements on oil and gas companies to install technologies to monitor methane leaks in pipelines, wells, and storage facilities.

"With the risks of methane emissions now determined to be higher than previously estimated, this is not the time to be relaxing regulations," APS stated in the comment.

Fortunately, regulations con- cerning methane leaks were put in place when new EPA rules were finalized during the last few months of the previous administration. But with support from APS Government Affairs, Society members pushed back by asking their congressional members to support a reversal of the rollback.

Both the House and Senate had recently introduced a joint resolution of disapproval via the Congressional Review Act, which provides an opportunity to quickly address the issue rather than going through the lengthy rulemaking process.

"The House Science Committee recently approved a reversal of the Trump Administration’s rollback of methane emissions regulations, following robust engagement by APS members to support the change. The resolution, which was passed by the Senate in April, will now head to President Biden for his signature."
David Wirth Named 2021 PhysTEC Teacher of the Year

BY LEAH POFENBERGER

Each year, the Physics Teacher Education Coalition (PhysTEC) recognizes outstanding physics educators with the PhysTEC Teacher of the Year award. The winner of the 2021 PhysTEC Teacher of the Year award is David Wirth, who teaches at Millennium High School in Goodyear, AZ.

PhysTEC is a joint initiative between APS and the American Association of Physics Teachers (AAPT) to address a critical shortage of qualified physics teachers in the United States through improved teacher education programs. Alumni of PhysTEC member institutions are selected for the Teacher of the Year award to highlight exemplary educators who demonstrate the value of teacher preparedness. Each year, PhysTEC names one national Teacher of the Year as well as local Teachers of the Year—this year, ten local winners were selected.

David Wirth, an alumnum of PhysTEC member institution Arizona State University, has spent a 29-year teaching career bringing students unique opportunities to take their enthusiasm for physics beyond the classroom. Through co-founding an annual math and science expo and science fair, Wirth has inspired students to pursue careers in science.

In the classroom, Wirth uses the Modeling Instruction method, as well as the latest pedagogical best practices, to create an exceptional learning environment for his students. He has also raised over $50,000 in grants to purchase equipment to give students opportunities to explore physics in hands-on ways and build confidence in their physics skills. Wirth also mentors fellow teachers, sharing techniques he has tested in his own classroom.

Beyond the classroom, Wirth continues to provide students with opportunities to learn and grow their enthusiasm for science.

Wirth is the latest in a long line of distinguished teachers honored by PhysTEC for their outstanding contributions to physics education.

JOURNALS

APS to Launch New Open-Access Energy Sciences Journal: PRX Energy

As part of its strategy to provide expanded open-access offerings in the Physical Review journal portfolio, APS is launching PRX Energy, a new selective journal featuring papers on energy sources, storage, and utilization research. Submissions will be accepted starting in late summer 2021 with the first papers published in the fall.

“The physics community has long been central to fundamental energy science and many resulting applications,” said APS Editor in Chief Michael Thoennessen. “But communication and collaboration across traditional boundaries is now critical, as researchers and stakeholders from a diverse array of disciplines and regions focus their efforts on achieving a sustainable energy future.”

PRX Energy will continue the path set by Physical Review X (PRX), the society’s selective multidisciplinary journal across all areas of physical science, in celebrating its 10th anniversary this year, and PRX Quantum, which launched one year ago with a focus on quantum information science. Publication charges will be waived for submissions until 2023.

“PRX Energy is the latest in a series of selective topical journals that draw on the strength of the Physical Review brand,” said APS Publisher Matthew Salter. “This new journal will enable APS to better serve scientists working at the interface of physics, engineering, and materials science.”

In addition to broadening the open-access options for authors in energy science, the journal launch will enhance the ways that APS serves applied and industrial physicists.

