2016 APS General Election

Voting will be open from June 20 to July 29, so watch for an email with information on voting procedures. Those who are elected will begin their terms on January 1, 2017. Information on voting, and the candidates’ statements and biographical information, are available at http://go.aps.org/aps-vote-2016

Vice President

David Gross, University of California, Santa Barbara

“I have been a member of the APS for over 50 years and have benefited from its journals, its meetings and its role as the premier physics society in the advocacy of Physics. As Vice-President I would seek to continue and strengthen the role of the society in serving the community of physicists, informing the public and encouraging public support for science.”

David A. Weitz, Harvard University

“My goal in this position will be to work tirelessly for, and with, the members of our Society …. Research budgets are destined to remain approximately flat for the foreseeable future. Nevertheless, we must work to convince our political leaders of the value of our work.”

ELECTION continued on page 7

Careers Report

Serving the Next Generation of Physicists at APS Meetings

By Crystal Bailey, APS Careers Program Manager

According to the AIP Statistical Research Center, less than a quarter of physics Ph.D. graduates will end up in permanent faculty jobs (1). And even though many well intentioned mentors would like to prepare their students for eventual careers outside of academia, many do not have networks or experience to do so, especially for careers in the private sector.

In bringing together so many physicists across all subfields and sectors, APS meetings present a great opportunity to bridge that gap. Students often have questions about private-sector careers, such as how the culture differs from that in academia, what kinds of problems physicists are working on, and what extra preparation they might need to do well. APS provides an opportunity for students to get answers to these questions through informal Q&A panels with industry physicists at our annual and division meetings.

For example, the 2016 APS March Meeting included a special panel focused on careers in industry, “Meet Your Future: An Interactive Session on Industrial Careers for Physicists,” at which several physicists from industry answered questions. At this session Barbara Jones, current chair of the 2015 Nobel Prize in Physics

Kavli Session Celebrates Neutrino Physics

By David Voss

2016 APS April Meeting —

This year’s Fred Kavli Keynote Session at the APS April Meeting in Salt Lake City featured two Nobel laureates and a retrospective on the life of a physicist who many feel would have shared the prize had he been alive. The occasion was the 60th anniversary of the first detection of neutrinos by Clyde Cowan and Frederick Reines. Speakers Arthur McDonald, professor emeritus at Queen’s College in Kingston, Ontario, took the audience on a journey to the Sudbury Neutrino Observatory, where he led one of the teams that showed neutrinos changing from one flavor to another. He started by mentioning the observation by Cowan and Reines of antineutrinos from the nuclear reactor at the Savannah River power plant in South Carolina in 1956, but the neutrino oscillation story really starts with measurements of solar neutrinos from the sun led by Ray Davis in the late 1960s. The solar neutrino flux measured was three times lower than what John Bahcall had predicted.

The solar neutrino problem

McDonald explained that one of the ideas proposed to resolve this neutrino deficit was to assume that

Kavli continued on page 4

Research News: Editors’ Choice

A Monthly Recap of Papers Selected by the Physics Editors

Shine Bright Like a Firefly

Taking inspiration from fireflies, scientists have fabricated an organic light-emitting diode (OLED) with a complex surface pattern that improves the output efficiency by 61% compared to a smooth surface. Fireflies signal potential mates by emitting light from a photogenic region on their abdomens, the most efficient bioluminescent organ known. This organ has a specially patterned outer shell, or cuticle, with micrometer-scale tile-like features, as well as nanosized linear ridges. These surface structures help light escape from the cuticle to the air. While previous work focused on a single type of cuticle structure, Jeong et al. (Nano Letters 16, 2994) have investigated the hierarchical combination of micro- and nanostuctures. They imaged the cuticles of male fireflies (Pyrocoelia rufa) and showed that the hierarchical structure reduced internal reflection. The team reproduced the firefly cuticle pattern in a UV resin that they placed on top of an OLED.

Fireflies have a patterned light-emitting region (left) that can be copied in light-emitting diodes to improve efficiency.

Firefly Lantern

Bioinspired LED

BOUCHET continued on page 6

In Memoriam Peter Adams

Page 5

WWW.APS.ORG/PUBLICATIONS/APSNEWS
“If this is really true, then it would possibly be the exciting thing that I have seen in particle physics in my career — more exciting than the discovery of the Higgs itself.”

Coda Caki, Cornell University.

New York Times, May 2, 2016, on the mysterious 750 GeV signal seen at CERN.

“It’s taken as an insult if a physi- cist is considered too philosophical. Most physicists think that philoso- phers just sit in their armchairs and think. Physicists are very down-to- earth, empirical people. They don’t want to think hard about what it all means or where it all comes from.”


“Next Gen ... is the first [set of] scientific standards that I am aware of where scientists actually had an input in designing the standards.”


