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New Members of the PhysTEC 5+ Club
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2018 APS April Meeting: "Hello, Columbus"

Attendees in fields from "Quarks to the Cosmos," including particle physics, nuclear physics, astrophysics, and gravitation, will gather in Columbus, Ohio, April 14–17, at the Columbus Convention Center for the 2018 APS April Meeting. The meeting theme this year is "A Feynman Century," marking the 100th anniversary of the Nobel-winning physicist's birth with a Kavli Foundation Plenary Session and an invited session on his legacy.


Getty Images

The Kavli session will be held on Saturday, April 14 (8:30 a.m.) and will feature a presentation by Joan Feynman (Jet Propulsion Lab, retired) on life with her brother Richard and her concerns about climate change. Christopher Monroe (University of Maryland and IonQ) will discuss Richard Feynman's involvement in the origins of quantum computing. Roxanne Springer (Duke University) will talk about Feynman's contributions to quantum field theory. Discussions about Feynman will continue at an APS Forum on the History of Physics invited session on Monday, April 16 (room B130) at 1:30 p.m., with Paul Halperin (University of the Sciences), John Preskill (California Institute of Technology), and Virginia Trimble (University of California at Irvine).

Two skill-building events for women will take place at the meeting. The first, for postdocs and early career researchers, is a Professional Skills Development Workshop for Women on persuasive communication, negotiation, and leadership (Friday, April 13, 8 a.m.–4 p.m.). The second is a Professional Skills Seminar specifically for undergraduate and graduate women in physics (Sunday, April 15 4-6 p.m.). The seminar will focus on professional skills

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Physical Review B: Condensed Matter, Then and Now

PHYSICAL REVIEW B
covering condensed matter and materials physics

By Sarma Kancharla and Laurens Molenkamp

The late Peter Adams, founding editor of *Physical Review B* (PRB), impishly used to say that the journal was created in 1970 because *The Physical Review* had reached its binding limit. Apocryphal as that sounds, the birth of PRB couldn't have happened sooner because solid state physics, the core charge of the journal, would soon morph into the broader arena of condensed matter physics (CMP) and then materials physics.

The 125th anniversary of the founding of *The Physical Review* and the family of journals published by APS offers a chance to look back at some of the landmark publications that have led to PRB becoming not only the largest journal in all of physics but also a venue for excellence.

125 YEARS

There is no better place to start than the Nobel Prize–winning pair of papers in 1971 by Wilson which

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APS Strategic Planning: Get Involved!

APS leadership is developing a new Strategic Plan for the Society and member input is vital for the success of this effort. Please attend one of the Town Hall meetings and submit comments via the website.

Town Hall: 2018 APS March Meeting in Los Angeles, Thursday, March 8, 1:00-2:30 p.m., in room 305 of the Los Angeles Convention Center.

Town Hall: 2018 APS April Meeting in Columbus, Ohio, Monday, April 16, 3:30-5:00 p.m., in room B-130 of the Columbus Convention Center.

Strategic planning will also be on the agenda of the annual APS Business Meeting in Columbus: Friday, April 13, 4:00-5:00 p.m. in room A-216 of the Columbus Convention Center.

Please visit **go.aps.org/strategicplan** to learn more about the planning process and to upload comments.

Profiles in Versatility

Staying on Pointe: Physicist Twirls Her Way to Successful Ballet Career

By Alaina G. Levine

Merritt Moore's scientific resume is impressive: She recently received her Ph.D. in quantum physics from the University of Oxford, and she graduated with her bachelor's in physics from Harvard with honors.

But there is much more—she's been a dancer since she was 13 years old. Moore is an internationally known ballerina, and has danced professionally with companies all over the world, including the Zürich Ballet Company, Boston Ballet, English National Ballet, and London Contemporary Ballet Theatre. She has performed at a special exhibition at the Victoria & Albert Museum in which she danced with robots, at a virtual reality and dance event at the Barbican Centre in London, and at the Imagine Science Film festival, in which she collaborated with filmmakers to visualize scientific principles through art.

A certified science junkie, Moore began her love affair with mathematics as a kid, and she took her first physics class in high school. "I knew I was going to love it," she says. "Then the more I learned about quantum mechanics and … new quantum technologies, I was hooked." So physics seemed the logical career choice.

But first she had to balance that with her love of ballet. In her hometown of Los Angeles, she


Physicist Merritt Moore combines a career in science and acclaim as a performing artist.

intensely pursued dance, but as she advanced she began to grow tired of it. In fact, when she had the chance to study abroad in Italy as a 15-year-old, she specifically looked for a hamlet to live in that did not offer any dance classes. But a chance encounter sent her whirling back to ballet.

One day in Italy Moore found herself in a "dingy" gym and saw a ballet class being taught with a very different approach than she was used to. "Many teachers want you to look identical to the girl to your left and right, and there's a perfect body type that everyone is striving for, but this instructor … was like 'no, be you, be unique, and that will allow you to be strong'." It changed my whole outlook." And it reignited Moore's dancing fever. Pretty soon, she traveled every weekend from Viterbo, the little town she was studying in, to Rome, where the teacher was based, where she would train by day, and sleep on her kitchen floor. The lessons were so magnetic that even when Moore returned home, she continued training with this teacher for six years, heading to Rome every chance she could get.

"It's different learning from the top of the top. She was a prima ballerina," adds Moore. "She would say if you want to be a ballet dancer you can't be a ballet dancer

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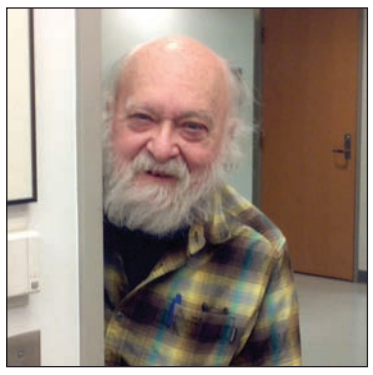
Spotlight on Development

The Leo P. Kadanoff Prize

APS is pleased to announce the establishment of the *Leo P. Kadanoff Prize* to honor the memory and celebrate the legacy of one of the giants in the field of statistical and nonlinear physics. We have launched an effort to endow this Prize, and invite you to consider supporting it.

