**Physics Highlights from 2018**

The editors of *Physics (physics.org)* look back at their favorite stories of 2018, from groundbreaking research to a poem inspired by quantum physics.

**Graphene: A New Superconductor**

2018’s splashiest condensed-matter-physics result came from two sheets of graphene. Researchers in the USA and Japan reported finding superconductivity in stacked graphene bilayers in which one layer is twisted with respect to the other. The superconductivity they saw resembles that of high-temperature superconductors, potentially allowing use of twisted graphene as a model system for studying this behavior. The group took the APS March Meeting by storm when they announced the result in a standing-room-only talk, which was also live-streamed.

**The Higgs Shows up with the Heaviest Quarks**

After detecting the Higgs boson in 2012, the next order of business was testing whether it behaves as expected. Two such experiments at CERN, which measured the interactions of the heaviest quarks with the Higgs, attained the gold standard of “5 sigma” statistical significance. Probing proton-proton collisions, **CMS and ATLAS** determined the interaction strength between the top quark and the Higgs boson by measuring how often the Higgs boson is produced with a top quark and a top anti-quark (see physics.ap.org/articles/v11/81). The same collaborations later reported the first observation of the Higgs boson decaying into bottom quarks (see physics.ap.org/articles/v11/91). This decay is the most likely fate of the Higgs boson, but it was extremely difficult to see above the heavy background of bottom quarks generated in a typical experiment. So far, all measurements agree with the standard model of particle physics, but the uncertainties have enough wiggle room to allow for new physics.

**Dark-Matter Theories Take Their Lumps**

Plenty of shakeups this year in the realm of dark matter. With a disappointment showing from the main dark matter contenders called WIMPs, other “less WIMPy” ideas have emerged as potential alternatives. The experiments sparked a series of theoretical studies, each attempting to explain this unconventional behavior (see physics.ap.org/articles/v11/84). One prediction indicates that twisted graphene’s superconductivity might also be topological, a desirable property for quantum computation.

**Blending Paint with Physics**

By Leah Poffenberger

**2018 APS Division of Fluid Dynamics Meeting, Atlanta—**

Five years ago, Roberto Zenit, a physicist based in the National Autonomous University of Mexico, was studying biological flows when art historian Sandra Zetina enlisted him for a project: using fluid dynamics to uncover the secret behind modern art techniques.

“At this year’s Division of Fluid Dynamics meeting—his 20th—Zenit, an APS Fellow and member of the editorial board of **Physical Review Fluids**, presented the work of a cross-disciplinary collaboration that tapped into the minds of influential modern artists.

“I’m not qualified to tell you about art, but I do know that every painting starts in the same place,” said Zenit during his invited talk.

“There’s a blank canvas, and then materials to create the art with certain properties, certain viscosities, and densities, and then you need somebody who knows about fluids, a person who has developed certain knowledge about the way the fluids behave. Painting is fluid mechanical.”

In the 19th century, modern art emerged as an artistic movement through rejection of traditional artistic methods and the adoption of new ideas in painting. The techniques created as part of a 1936 artists’ workshop held by Mexican painter David Alfaro Siqueiros were influential in the development of modern artistic methods.

**International News**

**The APS Task Force on Expanding International Engagement**

By Jonathan Bagger

**Editor’s note:** The following is an introduction and accompaniment to this month’s Back Page (p. 8).

Physics is a worldwide effort. Today, close to one quarter of APS members live outside the United States. Three-quarters of the papers published in APS journals have corresponding authors with international affiliations. And so much of science is done by collaborations that cross national borders.

What is the role of APS in this global endeavor? The Society’s Office of International Affairs has long been part of the APS, advancing physics, furthering cross-cultural communication, and speaking out for oppressed scientists. Today, the APS Committee on International Scientific Affairs and the APS Office of International Affairs have built a portfolio of programs that serve APS members and physicists worldwide.

But there is clearly more to do. The APS strategic plan that covers years 2013 to 2017 identified expanding international engagement as a key goal of the Society, and in March 2017, APS Chief Executive Officer Kate Kirby launched the APS Task Force on Expanding International Engagement.

The Task Force was composed of 12 APS members living or working across the globe with a broad range of research interests and leadership experiences. The Task Force worked for nearly 18 months to understand the priorities of all APS stakeholders and to identify goals and recommendations for the Society’s leadership. As Chair of the Task Force, I am deeply grateful for the time and talent they devoted to the task, as well as for input and guidance we received from the APS Board and Council, APS journal editors and staff, and APS members worldwide.

Our committee’s report identifies guiding principles, shared values, overarching goals, a set of supporting recommendations, as well as an implementation plan. In November 2018, I was proud to present the Task Force’s Report, Recommendations & Implementation Plan to the APS Council of Representatives at its meeting in Dallas, Texas. Our recommendations were well received and fully adopted by the Council. I am pleased that APS members will learn more about this effort on the Back Page of this issue of *Physics News*. Likewise, the full report is available on the APS website at aps.org/programs/international/.

In reading the Back Page, you will see that our wide-ranging recommendations affect all aspects of APS. Our implementation plan provides concrete actions the Society can take to ensure our research collaborations will have the most impact. This will be done with the guidance of the Committee on International Scientific Affairs (CISA) and the APS Office of International Affairs, in coordination with other APS committees and departments.

Our primary recommendation is that APS deepen its international engagement across the full range of Society activities. This is a transformational recommendation, one that affects the entire APS, not just the people that have the direct purview of the APS Office of International Affairs. We believe that our report can serve as a useful guide towards expanding the Society’s service, not just to APS members, but to the entire international physics community.

**Plasma physics and plants**

**A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY**

**APS.ORG/APSNOWS**

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**T A S K F O R C E continued on page 5**
Shoucheng Zhang 1963-2018

By Daniel Garisto

Shoucheng Zhang, a theoretical physicist whose research pushed the frontiers of understanding exotic states of matter, has died at 55. His family released a statement saying that he had passed away “after fighting a brave battle with depression.” News outlets have reported that the family confirmed Zhang died from suicide.

Zhang, a pioneer in topological insulators, also worked on high temperature superconductivity and predicted the quantum Hall effect. While serving as a Fellow of the APS, Zhang had also won the APS Oliver Buckley Prize for his “exceptional research leadership, the Alexander von Humboldt prize, and the Dirac Medal.

“He was one of the brightest theoretical physicists of his generation and it’s an enormous loss for the whole community that this happened,” said Laurens Molenkamp, the Editor of Physical Review B. “I lost a friend.”

In addition to his career in physics, Zhang was an entrepreneur who had a profound impact on engineering.

Shoucheng Zhang was born in Shanghai in 1963 and began attending the University of Würzburg when he was only 15. He then moved on to the Free University of Berlin, and later Stony Brook University, where he earned his PhD.

At Stony Brook, he initially studied supergravity with his advisor Peter van Nieuwenhuizen, before turning to condensed matter physics on the advice of his personal hero, Nobel laureate Chen-Ning Yang. He had a deep faith in elegant mathematics to reveal important physics, but at the same time, he was also very interested in phenomena that can be measured in the real world.

Shoucheng Zhang

With Kivelson and Hans-Jürgen Werner, Zhang developed a topological quantum field theory that explained phenomenological features of the fractional quantum Hall effect. Zhang later used this approach to more broadly make predictions about properties of quantum Hall systems. Experiments quickly confirmed his theories.

In 1993, Zhang became one of the youngest professors at Stanford, where he remained until his death. Students spoke fondly about Zhang. “Shoucheng was a wonderful person who always pushed his students (myself included) to think originally and creatively,” said Bogdan Bernevig, a former student who is now a professor at Princeton. “I owe a lot of what I am, intellectually, to him.”

Zhang turned his attention to high-temperature superconductivity, where he established a symmetry principle that unified the antiferromagnetic and superconducting states of matter.

Werner Hanke, a professor at the University of Würzburg who collaborated with Zhang on this research said that “one of his central gifts was certainly his infectious enthusiasm,” which led to a love for “exploring radically new ideas.”

