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Catching *Particle Fever*
See p. 5.

Neil deGrasse Tyson on Science in Popular Culture

By Calla Cofield

APS April Meeting, Savannah
Science has become part of the pop-culture lexicon, and it's here to stay. That was the thesis of Neil deGrasse Tyson's plenary talk at the APS April Meeting. But he also drove home that this cultural shift doesn't let physicists off the hook. To communicate with the general public, scientists need to meet them half way, which means knowing a few things about "life outside the lab."

One of the most popular pages on Facebook is titled "I F***ing Love Science"; the number one sitcom in America is *The Big Bang Theory*, about a group of physicists; Comic-Con, once a small meeting of comic book artists and fans is now one of the top events for the movie and television industry, and regularly features events centered on science. Tyson showed a gallery of images featuring science jokes and said, "If science is embraced by artists, that's the best evidence that it's become mainstream."

Photo by Michael Lucibella

Physicists and popular culture need to come together.

Perhaps the most prominent evidence that the general public

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Update on APS Corporate Reform

APS April Meeting, Savannah
The APS Ad Hoc Committee on Corporate Reform unveiled its preliminary vision for the future governance of the Society at a Town Hall session held at the APS April Meeting. A video of the presentation can be found on the APS corporate reform web site. (http://www.aps.org/about/reform/). The draft proposal alters the roles and relationships of the Society's governing bodies, creates a chief executive officer, and further distinguishes the responsibilities of the member-elected APS Council from the smaller Executive Board.

"It's not final yet," said Sam Aronson of Brookhaven National Laboratory, the APS President-elect. "We're not done, but we are starting to form ideas that we are preparing to present to the Council."

The recommendation splits the governance of the Society between a Board of Directors, which is legally required, and a Council of representatives. It is likely that the Council will continue to be elected by the units and divisions, while the Board will include members of the presidential line and several Councilors elected from the Council, similar to the present Executive Board.

The vision is that the Council would now focus primarily on high- level policy and on scientific issues, such as approving APS statements and forming new divisions.

"The membership has to have a way to express itself on issues that they think are important," said APS President Malcolm Beasley. "To identify and frame the issues that the members have, that they feel are important for the APS to do or

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Safer Spaceflight to Mars

By Michael Lucibella

APS April Meeting, Savannah
Recent discoveries about the dangers of radiation exposure during interplanetary travel have prompted the National Aeronautics and Space Administration (NASA) to make radiation protection a fundamental part of spacecraft design. To get a better understanding of these risks, a team at the Marshall Space Flight Center is building a comprehensive database of simulated cosmic-radiation effects using a long-established particle physics tool.

"We need to think about radiation from the early stages of design, just like we think about oxygen, temperature, pressure and so on," said Nasser Barghouty of NASA's Marshall Space Flight Center. "You need the nuclear-physics tools to estimate how much radiation is inside a certain structure, inside the suit, inside your liver, and so on and so forth."

"Once you leave the protective atmosphere of Earth, you are bombarded by space radiation from the very low energy up to the highest energy," adds Mohammed Sabra, also of NASA's Marshall Space Flight Center.

To assess the hazards, the space agency is integrating the program Geant4 (for "geometry and tracking") into the design process for spacecraft. Geant4 has been a mainstay for years, helping nuclear physicists simulate collisions at the LHC, SLAC, and the Tevatron. The program also calculates how different types and energies of radiation affect different materials, spacecraft, and even the crew.

Sabra and Barghouty used Geant4 to calculate the effectiveness of two shapes, a slab of aluminum and a spherical shell of aluminum, against a bombardment of iron nuclei. They presented the results of these simulations at the 2014 APS

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Photo courtesy of NASA

Mars missions will need designed-in radiation shielding.

Congress Weighs the Future of Science Funding

By Michael Lucibella

Capitol Hill is flush with proposals to modify the federal science budget. Though experts say that many of the various funding plans have little chance of becoming law, the proposals offer insight into the direction and obstacles facing federal science funding in the coming years.

Dueling Visions of the Federal Government

The president released his budget proposal for Fiscal Year 2015 on March 4, which keeps overall discretionary spending roughly in line with inflation over the next decade. On April 1, the House Budget Committee released its proposal, which would reduce overall discretionary spending by $5.1 trillion over the next ten years.

These budgets are essentially a list of their respective authors' priorities, and the size of increases and decreases reflects the importance assigned to each program. The two documents offer contrasting views of the role of the federal government in American society, and hence the role of government support of the sciences.

By law, the discretionary budget for 2015 is limited to about $1.01 trillion by spending caps agreed to in the 2014 omnibus appropriations bill (that is, one bill covering budgets from almost all agencies). This breaks down to $492 billion for non-defense funding and $521 billion for defense, nearly identical to last year.

"This is a tough fiscal year," said Matthew Hourihan, director of the R&D Budget and Policy Program at the American Association for the Advancement of Science (AAAS). "There are a lot of fiscal constraints."

The president's budget pushes the boundaries somewhat. It proposes increasing the total federal discretionary budget by 0.2% over last year, with research and development programs increasing by 0.6% and specifically non-defense R&D growing by 0.8%. In contrast, inflation is expected to rise to 1.7% over the next year.

These numbers, calculated by AAAS, cover all areas of science including medical, biological, energy, and basic physical sciences. It also bins basic science together with applied-technology development, two different ends of the research spectrum.

"Total [basic] research would actually decline by a little bit," Hourihan said.

Separating out basic physical science research yields a more mixed bag. When taking inflation into account, the National Institute of Standards and Technology (NIST) got a 2.4% bump, while the Department of Energy (DOE) Office of Science dropped 0.4%. The National Science Foundation (NSF) is down about 1.4%, and the National Aeronautics and Space Administration (NASA) loses 2.7%. Research within the Defense Department would drop by 12%. Within DOE, sustainable energy research continues to be a priority with its Advanced Research Projects Administration-Energy division getting about a 15% increase, while high-energy physics is slated for a 6.6% cut.

"[I would challenge] the White House proposition that somehow the president's budget reflects the importance of R&D," said Michael Lubell, the APS director of public affairs.

The Republican-authored House budget proposal, the so-called "Ryan Budget," takes a different approach to science funding and emphasizes military R&D funding over non-defense research. In unadjusted dollars, defense R&D would climb a total of about $42 billion, or 5.8%, over the president's request in the next ten years, while non-defense R&D would drop by $112 billion or 16.9% in the same period of time.

"If you compare the president's request to the House budget request [for non-defense R&D], there's a difference of over $100 billion," Hourihan said.

The partisan divide in Washington is so deep, however, that neither proposal is likely to pass. The Ryan Budget passed in the House on April 10, but has little chance to get through the Democrat-controlled Senate.

"The House budget resolution in the grand scheme of things doesn't really matter too much," Hourihan said. "It does represent one vision for the shape and composition of government. It is a cam-

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Members in the Media

"Now it seems that Hawking and Unruh were right!… Now we know that gravity is indeed quantized, involving graviton particles."

***Max Tegmark**, Massachusetts Institute of Technology, reacting to the recent BICEP2 results,* The New York Times*, March 25, 2014.*

"We don't really understand antimatter…. For instance, the fundamental laws of physics suggest there should be equal amounts of matter and antimatter in the universe, but our observations tell us there is vastly more matter than antimatter in the universe, and there is no agreed-upon explanation for that."