By seamlessly connecting the communities that conduct fundamental and applied research, such as physics, chemistry, materials, engineering, technology, biology, environmental studies, and policy, we can move more quickly toward discovering the critical energy solutions for the future, a primary motivator of the next generation of physicists and the catalyst for industry,” said APS Chief External Affairs Office Francis Slaney.

APS CEO Jonathan Bagger emphasized the breadth of the Society’s commitment to all areas of physical science research, saying that “any physicist who is inspired to use their scientific talent to address global challenges should feel at home at APS.”

For more information on the Physical Review journals published by APS, visit journals.aps.org.

MEETINGS

Celebrating Sakharov

BY DAVID VOS

Born 100 years ago, Russian physicist Andrei Dmitrievich Sakharov was a complex man who achieved stardom in the Soviet Union for his role in the development of the USSR’s nuclear weapons but then became one of the world’s most outspoken activists for human rights. One of the most prestigious prizes awarded by the APS bears his name.

To recognize Sakharov’s achievements as a physicist and peace campaigner, several APS units came together with the Russian-American Science Association (RASA) to organize “Sakharov-100: Physics, Peace, Human Rights—Celebrating his contributions to science and humanity.” Meeting support and assistance was provided by APS.

“The Sakharov-100” webinar reached 396 people from 31 countries distributed on each continent including the US, Russia, and Europe,” said Vladimir Shiltsev (Fermilab), a member of the organizing committee. “It was a true celebration of an amazing human being.”

The conference was the work of members of the APS Forum on the History of Physics, the APS Forum on International Physics, the APS Forum on Physics and Society, and the APS Committee on the International Freedom of Scientists, in collaboration with RASA. The Organizing Committee of the “Sakharov-100” event included Luisa Cifarelli (U.Bologna, APS FIP), Claire Yankelevich Bonner and Marina Sakharov-Liberman (video recording), Zafra Lerman (Malta Conferences Foundation), Alexander Kabanov (University of North Carolina at Chapel Hill), and Peter Vorobieff (University of New Mexico, APS CIP). The wide-ranging conversation touched on Sakharov’s humanity and achievements, with reminiscences from family and colleagues.

“The Sakharov Centennial event opened my eyes to the scope and breadth of his impact on our world. His story is a must-know for students of history, science, and physics,” said Alan Herd, a member of the organizing committee.

A list of sessions and a video recording of the entire event are available at engage.aps.org/fip/resources/activities/sakharov.
When you first started working in quantum research in 2001, what was your lab’s motivation?

Quantum technology was far less commercializable, and I think we had much less funding. Our motivation was not so ambitious as to build a practical quantum computer but to investigate fundamental questions in quantum technology. We had to build high-precision devices to build quantum networks and quantum logic gates, and how to realize simple toy models of algorithms.

What experiments did you work on?

As a master’s student, I worked on many different projects. Professor Pan assigned me to entangle six individual photons for the first time. We experimentally demonstrated Shor’s algorithm—the single most shocking algorithm in quantum technology—using photons. [Editor’s note: Shor’s algorithm is a quantum computing algorithm for factoring numbers that is anticipated to be a threat to current encryption systems.] At that time, we used four photons, and we entangled them in states 1 and 3. It was extremely simple, but we were the first to do it with entangled photons.

We demonstrated how to encode the state of a single photon into the entangled state of multiple photons. We had to figure out how to get four photons lost during transmission, we could still recover some quantum information. We also created a quasiparticle called an anyon out of photons and proved that the anyons are neither bosons nor fermions, but something in between.

Now, your team is very much focused on developing a practical quantum computer. When did the shift toward technology happen?

2011 was a big year, because the Chinese government officially approved US$100 million in funding for the Micius satellite project. In 2013, they approved another major project for a similar amount of money, to build a fiber optic backbone to connect Beijing to Shanghai. [Editor’s note: Lai’s team has used this infrastructure to conduct experiments related to quantum key distribution, a method for encrypting information that uses single photons.] In one recent milestone, your group demonstrated quantum advantage using photons, following a similar announcement from Google in 2019 where they performed a different algorithm using superconducting circuits. What is the significance of these quantum advantage experiments?