“Physics isn’t what I do; it is what I do.”


“He was not just looking for a convenient way to do these calcula- tions,” Langer said. He sought “the truth of the situation.”


“You know, the facts speak for themselves. It’s like you’ve got a hospital and you’re not bothering to check if your doctors are using antibiotics or bloodletting.”


“I don’t watch the show with a pad of paper and calculator,” he said. “If they get the science right, it’s like an Easter egg hidden in the story.”

James Kalafatis, University of Minnesota, Tech Insider, April 26, 2016, on the science in the TV show “The Flash.”

“I remember pleading with my family ‘Let’s try not to fold ... If we fold, we don’t have anything’.”

Xiaoxing Xi, Temple University. 60 Minutes, May 13, 2016, on the pressures of the new-dropped esper- onage case against him.

“I think Harry was happiest when he was running one of his workshops and getting on the ground with the kids building mod- els of buckyballs.”

Mark Riley. Florida State University, New York Times, May 4, 2016, on the death of Harold Kroto, co-discoverer of buckminsterfullerene.

“I am lucky enough to have a successful private company where I don’t have to answer to anyone else for what I do, so I can do crazy projects like that.”

Stephen Wolfram. Wolfram Research. cnbc.com, April 7, 2016, on his Wolfram/Alpha search engine.

“Scientists of the past were not just like scientists of today who didn’t know as much as we know. They had completely different ideas of what there was to know, or how you go about learning it.”


Members of the Media

This Month in Physics History

June 1785: Coulomb Measures the Electric Force

By Richard Williams

Around 600 BC, the Greek philosopher Thales wrote that when he rubbed pieces of amber with fur, he observed attracted bits of straw and other small objects. When scientists began to study the phenomenon, they already had a word for it, thanks to Thales’ “electricity,” derived from “elektron,” the Greek word for amber. In studying this force, others observed that charged objects sometimes attract one another and sometimes repel. Twenty- three years later, in 1768, Benjamin Franklin attributed this effect to the existence of two electrical fluids, one positive and the other negative.

Much of the modern physical description of electric forces comes from careful experiments done by the French scientist Charles Augustin Coulomb (1736-1806).

His parents came from wealthy families liv- ing near Montpellier [1], and they moved to Paris when Coulomb’s father began work there. Coulomb earned a degree at the engineering school at Mezières and became a lieutenant in the military engineering service. As a trained army engineer, he received several assign- ments in France. In 1764, Coulomb was sent to Martinique to supervise the construction of a fort. Coulomb oversaw the construction from 1764 to 1772, and then he returned to France. His health, impaired by the tropical ailments of Martinique, would trouble him for the rest of his life. With his return, his attention also shifted — after many projects in engineering, he began to work on pure physics.

Coulomb became interested in measuring the electrical force between small charged objects and perfected a torqued balance which could reliably measure such small forces [2]. He suspended a needle on a fiber of silver, copper, or silk. The needle held a small charged object known as a pith ball at one end and a counterweight at the other end, balanced so that the needle could oscillate in a horizontal plane. The calibrated torsion bal- ance measured the force needed to twist the needle through a given angle. By bringing a similarly charged pith ball near the end on the needle, Coulomb determined the repulsive force between the charged balls as a func- tion of their separation. With these experiments, he launched the quantitative study of electric force.

He wrote “The repulsive force of two small globes with the same nature of electricity is inversely propor- tional to the square of the distance between the centers of the two globes.”

When the two pith balls had charges of opposite sign, the experiment described above did not work well. If the balls came too close to one another, they would jump together and stick, ending the experi- ment. With difficulty, he did measure the relation between force and separation in this case, but he decided to use a completely independent method to confirm the result [3]. He suspended a needle with a small plate on one end, and the plate was charged. The opposite charge was placed on the surface of a hollow sphere of copper or metal- coated cardboard, about a foot in diameter. Coulomb assumed that the large sphere would behave as if its charge were concentrated in a point at its center. The needle was made to oscillate in a narrow arc in the hori- zontal plane. The period of oscil- lation depended on the force between the charged sphere and the charged plate on the needle, just as the period of the ordinary simple pendu- lum depends on the force exerted by gravity. Coulomb then measured the oscillation at various dis- tances from the large sphere and, using an equation simi- lar to that for the pendulum, he related the period to the force between the charges.

The result: Coulomb’s law [3]. “We have arrived here by a method absolutely different from the first ... to confirm the existence of the electric fluid called ‘positive’ for the electric fluid, ordinarily called ‘negative,’ is as the inverse square of the distance.” He went on to show that, for a charged metal object or other conducting object, all the charge resides on the surface, no matter the shape of the object [4].

