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APS NEWS

APS physics

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PROFILE IN VERSATILITY

Jessica Esquivel Powers a Career in Particles and People

BY ALAINA G. LEVINE

Jessica Esquivel is a particle physicist, science outreach specialist, and advocate for Black, Latinx, and LGBTQ+ people in STEM, and she has made it her personal mission to enable the success of minoritized populations in science. As an associate scientist at Fermilab, she created her own job, spending half of her time on scientific pursuits to observe physics beyond the standard model, and the other half on workforce development and diversity, equity, and inclusion (DEI) projects. She is the co-founder of the twitter movement #BlackinPhysics and was recently named an AAAS IF/THEN Ambassador, a program dedicated to increasing the number of women in STEM.

"I learned then that while physics amazed me, the road to be a physicist was going to be one with naysayers, non-believers, and barriers," she told AAAS. "I'm here now—a PhD-toting afrolatinX physicist among a group of only around 150 physics PhD-holding Black women in the country."

Her journey began as a tot, as she became transfixed by all things space and science. "I was always a pretty nerdy kid. I liked sci-fi movies and shows and reading about kids saving the galaxy," she says. "STEM was always with me as I was growing up." Most of her family pursued health care professions, but Esquivel's time in STEM-focused summer camps and a science magnet high school showed her a different calling. "Physics caught my attention. I found physics hard, but I liked that it was hard, that it pushed me," she says. "That challenge and rigor kept attracting me. I fell in love with physics for real, for real."

But that love affair, like so many, was complicated. When she arrived at St. Mary's University in San Antonio, Texas, she considered studying electrical engineering,

Jessica Esquivel

because growing up, "we saw engineers having money and thought that was a meal ticket." But her first college physics class reminded her why she loves physics. "Learning about superposition of different states and Schrodinger's cat blew my mind. This new physics really

ESQUIVEL CONTINUED ON PAGE 7

2021 APS GENERAL ELECTION

The Results Are In!

Congratulations to these newly elected members of APS leadership!

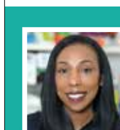
Vice President

Young-Kee Kim
The University of Chicago

Treasurer

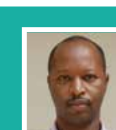
David G. Seiler
Retired, National Institute of Standards and Technology

General Councilor



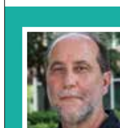
Kandice Tanner
National Cancer Institute, National Institutes of Health

International Councilor



Omololu Akin-Ojo
East African Institute for Fundamental Research, University of Rwanda

Chair-Elect, Nominating Committee



José N. Onuchic
Rice University

APS physics

Thank you to all who voted, and special thanks to our candidates.

MORE INFO
go.aps.org/generalelection

ABOUT APS

A New Home for the APS Editorial Office

BY DAVID BARNSTONE

The APS Board of Directors unanimously approved the sale of its editorial office building in Ridge, New York at a meeting on August 27. The editorial operations of the *Physical Review* journals will be relocated to a smaller office space on Long Island in early 2022.

"Selling the building at Ridge is difficult for many, especially for those who have built their careers there," said APS CEO Jonathan Bagger. "But the *Physical Review* is much more than a building; it represents a suite of journals with a tradition of excellence in publishing that stretches back over 100 years."

For much of its history, APS journal operations moved with its Editor in Chief. When Dutch-American physicist Samuel Goudsmit assumed the role in 1951, the editorial offices were located at Brookhaven National Laboratory

NEW HOME CONTINUED ON PAGE 6

INTERNATIONAL

The South African Institute of Physics Honors Five APS Members as Fellows

BY IRVY (IGLE) GLEDHILL

National boundaries look very small when they are viewed in the context of the universe. In their pursuit of understanding of the physical and meta-physical world, physicists build bridges between continents and form close bonds across the planet. The South African Institute of Physics, SAIP, has stated emphatically that it values those bridges by electing new Fellows, five of whom are APS members.

Kétévi Assamagan, originally from Togo, is a world class leader in experimental high energy physics. He co-founded the African School of Fundamental Physics and Applications, a biennial capacity-building event that is significantly increasing Africa's participation in global, large-scale research infrastructures in accelerator and particle physics.

A recent project under his leadership is initiating the African Strategy on Fundamental and Applied Physics. Like Snowmass, this is a planning project where the community, as a self-organizing complex system, prioritizes collaborative initiatives in particle and nuclear physics, with cross-links and support to associated disciplines and applied fields.

Sylvester James Gates, Jr., is a renowned expert in supersymmetry, supergravity, and superstring theory. He is President of APS and was awarded the 2011 National Medal of Science.

Gates has many interactions with, and in, South Africa: he referees proposals for the National Research Foundation, he has been a Fellow of the Institute for Advanced Study in Stellenbosch, and he has artfully strung concepts together in many lectures. In 2003, during his early days in science policy, he was a member of an international panel reviewing physics in South Africa. At the time, the discipline was in crisis, with declining numbers of students and decreasing funding. His empathy and experience were evident in the review "Shaping the Future of Physics in South Africa." The review is credited with re-launching the South African physics community on its current upward trajectory.

James Gubernatis has worked with absolute commitment for physics across Africa and in South Africa and for the development of the physics community.

Through the APS Committee on International Scientific Affairs (CISA), Gubernatis has been a driving force and chief correspondent for the Physics in Africa project and survey. The project is a partnership between APS, The Institute of Physics (IOP), the European Physical Society (EPS), SAIP, and the Abdus Salam International Centre for Theoretical Physics (ICTP). Five areas for action emerged from the survey: communication, new physical societies, lack of experimental equipment, physics

FELLOWS CONTINUED ON PAGE 6

Kétévi Assamagan

S. James Gates, Jr.

James Gubernatis

Richard Martin

Sekazi Mtingwa

ETHICS

October Ethics Corner

BY NAN PHINNEY

As fall meeting season approaches, APS remains committed to ensuring a safe and respectful experience for all attendees. Whether the meeting takes place in-person or virtually, all participants are expected to adhere to the APS Code of Conduct for Meetings, in order to uphold a collegial, inclusive, and professional environment. However, a recent survey of early career APS members shows that inappropriate conduct still occurs too often.

Changing the physics culture requires more aggressive action and commitment from APS members to confront inappropriate behavior when possible. The following Frequently Asked Questions are intended to familiarize meeting attendees with the process of reporting misconduct at an APS Meeting.

What should I do if I witness misconduct at an APS meeting?

A powerful deterrent for misconduct is immediate intervention. If an observer feels able and safe calling out misconduct on-the-spot, they should respectfully intervene. Whether or not they intervene, any attendee who witnesses misconduct has a responsibility to report the incident to APS.

Where do I report misconduct?

All incidents should be reported to an APS staff member on site or through EthicsPoint: aps.ethicspoint.org. Reports should include detailed information, including names of other witnesses.

How long will it take to get a response?

Reports to aps.ethicspoint.com receive a response within 48 hours. For immediate connection to an EthicsPoint resolution specialist, call (844) 660-3924.

How will APS respond?