They are experimental results that allow us to believe that a quantum computer can solve a problem which a classical computer cannot solve.

After Google announced quantum advantage in 2019, other researchers later claimed they’d devised a classically equivalent method for performing their quantum computer. What’s the point when quantum advantage is a conceptually moving target?

Quantum advantage is not a single-shot achievement. It will be the result of long-term competition between quantum devices and classical simulation. I see it as a game between quantum scientists and computational scientists. Computational scientists are clever, so they will continue to come up with new algorithms to challenge quantum scientists.

So it’s still possible that someone could develop a classical algorithm that outperforms what your quantum computer achieved?

Yes, in principle. We expect people to come up with better classical algorithms. But I also think that eventually we will outpace classical methods with high hardware improvements and larger quantum processors, whose computing power grows exponentially with the number of qubits. In this spirit, we recently [posted arXiv papers on] upgraded quantum computers, one with 113 photonic qubits, and another one with 56 superconducting qubits.

What are the big challenges ahead for quantum computing?

I see three goals ahead. Our first goal is to make a quantum computer that can be simulated by any classical computer. The second goal is to make near-term applications in quantum chemistry. And the last goal is to have a fault-tolerant quantum computer. Achieving the first goal will give us confidence for the second and third. We also deliver meaningful intermediate results for government and funding agencies. It’s what in Chinese we call yuntu shidao, laying eggs along the way. The idea is to place milestones along the ascent to Mount Everest.

So Everest is building a fault-tolerant quantum computer, and the eggs are smaller achievements along the way.

This strategy will keep the field healthy. If we lay eggs along the way, we are delivering honest results of what our quantum computers can do. This way, we can avoid hype and disappointment.

Is there a problem with hype in China about quantum computing?

I think the hype is everywhere, as startups are launching throughout the world.

What’s your assessment of the startups in China?

As a master’s student, I am not sure whether startups have a clear strategy to building successful and really useful quantum computers.

What is the next egg that quantum computing should lay?

The next egg is to have an application using a noisy intermediate scale quantum device [See APS News, May 2021] on many different projects. Professors Pan and Andrew reported the development of nearest term applications of quantum computers is to study quantum mechanics itself—many-body problems, quantum chemistry, and quantum materials. What are you working on now?

A company in Canada called Xanadu has proposed a number of applications related to boson sampling. These applications are linked to graph-based problems, quantum chemistry, and machine learning. I think all these applications could be used in this way. Last year, I also started a new project to make an atomic array in optical tweezers.

You did your PhD at the University of Cambridge. What is your perspective on the different working styles in China versus the UK?

There is not much difference. A vast majority of our faculty has spent time overseas, and when we return to China, we bring working styles from Cambridge, Heidelberg, Stanford, and so on. One difference is that in the UK, our culture is more Confucian-like. We call it zhong-yong—seeking balance. Students are more modest and self-preserving, and they challenge their professors less.

You’ve been working in this field for nearly two decades now. How much has it met your expectations?

Looking back to today, I’m surprised at what we have achieved. There is a saying in Chinese: People are usually overly optimistic what they can do in the next 10 years, but overly pessimistic about what they can do in the next 5 years. I’m very optimistic about the next 10 years.

This interview has been edited and condensed for clarity.

The author is a freelance science writer based in Columbus, Ohio.
Do our instructional activities and techniques help build class room environments that promote diversity and inclusion, as well as foster understanding and appreciation of science? How can we support faculty who would like to implement new teaching approaches or engage students in new pedagogies? What are the best ways to support faculty in their efforts to meet the needs of their students? How can we best support APS members across all APS units.

While PER represents a relatively young sub-field of physics, it is one of the most well-established and well-funded in the APS. The vibrance of this new field and GPER’s members are students or PER faculty who contribute substantially to generalized knowledge to the department, as well as bringing in knowledge in education to the department, as well as contributing to a well-educated and knowledgeable research and teaching faculty.

