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APS News

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Get Ready for the APS March Meeting 2023

In Las Vegas or online, engage with peers from across the globe.

BY LIZ BOATMAN



Credit: APS

March is nearly here — and so is the APS March Meeting 2023. The March Meeting is the largest annual gathering of physicists, bringing together people from around the world. Participants can attend the in-person event in Las Vegas from March 5-10, or join the virtual meeting, scheduled March 20-22, from the comfort of home, office, lab, or space station. Attendees can also participate in both.

For the in-person event, core meeting activities will take place in Caesar's Forum, a new smoke-free, casino-free convention center. All talks scheduled for Las Vegas will be given in-person, and then recorded and uploaded to the virtual meeting platform about a week later for post-meeting access. All in-person attendees will have access to the virtual meeting platform. APS encourages Las Vegas attendees to book their rooms in the APS hotel block by Friday, Feb. 3.

The Society hasn't held a major meeting in Las Vegas since 1986, when 4,000 physicists flocked to the iconic MGM Grand Hotel. Allegedly, the casinos suffered one of their worst weekends ever; the physicists avoided gambling like the plague, instead cramming into conference talks, according to *Quartz*. In a cheeky 2013 Letter to the Editor of *APS News*, Marvin Co-

March Meeting continued on page 12

Robert Rosner, 2023 APS President, Takes the Helm

An interview with the next APS president.

BY TARYN MACKINNEY

Robert Rosner likes big questions.

How could nuclear power help humanity in a warming climate? How can physicists better explain their work to the public? And why are magnetic fields... well, everywhere? "The nerve of them, being so ubiquitous," he says.

Rosner is an eminent theoretical physicist and the 2023 APS President, and his love for the field stretches back to childhood. "I loved puzzles; I always read science articles, books," he says. He earned his bachelor's degree in physics from Brandeis and his doctorate from Harvard and has been at the University of Chicago since 1987.

Rosner's research focuses on fluid dynamics, plasma physics, and computational physics, but energy issues — both science and policy — loom large, too. "Why do I care? That's simple: climate change," he says.

Rosner spoke with *APS News* about his background and the challenges and opportunities that lie

Robert Rosner *Credit: University of Chicago*

ahead for APS and physics. This interview has been edited for brevity and clarity.

What first got you into physics?

I don't remember a time when I didn't love science. When I was a kid

Rosner continued on page 11

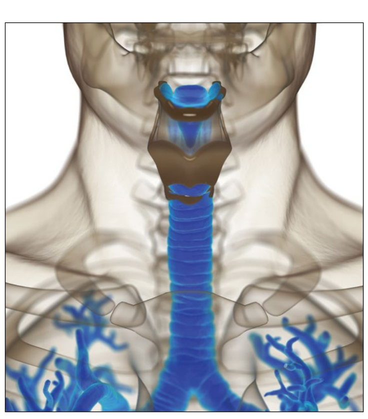
Designing Self-Powered Breath Sensors to Track Chronic Respiratory Conditions

At an APS meeting on fluid dynamics, engineers presented an implantable sensor that can detect signs of an asthma attack in rabbits.

BY TESS JOOSSE

When it's resting, the average human body produces about 100 watts of power — energy that could someday power lifesaving medical devices. At the 2022 APS Division of Fluid Dynamics meeting in Indianapolis, Indiana, in November, Lucy Fitzgerald, a doctoral student in mechanical and aerospace engineering at the University of Virginia, presented new research designing and testing an implantable airflow sensor that harnesses lungs' own breath for power. Their work was published in *Royal Society Open Science*.

Many patients with respiratory conditions like chronic obstructive pulmonary disease or asthma require, or would benefit from, regular monitoring by a breath sensor. "Most sensing that you see is via a wearable, or something that you breathe into," Fitzgerald explains. The nasal tubes or chest straps available today are often inconvenient or



The human airway. *Credit: Anatomy Insider / Adobe*

uncomfortable, and Fitzgerald set out to design a sensor that could be inserted in a person's airway.

But engineers encounter two major problems when trying to create implantable sensors: "power and real estate," Fitzgerald says. Stuffing the respiratory system with a

Breath Sensors continued on page 3

The 2022 Physics Laureates Share Their Stories in Stockholm

As the Nobel Prize returns to 'real life,' quantum physicists challenge our view of reality.

BY ABIGAIL DOVE

On a frigid December morning in Stockholm, hundreds of people gathered in lines, queueing up for a unique Swedish ritual.

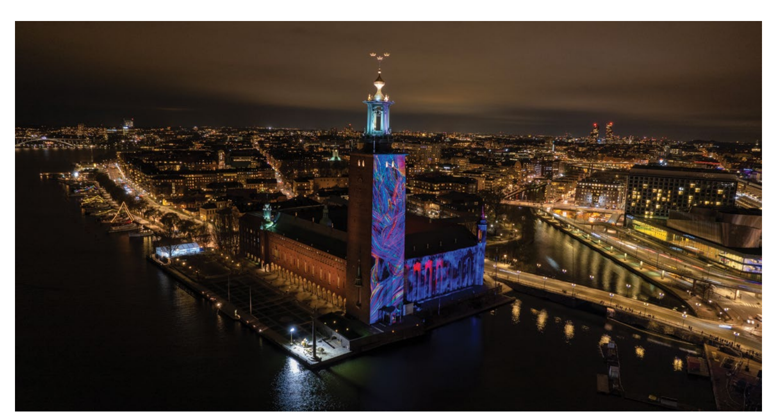
They weren't waiting for an ice hockey game, Christmas markets, or cold-water swimming. They were waiting for another tradition: the 2022 Nobel Prize lectures.

Getting swept up in Nobel Prize excitement is an annual rite in Sweden's capital, birthplace of the prize's founder Alfred Nobel, home to the secretive committees that select the prizewinners, and the site of the extravagant award ceremony. In the days leading up to the ceremony, posters featuring the prizewinners appear in train stations, popular science exhibitions abound, and art inspired by the prizes is projected onto buildings.

For many, the Nobel lectures are a highlight, an opportunity to hear from the laureates themselves. Most Nobel lectures are free and open to members of the public, provided they line up early enough — an endurance sport in the cold winter.

As the Nobel Prize's first in-person gathering since the COVID-19 pandemic, this year's events felt especially exciting, although the theme of the physics prize — the otherworldly phenomenon of quantum entanglement — was an ironic backdrop for "real life" celebrations.

Quantum entanglement describes strangely linked particles. Observing the properties of one particle determines the properties of its partner, even when they are vast distances apart.



"Conscience," a Nobel Prize-inspired light display, brightens Stockholm's City Hall in December 2022. *Credit: Benoît Derrier*

Quantum mechanics long predicted entanglement, but its counterintuitive nature left many physicists baffled — including Albert Einstein, who famously dismissed it as "spooky action at a distance." It was only after experimental evidence from the physics laureates Alain Aspect (École Polytechnique), John Clauser (Lawrence Livermore/Berkeley), and Anton Zellinger (University of Vienna) that quantum entanglement was accepted, fundamentally changing our understanding of nature and seeding fields like quantum information science.

On Dec. 8, in a packed auditorium at Stockholm University, Aspect, Clauser, and Zellinger each took the stage to tell their stories.

Clauser is credited with performing the first experimental tests of quantum entanglement. In 1972, Clauser, then a cash-strapped postdoc, hobbled together an unwieldy apparatus that spat out pairs of photons. Clauser recalled that he and his colleagues had set out to find "hidden variables," theorized traits of particles that would make entanglement more intuitive and less spooky, but that were incompatible with quantum mechanics.

Instead, Clauser's experiments showed that hidden variables, favored by Einstein, could not explain the behavior of entangled particles. "Our experiment was a test of Einstein's whole platform for doing physics, and we effectively were putting him out of business," Clauser explained. "The idea of hidden variables was dead on arrival."

Next, physicists had to eliminate other loopholes that could explain the connection between entangled photons. Almost a decade after Clauser's experiment, Aspect developed a more sophisticated experimental apparatus that emitted

Physics Laureates continued on page 4

Making a Beef Patty — Without the Beef

Meet Dr. Huan Yan, a chemical physicist at the plant-based meat company Impossible Foods.

BY ALAINA G. LEVINE

When Impossible Foods launched in 2011, the company's mission was "to restore biodiversity and reduce the impact of climate change by transforming the global food system" — no small task. But in the dozen years since, the start-up did what many thought was indeed impossible, developing tasty, nutritious, and more sustainable meat, dairy, and fish substitutes, using only plants — no critters involved.

To succeed, Impossible Foods needed to attract bright scientists of all stripes, including biologists, chemists, materials scientists, and plant scientists, to join the team and scrutinize why meat looks, cooks, and tastes the way it does. One of its recruits? Dr. Huan Yan, a chemical physicist.

Yan, who earned her doctorate in chemical physics from Kent State University in 2015, first dabbled in food science at a California-based consulting firm, improving testing for pesticide residues, heavy metals, and allergens. After a year, Yan joined Impossible Foods and, in the seven years that followed, worked her way from a team lead to a senior scientist to Director of Research and Development (R&D) Analytics.

"We're looking at proteins and small molecules, profiling the nutritional analysis and the chemistries or physical properties behind [animal] meats, so that we can recreate all that," Yan says. "That's a very interesting and scientific problem for us to solve."

When you bite into an Impossible Burger (and, full disclosure, this reporter eats them regularly), one of the first qualities you notice is the texture, which is surprisingly congruent with real beef. This is by design. By harnessing the tools of diverse fields, including analytical chemistry, Yan's team can identify molecules that create flavor and proteins that add texture, and then recreate them from the building blocks of plants.

"We need to have that materials science and physics knowledge to be really innovative on that front," Yan says. Physics indeed plays a role, as Impossible Foods researchers study interactions between molecules, and ingredients' viscosity and phase transitions, to improve the products.