APS staff investigate complaints and, if appropriate, confidentially communicate accusations of inappropriate conduct to the offender. Repeat offenses trigger increased sanctions, including potential exclusion from future meetings. Retaliation for complaints of misconduct will not be tolerated by APS.

Visit aps.org/programs/ethics/ for more information.

The author is chair-elect of the APS Ethics Committee.

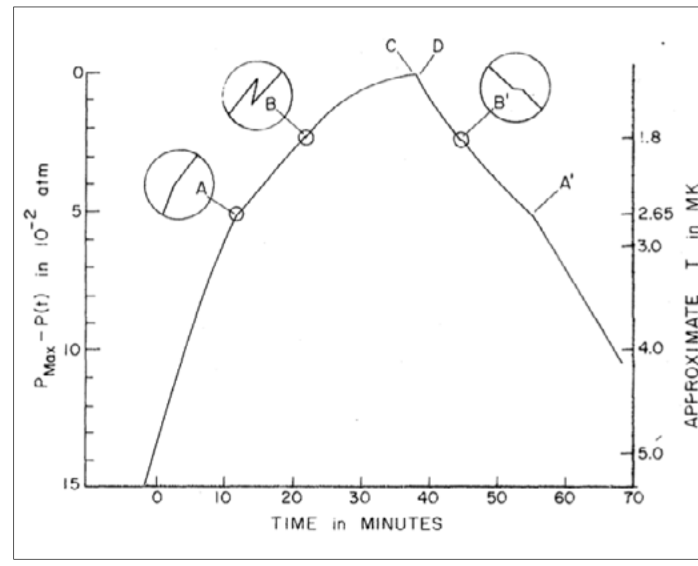
THIS MONTH IN

Physics History

October 1972: Publication of Discovery of Superfluid Helium-3

BY DANIEL GARISTO

Helium-3 and helium-4 have the same charge, same valence electrons, and roughly the same mass—but in one way, they couldn't be more different. Helium-4 a boson, following Bose-Einstein statistics; sans neutron, helium-3 is a fermion, obeying Fermi-Dirac statistics. For decades, it was unclear what phenomena the two would share in common. After superfluidity was observed in helium-4 in 1938, the mystery of whether helium-3 would display the same behavior would remain unsolved for nearly 35 years.



Time evolution of the pressure in the Pomeranchuk cell during compression and subsequent decompression. D.D. OSHEROFF, R.C. RICHARDSON, AND D.M. LEE, "EVIDENCE FOR A NEW PHASE IN SOLID HE3," *PRL*, **28**, 886--PUBLISHED 3 APRIL 1927.

Pyotr Kapitsa, and separately, Don Misener and John Allen, were the first to observe superfluidity in helium-4. At 2.2 kelvin, the liquid helium suddenly began to behave strangely, flowing without apparent viscosity. The state reminded Kapitsa of a superconductor, so he dubbed it a "superfluid." Theorists quickly connected some of the dots: liquid helium-4 was a Bose-Einstein condensate whose atoms congregated at a ground state, creating a viscosity-free flow.

Physicists wondered if helium-3 was also a superfluid, but the inquiry stalled until the Bardeen-Cooper-Schrieffer (BCS) theory of superconductivity was introduced in 1957. During the early 1960s, several groups of researchers proposed hypothetical superfluid states of helium-3 inspired by BCS theory. Lev Pitaevskii showed how Cooper pairs of helium-3 atoms would be substantially different from Cooper pairs of electrons. Then came two models—one by Philip Anderson and Pierre Morel and another by Roger Balian and N. Richard Werthamer (and independently by Yuri Vdovin)— that would end up both accurately describing two different states of helium-3 superfluid.

The challenge was then for experimentalists to cool helium-3 and actually observe the hypothetical superfluid phase. One fundamental stumbling block was the difficulty of obtaining large amounts of helium-3, which came from slowly decaying tritium made in nuclear reactors. Another problem: getting the helium-3 cold enough.

For nearly every substance, the solid phase has a lower entropy than the liquid phase, and therefore it melts when heated. In 1950, Isaac Pomeranchuk proposed that it would be the reverse for liquid helium-3 below .3 kelvin. The entropy of the solid phase would be higher than the liquid phase, he reasoned, so compressing the liquid phase into a solid would cool it. Fifteen years after he proposed the effect, physicists began using it to get helium-3 to otherwise impossibly frigid temperatures in eponymous Pomeranchuk cells.

By 1970, physicists had spent decades searching for some additional phase transition in helium-3, including several years at millikelvin temperatures, without any evidence. According to David Lee, "a mood of gloom and pessimism prevailed." At Cornell, Lee, Robert Coleman Richardson, and graduate student Douglas Osheroff were part of a small group poised to make a breakthrough.

Lee, the son of an electrical engineer and elementary school teacher, was born in 1931 and grew up in and around New York city. During college he considered a career in medicine but opted for physics because he found the biology courses boring. Osheroff, born in 1945, came from a family of physicians but hated the sight of blood and was determined to never become one. Richardson, born in 1937, grew up an avid boy scout, without, as he put it "any special scientific interests." He eventually decided on a PhD in physics after a stint in the Army preparing to get an MBA proved miserable.

In 1971, while Osheroff was recovering from a skiing injury, he developed a new design for a Pomeranchuk cell that allowed the group to monitor minute changes to the melting pressure indicative of a phase transition.

HISTORY CONTINUED ON PAGE 3

APS NEWS

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Contributing Correspondents .... **Sophia Chen and Alaina G. Levine**
Design and Production .... **Leanne Poteet**

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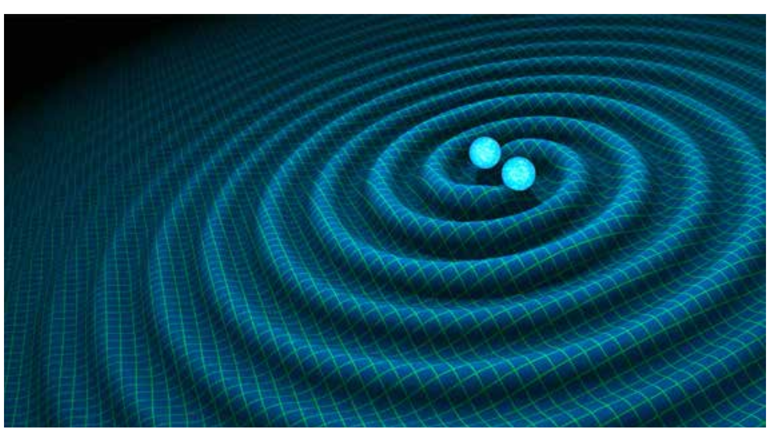
UNIT PROFILE

The Division of Gravitational Physics

BY ABIGAIL DOVE

With around 1,700 members, the Division of Gravitational Physics (DGRAV) is a home for physicists interested in the study of gravity. This spans the detection and interpretation of gravitational waves, experimental tests of gravitational theories, computational general relativity, relativistic astrophysics, solutions to Einstein's equations and their properties, alternative theories of gravity, classical and quantum cosmology, and quantum gravity.