***Holger Müller**, University of California at Berkeley,* FoxNews.com*, April 2, 2014.*

"Modern telecommunication networks require synchronization to about a millionth of a second per day…. Power grids also...(and) GPS systems require about 1 billionth of a second per day. All of these technologies, and many more that we use every day, rely on exquisite timing and synchronization that is only possible with atomic clocks."

***Tom O'Brian**, National Institute of Standards and Technology, on the importance of improving the accuracy of atomic clocks,* CNN.com*, April 3, 2014.*

"For me, it's fascinating because it's a story of exploration. Human beings are extremely curious. We want to know what's beyond the next hill; what's around the next corner. Nature is really a big mystery, a puzzle. It provides clues, but we're always asking: How does it all fit together?"

***Dirk Morr**, University of Illinois at Chicago, on the legacy of Star Trek,* The Chicago Tribune*, April 7, 2014.*

"This is a very exciting signal, and while the case is not yet closed, in the future we might well look back and say this was where we saw dark matter annihilation for the first time."

***Tracy Slatyer**, Massachusetts Institute of Technology, on surprising gamma emissions from the galactic center,* NBCNews.com*, April 7, 2014.*

"The speakers are great, the bands are famous. I basically built and designed the largest homemade modular synthesizer since well, probably ever. They knew about the work I did and were impressed."

***Joseph Paradiso**, Massachusetts Institute of Technology, on his upcoming appearance at Moogfest, an art and music festival,* The Boston Globe*, April 8, 2014.*

"If we reduce the number of connected pieces, maybe we can reduce the societal cost of failures."

***David Newman**, University of Alaska, on how to design a power grid network that can resist cascading power failures,* NBCNews.com*, April 8, 2014.*

"You know what else you can stretch by 20 percent? Rubber.… In comparison, silicon, which is in today's electronics, can only stretch by 1 percent before it cracks."

***James Hone**, Columbia University, on the physical characteristics of graphene,* The New York Times*, April 13, 2014.*

"The way that energy prices have come down in the US makes it a real opportunity now to innovate in manufacturing that wasn't possible before. We have big tools, and making those available and helping grow that Chicago ecosystem is a big goal for me."

***Peter Littlewood**, Argonne National Lab, on some of his plans upon being named the new director,* The Chicago Tribune*, April 13, 2014.*

"By looking at how the insects turn, we might be able to say what the 'pilot' is thinking."

***Jane Wang**, Cornell University, commenting on research studying how fruit flies turn*, The Los Angeles Times*, April 14, 2014.*

"I'd be more upset, except the idea is so stupid that in the end, it will just reflect badly on them."

***Lawrence Krauss**, Arizona State University, on an interview with him appearing in the preview for a movie promoting geocentricism,* Yahoo News*, April 16, 2014.*

This Month in Physics History

May 21, 1946: Louis Slotin Becomes Second Victim of "Demon Core"

One of the most riveting scenes in the 1989 film *Fat Man and Little Boy* isn't its masterful depiction of the Trinity Test. It's a scene in which a fictional physicist named Michael Merriman botches a criticality experiment, receiving a fatal dose of radiation. Merriman is a composite character, based on two real physicists, whose deaths made them a different kind of casualty of war.

The criticality research at Los Alamos National Laboratory was highly dangerous due to the radioactive substances involved. Robert R. Wilson recalled his own brush with death while assisting a physicist in the Critical Assemblies Group to determine when criticality was reached as one stacked a series of enriched uranium hydride cubes. The group didn't rely on the usual elaborate safety devices commonly used at cyclotron facilities at the time. Instead, they used a simple set-up involving a wooden table, a single neutron counter to monitor criticality, and several cubes of enriched uranium hydride.

Photo courtesy of U.S. Department of Energy

Recreation of the Slotin incident of "tickling the dragon's tail" which shows the configuration of beryllium reflector shells prior to the criticality.

Wilson watched as the physicist started stacking uranium cubes, and then noticed with alarm that the neutron counter wasn't working because the voltage supply was burnt out. When the counter was turned back on, it lit up immediately. "A few more cubes and the stack would have exceeded criticality and could well have become lethal," Wilson recalled.

Furious, Wilson raged about it to Oppenheimer himself, but he had to leave for Trinity the very next day, so he let the incident drop. Had he stayed and pursued the matter, Wilson believed, "I might have saved the lives of two people. To this day, the incident is on my conscience." Those two people were Harry K. Daghlian, Jr. and Louis Slotin, both of whom died of acute radiation poisoning after accidents that occurred while conducting criticality experiments with the same plutonium core, dubbed the "demon core."

Daghlian was an Armenian-American physicist who joined the Critical Assembly Group while still a graduate student in 1944. On August 21, 1945, he was building a neutron reflector, carefully surrounding a core of plutonium with tungsten carbide bricks, the better to serve as a radiation shield. He accidentally dropped a brick into the center, triggering a critical reaction. Daghlian heroically dismantled the pile manually to halt the reaction, but at great personal cost. The dose of radiation he received as a result was so high, he died within 25 days of the accident.

The physical deterioration was horrifying, and Daghlian allowed it all to be documented for posterity. His right hand blistered, the nails turned blue, and the skin reddened as both hands and abdomen began to swell. The redness spread and his skin sloughed off in layers, and he was plagued by abdominal cramps and diarrhea. He was emaciated by the time he mercifully slipped into a coma, having lost most of the skin of his abdomen and lower chest. His death certificate listed the cause of death as "severe burns, upper extremities and trunk."

The Canadian-born Slotin notably assembled the core for Trinity, and was also an expert in conducting a delicate experiment nicknamed "ticking the dragon's tail." It involved placing two half-spheres of beryllium around the core and moving them closer and further away while monitoring the rate at which neutrons multiplied in the core, bringing the pile to the very edge of going critical. If the two beryllium spheres closed, even for a moment, the mass would go critical and release a burst of ionizing radiation.

Slotin was a bit of a daredevil, a former amateur boxer who favored jeans and cowboy boots, and told tales of his days as an anti-aircraft gunner during the Spanish Civil War–although his brother later said that Slotin had actually just been on a walking tour through Spain, and played no part in the war. He brought a bit of that mentality to his research, despite the fact that he had witnessed Daghlian's demise. Whenever he performed the experiment, he preferred to remove the shims used to keep the spheres apart and separate them by using just the blade of a simple screwdriver. A dismayed Enrico Fermi told Slotin he would be "dead within a year" if he continued to flout the safety protocols.

Sadly, Fermi was right. On May 21, 1946, as six others looked on, the screwdriver Slotin used to keep the spheres apart slipped, and they came together; the core went supercritical with flash of blue light and massive wave of neutron radiation. Slotin used his body to shield his colleagues from the blast as much as possible while quickly knocking the two spheres apart to stop the chain reaction. None of the assembled men were wearing their dosimetry badges, so accounts of just how much radiation they may have received vary. But for Slotin, it was lethal.

Slotin reported an immediate sour taste in his mouth and a burning sensation in his left hand (used to knock apart the spheres). He vomited as he was rushed to the hospital, and his condition quickly worsened, as he suffered severe diarrhea, swollen hands, massive blistering, and gangrene.