PER faculty contribute substantially to the education research at their university and bringing in knowledge in education to the department, as well as contributing to a well-educated and knowledgeable research and teaching faculty.

In the age of coronavirus, many APS members may be thinking especially deeply about physics education research, in planning the future of undergraduate teaching and learning in the physics classroom, online, and perspectives on how technology in transitioning to remote learning might be rethought in the post-COVID world.

For APS members interested in bringing more about physics education research general, the Physical Review Physics Education Research (PRPER) is an APS member and has an excellent resource. The most recent edition of PRPER focuses on high-quality student experiment design and introductory laboratories to the end of the course. The use of homework assignments and teaching the physics of culture on women physicists’ career choices.

Additionally, many findings from PER researchers are synthesized in the Effective Practices for Physics Programs (EPP) Project, an initiative led by APS in collaboration with the American Association of Physics Teachers (AAPT) to document evidence-based recommendations and best practices for undergraduate physics education. The aim of EPP is to develop a resource that will help a wide variety of physics programs thrive for excellence within their particular opportunities and constraints, recognizing that what makes for a thriving physics program at one private university is not necessarily the same as that for a liberal arts college, a large state school, or a community college.

Going forward, the GPER executive committeereport their goals for the unit are two-fold. Looking inward, to continue the advancement of PER as a sub-discipline of physics, looking outward, to advocate for further integration of PER into the broader physics community. “We also see opportunities to venues that foster new conversations between researchers in physics education and APS members who do not specialize in PER,” explained Kryjevskaia. “I would like us to actively seek out an environment that welcomes and supports everyone, particularly those who are just beginning a new journey and who rely on our community for support, regardless of whether that support is needed in the form of advice, resources, or career development.”

Overall, GPER stands out a vibrant and growing field, with opportunities for new ideas, resources, and research about physics education. More information on this unit can be found here:

aps.org/gper

The author is a freelance writer in Stockholm, Sweden.

BANGLADESH CONTINUED FROM PAGE 3

The Minister of Education of Bangladesh, Dipu Moni, inaugurated the conference. Earl R. Miller, US Ambassador to Bangladesh, spoke on US educational and research opportunities for Bangladeshi students, scientists, and entrepreneurs. The JILA explained Bose-Einstein condensation for a general audience, and the other US and Bangladesh speakers covered large areas of physics and astronomy. Clark spoke on how neutrinos, which can travel through matter easily, enable imaging structures in dense matter, testing quantum entanglement and studying matter-wave optics. Anil Pradhan (OSU) spoke about modeling of exo-planets, and I presented a spectroscopic interpretation of observation of lanthanide following the detection of gravitational waves created during the merger of two neutron stars. M. Zahid Hasan (Princeton) discussed topological concepts of quantum phases of matter with experimental verification of a topological insulator whose surface hosting an unpaired Dirac fermion can give rise to topological superconductors with helical Cooper pairing. Khandaker Murtalib (Florida) spoke on the study of thermoelectricity for possible use in green energy production. Sheikh A. Kabir (OSU) spoke about ceramic nano-heterostructures in materials design that can be platforms for sensing and biomedical applications and presented results on the successful creation of various nanofibers and nanofiber-structured materials with the use of lithographic techniques. Among the Bangladesh speakers, two students are looking outward, to advocate for further integration of PER into the broader physics community. The session included Education/USA Director Iqbal Sohel (US State Department). At the concluding ceremony, General Clark, Nahar, and Hasan were honored as new Fellows of the BPS by its President Mesbahuddin Ahmed.

The impact of the conference was very inspiring. Audience questions indicated high interest in opportunities for students in the US and exchange research programs. However, students and researchers were encouraged to find their qualifications, particularly in research, do not match the standards of the universities they would like to attend or visit. It would be highly beneficial to initiate an International School of Young Physicists (ISYP), similar to the ISYP Europe. Further, run by International Astronomers run by International Astronomical Union (see APS News, October 2020), for students and young researchers in developing countries.