"Gravity is a very old field, dating back to Newton and Einstein," noted DGRAV chair Gabriela Gonzales (Louisiana State University). However, DGRAV is a relative newcomer among APS's ranks. The unit got its start as the Topical Group in Gravitation in 1995 and achieved full division status in 2016.



An artist's impression of gravitational waves generated by binary neutron stars.
CREDITS: R. HURT/CALTECH-JPL

It now enjoys more influence and visibility within APS, with a greater number of invited sessions at APS Meetings and more seats on the APS Council.

Research in gravitational physics spans the very large to the very small. At one end of the spectrum, gravitational physics has considerable overlap with astrophysics and cosmology and is central to understanding phenomena such as black holes and gravitational waves. At the other, gravity intersects with elementary-particle and quantum physics and is central to questions about the unification of the four fundamental forces.

This is an especially exciting time in the world of gravitational physics, which has transitioned from a highly mathematical field to an experimental one with the construction of large observatories to detect gravitational waves, ripples in space-time caused by high-energy events like a collision of two black holes or a supernova. Einstein's theory of general relativity predicted the existence of gravitational waves, but they were not observed until 2015, thanks to the highly sophisticated Laser Interferometer Gravitational-Wave Observatory (LIGO) detector. LIGO is composed of two giant L-shaped interferometers, one in Hanford, Washington, the other almost two thousand miles away in Livingston, Louisiana. Passing gravitational waves will cause one four-kilometer-long arm of the interferometer to stretch while the other compresses, but the difference is inconceivably small—1000 times smaller than the nucleus of an atom. LIGO researchers were awarded the

DGRAV CONTINUED ON PAGE 5

CAREERS

Medical Physicist: An Exciting Career with Many Options

BY TAWANDA W. JOHNSON

After Julianne M. Pollard-Larkin learned that her mother had been diagnosed with breast cancer, she discovered that a medical physicist was helping with her treatment plan. Intrigued, Pollard-Larkin sought more information about his role.

"Since I was already a physics undergrad major, I asked him what a physicist had to do with my mom's treatment, and he explained the quality assurance and treatment planning that gets done behind the scenes to facilitate treatment. After that, I was sold!" recalled Pollard-Larkin, who is Associate Professor and Section Chief of Thoracic Service in the Department of Radiation Physics at The University of Texas MD Anderson Cancer Center.

Pollard-Larkin, who earned her PhD in biomedical physics at UCLA, described her career as "the most rewarding thing I have engaged in." Pollard-Larkin's typical day includes working with several Varian linear accelerators, CT scanners, and associated software to determine patient treatments and quality assurance measurements.

"Linear accelerators are quintessential physics machines, which allow for electrons to be accelerated at high speed inside of a wave guide before striking a metal target, which will then give off the high energy X-rays needed for treating deep-seated disease in patients," she explained.

Medical physicists can take many career paths, including in industry, academia, and clinical settings, according to job surveys conducted by the APS Careers team.

Tyler Blackwell

Julianne Pollard-Larkin

Jennifer Pursley

Richard Spencer

APS Careers routinely conducts surveys to update its Job Prospects page, which keeps members abreast of the types of career opportunities that exist for physics degree holders.

According to the US Bureau of Labor Statistics, the physics field is slated to grow nine percent between 2018 and 2028. Starting salaries for medical physicists in the field range from $80,000 to $130,000.

Medical physicists who work in government or industry often conduct research and development for new technologies; translate technologies for clinical use; test and manage machines and systems

MEDICAL CONTINUED ON PAGE 4

HISTORY CONTINUED FROM PAGE 2

Late that November, Osheroff saw what would become an iconic image: the plot of the pressure during a cooling and warming cycle of helium-3 had two distinctive features on the way up (A and B) and two on the way down (A' and B'). The bumps were small, but indicative of a phase transition. "All three of us were in a state of euphoria and knew we were on the brink of a major discovery," Lee wrote. However, because the cell contained both liquid and solid helium-3, the researchers assumed that the transition was occurring in solid helium-3, and in April 1972, they published "Evidence for a New Phase of Solid He3" in *Physical Review Letters*.

To better understand the nature of the transition, the Cornell group (with the addition of Willy Gully) employed one of the first applications of nuclear magnetic resonance imaging, to observe where in the Pomeranchuk cell the transition was taking place. Solid and liquid helium have different magnetic properties, which show up clearly in NMR. Early one morning, Osheroff saw the NMR results and promptly called Lee to announce that the transition was, in fact, happening in liquid helium.

The researchers were therefore eager to correct their first paper and submitted a second manuscript to PRL. Ironically, the manuscript was initially rejected by a referee, and it was only after appeal that they managed to get it published in October 1972.

A theoretical answer to the observation came swiftly and decisively from Anthony Leggett, a condensed matter theorist in Sussex. Born in 1938, Leggett spent his formative years in and around London. He won a scholarship to Oxford, where he got his first undergraduate degree in classics, and, unusually, decided to go back for another in physics.

In July of 1972, Leggett was on a holiday climbing in Scotland when he heard that Richardson would be visiting Sussex and wished to speak with him. Cancelling his plans, he met with Richardson, who explained the forthcoming NMR data.

Leggett was struck by how much the Larmor frequency of the liquid helium changed at the A transition. It could be explained by the presence of an additional magnetic field of about 30 Gauss that helium atoms exerted on each other, but with one hitch: even at their closest, the maximum magnetic field one atom could exert on another was less than 1 Gauss. Leggett later wrote that "my initial reaction to these results was that they were so extraordinary that they might be the first evidence for a breakdown of some fundamental principle of quantum mechanics." With this in mind, he set out to prove that the shifted response to NMR could simply not occur.

Instead he ended up explaining it, by introducing spontaneously broken spin-orbit symmetry. How can the weak dipole moments of paired helium atoms conspire to create a 30 Gauss magnetic field? Leggett's answer was that, like a ferromagnet, the spins were forced into alignment—at the A transition, every Cooper pair would have to decide together on whether they oriented parallel or perpendicularly. In his paper, Leggett concluded "If the hypothesis is correct, we should expect liquid He3 in phase II to show all the phenomena (superfluidity etc.) predicted' for a BCS-type phase."

Further research corroborated the findings of 1972: liquid helium-3 was a bonafide superfluid, with all of the macroscopic quantum oddities and not one, or two, but three phases. Lee, Osheroff, and Richardson would win the Nobel Prize in 1996, and Leggett would follow suit in 2003.

The author is a science writer based in Bellport, New York.

MEDICAL CONTINUED FROM PAGE 3

that include linear accelerators and MRIs; train physicians and clinicians on equipment use; market new products; and develop clinical value propositions.

An academic medical physicist typically has the following responsibilities: mentoring and teaching students and residents; writing and applying for grants; overseeing research and development on new technologies; serving on department committees; and developing and delivering patient treatments (in a joint clinical position).

Typical activities for clinical physicists include: consulting with patients and physicians; overseeing delivery of treatment to patients, such as radiation treatment for cancer; developing patient treatment plans and checking charts; performing quality assurance on medical equipment; and mentoring/training residents and students (if in a joint academic position).

Physicists are well-suited for careers in the medical physics field.