Nine days after the accident, Slotin died after "a total disintegration of bodily functions." Ironically, he had become disillusioned with the postwar atomic tests, and one reason for that ill-fated ex-

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Washington Dispatch

Updates from the APS Office of Public Affairs

POLICY UPDATE: Fiscal Year 2015 Budget

The Obama Administration has released its budget request for Fiscal Year 2015 (FY15) in full. The request adheres to the top line spending number of $1.014 trillion stipulated by the Ryan-Murray budget agreement. That agreement allows for a 0.02% increase in spending from FY14 to FY15, highly constraining individual items. The Administration, although supportive of scientific research in general, has shown a bias toward applied research over basic research in choosing how to distribute the modest overall increase. A table of requested funding for selected agencies is available online at http://www.aps.org/publications/apsnews/

During regular order, both the House and Senate would typically pass their own budgets in response to the president's budget. Since top-line FY15 spending had already been settled on under the Ryan-Murray agreement, the Senate has opted not to pass an FY15 budget. The House, however, has passed an FY15 budget resolution, H.Con. Res.96. Although it does not address specific science accounts, the accompanying committee report (Report 113-403) does include a statement on "shifting the focus back to basic research." The report also discusses certain areas, such as the Department of Energy's (DOE) Biological and Environmental Research (BER), that "could potentially crowd out private investment" and therefore gives direction to pare down areas of applied research.

Congressional appropriators have already begun consideration of the president's budget request. The House Commerce, Justice, Science, and Related Agencies Appropriations subcommittee held a hearing in March during which appropriators expressed concern that the US support of science has been declining as compared to other nations. The subcommittee was generally amenable to the Administration's request.

The House Energy and Water Development Appropriations subcommittee reacted positively to the Administration's request in a hearing in March. There were questions regarding the decreases to Fusion Energy Science (FES) and to High Energy Physics (HEP). Office of Science Acting Director Patricia Dehmer explained to committee members that the decrease in FES reflected slippage in the International Thermonuclear Experimental Reactor (ITER) schedule. It is worthwhile noting, however, that the total cut to FES (-$88M) is nearly double the planned cut to the US contribution to ITER (-$50M). When asked about the cuts to HEP, Dehmer explained that the high energy physics community had yet to complete the P5 report (Particle Physics Project Prioritization Panel) and that DOE is awaiting recommendations.

WASHINGTON OFFICE ACTIVITIES

MEDIA UPDATE

Roll Call, a leading newspaper on Capitol Hill, published the latest column by APS director of public affairs Michael S. Lubell on March 25. Titled "Scientists Are Becoming a Rarer Congressional Breed, and That's Not a Good Thing," the piece points out the importance of having congressional members who comprehend the scientific enterprise. http://bit.ly/OZqYq6

In other media news, *The Hill,* another prominent Capitol Hill newspaper, published an op-ed on March 31 that cites the need to extend nuclear power plant licenses to bolster clean electricity options in the United States. Roy Schwitters, a physics professor at the University of Texas at Austin and John W. Rowe, chairman emeritus of Exelon Corp., were the authors. http://bit.ly/1kwKE39

Panel on Public Affairs (POPA)

A proposed APS Statement on Undergraduate Research was approved by the APS Council at its April 2014 meeting. The statement can be viewed at: http://www.aps.org/policy/statements/14-1.cfm

As part of its normal review process, POPA is continuing consideration of the APS 2007 Statement on Climate Change. Information about the process can be found at: http://www.aps.org/policy/statements/climate-review.cfm

POPA approved a rewording of the APS Statement on Civic Engagement of Scientists (08.1). The new version of the statement will now be presented to the APS Council for comment prior to its review at the next APS Executive Board meeting.

The APS Committee on the Status of Women in Physics and the APS Committee on Careers and Professional Development are both working with the POPA Subcommittee on Physics & the Public to draft statements that will be considered by POPA at its June meeting.

APS members can log in to obtain a template for study proposals, along with a suggestion box for future POPA studies at: http://www.aps.org/policy/reports/popa-reports/suggestions/

Historical Sites: Savannah River Nuclear Plant

Photo by Ken Cole

APS President Malcolm Beasley (left) presents a plaque to Doug Hintze, acting chief financial officer of the Savannah River Site in South Carolina, which reads "In 1956 Clyde Cowan and Frederick Reines used the flux from P Reactor at the Savannah River site to perform the first experiment that conclusively detected the neutrino, thereby establishing the existence of the particle postulated 26 years earlier by Wolfgang Pauli to explain the apparent lack of conservation of energy in beta decay." The presentation was made on April 6, 2014 at the APS April Meeting in Savannah, Georgia.

International News

...from the APS Office of International Affairs

Thoughts about Russian Science, with Love and Bitterness

By Vladimir Zelevinsky

Vera and Vladimir Zelevinsky.

At the end of August 1992, I came with my family to East Lansing, Michigan, to take a job as a visiting professor at Michigan State University (MSU). I did not expect at that time that this would be lifelong work, but MSU became a new home and I am still here. Before that I was working for many years at one of the best (I believe it's the best, but I am not unbiased) scientific institutions of the former Soviet Union, the Budker Institute of Nuclear Physics (BINP) in Novosibirsk. In Siberia, I left a big part of my life: the famous Institute and close friends. My feelings of love and nostalgia are mixed with painful bitterness concerning what is happening with fundamental science in Russia.

Twenty years ago, my colleague from the BINP, Valentin Sokolov and I published in the German journal *Physikalische Blätter*, [vol. 50, issue 6, p. 577 (1994)] an article with the title (in English translation) "Russia: Will the Science Survive?". In the very first sentence we acknowledged that "Russian fundamental science is now painfully dying." Now, in 2014, as one Russian journalist said "The patient is still alive although the conditions are not favorable for his existence."

The situation has now become really critical due to the recent so-called reform of the Russian Academy of Sciences (RAS) and the general political situation in the country. Unfortunately, during the past two decades the leadership of the RAS did not make any serious and absolutely necessary changes. As we wrote in 1994, the RAS itself, contrary to its official status as a public society with membership by elections, grew into a huge unwieldy organization with an extremely inflated bureaucratic staff; the overwhelming majority of "non-member" scientists had no way to influence any decisions of the Academy leadership; a deep gap of distrust and even confrontation opened widely between "rank-and-file" scientists and scientific generals.

The fundamental sciences have always had their natural home in the RAS, but for many years they have had a very low level of financial support. Even worse is the situation in the research universities (which is quite a small fraction of

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Sister of Imprisoned Physicist Accepts Sakharov Prize

By Michael Lucibella

APS April Meeting, Savanna For the first time in its history, the APS Andrei Sakharov Prize was awarded to a scientist in jail. Omid Kokabee, one of this year's two recipients, has been imprisoned in Iran for more than three years. His sister Leila traveled to the April Meeting in Savannah, Georgia to receive the prize on his behalf.

Kokabee, an Iranian citizen studying laser physics at the University of Texas at Austin, was arrested at Tehran's international airport in January, 2011 and charged with "communicating with a hostile foreign government." He was sentenced to 10 years in prison after a trial in which he was not allowed to testify or speak to a lawyer.

Two days after receiving the Sakharov Prize, Kokabee's parents were permitted to visit him in person for the first time since his incarceration. They brought photos of the event and news about efforts to effect his release transmitted from the US by Leila.

During the APS April Meeting in Savannah, the Society's international affairs department set up a table at the convention center to raise awareness about his imprisonment. "We had a lot of people come up and read the information," said Michele Irwin, the APS international affairs administrator. There were a lot of people I spoke with who hadn't heard of his case, which is kind of surprising considering the press it's gotten."

In addition to sharing information about the jailed physicist, Irwin and members of the Committee on International Freedom of Scientists used their table to help collect signatures for a petition calling for his release. In January, the website FreeOmid.org organized this latest petition to effect his release.