Yan says the company emphasizes not only innovation and creativity, but compassion, a value she saw firsthand in her earliest interaction with the company. She was en route to an interview at Impossible Foods, headquartered in the San Francisco Bay Area, when she hit a traffic jam. She was 20 minutes late, but to her surprise, "everyone was super understanding and super kind," she recalls, a response she says is consistent with the company's culture. "And in the end, I got the offer."

For Yan, workplace ethos is only part of Impossible Foods' appeal.

> "Being able to make delicious, nutritious meat from plants is actually helpful for the environment," Yan says.

The company's aim — to create more sustainable food that's better for the planet — resonates with her.

"When I was in school, I wasn't thinking a lot [about] my purpose. I was just thinking, 'Okay, let me just get a job and make a living,'" Yan says. But now, she sees her work as mission-driven.

That's because animal agriculture uses 30% to 50% of Earth's ice-free land and about a third of all freshwater, and the livestock sector produces at least a seventh of greenhouse gas emissions, according to the United Nations Climate secretariat — a problem that Impossible Foods aims to help fix.

"Being able to make delicious, nutritious meat from plants is actually helpful for the environment," Yan

Impossible Foods continued on page 11

Can you guess what this burger doesn't have? Animal meat.
Credit: Impossible Foods

THIS MONTH IN PHYSICS HISTORY

February 1947: The First Animals, Fruit Flies, Rocket Into Space and Return to Earth

The U.S. military launches the flies on a V-2 missile, kicking off a frenzy of animals-in-space experiments.

BY TESS JOOSSE

Credit: Elia King / APS. V-2 photograph: Public domain / U.S. Army. V-2 diagram: Public domain / U.S. Air Force.

Before John Glenn, Neil Armstrong, or Sally Ride could step into a spacesuit and rocket into the annals of history, an intrepid bunch of fruit flies had to pave the way.

Of course, the flies didn't have much of a say when they blasted off on a V-2 rocket launched from New Mexico's White Sands Proving Grounds on Feb. 20, 1947. But as the first animals intentionally shot into and returned alive from space, the insects' journey heralded a new age in space research and exploration.

The flies' flight traces to the summer of 1945, when a load of German-made V-2 rocket parts arrived at White Sands, a newly established military testing area that is "almost as isolated as a valley of the Moon, which it resembles," wrote Lloyd Mallan in *Men, Rockets and Space Rats*, an on-the-ground chronicle of early spaceflight efforts published in 1955. The U.S. also imported a group of scientists and engineers from postwar Germany to assist with experiments using the V-2s, part of the intelligence operation later known as Operation Paperclip.

Standing 46 feet tall, weighing 28,000 pounds, and equipped with a guidance system, the V-2 rocket was the world's first long-range ballistic missile. As the war ended, both the Soviet Union and the U.S. scrambled to capture V-2 technology and know-how for study and missile development.

By this time, the fruit fly (*Drosophila melanogaster*) had become a star player in genetic and biomedical research. Kitchen proprietors know them well as the pests that linger around overripe bananas, but for scientists looking for an inexpensive model organism, fruit flies are a dream. "They can be easily cultured and maintained in small lab spaces; they develop from embryo to adult in about ten days; [and] they reproduce by the thousands," writes Harvard University biologist Stephanie Mohr in *First in Fly: Drosophila Research and Biological Discovery*.

Beyond their ubiquity and usability, fruit flies have simple genomes with only four chromosome pairs, yet are quite like humans in how their traits are inherited, genes are structured, and cells work. Some estimates conclude that nearly 75% of all disease-causing genes known in humans are also found in fruit flies, and to date, at least five Nobel Prizes in Physiology or Medicine have been awarded for research done in the tiny insects.

The second of those five was awarded in 1946, only a few months before the flies' ride on the V-2, to geneticist Hermann Joseph Muller "for the discovery of the production of mutations by means of x-ray irradiation." In a series of experiments in 1926 and 1927, Muller found that bombarding flies with x-rays induced mutations in their genes, particularly mutations that were lethal when passed to the flies' offspring.

Muller's work dovetailed with concerns over how cosmic radiation from the high-energy particles careening around space would impact a human body. While cosmic rays and x-rays are different, they both expose the body to potentially harmful radiation (today, an astronaut spending a year on the International Space Station is exposed to radiation equivalent to around 900 chest x-rays, according to NASA). "No one can determine the effects of cosmic rays on living cells or tissues without subjecting some of those cells and tissues to radiation," wrote Mallan. Fruit flies could be easy first test subjects.

When V-2 work began at White Sands, a group of scientists quickly recognized the missiles' potential for space research, and in early 1946, a panel there began fielding proposals from civilian engineers and researchers. It quickly approved a plan, concocted by scientists from Harvard and the U.S. Naval Research Laboratory, to launch fruit flies and corn seeds on a rocket.

Up they went on Feb. 20, 1947. The flies reached an altitude of 109 kilometers in 190 seconds (space starts at 100 kilometers, according to NASA), then parachuted back down to Earth, where they were recovered alive and examined by biologists. "Analysis made by Harvard on recovered seeds and flies has shown that no detectable changes are produced by the radiation," wrote U.S. Naval Research Laboratory nuclear physicist Ernst H. Krause in a report published that same year.

> "After you stare enough fruit flies straight in the eye, you start to have hallucinations. I'm beginning to think I can see their eyelashes," Simons said.

In the years after, a parade of rodents, monkeys, dogs, cats, and other animals were launched into space to further study the effects of radiation and other phenomena like microgravity. These animals traveled on both American and Soviet launches and included the first primate in space in 1949, a rhesus macaque named Albert II (the first Albert died during a failed launch in 1948), and the famous mutt Laika, who became the first animal to orbit Earth in 1957. Soviet cosmonaut Yuri Gagarin became the first human to go to space in 1961, and American astronauts soon followed.

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Here's How Honeybees Fly in Windy Conditions

New research suggests that even in turbulent wind, honeybees maintain their average flying velocity and move in a zig-zag-like pattern.

BY MARGARET OSBORNE

Honeybees are among the most important pollinators of the world's agricultural crops. About a third of the food in our diet relies at least partially on these insects, and they're estimated to contribute around $12 billion to the United States economy alone.

"Bees are natural pollinators and important to the environment," says Bardia Hejazi, a physicist at the Max Planck Institute for Dynamics and Self-Organization in Germany. "It's important to understand how they behave, how they manage to maneuver through different environments."


Honeybees at the Max Planck Institute for Dynamics and Self-Organization in Germany. Credit: Bardia Hejazi

Hejazi had always been interested in combining physics and animal studies, so when his institution procured three Carniolan honeybee hives, he jumped on the opportunity to work with them. With a background in turbulence research, he decided to study how honeybees fly in windy conditions — a question that could someday assist in the design of small flying robots.

At the 2022 APS Division of Fluid Dynamics meeting in Indianapolis, Indiana, in November, Hejazi discussed findings from his research, published in the *New Journal of Physics*. He found that bees' average velocity isn't affected by windy conditions, but that the insects tend to fly in a zig-zagging motion when they encounter turbulence.

To test how bees respond to wind, the team manufactured turbulence outside one of the hives using four fans behind a grid of flaps. The flaps could open and close independently of one another, and their movement was controlled by a computer.

"Depending on how many you move, in what sequence you move them, you can create different types of turbulence structures," Hejazi explains.

Over a week in September 2021, they tested how bees flew in eight different turbulence scenarios and compared them to a no-wind baseline. To coax the bees to fly in the right direction, they assembled screens on either side of the hive. A fence, bordered with trees and bushes, served as a natural barrier on the opposite side of the hive. To film the bees flying, the team set up three GoPro cameras in the experiment area, each placed at a different angle.

With three different images of the same bee, the researchers used computer codes to track its path in three dimensions. The team then used this data to calculate the bees' velocity and acceleration.

They found that the bees' average velocity didn't seem to be affected by the wind — not what you'd expect from a small insect battling strong gales.

"If you, for example, are walking in headwind, you're slower, you're fighting against the wind, right? And maybe your velocity is less because of that," Hejazi says. Or the opposite could be true: If you're riding a bicycle downwind, you're probably going faster.

"[But the bees are] maintaining that average velocity, regardless of

Honeybees continued on page 11

At Honeywell, APS Bridge Program Grad Finds Success Studying Failure

When hardware doesn't work, Fernand Torres-Davila must "figure out why."

BY LIZ BOATMAN

Fernand Torres-Davila was five years old when he first saw the world clearly. With thick lenses in his new glasses, he gazed up and spotted individual stars.

Torres-Davila was amazed not just by what the world looked like from his "fresh point of view," but by the fact that a seemingly simple innovation — curved glass fitted in a frame — could have such a major impact. This, he says, sparked his early interest in science, an interest that would eventually lead him to enroll in an APS Bridge Program at the University of Central Florida (UCF) to pursue graduate studies in physics and, afterward, land a job as a Honeywell engineer.


Fernand Torres-Davila

Growing up in Puerto Rico, Torres-Davila was drawn to astronomy because of the stunning night sky, he says. Then, in high school, he took a physics class. "[My teacher] was eccentric — very passionate about the field," he says. "It was a very fun class." Torres-Davila realized he had a passion for the broader field of physics, not just astronomy. Around the same time, he developed an interest in electronics, robotics, and chemistry; picking one would be tough.

When it came time to plan for college, Torres-Davila made a list of "must-haves." It included good physics and chemistry programs, as well as an observatory, he says. The Universidad de Puerto Rico, Humacao (UPRH) fit the bill, and it was only an hour's drive from his family's town, Bayamón.

In 2011, the summer before starting his undergraduate studies, Torres-Davila enrolled in advanced math courses, which catapulted him ahead in his first year of college. Once at UPRH, he enrolled in the Physics Applied to Electronics program, which allowed him to combine his interests.