Coulomb’s law underlies much of atomic physics. The attractive force F between an electron of charge e a distance r from a nucleus of atomic number Z and charge Ze is F = Ze2/4r3. Ernest Rutherford, studying the scattering of alpha particles, used this equation to show that the diameter of the atomic nucleus is orders of magnitude less than that of the atom — i.e., that the nucleus is effectively a point mass. Later, Niels Bohr used this result as the starting point of COULOMB continued on page 3

Charles Augustin Coulomb (top) used a calibrated torsion balance (bottom) to measure the force be- tween electric charges.
 profiles in versatility

IBM Technology at Work In Africa

It was a bright and sunny morning in June 2016 when Kamal Bhattacharya, a senior manager for information technology and cloud computing at IBM Research, got a game-changing phone call from his boss. The company was going to launch a research lab in Africa, IBM’s 12th such lab and its first on the continent. The conversation consisted of a simple query — did Bhattacharya want to take the reins and lead the charge? His answer was also simple — a resounding yes.

So in 2012, Bhattacharya and his family packed up their things and moved across the Indian Ocean to Nairobi to launch IBM Research’s Kenya lab, which ended its operations last year. Today, he is the country manager for information technology and cloud computing in Kenya with the goal of establishing the lab specifically to address growth challenges in Africa, through commercially viable innovation that impacts people’s lives. But he had to start from scratch. There wasn’t a lab already established in any African country. There were no local regulations that we had to look at; it was the opportunity to define what it is we wanted to do,” says Bhattacharya. “It was an ambitious effort for IBM to set up this lab in Africa; I had no peers and there was no precedence.”

But as a veteran IBM employee since 1987, Bhattacharya has seen it all. He has worked on four continents and in multiple roles throughout the organization, he was uniquely suited for the challenge. In particular, his diverse worldview aided him in understanding the significance of the assignment. When Africa was the only continent where IBM did not have a presence, there was much opportunity to be pursued; it was an unprecedented time for the organization to evaluate how to go about it. “We were thinking commercial impact,” says Bhattacharya. “What’s in a lab? It depends on what the facility would look like. How would we set up the lab? How would we go where we face the most pressing challenges at the first point of care. For example, when someone goes to a primary physician, a software program called a “cognitive advisor” will enable the doctor to more accurately identify and treat medical problems and patients to move to the next step, whether it is to send them to a hospital or provide them with a prescription.”

Another key accomplishment of the lab has been the improvement of Kenya’s regulatory business environment, as measured by the World Bank. Bhattacharya and his team analyzed multiple aspects of regional and national government to pinpoint what processes could be improved to increase the country’s rank in the world’s benchmark assessment. They scrutinized everything from how to start a business to trading across borders, and made recommendations for improving efficiency through both process reengineering and through technology. “In the first year, we helped Kenya increase its rank by 28 points,” says Bhattacharya. “It was such a great work that the team does — it is a lot of technology and a lot of policy and legal work. We brought together people who can understand this at a very deep level. Now we have become a trusted advisor to the Kenya government and our approach is core to the government’s desire to make things easier, especially for small and medium businesses.”

Another interesting concept and technology developed by the lab relates to financial inclusion. Across Africa, only 20% of people have access to formal financial services. Kenya, a leader in mobile money products, is a fertile ground for experimentation on more inclusive mobile banking products that geared toward the low-income population. So IBM Research — Africa engineers, in collaboration with financial institutions, built cognitive algorithms based on machine learning that provide the banks with the information they need to assess a customer’s data gleaned from various outputs such as call records and even social media activity. The innovation “can help banks and financial services companies provide loans with much lower risk and at a much bigger scale,” he notes. The lab has had its share of false starts, however. “Over time we have learned how to fail because some of the ideas we had were innovative but were not commercially viable, or vice versa,” he notes. Other ideas “didn’t address social challenges we cared about.”

Regardless, Bhattacharya, who received his doctorate in water science from the University of Göttingen in Germany in 1998, says he is well prepared for the large-scale challenge of leading the R&D center precisely because of his education. “My way of thinking, which I learned as a physicist, was attractive to IBM. Physics strives for a simplicity and elegance and it requires you to have a common sense,” he notes. “At the end of the day, when it comes to engineering systems relevant to society, things never turn out to be as pretty as they were in [physics]. Sometimes you have to make compromises on purity because you want to get things done. Once you make that transition, a lot of complementary skills in physics and engineering have tremendous value in making the world better.”

Bhattacharya continues to press forward with innovations in cognitively relevant technologies to Africa. Last year, he launched the second IBM Research – Africa site in Johannesburg, South Africa, which is currently looking at problems in...
I was gratified to see “The Back Page” column by Michael Falk and Ellen Long (APS News, March 2016) in which Falk recalled his 1994 letter to APS News defending the APS Council action on Proposition 2. I write to correct the preceding letter in that issue defining the action, as the representation here on the APS Panel on Public Affairs (POPA).