Zhang’s seminal work, though, would be in topological insulators. Along with Molenkamp and Charles Kane, he helped introduce the new state of matter—an insulator with its surface protected by a conductor. Topological insulators have been observed in materials such as mercuric telluride (HgTe). The field that has grown around them is so small a part due to Zhang’s work.

“Shoucheng was an outstanding teacher and mentor...who could explain the most complex concepts.”

Zhang continued on page 6

This Month in Physics History

January 6, 1912: Alfred Wegener Presents His Theory of Continental Drift

The notion that the continents were once joined together dates back to at least the 17th century, with the Flemish cartographer and geographer Abraham Ortelius. Ortelius created the first modern map of the world, in 1595. He noted how the geometry of the coasts of America and Europe/Africa seemed to match like puzzle pieces, and proposed that they had gradually drifted apart over time due to earthquakes and floods. But it was a German scientist named Alfred Wegener who developed a robust hypothesis of continental drift over 30 years ago.

Born in 1880, Wegener earned his PhD in astronomy from the University of Berlin in 1904, but his scientific interests were much broader, encompassing geophysics, meteorology, and climatology. His work in meteorology was especially significant, since he pioneered the use of balloons to track air circulation and published a widely used standard textbook. He became a tutor at the University of Marburg, taking time out to join expeditions to Greenland in 1906 and 1912 to study polar air circulation.

While browsing in the university library one day, Wegener happened upon a scientific paper listing fossils of plants and animals on opposite sides of the Atlantic. He presented the similarity of faunas and floras between these continents and is less bound by restrictions or tied down by ugly, awkward facts than most of its rival theories.”

The fact that Wegener didn’t really have a convincing mechanism for how continental drift might occur didn’t help his theory gain broad acceptance. But the theory did find the occasional champion, notably British geologist Arthur Holmes and South African geologist Alexander Du Toit. In the 1950s, greater exploration of Earth’s crust along the ocean floor provided supporting evidence that continents indeed moved on crustal plates that spread or subducted at mid-ocean ridges. By the late 1960s, plate tectonics was the scientific consensus among geologists.

In 1924, Wegener became a professor of meteorology and geophysics at the University of Gießen in Austria. Ever the adventurer, he met with a dramatic end during his final expedition to Greenland. His team set out in 1930 with the goal of establishing three permanent stations on the ice sheet to monitor its thickness and observe Arctic weather year-round. For the expedition to succeed, Wegener’s new observation that geologically younger oceans were shallower than their older counterparts.

Wegener’s hypothesis invited plenty of skepticism, especially from geologists, who resented this outsider’s revolutionary ideas. The American Association of Petroleum Geologists hated the American translation so much it organized a special symposium to oppose the theory of continental drift. Among his detractors was geologist Frank Koss(mat, who argued that the ocean crust was just too tough for continents to “simply plough through.” The University of Chicago’s Robert Chamberlin was especially harsh: “Wegener’s hypothesis... is of the footloose type,” he observed, “in that it takes considerable liberty with our globe, and is less bound by restrictions or tied down by ugly, awkward facts than most of its rival theories.”

This Month in Physics History
New Supported Sites Chosen for PhysTEC
By Thomas Hone

PhysTEC (the Physics Teacher Education Coalition) is pleased to announce awards to four new sites: Appalachian State University, Texas A&M University-Corpus Christi, the University of Kansas, and Worcester Polytechnic Institute. These new PhysTEC Supported Sites are well poised to dramati-
cally improve their physics teacher education programs and have impacts beyond their campuses, serving as national models for program improvement.

Supported by making each insti-
tution’s physics teacher education program is hiring a Teacher-in-
Residence (TIR). The TIR will work with the team at each site to train school physics teachers, mentor learning assistants, and organize a mentoring program for pre-service teachers. Furthermore, the TIR program will expand and sustain a community of high school physics educators who will continue to develop pre-service and in-service.

Building on the rapid growth in the number of physics majors at all levels, the University of Kansas—University Commerce—project leader plans to attract more money to physics teach-
ing and implement new support for them on their pathway through the program. The project leaders will develop new recruiting materials and advertise in lower division STEM classes, at university events, at local high schools and commu-
nity colleges, and through connect-
ions with local industry.

Appalachian State will focus on developing an understanding of best practices in collaborating with rural school districts and with first-
generation college goers as well look for ways to strengthen reten-
tion of physics secondary education students and teachers.

At the University of Kansas, project leaders will integrate PhysTEC into their Teaching UCanTeach program for preparing STEM teachers. The result will be new pathways for physics majors to become certified teachers, and opportunities for those majoring in mathematics and other STEM fields to pursue physics and obtain certification in teaching physics. In addition, they will impanel an external advisory board, consisting of area high school physics teachers and administrators, to mentor newly graduated teachers and provide an outside assessment of their teacher preparation program.

Similarly, Worcester Polytechnic Institute will not only seek new ways to improve recruitment efforts but also coordinate advising and mentoring among students in the physics teacher education pro-
gram, faculty, in-service teachers, academic advising, and the STEM Education Center as well as create an assessment model to determine factors that influence the recruit-
ment and retention of students who pursue careers as physics teachers. These new comprehensive sites are expected to graduate relatively large numbers of teachers, with an aim of becoming thriving programs that graduate five or more physics teachers per year. The project will offer up to $100,000 per year for 3 years for the institution to achieve levels of participation in PhysTEC. In addition, they will be able to network with the best programs throughout the country.

Each site will also be addressing the six Physics Teacher Education Program Analysis (PTEA) rubric standards. These standards are: an institution-wide commitment; leader-
ship and collaboration; recruitment;
knowledge and skills for teaching physics; mentoring and professional support; and program assessment.

In the United States, there are over 27,000 teachers of high school physics who serve students in over 20,000 public and private high schools. While many of these physics teachers are excellent edu-
cators, fewer than half have a major or minor in physics or physics edu-
cation. Physics consistently rates as a K-12 education field with a "severe shortage" of teachers, as demand far exceeds supply for their project goals. In addition, by a vision of educating sufficient numbers of qualified teachers to provide an adequate physics edu-
cation for all students.

To date, the PhysTEC project has funded over 40 institutions to implement PhysTEC and obtain certification to teach physics. In addition, there will impanel an external advisory board, consisting of area high school physics teachers and administrators, to mentor newly graduated teachers and provide an outside assessment of their teacher preparation program.

2018 APS Division of Plasma Physics Meeting
By Katherine Kornei

Portland, Oregon—This past November, the 60th Annual Meeting of the APS Division of Plasma Physics (DPP) was joined by the 71st Annual Gaseous Electronics Conference. The present-
ations—more than 2,000 in total—ran the gamut from astro-
physical plasmas to applications in biomedicine, along with funda-
mental plasma physics. Here are a couple of highlights.

No Flies, Just Plasma
Gabe Xu, an aerospace engi-
er at the University of Alabama in Huntsville, presented a study of the response of Venus flytraps—the carnivorous plants known for catching unsuspecting insects—to plasma. Xu and his collaborators, Alexander Volkov and Vladimir Kolobov, were interested in the effect of plasma-produced reactive oxygen and nitrogen species (“RONS”) on the plants’ ability to attract prey. Molecules such as O2-, O3-, H2O2 and NO occur in a variety of plants and animals as part of their biological signaling systems.