"They bring a unique perspective to industrial research, development, and services. Their critical thinking contributes to solving systems' problems, and their deep, technical knowledge and mastery of advanced mathematical techniques enable them to tackle complex problems," said Dan Pisano, Director of Industrial Engagement at APS.

It was a "no-brainer" for Tyler Blackwell to become a medical physicist after he learned he could have an impact on patient care.

"At the heart of it, we're focused on the accurate and safe delivery of radiation treatments. That implies a number of ways in which physicists can have an impact. On the industry side, for us, that means designing programs that optimize planning methods and dose delivery for breast cancer, for example, or creating independent secondary dose algorithms to validate calculations done in treatment planning systems," he said.

As a medical physicist at the National Institutes of Health (NIH) and emergency room physician, Richard Spencer said he enjoys great satisfaction in his career.

"Medical physics is the best of both worlds—the physics content ranges from applied to theoretical, but improving human health is always the goal. And this perspective is particularly appealing to me as a practicing physician," he said.

Spencer added, "some of our magnetic resonance imaging (MRI) work applying the mathematics of inverse problems to brain imaging has been described in just those terms: 'Clever math enables MRI to map molecules implicated in multiple sclerosis, other diseases' (*Science*, March 20, 2019). This capability may prove to be of benefit in understanding Alzheimer's disease, one of the greatest medical challenges we face. Overall, my career as a government physicist at the NIH has been enormously rewarding by permitting me to apply some hard-core physics to major, unsolved problems in medicine."

When Jennifer Pursley decided to become a medical physicist, she, too, longed to make an impact on patient care.

"When I first learned about medical physics, I was attracted to the idea that my work and research would have a direct impact on improving treatments for patients," said Pursley, who works at Massachusetts General Hospital and Harvard Medical School.

Her main clinical focus is on treatment planning for patients receiving photon radiation.

"I am responsible for the software we use for treatment planning (RayStation) and imaging (MIM Maestro). I take the lead on commissioning updates to these systems, which must all be tested carefully as incorrect usage can lead to errors in treatment," she explained.

Pursley added, "Now most of the basic physics is hidden from the user in these amazing software systems. We take a patient's CT scan and put it into the software, which simulates a linear accelerator, then view the expected radiation dose to the patient as we simulate radiation delivery with different accelerator settings. But behind the software is a model of the radiation from that linear accelerator, a model which has to be commissioned and tested by the physicist based on radiation measurements made by the physicist."

A career in medical physics is a rewarding one, said Pursley.

"During my 10 years as a clinical medical physicist, I've felt great satisfaction from many small achievements that have improved our treatments of patients or improved our treatment workflow, so staff have more time to focus on patient care," she said.

"Medical physics is the best of both worlds—the physics content ranges from applied to theoretical, but improving human health is always the goal."

For more information about becoming a medical physicist, check out the APS webinar, Why Now is the Time to Join Medical Physics. Additional information can be found from the APS Careers 2020 Guide.

The author is Senior Public Relations Manager in the APS Communications Department. Midhat Farooq, APS Careers Program Manager, also contributed to this article.

APS Members Thank Congress for Acting on Science Legislation

BY TAWANDA W. JOHNSON

Nearly 600 APS members recently wrote letters to say "thank you" to Congress after the National Science Foundation (NSF) for the Future Act and the Department of Energy (DOE) Science for the Future Act successfully passed the US House of Representatives with strong bipartisan support.

"In most of our campaigns, we are asking Congress to take an action on behalf of our community, but it's always important to thank them when we have the chance for something they've done for science," said Callie Pruett, Senior Strategist for Grassroots Advocacy. "It was wonderful to see our membership express their gratitude for these key pieces of legislation. Nearly 600 members took the time to say thank you."

The bipartisan NSF for the Future Act is the first comprehensive NSF reauthorization since 2010. It authorizes robust funding increases for five years and establishes a structure that expands NSF's use-inspired research programs to accelerate American innovation while also strengthening NSF's curiosity-driven fundamental research programs.

Additionally, it supports growing the US domestic STEM workforce by increasing the number of Graduate Research Fellowships Program recipients by 50 percent over five years and requires the director to ensure program outreach to candidates from a wider group of institutions from all regions of the country.

S. James Gates, Jr., APS President and Brown University Physics Professor, partnered with Gerald C. Blazey, Vice President for Research and Innovation Partnerships at Northern Illinois University, to co-write an op-ed about the legislation in The Hill (see *APS News*, September 2021). The piece stressed the importance of a provision in the bill calling for a pilot partnership between research-intensive universities and emerging research institutions—colleges and universities that have smaller research footprints and capacity, due, in part, to monetary and equipment constraints.

"The benefits of creating this partnership pilot-program would be substantial, both for students and faculty members. For example, students with little formal research training could gain meaningful experience in a laboratory setting, using cutting-edge equipment that otherwise would not have been available. Meanwhile, lead investigators could develop powerful insights into the lived experiences of non-traditional and under-represented students, as well as strengthen their scientific knowledge through partnerships with

LETTERS CONTINUED ON PAGE 7

FYI: SCIENCE POLICY NEWS FROM AIP

Biden Administration Sets R&D Priorities Across Agencies

BY ADRIA SCHWARBER

The Biden administration released its first R&D priorities memorandum on August 27, providing guidance to federal agencies as they draft their budget plans for fiscal year 2023. The last several administrations have released such memoranda annually, detailing how R&D programs are expected to mesh with the president's larger policy agenda.

As is usual, the memo is signed by the heads of the White House Office of Science and Technology Policy and the Office of Management and Budget, who will guide the preparation of the president's budget request, which is due to be submitted to Congress in February.

The memo identifies goals such as improving preparedness for pandemics and other major risks, better characterizing and mitigating the impacts of climate change, and using R&D programs to promote social equity. It also reinforces the administration's goal of leveraging innovation to bolster the supply chains for critical technologies and promote domestic manufacturing.

According to the memo, the administration is committed to the principle of "invent it here; make it here," whereby the products of federally funded R&D are manufactured domestically. This priority has already been implemented in a new Department of Energy policy requiring its funding recipients to "substantially manufacture" resulting inventions in the US, which has faced criticism that it could impose burdens that would hamper product commercialization.

The memo also carries forward certain Trump administration priorities, such as promoting "critical and emerging" technologies, specifically listing artificial intelligence, quantum information science, advanced communications, microelectronics, high-performance computing, biotechnology, robotics, and space technologies. It further states, "Agencies should coordinate to leverage these technologies to ensure the sharing and use of the vast troves of federal government datasets to enable large-scale data analysis, and high-fidelity, high-resolution modeling and simulation to address critical challenges in public health, climate science, and disaster resilience."

FYI SCIENCE POLICY NEWS FROM AIP

In addition, the memo includes extensive direction on R&D efforts that agencies should pursue to support the administration's climate change mitigation goals, which center around the US achieving net-zero emissions by 2050. Agencies are directed to support all stages of clean energy technology development, from research through deployment, including by procuring "promising innovative climate technologies exiting the federal R&D pipeline to increase their marketability."

