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APS NEWS

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JOURNALS

New Journal Launch: *Physical Review Research*

APS has announced the newest title in its portfolio of peer-reviewed journals—*Physical Review Research* (PRResearch). The publication will be fully open-access (OA) and cover the entire range of physics, including interdisciplinary and newly emerging areas. The journal will open for submissions this spring with the aim to publish its first papers in the second half of this year.

"As we continue to expand publishing options for our authors and readers, *Physical Review Research* is the latest addition to our world-leading family of journals in physics and related research areas," says APS Publisher Matthew Salter. "This new journal will aim to advance and disseminate scientific research and discovery, promote physics, and serve the broader physics community. In these ways it will directly support our mission at APS."

PRResearch will become the fourth fully OA journal within the APS suite of peer-reviewed journals, which also includes nine prestigious hybrid titles. All articles published in the new journal will be immediately free to read, and readers anywhere in the world may reuse the content according to the terms of a CC-BY 4.0 International license.

"PRResearch will be positioned alongside *Physical Review A–E*, with similar selection criteria to these established topical titles" explains Michael Thoennessen, Editor in Chief for the APS journals. "It will offer a fully OA option for all authors who prefer or require that model and seek the *Physical Review* refereeing and publishing experience they value and trust."

Among the open access titles published by APS, PRResearch will complement *Physical Review X* (PRX), which has a similarly broad scope but is extremely selective as the highest impact, fully OA, multidisciplinary physics journal in the world. According to the author guidelines, manuscripts directly submitted, or transferred from PRX or another journal in the family, to PRResearch should:

- Present important and novel results that advance a particular field of research
- Generate interest for readers with a connection to physics
- Represent an authoritative and substantive addition to the body of literature
- Explore the subject matter comprehensively and thoroughly

"Submissions to PRResearch will be handled by the same professional editorial team of Ph.D. scientists who manage peer review

PRRESEARCH CONTINUED ON PAGE 7

LEADERSHIP

2019 APS President David Gross

BY LEAH POFFENBERGER

David Gross has been a member of APS for over 50 years, during which he has become a renowned and highly decorated theoretical physicist—and a Nobel Laureate, after winning the Nobel Prize in Physics in 2004. He was Director of the Kavli Institute of Theoretical Physics (KITP) at the University of California from 1997 to 2012, and now serves as the president of APS. Gross sat down with APS News *to discuss his goals for his presidential year, the new APS Strategic Plan, and the future of APS. The interview has been edited for length and clarity.*

Q: Can you outline your plans for the presidential year?

A: One thing that I have learned from serving as APS Vice President and President Elect is that in this position you have to swing with the punches. Larger national goals for the APS are currently on hold, as we are largely in a defensive mode trying to prevent bad things from happening. APS has had some important victories in this regard in recent years.

David Gross

Internally, last year was a very busy year for all of us, especially for APS management and members of the Board and Council, as we put together a Strategic Plan for the society [see go.aps.org/strategicplan].

It was a lot of work, but worthwhile. I am very pleased that the Strategic Plan contains new initiatives that are exciting and will lead to new programs and new ways of doing things. There are

PRESIDENT CONTINUED ON PAGE 7

Reminder: APS Innovation Fund

On February 7, all APS members were sent an email about the launch of a new initiative: the APS Innovation Fund (IF). The IF is part of the APS Strategic Plan: 2019 and initial proposals are due on March 18. For more information, see page 3 and visit go.aps.org/innovationfund

MEETINGS

APS April Meeting Preview

This year's APS April Meeting will head to Denver, Colorado, where attendees can share in a range of symposia, scientific presentations, and workshops. In keeping with the conference theme of "Quarks to the Cosmos," the topics will touch on the smallest constituents of matter and the largest structures in the universe. More than 1,000 conference-goers will converge on the Sheraton Denver Downtown Hotel for four days of physics organized by 22 APS membership units and committees.

Three distinguished scientists will speak about neutrino physics at the Kavli Foundation Keynote Plenary Session on Monday, April 15 (8:30 AM–10:15 AM). André de Gouvêa (Northwestern University) will discuss neutrino mass and physics beyond the Standard Model. Susanne Mertens (TUM/MPI-Munich) will cover different direct and indirect approaches to measurement of the neutrino mass. Marcos Santander (University of Alabama) will present recent results from the

MEETING CONTINUED ON PAGE 6

STRATEGIC PLAN

APS Strategic Plan: Process and Results

Physicist Nan Phinney (SLAC) served as Chair of the APS Strategic Plan Steering Committee. She spoke with APS News *about the APS Strategic Plan: 2019 and how it came together over the past year. For more on the new Strategic Plan see the special insert in this issue. The interview has been edited for length and clarity.*

Q: What is a strategic plan and why does APS need one?

A: In general, it's a good idea for any organization to look ahead and decide where it wants to be in five years. It's easy to get buried in solving today's problems and forget the longer perspective.

The Strategic Plan from a few years ago (*APS Strategic Plan: 2015–2017*) was created before the APS corporate reform (aps.org/about/reform/), when APS was run by a triumvirate. That Strategic Plan didn't cover APS as a whole. For instance, publishing is a very important part of APS and the old Strategic Plan didn't really address it. And one of the big issues now is open access—how do we respond to that without losing the peer review process that everyone values.

Q: How did the process for creating the new Strategic Plan work?

A: The planning for the new Strategic Plan was very thorough.

There were four subcommittees that addressed various key issues (go.aps.org/strategicplan). I would

APS PLAN CONTINUED ON PAGE 7

JOURNALS

Embracing All Aspects of Materials Research

BY CHRIS LEIGHTON AND ATHANASIOS CHANTIS

The field of materials science is inextricably intertwined with numerous fields of physics. It is thus unsurprising that materials-related research has traditionally featured prominently in several *Physical Review* journals, including *Physical Review Letters*, *Physical Review B*, *Physical Review E*, *Physical Review X*, *Physical Review Applied*, and *Reviews of Modern Physics*. Historically, however, the *Physical Review* never featured a journal with an *explicit* focus on materials research. This changed on April 4, 2017, when *Physical Review Materials*, the youngest member of the *Physical Review* family, was launched.

The original goal of *Physical Review Materials*, which was created in response to substantial analysis and information gathering by APS, was to fully embrace *all aspects of materials research*, across many disciplines. The latter include not only physics, but also materials science, and many fields of chemistry and engineering (electrical, chemical, mechanical, etc.), reflecting the interdisciplinary nature of the field. Inclusiveness, broadening of the footprint of the *Physical Review*, and expansion to non-traditional areas were thus anticipated (and welcomed) goals of the journal. The intention was to publish high quality, original experimental and

PRM CONTINUED ON PAGE 5

CAREERS

A Mile in My Shoes: The Story of My Personal Journey to a Fulfilling Physics Career, and What You Can Learn from It

BY CRYSTAL BAILEY

In my role at APS, I'm often in the position of advising students about the career outcomes they might expect once they receive their degree. A big part of my mission at APS is helping students to expand their vision beyond the confines of academia to encompass a much broader spectrum of possibility (as an aside, did you know that out of all physics PhDs initially employed in potentially permanent positions, 70% were in the private sector? You can read a lot more about that in an AIP Statistical Research Center report - go.aps.org/2UdSh2s, and in an article I wrote in 2013 for the FGSA Newsletter - go.aps.org/2GNDI2y).

In the process of advising students about careers I am also occasionally in the position to share details about my own personal career journey from a nuclear physics graduate student to a program manager at one of the largest physics societies in the world—and the "cautionary tales" that come along with that story. So I would like to take a moment to share three key pieces of advice that I wish someone had been there to give me as I embarked on my graduate education in physics.