"They started a petition to get Omid freed and asked APS, Amnesty International, the Committee of Concerned Scientists and an organization called United for Iran to sponsor the petition," Irwin said. "We thought this could be a good opportunity to inform and educate APS attendees about Omid's case."

Irwin said that the group's plan is to get about 1,000 signatures and send it to the supreme leader of Iran, Ayatollah Ali Khamenei. The organizers hope that the petition will help raise awareness in the physics community about what's happened to Kokabee.

Astrophysics Highlights from the APS April Meeting

By Calla Cofield

Feeding Time for Milky Way's Black Hole

Astronomers will get the extremely rare opportunity to observe a black hole eating a light snack. A gas cloud three times the mass of Earth is about to skim the outer rim of Sagittarius A*(Sgr*)–the supermassive black hole at the center of our galaxy–and some of the dust is expected to get pulled into the black hole's gaping maw. Over a dozen telescopes will observe various stages of the event. The closest approach of the gas cloud is beginning now and will last about one year, with matter expected to continue to fall in for a few decades.

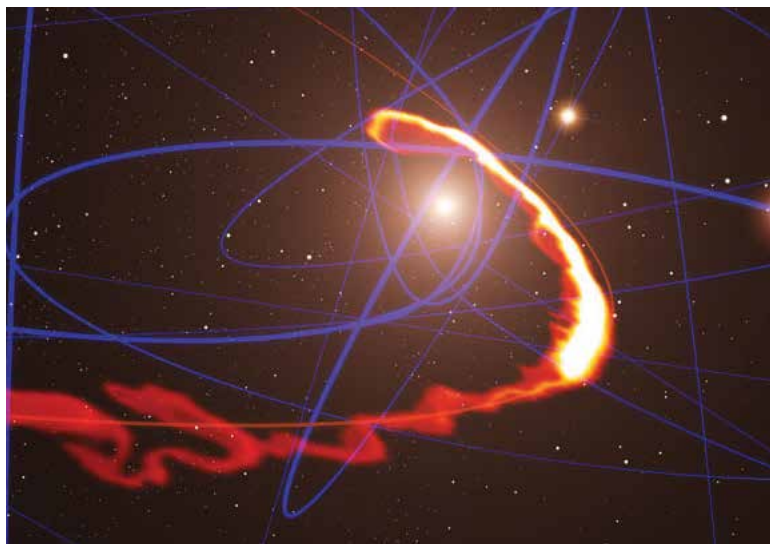

Photo courtesy of ESO/S. Gillessen/MPE/Marc Schartmann

Simulation of a black hole consuming a gas cloud.

At the APS April Meeting, Daryl Haggard of Northwestern University spoke to reporters about what this event reveals about the feeding habits and growth patterns of black holes. Do black holes grow rapidly at the beginning of their lives and then plateau, similar to humans? Or do the black holes eat mid-sized meals periodically, causing them to grow in fits and starts? The encounter will provide new information about how frequently these events may occur. There is also the hope that the in-falling gas will cause the accretion disk of Sgr* to light up, which could provide some interesting comparison data for observations of accretion disks around other black holes.

Stefan Gillessen of the Max Planck Institute for Extraterrestrial Physics says the movement of the gas cloud will allow astronomers to probe the atmosphere around Sgr* and finally obtain observational evidence to compare to simulation. The cloud has already been stretched out by the pull of the black hole, and some of the gas may have already swung around to the other side. Predictions suggest the pull of the black hole will undo the ball-shape of the dust cloud and send it swirling, like milk poured into stirred coffee. But how will those predictions compare with the real thing? "All I can say," concluded Gillesen, "Is that we'd better watch."

IceCube and Neutrino Astronomy

Last November, the IceCube collaboration published results confirming their detection of high-energy neutrinos originating outside the solar system. At a press conference at the APS April Meeting, Christopher Weaver, a graduate student at the University of Wisconsin, spoke about a new analysis that confirmed the November announcement. Via a different type of analysis, Weaver measured the same rate of arrival of high-energy astrophysical neutrinos to the IceCube detector.

Weaver's analysis, as yet unpublished, looks specifically for muon neutrinos, which create very clear, pointed tracks through the IceCube detector. These tracks make the muon neutrinos easily distinguishable from background, and their orientation may also help scientists trace the neutrinos back to their sources. The analysis also looked at a wider energy range than the November starting analysis, providing researchers with a better understanding of the background neutrinos reaching the detector.

The analysis also identified two new, very-high-energy neutrinos close to the PeV range. "The case remains the same, and in fact we have a stronger case now," said Naoko Neilson, a postdoc at the University of Wisconsin who delivered a plenary session talk. She defended the reasons for pursuing neutrino astronomy, and compared it to observations in different photon wavelengths: Optical, radio, infrared and other wavelengths each reveal new information about a single astrophysical source.

To complement these techniques, IceCube will have to be able to pinpoint the sources of cosmic neutrinos. Currently, the cosmic neutrinos detected by IceCube appear as a haze in the sky, and Neilson says they could be coming from as many as 50 separate sources. But with more time and more data, Neilson says she's confident the experiment will reach this goal.

"Think about gamma-ray astronomy: We take for granted that it is astronomy now," said Neilsen. "It all started with diffuse celestial radiation, and then in the '70s and '80s people started resolving gamma-ray sources and now we have a very thick catalogue [of gamma-ray sources]…. Hopefully in the near future, I can come back to you and say we've measured the first handful of neutrino sources. And hopefully before my career or my life is done, we can get to the point where we talk about a neutrino astronomy catalogue."

HAWC Observatory Online

At a press conference, Petra Huentemeyer of Michigan Technological University gave a status update and early results from the High-Altitude Water Chernkov (HAWC) observatory. HAWC will produce a wide-field picture of the universe in TeV gamma rays and cosmic rays. With just one third of its total planned array online, HAWC has already exceeded the sensitivity of its predecessor MILAGRO.

In recent years, the Fermi Gamma-Ray Space Telescope, which detects photons with energies up to 300 GeV, has provided a tremendous wide-field map of the gamma-ray universe, and identified hundreds of point sources that have been studied in detail by non-survey telescopes. If HAWC reaches its full capability, it will provide a similar all-sky gamma-ray map up to 100 TeV. In the same fashion as Fermi, Huentemeyer says HAWC will work cooperatively with TeV point-source telescopes like VERITAS, HESS and MAGIC.

HAWC's sky map thus far has succeeded in identifying gamma-ray standard candles such as the Crab Nebula. In addition, it shows two mysterious cosmic ray excesses originally spotted by MILAGRO, and a new, third excess. Looking forward, Huentemeyer says HAWC may have a better chance of figuring out what those excesses are–attempts at explanation range from magnetic-field turbulences to dark matter. But HAWC will also try to help answer major questions about how cosmic rays are produced, how they are accelerated and where they come from.

"It has a high discovery potential," said Huentemeyer. "This is just the beginning."

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April Meeting. They hope to refine these simulations of basic shapes into the designs of a full spacecraft.

"If you go to Mars and back, that's a two-and-a-half-year trek, and the radiation level is lethal for any human being in a typical spacecraft," Barghouty said.

The best way to shield against this onslaught of cosmic radiation is not obvious, but the researchers say that the most important first step is to find out how the building materials of a spacecraft react to being immersed in such a hazardous environment. Geant4, as well as other programs, have previously been used to simulate a narrow range of materials reacting to specific kinds of radiation. Now, the NASA team is working on how to put together a broad database of effects.