His science classes used English textbooks, but class conversation and homework assignments were in Spanish — typical for undergraduate science courses in Puerto Rico, he says.

As the semesters progressed, Torres-Davila's adviser, Luis G. Rosa, became one of his champions. Rosa guided him toward research experiences, first at UPRH, funded through the NIH-RISE program, and then at the University of Nebraska-Lincoln. These experiences helped put Torres-Davila on track to a doctorate in the field.

But at the end of college, Torres-Davila still wasn't sure. Was a doctoral program in physics for him? Rosa chimed in with words of encouragement. "He said, 'you should definitely apply to grad school … You'll have what it takes to get through,'" Torres-Davila explains.

Torres-Davila chose to enroll in the APS Bridge Program at UCF. He felt that a bridge program would offer more security and support, and UCF was an easy plane ride home to Puerto Rico. He also had extended family in Orlando. His aunt and uncle there "played a huge part in

Torres-Davila continued on page 4

Breath Sensors continued from page 1

bulky sensor burdened by a battery that must be periodically replaced is "really a non-starter. You can't have a lot of blockage or you're going to make the problem worse," explains co-author Daniel Quinn, an assistant professor in engineering at the University of Virginia.

A sensor that harvests energy from what it is sensing — that's "self-powered by design" — could be well-suited to monitoring airflow in the lungs, the researchers suggest. Engineers have created self-powered-by-design sensors in other contexts — for example, a sensor on a fish's fin that measures its activity as it swims down a stream. "The flow is both the power source and the thing we're trying to measure," Quinn explains.

could distinguish between 28 and 30 breaths per minute.

Some elements of the sensor's performance surprised the team. "You might just think the faster you breathe, the more power you're going to generate. But it's not quite that simple, because the amplitude of your breath changes," Quinn says. While you can take shallow fast breaths, it's not really possible to take deep fast breaths, he explains.

"You kind of want an intermediate frequency at a high amplitude that actually gets you the maximum power," he says — the breathing a person might experience while jogging.

These parameters will depend on the shape and size of the sensor, and will guide the engineers in creating

> A sensor that harvests energy from what it is sensing — that's "self-powered by design" — could be well-suited to monitoring airflow in the lungs, the researchers suggest.

Fitzgerald and her colleagues set out to "marry these two ideas" and create a sensor that is both implantable and self-powered. They first created a mathematical model of the sensor by combining three sets of equations, predicting how the sensor will move, how it converts mechanical strain to voltage, and how the fluid flow — the breath — will move in and out of the trachea.

Next, the team tested their model on the lab bench. They built the sensor out of a piezoelectric polymer (a material that can generate electric charge when bent) and set up a machine to simulate breath flow. "It's a big box that's essentially a programmable lung," says Fitzgerald.

The simulator could approximate around 200 different "types" of breathing, from sleeping to meditating to jogging, each with different amplitudes and frequencies. The researchers attached a long tube to the simulator, affixed the fingernail-sized sensor to the end of the tube, then attached the sensor to an electrical circuit connected to a computer. Fitzgerald then built software to collect data from both the sensor and the "lung."

They tested the sensor against many types of breath, comparing its performance to their initial model. They found, for example, that it

a viable prototype for use in a living system. Their benchtop model, at 12-by-7 millimeters, is too big to go inside an airway, so they are now studying how its functions hold up as it shrinks in size.

Recently, Fitzgerald and Quinn teamed up with a throat surgeon at the University of Virginia to implant a smaller version of their sensor in live, unconscious rabbits. The researchers then used a drug to induce asthmatic breathing in the rabbits, and found the sensor was able to detect signs of the asthma attack in the animals.

In these experiments, the sensor is only in the rabbits' airways for a few minutes at a time. "Right now, it's more about testing how you would actually install this," Quinn explains. In the future, the team hopes their work will help lead to a sensor in humans that allows for long-term monitoring.

"Oftentimes, for [chronic respiratory] conditions, you have to have multiple doctor's visits where sometimes they just put a scope down your throat and say, 'looks good,'" Fitzgerald says. "If you had more continuous monitoring, you might be able to avoid that."

Tess Joosse is a science journalist based in Madison, Wisconsin.

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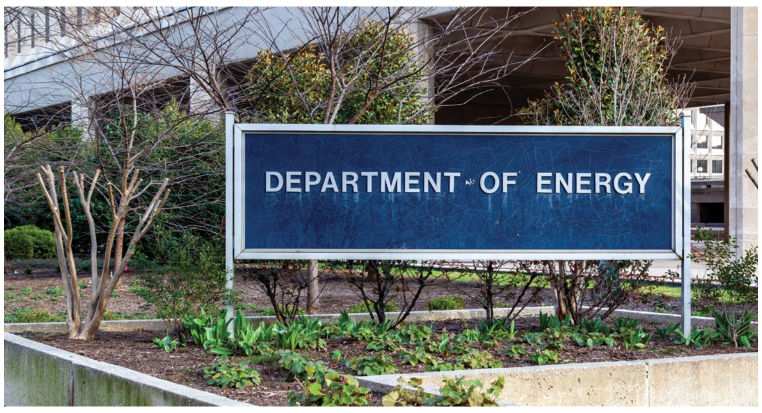
U.S. Science Budgets for 2023 Fall Short of CHIPS Act Ambitions

BY MITCH AMBROSE



Credit: JHVEPhoto - stock.adobe.com

In the final days of 2022, and after a monthslong stalemate, Congress passed legislation that will raise the budgets of federal agencies for the rest of fiscal year 2023. Most science agencies will receive increases that keep pace with inflation; a few will see double-digit percentage boosts.

However, these increases fall short of the ambitious targets Congress set in mid-2022 through the CHIPS and Science Act, which recommended ramping up budgets for three agencies — the National Science Foundation (NSF), the Department of Energy's (DOE) Office of Science, and the National Institute of Standards and Technology (NIST).

The Act did have some influence: Congress gave the NSF $1 billion extra via a special supplemental appropriation. In absolute terms, it is the largest increase the agency has ever received. The supplement also includes nearly a half-billion dollars to launch a set of regional hubs for technology development that the Act authorized.

The supplement increases the NSF's total budget by 12%, to $9.9 billion, for this fiscal year. But the CHIPS and Science Act recommended a 35% increase, with the aim of more than doubling the agency's budget over five years.

The supplement gave lawmakers a convenient way to boost science funding, because that money does not count against the agreed-upon limits on overall federal spending. But to sustain the elevated funding in future years, lawmakers will need to either make extra room in agencies' ordinary budgets or broker new supplements. That task may prove difficult with a new Republican majority in the House of Representatives, which aims to curb federal spending.

The budget for the DOE Office of Science is rising 8% to $8.1 billion, more than double the increase requested by the Biden administration but below the nearly 20% boost proposed in the CHIPS and Science Act. However, the office just received a one-time boost of $1.55 billion for infrastructure projects via the Inflation Reduction Act, which Democrats passed this summer with no Republican support. Much of this extra money will help accelerate the construction schedules of major projects already underway.

The NIST's budget is jumping 32% to $1.6 billion, though about half of the extra money is going to "earmarks," projects outside the agency that are directly selected by lawmakers. Congress revived earmarking last year with bipartisan support after a decade-long moratorium. Many of the earmarks in the NIST budget are not related to the agency's mission, instead going to upgrades at universities in lawmakers' home districts.

Excluding earmarks, NIST's budget is increasing by 18% — a meaningful bump, but far short of the nearly 50% increase proposed in the CHIPS and Science Act.

The NIST is also responsible for stewarding a $50 billion initiative to shore up the U.S. semiconductor industry, money that the CHIPS and Science Act guarantees — unlike budget targets for agencies, which the Act only recommends. For this fiscal year, the NIST is receiving an initial $7 billion installment from the Act, which it must juggle alongside the money it receives through the ordinary budget process.

Congressional attention will soon turn to the federal budget for fiscal year 2024, which begins on Oct. 1. President Biden is expected to submit his 2024 budget request to Congress in early February, and he is likely to use the CHIPS and Science Act as a guidepost for his science proposals.

Mitch Ambrose is Director of FYI. Published by the American Institute of Physics since 1989, FYI is a trusted source of science policy news. Sign up for free FYI emails at aip.org/fyi.

Task Force Gets to Work Reviewing APS Committees

APS has long relied on standing committees to provide expert advice to APS leadership on a range of topics relevant to the physics community. Currently, 26 committees — composed of APS members — advise the Society's Board and Council on diverse areas, from ethics to education, public affairs to honors policies. Over time, the number of committees and the scope of their work has grown.

Recently, the APS Board of Directors established a task force, chaired by Peter Schiffer, to assess these committees and recommend improvements. The task force will review the committees' structures and operations, member selection processes, and experiences of committee members and the staff who support them. The task force will work over the next 18 months and report to the Board and Council.

Now, APS needs your feedback. Have you served on or interacted with an APS committee? What was your experience like, and what would you improve? To share feedback, visit https://go.aps.org/26committees.

Questions? Contact Jeanette Russo, APS Corporate Secretary, at governance@aps.org.

Physics Laureates continued from page 1

more photons, more quickly, reducing the possibility that outside forces were affecting them — and confirming quantum entanglement. "In 100 seconds, we could excite 10^4 photons. It took John Clauser hours or maybe even days to have this!," Aspect explained, poking fun at his fellow laureate, who was laughing in the front row.

Then, in 1997, Anton Zellinger demonstrated entanglement between photons a half kilometer apart, the furthest distance yet. In 2015, his team, working in tunnels beneath the dungeons of an old Austrian palace, replicated the finding using fiber optic cables and cutting-edge detectors.