Crystal Bailey

Have a Good Reason to Be There

The primary reasons I went to graduate school were: a) I was good at and enjoyed doing research, and grad school was a good way to continue that, and b) it's what everyone expected me to do. At no point did I consider whether a PhD in physics was actually necessary for me to achieve a future career goal (believe it or not, I actually wasn't interested in a permanent career in academia, which of course I (wrongly!) believed was the only thing I could do with a PhD).

As you advance in your education, your goals and priorities will change, but having a "guiding star"—at least one career outcome that you think you might enjoy—which actually requires the degree you're pursuing will give you resilience in the face of difficulty. When things got tough for me as a graduate student, not actually wanting the career outcome I thought my degree would lead to did nothing to motivate me to stay engaged. You don't have to stick to your plan, but having some sort of plan—a reason for being there—is hugely important.

Choose Your Advisor Very, Very, Carefully

All of us have heard horror stories about heartless research advisors who seem to be on a mission to make their graduate students miserable. But you don't have to be working for someone like that to still have a problematic relationship. In my case, my thesis advisor was a great person—there was just a mismatch between his style of management and what I needed in order to be productive and happy. This was a stressor

JOURNEY CONTINUED ON PAGE 5

Beginning with this issue, *APS News* has a new design. Among the changes readers will see is a top line on page 1 pointing to articles of special interest, more readable fonts, and additional subject headings to improve navigation. We hope you like the result and welcome feedback at letters@aps.org.

- David Voss, Editor, *APS News*.

THIS MONTH IN

Physics History

March 29, 1959: Lyman Briggs Publishes Research Results on Spin of a Baseball

It's the spin, not the speed, that is critical for achieving the unique trajectory of a curve ball in baseball. We know this because of a physicist and lifelong baseball fan named Lyman Briggs, who conducted wind tunnel experiments in the late 1950s to determine the answer once and for all. And he did that work after retiring from a long, distinguished physics career, proving that there really is no age limit to scientific curiosity.

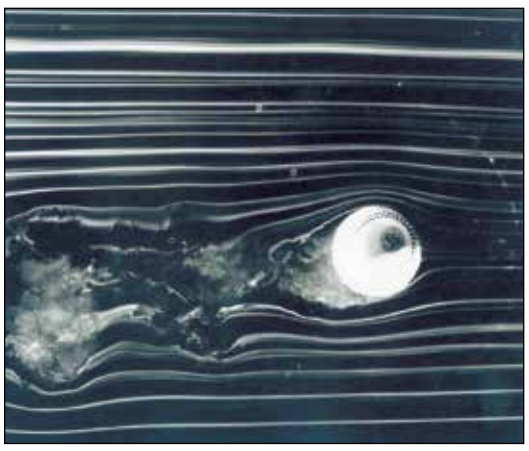
Born in 1874 in Battle Creek, Michigan, Briggs' family ancestors came to America in 1621 on a ship called the *Fortune*, which followed the original *Mayflower*. He never attended high school, but was admitted to Michigan Agricultural College (now Michigan State University) by examination, graduating second in his class four years later. He majored in agriculture, but his true interests lay in mechanical engineering and physics. He earned a master's degree in physics in 1895 from the University of Michigan, Ann Arbor, and finished his PhD at Johns Hopkins University in 1903.

Briggs married his wife, Katherine Cooke, in 1896 while still an undergraduate. (Katherine and their daughter, Isabel, later developed the Myers-Briggs Type Indicator personality test.) After getting his PhD, he joined the US Department of Agriculture, helping found the field of soil physics. One research area was studying how a plant's environment affected its water uptake.

In 1920, Briggs joined the National Bureau of Standards (NBS, now the National Institute of Standards and Technology), heading the Engineering Physics Division. Along with Hugh L. Dryden, he did pioneering research on the aerodynamics of very high-speed airfoils. He also co-invented an earth inductor compass, used to determine an airplane's bearing in relation to the Earth's magnetic field. (Charles Lindbergh used such a compass on his historic trans-Atlantic flight in 1927.) In 1932, President Herbert C. Hoover nominated Briggs as the new director for NBS, but his Congressional approval was delayed, and Franklin D. Roosevelt became president in the interim. Roosevelt honored his predecessor's choice, purportedly saying he had no idea what Briggs' personal politics might be: "All I know is that he is the best qualified man for the job."

During World War II, Roosevelt appointed the 65-year-old Briggs to head the Advisory Committee on Uranium, with the objective of investigating its fission potential. Progress was slow, in part due to Briggs' own poor health. It was a British team, headed by German refugees Otto Frisch and Rudolf Peierls, who discovered that purified U-235 could be used to make an atomic bomb. A committee of prominent British scientists sent their report to Briggs, but heard nothing.

Finally, a frustrated Marcus Oliphant (who mentored Frisch and Peierls) flew to Washington to meet with Briggs personally, and was "amazed



Airflow moving past a spinning baseball in a wind tunnel. NOTRE DAME UNIVERSITY

and distressed" to discover that Briggs had merely put the reports in his safe and hadn't shown them to anyone. Oliphant insisted on meeting with the full Uranium Committee, and ultimately persuaded US physicists to devote their efforts to developing the bomb. That effort ultimately became the Manhattan Project. Briggs retired from NBS in 1945, at age 72, just as the war was ending. But he still continued his research, setting up a laboratory at NBS for studying fluids under negative pressure—a return of sorts to his work on water uptake via capillary action of plants as a young scientist.

The war brought on a rubber shortage, so the rubber cores of baseballs during that period were replaced with cork. Pitchers loved it, but batters complained that the new balls didn't travel as far when hit. Briggs conducted experiments at NBS and reported in a January 1945 article in the NBS *Journal of Research* that "a hard-hit ball [with a cork center] might be expected to fall about 30 feet shorter than the prewar ball hit under the same conditions."

Nearly 15 years later, Briggs was back with more baseball physics experiments. There was a longstanding heated debate about whether a curve ball thrown by a baseball pitcher really curved, or whether it was an optical illusion. (St. Louis Cardinals pitcher Dizzy Dean once famously countered in the 1930s, "Ball can't curve? Shucks, get behind a tree and I'll hit you with an optical illusion." Briggs knew the so-called Magnus Effect (in which a spinning object moving through a fluid experiences a differential pressure that causes the object to be deflected) played a role, but how much did the curvature depend on speed, and how much on the ball's spin?

He set out to settle the debate once and for all, with the help of the Washington Senators baseball team. Pitchers threw baseballs at Griffith Field

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Editor.....David Voss
Staff Science Writer.....Leah Poffenberger
Contributing Correspondent.....Alaina G. Levine
Design and Production.....Nancy Bennett-Karasik

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HONORS

2019 APS Medal Ceremony and Leadership Convocation

BY LEAH POFFENBERGER

APS membership comprises 47 "units"–Divisions, Forums, Topical Groups, and regional Sections. Each year, leaders of these units congregate in Washington D.C. for the annual APS Leadership Convocation, Medal Ceremony, and Congressional Visits Day. At this year's Convocation (January 31 to February 2), attendees had the chance to meet with other unit leaders, learn about current and upcoming programs at APS, and participate in advocacy efforts in support of science.

Congressional Visits Day on Thursday, January 31, organized by the APS Office of Government Affairs, took unit leaders to Capitol Hill to meet with Congressional representatives from across the country to advocate for support of science. Discussions ranged from research funding to the need for reform of the visa system to ensure scientific mobility.

The APS Medal Ceremony and Reception took place on Thursday night, honoring Harvard physicist Bertrand I. Halperin. APS President David Gross presented Halperin with the 2019 APS Medal for Exceptional Achievement in Research for his "seminal contributions to theoretical condensed matter physics."

A plenary session Friday morning allowed convocation attendees the chance to hear from the APS staff leadership about the status of APS as an organization, new developments in journal publishing, and efforts in science policy and government affairs. More sessions throughout the day, led by APS employees, provided unit leaders with an overview of the many programs and services offered at APS.