"[W]e are performing the simulations for all biologically significant cosmic-ray nuclei (protons through iron) and for all targets of interest to mission designers, from gallium arsenide used in solar-cell materials, to tungsten in microelectronics, to water and polymers for shielding purposes, and over a large energy range," Barghouty said.

"The real danger is we really don't know the exact biological effects of these heavy ions on a cell or a tissue. That's a complete unknown," Barghouty said. "We can calculate a lot of things, but how do you translate that to real effects on humans as opposed to electronics and so on. That's another side of the challenges being addressed."

A Unified Theory of Journalistic Caution

By Calla Cofield

APS April Meeting, Savannah

For the last five years, I've attended the APS April Meeting and the APS March Meeting as a journalist, writing primarily for *APS News*. It's a thrill to learn about physics at the cutting edge, but what I love most–what no press release or research paper can capture–is the chance to talk to physicists face to face: to hear them talk about the questions that keep them up at night.

Of course, no matter how confident or excited a scientist is about his or her results, it's the duty of any good science writer to cross-check those results with outside sources. Even great physicists can be wrong.

I was reminded of this during a talk at the APS April Meeting by physicist and author Paul Halpern on Albert Einstein's theory of distant parallelism. If you've never heard of distant parallelism, that's probably because it was wrong, and thus never found a place in physics. Einstein believed that this theory united the forces of gravity and electromagnetism.

Halpern explained that while Einstein did not like personal publicity, he had no problem promoting his work to the press. In 1929, Einstein was at the height of his celebrity status, and as Halpern put it, "was seen as a kind of prophet." Most people took Einstein's promotion of his new theory at face value; *The New York Times* printed a few stories exclusively about Einstein's new theory and continued to mention it in nearly a dozen others. In an article published in the paper on January 12, 1929, the journalist paraphrases Einstein as saying that distant parallelism was "his most important contribution to mankind; scientifically more important than

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provide, is partly what the new Council would do."

The Board of Directors would have final fiduciary responsibility for the Society, approving budgets and overseeing the operation of the Society, as Boards do in most organizations. It also would have responsibility for long-range strategic planning.

In addition, the executive team (a triumvirate of executive officer, Editor in Chief, and treasurer/publisher) that has run the day-to-day operations of the Society and its journals will likely be changed. Joseph Serene, the APS treasurer/publisher, has already announced his retirement at the end of August 2014. The proposal establishes a chief executive officer to oversee the Society's top operating officers. This CEO would also be a non-voting member of the board.

"The plan to introduce a chief executive officer–that is the new part," Beasley said. "There is still some uncertainty about how exactly the positions of Editor in Chief and publisher will fit into the proposed scheme."

APS is now governed by a Council and Executive Board, but members of the Committee on Corporate Reform say that by dividing up the two bodies' responsibilities they can each specialize in their respective areas.

"I think there's widespread feeling, including among many of the Council members, that the Council itself is not being well used," Aronson said. "It's primarily being used as a rubber stamp for decisions from the Executive Board."

These recommendations come after months of deliberation and consultation with outside experts. The Committee, formed in September, interviewed dozens of people from within the organization as well as representatives from other major scientific societies to compare leadership structures.

"Almost all scientific societies have the structure that we're proposing," Beasley said. "That's not a reason to do so, but it tells you that it makes sense."

The reform process has been motivated in part by recent changes to the rules of incorporation in Washington D.C., which puts the APS corporate structure somewhat at odds with the law. In addition, since it was established, the responsibilities of the existing treasurer/publisher position have grown too large for one person. Beasley and Aronson said that they wanted to keep the Society's leadership up-to-date and able to respond to upcoming challenges.

"I think it's a good idea for any organization to look at its governance structure regularly just to make sure that it's aligned still with the needs of the Society," Aronson said. "I don't think it's a question of fixing (or not) something that isn't broken; it's a question of looking to the future."

Currently the Committee is taking feedback it's received from members and planning to put together a final list of recommendations by mid-May. The Committee hopes to hold a meeting with the Committee on Constitution and Bylaws by June 5 and secure Council support at their June 13 meeting in Phoenix. If approved by the Council, the Committee is aiming to hold a membership-wide vote on the plan sometime in September or October.

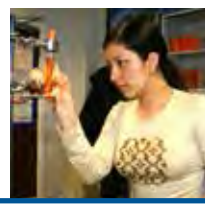
Aronson said that he has been hearing some concerns from the membership about the timeframe of the process. At various meetings, members raised concerns that there wasn't enough time to fully review and discuss the proposed changes.

"I think the right thing for us to do at this point is to make a good effort to keep pushing this along," Aronson said. "Let's just go at the rate we think we can go and modify the schedule if we think it needs more work."

Both Beasley and Aronson urged that members look at the APS website on corporate reform as a means of engaging in the reform process. As Beasley noted, "It is must reading if you want to understand deeply the reform initiative, the reasons for it, the data that has been gathered, the values that must be preserved in any reforms and more details on the proposals themselves." Links to information about the corporate reform initiative and a place to provide feedback are available at http://www.aps.org/about/reform

Education Corner

APS educational programs and publications



APS Conference: Innovation and Entrepreneurship in Education

On June 5-6, APS is holding the conference "Reinventing the Physicist: Innovation and Entrepreneurship Education for the 21st Century" at the American Center for Physics in College Park, MD. This conference will focus on strategies for implementing Innovation and Entrepreneurship education in undergraduate classrooms, and will be primarily targeted toward physics department leaders. Sessions will feature existing programs that have successfully implemented innovation and entrepreneurship components (such as the Scienceworks program at Carthage College, and the Case Western Physics Entrepreneurship Program). Also featured are "success stories" of students who have graduated from these programs and started companies or found employment in companies as a result of these programs. In addition, the conference will highlight resources for educators who are interested in developing innovation and entrepreneurship curricula, or in promoting entrepreneurship among their students and faculty. Representatives from the National Collegiate Innovators and Inventors Alliance (NCIIA) will (1) provide information on existing programs that focus on translating research into viable commercial innovation, and (2) discuss new opportunities for collaboration with departments seeking to implement innovation and entrepreneurship components. For more information, and to register for the conference, please visit: http://www.aps.org/programs/education/conferences/innovation

Free Guide to producing the Research Mentor Training Seminar

APS offers a free guide to the Physics Research Mentor Training Seminar, which helps physics faculty, postdocs, and graduate students succeed in mentorship roles. It is ideal for Research Experiences for Undergraduates (REU) programs and can be run as a weekly seminar during the summer. The guide for this seminar is available in pdf format at www.aps.org; enter "mentor training" in the search bar and select the first option in the search return to learn more and access the guide.

2014 PhysTEC Conference

The 2014 PhysTEC Conference will be held in Austin, Texas on May 19-20, in conjunction with the UTeach Conference. The PhysTEC Conference is the nation's largest meeting dedicated to physics teacher education. This year's theme is "Building Leadership," and the Conference features workshops, panel discussions, presentations by national leaders, and a contributed poster session. There will be a PhysTEC-UTeach joint plenary session by Arthur Levine (Woodrow Wilson Foundation). Other plenary speakers include Nicole Gillespie (Knowles Science Teaching Foundation), David E. Meltzer (Arizona State University) and Susan Singer (National Science Foundation). Additional conference information can be found here: www.phystec.org/conferences/2014

APS Bridge Program 2014 Summer Meeting

Registration is now open for the APS Bridge Program Summer Meeting, which will be held June 25-27 at the American Center for Physics in College Park, MD. This annual meeting will bring together experts to discuss efforts to increase the number of underrepresented minorities (URMs) who receive PhDs in physics. This year's conference will focus on exploring and understanding the role of the MS degree in preparing URMs for PhD physics programs. Workshops, panel discussions, and presentations will address topics including:

- establishing relationships among MS-granting and PhD-granting institutions
- role of master's degrees for URM students
- barriers to student advancement to the PhD
- mentoring
- non-cognitive admissions measures.