Sultana Nahar is a research professor of astronomy at The Ohio State University, co-author of the textbook Atomic Astrophysics and Spectroscopy, creator of the NORDA–Atomic Data–code, codirector of the IYAFP, and adjunct professor of physics at Aligarh Muslim University and the University of Dhaka. She has been funded over a dozen educational and research programs in Bangladesh.

A. A. Mamun (Jahangirnagar) discussed identification of new nuclear-acoustic waves in cold degenerate quantum plasma. Khondkar M. Masud (Dhaka), founder of the Department of Medical Physics at the University of Dhaka, spoke about imaging techniques that he has developed for the study of the stomach, lungs, and any small region inside the body and the characterization of breast tumors to determine malignancy. Syed M. Hossain (BAEC) described the nuclear infrastructure in Bangladesh. Golam Mohammed Bhuyan (Dhaka) reported his theoretical study of the behavior of liquid metallic binary alloys. M. Idrfi Miah (Chittagong), who does his research in Australia whenever the opportunity arises, spoke on multiphoton spin generation and detection in semiconductors. M. A. Hakim (BUET) presented results on size dependent properties of nanostructured materials. Saleh H. Shabir (UDEN) reported on his collaborative work in Pakistan, India, Turkey, Malaysia, Japan, and the US with the USDOE.

METHANE CONTINUED FROM PAGE 4

process to reverse the rollback of methane emissions regulations. Supported by a strong grassroots effort among APS members, Sen. Murkowski (R-AK) successfully advanced the resolution in the Senate in May in a bipartisan manner, joined by Republican Sens. Lindsey Graham (SC), John Thune (SD), Jerry Moran (NE), Mike Lee (UT), and the creation of jobs through the technological gaps in methane issue via a joint study with the USDOE. Members of the US Senate and House have not been observed before: Sheikh A. Akbar (OSU) presented new findings that can be platforms for sensing and developing new sensors and sensing platforms for possible use in green energy production. Sheikh A. Kabir (OSU) spoke about ceramic nano-heterostructures in materials design that can be platforms for sensing and biomedical applications and presented results on the successful creation of various nanofibers and nanofiber-structured materials with the use of lithographic techniques. Among the Bangladesh speakers, two students are looking outward, to advocate for further integration of PER into the broader physics community. The session included Education/USA Director Iqbal Sohel (US State Department). At the concluding ceremony, General Clark, Nahar, and Hasan were honored as new Fellows of the BPS by its President Mesbahuddin Ahmed.

The impact of the conference was very inspiring. Audience questions indicated high interest in opportunities for students in the US and exchange research programs. However, students and researchers were encouraged to find their qualifications, particularly in research, do not match the standards of the universities they would like to attend or visit. It would be highly beneficial to initiate an International School of Young Physicists (ISYP), similar to the ISYP Europe. Further, run by International Astronomers run by International Astronomical Union (see APS News, October 2020), for students and young researchers in developing countries.

Sultana Nahar is a research professor of astronomy at The Ohio State University, co-author of the textbook Atomic Astrophysics and Spectroscopy, creator of the NORDA–Atomic Data–code, codirector of the IYAFP, and adjunct professor of physics at Aligarh Muslim University and the University of Dhaka. She has been funded over a dozen educational and research programs in Bangladesh.