Using an atmospheric-pressure plasma jet, the researchers directed helium plasma at the Venus fly-
traps. The team left a roughly 1-centimeter gap between the tip of the jet and the plants’ leaves. Xu and his colleagues found that the Venus flytraps exposed to RONS closed after roughly 1 second and reopened a few days later, consist-
tent with the timing recorded for plants dining on insects. (Short "sensor hairs" on the insides of the leaves, when bent, normally induce electrical signals that cause the traps to snap shut.) Presumably the plant is absorbing the RONS, which are triggering some bio-
logical chemical behavior, said Xu. What the mechanism is that induces closure still remains elu-
sive, however. "We’re quite in the dark about the actual biologi-
cal and chemical pathways which are responsible for the observed effects," Xu said. Xu and his collaborators plan on testing how plasma-pro-
duced RONS affect other plants, like mimosa pudica, which also exhibit a mechanical response. "If we can determine what kind of sig-
nals the plasma is passing to the ‘brains’ of the plant, then we can better understand the bioelectro-
chemical mechanism," said Xu.
Link to abstract: aps.org/
Meeting/GEC18/Session/ET4.6
Plasma in the Vineyard
Wine is a multi-billion-dollar industry, and the best reds and whites are produced from healthy grapes. But wine grapes, like many other fruits, are marked by a bio-
logical peculiarity: they must be exposed to a certain number of chilling hours to achieve their full potential. Genetically, a toxic chemical named vitamin C, an essential nutrient that is sometimes used to break grape bud dormancy. The next step will be to replicate these results in vine-
yards, said Mujahid. These findings reveal that plasma is a general alternative to applying hydro-

 chilling hours)—a cumulative duration of cold temperatures—to coax them out of dormancy in the spring. However, as the cli-
mate warms, some winegrowing regions may not receive a sufficient number of cold nights to satisfy this chilling requirement. That’s where plasma comes in.
Zaka-ul-Islam Mujahid, a plasma physicist at Jazan University in Saudi Arabia, and his colleagues applied 2.5, and 10 minutes of plasma to dormant Muscat of Alexandria grape vines in the laboratory. They found that the short treatment released from dormancy plants that had never been chilled. The plasma-treated plants also exhibited healthier-looking leaves and vines and more synchronous growth than untreated plants. "In just a few minutes you can have the same effect...that you have with two months of chilling," said Mujahid. These findings reveal that plasma is a general alternative to applying hydro-

A grape vine swells with buds in early spring.
Teaching Physics

The November 2018 issue of APS News reported that physics graduates are wondering what to do with their degrees (“I Graduated – What Now?”). As a former high school physics, chemistry, and mathematics teacher in mostly inner-city Chicago Public Schools, I would highly recommend that every physics major program in higher education offer training in high school physics teaching to its students. All students in higher education must take electives and a state teaching certificate in high school physics would offer almost immediate employment, especially in the big cities of America. The starting salary of a certified teacher in physics, chemistry, or mathematics almost everywhere in the US is about $50,000 per year. There is a critical need for high school physics, chemistry, and especially mathematics teachers. And since most physics majors take many mathematics courses in order to master the subject matter, and sometimes mathematics teaching position) not only paid my daily living expenses but also helped pay for my other master’s degree and my after-retirement PhD with both savings and my pension.

Sadly, after retirement I found that recent BA graduates in fields such as business, psychology, art, history, criminal justice, and film could only find employment for about $10.00 per hour in coffee shops and fast-food restaurants. There are virtually no teaching positions anywhere in history, art, music, or biology.

Physics departments should make potential bachelor’s candidates aware that a physics degree combined with a high school physics teaching certificate will mean almost immediate well-paying lifetime employment almost everywhere in America.

Stewart Brekke
Downers Grove, Illinois

By Mariah Heisinger

APS recently took steps to help curb greenhouse gas (GHG) emissions by offering members an opportunity to mitigate their carbon footprint by making a donation to an environmental organization of their choice.

In November 2018, APS unveiled the pilot campaign by providing Division of Fluid Dynamics (DFD) members the ability to mitigate the effect of their travel to and from the DFD annual meeting in Atlanta, Georgia. Rather than promoting the purchase of carbon offsets, which have often been criticized as being insubstantial, the Society provided members with an estimate of their carbon footprint from traveling to and from the meeting and provided options for donation.

APS calculated a suggested donation amount using an estimate of the average travel-related GHG emissions per person and the social cost of carbon as published by the Intergenerational Working Group, an organization of agencies charged with determining the social cost of GHGs.

“DFD is proud to be the first APS division to offer this step toward mitigating the carbon footprint from Society activities. As members of a scientific society, it is a responsibility to support our society and the scientific community in continually implementing forward-thinking strategies in the critical fight against climate change,” said Eckart Meiburg, a professor of mechanical engineering at UC Santa Barbara and 2018 chair of DFD.

For those without a preferred organization, APS suggested directing donations to the Clean Energy Trust (CET). The Trust (cleanenergytrust.org) is a nonprofit clean technology accelerator focused on bringing scientific and technological innovations to market as a way to change how the world generates, consumes, and reuses energy and natural resources. CET is a 501(c)3 public charity, and donations are tax deductible. By donating to CET, DFD meeting attendees supported an investment in entrepreneurs who are working to commercialize clean technology startups, reduce GHG emissions, and mitigate the risks of climate change.

The DFD effort follows APS’s recent release of its Greenhouse Gas Inventory, which examined the Society’s day-to-day operations and select activities that contribute to its carbon footprint. Members of travel to and from annual meetings was the second-largest activity for the 2018 meeting received information about the pilot ahead of their travel and were notified throughout the meeting about participating in the campaign. APS also launched a social media campaign to inform members.

CET has received several donations from APS members, and another organization reached out to APS expressing interest in being involved with future iterations of the campaign. During upcoming meetings, APS will improve upon the climate change mitigation effort and aims to make the donation option available earlier in the reg-

The APS Office of Government Affairs

APS Launches Campaign to Help Members Mitigate Their Carbon Footprint

Noah Strycker

While the Trump administration’s new emissions regulations are being challenged in court, the American Physical Society (APS) has launched a social media campaign to help its members mitigate their carbon footprint.

APS recently unveiled a pilot carbon offsetting campaign for Division of Fluid Dynamics (DFD) members. The effort was the first of its kind at any APS division and set the stage for a broader campaign to launch in 2019.

On November 23, 2018, the Trump administration released volume two of the Fourth National Climate Assessment (NCA4). Mandated by law, the assessment documents and projects the impacts of climate change on the environment, economy, and public health of the US. The first volume, which examines the physical science of climate change, appeared in November 2017. Although there have been no indications the administration interfered with NCA4’s production, top officials have criticized its methods and conclusions. It is also widely suspected that the administration’s decision to release it the day after Thanksgiving was a deliberate attempt to minimize attention to it.

NCA4 concludes climate impacts are “intensifying” across the US and that the evidence of anthropogenic climate change is “overwhelming and continues to strengthen.” It also offers detailed accounts of localized impacts, along with accompanying resilience and mitigation planning tools, and includes a more systematic analysis of the economic damages of climate change than its predecessors.

Asking by reporters about NCA4, President Trump replied, “I’ve seen it. I’ve read some of it, and it’s fine.” But when pressed on his views of its assessment of the economic damage climate change could cause to the US, he said, “I don’t believe it.”

Trump has famously said he believes climate change is a “hoax.” In more recent interviews, he has acknowledged the climate is changing but, rejecting the scientific consensus, he has also suggested it is the result of natural variability.

Acting Environmental Protection Agency (EPA) Administrator Andrew Wheeler offered the administration’s most detailed criticisms of NCA4 in a live interview with the Washington Post November 28. While he thanked the federal employees who worked on the report, he argued it is based on overly pessimistic assumptions that do not take sufficient account of future technological improvements that would reduce greenhouse gas emissions.

Wheeler also suggested the Obama administration had specifically instructed the report’s authors to use a “worst-case scenario.” He said the next national assessment, due in four years, might assume more technological advances in reducing emissions.

Later that day, the EPA released a “fact check” pointing to a 2015 study by the US Global Change Research Program (USGCRP) as evidence the assessment team had been “pushed” into employing a high-emissions scenario called RCP8.5. A “representative concentration pathway” (RCP) is a particular emissions trajectory that can be consistent with a variety of scenarios for future energy demand, energy sources employed, and other factors.

The memo in question actually NCA4 continued on page 7
Is weather the culprit?

By Katherine Kornei

Elizabeth Austin has seen a lot of weather. Taught in atmospheric physics, she investigates the role of weather in crimes and accidents as a forensic meteorologist. “It’s a niche,” she admits of her profession, which combines the skills of a physicist, a chemist, and a meteorologist and requires careful navigating of complex court cases. Born in New York and raised in Southern California, Austin grew up backpacking in the mountains of the western United States. Those camping trips solidified her interest in nature. In high school, Austin realized that she could combine her passions for nature and science when her physics teacher showed her a movie of the Tacoma Narrows Bridge ripping itself apart in high winds. The combination of physics and atmospheric science that contributed to the bridge’s demise fascinated Austin. She had found her field.