I was responsible for bringing the issue to the attention of POPA, motivated by my longtime association with the Aspen Center for Physics. I believed not only that Proposition 2 was morally wrong, but as an Aspen homeowner whom gay inlaws now felt uncomfortable visiting, I felt that it trampled my property rights. After considerable discussion, POPA took action, and the resolution ultimately passed. There was not unanimous support for APS getting involved; my recollection is that both in POPA and in Council, the vote was roughly 2 to 1.

This episode had an interesting history as a POPA member was finished, I was asked to run for Chair of POPA and was told by the Nominating Committee that I was very likely to be selected. Anticipating a heavy workload, I resigned a year early from a National Academy commission on which I had served two years of a three-year term. In November 1995, I was informed that I had not been elected as chair; it appears that in suggesting APS take action on Proposition 2, I had made enemies as well as friends. I was not informed who was elected POPA Chair, a defect in the APS election procedure.

Having now an open black box of time, and seeing that any further discussion was closed, I decided to resume piano lessons and regular practice that I had stopped at age 16. I have never regretted this decision, which has brought me great pleasure over the years.

Stephen L. Adler
Princeton, New Jersey

The story then switches to the year 1968. The year 1968 is a good starting point. Buoyed by thousands of anti-war college students, Minnesota Sen. Eugene McCarthy nearly upset President Lyndon Johnson in the first-in-the-nation New Hampshire primary on March 12. Within days, sensing Johnson’s weakness, Robert Kennedy, then a New York senator, announced his candidacy as well. Two weeks later, after Johnson unexpectedly announced he would not stand for re-election, Hubert Humphrey, his vice president, jumped in.

By the time Democrats converged on the convention the following month, the Democratic candidates were split between a youth cohort, Peter, Paul, and Mary, who sang “All Along the Watchtower” and a disaffected middle-aged cohort, which was represented by the Byrds with their protest anthem “Mr. Tambourine Man.” The year 1968 was a good starting point for a review of the current political environment going into the 2016 election.

Atmospheric neutrinos

Takaaki Kajita, leader of the team at the Superkamiokande experiment, then talked about the role played by neutrinos created in cosmic ray interactions in the atmosphere in proving the existence of neutrino flavor oscillations. Little over 50 years ago, two underground experiments—one in Sudbury, Canada—and one in Kamioka, Japan—reported the first detection of atmospheric neutrinos by observing the muons they produced. With increasing depth, the muon flux decreases directly by cosmic ray decreases and plateaus to a level where the muons produced in all of the late John Bahcall, a physicist who was at home both in theory and experiment. His wife and scientific collaborator Neta gave the third talk in the keynote session on his involvement in the neutrino story, which she framed as a tale of “individual courage, amazing perseverance, and triumph over 40 years.” It began, she said, as a simple question—“how does the sun shine?”

The basic scheme of nuclear reactions was in hand, but John Bahcall sought to answer the question in the early 1960s with a solar model and detailed calculations. At about the same time, Ray Davis was proposing to detect solar neutrinos with a large tank of carbon tetrachloride. In 1968 the first results came in and it was a good-news/bad-news situation. “The good news was that neutrinos were detected,” said Neta Bahcall. “The bad news was [the flux] was three times lower than John predicted.” The discrepancy remained a mystery for 40 years.

The solution was neutrino oscillations, covered by the first two speakers. Neta recounted how in the intervening years she and John met, married, and had a family. During this time, however, John had to withstand the criticism from particle physicists that “astrophysicists can’t calculate the sun to a factor of three,” Neta said. The only alternatives were that Davis’ experiment was wrong or that current understanding of neutrino physics was wrong. The experiment and theory were checked and rechecked, but few believed the latter possibility, Neta recalled.

John Bahcall died in 2005 having mentored over 300 students and postdocs, with several other key astrophysical discoveries to his name. He didn’t live to see the final stages of the Superkamiokande and SNO results, but as Neta concluded in quoting astrophysicist Michael Turner, “John mastered the nuclear oven of the Sun and triumphed.”