Zellinger's team was also the first to encrypt and decrypt a message using quantum cryptography, a technology that uses entangled photons to transmit data securely. The message? An image of the Venus of Willendorf, a 30,000-year-old carving of a nude woman, discovered not far from Vienna. "I told my colleagues that the image we encode has to be something that is Austrian and beyond any doubt a peaceful symbol," he said. "It is also the first and so far the only time that a naked person was pictured in *Physical Review Letters!*"

John Clauser giving his Nobel lecture. Credit: © Nobel Prize Outreach. Photo: Anna Svanberg

"Our experiment was a test of Einstein's whole platform for doing physics, and we effectively were putting him out of business," Clauser explained.

The audience applauded after each speech, fanfare guaranteed for Nobel laureates. But the Prize is not without its critics. No more than three scientists can receive the award annually, but research in physics — like in much of science — often requires the labor of hundreds or thousands of people.

The laureates seemed aware of this. Aspect closed his lecture with dozens of acknowledgements, including mentors, collaborators (several of whom sat in the front row), and the author of his first quantum mechanics textbook. And Zellinger included in his presentation every collaborator with whom he has co-authored a paper; the lists of names took up slide after slide.

Zellinger also highlighted another champion of physics. His talk, he said, was dedicated to taxpayers, who so often make science research possible. "That is really a big privilege," he said.

Before he could finish his sentence, the audience burst into applause.

Abigail Dove is a writer based in Stockholm, Sweden.

Torres-Davila continued from page 3

getting me through that transition," he says. "They made me feel right at home."

Still, "that first semester was really challenging," he says. He reasoned that taking extra undergraduate courses at UCF might help him establish a "baseline."

"I felt having the opportunity to take the undergrad courses ahead of the actual grad courses would make me feel more comfortable in pursuing [my master's]," he says. "It definitely helped," he says. When he enrolled in graduate physics courses in his second year, he felt better prepared.

The physics department was much larger at UCF than at UPRH, which had a "small but united feel." His coursework changed, too: Now everything was in English, and group work in class wasn't the same.

But Torres-Davila received encouragement from his family, as well as staff and faculty at UCF — especially his advisor, Laurene Tetard. And his aunt and uncle in Orlando "always made sure to say how proud they were," he says.

For his master's research, Torres-Davila studied how two-dimensional materials could drive catalytic reactions, like the hydrogenation of carbon dioxide into water and other useful chemical products. This work served as the basis for his doctoral research.

After passing his candidacy exam to continue in the UCF doctoral program, Torres-Davila sailed through the rest of his program. His research group was one of the best aspects of graduate school, he says.

"I always tried to keep track of what everyone was working on, so I could help out, and they did the same," says Torres-Davila. And Tetard, his adviser, was "always looking out for what was best for us," he says. "I have nothing but gratitude for her."

After graduating with his doctorate in August 2021, he decided to take a short break. "I prioritized spending some time off to cool down my brain and see relatives I hadn't seen in a while," he says — including his new baby niece in Wisconsin.

After several months, Torres-Davila felt ready to tackle job applications head on. He landed a position as an Advanced Hardware Engineer at Honeywell, a Fortune 500 company that creates and manufactures technologies. "I was a lot more confident in my own abilities" going into the job than into grad school, he says, in part because, at Honeywell, he was building off the lab skills he'd been cultivating since college — over a decade of experience.

As a Honeywell hardware engineer, Torres-Davila works in electronics failure analysis for a division based out of Florida. "We're given something that isn't working, that should be," he says, and "we have to figure out why." He uses an array of lab techniques and equipment to chase down the root cause behind the failure in a single component, device, or circuit. It's admittedly more complicated than the technology that first sparked his interest in science: eyeglasses.

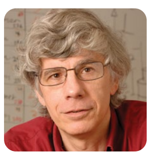
What advice does Torres-Davila have for other young physicists? "Don't be discouraged when stuff doesn't go according to plan," he says. "Everyone's path is unique."

Liz Boatman is a staff writer for APS News.

AMERICAN PHYSICAL SOCIETY

2022-23 Prizes & Awards

APS congratulates all prize and award recipients. Recipients will be honored at APS meetings throughout the year, and each will be invited to give a talk at the meeting where they receive their prize or award. For the full schedule of APS meetings, visit aps.org/meeting.



APS Medal for Exceptional Achievement in Research

Sidney Nagel
University of Chicago

For incisive experiments, numerical simulations and concepts that have expanded and unified soft matter physics.

Abraham Pais Prize for History of Physics

Jürgen Renn
Max Planck Institute for the History of Science

For contributions to the historiography of modern and early modern science, in particular studies of Albert Einstein; and for contributing scholarship and taking public stances that directly raise the social relevance of science historiography.

Aneesur Rahman Prize for Computational Physics

Pablo G. Debenedetti
Princeton University

For seminal contributions to the science of supercooled liquids and glasses, water, and aqueous solutions, through ground-breaking simulations.

Arthur L. Schawlow Prize in Laser Science

Demetrios Christodoulides
University of Central Florida

For pioneering several areas in laser sciences, among them, the fields of parity-time non-Hermitian optics, accelerating Airy waves, and discrete solitons in periodic media.

Dannie Heineman Prize for Mathematical Physics

Nikita Nekrasov
State University of New York, Stony Brook

For the elegant application of powerful mathematical techniques to extract exact results for quantum field theories, as well as shedding light on integrable systems and non-commutative geometry.

David Adler Lectureship Award in the Field of Materials Physics

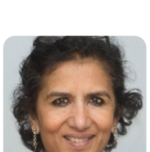
Elbio Dagotto
University of Tennessee, Knoxville

For pioneering work on the theoretical framework of correlated electron systems and describing their importance through elegant written and oral communications.

Davisson-Germer Prize in Atomic or Surface Physics

Feng Liu
University of Utah

For elucidating the influence of strain on epitaxy and nanostructure growth, and using these concepts to predict surface-based topological-insulator materials.



Dwight Nicholson Medal for Outreach

Chandralekha Singh
University of Pittsburgh

For work in broadening access to physics through research and removing barriers to success in the field faced by marginalized groups and how to overcome them, by addressing those challenges directly through meaningful, research-based action.

Earle K. Plyler Prize for Molecular Spectroscopy & Dynamics

Xiaoyang Zhu
Columbia University

For seminal research in the spectroscopy and dynamics of molecular condensed materials.

Early Career Award for Soft Matter Research

Pierre-Thomas Brun
Princeton University

For creative and groundbreaking contributions in developing soft functional materials using mechanical and hydrodynamic instabilities, elasticity and flow, from bubble casting for soft robotics to pendant drops coated on the underside of a substrate.

Edward A. Bouchet Award

Carlos R. Ordonez
University of Houston

For outstanding and impactful seminal research in different areas of physics and, in parallel, for being a dedicated advocate for advancement in physics in Latin America and in the Hispanic Community in the USA.

Einstein Prize

Gary T. Horowitz
University of California, Santa Barbara

For fundamental contributions to classical gravity and gravitational aspects of string theory.

TEAM AWARD

Excellence in Physics Education Award

For developing an active, inclusive, and supportive community of physics educators dedicated to integrating computation into their instruction; creating, reviewing, and disseminating instructional materials; and generating knowledge of computation in physics curricula and of effective practices.

Marcos Caballero
Michigan State University

Norman Chonacky
Yale University

Larry Engelhardt
Francis Marion University

Robert C. Hilborn
American Association of Physics Teachers

Marie Lopez del Puerto
University of St.Thomas (Minnesota)

Kelly Roos
Bradley University

Fluid Dynamics Prize

Elisabeth Charlaix
Universite Grenoble Alpes

For a ground-breaking exploration of the liquid-solid interface leading in particular to a quantitative understanding of the Navier slip condition, based on an exquisite surface force apparatus developed for this purpose.

Francis M. Pipkin Award

Andrew Geraci
Northwestern University

For developing new precision measurement techniques to search for weakly coupled interactions of mesoscopic range and demonstrating the precision sensing capability of optically levitated nanoparticles.

George E. Duvall Shock Compression Science Award

Bruce Remington
Lawrence Livermore National Laboratory

For pioneering laser-driven high-pressure, solid-state material dynamics in high-energy density regimes.

George E. Valley Jr., Prize

Lina Necib
Massachusetts Institute of Technology

For the discovery of a massive, previously unknown stellar structure that may have shaped the history of the Milky Way, and the development of groundbreaking new methods to study our Galaxy's dark matter halo and growth history.

Hans A. Bethe Prize

Frank Calaprice
Princeton University

For pioneering work on large-scale ultra-low-background detectors, specifically Borexino, measuring the complete spectroscopy of solar neutrinos, culminating in observation of CNO neutrinos, thus experimentally proving operation of all the nuclear-energy driving reactions of stellar evolution.

Henry Primakoff Award for Early-Career Particle Physics

Bernhard Mistlberger
SLAC National Accelerator Laboratory

For groundbreaking contributions to high-precision quantum field theory, including the next-to-next-to-next-to-leading order QCD corrections to the production of Higgs and electroweak vector bosons at hadron colliders.

Herbert P. Broida Award

Lai-Sheng Wang
Brown University

For pioneering work in characterizing solution species in the gas phase using high-resolution photoelectron imaging of cryogenically-cooled anions, and outstanding contributions in the investigation of size-selected boron clusters.

Herman Feshbach Prize in Theoretical Nuclear Physics

Michael Ramsey-Musolf
University of Massachusetts, Amherst and Shanghai Jiao Tong University

For seminal contributions in precision electroweak studies of nuclear and hadronic systems, making fundamental symmetry experiments powerful probes of strong interactions and new physics.

I.I. Rabi Prize in Atomic, Molecular, and Optical Physics

Adam M. Kaufman
JILA

For seminal developments in optical tweezer arrays and clocks based on alkaline earth atoms, with applications to metrology and quantum information processing.