An evening reception celebrating the 90th anniversary of *Reviews of Modern Physics* (RMP) brought unit leaders together with RMP and *Physical Review* editors. This was followed by an address by APS Past President Roger Falcone.

On Saturday morning, 2019 APS President David Gross spoke to convocation attendees about his priorities for the coming year, especially focusing on rolling out the new APS Strategic Plan and kicking off the APS Innovation Fund. The Convocation wrapped up with discussions among unit leaders, APS leadership, and staff about specific implementation goals for 2019 and beyond.

APS President David Gross (L) presents the APS Medal to Betrand I. Halperin (R).
KYLE BERGENER

BRIGGS CONTINUED FROM PAGE 2

and Briggs photographed the flight path with a stroboscopic camera to capture speed and curvature. He also experimented with propelling a ball from an airgun and photographing the flight path. The balls had been marked to also measure the spin, but the marks were too small to show up on the resulting photographs.

So Briggs turned to the NBS wind tunnel he helped build back in 1917, tossing in baseballs and letting them freefall against the horizontal wind streams, causing the balls to curve. When the baseballs hit the ground, they bounced off a piece of cardboard treated with lampblack, putting a smudge on the ball to show the point of impact. The results, published on March 29, 1959, were clear: the speed of the ball had little effect on how much a curveball curves; spin is the critical factor.

Briggs died on March 25, 1963, at age 88. Edward Condon, who succeeded him as NBS director, declared, "Briggs should always be remembered as one of the great figures in Washington during the first half of the century, when the Federal Government was slowly and stumblingly groping towards a realization of the important role science must play in the full future development of human society."

Further Reading:

1. Briggs, Lyman J. (1945) "Methods for measuring the coefficient of restitution and the spin of a ball," *J. Res. Natl. Bur. Stand*. **34**: 1-23.
2. Briggs, Lyman J. (1959) "Effect of spin and speed on the lateral deflection (curve) of a baseball and the Magnus effect for smooth spheres," *Am. J. Phys*. **27**: 589-96.

STRATEGIC PLAN

APS Innovation Fund: Advancing the Physics Enterprise

As part of the recently adopted *APS Strategic Plan: 2019* APS has launched a new program—the *APS Innovation Fund (IF)*—to foster collaborative partnerships that support the interests of the physics community. **An IF announcement email went to all APS members on February 7, 2019. The deadline for preliminary proposals is March 18.** To download the preliminary proposal form, visit the IF webpage at aps.org/programs/innovation/fund/.

APS members may submit proposals to work with APS staff in developing innovative activities in areas of public engagement, advocacy, education, diversity, and careers, among many others. The 3–5 projects that are ultimately selected will be funded for up to two years with grants ranging from $25,000–$100,000 per year. After two years, funded projects will end, obtain outside funding, or be deemed important enough to be integrated into APS's operating budget.

The IF process begins with a brief preliminary proposal. Members need to identify an APS unit or committee, which will be asked to provide a brief statement of support. APS staff will also assist by preparing a comment regarding impacts on staffing and existing programs.

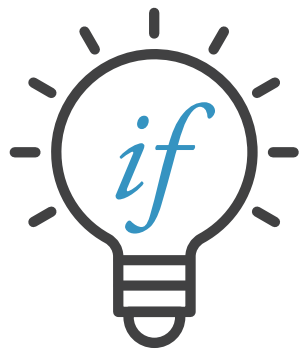
Investigators whose preliminary proposals are selected in the first phase will be invited to submit 5-page full proposals.

The proposals will be reviewed by the APS Innovation Fund Committee, which will assess applications against four standards: proposals must be relevant, beneficial, innovative, and measurable.

The proposals must be new concepts and not continuations of current APS activities. The fund will not support physics research or the salaries of graduate students and staff running existing efforts.

Important Deadlines

March 18, 2019: Deadline for submission of preliminary proposals
March 18–25, 2019: Units and Committees are contacted for comment on pre-proposals
April–May 2019: Proposals are reviewed by the APS Innovation Fund Committee



May 2019: Finalists are notified and asked to develop a full proposal in collaboration with APS staff
June 15, 2019: Deadline for finalists to submit full proposals
August 2019: Grant recipients are notified

APS Innovation Fund Committee: 2019 APS President David Gross (co-chair), APS Director of Project Development Theodore Hodapp (co-chair), 2019 Speaker-Elect of the APS Council Andrea Liu (University of Pennsylvania), APS Chief Government Affairs Officer Francis Slakey, and 2019 Speaker of the APS Council John Rumble (R&R Data Services).

WOMEN IN PHYSICS

CUWiP Grows for Eight Years in a Row

BY LEAH POFFENBERGER

The APS Conferences for Undergraduate Women in Physics (CUWiP) support women pursuing degrees in physics with the opportunity to experience a professional conference and meet other women in physics. The 2019 conferences, held January 18 through January 20, spanned 12 different sites and hit a record attendance of around 2,000, continuing a trend of growth for the past 8 years.

A hallmark of CUWiP is its character as a multi-site event: Attendees will travel to the site nearest them, instead of converging at one location. All locations saw an increase in applicants and attendees compared to previous years. The universities that hosted the event are: College of New Jersey, College of William and Mary, Michigan State University, Northwestern University, Texas A&M University - Corpus Christi, University of Alabama, Tuscaloosa, University of California, Davis, University of California, Santa Barbara, University of Massachusetts, Amherst, University of Ottawa (Canada), University of Washington, Seattle, and Utah State University.

CUWiP attendees at a poster presentation by Sahar Ahmadi (University of California, Santa Cruz) on dark matter research.

"CUWiP now attracts nearly every female undergraduate physics major in the US, largely due in part to targeted marketing, institutions committed to promoting the continuation of degrees by female undergraduates, and the value seen by past attendees," said Kai Wright, APS Women's Programs Coordinator. "We received over 2600 applicants for the 2019 CIWiP, more than any previous CUWiP."

Northwestern University in Evanston, Illinois, welcomes attendees to their CUWiP conference.

At each site, undergraduate women had the opportunity to attend talks by faculty, panel discussions about graduate school and careers in physics, laboratory tours and more. Fabiola Gianotti, CERN Director-General, was the CUWiP keynote speaker and gave a talk titled "Why a professional life in physics?"

"Dr. Gianotti's talk gave details of her path to becoming a physicist which included her study of humanities, constant curiosity as a child, and continuous quest for knowledge. Her research in experimental particle physics and high-energy accelerators was of particular interest to attendees who were eager to ask questions during her Q&A session. Dr. Gianotti expressed that it does not matter if you had a late start in physics as long as you have a passion," said Wright.

For more information on CUWiP, visit go.aps.org/2GsPHBz

GOVERNMENT AFFAIRS

Congressional Visit Day Primer

BY LEAH POFFENBERGER

The APS Office of Government Affairs (OGA) plays a vital role in speaking up for physics, and science as a whole, in the creation of government policy. But its most effective work isn't done alone: Partnering with APS members who can speak as both constituents and physicists is more likely to get results (see OGA article on this page).

In conjunction with the APS Leadership Convocation held in Washington D.C. every year (see p. 3), this partnership comes to life through an annual Congressional Visits Day (CVD). At this year's CVD, APS members, including the Presidential Line, attended nearly 100 meetings in congressional offices.

Participating in CVD doesn't require special skills or lobbying experience, thanks to groundwork laid by OGA. At a pre-CVD briefing, attendees were given issue briefs, based on APS reports, to familiarize themselves with policy points and to give to staffers at congressional offices. The issues of concern this year were: supporting research and development funding, rebuilding research infrastructure, F-1 visa reform, sexual harassment in science, and climate change. The pre-brief also featured a "mock meeting," to familiarize first-time CVD-goers on what to expect during their visits with congressional offices.

On the day of the visits, CVD participants, broken into groups based on state and congressional district, spread out on Capitol Hill for a full day of meetings with their respective representatives and senators. These groups include APS members from a variety of physics backgrounds and levels of experience—graduate students are often among the most compelling and effective CVD attendees.