After earning a bachelor’s degree in Atmospheric Science at the University of California, Los Angeles, Austin enrolled in a graduate program at the University of Nevada, Reno. It was during graduate school that a colleague told Austin about forensic meteorology. The idea that science could be used to solve mysteries and determine the causes of accidents was “so up my alley,” says Austin. “It was a combination of everything I was interested in.”

Soon after finishing her MS and PhD in Atmospheric Physics, Austin founded a research and consulting firm that, in its present incarnation, is called WeatherExtreme Ltd. Originally a one-woman show, WeatherExtreme Ltd. now has employees across the United States and in Nepal. The firm provides weather forecasting services and weather-related prob- lemsolving for helping compa- nies determine the best location for their headquarters. The scien- tists at WeatherExtreme Ltd. also investigate court cases in which people have been hurt in part due to weather. The public has a certain fascination with the idea that a nat- ural phenomenon like weather can cause—or at least strongly contrib- ute to—an accident, Austin says. Austin is often asked to provide an expert opinion on crimes and accidents that involve the weather. She’s been involved in over 1,500 cases spanning the fields of aviation, tornadoes, boating, and avalanches. After years of appearing in courtrooms, Austin has prac- ticed representing the meteorological facts in simple terms that juries can understand. But her work some- times still takes a mental toll, Austin says, particularly when the de- fendants involve children. One case sticks with her: a fifteen-year-old girl went parasailing in Florida in 2007 and was killed after para- sailing rope snapped in high winds and she was blown into a build- ing. The winds weren’t unexpected, Austin showed: A National Weather Service area forecast issued earlier that morning had called for strong thunderstorms and wind gusts to 40 miles an hour. Austin’s work on that case contributed to the passing of the Florida Parasailing Act in 2014, which prohibits commercial parasailing in certain wind, rain, fog, and thunderstorm conditions.

A frequent public lecturer about forensic meteorology, Austin also holds a faculty position in the Atmospheric Science Department at the University of Nevada at Reno. In 2018, she was featured on The Weather Channel series “Storm of Suspicion,” which focuses on criminal cases in which the weather played a role. Austin’s favorite atmospheric phenomenon is a rare event called a waterspout. These features, which are funnels of swirling air that appear over water, resemble small tornadoes. In September 1998, Austin saw several waters- spouts on Lake Tahoe, the largest of which was about 100 meters in diameter. Austin recalls scien- tists from the National Oceanic and Atmospheric Administration flocking to Lake Tahoe to study that event, something she remembers as “unbelievable.”

The many different fields in which Austin is fluent—such as the fluid dynamics of the atmosphere and atmospheric chemistry—are linked by physics. “Physics is a huge part of what I do,” she says. “You kind of have to be a jack of all trades.”

The author is a freelance writer in Portland, Oregon.

Today, with isolationism on the rise globally, these fundamen- tal principles are under threat. By increasing its international engagement, following the goals and recommendations presented by the Task Force on Expanding International Engagement, APS can stand in support of the global phys- ics community and of the values we share worldwide.

Jonathan Bagger is the Director of TRIUMF and served as Chair of the APS Task Force on Expanding International Engagement. He also has served on the APS Board of Directors, Council of Representatives, and has Chaired the APS Division of Particles and Fields (DPF) and Committee on International Scientific Affairs (CSA).

FECS continues from page 1

material science and microbiology, and Gardner is an instrumental sci- entist whose career has taken him from his native England to the US and now to Australia.

The Forum on Graduate Student Affairs (FGSA) has existed since 2001 to provide support for physics graduate students, and Longobardi and Gardner emphasize that a counterpart to meet the unique needs of post-docs and early-career scientists was long overdue. “Post-docs have different needs than the graduate student commu- nity,” underscores Longobardi. Principally, many FECS members have families, which adds another dimension of complexity to the already challenging tasks of relo- cating and, if necessary, applying for visas. Added Gardner, many aspects of the professional land- scape are unfamiliar to early-career scientists as they finish their post- doctoral fellowships. “Many early career scientists need to realize the different opportunities in front of them, what the competition in the job market looks like, who is involved in leaving the USA for work, or even what to ask when interviewing for a job,” he said.

Importantly, Austin’s firm’s present incarnation is called WeatherExtreme. The many different fields in which Austin is fluent—such as the fluid dynamics of the atmosphere and atmospheric chemistry—are linked by physics. “Physics is a huge part of what I do,” she says. “You kind of have to be a jack of all trades.”

The author is a freelance writer in Portland, Oregon.

JASON GARDNER

Jason Gardner

February 2019 - 10

I cannot think of a better time for this report to appear. Physics relies on the free circulation of people and ideas. I need only look at my laboratory, TRIUMF, to see this demonstrated every day. Our visitors and users travel to Canada from some 39 countries, spanning every continent except Antarctica. Our students and staff hold pass- ports from 30 nations.

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candies have been voting for (see physics.aps.org/ articles/v11/48). One of these dark matter options, primordial black holes, emerged to attention following the detections of black hole mergers by the LIGO-Virgo collaboration, but the excitement went down after a supernova study found that black holes cannot account for all of the dark matter (see physics.aps.org/v11/97). However, the biggest splash of the year was an unexpected absorption signal from hydrogen gas that occurred in the Large Hadron Collider at CERN. This result is that dark matter particles carry a very small (one could say WIMPy) electric charge.

Quantum Cryptography via Satellite

Researchers in China and Austria used a satellite link to hold the first intercontinental video-conference protected by quantum cryptography. This is a tricky quantum concept. It's like watching the world's tiniest video conference only one atomic layer at a time was the standard for the world. Whether physicists will adopt its word choices and its structure. One such artist, poet Amy Catanzano, thinks that poetry could provide a tool for developing, but knitted sweaters are very bulky. "When [Zetina] was studying painting with Siqueiros during this period, she had the vision to involve fluid mechanics. She came to me with these paintings and asked me the question, 'How do you paint like that?' What do you need to know to produce these patterns?' said Zenit. "Siqueiros and Zenit combined historical detective work—searching through letters Siqueiros wrote during the 1936 conference and watching videos of Pollock painting—with fluid mechanics experiments to characterize how the artist achieved her signature styles." Siqueiros described his acciden- tal painting technique in a letter, which Zenit translated into English: "If there are two pools of paint that superimpose on top of each other, the fluid can infuse both [or combine]." Using Siqueiros' vague instructions, Zenit's lab began experimenting with layering liquids with different viscosities and densities. "First, we poured a layer of viscous fluid—black paint in this case—and on top of that, we poured a second layer of paint of a different color. You end up with two layers. You can see that some time is, progressively as time advances the white paint will infil- trate into the black paint to generate these incredibly rich and fascinating pat- terns of this accidental painting tech- nique," said Zenit. "The lines only appear in this manner if the top fluid is denser than the fluid below. Also, the famous artists of his past: the lab has now an artist in residence, Joshua People, who is an expert in watercolor painting, who wanted to understand how physics made his art possible.

Understanding how techniques were achieved—thanks to fluid dynamics research—has allowed the artists to recreate and reclaim innovative modern art techniques, integrating them into new works of art. Zenit's research has also been used to develop a new technique called the "Siqueiros technique." "It is a method of dripping paint from a stick over a horizontal canvas also held at an angle. Zenit and Zetina: How did he create the straight, steady filaments of paint that build up to create his art? What is what Pollock knew—we want to explore the physical space in which he works to generate these steady filaments." Using historical movies of Pollock painting, Zenit measured how thick the film of paint was and used his hands and from what he height he dripped paint and build an experi- mental setup to test what affected the straightness of the filaments. The found was, at a reasonable paint viscosity, speed was the key factor. Zenit then filmed Pollock's signature straight lines rather than paint curling or peeling.