Irving Langmuir Award in Chemical Physics

Valeria Molinero
University of Utah

For seminal contributions in understanding the crystallization of water and heterogenous nucleation.

TEAM AWARD

Irwin Oppenheim Award

For elucidating the stochastic force dynamics of a model biological micro-swimmer using an innovative combination of direct model-independent force measurement, simulation, and analytical modeling.

Wylie Ahmed
California State University, Fullerton

Nicholas Brubaker
California State University, Fullerton

Mauricio Gomez
California State University, Fullerton

Corbyn Jones
California State University, Fullerton

Anthony McKnight
University of Virginia

Ryan Muoio
California State University, Fullerton

J. J. Sakurai Prize for Theoretical Particle Physics

Heinrich Leutwyler
University of Bern, Switzerland

For fundamental contributions to the effective field theory of pions at low energies, and for proposing that the gluon is a color octet

TEAM AWARD

James C. McGroddy Prize for New Materials

For seminal contributions to the synthesis and assembly of high-quality 2D materials and their heterostructures.

James Hone
Columbia University

Takashi Taniguchi
National Institute for Materials Science

Emanuel Tutuc
The University of Texas at Austin

Kenji Watanabe
National Institute for Materials Science

James Clerk Maxwell Prize for Plasma Physics

Amitava Bhattacharjee
Princeton University

For seminal theoretical investigations of a wide range of fundamental plasma processes, including magnetic reconnection, magnetohydrodynamic turbulence, dynamo action, and dusty plasmas, and for pioneering contributions to linking laboratory plasmas to space and astrophysical plasmas.

TEAM AWARD

John Dawson Award for Excellence in Plasma Physics Research

For the first laboratory demonstration of a burning deuterium-tritium plasma where alpha heating dominates the plasma energetics.

Burning Plasma Team:

B. Bachmann
K. L. Baker
R. Bionta
D. A. Callahan
D. T. Casey
D. S. Clark
J.-M. G. Di Nicola
L. Divol
T. Doeppner
M. J. Edwards
M. Gatu Johnson
K. Hahn
E. P. Hartouni
M. Hohenberger
O. A. Hurricane
S. Khan
A. L. Kritcher
O. L. Landen
B. J. MacGowan
A. G. MacPhee
M. M. Marinak
K. Meaney
A. S. Moore
A. Nikroo
A. Pak
P. K. Patel
J. E. Ralph
H. F. Robey
J. S. Ross
S. M. Sepke
R. Tommasini
P. Volegov
C. R. Weber
B. M. Van Wonterghem
C. V. Young, A. B. Zylstra

NIF-ICF Team

John H. Dillon Medal

Vivek Sharma
University of Illinois Chicago

For fundamental advances toward a molecular-level understanding of non-equilibrium polymer dynamics and for developing methods to accurately measure extensional deformation of polymeric materials and interfacial flows.

John Wheatley Award

James E. Gubernatis
Los Alamos National Laboratory (retired)

For ongoing commitment to developing physics in Africa through initiating the African School on Electronic Structure Methods and Applications and leadership in bringing together African physicists from across the continent to create a Pan-African physics communication vehicle.

Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction

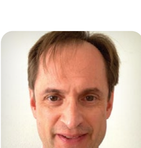
Laura Clarke
North Carolina State University

For leadership and dedicated efforts in developing sustainable laboratory experiences and courses throughout the entire physics curriculum that address the needs of diverse students who are considering careers in both industry and graduate study.

Joseph A. Burton Forum Award

Richard A. Meserve
Carnegie Institution for Science

For outstanding service to science and to the nation in the safe, secure and peaceful use of nuclear power and in the proper and powerful application of science in important legal matters, and for wise counsel on policy issues involving science.



Joseph F. Keithley Award For Advances in Measurement Science

Joel Ullom
National Institute of Standards and Technology

For the development of ultrasensitive multi-pixel transition-edge-sensor calorimeters and spectrometers for applications in astrophysics, nuclear security, materials analysis, and metrology.

Julius Edgar Lilienfeld Prize

Albert-László Barabási
Northeastern University

For pioneering work on the statistical physics of networks that transformed the study of complex systems, and for lasting contributions in communicating the significance of this rapidly developing field to a broad range of audiences.

Lars Onsager Prize

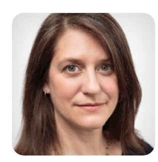
Peter Hanggi
University of Augsburg

For the development of Brownian motors and pioneering contributions to nonequilibrium statistical physics, relativistic and quantum thermodynamics.

Leo P. Kadanoff Prize

Itamar Procaccia
Weizmann Institute of Science

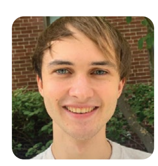
For groundbreaking contributions to statistical and nonlinear physics, including the Grassberger-Procaccia algorithm for obtaining the attractor dimension from chaotic time series, and approaches to describe complex multifractals, diffusion-limited aggregation, and polymer drag reduction in turbulent flows.



Leo Szilard Lectureship Award

Laura Grego
Union of Concerned Scientists

For significant, influential analyses of critical issues in international security and arms control, especially in the areas of missile defense, space weapons, and space security; for sustained activities educating students, colleagues, policymakers, and the public about these issues.



LeRoy Apker Award

Adam Dionne
Williams College

For the development of a novel experimental and theoretical framework to establish a new understanding of nutrient dispersal and transport in Physarum polycephalum.

LeRoy Apker Award

Matthew Cufari
Syracuse University

For verifying the Hills Mechanism as a viable method to generate repeating partial tidal disruption events.

TEAM AWARD

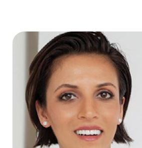
Lev D. Landau and Lyman Spitzer Jr. Award for Outstanding Contributions to Plasma Physics

For the theoretical development of the field-particle correlation technique and its application to spacecraft measurements directly showing that electron Landau damping plays a role in the dissipation of space plasma turbulence.

Christopher Chen
Queen Mary University of London

Gregory G. Howes
University of Iowa

Kristopher G. Klein
University of Arizona



Maria Goeppert Mayer Award

Prineha Narang
Harvard University

For pioneering the development of ab initio computational physics approaches to light-matter coupling and non-equilibrium dynamics and their application to the understanding, prediction and design of quantum materials.

Max Delbruck Prize in Biological Physics

Arup K. Chakraborty
Massachusetts Institute of Technology

For the leading role in initiating the field of computational immunology, aimed at applying approaches from physical sciences and engineering to unravel the mechanistic underpinnings of the adaptive immune response to pathogens, and to harness this understanding to help design vaccines and therapy.

Mildred Dresselhaus Prize in Nanoscience or Nanomaterials

Eva Andrei
Rutgers University

For the experimental exploration of the exotic properties of low-dimensional electron systems, including the discovery of the fractional quantum Hall effect in graphene and the electronic structure of twisted graphene bilayers that led to the field of moiré materials.

Neil Ashcroft Early Career Award for Studies of Matter at Extreme High Pressure Conditions

Richard G. Kraus
Lawrence Livermore National Laboratory

For extraordinary achievements and leadership within extreme high-pressure science, including novel measurements on material properties, laboratory constraints on planetary evolution, creation of complete equations of state, and the future of programmatic science.

Norman F. Ramsey Prize in Atomic, Molecular and Optical Physics, and in Precision Tests of Fundamental Laws and Symmetries

Olga Kocharovskaya
Texas A&M University

For pioneering work in quantum coherence and x-ray quantum optics.

TEAM AWARD

Oliver E. Buckley Condensed Matter Physics Prize

For innovative applications of scanning tunneling microscopy and spectroscopy to complex quantum states of matter.

J. C. Seamus Davis
University of Oxford

Ali Yazdani
Princeton University

Polymer Physics Prize

Jian Ping Gong
Hokkaido University

For outstanding contributions to the understanding of mechanical and fracture properties of hydrogels based on novel network architectures and for discovering the concept of double network gels based on internal overstressed sacrificial bonds.

Prize for a Faculty Member for Research in an Undergraduate Institution

Rae Anderson
University of San Diego

For outstanding contributions and innovative approaches to a fundamental understanding of biopolymer composite dynamics and highly impactful research opportunities and physics training to a diverse set of undergraduate students.

Richard A. Isaacson Award in Gravitational-Wave Science

Emanuele Berti
Johns Hopkins University

For contributions to gravitational-wave science through groundbreaking studies of black hole quasinormal modes, higher multipole radiation, astrophysical detection rates, spin evolution, and tests of general relativity, and for leadership in preparing impactful white papers and review articles.

Robert R. Wilson Prize for Achievement in the Physics of Particle Accelerators

Alex Dragt
University of Maryland, College Park

For pioneering contributions to the development and application of Lie methods in accelerator physics and nonlinear dynamics.

Rolf Landauer and Charles H. Bennett Award in Quantum Computing

Nathalie de Leon
Princeton University

For substantial contributions to the field of experimental quantum information science with an emphasis on materials discovery and enhancement, and using materials to enable improved coherence across a wide range of physical platforms for quantum computing, sensing, and communication.

TEAM AWARD

Stanley Corrsin Award

For seminal and visionary contributions to the development of immersed boundary methods, and for elegantly applying these methods to reveal the physics of a wide variety of fluid flows in complex geometries, including animal locomotion and heart flows.

Rajat Mittal
Johns Hopkins University

Roberto Verzicco
University of Rome Tor Vergata

Stuart Jay Freedman Award in Experimental Nuclear Physics

Ronald Fernando Garcia Ruiz
Massachusetts Institute of Technology

For novel studies of exotic nuclei using precision laser spectroscopy measurements, including the first spectroscopy of short-lived radioactive molecules.