Most of the meetings, typically lasting 15 to 20 minutes, but sometimes longer, are with congressional staffers responsible for handling science policy issues. At some meetings, the Congressperson may drop by to express support for science funding or express interest in co-sponsoring bills to address issues laid out by policy briefs.

After a long day of meetings, CVD participants were invited to the National Press Building where OGA is located, to decompress and debrief. Attendees shared their experiences, highlighting successes, and reflecting on the day's meetings.

While CVD is a special annual event for APS, OGA recognizes the value of connecting constituents and representatives year-round. Any APS member with a desire to influence science policy or advocate for issues in physics can contact OGA for assistance setting up their own congressional visit day. To advocate on science policy issues, visit OGA's Advocacy Dashboard at aps.org/policy/issues/.

GOVERNMENT AFFAIRS

APS Members Advocate for Science on Capitol Hill During Congressional Visits Day

BY TAWANDA W. JOHNSON

On a mission for science, about 60 leaders of APS membership units recently braved the polar vortex that blanketed Capitol Hill to advocate for action on crucial policy issues during the Society's first Congressional Visits Day (CVD) of the new year.

APS Unit leaders representing Texas — Carlos Bertulani (far left); Christina Markert (third from left); and Sally Hicks (far right) — met with Patrick Michaels (second from left) concerning science policy issues and their impact on the state.

Representing 25 states across the country, the volunteers visited nearly 100 congressional offices to advocate for: supporting federally funded scientific research; requesting action on climate change; rebuilding America's research infrastructure; promoting legislation to address sexual harassment in the sciences; and making the F-1 visa "dual intent" to enable international students to simultaneously study and apply for citizenship in the United States. The unit leaders shared personal stories related to the issues and explained to staffers how those stories affected their congressional members' districts and states.

"The APS Office of Government Affairs (OGA) mobilized APS members to add their voices to these important science policy issues," said APS President David Gross. "As stated in our newly released strategic plan, 'APS is committed to advocating effectively for the conditions that support a robust scientific research enterprise, which enhances economic growth and trains people to address some of the urgent problems facing society.'"

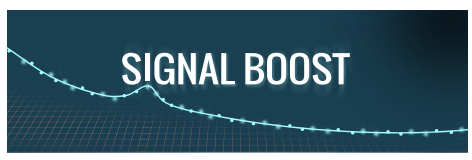
Nadia Fomin, assistant professor of physics at the University of Tennessee, Knoxville, noted that she and her colleagues received favorable feedback after advocating for sustained, robust federally funded research during a total of 10 congressional meetings. They included talking with staffers representing U.S. Senators Lamar Alexander and Marsha Blackburn, both of whom represent her state.

Stacy Palen, physics professor and director of the Ott Planetarium at Weber University in Utah, said her discussion about climate change went well with staffers representing U.S. Senators Mitt Romney and Mike Lee, and U.S. Representative Rob Bishop. Palen explained that the Hill Air Force Base, situated on a plateau in her state, is at risk because it is susceptible to flash floods, droughts and wildfires due to climate change.

"The DoD report was very helpful in making the case that climate change is a national security issue," she said. Palen added that staffers were amenable to her point and asked if they could follow up with her to gather more information.

The importance of America's research infrastructure captured the attention of a staffer during a discussion in U.S. Senator Pat Toomey's office. Nitin Samarth, chair-elect of the APS Division of Materials Physics and head of the Physics Department at Penn State University, highlighted the

CVD CONTINUED ON PAGE 6



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

Droegemeier Outlines Agenda in First Speech as OSTP Director

BY WILLIAM THOMAS

On February 15, Oklahoma meteorologist Kelvin Droegemeier made his first public appearance as director of the White House Office of Science and Technology Policy (OSTP), addressing a large audience at the annual meeting of the American Association for the Advancement of Science in Washington, D.C.

In his remarks, he outlined a set of policy priorities while avoiding such controversial issues as President Trump's views on climate change and proposed cuts to research budgets. Striking an optimistic tone, he said "there is literally no better time in the history of this planet or any better place on Earth to be engaging the quest for scientific knowledge and understanding than right here, right now in America."

Droegemeier grouped his ideas for the future into three "pillars," which he said will support a new "bold era" in science and technology. He said the first pillar involves taking a long-term, holistic view of research, and he called for a new quadrennial assessment of the U.S. R&D enterprise placed in a global context.

In addition, Droegemeier stressed the benefits of viewing R&D in terms of "thematic portfolios" that cut across research topics and disciplines. As an example, he pointed to artificial intelligence, noting it spans numerous disciplines ranging from computer science to psychology and ethics. He said this heterogeneity presently makes it difficult to answer such elemental policy questions as how much funding is dedicated to the field or how many students and researchers are working in it.

Droegemeier emphasized that thinking in terms of portfolios makes it easier to leverage the links between R&D programs, arguing, "If we do this, we'll maximize the use of available dollars, minimize unnecessary duplication, and greatly ... increase collaboration." He did not indicate how his concept relates to the model set by current cross-cutting efforts such as the National Nanotechnology Initiative. He did say, though, it would not involve any "wholesale change" in the structure of federal research budgets.

The second pillar involves improving partnerships among actors in the federal government, industry, academia, and nonprofit sectors, focusing on "intersection points" such as data use, workforce development, and access to facilities. He also said that reforming intellectual property policies would likewise promote innovation.

Expressing a desire to "rekindle those famous blue-sky industrial research labs of the past," Droegemeier proposed the creation

OSTP CONTINUED ON PAGE 6

Physics Teacher Education Coalition

PhysTEC recognizes the following institutions for graduating 5 or more well-prepared physics teachers in the past academic year. These colleges and universities are leaders in addressing the nationwide shortage of high school physics teachers.

The 5+ Club

2017-2018

Brigham Young University (21)

Rutgers The State University of New Jersey (8)

Virginia Tech (8)

University of Kentucky (6)

The College of New Jersey (5)

PhysTEC is led by the American Physical Society (APS) and the American Association of Physics Teachers (AAPT). The 5+ Club application opens annually in September.

INTERNATIONAL

African Light Source Garners Critical Political Backing

BY DANIEL GARISTO

Over 300 scientists congregated in Accra, Ghana from January 28 to February 2 to discuss progress and ways to move forward with an African synchrotron. This second African Light Source (AfLS) Conference was the first to be held in Africa, and attracted twice as many as the inaugural conference, which was held in Grenoble, France in 2015.

In addition to the scientists who attended, high-ranking members of the Ghanaian government attended; the keynote address was delivered by Minister of Environment, Science, Technology, and Innovation Kwabena Frimpong Boateng, and President Nana Akufo-Addo pledged to support the African Light Source (AfLS) initiative.

Opening ceremony of the African Light Source Conference in Accra, Ghana. On the dais are David Dodoo-Arhin (Conference Coordinator), Gilberto Artioli (University of Padova), Simon Connell (University of Johannesburg), Robert Kingsford-Abdoh (University of Ghana), Kwabena Frimpong Boateng (Minister of Environment, Science, Technology and Innovation, Ghana), Kwame Offei, (Pro-Vice-Chancellor, Academic and Students Affairs, University of Ghana), and Michele Zema (International Union of Crystallography). UNIVERSITY OF GHANA

"The most exciting thing is the Ghanaian government's excitement about the project," said Simon Connell, a physicist at the University of Johannesburg and the chair of the AfLS organizing committee.

At the first AfLS meeting, the attendees generated five "Grenoble Resolutions" establishing the importance of a light source in Africa, and a roadmap to planning the AfLS. Now, some of those initial goals are starting to be met.

There are 47 light sources around the world, but none currently in Africa. Synchrotron light sources are massive electron accelerators that generate high intensity X-ray, ultraviolet, and infrared light. This light enables a variety of precision measurements across fields as diverse as drug discovery to paleontology.