What we see is that when the speed of the hand is small when the film coils because of a buckling instability. Fluid doesn't have the room to flow freely and it buckles and curls," said Zenit. "When you move the substrate at a high enough rate, you are able to prevent curling." Physicists work on topological materi- als that are antiferromagnetic. The author is a freelance sci -
documents USGCRP’s decision to use both RCP8.5 and a moderate-emissions scenario called RCP4.5 as the “core scenarios” in its analysis. It states these scenarios are in line with the ranges of scenarios considered in the third NCA and the Intergovernmental Panel on Climate Change’s Fifth Assessment Report, which were both released in 2014. NCA4 itself states that RCP8.5, which generally assumes high population growth and the use of carbon-intensive energy sources, is consistent with current global emissions trends. RCP4.5, it notes, is associated with lower population growth, more technological innovation, and the use of energy sources with a lower carbon intensity. Justifying its use of the scenarios, the report states they “capture a range of potential greenhouse gas pathways and associated atmospheric concentration levels through 2100,” while noting it does not assess the “feasibility of the socioeconomic assumptions” underlying them. The report further states, “the resulting range of projections reflects, in part, the uncertainty that comes with quantifying future human activities and their influence on climate.”

Adria Schoenberger is a Science Policy Analyst and William Thomas is Senior Science Policy Analyst with FYI at the American Institute of Physics. FYI has been a trusted source of science policy and funding news since 1989, and is read by members of Congress and their staff, federal agency heads, journalists, and US scientific leaders. Sign up for free FYI emails at aip.org/fyi

The Task Force’s ultimate observation, however, was that APS must deepen its international engagement across the full range of Society activities. This is a transformational proposition, one that affects far more programs than under the direct purview of the APS Office of International Affairs. Therefore, international goals must be embraced by the APS leadership and consistently incorporated into the Society’s ongoing strategic planning. More specifically, the Task Force asserted that APS must allocate sufficient resources (staff, financial, and leadership attention) to develop and implement a five-year roadmap with near-, mid-, and long-term goals.

The Task Force emphasized that if the Society is indeed committed to expanding its international engagement, APS must make transformative change a priority and commit resources accordingly. In particular, some international activities may be especially attractive to potential donors or foundations, and APS may launch fundraising campaigns for certain new initiatives.

**Conclusion**

The Task Force recommendations covered a wide range. Most importantly, the Task Force hopes that APS members, leaders, and staff will embrace its overarching proposal: that APS fully incorporate international engagement into all of the Society’s activities. To realize this vision, the Society must proactively welcome international members and integrate them into all APS activities and leadership levels. Even the most carefully developed recommendations, however, have little impact without follow-on commitment to progress. Consequently, the Task Force stressed that its report represents merely the first step towards expanding the American Physical Society’s service to the international physics community. Doing so will not only benefit the APS members, but will also strengthen the Society’s leadership in serving all physicists worldwide.

**Recommendations:**

1. **Leadership:** Hold regular summits of physical society presidents and leaders of international physics organizations; partner with national physics societies toward joint advocacy on issues of common concern. Include more international members in APS leadership at all levels (Units, Advisory Committees, Prize and Award Committees, Nominating Committees, etc.).

2. **Units:** Empower Units to expand joint activities; establish a “Senior Staff Working Group” with a clear mandate to strengthen linkages and activities with international partners.

3. **Senior Staff & Programs:** Expand international reach of APS programs; ensure senior staff include international community in program plans.

4. **Editors:** Increase and facilitate the APS profile and editorial presence at international meetings; increase, as appropriate, the number of associate editors, editorial board members, and reviewers from international communities.

5. **Goal 3: Expand international opportunities for young physicists; better prepare young physicists for international careers.**

**Recommendations:**

1. **Increase connections to the international private sector/industry to improve career development opportunities outside academia.**

2. **Establish additional summer research opportunities for U.S. and non-U.S. undergraduate students at premier research facilities outside the country of their home institution.**

3. **Increase and facilitate the APS profile and editorial presence at international meetings; increase, as appropriate, the number of associate editors, editorial board members, and reviewers from international communities.**

4. **Develop new and/or strengthen existing electronic communications vehicles for physics communities outside the U.S., especially for those without established physics societies.**

**Goal 2: Integrate international affairs across all APS activities.**

**Recommendations:**

1. **Advocate for international research activities and for stable funding for large-scale international projects.**

2. **Promote and advocate for scientific mobility (e.g., visas and immigration policies, removing barriers to engagement), including a proper balance between -open science; scientific exchange; and intellectual property and security concerns.**

3. **Establish an APS State Department Fellowship Program and/or expand APS sponsorship of existing AIP State Department Fellowships to further engage APS members in policy formation.**

**Implementation**

Along with its recommendations, the Task Force also developed an Implementation Plan with specific actions designed to accomplish each goal. This Plan gives the pragmatic next steps for each recommendation and is provided in Appendix A of the full report (aps.org/programs/international). The Task Force also recognized the need for APS to consider: 1) evaluation and assessment of current international programs; 2) measures of success (metrics) for existing and future international activities; and, 3) impact upon resources and sustainability of key initiatives.

The Task Force’s ultimate observation, however, was that APS must deepen its international engagement across the full range of Society activities. This is a transformational proposition, one that affects far more programs than under the direct purview of the APS Office of International Affairs. Therefore, international goals must be embraced by the APS leadership and consistently incorporated into the Society’s ongoing strategic planning. More specifically, the Task Force asserted that APS must allocate sufficient resources (staff, financial, and leadership attention) to develop and implement a five-year roadmap with near-, mid-, and long-term goals.

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Physics is a global endeavor, with some of the greatest breakthroughs and achievements realized through international collaboration. The APS membership reflects the international nature of physics, with nearly one-quarter living outside of the United States (Fig. 1). Physicists cross continents to attend the Society’s annual meetings, with nearly one-third of all March Meeting participants coming from outside the United States, making it one of the largest and most internationally diverse gatherings of physicists worldwide. Moreover, international issues cut across essentially all interests of APS, and their importance is increasing:

- **Research**: International research collaborations are on the rise; more countries are partnering to build large-scale collaborations and facilities.
- **Industry**: Companies are increasingly multinational; more U.S. corporations are expanding offshore research and development facilities.
- **Journals**: Three quarters of corresponding authors publishing in APS journals are now from outside the United States.
- **Education**: The United States competes to attract and retain first-rate students and scientists, yet international applications to U.S. physics Ph.D. programs are declining.
- **Outreach**: APS engages physicists at all levels worldwide, offering K-12 students hands-on physics activities and bringing the excitement of physics to U.S. and, increasingly, to international audiences.
- **Policy**: Open exchange is the lifeblood of scientific progress; recent government policies restricting scientific mobility are affecting U.S. participation in international collaborations, as well as international participation in U.S.-based collaborations.
- **Membership**: Nearly one-quarter of APS membership lives outside the United States; APS surveys indicate that many members would welcome a more international outlook from the Society.

The APS Strategic Plan: 2013-2017 recognized that expanded international engagement was key to the Society’s service to the physics community. Consequently, APS created new international programs to serve its members, increased its offerings to physicists in the developing world, established ongoing physicist exchanges with new international partners, and united with other national and international physical societies to carry out a suite of joint activities. Then, with the development and upcoming launch of the APS Strategic Plan: 2019, APS leadership decided it was time to take the Society’s international efforts to the next level, and in March 2017, APS Chief Executive Officer Kate Kirby launched the APS Task Force on Expanding International Engagement. The Task Force worked for nearly 18 months to understand the interests, concerns and priorities of all APS stakeholders and to create an international strategy to serve the larger APS mission.

### Guiding Principles

- **International partnerships strengthen APS.** Expanded and strengthened partnerships with other national, regional, or international physics organizations will enable APS to better serve the global physics community. While increased international partnerships and activities may attract new APS members, the Society is not aiming to grow its membership through expanded international engagement. The APS does not aim to be “proactive inclusion” of international members across all of its activities.
- **Representative Leadership:** Non-U.S. members comprise 24% of total membership, but international members are not proportionally represented across the Society’s leadership (i.e., Unit Leaders, Program Committees, Advisory Committees, etc.). APS must work to ensure that international voices are included in all aspects of the Society’s leadership and advisory roles.