The Kadanoff Prize was proposed by the APS Topical Group on Statistical and Nonlinear Physics (GSNP) to recognize a scientist or scientists whose work (theoretical, experimental or computational) has opened up new vistas for statistical and/or nonlinear physics.

APS has launched a $300,000 endowment campaign to allow the Kadanoff Prize to be given in perpetuity. We are enormously grateful to family members, friends, and colleagues of Leo Kadanoff who have already raised commitments totaling over $100,000 toward the endowment goal, and are currently seeking the balance—with a projected completion in 2019. We greatly appreciate the participation of members across a broad sector of APS including the Leadership of GSNP.



Leo Kadanoff

Gifts of any amount will be greatly appreciated and recognized on the Kadanoff website. Moreover, gifts of $1,000 or more will help us reach our goal for opening up the one-year nomination process on-time and ensure that the first Kadanoff Prize will be awarded at the 2019 APS March Meeting in Boston.

For more information on ways to make a gift in support of the *Leo P. Kadanoff Prize*, please visit the Leo P. Kadanoff campaign website aps.org/about/support/campaigns/kadanoff/ or contact, Irene I. Lukoff, APS Director of Development, at lukoff@aps.org or 301-209-3224.

This Month in Physics History

March 22, 1895: Screening of the Lumière Brothers' First Film

Millions flock to movie theaters every weekend to view the latest Hollywood blockbusters, and the multimillion-dollar film industry dominates popular culture. Among the early pioneers who made this revolution possible were two French brothers: Auguste and Louis Lumière.

Auguste was the elder, born in 1862, while Louis was born two years later. Their father, Antoine, started out as a portrait painter before switching to photography, setting up his own small business making photographic plates in Lyons. Both sons completed technical school, with a solid grasp of organic chemistry, although Louis preferred physics and Auguste gravitated towards biochemistry and medicine. They went to work for their father. After experimenting with his father's equipment, Louis in particular became fascinated with the underlying science. At just 17, he invented a new "dry plate" process for developing film.

Auguste and Louis Lumière

At the time, photographic plates used wet emulsions that required a darkroom during preparation and immediately after exposure of the plate. A dry plate process existed, but the Lumières' "blue plate" improved on that significantly, reducing the need for a darkroom. Under the two brothers, business boomed, and the family company became the biggest manufacturer of photographic plates in Europe by the 1890s, producing around 15 million plates per year. That wealth freed up the brothers to experiment with other forms of photography.

A frame from one of the brothers' debut films "Workers Leaving the Lumière Factory"

Photography was still in its infancy, but some investigators were already experimenting with making the images move, including famed photographer Eadweard Muybridge, who pioneered a process in which a series of pictures would be taken of a subject in motion and then shown in rapid sequence. His Zoopraxiscope (inspired by a children's toy known as a zoetrope) projected images from painted rotating glass disks, and was arguably the first film projector.

In the winter of 1894 Antoine, then in Paris, witnessed an exhibition of Thomas Edison's kinetoscope, which showed short moving films produced by a companion invention, the kinetograph. Antoine snagged a sample of film from one of the exhibitors there to show his sons. He thought they could develop a better, cheaper alternative to the kinetoscope and kinetograph, combining the viewing, developing, and recording functions into one device. Instead of the single-viewer kinetoscope, he envisioned projecting films onto a large screen so that many people could watch all at once.

The brothers began experimenting at once, and by the following year they invented the Cinematographe, which weighed just 11 pounds and could be operated with a simple hand crank rather than relying on electrical power. Louis drew inspiration one sleepless night from how a sewing machine operates, and invented a claw mechanism to pull the film through the camera. In contrast to the sprocket system used by Edison, the Lumières' device formed the basis of subsequent early cinema cameras. However, it recorded and projected at much slower speeds than Edison's Kinetoscope (16 frames per second compared to 48 frames per second).

The brothers used their invention to shoot footage of workers leaving their factory at the end of the day, and presented the short film in Paris on March 22, 1895. Over the next several months, they shot several more one-minute films and gave a second demonstration of the Cinématographe to the French Photographic Congress in Lyon that June. Their father Antoine organized a public screening several months later at the Grand Café on the Boulevard des Capucines. Among those in the audience: illusionist and future pioneering director Georges Méliès, who made one of the first science-fiction films (1902's *A Trip to the Moon*). While the brothers were initially reluctant to hold a public screening, feeling it was premature, Louis later observed that on that day "was really born the expression, 'I have been to a movie.'"

This wasn't necessarily the first public screening, since another pair of brothers in New York,

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FILMS continued from page 2

Grey and Otway Latham, showed films of boxing matches for paying audiences beginning in May of 1895. (Their father, Woodville, co-invented the Latham loop, which enabled continuous shooting and projecting of much longer films.) The following year, Louis and Auguste opened several Cinematographe theaters in London, Brussels, Belgium, and New York, where they screened more than 40 short films they produced that year, mostly scenes from French daily life. The most famous featured a train rushing towards the audience, sometimes causing panic and the occasional fainting spell.

At first the public didn't have much interest in these shows, which offered 10 short films in 15 minutes for one franc (in Paris). But word quickly spread, and soon people were lining up to marvel at the moving pictures. Cinema would go on to transform popular entertainment, but the Lumière brothers—having helped spark the revolution—soon lost interest in making moving films. A failed attempt to sell equipment and film in New York may have contributed to this, as Edison's format soon dominated the fledgling industry over their own. By 1896, the original Cinematographe had been supplanted by the Lumière's Model B, which projected films only in the Edison format.

In 1905, the brothers decided to focus instead on developing a practical process for color photography: the Lumière Autochrome, introduced in 1907. James Clerk Maxwell used various colored filters to project color images of his subjects, but printed images (photographs) were not possible until Louis Ducos du Hauron figured out how to superimpose positive and negative images shot through colored filters. But it was a complicated and time-consuming process. The Autochrome improved on that early dry plate process, and became the preferred method for color photography for the next 30 years.

Louis went on to direct thousands of reels of film for the Cinetomatographe and a technique for stereoscopic photography in 1935 capable of creating hologram-like images. Auguste focused on his interest in biochemistry and medicine, researching cancer and tuberculosis, among other diseases, and publishing a book, *Life, Illness, and Death: Colloidal Phenomena*, in 1928. He died in 1954 at home in Lyons, at the age of 91—six years after the passing of his younger brother Louis.