The entire symposium can be viewed on the APS Youtube channel at go.aps.org/1Ugfu1J

Prepared by APS News at the APS 2016 Kavli Keynote Session with Guest Hosts Arthur McDonald and Takaaki Kajita
Peter Adams 1937–2016

Peter Adams, longtime editor with the APS Physical Review journals, died on April 16, 2016. Adams joined the editorial office in 1969, while it was located at Brookhaven National Laboratory, where he carried out research in condensed matter physics. He played a key role in the split of the single Physical Review into Physical Review A through D, and in 1970 he became the first full-time editor to lead Physical Review B, a position he held until 2012. During his 47 years at the APS, Adams also held appointments as deputy managing editor and deputy editor in chief of the journals. In those roles he was responsible for the design and development of a computer-based UNIX project to move all editorial operations, data management, journal-page composition, and printing into the digital era. “When I joined APS as an editor for PRB in 1996, Peter took me under his wing,” says Daniel Kulp, Interim Editor in Chief and Editorial Director of the APS journals. “Just about everything I know about editorial work came from him. Peter was always open to sharing his knowledge and insight with the entire editorial staff. For Peter Adams, longtime editor with the APS Physical Review journals, died on April 16, 2016. Adams joined the editorial office in 1969, while it was located at Brookhaven National Laboratory, where he carried out research in condensed matter physics. He played a key role in the split of the single Physical Review into Physical Review A through D, and in 1970 he became the first full-time editor to lead Physical Review B, a position he held until 2012. During his 47 years at the APS, Adams also held appointments as deputy managing editor and deputy editor in chief of the journals. In those roles he was responsible for the design and development of a computer-based UNIX project to move all editorial operations, data management, journal-page composition, and printing into the digital era. “When I joined APS as an editor for PRB in 1996, Peter took me under his wing,” says Daniel Kulp, Interim Editor in Chief and Editorial Director of the APS journals. “Just about everything I know about editorial work came from him. Peter was always open to sharing his knowledge and insight with the entire editorial staff. For ADAMS continued on page 6

Education & Diversity Update

2017 Graduate Education and Bridge Program Conference

At its 2017 NMC meeting, the APS Graduate Education and Bridge Program Conference jointly at the Hyatt Regency Atlanta on February 10–12. The conference will feature plenary talks on physics graduate education, as well as panels and interactive discussions on diversity. Student programming includes networking, a graduate student poster session, and professional development opportunities. Email bridgeprogram@aps.org for more information.

2017 Physics Teacher Education Coalition Conference

The 2017 Physics Teacher Education Coalition (PhysTEC) Conference is the nation’s largest meeting dedicated to educating physics teachers. It will take place February 17-18 at the Hyatt Regency Atlanta. The conference features workshops, poster sessions, panel discussions on best practices, and presentations by national leaders in physics teacher education, as well as excellent networking opportunities. The conference will directly precede the 2017 AAPT Winter Meeting.

Is your institution interested in joining PhysTEC? Institutions that are involved in or wish to become involved in preparing preservice physics teachers are invited to join the Physics Teacher Education Coalition (PhysTEC). Go to phytetec.org/webdocs/Join.cfm for more information.

Fall 2016 APS National Mentoring Community Conference

The National Mentoring Community Conference will be held October 21-23, 2016 at the University of Houston. This conference will feature plenary talks by Louisiana State University Professor Gabriela Gonzalez, spokesperson for the Laser Interferometer Gravitational-Wave Observatory project that detected gravitational waves in 2015. Florida Institute of Technology Professor Hakeem Johnson, expert on using socio-cultural factors to broaden participation in STEM. There will also be mentoring and career workshops. A Research Experiences for Undergraduates / Grad School Fair, an undergraduate research poster session, a NASA tour, and much more! Visit go.aps.org/nmc-conference to register and learn more.

Join the APS Undergraduate Mentoring Community

The APS National Mentoring Community (NMC) is an effort to increase the number of African American, Hispanic-American, and Native American undergraduates obtaining physics bachelor's degrees. NMC connects students with faculty mentors and supports those relationships with resources and networking opportunities. Register to become an NMC Mentor at www.aps.org/nmc.

RESEARCH continued from page 1

Compared to a smooth-surface OLED, this bio-inspired device emitted more light and also had a wider angle of illumination.

Turbulence on the Red Planet

Experiments suggest that boiling water could be a key factor shaping the planet’s surface. These dense, Earth-sized objects with less than 8 to 10 solar masses ing scientists’ understanding of neutron stars. Lunar Iron Points to Nearby Supernova

Researchers studying lunar soil samples have uncovered high levels of an iron isotope ( 60Fe) consistent with fallout from a nearby supernova about 2 million years ago. Nearby supernova might be connected with extinctions on Earth. Besides emitting deadly radiation, these new elements such as 60Fe, which can settle on planetary bodies

iron isotopes in lunar soil samples are consistent with a nearby supernova occurring 2 million years ago.