While African scientists can and do work at light sources on other continents, a light source in Africa could reverse the brain drain, or diaspora of talented African scientists. Prosper Ngabonziza, a physicist at Max Planck Institute for Solid State Research in Germany is a member of the African Diaspora.

"For us scientists who are in the Diaspora, the most important thing is coming together," he said. "Even before we have a proper light source in Africa, [the AfLS project] is a door for collaboration between African scientists." The work Ngabonziza does in Germany is not possible with present facilities in Africa.

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JOURNEY CONTINUED FROM PAGE 2

which, combined with my lack of purpose in being in grad school, as well as some technical setbacks in my research, eventually drove me to leave the program (spoiler alert: I did come back and finish the PhD several years later. But not until after having to take my qualifying exams a second time to re-establish my candidacy. Not fun. More about that below).

The truth is, things may have been very different if I had considered talking to my advisor about the issues, or better yet, had sought out a new research advisor—someone who was more hands-on. Students are often very reluctant to seek out new mentorship, especially when they feel that their current advisor has invested years of resources into them. But at the end of the day, it is your life you're leading, not your advisor's, and your needs must take priority. Besides, most advisors are genuinely invested in the well-being of their students, and would rather see you be successful with someone who is a good fit than see you continue to struggle in a dysfunctional situation.

If You Leave, Leave FOR Something

My decision to leave the grad program with my Master's happened abruptly, and without much thought to what I might do instead—I was unhappy and I just wanted out. What happened next was an adventure which I don't regret, despite the tough consequences it brought for me: I moved to Nova Scotia, played the banjo, and "lived free" for several months. But I was also unemployed for the majority of the time I was there, and had to worry constantly about scraping together enough money for rent and food. It was very disheartening to have an advanced physics degree and not be able to secure a job as a line cook or bartender (I didn't have any experience), which were the only jobs available where I was living.

Eventually I moved back to the States and reconnected with my passion for teaching physics by filling in as an instructor for undergraduate labs and discussions at my old university. This led me to pursue a PhD in physics with the purpose of going into the field of Physics Education Research (PER). And though this meant retaking the quals—after having already passed them eight years prior—I felt so passionate about this goal that I was willing to tackle anything (if only I had had that level of determination starting out, things would have gone more smoothly for me!). And though I didn't ultimately end up working in the PER field, in my role at APS I am still engaged in the act of teaching on a daily basis—only instead of Maxwell's Equations, I'm teaching physics students how to pursue successful careers.

And though I did eventually finish the PhD, there would have been loads of great career options available to me with a physics MS or BS, if I had known about them. So if you happen to be considering leaving grad school, my advice is to take the time first to really form an alternate plan before you take the plunge—because that decision can be hard to reverse. Use self-assessment tools to learn about other things which might be a good fit, and conduct informational interviews to get the "inside scoop" on what those careers are like. If you can be as intentional and well-informed about your options as possible, whether you're entering the workforce with a BS, MS or PhD, you have a much higher likelihood of connecting with a career path that truly works for you.

Crystal Bailey is Head of Career Programs at APS. She completed her PhD in nuclear physics in 2009 and has been working on ways to help students broaden their career horizons ever since. You can reach her at bailey@aps.org. This article is reprinted from the APS Forum on Graduate Student Affairs Newsletter (Fall 2017). For more on APS career programs, visit aps.org/careers/.

PRM CONTINUED FROM PAGE 1

theoretical research, covering all aspects of the prediction, synthesis, processing, structure, properties, and performance of materials. A journal complementing *Physical Review B*, *Physical Review E*, and *Physical Review Applied* was thus envisioned, publishing Regular Articles, Rapid Communications, and Reviews, based on a fair and expedient review process.

The response of the international materials research community to the launch of *Physical Review Materials* has been highly encouraging. The volume and quality of manuscript submissions has been such that the journal published its 1000th paper by November 2018, only 17 months since the first issue. More important is the depth, breadth, and significance of these papers, which encompass: synthesis and processing; structure and mechanical properties; experimental and theoretical methods; 2D materials; topological materials; ferroic materials; semiconductors; superconductors; metamaterials and optical materials; materials for energy; soft and amorphous materials; materials for catalysis and electrochemistry; and nanomaterials. Several areas have emerged as particular strengths of *Physical Review Materials*, including mechanical properties, interfaces and surfaces, ferroic materials, 2D materials, materials for energy harvesting and storage, first-principles-based calculation and prediction, machine learning, and functional materials such as oxides. The fraction of manuscripts combining experiment and theory has also been notably large, accurately reflecting a characteristic of the field. Overlap with journals such as *Physical Review B*, *Physical Review Applied*, and *Physical Review E*, has of course arisen, but the journal has rapidly developed a unique character and scope, shaped by both authors and referees. Efficient collaboration among these journals has in fact emerged as an important by-product, strengthening the *Physical Review* at the same time as broadening its scope and impact.

Journal operations have of course grown to keep pace with the above, including not only journal staff but also our outstanding Editorial Board. This board now comprises 28 preeminent scientists from the US, Europe, Asia, and Australia, representing universities, national laboratories, user facilities, and research institutes. The group is diverse in every respect, and their service to the journal has played a significant role, along with our many dedicated referees, in enabling us to achieve the goal of offering a particularly rapid and fair review process. Significantly, a new article type has also recently been added to the journal: Research Updates. These are focused, concise reviews of emerging areas of materials research, designed to provide an early and valuable resource to readers studying or entering new fields. The first three such articles have now been published, on the topics of machine learning in materials research [1], the properties of a pivotal Dirac material (Cd_3As_2) [2], and the emergence of a promising new material in semiconductor research and applications (ScN) [3]. Further Research Updates are anticipated due to what is already a positive response from authors, referees, and readers. This response mirrors general feedback from the community regarding the scope, aims, and published papers in *Physical Review Materials*. Our Editors work hard to interact with and listen to community members, particularly at conferences and meetings, and we warmly welcome further feedback.

Looking forward, our goals are to build on the strong response of the materials community, and the steady stream of manuscripts it has generated, to broaden and deepen the international impact of the journal. Further expansion and community engagement in fields such as soft matter, polymers, self-assembly, processing, solid-state and materials chemistry, and materials for catalysis and electrochemistry is planned, among other initiatives, along with consolidation of our footprint in existing areas of strength. The journal will enter a new phase of its life in 2019 with the publication of some key metrics, which we anticipate will help further solidify the journal's standing. We would like to take this opportunity to thank the authors, referees, APS staff, and supporters who have helped start *Physical Review Materials* on its path. We look forward to further establishing the journal as a preeminent choice for high quality, significant, and impactful materials research.

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Chris Leighton is Lead Editor of Physical Review Materials *and Distinguished McKnight University Professor in the Department of Chemical Engineering and Materials Science, University of Minnesota. Athanasios Chantis is Managing Editor of* Physical Review Materials.

MEETING CONTINUED FROM PAGE 1

IceCube experiment, a cubic-kilometer detector at the South Pole.

Several events will kick things off as a prelude to the technical sessions. The APS Topical Group on Hadronic Physics (GHP) is hosting their 8th workshop (jlab.org/indico/event/282/), also at the Sheraton, from April 10 through 12. The APS Topical Group on Precision Measurements and Fundamental Constants is holding a pre-meeting workshop on "New Ideas in Dark Matter Searches" on Friday, April 12 (8:50 AM–5:15 PM). Also on Friday (4–5 PM), APS holds its Annual Business Meeting with presentations from APS leadership and a chance to ask questions in-person and online.

On Saturday, April 13, members of the Partnership for Integration of Computation into Undergraduate Physics (PICUP) will hold a workshop (6:30–9:30 PM) on the importance of integrating computation into the physics curriculum and guide participants in discussing and planning how they would integrate computation into their courses (for more, see the Back Page in this issue).