Further Reading:

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Lumière L., ed. 1967. The Lumière Cinematogrpahy. *A Technological History of Motion Pictures and Television*. University of California Press.

Macgowan K. 1965. *Behind the Screen: The History and Techniques of the Motion Picture*. Delacorte Press.

News from the APS Office of Government Affairs

APS Unit Leaders Kick-Off APS 2018 Advocacy With More Than 90 Meetings on Capitol Hill

By Tawanda W. Johnson, APS Press Secretary

Forty-eight volunteers representing APS Unit leadership took to Capitol Hill on February 1 to make the case for critical science policy issues.The volunteers represented 35 units and participated in 93 meetings, representing 25 states and one territory during the Society's Congressional Visits Day (CVD), the first of 2018.

"There was an almost universally positive reception from staffers in the Illinois offices we visited. Even in the most difficult [meetings], we were able to find some common ground and have a meaningful discussion," said Marion White, a Chicago-area physicist and secretary/treasurer for the APS Division of Physics of Beams.

White, who described her experience as "amazing" and "life-changing," said she decided to participate in CVD because the United States has "fallen behind much of the rest of the developed world in science, technology, and education."

She further explained, "The threats to our security from climate change, disease, cyber attacks, [and] many others appear to be ignored at the highest levels. I decided if I could contribute to anything positive, I should try."

Kristan Corwin, chair-elect of the APS Division of Laser Sciences and associate dean for research at Kansas State University, expressed a similar concern about the country's declining role as a global leader.

"I felt there has never been a more urgent need for scientists to reach out to Congress and ask for its help to preserve our nation's leadership position in science and technology. Furthermore, I felt empowered by my experience as an associate dean with a bigger view of how academic research benefits and shapes our society at large."

Kristan Corwin advocated for science in a recent visit to the office of U.S. Senator Pat Roberts of Kansas.

Corwin said she had a "wonderful" experience during the CVD. "Greg Mack [manager of grassroots advocacy] and the APS as a whole displayed a deep knowledge of the big issues, and also an understanding of what we might be able to ask for to advance the agenda of science funding immediately, with an eye toward the long run."

She added, "I found the staffers were really interested in how the larger issues affect their universities and districts back home, and what they can do to help."

During their meetings with Congress, APS members addressed the following issues: research funding and infrastructure, STEM education, H-1B visas, and climate change. The APS Office of Government Affairs (APS OGA) identified these issues after surveying members during various meetings held last year. Volunteers were asked to advocate for research and infrastructure funding and to choose among the other issues based on their particular interests.

To ensure volunteers were adequately prepared for the meetings, Mack first showed a video, and then organized small-group web videoconferences and an in-person training session. APS OGA also supplied them with materials and scheduled their meetings.

"We were strategic in our approach to the meetings and wanted the APS members to be as prepared and comfortable as possible," he said. "In addition to the online preparation, during the in-person session we held a mock meeting, and the volunteers had opportunities to brainstorm about the most crucial part of their meetings: telling their personal stories and connecting the issues to their states and districts."

Mack added, "I feel everyone had a good handle on the issues and was equipped with pertinent information and materials to have constructive conversations."

"We're off to a good start with our first CVD of 2018," said Francis Slakey, chief government

UNIT LEADERS continued on page 6

PhysTEC Announces New Members of The 5+ Club

The Physics Teacher Education Coalition (PhysTEC) has announced the newest members of "The 5+ Club"—institutions that graduated 5 or more well-prepared high school physics teachers. PhysTEC is a project of APS and the American Association of Physics Teachers (AAPT) to address the severe national shortage of K-12 physics teachers. Every year the coalition recognizes those institutions that were especially high performers.

Few colleges and universities graduate more than two physics teachers each year, and most commonly that number is zero. Since 2001, PhysTEC has funded universities to transform their physics teacher education programs into national models. The project is supported by the National Science Foundation, and the APS 21st Century Campaign, and by direct and in-kind support from each of its partner institutions.

PhysTEC first awarded The 5+ Club honors to six institutions during the 2011-2012 academic year. This year's awardees include nine universities that graduated a total of 53 highly qualified teachers for the 2016–2017 academic year. To put this number in perspective, if U.S. colleges and universities collectively graduated about 800 new physics teachers per year, the national shortage would be largely addressed.

The new members of The 5+ Club (and numbers graduated) are Rutgers University (8), Brigham Young University (7), Rowan University (6), Stony Brook University (6), The University of Texas at Austin (6), City College of New York (5), Georgia State University (5), Illinois State University (5), University of Wisconsin – River Falls (5).

For every complete application that documents five or more physics teacher graduates in a single academic year, the PhysTEC project will

- send a letter of commendation cosigned by APS and AAPT presidents to the university president (and cc'd to other relevant administrators)
- award a certificate, presented at the PhysTEC conference
- publicize awardees to APS and AAPT members
- provide a press release on the award.

For more information on PhysTEC and The 5+ Club, visit phystec.org

Joseph Polchinski 1954-2018

Joseph Polchinski, a prominent theoretical physicist and leading researchers in string theory, died on February 2 at age 63. He was a professor of physics at the University of California Santa Barbara (UCSB) and a Permanent Member of the Kavli Institute of Theoretical Physics. Polchinski was a Fellow of the APS and a member of the U.S. National Academy of Sciences.

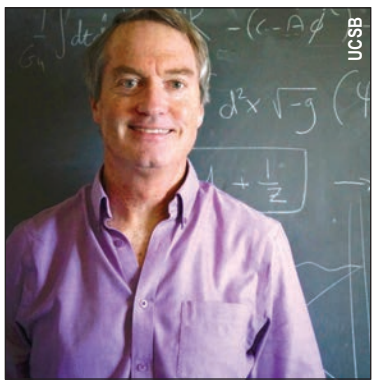
"His research has had a profound and lasting impact on our understanding of the universe," said UCSB Chancellor Henry Yang in a note to the campus community. "Throughout his career, he demonstrated tremendous creativity and insight not only in discovering new scientific truths, but also in communicating these complex ideas in a highly accessible and thought-provoking way."

Polchinski received his bachelor's degree in physics from the California Institute of Technology in 1975 and his Ph.D. from the University of California at Berkeley in 1980. After postdoctoral work at SLAC and Harvard University, he joined the faculty of the University of Texas at Austin in 1984 and moved to UCSB in 1992. He was a winner of the 2007 APS/AIP Dannie Heineman Prize in Mathematical Physics and shared in the 2017 Breakthrough Prize in Fundamental Physics, among several other awards.