Thomas H. Stix Award for Outstanding Early Career Contributions to Plasma Physics Research

Jonathan Squire
University of Otago

For theoretical contributions to our understanding of plasma waves and turbulence in astrophysical plasmas and the solar wind, and for the discovery and characterization of a broad class of instabilities in dusty astrophysical plasmas.

Tom W. Bonner Prize in Nuclear Physics

Jen-Chieh Peng
University of Illinois, Urbana-Champaign

For pioneering work on studying antiquark distributions in the nucleons and nuclei using the Drell-Yan process as an experimental tool, and for seminal work on elucidating the origins of the flavor asymmetries of the light-quark sea in the nucleons.

TEAM AWARD

W.K.H. Panofsky Prize in Experimental Particle Physics

For leadership and technical ingenuity in achieving a measurement of the muon anomalous magnetic moment with a precision suitable to probe Standard Model mediated loop diagrams and possible manifestations of new physics, which inspired a vibrant synergy between experimental and theoretical particle physics to determine a comparably precise Standard Model prediction and interpret the implications of a possible discrepancy.

William M. Morse
Brookhaven National Laboratory

Bradley Lee Roberts
Boston University

Dissertation Awards

Andreas Acrivos Dissertation Award in Fluid Dynamics

Daphné Lemasquerier
University of Texas

For an insightful and comprehensive study, based on innovative and elegant laboratory experiments, numerical analysis and theoretical modelling, of the non-linear dynamics of Jupiter, including its shallow vortices, deep jets and their complex interactions.

Carl E. Anderson Division of Laser Science Dissertation Award

Christoper Panuski
Massachusetts Institute of Technology

For extraordinary work that has significantly advanced the field of optics, precision measurement, and electro-optic device; in particular, such research accomplishments are milestones on the road to the control and measurement of complex optical fields.

Award for Outstanding Doctoral Thesis Research in Biological Physics

Jonathon L. Yuly
Duke University

For showing that a universal free energy landscape underpins near-reversible electron bifurcation reactions and assures their high efficiency for transducing energy without short-circuiting, thus addressing a central puzzle in molecular bioenergetics that had persisted for over 50 years.

Dissertation Award in Statistical and Nonlinear Physics

Adrian Van Kan
University of California, Berkeley

For outstanding contributions to the understanding of quasi-two dimensional turbulence, demonstrating the presence and nature of phase transitions in such systems using a combination of simulations, modeling and stochastic methods with applications to geophysical flows.

Dissertation Award in Nuclear Physics

Agnieszka Sorensen
University of Washington

For an innovative approach to study the speed of sound in dense nuclear matter using moments of baryon distributions and developing of a framework of simulations and modeling of QCD phases and transitions in nucleus-nucleus collisions.

Dissertation Award in Nuclear Physics

Aobo Li
University of North Carolina, Chapel Hill

For the invention of a novel machine learning algorithm that broke down significant technological barriers with monolithic liquid scintillator detectors and, in turn, delivered the world's most sensitive search for neutrinoless double beta decay.

Deborah Jin Award for Outstanding Doctoral Thesis Research in Atomic, Molecular, or Optical Physics

Harry Levine
Harvard University

For ground-breaking contributions to the realization of programmable quantum simulators and quantum information processing based on Rydberg atom arrays.

Marshall N. Rosenbluth Outstanding Doctoral Thesis Award

Alison Ruth Christopherson
Lawrence Livermore National Laboratory

For theories of fusion alpha heating and metrics to assess proximity to thermonuclear ignition in inertially confined plasmas, and for the development of a novel measurement of hot electron preheat and its spatial distribution in direct-drive laser fusion

Nicholas Metropolis Award for Outstanding Doctoral Thesis Work in Computational Physics

Mark Turiansky
University of California, Santa Barbara

For the development of novel computational techniques that enable the study of point defects in semiconductors entirely from first principles, and their application to spin centers and single photon emitters for quantum information science.

Richard L. Greene Dissertation Award in Experimental Condensed Matter or Materials Physics

Tiarnan A.S. Doherty
University of Cambridge

For characterizing nanostructure and understanding its influence on phase stability and performance in Halide perovskites.

Richard L. Greene Dissertation Award in Experimental Condensed Matter or Materials Physics

Suraj Cheema
University of California, Berkeley

For atomic-scale design of ferroelectricity and negative capacitance in ultrathin HfO_2-ZrO_2 films on Si.

Fellowships

APS GENERAL

Ling Miao
APS Journals

DAMOP

Andrew D Ludlow
National Institute of Standards and Technology

Arvinder Sandhu
University of Arizona

Ehud Altman
University of California, Berkeley

Giovanna Morigi
Universität des Saarlandes

Hui Zhai
Tsinghua University

José R. Crespo López-Urrutia
Max-Planck-Institut für Kernphysik

Weiping Zhang
Shanghai Jiao Tong University

Wes Campbell
University of California, Los Angeles

DAP

Anna Frebel
Massachusetts Institute of Technology

Eve Ostriker
Princeton University

Juan Estrada
Fermilab

Kevork Abazajian
University of California, Irvine

Mustapha Ishak-Boushaki
University of Texas at Dallas

Paul Martini
Ohio State University

Smadar Naoz
University of California, Los Angeles

DBIO

Greg Stephens
Vrije Universiteit Amsterdam

Olga Dudko
University of California, San Diego

Roya Zandi
University of California, Riverside

Thomas Gregor
Princeton University

DCMP

Alexander Levchenko
University of Wisconsin, Madison

Andrei B. Bernevig
Princeton University

Di Xiao
University of Washington

Fabrizio Carbone
Ecole Polytechnique Federale de Lausanne

Frank Koppens
ICFO, The Institute of Photonic Sciences

Kenneth Burch
Boston College

Liang Fu
Massachusetts Institute of Technology

Lu Li
University of Michigan

Maia Garcia Vergniory
Max Planck Institute

Nuh Gedik
Massachusetts Institute of Technology

Oskar Vafek
Florida State University

Philip Hofmann
Aarhus University

Roman Lutchyn
Microsoft Corp.

Sumathi Rao
Harish-Chandra Research Institute

DCOMP

Eva Zurek
State University of New York, Buffalo

Gang Zhang
Agency for Science, Technology and Research

Gianaurelio Cuniberti
Technische Universität Dresden

Jorge Iniguez
Luxembourg Institute of Science and Technology

Yugui Yao
Beijing Institute of Technology

DCP

David Mazziotti
University of Chicago

Scott Kable
University of New South Wales

Prashant K. Jain
University of Illinois, Urbana-Champaign

DFD

Arezoo Ardekani
Purdue University

Eva Kanso
University of Southern California

Jean-Luc Thiffeault
University of Wisconsin, Madison

Jose Gordillo
Universidad de Sevilla

Nicholas T. Ouellette
Stanford University

Paulo Arratia
University of Pennsylvania

Tamer A. Zaki
Johns Hopkins University

Wolfgang Schröder
RWTH Aachen University

DGRAV

Keita Kawabe
California Institute of Technology

Nicolas Yunes
University of Illinois, Urbana-Champaign

Raymond Frey
University of Oregon

Stephon Alexander
Brown University

DLS

Nir Davidson
Weizmann Institute of Science

Shuang Zhang
The University of Hong Kong

Tara Fortier
National Institute of Standards and Technology

DMP

Angela Hight Walker
National Institute of Standards and Technology

Christoph M. Boehme
University of Utah

James Hone
Columbia University

Jiwoong Park
University of Chicago

Lena Kourkoutis
Cornell University

Mark Rzchowski
University of Wisconsin, Madison

Ni Ni
University of California, Los Angeles

DNP

Andrew W. Steiner
University of Tennessee

Bjoern P. Schenke
Brookhaven National Laboratory

Carla Frohlich
North Carolina State University

Claude Pruneau
Wayne State University

Daniel W. Bardayan
University of Notre Dame

Huey-Wen Lin
Michigan State University

Libby McCutchan
Brookhaven National Laboratory

Michael Kohl
Hampton University

DPB

Alexei Fedotov
Brookhaven National Laboratory

Daniela C Leitner
Lawrence Berkeley National Laboratory

Srinivas Krishnagopal
Centre for Excellence in Basic Sciences

DPF

Alysia D. Marino
University of Colorado

Evelyn Thomson
University of Pennsylvania

Jodi Ann Cooley
Southern Methodist University

Junjie Zhu
University of Michigan

Maxim Pospelov
University of Minnesota

Michael D. Hildreth
University of Notre Dame

Per Kraus
University of California, Los Angeles

Radu Roiban
Pennsylvania State University

Vittorio Paolone
University of Pittsburgh

Zoltan Fodor
Pennsylvania State University

DPOLY

Friederike Schmid
University of Mainz

LaShanda Korley
University of Delaware

Lei Zhu
Case Western Reserve University

DPP

Andrea L. Kritcher
Lawrence Livermore National Laboratory

Craig Kletzing
University of Iowa

Franklin Dollar
University of California, Irvine

Louise Willingale
University of Michigan

Matt Landreman
University of Maryland, College Park

Michael Van Zeeland
General Atomics, San Diego

Nuno F. Loureiro
Massachusetts Institute of Technology

Ronnie Shepherd
Lawrence Livermore National Laboratory

DQI

David I. Schuster
University of Chicago

Gloria Platero
Consejo Superior de Investigaciones Científicas, Madrid

Lieven Mark Koenraad Vandersypen
Delft University of Technology

Rolando D. Somma
Los Alamos National Laboratory

Steven T. Flammia
Amazon

DSOFT

Devaraj Van Der Meer
University of Twente

Eric R. Dufresne
ETH Zurich

Lynn Walker
Carnegie Mellon University

Rae Anderson
University of San Diego

FDI

Nicole M. Lloyd-Ronning
Los Alamos National Laboratory

Ramón Barthelemy
University of Utah

Shobhana Narasimhan
Jawaharlal Nehru Centre for Advanced Scientific Research

FED

Alfonso M. Albano
Bryn Mawr College

Crystal Bailey
American Physical Society

Juan Burciaga
Colorado College

Laird Kramer
Florida International University

Mitchell R. Wayne
University of Notre Dame

Paul Woafo
University of Yaounde

FHPP

Clayton Gearhart
Saint John's University, CSB+SJU

Dava Sobel
Author

Joseph D. Martin
Durham University

FIAP

Daniel Worledge
IBM Research, Almaden

Donnell Walton
Corning Inc.