The first white dwarf with an almost purely oxygen atmosphere has been discovered in new data from the Sloan Digital Sky Survey. The oxygenated dwarf is one of about 32,000 in the survey, but its almost purely oxygen atmosphere is typical of the red planet (less than 1% of Earth’s sea-level pressure). Its spectrum reveals an atmosphere with a unique chemistry, challenging scientists’ understanding of stellar evolution. As they age, stars with less than 8 to 10 solar masses typically become white dwarfs. These dense, Earth-sized objects form once hydrogen and helium have been largely consumed and can no longer fuel the fusion that counteracts gravity. The remaining hydrogen and helium float to the surface, where they dominate the visible emission spectrum. Kepler et al. (Science 352, 67), however, found a dwarf whose spectrum was dominated by oxygen lines, suggesting the outer layer of hydrogen and helium disappeared as the white dwarf formed. Instead of hydrogen and helium, they within the blast zone. Since this isotope has a radioactive half-life of 2.6 million years, finding high levels of it in a geological sample imply a fairly recent (and close) supernova. The supernova hypothesis — first proposed in 1999 — is supported by recent observations of 60Fe in the Earth’s oceanic crust. But the unworked surface of the Moon is a better record. Fimiani et al. (Phys. Rev. Lett. 116, 151104) obtained lunar soil samples from the Apollo missions. They found the ratio of 60Fe to total iron was around 1 part in 10^10, which is about 10 times higher than the measured background. Cosmic-ray interactions — another possible source of 60Fe — could not account for this high concentration. (Adapted from the Physics article “Supernova Footprint on the Moon.”)

Theorists Tackle a 750 GeV Bump

A quartet of papers in Physical Review Letters attempts to explain the origin of a 750 GeV signal found last year at the LHC. The observation has generated many theory papers and, if confirmed, would imply the existence of surprising new particles. Three of the papers center around some new 750 GeV bosons: a pion-like boson associated with a new type of strong force (Y. Nakai et al., Phys. Rev. Lett. 116, 151802), a Higgs-like boson that couples to new kinds of fermions (G. Li et al., Phys. Rev. Lett. 116, 151803), or a boson that is the supersymmetric partner of a hypothetical fermion called the goldstino (C. Peterson and R. Torre, Phys. Rev. Lett. 116, 151804). The fourth (W. S. Cho et al., Phys. Rev. Lett. 116, 151805) suggests that the signal is not due to a 750 GeV particle at all, but to some even heavier particles that decay via a cascade to lighter particles along with photon pairs of about 750 GeV. By the fall of 2016, the LHC should have collected enough data to determine whether the hint is a real signal or a statistical fluctuation. (Adapted from the Physics article “Explaining a 750 GeV Bump.”)

RESEARCH continued from page 1

Compared to a smooth-surface OLED, this bio-inspired device emitted more light and also had a wider angle of illumination.

Turbulence on the Red Planet

Experiments suggest that boiling water could be a key factor shaping the planet’s surface. These dense, Earth-sized objects with less than 8 to 10 solar masses ing scientists’ understanding of neutron stars. Lunar Iron Points to Nearby Supernova

Researchers studying lunar soil samples have uncovered high levels of an iron isotope ( 60Fe) consistent with fallout from a nearby supernova about 2 million years ago. Nearby supernova might be connected with extinctions on Earth. Besides emitting deadly radiation, these new elements such as 60Fe, which can settle on planetary bodies

iron isotopes in lunar soil samples are consistent with a nearby supernova occurring 2 million years ago.

The first white dwarf with an almost purely oxygen atmosphere has been discovered in new data from the Sloan Digital Sky Survey. The oxygenated dwarf is one of about 32,000 in the survey, but its almost purely oxygen atmosphere is typical of the red planet (less than 1% of Earth’s sea-level pressure). Its spectrum reveals an atmosphere with a unique chemistry, challenging scientists’ understanding of stellar evolution. As they age, stars with less than 8 to 10 solar masses typically become white dwarfs. These dense, Earth-sized objects form once hydrogen and helium have been largely consumed and can no longer fuel the fusion that counteracts gravity. The remaining hydrogen and helium float to the surface, where they dominate the visible emission spectrum. Kepler et al. (Science 352, 67), however, found a dwarf whose spectrum was dominated by oxygen lines, suggesting the outer layer of hydrogen and helium disappeared as the white dwarf formed. Instead of hydrogen and helium, they within the blast zone. Since this isotope has a radioactive half-life of 2.6 million years, finding high levels of it in a geological sample imply a fairly recent (and close) supernova. The supernova hypothesis — first proposed in 1999 — is supported by recent observations of 60Fe in the Earth’s oceanic crust. But the unworked surface of the Moon is a better record. Fimiani et al. (Phys. Rev. Lett. 116, 151104) obtained lunar soil samples from the Apollo missions. They found the ratio of 60Fe to total iron was around 1 part in 10^10, which is about 10 times higher than the measured background. Cosmic-ray interactions — another possible source of 60Fe — could not account for this high concentration. (Adapted from the Physics article “Supernova Footprint on the Moon.”)