In a 1995 paper in *Physical Review Letters*, Polchinski extended string theory—the theoretical framework that casts one-dimensional strings rather than point particles as the fundamental objects of nature—to higher dimensional entities called "D-branes." And in 1998 he literally wrote the textbook on string theory (in two volumes).

More recently, Polchinski had been studying black holes and in 2012 co-authored a paper showing that quantum entanglement of particles required the existence of a hot "firewall" at the event horizon. This effort to resolve the black hole information paradox (which concerns the fate of information falling past the event horizon of a black hole) generated considerable debate.

In 2015, Polchinski was diagnosed with brain cancer, and in 2017 he posted a memoir on the arXiv in which he wrote "It is interesting to go through one's life like this. It has taken a rather linear path, from the How and Why Wonder Books to today, with few deviations. I have not achieved my early science fiction goals, nor explained why there is something rather than nothing, but I have had an impact on the most fundamental questions of science."



Joseph Polchinski

Polchinski, J. "Dirichlet Branes and Ramond-Ramond Charges," Phys. Rev. Lett. 75, 4724 (1995).

Polchinski, J. "Memories of a Theoretical Physicist," arxiv.org/abs/1708.09093

New York Times obituary: Joseph Polchinski (February 7, 2018)

2018 Review of APS Honors Program Underway

By Mary Raucci, APS Honors Program Manager

The APS Honors program is an important way that the physics community recognizes achievement and excellence. APS is committed to continuous improvement and is now undertaking a review of the program's policies and procedures. This may impact how APS prizes, awards, and Fellowships are handled in the future.

In addition, as a follow-up to the 2016 APS Prizes and Awards Task Force Report, the APS Board and Council of Representatives have requested that the Committee on Prizes and Awards conduct a review of existing prizes and awards. The scope will include a deeper look at the relevance, possible overlap, financial concerns, and overhead implications for APS honors at all levels.

The purpose of the review was outlined by Nick Bigelow, 2018 chair of the APS Committee on Prizes and Awards. "The Committee will be reviewing 73 active and new prizes and awards, including evaluation of any financial gap in existing endowment funds. We will also try to assess the impact of supporting these APS honors on development and administrative staff," said Bigelow.

With the continuing increase of requests for new prizes and awards, there are growing concerns about donor fatigue, but more importantly about the strain that the increased workload is putting on our volunteers and staff. "To ensure that each honor receives an appropriate and diverse pool of nominees takes a lot of time and effort by our many APS volunteers," said Trish Lettieri, APS Director of Membership. "It also takes a lot of time and energy by the selection committee members to review and choose deserving recipients. We already ask a lot of our members."

Mary Raucci

Committee members have begun researching other scientific societies to establish benchmarks and will now start a review of the individual honors. A preliminary discussion regarding the scope of

HONORS continued on page 7

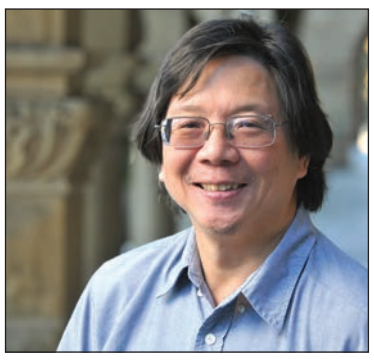
Physics is Part of the "World view" of This Cybersecurity Expert

By Katherine Kornei

Herbert Lin spends most of his time thinking about cybersecurity, data breaches, and power grids, all from a physics perspective. Lin, a senior research scholar and Hank J. Holland Fellow in Cyber Policy and Security at Stanford University, acknowledges he hasn't used graduate-level physics since his qualifying exam in the 1970s. "But it still affects everything about the way that I look at the world," he says. Lin even carries around his 40-year-old physics textbooks whenever he moves. "I should get rid of those books," he says. "But I can't. It's like cutting off an arm."

The physicist at heart is also fascinated by psychology and sociology. Lin's doctoral research at MIT focused on the psychological difficulties that undergraduates encounter when learning physics. "I wanted to understand better what it meant to be a good teacher," he says. There are definite differences in how physicists and social scientists tackle a challenge, however, Lin notes. "[Physics is about] stripping a problem down to its essence," he says. "That method drives social scientists crazy—they like to consider a problem in all of its complexity."

Physics, psychology, economics, and sociology collide at the intersection of public policy and cybersecurity, where Lin has been working in some form for the last 25 years. Lin's interest in cybersecurity developed in high school. "I was able to explore computer security, shall we say … and I never abandoned the mindset of a hacker," he says. These days, Lin spends his time thinking about how to attribute breaches in cybersecurity, international diplomacy ("I think a lot about North Korea," he says), and what is an appropriate response to a cyber attack. "Mostly we think about how people are



Herbert Lin

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PRB continued from page 1

laid the foundation of the renormalization group theory of phase transitions. These papers not only revolutionized our understanding of scaling and critical phenomena, but soon provided a practical solution of the Kondo problem—the mysterious low-temperature rise in resistivity of a metal with magnetic impurities.

New tools also yielded new insights: The invention of the scanning tunneling microscope in 1981 showed us surfaces at the atomic scale and was a harbinger of the nanophysics revolution of quantum dots, clusters, fullerenes, and nanowires that was to come. In a pair of highly cited papers that appeared in *Physical Review Letters* and PRB in the early 1980s, Tersoff and Hamann presented the first systematic theoretical study of scanning tunneling microscopy.

The discovery of high-transition-temperature superconductivity in layered cuprates in 1986 set off a frenzy of activity that has few parallels. Theorists responded with new ideas and tools, and experimental techniques—from spectroscopy to material synthesis—saw tremendous improvements. One of the most studied models for superconductivity in the cuprates, the *t-J* model, was introduced by Zhang and Rice in 1988 as a Rapid Communication in PRB. The quest to unravel the physics of the cuprates remains an open and active one.

Technological impact is a hallmark of many PRB papers. Perhaps the fastest advance was the discovery of the giant magnetoresistance (GMR) effect in 1988 by Grünberg (and independently by Fert, published in PRL). GMR-based computer hard disk drives became the norm within a few years, dramatically increasing storage density and speed.