Eric Pop
Stanford University

Matthew C. Thompson
Zap Energy Inc.

Michael Johnston
University of Oxford

Mona Jarrahi
University of California, Los Angeles

Siddharth Ramachandran
Boston University

Zetian Mi
University of Michigan

FIP

Chong-Sun Chu
National Tsing Hua University

Jaehoon Yu
University of Texas at Arlington

Maria Longobardi
University of Basel

Wague Ahmadou
University Cheikh Anta Diop

YiFang Wang
Institute of High Energy Physics

FOEP

Emily Edwards
University of Illinois, Urbana-Champaign

Michael Albrow
Fermilab

Robert Nemiroff
Michigan Technological University

FPS

Ibiyinka Fuwape
Michael and Cecilia Ibru University

Jean Bio Chabi Orou
Institut de Mathématiques et de Sciences Physiques

Mary Hockaday
Los Alamos National Laboratory

Richard P. Taylor
University of Oregon

GDS

Jesse Thaler
Massachusetts Institute of Technology

Rama Vasudevan
Oak Ridge National Laboratory

GFB

Or Hen
Massachusetts Institute of Technology

GHP

Andrei Alexandru
George Washington University

Renee Fatemi
University of Kentucky

GIMS

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Massachusetts Institute of Technology

Leo Gross
IBM Research, Zurich

GMAG

Jonathan R. Friedman
Amherst College

Kyung-Jin Lee
Korea Advanced Institute of Science and Technology

Sergio O. Valenzuela
Institut Catala de Nanotecnologia

GMED

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University of Wisconsin,Madison

GPAP

Justin C. Kasper
BWX Technologies, Inc.

GPC

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University of Exeter

Michael Ghil
University of California, Los Angeles

GPER

Marcos Daniel Caballero
Michigan State University

GPMFC

Michael Tarbutt
Imperial College London

GSCCM

Malcolm McMahon
University of Edinburgh

GSNP

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University of Houston

Santo Fortunato
Indiana University Bloomington

Srikanth Sastry
Jawaharlal Nehru Centre for Advanced Scientific Research

Seeking Nominations

APS is seeking nominations for APS prizes and awards to recognize achievements in research, education, and public service. APS awards are open to all members of the scientific community.

APS especially encourages nominations of individuals belonging to groups underrepresented in physics, including women, LGBT+ people, disabled people, people from outside the U.S., and Black, Indigenous, and Hispanic people and other people of color.

Learn more at:
aps.org/programs/honors

Rosner continued from page 1

in Germany, I had a subscription to this monthly magazine called *Kosmos* — it covered all sciences, and I loved it. I would get their science kits; I built stuff all the time.

When I came to the States, at 12, I continued that — devouring science magazines, building stuff. In high school, I took regular physics, AP physics; I took regular math, calculus, advanced math. I loved it all.

What was physics in college like for you?

Brandeis was a relatively young school, but it had a fantastic physics faculty and a small cohort of physics majors. It was an amazing experience for me; the die was cast.

But I also learned that I was not cut out to be an experimentalist. I was a danger in the lab. Once, I was working in a lab as an undergrad, and I was wiring this instrument — a big metal chassis, maybe three feet by two feet. I had it propped up in front of me on the bench. I was soldering some junctions, but I was klutzy, and the whole thing fell toward me. It was heavy — 60 or 70 pounds. I couldn't get my hand out of the way fast enough. The chassis pushed the soldering gun into my cheek.

Did it leave a scar?

I had a scar for years. I branded myself.

How did your interests evolve in graduate school?

At Harvard, I discovered what I really liked to do. As a theorist, though, they'd make you take a course to show you what experiments were about. I viewed that as punishment. So I picked a project with an experimentalist named Paul Horowitz, who was working northwest of Cambridge, at an observatory with an optical telescope, looking at the Crab pulsar.

In January, I drove out there in my Volkswagen bug. My job was to go up to the prime focus of this telescope, outside, where the photomultiplier detector was. Paul would say on the intercom, "Bob, can you wiggle the wire?" It was 1:00am, minus 20 degrees. I thought, "Now I know for damn sure: I'm never, ever in this business."

Strictly theory.

Theory, yes! After that, I got interested in fluid dynamics and plasma physics.

At the University of Chicago, I continued doing astrophysics but also returned to just the physics part. My physics was divided between fluid dynamics and plasma physics related to terrestrial laboratories, and the same physics, but applied to astronomy.

Let's turn to a big challenge facing physics — public skepticism of science. What role do you think physicists have in tackling this?

Historically, physicists played a big role in public policy; witness what happened during World War II or the Cold War. While I think the physics community continues to be an invaluable source of expertise, there's been a long-term trend toward skepticism of expertise in general — not just science. Particularly worrisome is the potential partisan nature of this skepticism.

How all that's dealt with best is, itself, a research question. And we as physicists have to do more to engage with folks who have thought deeply about this problem.

We have to play a bigger role in training ourselves to speak to the public. And we have to support folks in all science fields that have something to say about policy. This is a tall order. But APS has a project already ongoing in this direction, the Science Trust Project. I want to strongly support that.

And APS is a member organization. Our members are real people. So I think we can drive this process of engaging the public in a way that hasn't been done before.

In a 2020 *UChicago News* article, you expressed concern about physics' lack of diversity. Only 20% of physics doctoral degrees go to women; only 6% go to Black, Indigenous, and Hispanic people. Why and how should APS work to improve this?

One reason is the health of the discipline itself. To do physics well, you need to be smart, and being smart doesn't depend on sex or race or ethnic background. There are smart people everywhere, and we need to attract them; if we push people away, that's a detriment to the field. We are poorer for not engaging everyone.

There are initiatives that my predecessors put in place — Jim Gates' initiative, DELTA-PHY, for example — that I want to push forward. One of the things I've discussed with him is whether we can form closer relations with physics societies whose members may not have felt represented within APS. We need to figure out how APS and these societies can help each other. If it's not a win for all sides, it's dead on arrival.

What else is on your radar, as APS President, for 2023?

We have this incredible transition to open access journals; we have to weather that well. We're also looking at our organization itself: There's a task force on committees, led by Peter Schiffer, that will address how we should operate in a more efficient, effective way.

And we're going to build stronger relations with our sister science societies, like AAAS and AIP, and the societies that are members of AIP. This goes to the heart of how we, as science societies, are looked at by the public, including the political world.

What questions in physics are you excited about?

My own hobby horse — the question I'm interested in — is, where the heck are cosmic magnetic fields from? Why are they so ubiquitous? Have they existed right from the Big Bang, before photons decoupled from matter, or only afterwards? Why do all these galaxies and stars have magnetic fields? I've pondered that for many years.

You're also quite involved in energy policy. What interests you in this space?

Climate change is driving us to change our energy systems, and the question is how to do that in a way that works not just technically, but economically. One hundred years from now, what will things be like? We could be building new kinds of nuclear fission reactors, safer ones, and dealing effectively with nuclear waste; perhaps we might even manage controlled fusion on an industrial scale, building fusion power reactors. Can nuclear power compete economically with wind and solar power coupled to grid-scale storage?

We don't know, and that means we have to explore everything. During these next few decades, we're going to find out the answers to these questions. And then we have to act — we have to go for it.

> "Climate change is driving us to change our energy systems . . . One hundred years from now, what will things be like?" — Rosner

Taryn MacKinney is the Editor of APS News.

Fruit Flies continued from page 2

But even as scientists turned their attention to mammals, the fruit fly work continued. In 1952, the military established the Space Biology Laboratory at Holloman Air Force Base near White Sands to coordinate the animal studies. Mallan writes of how laboratory head Major David Simons spent hours painstakingly transferring flies one by one with tweezers into bottles to send up in rockets. "After you stare enough fruit flies straight in the eye, you start to have hallucinations. I'm beginning to think I can see their eyelashes," Simons said.

Over the next several decades, studies showed that fruit flies sent to or born in space died earlier, accumulated more genetic mutations, and had damaged sperm and impaired immune systems when compared to earthbound flies. In the 2010s, NASA sent several waves of flies to the International Space Station; when they returned, experiments found that the flies' hearts had changed shape and were worse at pumping blood. Others revealed that the flies' central nervous systems were altered by spaceflight, and that artificial gravity helped temper some of the effects.

The humble fruit fly — the first animal sent up in space.

Today, NASA regulates how much radiation astronauts can receive over their careers. Scientists have recommended the agency revise its guidelines as it looks towards returning humans to the moon in 2025, for the first time since 1972. Researchers are still trying to understand how radiation and low gravity will affect those astronauts. When NASA's Orion capsule orbited the moon for several weeks this past November and December, two mannequins with radiation monitors embedded in their artificial organs, as well as yeast cells to be studied for genetic mutations, were onboard. This time, the fruit flies were kept on Earth.

Tess Joosse is a science journalist based in Madison, Wisconsin.

TEAM-UP Together Announces First Scholarship Recipients

In December 2022, TEAM-UP Together, a partnership between five organizations, announced scholarships for 31 African American students in physics and astronomy. Each recipient will receive $10,000 for the 2022-23 academic year, as well as mentorship, research experiences, and a supportive community.