Who should attend: faculty, students, and administrators interested in increasing the number of underrepresented students pursuing PhDs in physics. Learn more at apsbridgeprogram.org/conferences/summer14/

NSF DUE Physics Rotator Position

The National Science Foundation's Division of Undergraduate Education (NSF DUE) is seeking candidates for the physics rotator position in DUE. Learn more about Intergovernmental Personnel Act (IPA) assignments at http://www.nsf.gov/careers/rotator/ipa.jsp and/or contact Division Director Susan Singer at srsinger@nsf.gov

Southern Oregon University Suspends Physics Program

By Bushraa Khatib

In March, 2014, Southern Oregon University (SOU) announced suspension of its current physics major program. This surprising development–SOU was doing well in numbers, graduating about five majors a year–serves as a wake-up call to other small- to mid-size physics programs that could face similar situations.

SOU's retrenchment plan states that "Programs targeted for cuts have low enrollment, attracting few students and producing very few graduates, or are not currently meeting the needs of the regional workforce." Physics is not alone–art history, French, photography, professional writing, and film techniques were also eliminated. The university has agreed to let students that have finished their general physics requirements take two years to finish. The fate of faculty is uncertain at the moment.

To support the department and its students, APS and many other members of the physics community wrote letters to the university in support of continuing the major. SOU acknowledged that physics had considerable outside support, noting that, "The largest number of total comments (70) pertained to the proposed elimination of the physics major." Unfortunately, this support did not sway the university.

Physics department chair Peter Wu says that he feels like a deer caught in the headlights. According to Wu, students are understandably upset but have not done much in response to the announcement. He wrote a proposal for the new streamlined program, but has not heard anything yet.

APS director of education and diversity Theodore Hodapp commented, "We are seeing many of these regional public institutions facing a similar threat, with the number of graduates being used as a proxy for viability." Also, Paul Cottle, chair of the APS Committee on Education, warned that, "despite graduating smaller numbers, physics majors have a disproportionate impact on the economy, and broader educational goals of the nation."

The closure of the physics major comes at a time of great uncertainty across SOU, with many factors making the future of physics there unclear. For example, the university president's contract is up for renewal in July. The deans of Arts and Sciences were eliminated for financial reasons, transferring the physics department to the newly created science, technology, engineering, and math (STEM) division. On top of this, nine months ago, Oregon passed legislation dissolving the Oregon university system, and SOU was asked to form its own regional board.

SOU's decision to discontinue numerous programs is difficult to reconcile with legislation passed in 2011, known as the 40-40-20 rule. This bill aims to have 40% of adult Oregonians hold a bachelor's or advanced degree, 40% hold an associate's degree or a meaningful postsecondary certificate, and all adult Oregonians to hold a high school diploma or equivalent by the year 2025. (http://www.ous.edu/partner/404020).

Other administrative policies are also raising concerns at SOU. In past years, the lower division science requirement for many departments was three courses. Wu says that medium-sized universities typically survived by teaching large introductory courses with high enrollment, thus balancing out low enrollment in upper-level elective courses. But now, the university is planning to require only one such course. This is problematic for physics departments already struggling to justify their enrollments and numbers of graduates.

Wu says that reactions to this kind of situation depend on the particular institution–every university is different and there is no one-size-fits-all solution to keeping a physics department open when under threat of closing. To ensure survival, Wu says, "Small programs need to find their niche and find it soon. Don't sit on your laurels too long."

Profiles In Versatility

Physicist-Filmmakers Catch *Particle Fever*

By Alaina G. Levine

Mark Levinson and David Kaplan came together to create the film *Particle Fever*, which chronicles the story of the search for the Higgs boson. In the following abridged interview, the filmmakers share their experiences and how their backgrounds, both past and present, helped them meet the challenges. The full interview is available at http://www.aps.org/apsnews.

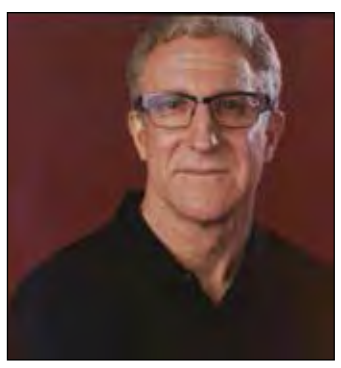


Photo by Myrna Suarez

Mark Levinson **David Kaplan**

Alaina: Why did you make this movie?

David Kaplan, Producer: I knew a very dramatic thing was going to happen in particle physics, dramatic in that everyone who had been working in the field, at least in my narrow theory side, was going to be affected by whatever came out of the LHC. I naturally tended towards film because there's a little [filmmaking] in my background. But that seemed to be the best way to capture the events and the experience of it. I had never seen anything like this before, where you are in real-time going with physicists through the emotional roller coaster and experiencing it, as opposed to something simply being explained to you. It seemed like an obvious time to do it, and I also thought that if I don't do it, nobody would do it. Nobody would capture the experience of the physicists from inside.

Mark Levinson, Director: From my perspective I was a feature filmmaker. For me it represented the opportunity to show, in a narrative dramatic form, this incredible subject and incredible story. It was this opportunity to combine these two threads of my life, and hopefully show authentically what was happening. I still think the most amazing thing [is] that we come up with these incredible theories that have all this abstraction, and [they predict] something about the physical world.

Alaina: How has being a physicist helped you in the filmmaking process?

David: I think being a physicist helps in being a human being, because you look at any complicated situation and attempt to break it down to its elements and figure out a path that is not biased by what other people are saying but by logic. You can [eliminate] a lot of bad directions very quickly by looking at a situation and boiling it down. That's good for any complicated thing. For the simplest things in life it's not good to be a physicist, because you're a pain in the ass and you take a long time to do very simple things.

Mark: For me, the great advantage of having a physics background was that I didn't have to do a lot of research to catch up. The second I met David, I could think about the filmmaking. I

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didn't have to learn physics, which would have been a huge endeavor. Perhaps the greater advantage that the film has from [our spearheading it] was that we knew what we could leave out: "This is the story, this is the physics we need, this is what we don't need" and that became really crucial.

David: (laughs) We weren't always on the same page.

Mark: (laughs) Well mostly. And we both had the same perspective, that mostly less is more.

David: That's definitely true. I think I even pushed for even less (laughs) but didn't win. But this is why the film had to be made by people who really knew the subject. Because somebody coming in has a lot of ramp-up time and then they get very excited about the physics as stuff they just learned and they want to talk about it to everybody, and that's not what we wanted to do. In fact, the last thing we put in the film was the physics, [but only] for the sake of the narrative, not for the sake of teaching the audience something.

Alaina: In the course of making the film and with your interviews, was there new information that you were surprised to learn?

David: I was surprised by the near-universal acceptance that somebody needs to make this film. And in fact some of my colleagues immediately thought it was brilliant idea. It may be that we are finally in a transition period where our generation has totally accepted the fact that we absolutely have to reach out to the public and to take a few more steps towards them, giving them a sense of what we do and what science is and even what the experience is.

Mark: For me, I would say two things. One, I did learn the whole idea of the multiverse. When I was in physics it wasn't anything that was discussed.