Theorists Tackle a 750 GeV Bump

A quartet of papers in Physical Review Letters attempts to explain the origin of a 750 GeV signal found last year at the LHC. The observation has generated many theory papers and, if confirmed, would imply the existence of surprising new particles. Three of the papers center around some new 750 GeV bosons: a pion-like boson associated with a new type of strong force (Y. Nakai et al., Phys. Rev. Lett. 116, 151802), a Higgs-like boson that couples to new kinds of fermions (G. Li et al., Phys. Rev. Lett. 116, 151803), or a boson that is the supersymmetric partner of a hypothetical fermion called the goldstino (C. Peterson and R. Torre, Phys. Rev. Lett. 116, 151804). The fourth (W. S. Cho et al., Phys. Rev. Lett. 116, 151805) suggests that the signal is not due to a 750 GeV particle at all, but to some even heavier particles that decay via a cascade to lighter particles along with photon pairs of about 750 GeV. By the fall of 2016, the LHC should have collected enough data to determine whether the hint is a real signal or a statistical fluctuation. (Adapted from the Physics article “Explaining a 750 GeV Bump.”)
2016 Edward Bouchet Award

This year’s recipient is Pablo Laguna at the Georgia Institute of Technology. His award citation reads: “For contributions to numerical relativity and astrophysics, in particular, on the simulation of colliding black holes.” He received the award at the 2016 APS April Meeting in Salt Lake City, Utah.

Pablo Laguna received his degree in physics from the Universidad Autónoma de Madrid, Spain in 1981 and his Ph.D. in physics from the University of Texas at Austin in 1987. In 1992, he joined the faculty at the University of Texas at Austin and the Institute for Gravitational Physics and Astronomy at Utah Tech prior to his current position at the University of Texas at Austin. Laguna is an investigator at the Institute for Gravitational Physics and Astronomy at the Georgia Institute of Technology.

Pablo Laguna was named a Fellow of the American Physical Society in 2008 and elected to the Mexican Academy of Science in 2007.
An ongoing theme in quantum physics is the interaction of small quantum systems with an environment. If that environment has many degrees of freedom and is weakly coupled, it can often be reasonable to treat its decohering effect on the small system using a "memoryless," or Markovian description. This Colloquium shows that for many phenomena a more refined, non-Markovian, treatment is necessary. The suite of developing theoretical tools is reviewed, with which recent progress on this problem has been based.

An ongoing theme in quantum physics is the interaction of small quantum systems with an environment. If that environment has many degrees of freedom and is weakly coupled, it can often be reasonable to treat its decohering effect on the small system using a "memoryless," or Markovian description. This Colloquium shows that for many phenomena a more refined, non-Markovian, treatment is necessary. The suite of developing theoretical tools is reviewed, with which recent progress on this problem has been based.

"The true drivers of change on the African continent will be technologies, and the ability for us in Africa to take a science-driven view to impact change and make a difference is what I am most proud of. It keeps me going every day."
Nuclear Energy, Global Warming, and the Politicization of Science

By Spencer Weart

Two quirks of physics pose an existential threat to civilization. In 1939, Frederic Joliot and two colleagues found that when a uranium nucleus is struck by a neutron and fissions, it emits two or three neutrons. That allows an explosive chain reaction and makes fission a potential weapon. It just happens to work out that way. And in 1859, John Tyndall found that two triatomic molecules, H₂O and CO₂, absorb infrared radiation but not visible light. That causes our planet’s greenhouse effect. He did not predict this; it just happens to work out that way. Today, if the United States and Russia were to use all their nuclear bombs, there is a good chance that vital ecosystems would be ruined, and agriculture and civilization would collapse. The same outcome is likely if we continue on the current trajectory of burning fossil fuels.

“...it was inevitable that scientists familiar with these quirks of nature would become deeply engaged in politics, and that science itself would become politicized.”

Whether either of these existential threats will come to pass is not yet clear. But this much is certain: that it is so is not coincidental. It was inevitable that scientists familiar with these quirks of nature would become deeply engaged in politics, and that science itself would become politicized. In this essay I will sketch the specific path that was followed in each case and draw some general conclusions.

First, the nuclear case. It wasn’t politicized—it was born political. Joliot’s fame allowed him to understand the potential implications of their measurement when they planned it. Within months of their publication of the number of neutrons per fission, the world’s premier scientist, Albert Einstein, brought unannounced to the presence of the world’s premier statesman, Franklin Roosevelt. By 1943, before any atomic bombs existed, scientists in the Manhattan Project were planning to take political action after the war’s end by going to the public with an information campaign. They meant to impress upon everyone the dreadful potential of atomic warfare ... and the hopeful potential of peaceful nuclear energy. That was the traditional outsiders’ route to politics: Explain matters to the public, and trust that appropriate official policies would follow. Meanwhile a few leaders took the insiders’ route: They privately approached policy makers within the U.S. government with advice (in particular, whether the first atomic bombs should be used on cities).