For climate research, the memo directs agencies to advance understanding of the economic and

FYI CONTINUED ON PAGE 7

HONORS

APS Celebrates Undergraduate Research with the LeRoy Apker Award Finalists

BY LEAH POFFENBERGER


Caelan Rose Brooks


Ryn Grutkoski


Catherine Ryczek


Hengrui Zhu


Alec Cao


Joseph Farah


Daniel Longenecker

Each year, APS recognizes outstanding achievement in physics by undergraduate students with the LeRoy Apker Award. The award was established with an endowment from Jean Dickey Apker in honor of her late husband, LeRoy Apker. The prestigious award, given to one student at a PhD-granting institution and one at a non-PhD-granting institution, aims to encourage students who demonstrate potential for future scientific accomplishment. To identify these promising, up-and-coming physicists, the Apker Award Selection Committee invites seven top nominees from around the United States to present their research at an annual selection meeting.

The 2021 Apker Finalists are (in order of presentation):

Caelan Rose Brooks
Ryn Grutkoski
Catherine Ryczek
Hengrui Zhu
Alec Cao
Joseph Farah
Daniel Longenecker

This year's meeting took place on August 8 and 9 in an online format for the second time, a departure from the traditional meeting, which brings the finalists to Washington, DC. The finalists—four from non-PhD-granting institutions and three from PhD-granting—were each given time to present and field questions from the selection committee of distinguished physicists. This year's Apker Selection committee members are: David Gross, Philip Bucksbaum, Nima Arkani-Hamed, Charles Conover, Yuliya Dozhenko, Shelly Lesher, Gregory Lovelace, and Theodore Yoder.

Brooks (Kutzown University of Pennsylvania), Grutkoski (Kenyon College), Ryczek (Hamilton College), and Zhu (Oberlin College)— the finalists from non-PhD-granting institutions—presented on the first day, taking the selection committee through a gamut of research topics. Brooks, who conducts AMO computational research, spoke on three projects involving modeling of dynamics and patterns in different types of materials. Grutkoski followed with a discussion of cosmology, presenting their research on building better models to describe preheating of the universe after cosmic inflation. Next, Ryczek described her work using low energy electron diffraction (LEED) data to analyze silica structures. Zhu rounded out the day, presenting his research into quasar extreme scattering events that led to the discovery of a new astrophysical phenomenon.

On the second day, Cao (University of California, Santa Barbara), Farah (University of Massachusetts, Boston) and Longenecker (Cornell University)—the finalists from PhD-granting institutions— had their opportunity to impress the committee. Cao kicked off the day with a talk on his research using ultracold atoms in optical lattices and degenerate quantum gasses to study quantum dynamics. Farah, who is a member of the Event Horizon Telescope collaboration, spoke next, describing his contributions to the efforts to image the black hole at the center of our galaxy. To conclude the day, Longenecker presented his work in cold gas soliton dynamics in a bid to better understand the behavior of far-from-equilibrium quantum nonlinear systems.

In recognition of their achievement, each finalist will receive an honorarium of $2000, $1000 for their undergraduate research institution's physics department, and a certificate.

The selection committee will choose two of the finalists to receive the Apker award, based on their mastery of their research topic, their original contribution to the field, and their ability to convey their accomplishments in a research talk. The winners will be announced in October, and each Apker Award recipient will receive $5000 for themselves and $5000 for their institution to support future undergraduate research. They will also be awarded a certificate and reimbursement for travel to an APS meeting, where they will give an invited talk to share their research with a broader group of their peers.

DGRAV CONTINUED FROM PAGE 3

2017 Nobel Prize in Physics (see *APS News*, October 2017) for the first capture of gravitational waves, and the facility continues to make great discoveries in collaboration with other gravitational wave detectors around the world.

In addition to the rapid advancements in the gravity field, another point of pride for DGRAV is its strong presence at the APS April Meeting. DGRAV typically sponsors 10 dedicated sessions on gravitational physics, in addition to several joint sessions partnered with other APS units such as the Divisions of Astrophysics (DAP) and Nuclear Physics (DNP; see *APS News*, January 2021), encouraging cross-talk and collaboration between these closely related branches of physics. Abstract submissions are open until December 20 for the upcoming 2022 April Meeting, currently slated as an in-person event in New York City on April 9 to 12.

In contrast to other APS divisions, DGRAV does not organize a divisional meeting, opting instead for multiple regional gravitational physics meetings throughout the year. These include the Eastern Gravity Meeting (EGM), the Gulf Coast Gravity Meeting (GCGM), the Midwest Relativity Meeting (MRM), and the Pacific Coast Gravity Meeting (PCGM). Accessibility is the guiding principle for organizing meetings in this way, explained Gonzalez.

"These meetings have low- or no-cost registration fees and are easier for people to attend, often occurring within driving distance," she noted. This enables more people to attend DGRAV meetings, particularly students. Another incentive for students to attend regional DGRAV meetings is the opportunity to win cash prizes for student talks.

Given the rapidly expanding nature of the gravitational physics field, empowering the next generation of gravitational physics researchers is a top priority at DGRAV. Graduate students and early-career researchers make up 50 percent of DGRAV's membership and play an important role in the division, including filling two Student Member positions in division leadership. "We're very proud of having an active graduate student community," said Gonzalez.

Looking to the future, the DGRAV executive committee's goals center on increasing engagement among the division's membership. Faced with fewer opportunities to meet during the pandemic, DGRAV is currently organizing a series of virtual seminars. "These will highlight new themes, new topics, and new people—especially young people," said Gonzalez. "Meetings are important for career development. It's not enough to answer a few questions after giving a talk; you need to meet with people, and that has not been happening during the pandemic."

Complementing this, Gonzalez underscored the importance of promoting the participation of women and under-represented minorities in the gravitational physics community. "We created a committee last year to find ways to increase diversity in our field as well as acknowledge the lack of diversity we have," she explained. While women currently comprise only 15 percent of DGRAV membership, Gonzalez pointed out that the division has historically had very diverse leadership. Men and women are equally represented in DGRAV's four chair line positions, and women account for an impressive 10 out of 14 members of the executive committee as a whole.

Overall, DGRAV stands out as a close and collaborative community at the cutting edge of an old field that has only grown more exciting. "We work together, and we are a very tight community," said Gonzalez. "If you are a DGRAV member, you get a voice in electing the people who organize the meetings and starting your own initiatives. We really promote that, especially from young people." More information on this unit can be found at the DGRAV website: engage.aps.org/dgrav/.

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FELLOWS CONTINUED FROM PAGE 1

education, and issues related to physics and society.

The African Physics Newsletter (APN) has grown from Gubernatis' observation that better communication was very much needed in a continent that stretches 5000 miles north-south and 4600 miles east-west. APN is free and run by African volunteers, with the unflagging encouragement of Gubernatis, and its existence—which is valued across the continent—is due to the generosity of APS in providing a mechanism for publication.

Gubernatis, along with Kennedy Reed and Nithanya Chetty, also helped to start the African School of Electronic Structure Methods and Applications (ASESMA) with a proposal to the International Union of Pure and Applied Physics (IUPAP). ASESMA is one of the most successful initiatives mounted in and across Africa. It has been sustained by the remarkable dedication of the school organizers. The extent and reach of the program and the number of respected African researchers involved are impressive.