A. A. Mamun (Jahangirnagar) discussed identification of new nuclear-acoustic waves in cold degenerate quantum plasma. Khondkar M. Masud (Dhaka), founder of the Department of Medical Physics at the University of Dhaka, spoke about imaging techniques that he has developed for the study of the stomach, lungs, and any small region inside the body and the characterization of breast tumors to determine malignancy. Syed M. Hossain (BAEC) described the nuclear infrastructure in Bangladesh. Golam Mohammed Bhuyan (Dhaka) reported his theoretical study of the behavior of liquid metallic binary alloys. M. Idrfi Miah (Chittagong), who does his research in Australia whenever the opportunity arises, spoke on multiphoton spin generation and detection in semiconductors. M. A. Hakim (BUET) presented results on size dependent properties of nanostructured materials. Saleh H. Shabir (UDEN) reported on his collaborative work in Pakistan, India, Turkey, Malaysia, Japan, and the US with the USDOE.

The impact of the conference was very inspiring. Audience questions indicated high interest in opportunities for students in the US and exchange research programs. However, students and researchers were encouraged to find their qualifications, particularly in research, do not match the standards of the universities they would like to attend or visit. It would be highly beneficial to initiate an International School of Young Physicists (ISYP), similar to the ISYP Europe. Further, run by International Astronomers run by International Astronomical Union (see APS News, October 2020), for students and young researchers in developing countries.

Sultana Nahar is a research professor of astronomy at The Ohio State University, co-author of the textbook Atomic Astrophysics and Spectroscopy, creator of the NORDA–Atomic Data–code, codirector of the IYAFP, and adjunct professor of physics at Aligarh Muslim University and the University of Dhaka. She has been funded over a dozen educational and research programs in Bangladesh.

A. A. Mamun (Jahangirnagar) discussed identification of new nuclear-acoustic waves in cold degenerate quantum plasma. Khondkar M. Masud (Dhaka), founder of the Department of Medical Physics at the University of Dhaka, spoke about imaging techniques that he has developed for the study of the stomach, lungs, and any small region inside the body and the characterization of breast tumors to determine malignancy. Syed M. Hossain (BAEC) described the nuclear infrastructure in Bangladesh. Golam Mohammed Bhuyan (Dhaka) reported his theoretical study of the behavior of liquid metallic binary alloys. M. Idrfi Miah (Chittagong), who does his research in Australia whenever the opportunity arises, spoke on multiphoton spin generation and detection in semiconductors. M. A. Hakim (BUET) presented results on size dependent properties of nanostructured materials. Saleh H. Shabir (UDEN) reported on his collaborative work in Pakistan, India, Turkey, Malaysia, Japan, and the US with the USDOE.

The impact of the conference was very inspiring. Audience questions indicated high interest in opportunities for students in the US and exchange research programs. However, students and researchers were encouraged to find their qualifications, particularly in research, do not match the standards of the universities they would like to attend or visit. It would be highly beneficial to initiate an International School of Young Physicists (ISYP), similar to the ISYP Europe. Further, run by International Astronomers run by International Astronomical Union (see APS News, October 2020), for students and young researchers in developing countries.

Sultana Nahar is a research professor of astronomy at The Ohio State University, co-author of the textbook Atomic Astrophysics and Spectroscopy, creator of the NORDA–Atomic Data–code, codirector of the IYAFP, and adjunct professor of physics at Aligarh Muslim University and the University of Dhaka. She has been funded over a dozen educational and research programs in Bangladesh. Null
Two Points of Light
By S. James Gates, Jr., Roxanne Hughes, Laura H. Greene, and Paul Cottle

The underrepresentation of Blacks and women in physics, from the undergraduate level all the way through to the senior ranks, is among the most stubborn and frustrating issues facing the physics community. According to the AIP Statistical Research Center [1, 2], Black students received 3% of the 2018 physics bachelor’s degrees in the US, falling from 5% in the 1990s. The number of Black students earning PhDs in the 2018–19 academic year was only half of what it was in 2011–12. Today, fewer than 1% of new physics PhDs are Black.

The percentage of women earning bachelor’s degrees has stagnated. The percentage of women earning bachelor’s degrees has been below 21% since 2000. There was a slow increase until 2012, but since it has remained at 20%.