Saturday evening, Katherine Freese (University of Michigan) will give a public lecture on "Dark Matter in the Universe," explaining for a general audience the evidence for this invisible component of the cosmos and the continuing investigation into its nature (7:00–8:00 PM).

A special Town Hall session on the APS Strategic Plan: 2019 will feature discussions of the planning process, the plan content, and implementation goals for the coming years. See the meeting website for date, time, and location.

For more information, see the APS April Meeting website at aps.org/meetings/april/.

CVD CONTINUED FROM PAGE 4

positive impact of the university's materials research user facility.

"I explained to the staffer that the Materials Innovation Platform user facility at Penn State, funded by the National Science Foundation at $20 million, is instrumental in attracting young scientists and students to careers in materials physics. The staffer reacted positively, and I stressed that we could use more facilities such as this one."

Another topic highlighted during CVD: promoting legislation to address sexual harassment in the sciences. Midhat Farooq, a Ph.D. physics student at the University of Michigan, said she was encouraged by the response she received concerning the legislation.

"My group met with the science staffer from U.S. Representative Debbie Dingell's office, and he said that it should be a 'no-brainer' for Ms. Dingell to support a bill that addresses sexual harassment in the sciences," she recalled.

APS leaders also did their part during CVD. Regarding the F-1 visa "dual intent" initiative, APS leadership pushed for amending Sections 101 and 214 of the Immigration and Nationality Act to help make the U.S. more attractive to international students.

"We want the U.S. to continue to attract the best and brightest students to our universities," Gross said.

To ensure that future CVDs remain effective, a survey of APS members' experiences on Capitol Hill has been circulated to them.

"OGA looks forward to responses from our participants to help us continue to make sure they have an enjoyable and impactful CVD. As concerned constituents and scientific experts, APS members are some of the most effective advocates on these policy issues," said Mariah Heinzerling, APS Science Policy Assistant.

Moving forward, OGA plans to continue to engage members in effecting change on Capitol Hill.

"A key goal of this office is to provide APS members with as many opportunities as possible to lend their voices in support of physics and policy issues that strengthen the scientific enterprise," said Francis Slakey, APS Chief Government Affairs Officer.

The author is press secretary in the APS Office of Government Affairs.

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of what he provisionally called "alpha institutes." He described them as a "scientific crucible" for bringing together experts from different sectors to address challenges in areas such as space exploration, climate change, and medicine. He said the institutes would be based at universities and colleges, with funding provided "primarily" by industry and nonprofit institutions.

The third pillar comprises steps that aim to protect and empower researchers as well as safeguard their work. Droegemeier spoke extensively about the lack of diversity in the sciences and the need to combat sexual harassment, emphasizing the importance of creating "safe, welcoming, and accommodating environments for performing research." He also expressed his desire to relieve researchers from "unnecessary and wasteful" regulatory requirements.

Droegemeier said one of his "top priorities" is to prevent the misappropriation of U.S.-funded research by "those attempting to do us harm" and "those who would seek to reap the benefits of our hard work without doing hard work themselves." He did not name specific threats, but the federal government is currently taking steps to prevent other nations, particularly China, from capitalizing on U.S. research. These include imposing new export controls in select technology areas and barring Department of Energy employees, contractors, and grantees from participating in talent recruitment programs operated by nations deemed "sensitive."

The author is Senior Science Policy Analyst at FYI.

AFLS CONTINUED FROM PAGE 5

"Prosper is an excellent scientist, but he's not in Africa. If we're successful, he can come back in Africa," Connell said.

At the meeting, conferees discussed the unique science that could be done at the AfLS. Study of diseases is a good example of this, according to Connell. Often, viruses that are more common in Africa, like specific strains of HIV, are ignored in the rest of the world. Precedent for large-scale African science exists in collaborations like the African Laser Centre, and facilities like the Southern African Large Telescope.

Right now, the logistics and ethics of sample transfer in and out of the continent can be tricky, and having facilities in Africa would ease some barriers to research. One plenary talk focused on the paleontological possibilities with the AfLS. Instead of transporting fossil samples out of Africa, and all the complications involved with that, researchers could ship them to closer colleagues, or more easily make the trek themselves.

This concern about location is also why the second meeting took place in Accra and not in Europe again. "It's easier to get participants, it's more serious, in terms of being a real African initiative," said Sekazi Mtingwa, a retired accelerator physicist from MIT. An African location also makes it easier for African scientists to perform experiments at it—nearly 80 percent of the attendees were based in Africa.

Still, international attendees from 5 other continents journeyed to Accra.

"In the 1970s–80s, many scientists in the U.S., Europe…helped us to realize a synchrotron facility in Japan," said Hitoshi Abe, a physicist at KEK. "Now it's our turn to support the AfLS project."

Interest in the AfLS goes beyond just the synchrotron community, and the meeting had scientific sponsors around the world, including DESY, the International Atomic Energy Agency, and Brookhaven National Lab's National Synchrotron Light Source-II.

Connell is careful to clarify that this is still fundamentally an Pan-African project. "There's no element of neo-colonialism, of the West thinking 'This is something Africa must have,'" he said. "Africa wants this."

The intent is that African nations would also be footing the majority of the bill for construction and operations. In the next few years, the AfLS organizing committee will generate a business plan that lays out models for how funding could be apportioned. So far, no nation has explicitly committed a monetary amount for the project, which would likely cost several hundreds of millions to a few billion US dollars.

Some cost-cutting proposals have included reusing spare parts from other synchrotrons that have been decommissioned. "We already rejected getting parts from the NSLS I," Connell said. "I don't see any point in Africa having one that someone else cast off because the technology was behind."

This year's AfLS meeting was held jointly with the Pan-African Conference on Crystallography as a way of broadening the scope of scientists, in part because the AfLS is relevant to their work. Many attendees of the crystallography conference had used a synchrotron in their research. They plan to exploit this synergy for future endeavors. "A light source is something that all people doing crystallography would aspire to, ultimately," said Connell.

So what are the next steps? The AfLS group is working on a Pre-Conceptual Design report—a main short-term goal—which they hope to send out in the next few weeks. This strategic plan would include specifications about the power of the synchrotron, including its beamlines and a business plan for acquiring resources to carry it out. Deciding an actual location will be one of the later tasks.

Luckily, there are models to work from. Researchers said they look to models like SIRIUS in Brazil as something to emulate. One of the key features of these light sources is that they trained a large number of scientists at international light sources and then managed to lure most back once the local light went online. The AfLS group hopes to send many young African scientists to synchrotrons for training, increasing the numbers of trainees from a few to hundreds.

More plans will be laid out next year, when the next African Light Source Conference is held in the third week of November 2020 at a location still to be decided.

The author is a freelance writer in New York.

PRESIDENT CONTINUED FROM PAGE 1

some that I'm particularly interested in—the Innovation Fund (IF) [see go.aps.org/innovationfund], a new annual meeting, and new ideas about the future of scientific publications.

Q: What is the purpose of the Innovation Fund?

A: APS is a membership organization with almost 60,000 members, many of whom are very active and eager to serve. APS has funds that could be used to meet new goals and implement new ideas of all these very talented people. That is the purpose of the Innovation Fund. I am always impressed with the talent and creativity of physicists, especially our members. I have no doubt that, given a challenge and an incentive to implement new ideas, new ideas will emerge from the society.

The format of the Innovation Fund is very flexible. We want to incentivize our members and staff to think of new ideas and to try them out. If they don't work—then we will go on and do something else. This mode of operation, where one can experiment, try new things and risk failure, I've always felt is central to a flourishing organization. It is an essential feature of a research institute like the KITP, but is equally important to the APS. So that is one of the motivations for the IF.

Q: You mentioned a new APS meeting, expanding on the annual leadership convocation. What are your thoughts along this line?