Richard Martin was nominated as an SAIP Fellow as a dynamic driver behind ASESMA, which is now in its second decade of operations. Martin, together with Chetty and Sandro Scandolo, was involved from the first school in South Africa that led to ASESMA. He has continued as an organizer of each school and as the chair of the International Advisory Panel. ASESMA has built up a network of experts in electronic structure calculations, which provides the capability of doing state of the art physics on low budgets with real impact. Martin is on the board of the African Materials Research Society and hopes to further materials research through close coupling of experiments and calculations.

He is also one of the founders of the US-Africa Initiative for Electronic Structure (USAfrI), which is sponsored by a grant from the APS Innovation Fund. It was the only successful application located outside the US. USAFRL's goal is to foster collaborations between US and African scientists and students. About 50 groups in the US have agreed to be potential collaborators.

Sekazi Mtingwa has had a lifetime of contributions to the development of physics among minorities in the US and has led significant efforts in strengthening physics in Africa.

Mtingwa's introduction to science and technology development in Africa began with a meeting of scientists, mathematicians, and technologists from the USA and Africa, convened by Nobel Laureate Abdus Salam in 1988 at the International Centre for Physics in Trieste, Italy. This group formed what was later named The Edward Bouchet Abdus Salam Institute, and from it sprang two significant initiatives. One, the African Light Source initiative, is the effort to provide Africa with a synchrotron. The second initiative is the African Laser Centre, in collaboration with the National Laser Centre in South Africa, and a loan program for researchers through which they can both borrow lasers and arrange vital visits of personnel to set up equipment.

Mtingwa co-founded the Light Sources for Africa, the Americas, Asia and Middle East Project (LAAAMP) in partnership with over thirty international organizations. He has recently been involved in the founding of the new Union of Physicists from Portuguese Speaking Countries in Africa, in the West African island nation of São Tomé e Principe. He is also Chair of the IUPAP C13 Commission on Physics for Development.

The South African Institute of Physics announces new Fellows and prize winners at its annual conference during a gala evening, which usually involves not only long speeches, but ululation for the winners, loud music, and dancing. Physics is, after all, fun.

The author thanks Simon Connell, Nithaya Chetty and Deena Naidoo.

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unrestricted to the maximum extent possible. Research that cannot be published openly because of national security concerns should be restricted through the established methods of security classification. These principles have been laid out in Presidential Directive NSDD-189 established during the Reagan administration [16] and reaffirmed by subsequent administrations from both parties and by independent reviews [17]. We call on the current administration to reaffirm this directive.

Regular readers of these pages know that APS has been working with our members to promote the ideals that we have just described [18]. APS consults with Congress on legislation and with the White House and federal agencies on how to craft and implement the best science policies. APS pushes back when policies are misdirected and briefs the Federal Courts to make sure that our community's voice is heard in critical matters. APS is working to inform and educate our members about our own responsibilities as scientists. Our recent Delta Phy webinar on science security and China is one example and so is our statement on science ethics.

Finally, APS has convened a series of direct meetings between leading US physicists and our counterparts in China to engage in face-to-face dialog on these issues. APS leadership attends these meetings, and we share a strong sense that both delegations know that these issues cannot be resolved until scientists address them ourselves. Although our two nations will continue to be engaged in vigorous competition in many areas, we are confident that scientists can come together as a community to take responsibility for the ethical conduct of science. This would reduce the international tensions in fundamental research and restore the basic partnerships that can advance the frontiers of science and technology for all.

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NEW HOME CONTINUED FROM PAGE 1

(BNL) on eastern Long Island, where Goudsmit was a senior scientist. *Physical Review* enjoyed substantial growth during his tenure. The next two decades saw the creation of its sister journal, *Physical Review Letters*, and the sub-journals *Physical Review A, B, C, and D.*

In 1979, APS journals moved into a modest 12,000 square foot office building near BNL. The "Ridge Office" has been home to a growing number of editorial, journal operations, and information systems staff ever since. A series of expansions increased the size of the building to its present 45,000 square feet.

The 2019 APS Strategic Plan called on APS to analyze its "use of physical assets," including the Society's office spaces in Ridge; College Park, Maryland; and Washington, DC. Shortly after this work began, the COVID-19 pandemic forced APS staff to abandon their offices and work from home indefinitely.

Employees quickly adapted to this new way of working. They came together to host the 2020 April Meeting completely online for the first time and have conducted most other Society business remotely since that time. The benefits of remote work—for both the staff and the organization—became clear to the Senior Leadership Team.

"The pandemic has shown us that APS can operate successfully with reduced physical infrastructure," said APS Board President S. James Gates, Jr. "We all look forward to coming back together for collaboration, networking, and exchanging ideas but we believe having a smaller, more flexible space will better accommodate our staff's current and future needs."

APS staff based in the New York metropolitan and Long Island areas gathered outside the building on September 17 to bid adieu to the Ridge Office and celebrate the many milestones they achieved there together.

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major universities," Gates and Blazey wrote.

Relatedly, the bipartisan DOE Science for the Future Act will give comprehensive policy guidance and funding authorization for the major research programs housed in DOE's Office of Science. These programs include research on materials and chemical science, climate science, fusion energy, scientific computing, high energy physics, and nuclear physics. The act also outlines guidance for the Office of Science's Workforce Development for Teachers and Scientists program to broaden participation of underrepresented groups in STEM programs supported by DOE.

Moreover, both the NSF for the Future Act and the DOE Science for the Future Act contain provisions that aim to reduce the consumption of helium by requiring the agencies to establish programs to support the purchase, installation, operation, and maintenance of equipment to capture, reuse, and recycle helium.

Mark Elsesser, Director of APS Government Affairs, said he is eager to see the bills go to conference with Senate-passed legislation focused on science, technology, and innovation.

"We will continue to work with APS leadership and our members to push Congress to include key priorities for the physics community in the final legislation, which we look forward to seeing passed and signed into law," he said.

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societal impacts of climate change, develop carbon inventories and baselines through expanded observational networks, and improve modeling of local and regional climate and extreme weather. Agencies are further instructed to use social science research and directly engage the public to ensure energy innovation and climate adaptation efforts incorporate the views of affected communities and advance the goals of economic and environmental justice.

The memo also emphasizes that equity considerations should inform actions across the entire federal R&D enterprise, directing agencies to "prioritize R&D investments in programs with strong potential to advance equity for all, including people of color and others who have been historically disadvantaged, marginalized, and adversely affected by persistent poverty and inequality."

As an example, the memo states that "open science and other participatory modes of research" can help such communities engage in the scientific enterprise. It also maintains that open-science practices can help build public trust in science.

To broaden participation in the STEM workforce, the memo discusses a new "Models of Equitable STEM Excellence" initiative that will highlight effective diversity, equity, and inclusion practices that work at scale. It also places an emphasis on supporting research and workforce development activities at Historically Black Colleges and Universities and other Minority Serving Institutions.