### Goal 1: Offer new/expanded ways to participate in the APS community.

**Recommendations:**

- Enable geographic APS Sections outside of the United States.
- Create incentives for physicists outside of the U.S. to belong to both APS and the national physical society in their country of residence.
APS Announces 2019 Prize and Award Recipients

APS extends congratulations to all recipients of these Society prizes and awards. Recipients will be honored at award ceremonies at various APS meetings throughout the year. The March and April meeting award ceremonies are open to all APS members and their guests. At the March Meeting, the APS Prizes and Awards Ceremony will be held Monday, March 4, 2019, 5:45 p.m. at the Boston Convention Center, Boston, Massachusetts. At the April Meeting, the APS Prizes and Awards Ceremony will be held Sunday, April 14, 2019, 5:30 p.m. at the Sheraton Denver Downtown Hotel, Denver, Colorado. In addition to the award ceremonies, many prize and award recipients will give invited talks during the meeting. Some recipients are recognized at APS unit meetings. For the schedule of APS meetings, please visit aps.org/meetings/calendar.cfm.

2019 APS MEDAL FOR EXCEPTIONAL ACHIEVEMENT IN RESEARCH

Bertrand I. Halperin
Harvard University
For his seminal contributions to theoretical condensed matter physics, especially his pioneering work on the role of topology in both classical and quantum systems.

2019 HANS A. BETHE PRIZE

Ken’ichi Nomoto
The University of Tokyo, Kavli Institute of Physics and Mathematics
For lasting contributions to our understanding of the nuclear astrophysics of the universe, including stellar evolution, the synthesis of new elements, the theory of core-collapse and thermonuclear supernovae, and gamma-ray bursts.

2019 TOM W. BONNER PRIZE IN NUCLEAR PHYSICS

Barbara V. Jacak
Lawrence Berkeley National Laboratory, University of California, Berkeley
For her leadership in the discovery and characterization of the quark-gluon plasma, in particular for her contributions to the PHENIX experiment and its explorations of jets as probes.

2019 HERBERT P. BROIDA PRIZE

Marsha I. Lester
University of Pennsylvania
For the development of innovative methods for generating and characterizing reactive intermediates using sophisticated laser techniques that elucidate important reaction pathways in atmospheric and combustion chemistry.

2019 OLIVER E. BUCKLEY CONDENSED MATTER PHYSICS PRIZE

Elihu Abrahams
University of California, Los Angeles
For pioneering research in the physics of disordered materials and hopping conductivity.

Alexei L. Efros
University of Utah
For his theoretical prediction, design and realization of non-magnetic insulators.

Boris I. Shklovskii
University of Minnesota
For profound contributions to the field of exactly solvable models in statistical mechanics and many body physics, in particular the construction of the widely studied Gaudin magnet and the Calogero-Sutherland, Shastry-Sutherland, and Calogero-Moser models.

2019 MAX DELBRUCK PRIZE IN BIOLOGICAL PHYSICS

Ken A. Dill
Stony Brook University
For independent contributions to a new view of protein folding, from the introduction and exploration of simple models, to detailed confrontations between theory and experiment.

Joseph Nelson Onuchic
Rice University
For his seminal contributions to computational methods for predicting the structure and function of macromolecules.

2019 PRIZE FOR A FACULTY MEMBER FOR RESEARCH IN AN UNDERGRADUATE INSTITUTION

Robert C. Forrey
Pennsylvania State University, Berks
For exceptional engagement of undergraduate students and early-career contributions to theoretical physics, including ultracold atomic and molecular collisions, master wave optics, metallic clusters and nanoparticles, and molecular astrophysics.

2019 HERMAN FESBACH PRIZE IN THEORETICAL NUCLEAR PHYSICS

Barry R. Holstein
University of Massachusetts, Amherst
For seminal theoretical studies of fundamental symmetries in nuclei, including radioactive nuclear decays, parity-violating nucleon-nucleon interactions, and chiral dynamics of mesons and baryons.

2018 FLUID DYNAMICS PRIZE

Keith Moffatt
University of Cambridge
For his fundamental contributions to fluid mechanics, including turbulence, Stokes flows, topological fluid mechanics, interfacial flows, and self-similarity.

2019 DANNIE HEINEMAN PRIZE FOR MATHEMATICAL PHYSICS

Francesco Calogero
The Sapienza University of Rome
For original contributions to the study of integrable systems, in particular the Calogero-Moser models.

Michel Gaudin
CEA - Saclay
For his seminal contributions to non-equilibrium statistical mechanics, including the discovery and exploration of simple models, to detailed confrontations between theory and experiment.

2019 LEO P. KADANOFF PRIZE FOR A FACULTY MEMBER FOR PLASMA PHYSICS

Keith H. Burrell
General Atomics
For pioneering research, including key experimental advances and diagnostic development, that established the links between plasma fluid flow and turbulent transport, leading to improved confinement regimes for magnetic plasma through turbulent transport reduction by shear flows.

2019 LEO P. KADANOFF PRIZE

M. Cristina Marchetti
University of California, Santa Barbara
For original contributions to equilibrium and non-equilibrium statistical mechanics, including profound work on equilibrium and driven vortex systems, and fundamental research and leadership in the growing field of active matter.

2019 IRVING LANGMIUR PRIZE IN CHEMICAL PHYSICS

Devarajan Thirumalai
University of Texas, Austin
For the development of analytical and computational approaches to soft-matter systems and their application to the transitional behavior of supercooled fluids and glasses, fielding dynamics of protein and RNA biomolecules, and functioning of molecular motors.

2019 JULIUS EDGAR LILIENTHAL PRIZE

Katherine Freese
University of Michigan, Stockholm University
For groundbreaking research at the interface of cosmology and particle physics, and for tireless efforts to communicate the excitement of physics to the general public.

2019 JAMES CLERK MAXWELL PRIZE

Xi Dai
Hong Kong University of Science and Technology
For original contributions to the study of the quark-gluon plasma, in particular for her contributions to the PHENIX experiment and its explorations of jets as probes.

2019 JAMES CLERK MAXWELL PRIZE

Claudia Felser
Max Planck Institute for Chemical Physics of Solids
For the development of innovative methods for generating and characterizing reactive intermediates using sophisticated laser techniques that elucidate important reaction pathways in atmospheric and combustion chemistry.

2019 JAMES CLERK MAXWELL PRIZE

Denvan Chandrasekaran
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For his seminal contributions to non-equilibrium statistical mechanics, including the discovery and exploration of simple models, to detailed confrontations between theory and experiment.

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2019 JAMES CLERK MAXWELL PRIZE

Randall Feenstra
Carnegie Mellon University
For pioneering developments of the techniques and concepts of spectroscopic scanning tunneling microscopy.

2019 JAMES CLERK MAXWELL PRIZE

Michel Gaudin
CEA - Saclay
For his seminal contributions to non-equilibrium statistical mechanics, including the discovery and exploration of simple models, to detailed confrontations between theory and experiment.

2019 JAMES CLERK MAXWELL PRIZE

Bill Sutherland
University of Utah
For his seminal contributions to non-equilibrium statistical mechanics, including the discovery and exploration of simple models, to detailed confrontations between theory and experiment.

2019 JAMES CLERK MAXWELL PRIZE

Christopher Jarzynski
University of Maryland, College Park
For seminal contributions to non-equilibrium thermodynamics and statistical mechanics that have had remarkable impact on experimental research in single-molecule and biological physics, engendering whole new fields of theoretical, numerical, and laboratory research, as well as for groundbreaking work on the thermodynamics of small systems.
2019 ABRAM H. PRIZE FOR HISTORY OF
PHYSICS

Helge Kragh
Niels Bohr Institute, University of Copenhagen
For influential contributions to the history of physics, especially analyses of cosmological theories and debates, the history of the quantum physics of elementary particles and the solid state, and biographical studies of Paul Dirac and Niels Bohr, and his early quantum atom.