Immediately after the war ended, the “atomic scientists” gave interviews to journalists, wrote articles, gave public speeches, and explained the potential risks to the general public. That, along with advice in (particularly, whether the first atomic bombs should be used on cities).

Second, radioactivity itself came to be seen as uniquely and horribly evil. Two medical physicists who had supported the test ban, John Gunman and Arthur Tappan, applied to civilian nuclear industry the argument that even low levels of radiation had a potential for widespread harm. Many others, for example the Union of Concerned Scientists, likewise learned to criticizing the safety of civilian reactors. Ultimately governments placed strict limits on emissions of radioactive substances — far stricter than they permitted for comparably carcinogenic and mutagenic substances from other industries (for example, coal-fired power plants). It is an open question whether this was a success for the politics of science.

“We need to broadcast a human-level explanation of how the scientific community manages to arrive at trustworthy conclusions.”

Next, the climate case. This was only gradually politicized. To be sure, by 1960 a few noted scientists had warned both the public and policy makers that there was a long-term risk of dangerous climate change from humanity’s CO₂ emissions. But they were not certain the risk was real, so the only policy they advocated — persistently, for decades — was better coordination and funding for climate research. They did get some money, but coordination remained sketchy. A turning point was a 1983 report issued by insiders at the Environmental Protection Agency, predicting dangerous impacts from fossil fuel emissions. President Ronald Reagan’s administration, hostile to anything that might stimulate regulation of industry, saw the report as a political attack. They attacked it in return, opening a caustic public debate. The issue was taken up the left by environmentalists (including the Union of Concerned Scientists). Again scientists were called on to give tutorials to journalists and groups of senators. Stephen Schneider, in particular, reached out to the media and wrote for the public. He faced acrid criticism from some colleagues: the sound bites necessary for television lacked the lengthy caveats and subtleties that they felt a true scientist must deploy. Wasn’t it dangerous to write scientific papers, and trust that the facts would usually persuade governments to adopt correct policies? By the late 1980s many leading climate scientists were saying that governments should vigorously restrict emissions. In response the fossil-fuel industry launched a coordinated public relations campaign to raise doubts about the validity of climate science. A lobbying effort meanwhile approached Congress and officials behind the scenes. Millions of dollars, eventually hundreds of millions, subsidized everything from book publications to primary election campaigns. Many people with anti-regulation convictions independently supported the campaign.

Not only scientific results were called into question. Far more than before, individual scientists came under vicious personal attack: some had to call for police protection or take up legal defense of their privacy and reputations. The attacks spread beyond the personal. The International Panel on Climate Change, which published the unanimous consensus of scientists representing the world’s governments, was denounced by one widely-read blogger as “guilty of nothing short of making the science fit their political agenda” [1]. A well-publicized scientist pointed to ambiguous quotations cherry-picked from a trove of stolen emails as indicating a “conspiracy to commit fraud.” [2] President Reagan’s 1980 U.S. senator repeatedly called global warming a “hoax” [3]. It was an assault, beyond any historical precedent, on the public’s trust in the expertise and integrity of an entire scientific community.

The nuclear and climate cases have much in common. Both began without noticeable partisan polarization, but split sharply into left vs. right as soon as government policies came into question. In particular, the issue of regulation of an important industry naturally divided people with different ideological commitments. In both cases scientists were deeply involved both inside the corridors of government and in appeals to the public, but got into trouble if they tried to do both. Results were mixed. Scientists were united in their efforts to make people fear nuclear war, and they contributed significantly to preventing it, so far. Scientists were successful at first in fostering a civilian nuclear industry, but disagree among experts contributed to limiting this success. A sustained effort to tell the world it must act to avert global warming has so far failed. The United States, but in most nations the progress has been too little, too late.

The chief difference between the cases is that the existential threat of nuclear war was perceived by all, whereas the threat of climate change has grown. There are several reasons why climate has proved intractable. For one, chauvinism and militarism are potent but diffuse foes, whereas the fossil fuel industry and right-wing ideology are vast and well organized concentrations of power. Today scientists must defend not only particular individuals, not only particular scientific results, but science itself: our methods and our community. Experience shows that in such a struggle, facts are not always convincing (even when they are understood, which is rare). We need to broadcast a human-level explanation of how the scientific community manages to arrive at trustworthy conclusions. It is the obligation of every scientist to participate in this crucial enterprise.

References
1. climatedepot.com, go.aps.org/1RJuD3OJ
2. americantikaker.com, go.aps.org/1RLU0DJ

Spencer Weart is historian Emeritus of the American Institute of Physics. His books include The Rise of Nuclear Fear and The Discovery of Global Warming. This article is adapted from a presentation at a 2016 APS April Meeting session organized by the Forum on Physics and Society.