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called to me," she says. "I had a great physics professor who was the department head and had a vested interest in getting BIPOC [Black, Indigenous, People of Color] people and women into physics. I told him my predicament: that I don't know any physicists who make money, so he suggested double majoring." And despite the engineering faculty telling her it was impossible, she graduated with a double major in 2011.

But it wasn't an easy road. There weren't a lot of Black people in either department, she notes. "At St. Mary's, we had a Black student union, but we were still the minority. But I felt I belonged because I am also Mexican, and I could speak Spanish," she says. "Yet, the fact I am Black, [and] a woman in a male-dominated field, I spent a lot of time trying to prove myself and working by myself."

Her physics mentor became a trusted ally in many ways. "He took a vested interest in me as a student and as a human being," she says. "He was one of the first people I came out to in the department. He always had a plan to get me where I needed to be successful to move on to the next stage of my career." Her mentor also helped her secure an internship at Northrup Grumman and land a Research Experience for Undergraduates (REU) at Columbia University, where she got her first exposure to particle physics research. This experience became the basis of her PhD at Syracuse University, which focused on machine learning techniques for muon and pion particle identification.

While "it was cool to be part of the MicroBooNE experiment from inception to creation to data taking," she says, her doctoral experience was anything but cool. She describes it as traumatic. "At Syracuse, it was a culture shock. I was the ONLY of everything—lesbian, Black, Mexican—and it was super, super isolating. Syracuse in general is a very segregated city by race and class, so... I was dealing with microaggressions at a much higher rate than in Texas."

It was really hard to focus on the school work. "I didn't have a community to collaborate and study with, which I was used to in undergrad, and I didn't seek that out because I felt like I didn't belong, like I wasn't smart enough to be there, that I had gotten in because I was Black and a woman. My advisor was hearing through the faculty grapevine that I wasn't going to make it, pass the quals, or survive the next courses," she says. "[These] were barriers to me doing well."

Her advisor offered her an enticing option: she could finish her PhD at Fermilab. In a nanosecond, she hopped a plane to Chicago and discovered a new avenue for doing physics, one where she is valued and nurtured. She immediately felt better, stronger, as Fermilab was "more inclusive," she says. And with offices focusing on communications and outreach, she was able to delve into her other passion of community engagement. "I became a fixture in those offices and they recognized I could be accessible, and especially to underrepresented minorities."

But, she adds, "it wasn't all ice cream and rainbows." When she inquired about working with a team doing machine learning, an area in which she had expertise, the group "straight out said no. I literally felt like I was in elementary school and the cool kids didn't want to sit with me." As she completed her doctoral research, "there were incidences where I presented my work and my expertise was being questioned left and right... They weren't asking questions to help me be better—there were questions instead to show I didn't know what I was talking about."

Still, Esquivel enjoyed the community engagement aspects as well as big science at Fermilab. She landed a postdoc to work on the Muon g-2 collaboration, where she got to advance both the science and scientific outreach she craved.

When the pandemic hit, conversations about social justice resonated with her. "The civil unrest in our country came to a crescendo with George Floyd's murder. Black people were dealing with collective trauma but people [at Fermilab] were going through their days like nothing was happening and that's when I realized we still have some work to do. The same issues I was battling with in grad school had followed me here." She notes there were only five Black scientists at the lab at the time. "We are all really siloed. This is the white supremacist structures that keep Black people separate so we can't find our collective power."

Esquivel and her Black colleagues launched an initiative called Change Now. They researched and wrote a strategic plan to enable Fermilab to be a more just, inclusive, and equitable place for Black scientists. "This was scary. I was a postdoc, a temp employee. And now I am stirring up shit. Throughout my career, they said keep your nose in the books until you get tenure and then you can do what you want. But I couldn't be silent. It was detrimental to my mental health. Conversations around race are difficult but they need to be done, you have to move through the conflict to move forward."

She knew it could be a "career killer," but she continued voicing her concerns. To her surprise, her boss asked her "what would your dream job look like at Fermilab? What would it take to stay?" Esquivel was open: "I told him the work I do on the side, the DEI, community engagement, these keynotes, that I am keeping secret because they are not valued in physics at this time. I said if I can't share this bleeding edge physics I am working on with people who look like me, it's not fulfilling to me."

> "I am a badass particle physicist because of—not in spite of—these identities."

Fermilab listened, and in May 2021, they created a job for her, as an associate scientist working on science and social justice initiatives. On the science side, she is currently working on software issues relating to data quality. One of her current social justice projects, which was selected as an APS Innovation Fund finalist, focuses on supporting the mental health of Black women and gender non-conforming people in physics. "I now have the ability to spearhead these initiatives to build from the ground up," says Esquivel.

Making physics a more diverse and equitable field will require a lot of work, but Esquivel is hopeful it's possible. "Change doesn't happen overnight. It takes continued work to change a system that is as American as apple pie," she says. "But I am seeing change in my department and collaboration in recognizing this anti-Black racism that is pervasive in America and not shying away from it and how we will dismantle these systems." Esquivel is already seeing results of a new DEI task force for the collaboration. "I'm literally seeing senior people discuss how the power dynamics in our field are hurting URMs...We are no longer shying away from having these conversations about race and white supremacist structures that Black scientists have to maneuver to get to where we are today."

Looking back on her journey so far, Esquivel is most proud of "finding my voice, and not [being] scared to use it... I still battle it to realize that I do have something to bring to the table that deserves to be spoken out loud. The way I move through the world because of my identities have shaped the way I think, and it is completely different than the homogeneity in physics right now. If we have any shot at solving these secrets of the universe, we need all these different thought processes."

As Esquivel told the California Academy of Sciences, "I am a badass particle physicist because of—not in spite of—these identities."

THE BACK PAGE

Current US Policy on China: The Risk to Open Science

PHILIP H. BUCKSBAUM, S. JAMES GATES JR., ROBERT ROSNER, FRANCES HELLMAN, JAMES HOLLENHORST, BAHA BALANTEKIN, AND JONATHAN BAGGER

We are writing to share with you our concerns about our federal government's current approach to research security. Free information exchange between research groups worldwide is essential for progress in science. Yet the US government is placing new restrictions on Chinese contact based on recent concerns that China is stealing knowledge and technology developed in US research labs. There are real threats to national security posed by unauthorized transfer of knowledge and technical expertise. But a response that chokes off legitimate scientific contacts only compounds the problem it seeks to solve. This will inevitably lead to the loss of US competitiveness and international prestige and threaten our future economic progress. A more effective approach to research security balances the responsibilities of the government and the scientists to address the problem. ***We scientists need to strengthen our partnership with the federal government to ensure that fundamental research remains open to all.***

A decade ago the term "research security" referred mainly to the protection of classified information. But now, along with "cybersecurity" and "data security," the phrase "research security" has been broadened to include work that is deemed of national interest despite NOT being classified, such as Quantum Information Science, and has become part of the national zeitgeist. In early January, all federal funding agencies were directed by the White House in a national security Presidential memo (NSPM-33) to establish new research security guidelines "to strengthen protections of United States Government-supported Research and Development (R&D) against foreign government interference and exploitation" [1]. This was established in the waning days of the Trump administration, but the concerns expressed are bipartisan and the order is still in force. The focus is especially on China. The FBI has made some high-profile arrests, but unlike famous cases of past decades which revolved around access to classified information at the weapons labs, many of those now accused are accomplished scientists engaged in university research in fundamental science, with close collaborations in China. Responding to pressure from funding agencies and the FBI, most research universities are also instituting new procedures to protect their research, even if it is unclassified, fundamental, and intended for open publication.