There are no easy, sweeping solutions to this stunning lack of representation. If we are to make progress, work needs to be done at multiple educational and career levels including middle and high schools where students are determining what careers fit with their interests and identities. Educators and science engagement experiences outside of school have great potential for sparking youth’s interest in STEMM (science, technology, engineering, math, and medicine), and maintaining that interest as they begin to make decisions on careers. Through these supportive and engaging physics experiences, the goal is for all students to feel like welcome members of the physics community—where they can learn to identify themselves as aspiring physicists.

Jones High School in Orlando, Florida, is one of the most successful in this regard. As Gates attended Jones in the late 1960s, it had a place at Jones High School, where one of us (Gates) had a composite major and minor in physics.

Jones High School in Orlando, Florida, is one of the most successful in this regard. As Gates attended Jones in the late 1960s, it had a place at Jones High School, where one of us (Gates) had a composite major and minor in physics.

The British computer scientist Alan Turing once said, “Sometimes it is the people no one imagines anything of who do the things that no one can imagine.”

Jones High School in Orlando, Florida, is one of the most successful in this regard. As Gates attended Jones in the late 1960s, it had a place at Jones High School, where one of us (Gates) had a composite major and minor in physics.

Gates credits his interest to Ms. Thelma Dudley, Ms. Lessie Weaver (English), and Mr. Freeman Coney (Physics) are memorable. The influence Mr. Coney had on Gates’ life was the most significant. He was the most profound, but many Jones High School teachers laid the foundation that led to his being awarded the National Medal of Science in 2013, and a current role as President of the American Physical Society (APS).

The credit for success and ambition of present-generation Jones students goes to current Principal Allison Kirby and the outstanding teachers and counselors she leads. They follow in a long line of school officials and teachers in this effort. Even in the face of the pandemic, Principal Kirby and her faculty kept their students focused on the prize of academic excellence and opportunities that their hard work will open for them in the future.

The Back Page is a forum for member commentary and opinion. The views expressed are not necessarily those of APS.

The SciGirls program has expanded to over 400 students, with 30% from underrepresented groups in STEMM (Black, Hispanic, Pacific Islander, Indigenous Peoples) and three separate summer camps, including the SciGirls Coding Camp. 

And yet, even with these empowering stories, some of our alumnae have told us about negative experiences in high school that made them question whether they could succeed, or if they even belonged in STEMM. Their stories reinforce the need for programs that help to maintain interest and a sense of belonging throughout middle and high school to persist in STEMM careers. It also points to the need for enhanced teacher training such as that provided by the PhysTEC and the APS STEP UP programs. One of us (Greene) is also inspired by the SciGirls program, and notes that in her high school years, no such programs existed, and she had no mentors for her to pursue a career in science.

Both women and people of color struggle to feel they belong even if they persist through high school into college. The intersectionality of marginalized identities makes their reasons for not persisting different [3] as Greene and Gates’ stories show. For women, even if they persist to a physics major in college, they have to overcome sexism [4, 5] and the isolation of sometimes being the only women. For women and men with multiple marginalized identities (e.g., race, income, class, ethnicity, sexual orientation), their isolation in multiple realms makes it difficult for them to feel like they belong in a majority White, middle class, and male field, like physics. This means that to help students and early career scientists thrive and make physics inclusive we need to incorporate multiple strategies [6, 7].

J.S. Gates, Jr. is the 2021 APS President, the Brown Theoretical Physics Center (BTPC) Director, and the recipient of the 2021 National Medal of Science. Reanne Hughes is the Director of the Center for Integrating Research and Learning (CIRL) at the National High Magnetic Field Laboratory (MagLab). Laurena Greene is Chief Scientist, National High Magnetic Field Laboratory and the Marie Kraft Professor of Physics at Florida State University. Paul Cottle is a member of the Physics Faculty at Florida State University.

References
7. APS Statement on Promoting an Inclusive Workplace, APS Committee on Minorities in Physics, APS Committee on the Status of Women in Physics.