If there is one field that dominates the list of all time top-cited papers in PRB, it is that of density functional approaches to compute the electronic band structure of complex materials. Some of the most influential papers by Kresse, Parr, Perdew, Vanderbilt, and Zunger, among others, were published in the 1980s and 1990s by PRB and have garnered tens of thousands of citations.

PRB has published many influential papers on topological insulators. For example, Yoichi Ando's group in 2010 reported the synthesis of a new bismuth-based 3D topological insulator with the largest surface to bulk conductance ratio. And in 2011, Savrasov and colleagues presented the first proposal for the realization of a Weyl semimetal, a unique state of matter that exhibits topological behavior in both bulk and surface.

But what is the journal's mission now? PRB strives to attract and publish high quality authoritative papers that should stand the test of time. PRB publishes papers in two formats: *Regular Articles* with no length limit, well suited for a thorough exposition of the research, and *Rapid Communications*, short letter-size papers for speedy publication of particularly important results. PRB's criteria for publication have remained the same: papers should present new and significant understanding and be important to the community in advancing physics.

The role of editors in managing the review process has changed significantly in the last 10 years to become more proactive. Editors now spend more time per paper and have access to more information to make decisions. For some years now, they have been rejecting about a quarter of submissions without external review, based on the quality of the manuscripts and the subject matter fit for the journal. This serves both to speed up the decision-making process and to make more efficient use of referee resources. Editors also often consult our large Editorial Board, our "eyes and ears" in the community, for advice. This helps us make thoughtful, consistent, and fair decisions, and helps authors publish the strongest most useful papers possible.

Since its founding, PRB has grown fourfold. Most of our published content now originates outside the U.S. (in 2017, authors from 70+ countries published their work in PRB). The PRB editorial team is equally international with ties to 15 countries. Our referee pool and Editorial Board are more diverse than ever.

Given this growth, following the literature in CMP outside of one's own subfield can be a challenge. To make it easier, starting in 2008 the editors of PRB have selected a few papers every week for their particular importance, interest, or readability as *Editors' Suggestions*.

In an era where the pressure to publish in high-profile journals is higher than ever, the one thing that has not changed at PRB over the years is the core value of our mission: to publish solid science minus the hype, vetted in a thorough and professionally run peer review process. In this endeavor, we would like to acknowledge the tireless work of our many thousands of referees, who are the real backbone of our journal.

In the last two decades, there has been an explosion of activity in CMP and PRB has thrived, publishing papers on graphene and other 2D materials, iron-based superconductors, multiferroics, frustrated magnets, metamaterials and nanophotonics, ultracold atoms in optical lattices, quantum spin Hall effect, and Majorana bound states, to cite a few examples. Machine learning, high-throughput computing, and first-principles methods combined with many-body techniques are poised to bring condensed matter and materials physics into a new realm.

With the trust and support of the community, we are excited to see what this journey of scientific discovery will bring in the decades to come.

Sarma Kancharla is a PRB Associate Editor and has been working for PRB for 10 years. PRB Lead Editor Laurens Molenkamp is Chair for Experimental Physics at Universität Würzburg.

Education & Diversity Update

Workshops at the 2018 APS April Meeting

Undergraduate and graduate women in physics are welcome to attend a 2-hour seminar on Sunday, April 15 from 4:00 p.m. - 6:00 p.m. The seminar, led by Evie Downie, professor of physics at George Washington University, will focus on professional skills that students can use to negotiate a position in academia, industry, or at a national lab; interact positively on teams and with a mentor or advisor; think tactically, articulate goals, enhance their personal presence; and develop alliances. Register at aps.org/meetings/april/diversity.cfm by March 16.

Women postdocs, faculty, and scientists are welcome to register for the Professional Skills Development Workshop for Women held on Friday, April 13 from 8:00 a.m. - 4:00 p.m. The workshop will have two sessions running concurrently, led by Yvette Huet and Nancy Houfek, and is designed to provide knowledge on persuasive communication skills, negotiation practices, and effective leadership tools. Travel funding is available. Register at aps.org/meetings/april/diversity.cfm by March 9.

Special Commentary

Being a Scientist in the American Economy: It's Not What You Think

By Joe Iadarola

Joe Iadarola

"You have a degree in *what*?" I get that question frequently because I work in the construction business, and no one expects that I have a bachelor's in physics. As federal lawmakers iron out details of the fiscal year 2018 budget, they should keep in mind that science deserves strong support, since it trains people like me for so many different careers that propel the American economy.

Myths abound when it comes to science and career options; let me shatter four of them.

First, we're not who you think we are. The vast majority of us with bachelor's degrees in physics don't work in universities—60 percent of us work in the private sector. And that's true of all science degree holders. We're not in ivory towers at gated universities. Instead, we're in construction, agriculture, and manufacturing. We develop and build for this country. So, the next time you see someone in a hard hat, remember that person might be a scientist.

Second, science degree holders are not all super geniuses. Maybe you've watched the "Big Bang Theory," and you think we're all Sheldon Cooper. I have a passion for science, but the similarity stops there. We don't all ace high school calculus. The fact is, science is open to being pursued by anyone who has the desire and interest.

Third, my interest in science wasn't a temporary enthusiasm. I didn't look back on my life and say: "Whew, I'm glad I got that out of my system." Instead, during high school, I honed my electrical skills while working for a master electrician in Silver Spring, Maryland. Later, at his urging, I took the exam to also become a master electrician. My physics degree came in handy while studying for that test. I recall having a good understanding of calculations, including the physical factors that play a part in them, as well as the importance of wire conductivity.

While working as an electrician, my science background was crucial to understanding LEDs (light-emitting diodes), including how to wire them and deal with their limitations. I also comprehend the wavelength of light that LEDs emit and how it differs from an incandescent bulb.

My interest in science never

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2018 APS Medal for Exceptional Achievement in Research

The 2018 APS Medal for Exceptional Achievement in Research was awarded on February 1 to Eugene Parker, professor emeritus at the University of Chicago, for his "many fundamental contributions to space physics, plasma physics, solar physics, and astrophysics during the past 60 plus years." (Top) The medal was presented to Parker by 2018 APS President Roger Falcone along with APS CEO Kate Kirby. (Bottom) Family members and colleagues joined in the celebration: from left to right, Eric Parker, Susan Kane-Parker, Niesje Parker, Eugene Parker (seated); Michael Turner, Rocky Kolb, and Young-Kee Kim (University of Chicago), and Timothy Gay (University of Nebraska-Lincoln, APS Speaker of the Council, and University of Chicago Ph.D. graduate). APS is accepting nominations for the 2019 APS Medal now through May 1.