The TEAM-UP Together scholarship program, sponsored by the Simons Foundation International, aims to reduce the financial barriers that prevent many Black students from completing their undergraduate education in the field. It is a partnership between the American Association of Physics Teachers, the American Astronomical Society, the American Institute of Physics, the American Physical Society, and the Society of Physics Students.

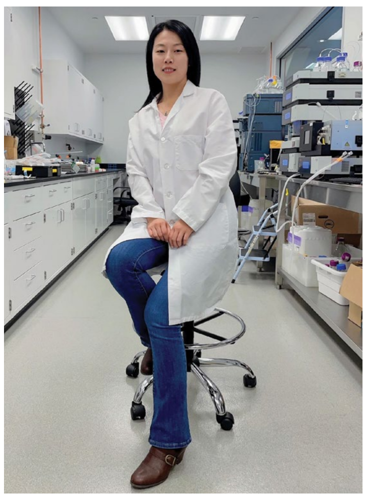
Applications for the next round of scholarships are due March 15. Learn more at www.spsnational.org/scholarships/teamup.

Impossible Foods from page 2

says. In 2019, a life-cycle analysis by a third-party consultant, Quantis, found that the Impossible Burger (now called Impossible Beef) uses 87% less water and 96% less land, and produces 89% fewer greenhouse gas emissions, than a beef patty.

That's important to Yan. "The mission is what really drives a lot of us working here," she says. "It's beyond just a job. ... It is more [about] being able to use what I know, and the science, [to] make an impact. That's very inspiring for me."

Alaina G. Levine is a professional speaker, STEM career coach, and author of the books Networking for Nerds *(Wiley) and* Create Your Unicorn Career *(forthcoming).*



Huan Yan, a chemical physicist at Impossible Foods. Credit: Huan Yan

Honeybees from page 3

the windy conditions that we're producing," he says. "We thought, 'That can't be. There has to be something going on.'"

So, Hejazi dug deeper into the data, examining exactly when the bees were speeding up and slowing down. He found that bees took a long time to accelerate, but they braked rapidly when making sharp turns, like a car that slows down around a curve. This pattern is called a flight-crash event, and it also occurs in fluid turbulence.

Further calculations showed that in conditions without wind, the bees tended to fly straight and turn sharply. But in wind, the bees didn't fly straight at all. Instead, they constantly made turns and performed evasive maneuvers. Hejazi says he could see these behaviors during the experiments, too.

"They had this really disturbed type of flight when they were trying to fight against the wind," he explains, adding that similar movements have been observed in bacteria and fruit flies.

"It's interesting to see that it's kind of universal across different scales, different systems," he says. "I was surprised."

Understanding how insects like honeybees fly may help engineers design drones and other robots that can maintain their speed and control as they move. But for now, Hejazi wants to expand his research and study how bees fly in relation to each other.

"How do they know not to bump into each other?" he asks. "What mechanisms do they use to identify each other? ... Learning as much as we can about how they fly and how they behave with each other — that's really helpful."

Hejazi and his colleagues manufactured turbulence using four fans behind a grid array with movable flaps. Credit: Bardia Hejazi

Margaret Osborne is a freelance writer based in Utah.

THE BACK PAGE

Taking the "Childlike" Out of Childlike Wonder

Kids are natural scientists. Why aren't more adults?

BY ASA STAHL

A graduate student is about to share his work in front of a live audience. He feels nervous, intimidated, and a little unprepared. His listeners have high standards and will not hesitate in their criticism.

They are, at most, six years old.

That was the first time I read my pop astronomy picture book, *The Big Bang Book*, to a group of children. Though it went well, what stuck with me most is the deluge of questions that came after the reading. In half an hour, a class of first-graders asked me more about astronomy than every adult I have met has, combined, over the course of my entire PhD.

I walked away from that school trying to understand why. If the common wisdom is that children are natural scientists, then what changes as they grow older?

I often see adults excited to meet physicists but unsure how to engage them. Some cast about for questions and come up empty, others think of questions but hold back for fear of looking ignorant, and many, though they like the idea of physics, will avoid it entirely because they see the field as closed to them.

The first-graders, on the other hand, were used to not knowing. The only obstacle they faced was shyness. Asking questions came naturally to them; they just had to be shown a little of what science has taught us to become excited about what they could learn.

Asa Stahl Credit: Brandon Martin

Yet children don't wonder about the world more than adults — so why don't adults ask more questions?

I believe that we, as scientists, have too zealously staked our territory. In our effort to be known for providing answers, we have also defined ourselves as the only ones who ask questions.

There are two reasons for this. First, we mainly sell physics to adults through what our field can explain and do. Science communicators, understandably, focus on physics' achievements, like the recent milestone of fusion ignition or the launching of Artemis I. We take the most exciting projects, describe them accessibly, and hope that it will not only momentarily engage people, but convert them into curious nerds like us — or at the very least, make them root more eagerly for science in the future.

At the same time, we are afraid of showing weakness. If the public frequently misinterprets our explanations, the thinking goes, then communicating what we don't know could be even more disastrous. With every admission of uncertainty, debate, or ignorance, we could undermine our field's authority.

Both these tendencies have profound drawbacks. Presenting results with overconfidence (or worse, defensiveness) can backfire because it builds distrust, as we saw during the pandemic. It's true that some people will seize on any description of scientific uncertainty as evidence that none of us know anything — but that audience probably isn't going to be convinced no matter what we say. On the contrary, playing it straight with the public could lead fewer people to become alienated.

At the same time, touting what physics has accomplished may attract interest in what we do — especially when it comes to momentous events, like the discovery of the Higgs boson — but it often confines science communication to neat explanations. In focusing on what we have learned, we risk presenting physics as a closed book. We lose the appeal of the unknown.

That sense of mystery and inquiry is the soul of physics, and it presents our best means of engaging the public. A professional physicist may have knowledge that a layperson doesn't, but the two probably share some of the same questions. That's common ground we can build on.

In this light, what we don't know as physicists is not a liability — it's a resource for relating with the public. The questions of physics are fundamental and universal, with a basic claim to everyone's imagination. I remember, as a third-grader, seeing a poster in my math classroom that asked, "What shape is the universe?" The diagrams of outer space, fit within spheres, toruses, and saddles, boggled my mind. At that age, the world seemed immutable and so intentionally run by adults. How could grown-ups not know the answer to such a simple question?

Those gaps in knowledge let wonder into our lives. The more we can outline the frontiers of scientific understanding to the public, the better chance we have of connecting them with what we care about, and of closing the gap between scientists and laypeople.

If we can accomplish this, it won't just be a victory for science communication. Our field is a shared endeavor for all humanity, meaning it progresses only as much as it's widely understood. The work isn't done until anyone who wants to can understand both the discoveries of physics and its mysteries.

That means we must reorient how we communicate science to strike a better balance between questions and answers. Whether a listener is six years old or sixty, we lose an opportunity when we pretend to know everything. Instead, we ought to show confidence in what we do know and excitement about what we don't. Most of all, it means relinquishing some of our authority as scientists, taking a step down from the pedestal we've placed ourselves on, and admitting we are still learning — so that everyone else can feel comfortable learning, too.

I believe that we, as scientists, have too zealously staked our territory. In our effort to be known for providing answers, we have also defined ourselves as the only ones who ask questions.

Asa Stahl is a doctoral candidate in astrophysics at Rice University and the author of the award-winning children's book, The Big Bang Book. *He was a 2022 AAAS Mass Media Fellow for* Science News; *his fellowship was sponsored by APS.*

March Meeting continued from page 1

hen of Berkeley, California, wrote that one casino manager reportedly said of the 1986 meeting attendees, "They came with a single twenty dollar bill and one shirt, and they changed neither."

Past March Meeting chair David Campbell says physicists have a long history of trying to beat the odds in Las Vegas. In the 1970s, several doctoral students from the University of California, Santa Cruz, applied chaos theory to roulette, using a computer embedded in a shoe. The group scored a 44% advantage over the casino — odds that a typical gambler never sees.

The in-person March Meeting will feature thousands of talks, as well as vibrant special sessions, including prize sessions and events inspired by the 2022 Nobel Prize in Physics. And this year's Kavli symposium, scheduled for March 5, is called "Frontier Physics from the Atomic to Astronomical Scales."

In-person attendees can also plan to connect with the vibrant host city, says Smitha Vishveshwara, chair of this year's March Meeting. The planning team is collaborating with physicist and circus performer Julia Ruth, a Vegas local, to showcase the area's performance artists at several meeting events. Like performance artists, Vishveshwara says, physicists use "creativity and rigor to discover and bring to life worlds that beguile the imagination."

Attendees of this year's virtual March Meeting won't square off with casino house odds, but they'll have access to excellent online events, including live keynote talks and poster slams, as well as live presentations drawn from abstracts *not* presented in Las Vegas. Virtual attendees will be able to submit questions in real time to presenters, both at talks and poster slams. Meanwhile, exhibitors will offer live workshops online, and attendees will be able to message companies and request private meetings.

Every March Meeting 2023 attendee — virtual and in-person — will have unlimited access to recorded talks and all ePosters via the virtual meeting platform until late June.

This year's dual format was recommended by the APS Committee on Scientific Meetings, which collected feedback after last year's hybrid March Meeting. "Our physics community, and the entire world, is still trying to find its feet in this post-pandemic world," says Vishveshwara. "Patience and adaptability, along with our colossal planning efforts, will tell us what format works best."

APS has also rolled out a new, tiered registration fee structure for the March Meeting and April Meeting, with the goal of reducing the financial barrier to attendance that affects many physicists and students around the world.

APS encourages attendees to review the meeting's COVID-19 information and Code of Conduct. Learn more about March Meeting 2023 at march.aps.org.

Liz Boatman is a staff writer for APS News.

Opinion articles on the Back Page are member commentary; their views are not necessarily those of APS. To respond to an opinion piece or pitch your own (we welcome both), email letters@aps.org.