2019 W.K.H. PANOFSKY PRIZE IN EXPERIMENTAL PARTICLE PHYSICS

Sheldon Leslie Stone
Syracuse University
For transformative contributions to flavor physics and hadron spectroscopy, in particular through intellectual leadership on detector construction and analysis on the CLEO and Large Hadron Collider beauty experiments, and for the longstanding, deeply influential advocacy for flavor physics at hadron colliders.

2019 EARLE K. PLYLER PRIZE FOR MOLECULAR SPECTROSCOPY AND DYNAMICS

Abraham Nitzan
Tel Aviv University and University of Pennsylvania
For deep theoretical insights in the fields of surface-enhanced Raman spectroscopy and molecular electronics.

2019 POLYMER PHYSICS PRIZE

Ronald G. Larson
University of Michigan
For wide-ranging, multi-disciplinary contributions to understanding the structure, dynamics, and rheology of polymeric materials in melt, solution, glassy, mesomorphic, and multi-phase states, including viscoelastic instabilities, constitutive equations, alignment transitions, and phase behavior.

2019 I. L. RABI PRIZE IN ATOMIC, MOLECULAR, AND OPTICAL PHYSICS

Kang-Kuen Ni
Harvard University
For seminal work on ultralow molecules, including original contributions to the understanding of chemical reactions in the quantum regime, deterministic creation of individual molecules with optical tweezers, and development of novel, high-precision techniques to interrogate and control the complete set of internal quantum resources.

2019 ARTHUR L. SCHAWLOW PRIZE IN LASER SCIENCE

Steven T. Cundiff
University of Michigan
For pioneering contributions to the field of ultrashort laser spectroscopy, including optical multidimensional coherent spectroscopy applied electronic excitation in solids and atomic vapors, and the development and application of femtosecond/frequency comb technology.

2019 ANEESUR RAHMAN PRIZE FOR COMPUTATIONAL PHYSICS

Sharon C. Glotzer
University of Michigan
For innovative molecular dynamics simulations of the self-assembly of variously shaped particles which opened up new directions in soft matter and materials science research.

2019 NORMAN F. RAMSEY PRIZE IN ATOMIC, MOLECULAR, AND OPTICAL PHYSICS, & IN PRECISION TESTS OF FUNDAMENTAL LAWS & SYMMETRIES

Jun Ye
JILA, NIST/University of Colorado, Boulder
For groundbreaking contributions to precision measurements and the quantum control of atomic and molecular systems, including atomic clocks.

2019 DAVID ADLER LECTURESHIP AWARD IN THE FIELD OF MATTERIALS PHYSICS

Giulia Galli
University of Chicago
For the invention of methods, especially for the enhancement of ab initio molecular dynamics, to understand, predict, and engineer the electronic and structural properties of materials.

2019 JOSEPH A. BURTON FORUM AWARD

Shirley Ann Jackson
Rensselaer Polytechnic Institute
For distinguished application of her knowledge of physics to public service and increasing diversity in physics as Chair of the Nuclear Regulatory Commission and the president of Rensselaer Polytechnic Institute, and for service on many government, charitable, and corporate boards.

2019 LEROY APERK AWARD

Eric S. Cooper
Pomona College
For outstanding contributions towards understanding the adaptive significance of hallucinations by modeling and comparing the flight of ants dispersed by hallucinogenic brain.

2019 POLYMER PHYSICS PRIZE

Ronald G. Larson
University of Michigan
For wide-ranging, multi-disciplinary contributions to understanding the structure, dynamics, and rheology of polymeric materials in melt, solution, glassy, mesomorphic, and multi-phase states, including viscoelastic instabilities, constitutive equations, alignment transitions, and phase behavior.

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2019 JOHN H. DILLON MEDAL

Richard Alan Moyer
University of California, San Diego
For exceptional investigations of surface effects in polymer glasses and amorphous aggregation.

2018 ANEESUR RAHMAN PRIZE FOR COMPUTATIONAL PHYSICS

Sharon C. Glotzer
University of Michigan
For innovative molecular dynamics simulations of the self-assembly of variously shaped particles which opened up new directions in soft matter and materials science research.

2018 STANLEY CORRIN AWARD

Anette Hosoi
Massachusetts Institute of Technology
For creative analysis of locomotion, contributions to the development of soft robotics as an emerging field, and her ability to combine mathematical analysis with physical insight.

2018 JOHN DAWSON AWARD FOR EXCELLENCE IN PLASMA PHYSICS RESEARCH

Todd E. Evans
General Atomics
For groundbreaking contributions to precision tests of fundamental laws & symmetries.

2018 GEORGE E. VALLEY, JR. PRIZE

Julia Mundy
Harvard University
For the precision engineering and synthesis of the first room-temperature magnetoresistive multi-ferroic material.

2018 ARTHUR L. SCHAWLOW PRIZE IN LASER SCIENCE

Steven T. Cundiff
University of Michigan
For pioneering contributions to the field of ultrashort laser spectroscopy, including optical multidimensional coherent spectroscopy applied electronic excitation in solids and atomic vapors, and the development and application of femtosecond/frequency comb technology.

2018 JOSEPH A. BURTON FORUM AWARD

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Massachusetts Institute of Technology
For creative analysis of locomotion, contributions to the development of soft robotics as an emerging field, and her ability to combine mathematical analysis with physical insight.
2019 GEORGE E. DUVALL SHOCK COMPRESSION SCIENCE AWARD

George T. Gray III
Los Alamos National Laboratory
For pioneering contributions in dynamic constitutive and damage response of materials, for leadership in developing programs and tools to advance our understanding of materials and structures in response to high-strain-rate and shock deformation, and for leadership in the technical community.

2018 LANDAU-SPIZTER AWARD

Yevgen Kazakov
Laboratory for Plasma Physics of the Royal Military Academy (LPP-ERMKMS), Brussels, Belgium

Jozef Ongena
Laboratory for Plasma Physics of the Royal Military Academy (LPP-ERMKMS), Brussels, Belgium

John C. Wright
MIT Plasma Science and Fusion Center, USA

Stephen J. Wukitch
MIT Plasma Science and Fusion Center, USA

For experimental verification, through collaborative experiments, of a novel and highly efficient ion cyclotron resonance heating scenario for plasma heating and generation of energetic ions in magnetic fusion devices.

2019 EXCELLENCE IN PHYSICS EDUCATION AWARD

Learning Assistant (LA) model and the associated Learning Assistant Alliance (LAA)

Steven Iona
University of Colorado, Boulder
University of Denver

Laurie S. Langdon
University of Colorado, Boulder

Richard McCray
University of Colorado, Boulder

Valerie K. Otero
University of Colorado, Boulder

Steven Pollock
University of Colorado, Boulder

For the development of the Learning Assistant (LA) model and the associated LA Alliance, which has enhanced physics teacher education and recruitment, supported undergraduate course transformation, and physics instructor professional development.

2018 STUART J. FREEDMAN AWARD IN EXPERIMENTAL NUCLEAR PHYSICS

Anna Kwiatkowski
TRIUMF
For outstanding and innovative contributions to precision mass measurements, commitment to mentoring of young researchers, and leadership in the low energy nuclear physics community.

2018 IRWIN OPPENHEIM AWARD

Benjamin Bennett
Northwestern University
For contributions to the field of quantum information science, including foundational work on quantum entanglement, quantum error correction, and quantum computing.

2018 MARIA GOEPPERT MAYER AWARD

Alyson Brooks
Rutgers University
For contributions to theoretical astrophysics, in particular, the use of numerical hydrodynamic simulations compared with observations to elucidate the essential physics of galaxy formation.

2019 DISTINGUISHED LECTURESHIP AWARD ON THE APPLICATIONS OF PHYSICS

Cynthia Keppel
Thomas Jefferson National Accelerator Facility
For pioneering work in proton therapy and for the promotion of the applications of physics to both experts and non-experts.

2019 JONATHAN F. REICHERT & BARBARA WOLF-FEICHERT AWARD FOR EXCELLENCE IN ADVANCED LABORATORY INSTRUCTION

Jonathan Home
ETH Zürich
For the development and demonstration of trapped ion quantum computing protocols, including Bell state stabilization by feedback control in mesoscopic chains, and the encoding of logical quantum states in the ion motion.