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that students can use to negotiate a position in academia, industry, or at a national lab, interact positively on teams and with a mentor or advisor, think tactically, articulate goals, enhance their personal presence, and develop alliances.

APS will hold its Annual Business Meeting with presentations by APS leadership and an opportunity to ask questions and share comments (4–5 p.m., room A216).

On Saturday, there will be a welcome reception and poster session (5:30 p.m.), followed later (7–8 p.m.) by Nobel laureate Rainer Weiss (MIT), who will present a lecture open to the public on "Exploring the Universe with Gravitational Waves."

Monday's plenary session (April 16, 8:30 a.m.) features three speakers: Njema Frazier (National Nuclear Security Administration, DOE) will discuss her agency's programs; Anne Archibald (Netherlands Institute for Radio Astronomy) will give a presentation on "Tests of General Relativity Using a Pulsar in a Triple System," and Marcelle Soares-Santos (Brandeis University) will present "Discovery, Characterization, and Physics Implications of the Electromagnetic Signatures of GW170817" on the first direct detection of a neutron star merger.

A distinguished lineup of speakers graces the plenary session on Tuesday (April 17, 8:30 a.m.). Astrophysicist Eugene Parker (University of Chicago), winner of the 2017 APS Medal for Exceptional Achievement in Research, will discuss the physics of magnetic fields in the Sun. 2017 Nobel Laureates Rainer Weiss (MIT) and Barry Barish (Caltech) will give presentations on LIGO and gravitational wave physics.

Throughout 2018, APS leadership will be engaged in developing a strategic plan for the coming years. Member input is vital to this process, so please be sure to attend the Town Hall on Strategic Planning on Monday, April 16, 3:30–5 p.m. in room B130 of the Convention Center. The Town Hall will be hosted by 2018 APS President Roger Falcone and APS Chief Executive Officer Kate Kirby.

For more on the April Meeting visit aps.org/meetings/april

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hacking us," he says. "But maybe we might want to hack them."

Lin is also an amateur magician, and he's quick to note the parallels between sleight of hand and his day job. In both magic and cybersecurity, you have to "pre-implant vulnerabilities," he said at a Stanford University seminar in 2015. With a magic trick, creating a vulnerability might be as simple as hiding a particular card under a participant's seat in advance, Lin says. In the field of cybersecurity, ensuring a vulnerability might involve designing a missile that turns off when it receives a certain radar code, for example. "You have to set the stage so when you come into it later on you can take advantage of what's there," Lin said at the seminar.

The Equifax data breach in September 2017—in which information from 143 million consumers was stolen from the credit reporting agency—is one recent example of a cybersecurity incident that affected the public. In an op-ed piece in the *Washington Post*, Lin advocated one way of combating similar events in the future: "Individual [credit] reports [should] be frozen by default, "thaw-able" only with the individual's consent," he wrote. Such a requirement, if enforced technically, would help to ensure that the sensitive data contained within the reports were available to others only with the permission of the individual associated with that credit report. But this idea isn't likely to make it into policy anytime soon, Lin concedes, because selling credit reports is big business: Equifax's 2016 revenue topped $3 billion, Lin noted in his op-ed.

Data breaches aren't going away anytime soon, Lin says. "Every boardroom should be contemplating the possibility that its company's computer systems will be destroyed and private email, salary information, and much more publicly revealed," Lin wrote in 2015.

Given his front-row seat to the limitations of technology, Lin has some reservations about the burgeoning "Internet of things," the growing system of networked devices that share data over the Internet. He recounted an incident a few years ago with an Internet-enabled thermostat, which was programmed by a smartphone. "It crashed in such a way that you couldn't turn on the heat, and there were people who froze," he says. "That is just totally asinine."

"I'll be damned," Lin says, "if I'm going to put in an Internet refrigerator."

The author is a freelance writer based in Portland, Oregon.

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affairs officer for APS OGA. "We'll face challenges in 2018 similar to the ones we faced last year," Slakey added, "and the APS OGA will continue to up its game and partner with our APS units."

In 2017, APS OGA assisted Society members with 14,873 contacts—phone calls, emails, and meetings—to their congressional representatives on crucial science policy issues. These included targeted approaches in specific states and districts, 15 nationwide online-campaigns for APS units, and activities at APS meetings. In many cases, the House and Senate took action influenced by the strong response from APS members.

APS OGA will continue to implement its effective integrated advocacy strategy in 2018, supplementing it with even more enhanced targeting and mobilization methods. The office also plans to bring in new voices and partners to advocate for science, including working with the Packard Foundation and nearly a dozen science and engineering organizations on a coordinated effort to advocate for the federal investment in research.


Lesya Horyn

Marion White (far right in orange sweater) stands with her Illinois delegation after advocating for science at U.S. Rep. Randy Hultgren's office (IL - 14th).

"We are always developing and offering ways to help APS members be a voice for physics," said Mack.

To learn more about the five issues the APS volunteers advocated for during the recent CVD and to take action, click on the Advocacy Dashboard.

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dimmed. Today, I work at Cooper Construction Services in Frederick as an estimator, a person who consults with clients to determine general construction costs. And my physics degree keeps paying dividends through critical-thinking skills and the comprehension of spreadsheets and budgets.

So, like many in my generation who graduated from college in 2008, I haven't followed a straight and predictable career path. In an increasingly competitive economy, having a background in science is worth every nickel. For example, the unemployment rate of science degree holders is just a few percent, and the jobs we fill have competitive starting salaries. Compare that to film-study majors who have unemployment rates near 13 percent.

The employment success in science is easily explained, and it shatters the last myth.

A science degree doesn't close doors; it throws them wide open. I didn't know where I would end up, but I knew that a science degree would take me there. I'm a proud graduate of the University of Maryland, and I knew that my degree in physics wasn't going to narrow my options. Instead, I knew that I'd learn the problem-solving skills and practical laboratory nuts-and-bolts that would open up a range of career paths.