A: We have had much discussion at the APS—for decades—about whether to restore the April Meeting, which used to be an annual meeting, to its original status. We decided not to touch the April Meeting but to create a different kind of meeting, one that addresses some of the goals that aren't addressed by any of the other meetings, by building on the leadership convocation, which already brings many people to Washington in early February. Such an "annual meeting" will be different than the other meetings that are organized by the units. It will be an all-APS meeting, something like the AAAS annual meeting. By highlighting advances in physics across all fields we hope to get attention from the media, Congress, and funding agencies, and be of interest to many of our members.

Q: You also mentioned new ideas in journal publishing as something you're focused on in your presidential year. What new ideas would you like to see in this area?

A: Journal publishing is at the heart of the mission of the APS. It is also a major source of revenue. A big part of the APS budget comes from the [revenue] of the publishing business of APS. But the very nature of scientific publishing, and its business model, is in flux because of advances in IT, the Internet, and the arXiv, and the growing demands for open access.

I'm committed to trying to address this problem for the long term. We should try to understand what scientific publishing might look like 10 years from now and think of ways whereby the community of physicists can play a leading role in shaping this future. Physicists have always taken advantage of new technologies to improve scientific communication. The world-wide web was invented by high energy physicists at CERN to communicate among particle physicists across the world. We, the theorists, invented the arXiv. The web and the arXiv have totally changed the way we disseminate scientific information. To some extent our journals haven't caught up to these innovations. I would like physics to take the lead within the scientific community to deal with this problem.

Q: Are there other key things beyond some of these programs you've already highlighted that you want members to know about the Strategic Plan?

A: When APS CEO Kate Kirby decided to launch the Strategic Plan process early last year, I did not believe that it would be completely ready to roll out at the leadership convocation this January. I am very impressed by the efforts at APS of the staff and the Board and all the committees who put in an incredible amount of work and completed the plan on schedule.

Many of the goals and plans contained in the strategic plan are kind of standard. We want to improve current operations and build on what APS has always been doing and doing well, to doing it even better. Given my limited time as President I will focus on implementing some of the newer initiatives. The whole plan is one for the next five to 10 years and it'll take some time to implement.

Q: We've already discussed that the changing journal publishing landscape presents a big challenge to APS. What are some other challenges you think are facing the organization in the next year or even five to 10 years?

A: APS is a membership organization that addresses the needs of science, especially physics, and especially our members. Our job at APS is to help our members deal with the challenges that our society faces. APS can amplify the voice of physicists in making informed decisions for society and informed decisions about support and management of science which is funded largely by society. There we have an enormously important role and that's not going to go away. In fact, it's become more important in the last few years. That's going to be an ongoing struggle. We probably need to do better. Always. I think we are learning how to advocate better.

APS has always played this role and continues to do that. We have all sorts of mechanisms to use our members and their knowledge and their expertise to advise the government, to advise Congress, to advise the science agencies. But this is not a good time. We are learning how precarious things can be. There are many, many, important issues facing our country and the world—issues that we are concerned about. We must continue to try to influence policies, ranging from very contentious issues ones like climate and the environment, to concerns about nuclear weapons, and finally to concerns that are more parochial regarding the scientific enterprise itself. We must continue to address these issues and advocate for rational solutions.

For more about APS President David Gross, see nobelprize.org/prizes/physics/2004/gross/biographical/

PRRESEARCH CONTINUED FROM PAGE 1

for all of the *Physical Review* titles," says Thoennessen. "We are currently recruiting active researchers to serve as editorial board members who will support the development of this new journal."

In addition to reaching a broad audience of readers across all of physics, papers of particular interest published in PRResearch will receive promotion via the journals website, social media, *Physics* magazine, and other outlets. These features are intended to maximize recognition of researchers and the impact of the work they publish in the journal.

"The *Physical Review* journals have served physics well for over 125 years, and this new journal is a step towards ensuring that they continue to do so well into the future," says Jeff Lewandowski, Associate Publisher at APS. "As science evolves to be more collaborative and global, *Physical Review Research* aims to meet the needs of the broadest research community, including the next generation of physicists and researchers working in related fields. With this new journal we hope to initiate conversations across traditional boundaries, invite new opportunities for collaboration, and enable future discoveries."

For more information on Physical Review Research *and to sign up for e-alerts, visit the journal website at journals.aps.org/prresearch.*

APS PLAN CONTINUED FROM PAGE 1

say the subcommittees really did a terrific job. They went out and identified their constituencies. They interviewed people in all of the supporting groups and committees that were relevant. And we had encouraged them to be bold. We told them not to stay inside the box and we reassured them that if their ideas were too bold, we might consider them, but we wouldn't necessarily publish them.

Each subcommittee wrote a very long report, much longer than anything that made it into the Strategic Plan. There are a lot of very thoughtful ideas in those reports. In compiling the Plan, the steering committee had to winnow the reports down. We obviously did not want a hundred-page document, and it needed to be lean and minimal. We also didn't want to tie the hands of the APS senior management in how they actually implement the Plan. So the strategic plan as published had to be kind of general. The subcommittees came up with many more ideas than appear in the final report and those will be considered by management over time.

Q: What was the role of the steering committee in arriving at the final Strategic Plan?

A: We met with the subcommittees early on to hear their plans for gathering input and to give them some guidance. Then there was a big exchange back and forth with the subcommittee chairs and the steering committee about their preliminary recommendations. We tried to identify areas that they shouldn't put a whole lot of effort into—things that weren't going to make it into prime time.

Then the subcommittees went off and talked some more and then they came back to give us final recommendations. With that input, the steering committee boiled everything down into the strategic plan.

The real work of the strategic plan was done by the subcommittees, but the steering committee also set up a very aggressive schedule and, to our astonishment, we actually made it. There were times in the summer of 2018 where we were having two or three two-and-a-half hour telephone conferences every week. We even called in from vacations in Oregon and Norway.

None of us wanted the process to drag on too long. It's also really important that something like this come out quickly after so many people put in so much work. And so there was one final meeting when we looked at each other and said, we are actually done.

Q: So, specifically your role was in chairing the Steering Committee, so you were seeing this from the highest levels?

A: The steering committee tried to give feedback like "This is a good idea, but it's probably not on the immediate radar, so don't emphasize it a lot." It was also a matter of time-ordering because the subcommittees in total came up with a ton of really, really great ideas. But APS can only focus on so many things at once and it will have to pick and choose the ones that can be accomplished in a reasonable amount of time and postpone the ones that are just going to take longer to sort out.

Q: And the input information came from many sources?

A: Right, right. There were comments from the convocation, from the town hall meetings, and a member comment form on the APS website, although I don't recall there being a lot of input on the website. The subcommittees developed a long list of people to reach out to. And they got input from a lot of different stakeholders.

Q: In general, it sounds like it was a very comprehensive process of getting input from all levels and at least opening the website up to member comment and gathering ideas from lots of different sources.

A: Yes, and we also solicited input from the APS staff and not just the senior management. We asked for comments from the next level staff, because often the next levels of management down in an organization have really good ideas, things that could open up new avenues of thinking.

Q: In terms of the implementation goals on the radar for the coming year, there are things like the APS Innovation Fund (go.aps.org/innovationfund) and a new potential all-APS meeting. How were those selected?

A: All of the major initiatives had a proponent or often several proponents. Those proponents could have been a member of a subcommittee, or a subcommittee chair, or a member of the steering committee. I'm not quite sure how any specific initiative is going to work, but there's nothing wrong with trying things. If they don't work, you give them up after a little while and do something else.

Q: What would you like members of APS to especially take away from the Strategic Plan?

A: I think the Strategic Plan manages to integrate all the aspects of APS into "one APS," which has a been a mantra for some time and which we are slowly achieving. There are a lot of creative ideas about how the different branches of APS could interact better and work together more closely, which I think will benefit the organization. And then there are a number of ideas like the APS Innovation Fund that we hope APS members will get excited about.