We scientists need to strengthen our partnership with the federal government to ensure that fundamental research remains open to all.

Why? What has changed? Is the federal government responding to the "greatest threat to democracy and freedom world-wide since World War II" (as described by the Director of National Intelligence) [2], or is this a xenophobic over-reaction (as suggested by some members of Congress), a new incarnation of McCarthyism, now focused on China? [3]. Certainly scientists of Chinese descent have been disproportionately targeted [4]. But in addition, it is important to understand that these latest fears about research security have a deeper connection to the changing landscape of international cooperation and competition in research.

The US was preeminent in science in the decades following World War II and is still so in many areas; but nowadays the most active research fields are truly international. US graduate degree programs have long been magnets for the best and brightest applicants from anywhere in the world. Today, nearly half of our physics graduate students studying in American universities are from other countries. When they graduate, many stay in the United States, enriching our economy. But the world is catching up.

China, especially, has focused on competing with the US in research. With a total R&D budget that is only slightly smaller than our own [5], China has been building its research infrastructure, including hundreds of new university programs, and leadership-class research facilities in many areas.

Of course, in most ways this is good news for science. More colleagues and more research training venues will inevitably expand progress in areas of physics we care deeply about. Many of us have not only welcomed this but helped to spur it along by attending or helping to organize conferences in China, holding summer schools and workshops there, and even spending some of our research effort in collaborations or in setting up new laboratories. All these efforts are paying off for both countries. China now leads the world in the number of papers submitted to the *Physical Review* and many other leading research journals. US scientists benefit from major research investments by China, such as the Daya Bay reactor neutrino experiment.

Recently, however, there have been cases of unfair and unethical research practices from China, such as talent contracts with clauses intended to keep them secret issued by Chinese research institutes competing not just to catch up with their US counterparts, but to leap ahead. There are also documented cases of research espionage carried out by trained foreign operatives posing as legitimate scientists, as well as allegations of coercion of Chinese students by their own government to induce them to reveal pre-publication research [6]. These nefarious practices might not be widespread, but they are truly disturbing [7].

As of this writing, the FBI claims that its counterintelligence cases involving improper technology transfer to China have risen dramatically, now accounting for fully one-third of its counterintelligence case load [8]. The FBI claims it has uncovered hundreds of breaches of research security, and this has led to some convictions for espionage. The Department of Justice (DOJ) says that 80 percent of its prosecutions for "economic espionage" now involve China. It has begun a "China Initiative" to emphasize this new strategic priority [9]. An updated list of accusations, convictions, and exonerations contains more than a dozen university professors as of this writing, as well as several other research scientists and students [10].

These are sobering and disturbing statistics that suggest China is using science collaborations to harm the US. But a closer look reveals a deeper and even more disturbing truth: the reactions by the US government to these serious problems are creating remedies that are worse than the disease they attempt to cure. US scientists have now come under suspicion simply for failing to disclose their connections and funding from Chinese talent programs, connections that were strongly encouraged by our government only a decade ago when China was beginning its push to build universities and modernize its research infrastructure [11]. Chinese students have also come under suspicion. A bill was introduced in Congress that would exclude from the US all Chinese students and postdocs in STEM fields, despite the fact that virtually none of these young people has any connection to the Chinese military system or government sponsored talent programs, or any indication that they are participating in international espionage [12]. Such a law could deprive our country of some of its most talented future scientists. This extreme legislation has little chance of becoming law; but the mere fact that such measures are politically appealing is truly chilling.

The DOJ China Initiative criminal prosecutions of academic scientists are going to trial now, and in many cases the *government's allegations are not holding up.* Some cases are being dismissed or dropped before coming to trial. Others see significant reductions in the charges. The judgments won against academics are often just *failures to disclose foreign connections.* To be specific, of thirteen professors prosecuted by the Department of Justice as of this writing, *all but two are charged with failure to disclose ties to China.* To be clear, ties to institutions other than one's own, particularly those that involve funding, are considered "conflicts of commitment" and failure to disclose these is an unacceptable practice, but such failures to disclose are generally not considered a crime prosecutable by the DOJ but instead result in sanctions by the individual's institution or agencies such as the NSF who fund the individual. This is a "hardball" prosecutorial tactic, where counterintelligence investigations and arrests by the FBI lead to trials for the infraction of receiving research funds or salary and not reporting it. Prominent scientists have been taken away in handcuffs, their research groups disbanded, and reputations ruined—over failure to properly disclose an activity. As scientists we understand that integrity in research reporting is essential. But we also have an obligation to call out wildly disproportionate responses when we see them, and the current response is that.

Many US scientists, and particularly those of Chinese origin, now fear that any contact with our colleagues in China is likely to be punished, no matter how divorced from real espionage or theft [13]. Participation in talent programs is now explicitly forbidden by DOE order within the National Labs [14]. According to this order, even benign activities that are essential for the conduct of science, such as serving on international science advisory committees for Chinese research institutes, now require a waiver that must be approved by the Secretary of Energy herself. Needless to say, the result of such an order is to curtail most of these activities, and the United States is the poorer for it. Some researchers are even hesitating to participate in anonymous reviews of research papers or grant proposals if the author happens to be in China.

The valuable research partnership between scientists and government that we cherish in the United States is now under threat from two sides: foreign governments are exploiting our international contacts for their own geopolitical advantage; and our own government is responding by arresting us. This makes no sense. How can we return to sanity? The key to progress may be appreciating that the FBI and Justice Department say they are just as concerned about the dangers of overreach as we are but don't have the tools to solve this issue without our active participation. We have learned from discussions with federal officials that in some recent instances where the research community has discovered and repaired ethical breaches by its members, the Justice Department and FBI have been willing to let our community handle the infraction, and careers have been preserved. This is an approach that we, as a community, should embrace.

The public's traditionally high regard for our honesty and their confidence in the importance of our work must not be taken for granted; it must be earned.

We, the scientists and students engaged in science and technology research, must intensify our commitment to research integrity. The public's traditionally high regard for our honesty and their confidence in the importance of our work must not be taken for granted; it must be earned. The elements of research integrity include objectivity, honesty, openness, accountability, fairness, disclosure, and stewardship [15]. Three elements of particular relevance here include the prompt disclosure of potential conflicts of commitment; the assurance that information exchanged between US and international scientists is not just one-way; and the protection of pre-publication research information from unauthorized premature transfer to competitors.

The Federal government must preserve open science in the United States. The government is our guarantor that fundamental research performed in the United States, by which we mean any research intended for open publication remains

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

APS News welcomes and encourages letters and submissions from APS members responding to these and other issues. Responses may be sent to: letters@aps.org