I have the federal government to thank for making a lot of this possible. The University of Maryland provides one of the country's best programs in physics, in part, because it has a research environment supported by the National Science Foundation, the National Institute of Standards and Technology, and the Office of Science at the Department of Energy. The federal funding of science enables students to participate in undergraduate research opportunities that prepare them for the diverse career opportunities ahead.

As President Trump and Congress finalize the federal budget, and as parents and students make decisions on schools and majors, remember that science is a sure-fire way to diverse employment paths. Career opportunities abound. The pay is great. And the rewards are long lasting.

The author is an estimator at Cooper Construction Services in Frederick County, Maryland. Opinions expressed are solely the author's and not those of his employer or of APS.

For information about APS efforts to support science funding, visit the website of the Office of Government Affairs at aps.org/policy. For more information on careers for physics graduates, visit the APS Careers page at aps.org/careers and the APS Industrial Physics page at aps.org/programs/industrial.

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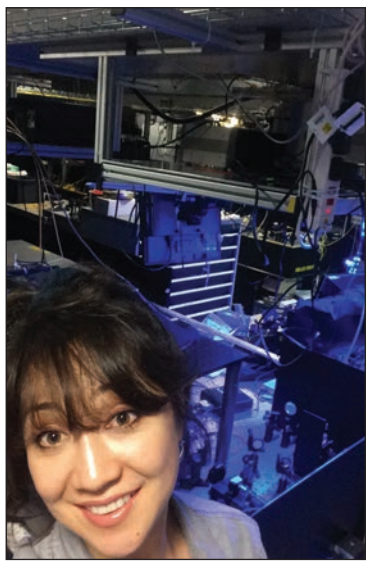
only in the studio. You have to be a ballet dancer on the bus, when you walk, and wherever you go. That's how you have to act when no one is watching. You have to be confident with being the best version of you."

When Moore entered Harvard in the fall of 2006, her love of both ballet and physics was secure. And yet, "dancing professionally didn't cross my mind," she says. But at the university, "I was lucky that there were lots of opportunities to dance. Incredible dance legends were teaching classes." But suddenly, an urgency set in. "I freaked out," she says, thinking to herself "Oh my God, I'm 19 and people retire at this age. I have to do it now! My greatest fear is regret and I didn't want to regret that I hadn't given it everything I had. So it was ok for me to go for it."

And go for it she did, auditioning 24 times in one year. In 2008, as a sophomore, Moore was accepted into the Zurich Ballet Company. She did her physics homework on the airplane, and although she officially took a year off from school to dance in Europe, she audited physics courses at ETH Zurich. The company offered to extend her contract into another season, but Moore declined. "Dancing is a really tough life, and I wasn't ready to sacrifice the physics for that." She came back to school in 2009, intending to abandon dance, and even threw out all of her leotards and shoes. "But that didn't last very long!" Within a few months she was back on stage, and joined the Boston Ballet.

But when it came time for graduation and decisions about future moves, Moore's ardor for science returned. "I knew I always wanted to continue with physics," she says. "So doing the Ph.D. was what I had to do while I had the momentum." Moore is clear that her training as a ballerina has primed her for success in physics. "Dance has given me this persistence and grit which is really important these days in science. I learned a lot through auditions. As a dancer and performer, we are used to putting ourselves out there and giving it all."

Moore earned her doctorate in quantum optics from Oxford in December 2017, and in January 2018, she was named to the Forbes 2018 30 Under 30 Europe list for Art & Culture. In the future, she's also aiming to explore artificial intelligence and machine learning with dance. "I want to explore physics through dance," she says. "I don't know what the path is going to be because I don't take the conventional path."



Merritt Moore in the lab

At the same time, Moore believes that, in some ways, physics research is easier to manage. "If I have a 20 hour day in the lab, 3 weeks in a row, I'm like 'At least my toes aren't bleeding, so this is fine.'"

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the review started with unit leaders at the 2018 APS Leadership Convocation. Input from APS units will continue to be solicited and then the Committee will present a preliminary review of its progress at the 2018 April Council meeting. The goal is to have a final report for the November Council meeting.

The APS Council of Representatives also updated the APS Policies and Procedures in April 2016, stating that "The number of recommended nominees in each year may not exceed one-half percent of the then current membership of the Society, excluding student members." This was a much-needed correction since previous allocations were based on the total APS membership which now includes almost 40% students, who are not eligible for Fellowship. This change was phased in over the past two years, and after the first full implementation with the 2018 Fellows election process, the Fellowship Committee will assess the impact of the reduction in the number of Fellows, and decide if any adjustments to the allocation formula, or other procedures, is needed.

Promoting a diverse and representative community of APS prize and award recipients and Fellows is a top-priority for APS. Under the guidance of the APS Board and Council, APS Honors staff have taken new actions in the current nomination cycle to further assist APS units in canvassing, promoting, and continuously monitoring the diversity of their respective prizes, awards, and Fellows nominations. These actions include distributing to executive committees reports of existing nominations still eligible, requesting they form selection committees early in the year, and asking all committees to review the Guidelines for Promoting Equity and the Unconscious Bias resources provided by the APS Committee on the Status of Women in Physics and the APS Committee on Minorities in Physics. And to better serve our members and volunteers, additional staff in the Membership Department have been reassigned to the Honors Division. Please contact Mary Raucci, APS Honors Program Manager, at raucci@aps.org with any questions.

The Back Page

Hard Line on Sanctions Harms Science Diplomacy

By Warren E. Pickett and Laura H. Greene

At the eleventh hour in September, the U.S. government blocked five scientists from four U.S. universities—ourselves and three of our colleagues—from traveling to Iran. We had been invited to attend and present scientific lectures at the 10th International Conference on Magnetic and Superconducting Materials, MSM2017. This series highlights the basic science behind exotic behavior of quantum materials, well before such materials are used in applications.

The MSM conferences enable scientists from scientifically developing countries to connect with peers in more developed nations. They are biennial international conferences that began in 1999, and have been held in countries ranging from Northern Africa (Tunisia, Morocco) through the Middle East (Jordan, Iran, Turkey), Southern Asia (Uzbekistan), and the Far East (India, Malaysia). In most of them, U.S. scientists attended, and MSM was to be held in Tehran in 2017. One of us (WEP) attended the MSM meetings in 2003 (Tunisia), 2007 (Morocco), and 2013 (Tunisia).