David: (laughs) It didn't exist.

Mark: It didn't exist. And so the big discovery for me was this concept and the reasons for it, and that was quite interesting. And the other thing is a little askew. I was a theorist–I was very abstract. The LHC would have almost been too practical for me. And so I had very little contact with experimentalists. Coming into contact with experimentalists and really getting to know them and understand them was terrific.

Alaina: For both of you, was there any way that your physics background hindered the process, or that it was a disadvantage for you?

David: I was trying to figure out why I was getting a PhD in particle physics, which was so incredibly impractical. I was off on vacation and I remember doing a very complicated logic puzzle that I spent a solid 10 days on it until I solved it. I discovered how tenacious the degree was making me: that I was willing to push for a very long time on a very hard problem that I didn't know I would solve. At that moment I decided everybody should get a PhD in physics. I think there are a handful of things you discover in college and you decide everybody should do that because it will make the world a better place.

Mark: I was talking to a film class last night and I said the good news is that I didn't go to film school, but the bad news is I got a PhD in physics (laughs). That was my path in, so you choose your poison. My wife occasionally says that she can see the physicist in me coming out, maybe more lately (laughs).

Alaina: What was July 4, 2012 like for you, both emotionally and logistically [when the announcement of the discovery of the Higgs boson was made]?

Mark: It was actually very interesting because we did not expect initially that there was going to be such a huge announcement. There was a regularly-scheduled physics conference in Australia where they were supposed to announce the latest results from the experiment and we weren't even going to cover it. Fabiola [Gianotti, spokeswoman at the time for the ATLAS experiment at CERN] was going to give a talk. But then a week and a half before, there was an internal memo sent around by the director general of CERN to employees that there was going to be a seminar on the morning of July 4, and that raised our suspicions. So I wrote to Fabiola and said "Are you going to do the presentation in Australia or at CERN?" and she said, "I'm going to be at CERN," and then I booked my ticket (laughs).

David: We were getting rumors along the way and we couldn't confirm it but that email from Fabiola was the nail in the coffin that we had to go over there.

Mark: I got over there and then it was quite interesting. They wouldn't open the auditorium until the morning because they didn't want people camping out overnight, so it became clear that it was big event. And then we heard that [Peter] Higgs was maybe going to be there. When you're in that situation there are so many practical things that you are thinking about. I'm just thinking "Jesus Christ I hope I'm not missing the most important event." When it was actually being done I was just concentrating on the practicalities and it was that night afterwards, when I went on the Internet and saw an explosion [of news] and I thought, wow we just witnessed an absolutely monumental thing. This is what we wanted.

Alaina: You couldn't have known when you started this project that this would be the climactic moment in the film. What did you think was going to be the climactic moment?

David: The film was not supposed to be about the Higgs. The film was supposed to be about the fact that people have been speculating about things like the multiverse, and for many years, people have assumed that there's going to be some new physics that comes with the Higgs. So there was a dichotomy that was growing between the possibility of seeing the new theory at the LHC or the possibility that we would never have access to the next theory, and the fear that generated within the community. I knew the LHC would say something about that, but I didn't know how definitively, and I even figured it would be an unhappy ending, which is hard to sell. So in that case I was hoping for the best, but in my mind the best ending would be any sort of information from the LHC that would emotionally impact the theorists.

(This interview has been edited for clarity and space.)

Alaina G. Levine is the author of Networking for Nerds *(Wiley, 2014) and President of Quantum Success Solutions, a science career and professional development consulting enterprise. She can be contacted through* www.alainalevine.com*, or followed on twitter @ AlainaGLevine.*

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all universities). Less than 20 percent of all university professors perform any scientific work. The whole budget (RAS + universities) for fundamental science is approximately the same as the Harvard budget. The salaries of scientists, apart from members of the Academy, are typically quite low, especially in the beginning of their careers. This pushes gifted young people out of science. The funds available for international collaboration and for journal subscriptions are extremely limited.

The complete absence of a consistent program for restructuring the Academy and for the general development of science in the country could continue for a long time. Last year this sleeping kingdom was awakened by unexpected reform from above. This reform, which was undertaken without any preliminary discussion with scientists, made the situation even worse. Now, scientific institutions have been removed from the RAS and have been transferred to a new bureaucratic organization called the Federal Agency of Scientific Organizations (FASO). Nobody knows how this organization, being led by non-scientist functionaries, will regulate and direct scientific policy. It is supposed to have a director of a scientific institution acting as a local tsar and personally appointing the scientific council of the institution, which earlier was elected by the scientists. The budgets are expected to be cut and in some places people have stopped working and anticipate a big staff reduction. This has already happened to the RAS Institutes in the humanities (several staff members were simply expelled from their premises, which were then occupied by the officials of FASO). One nonsensical part of the reform is the incorporation of the Academy of Medical Sciences and the Academy of the Agricultural Sciences into the RAS; those organizations have a different style and lower scientific prestige.

Unfortunately, the whole style of this reform and some of its specific features bring to mind another possible purpose: the militarization of science. Highly positioned officials have repeatedly required that science be redirected to immediate applications, especially for military purposes. Repression against scientists openly expressing a different opinion took place before the reform and this is seemingly intensifying now. This was clear first of all in non-academic institutions, especially those belonging to the so-called Kurchatov Center, lead by Mikhail Kovalchuk.

Last year the APS Committee on International Freedom of Scientists sent a letter, signed by the 2013 APS President Michael Turner, to the President of Russia expressing concern about the RAS reorganization. He also sent a letter to Kovalchuk on behalf of outstanding physicists Leonid Ponomarev (Kurchatov Institute proper) and Mikhail Danilov (Institute of Theoretical and Experimental Physics, ITEP) who were persecuted for their independent behavior. There was no answer to those letters; Ponomarev was forced to resign. The famous ITEP is in terrible shape, with a destroyed scientific infrastructure and a return to Soviet-style everyday life. Currently the same misfortune is threatening the best world-known institutions in physics, such as the BINP and the Petersburg Institute of Nuclear Physics.

Now the situation is rapidly deteriorating after the annexation of Crimea. The frenzied propaganda on TV and radio plus Orwellian special "hatred lessons'' in the schools all over the country are accompanied by an obedient administration in some scientific centers and institutions of higher learning. Just last week a prominent historian Andrei Zubov was fired from the Moscow Institute of International Relations with the explanation that he was punished for disagreement with the government policy. There is information that the same wave of persecution is going on in peripheral institutions. We should also remember that there are scientists imprisoned for many years after falsified accusations from special services. In spite of the fact that the Russian Constitution clearly forbids establishment of a state ideology, this is what happens in reality. This ideology, with a lot of similarity to what was going on in Germany 75 years ago, including what happened at the Olympic games and the "Anschluss" of Sudeten and Austria, was called by independent journalists "Russism."

Russian scientists are now making attempts to organize their grassroots activity to try to withstand those grave trends (it could be too late...). The most active part in this effort is played by physicists. We have to seriously think about all of the ways we can help them and support Russian science while it is still alive.

Vladimir Zelevinsky is a professor of physics at Michigan State University, East Lansing, Michigan.

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wants science as part of the entertainment landscape is a project of Tyson's own: He is the host of a reboot of Carl Sagan's popular science series *Cosmos*, airing on FOX (a prime-time network rather than a dedicated science channel).