2019 EARLY CAREER AWARD FOR SOFT MATTER RESEARCH

Aparna Baskaran
Brandeis University
For pathbreaking advances in our understanding of the physics of soft materials out of equilibrium, especially active and granular matter.

2018 THOMAS H. STIX AWARD FOR OUTSTANDING EARLY CAREER CONTRIBUTIONS TO PLASMA PHYSICS RESEARCH

Frederico Fuza
SLAC National Accelerator Laboratory
For seminal contributions that advanced the field of laboratory astrophysics through numerical simulations and leadership of experiments on particle acceleration,collisions, shock, and magnetic reconnection.

2018 JOHN WHEATLEY AWARD

Zia Mian
Princeton University
For promoting global peace and nuclear disarmament particularly in South Asia, through academic research, public speaking, technical and popular writing and organizing efforts to ban nuclear weapons.

2018 ROLF LANDAUER AND CHARLES H. PRIMAKOFF AWARD FOR EARLY-CAREER PARTICLE PHYSICS

Tanya Zelevinsky
Columbia University
For pioneering research on producing ultracold molecules confined in optical lattices and using them for precision spectroscopy, molecular clock techniques, and tests of fundamental physics.

2018 HENRY PRIMAKOFF AWARD FOR OUTSTANDING ACHIEVEMENT IN EXPERIMENTAL PHYSICS

Nhan Tran
Fermi National Accelerator Laboratory
For wide-ranging contributions to the Compact Muon Solenoid experiment, including the development of a novel pileup subtraction method at the Large Hadron Collider, and the use of jet substructure for the analysis of high-energy collisions.

2019 NEVEZ GROUP AWARD

Federico Rosei
Northwestern University
For sustained leadership and service to the international physics community, in particular for developing global collaborations through projects and networks in China, Mexico, and several African countries, and for exceptional mentoring efforts.

2019 LEONID AND ANNA KOROTEV AWARD

Federico Rosei
Northwestern University
For sustained leadership and service to the international physics community, in particular for developing global collaborations through projects and networks in China, Mexico, and several African countries, and for exceptional mentoring efforts.

2019 ALBERT A. BUNSHAH AWARD

Federico Rosei
Northwestern University
For sustained leadership and service to the international physics community, in particular for developing global collaborations through projects and networks in China, Mexico, and several African countries, and for exceptional mentoring efforts.

2019 FRANCIS M. PIPKIN AWARD

Tanya Zelevinsky
Columbia University
For pioneering research on producing ultracold molecules confined in optical lattices and using them for precision spectroscopy, molecular clock techniques, and tests of fundamental physics.

2019 ANNE T. STAFFA AWARD FOR OUTSTANDING CONTRIBUTIONS TO THE PROMOTION OF PHYSICS RESEARCH

Zia Mian
Princeton University
For promoting global peace and nuclear disarmament particularly in South Asia, through academic research, public speaking, technical and popular writing and organizing efforts to ban nuclear weapons.
Fellowships

2018 M. HILDRED BLEWETT FELLOWSHIP

Asma Al-Qasimi
University of Rochester

Vivian E. Ferry
University of Minnesota
For proposed research developing improved photovoltaic systems using spectrally-selective photonic structures.

Wafaa Bensalem
Carleton University

Saroo Bensalem
Saratoga, California

Steph Kubala
University of Wisconsin at Madison

Tamar Mentzel
Harvard University

Edbert Jarvis Sie
Massachusetts Institute of Technology
2018 ANDREAS ACRIVOS DISSERTATION AWARD IN FLUID DYNAMICS

Shabnam Raayai Ardakani
Massachusetts Institute of Technology
For experimental and theoretical contributions to understanding the mechanisms by which microstructured riblet surfaces can reduce or increase the viscous frictional drag experienced in high Reynolds number laminar boundary layer flows, and Taylor Couette flows.

2018 CARL E. ANDERSON DIVISION OF LASER SCIENCE DISSERTATION AWARD

Sara L. Campbell
University of Colorado, Boulder
For creating the world’s first quantum gas optical atomic clock and demonstrating a record long coherence time for light-matter interactions in monolayer transition metal dichalcogenides.

2018 OUTSTANDING DOCTORAL THESIS RESEARCH IN ATOMIC, MOLECULAR, OR OPTICAL PHYSICS

Rivka Bekenstein
Harvard University
For her work, “Electromagnetic waves in linear and nonlinear curved space systems.”

2019 NICHOLAS METROPOLIS AWARD FOR OUTSTANDING DOCTORAL THESIS WORK IN COMPUTATIONAL PHYSICS

Evan E. Schneider
Princeton University
For exemplary achievement in computational physics, by leveraging new architectures to develop methods for astrophysical simulation on the world’s fastest supercomputers.

2019 DISSERTATION AWARD IN NUCLEAR PHYSICS

Grayson Rich
University of Chicago
For his outstanding contributions to the first observation of coherent elastic neutrino-nucleus scattering as a member of the COHERENT neutrino experiment at the Oak Ridge National Laboratory.

2019 DISSEMINATION AWARD IN STATISTICAL AND NONLINEAR PHYSICS

Hong-Yan Shih
University of Illinois, Urbana-Champaign
For an outstanding doctoral thesis that relates the transition to turbulence in pipe flow and the evolution of interacting populations through collective effects.

2019 MITSUYOSHI TANAKA DISSERTATION AWARD IN EXPERIMENTAL PARTICLE PHYSICS

Benjamin Brubaker
Yale University
For outstanding contributions to the HAYSTAC (Holography At Yale Sensitive To Axion Cold Dark Matter) experimental detector, especially in its design and construction incorporating quantum measurement techniques, in addition to its operation including data acquisition and novel analysis techniques.

2018 DEBORAH JIN AWARD FOR OUTSTANDING DOCTORAL THESIS RESEARCH IN ATOMIC, MOLECULAR, OR OPTICAL PHYSICS

Gabriele Betancourt-Martinez
University of Maryland, College Park
Measuring and Interpreting the x-ray spectra of matter.

2018 CECILIA PAYNE-GAPOSCHKIN DOCTORAL DISSERTATION AWARD IN ASTROPHYSICS

Pakbin Cho
University of Rochester
For her work, “Electromagnetic waves in linear and nonlinear curved space systems.”

2019 J.J. AND NORIKO SAKURAI DISSERTATION AWARD

Nicholas L. Rodd
University of California, Berkeley
For developing powerful new techniques to search for dark matter signals in astrophysical datasets, for characterizing the excess of GeV gamma-rays from the inner Milky Way, and for cutting-edge predictions of annihilation signals from complex dark sectors and heavy weakly-interacting dark matter.

2018 OPTIMIZATION AND META-HEURISTICS FELLOWSHIP

Wafa Bensalem
Carleton University

2018 STANFORD R. OVSHINSKY SUSTAINABLE ENERGY FELLOWSHIP

Susmita Pal
University of Texas MD Anderson Cancer Center, Houston

2018 RICHARD L. GREENE DISSERTATION AWARD IN EXPERIMENTAL CONDENSED MATTER OR MATERIALS PHYSICS

Jasmine A. Nirody
University of California, Berkeley
Outstanding thesis work on investigating the molecular mechanism underlying the dynamics of bacterial flagellar motor by using both computational modeling methods and experiments.

2018 AWARD FOR OUTSTANDING DOCTORAL THESIS IN BIOPHYSICS

Edbert Jarvis Sie
Massachusetts Institute of Technology
For thesis topic, “Coherent light-matter interactions in monolayer transition metal dichalcogenides.”

2018 CECILIA PAYNE-GAPOSCHKIN DOCTORAL DISSERTATION AWARD IN ASTROPHYSICS

Uri Vool
Harvard University
For thesis topic, “Engineering synthetic quantum operations.”

2019 STANFORD R. OVSHINSKY SUSTAINABLE ENERGY FELLOWSHIP

Vivian E. Ferry
University of Minnesota
For proposed research developing improved photovoltaic systems using spectrally-selective photonic structures.

Nominate members for next years’ prizes, awards, and fellows: aps.org/programs/honors/index.cfm