In view of continuing tensions between the U.S. and Iran, and in spite of sanctions being relaxed in 2016, officials at our universities advised us in the summer of 2017 to inform the relevant U.S. agencies of the visit, and we did so. To assure compliance, our conference presentations would discuss only publicly available results, as is conventional in many scientific conferences; no new breakthroughs, which conceivably could conflict with the sanctions, would be announced.

Late in August, each of the attendees was informed that our "participation … is prohibited …" by the Iranian Transactions and Sanctions Regulations (ITSR), although our legal counsel could see no reason how such conference attendance could violate the sanctions. No specific legal reasoning was provided by the U.S. Treasury Department's Office of Foreign Assets Control (OFAC), which interprets the broadly stated sanctions and declined to issue licenses for this travel. We inquired about an appeal, but were told that was possible only if there were significant changes in our applications. Since we already seemed to be in complete compliance with ITSR, there was nothing to revise. A spouse of one of us (LHG), a musician who planned to accompany us and give a recital for the conference attendees and a broader audience, without a fee, was also denied under ITSR.

Above: In 1974, physicists from the U.S. visited the Landau Institute of Theoretical Physics in Moscow despite cold war tensions. From left to right: G. S. Bisnovati-Kogan, I. D. Novikov, V. L. Ginzburg, Y. B. Zeldovich, and David Pines. Below: Paul and May Chu, Farzaneh Akhavan, Jill and Warrent Pickett at a Tehran bazaar during their travels to Iran for a superconductivity conference.

This decision raises fundamental issues about the intent and application of the sanctions. First, the sanctions overwhelmingly focus on financial interactions between the two countries. Financial arrangements were never in question for this visit. No funds would be paid to the participants, or paid by them to the conference. Second, the conference is an established international conference and not an Iranian one, so it was simply being held in Iran in 2017. The Iranians would not have access to anything like sensitive information, and the conference proceedings would be published in the open literature.

Over the past four years, numerous U.S. academics have attended and presented talks at conferences in Iran without any known objection from the Treasury Department. Its denial of our application to travel did not provide reasoning, legal or otherwise. Denial of permission occurred only because the scientists, unlike the earlier visitors, requested explicit permission from OFAC. In February 2014 one of us (WEP), together with Tony Leggett (University of Illinois at Urbana–Champaign) and Paul C. W. Chu (University of Houston), visited Iran for two weeks. [Documentation of some of the activities of this visit can be seen at yclept.ucdavis.edu/iran.html] We attended and presented at their 4th National Conference on Advances in Superconductivity, and visited four major Iranian universities. At each campus we met with faculty groups, and sometimes administrators and student groups, to discuss science diplomacy issues. Faculty expressed great dismay in their isolation from the international scientific community, including issues such as getting their manuscripts treated objectively by international physics journals. APS publications have been forefront and steadfast in being fair and inclusive irrespective of nationality, including papers from Iranian (co)authors. Iranian students were disturbed about prospects for their scientific careers due to the lack of international communication and information exchange.

"Our activities were to have been an act of science diplomacy—that is, interaction between scientists for mutual enrichment. Science diplomacy is simply using the words and actions of science and communication between scientists to make a better world, whether it is improving water resources, furthering agriculture, discussing quantum materials, or increasing broad human communication and mutual understanding."

Our activities were to have been an act of *science diplomacy*—that is, interaction between scientists for mutual enrichment. Science diplomacy is simply using the words and actions of science and communication between scientists to make a better world, whether it is improving water resources, furthering agriculture, discussing quantum materials, or increasing broad human communication and mutual understanding.

The other of us (LHG) has had long-term and deep involvement in science diplomacy, which she made her signature theme during her 2017 year as president of APS. She has given scientific talks and workshops (to increase the scientific success of young scientists, especially women), and strengthened U.S. scientific ties with a variety of countries, including Indonesia, India, Oman, Ghana, Turkey, Tunisia, Brazil, and Cuba.

Science diplomacy has been specifically encouraged by the State Department for many years through its Science and Technology (S&T) Advisor, a position established in 2000. The position has suffered recent turmoil since the S&T Advisor, Dr. Vaughan Turekian, resigned in July before the end of his appointment [1]. Turekian had previously served as Director of the Office of Scientific Diplomacy of the American Association for the Advancement of Science (AAAS), which has direct relations with the corresponding staff in the State Department.

Very recently the National Academies released *U.S.-Iran Engagement in Science, Engineering, and Health (2010-2016)*, authored by Glenn Schweitzer; this report makes the point persuasively that such scientific diplomacy greatly benefits American science and policy. The State Department, AAAS, and the National Academies have worked together to promote science diplomacy, and in the 2010-2016 years cooperative activities of several hundred U.S. and Iranian scientists, engineers, and health specialists were supported by the National Academies for discussions and mutual information exchange. The U.S. Department of State has been a crucial supporter of these activities, and toward the end of this period the U.S. and Iran concluded a momentous agreement on the reduction of sanctions in response to the discontinuation of the Iranian nuclear weapons program.

Recall that in the midst of the cold war in the early 1960s, U.S. physicists visited their counterparts in the USSR. The climate at that time between these two heavily nuclear-armed and contentious countries dwarfs the current U.S.-Iran conflict. Yet reciprocal visits of materials physicists began around 1960 and continued for some years, providing a stunning example of how science diplomacy can persist under the direst political circumstances. We now understand that U.S. and USSR scientists working together in those formative years changed the face of theoretical condensed matter physics in the 20th century. Scientific diplomacy and broad diversity is essential to address the challenges of the 21st century. Iran has the legacy of several millennia of a well-educated society and rich culture. This legacy has been stalled by a lapse in societal progress in the mid-east and that part of Asia for several decades, but Iran has sustained support of higher education and even today has a high proportion of university students (around 4 million of a 75 million population).

We urge members of APS and indeed all scientists to engage in scientific diplomacy when opportunities arise, and more generally to promote scientific communication and international cooperation.

References:

[1] go.aps.org/2FE6kaY

Warren E. Pickett is Distinguished Professor of Physics, University of California Davis. Laura H. Greene is Chief Scientist at the National High Magnetic Field Laboratory, Francis Eppes Professor of Physics, Florida State University, and Past President of APS.

Warren E. Pickett

Laura H. Greene