For more information, including lists of members of the Strategic Planning committees, visit go.aps.org/strategicplan.

THE BACK PAGE

PICUP: The Partnership for the Integration of Computation into Undergraduate Physics

BY DANNY CABALLERO, LARRY ENGELHARDT, ROBERT HILBORN, MARIÉ LOPEZ DEL PUERTO, KELLY ROOS

Computation is how modern physics work is done. Many of the most recent noteworthy discoveries in physics [1,2,3] have involved extensive use of computation. Whether it be data reduction, data analysis and modeling, or simulation, the importance of computation in modern science cannot be overstated. In fact, leading voices in physics education have advocated for computation to be included in the experience of all current and prospective physics majors [4].

When we look nationally, we do find more and more physics faculty are integrating computation into their courses [5], but that those are faculty for whom computation is part of their research [6]. As we consider our roles as physics educators, we must reflect on how to teach the practice of physics in a way that represents the discipline authentically. We should afford our students the opportunity to engage with computation throughout the physics curriculum both to better support our students to enter an increasingly data-rich and model-driven world, and to better represent the discipline of physics in light of where it is and not where it was.

In considering such changes to the physics curriculum, we must acknowledge that there are significant challenges [7]. Faculty have a wide variety of responsibilities that put pressure on them. Some faculty might not feel they have the time or energy to make the necessary changes. Others might not feel expert enough to teach computation to their students. As computation is relatively absent from most courses and textbooks, there's the additional challenge of teaching students something new without much pedagogical support. Faculty might have questions like: what should my students learn; what if I get push back; or what if I fail? The typical reward structure for many faculty doesn't value innovative teaching, which might lead to additional questions: why should I do this; what should I be spending my time on; what if my department doesn't care about this?

While these are common challenges, they are not insurmountable. In fact, the Partnership for the Integration of Computation into Undergraduate Physics (PICUP) has been working to support faculty who are interested in, or even just curious about, integrating computation into their courses. PICUP's mission is to support the broader use of computation across the physics curriculum. We are faculty from across the United States that aim to lower the barriers for teaching computation and to provide support to those faculty and departments interested in adopting computation into their courses.

PICUP runs a variety of workshops and provides community support efforts. At national APS and American Association of Physics Teachers (AAPT) meetings, we conduct demonstration workshops that offer a short introduction to PICUP, hands-on experience with computation, and practical ways to integrate computation into a course using spreadsheets and Python. We also offer more immersive regional and departmental workshops that are tailored to the needs and interests of the faculty attending. These can include longer hands-on experiences as well as longer conversations about practical issues surrounding teaching computation and departmental change.

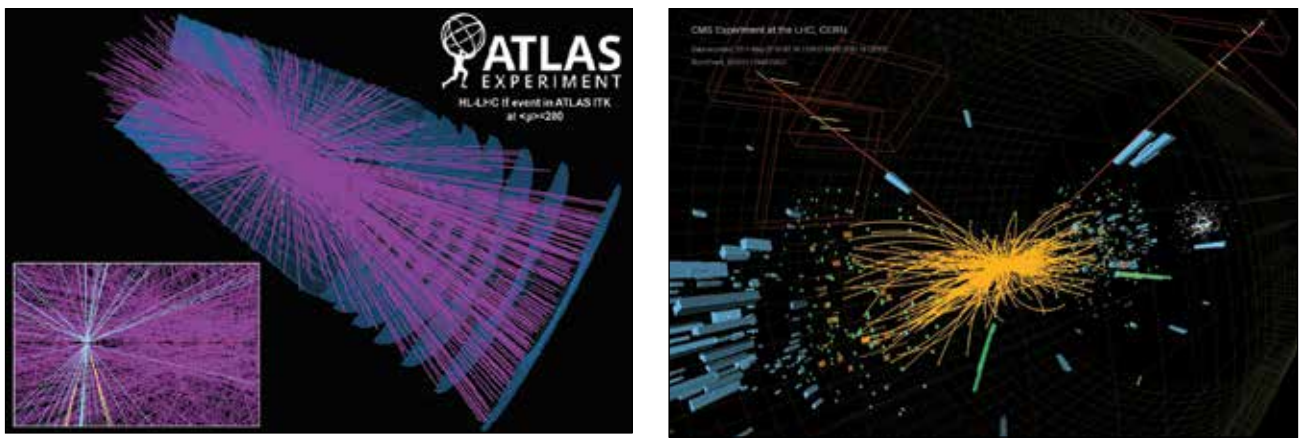
Our most immersive experience is a week-long summer workshop where faculty from across the US work collaboratively to develop plans and activities for integrating computation into their individual courses and/or the broader curriculum at their home institutions.

In addition to these various face-to-face workshops, PICUP provides a variety of virtual support and community development mechanisms. The PICUP community uses Slack—a web platform suited for team communication—for regular discussions. Community members can ask and answer questions, share materials, and generally support each other's efforts to integrate computation at their local institutions. We also host monthly online meetings where community members can discuss a variety of issues, from how to support students with little or no experience with computation to advocating for these changes with institutional administrators.

These workshops and the associated virtual interactions are aimed at helping faculty find the energy and space to work towards integrating computation while they develop greater expertise with teaching computation. We do this by discussing successes and failures while iteratively improving upon our efforts. Over the last several years, PICUP has worked to develop a community around computational integration so no faculty member is alone in the process.

In addition to support from PICUP personnel, our website (gopicup.org) also contains many ready-to-use exercises so that faculty can try computational activities that have already been used by others, perhaps, in similar circumstances. Materials on the PICUP website come in two flavors: Exercise Sets and Faculty Commons activities.

PICUP conducts workshops that offer hands-on experience with computation in physics and practical ways to integrate computation in physics courses



Particle physics efforts, like the hunt for the Higgs boson at the ATLAS (left) and CMS (right) experiments at CERN wouldn't be possible without a computational component.

Exercise Sets are substantial activities, which have a number of exercises and problems for students to work through. Exercise Sets include learning goals, so faculty know what the developer intended for their students to learn; instructor guides, so faculty can see precisely how the developer uses them in their course; a description of the relevant theory, so faculty can investigate the underlying physics and algorithms used in the exercises; as well as code for students to work from and solutions for faculty. Each Exercise Set is peer-reviewed to ensure all these supporting materials are present and are understandable and useful to others, as well as to provide an incentive to faculty who might receive credit for producing this kind of scholarly work.

Individual Exercise Sets often come in a variety of common implementations such as Python, Matlab, Mathematica, and spreadsheets, so that a faculty member might choose the implementation with which they are most comfortable. Most importantly, the materials in the Exercise Sets repository are easily adaptable to individual faculty interests and pedagogical preferences.

Faculty Commons activities are smaller in scale and can often be considered a single problem for students to work. The Faculty Commons is not peer-reviewed and is intended to be a place where faculty can quickly and easily upload materials for sharing and receiving community feedback. All materials posted to the PICUP website are Creative Commons 4.0 licensed and faculty can alter and reuse them as they see fit for non-commercial purposes.

The physics education community needs to increase the use of computation in the physics curriculum. Computation is a central tool of modern science. It has the potential to help students develop new and important insights into physical systems. It is needed by our students in their future work and for them to engage in an increasingly data-rich and model-driven society. PICUP is an organization that aims to support this work. We invite faculty to reach out and participate in this effort.

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Danny Caballero is the Lappan-Phillips Associate Professor of Physics Education in the Department of Physics and Astronomy at Michigan State University and an Associate Professor in the Center for Computing in Science Education at the University of Oslo. Larry Engelhardt is a Professor of Physics in the Department of Physics and Engineering at Francis Marion University. Robert Hilborn is the Associate Executive Officer for the American Association of Physics Teachers. Marie Lopez del Puerto is an Associate Professor of Physics in the Department of Physics at the University of St. Thomas. Kelly Roos is a Professor in the Caterpillar College of Engineering and Technology at Bradley University.