Tyson was already earning comparisons to Sagan, even before he took Sagan's old job. Through his very active Twitter account, a handful of popular books, various television appearances (on both news and entertainment), and an ongoing list of other outreach efforts, Tyson has worked hard to make himself a public face for science. His invigorating personality and down-to-earth explanations helped launch him into the rare realm of celebrity scientist.

At one point Tyson asked how many audience members did not own a television, or if they did, how many watched it infrequently. When many people raised their hands, Tyson replied, "Then most of you have no idea who I am."

Tyson's talk focused on convincing the audience that science had made its way into popular culture, and that being engaged with the public allowed him to participate in discussions about topics other than science. He also emphasized that scientists should learn about pop culture if they want to communicate with the public or even with their students.

Tyson showed his audience the top ten Twitter accounts in the world, each with an excess of 30 million followers. The list includes seven pop singers and President Obama. Tyson told his audience, "If you ever need to communicate with anyone who isn't a physicist, go learn who these people are. Because everybody else knows who they are. Otherwise don't go home crying that nobody understands you. You testify to Congress and you say they don't get it there's something wrong with them. Noooooo. There's something missing in your lexicon because everybody else is fluent here. And if you want them to fund what you're doing, learn something about what people are doing outside of the laboratory."

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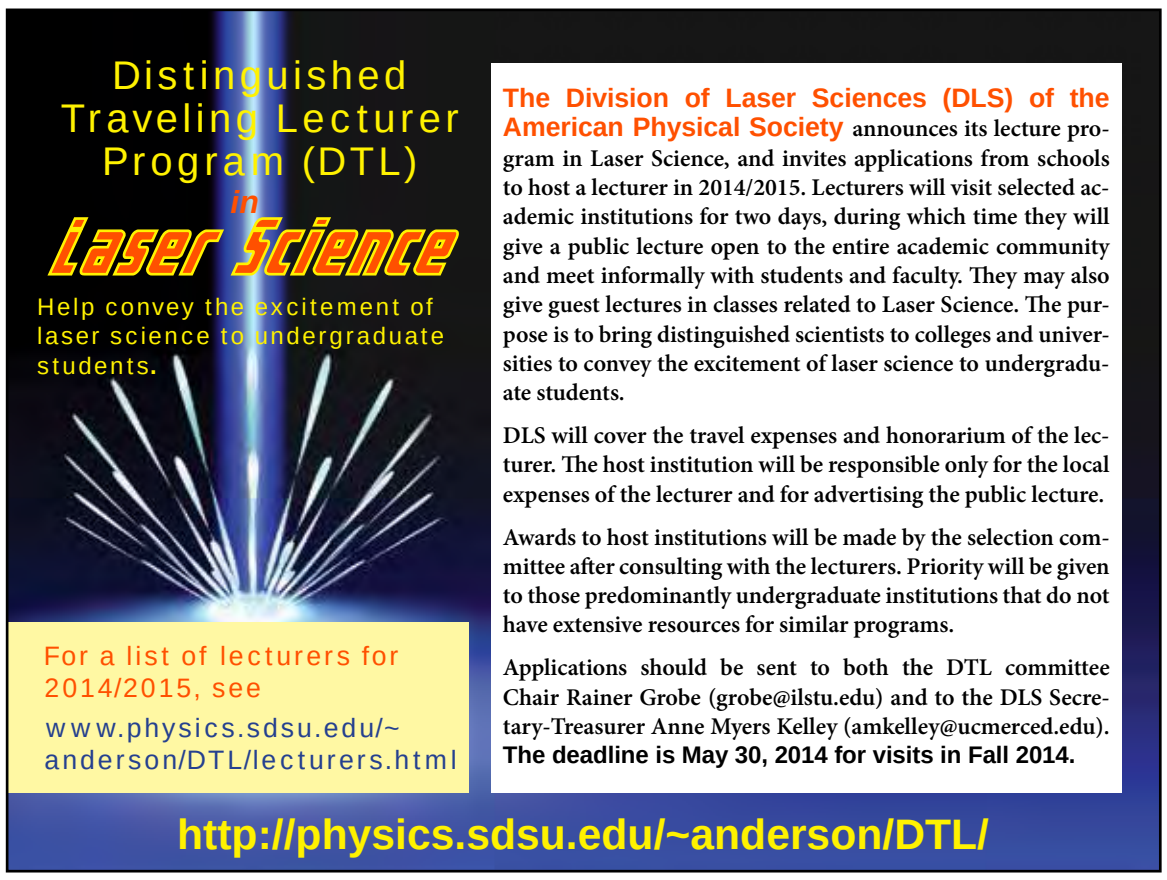
periment was to train a replacement, so Slotin could resume his prewar research in biophysics and radiobiology at the University of Chicago. He never got that chance.

In response to his death, Los Alamos ceased all hands-on experiments with critical assemblies, using remote controlled machines to protect the operators. As for the killer "demon core," it was used in one of the first postwar atomic bomb tests at Bikini Atoll, a mere five weeks after Slotin's death. The test went off without a hitch.

Further Reading:

1. Miller, Richard L. *Under the Cloud: The Decades of Nuclear Testing.* The Woodlands, Texas: Two Sixty Press, 1991.
2. Rhodes, Richard. *The Making of the Atomic Bomb*. New York: Simon & Schuster, 1987.
3. *A Review of Criticality Accidents, September 26, 1967*, Los Alamos National Laboratory. http://library.lanl.gov/cgi-bin/getfile?00314607.pdf

ANNOUNCEMENTS



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his original theory [of relativity]."

Other physicists promoted the theory as well (although perhaps they were not actually qualified to comment on the science); the chair of the New York University physics department openly discussed the hope that this theory could be used for some kind of anti-gravity device.

There was, however, a voice crying out in the wilderness: Wolfgang Pauli, who could understand Einstein's theories, pointed out that distant parallelism did not incorporate the newly-discovered property of spin, and that it also fell apart in various other ways. Pauli wrote letters to Einstein pointing out these flaws, but also took jabs at Einstein for the number of times he claimed to have found a unifying field theory. Eventually Pauli's writings on the subject veered into pure satire, as when he wrote that Einstein, in all his greatness, "blesses us with about one such theory per year," and that each new theory should be greeted with the cry, "'Einstein's new field theory is dead! Long live Einstein's new field theory!'"

It seems that neither Einstein nor the press learned their lesson with distant parallelism; in 1950, Einstein would promote yet another unification theory, and yet again the press would accept it uncritically.

Do I have it easier than a science writer living in 1929? Thanks to the Internet, it is easier to find someone like Pauli to help put things into perspective. Then again, it also gives a podium to everyone with a theory to share.

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paign document."

The divide between the two houses of Congress appears insurmountable, and analysts say there will likely be no grand bargain reached on spending, and no replay of the 2014 omnibus appropriations bill passed in January.

"I'm anticipating a continuing resolution," Lubell said. Usually when a federal budget isn't agreed upon, Congress passes a continuing resolution, which essentially carries over funding from the previous fiscal year. This means that budgets stay about flat in unadjusted dollars, and decline in real value because of inflation.

Sequestration's Legacy

Looking ahead to 2016, the picture is murkier still. The sequester, which was designed to reduce discretionary spending by nearly $1 trillion over eight years, hasn't entirely gone away. The budget agreement for 2014 reduced the mandatory cuts imposed on the discretionary budget by about half, and reduced those cuts for 2015 by a quarter. So far Congress hasn't made any agreements to reduce the sequester for 2016, but the deadline to do so is still far off.

"We'll see what happens; they keep coming up with these small deals," Hourihan said. "My fear is they're going to run out of small fixes."

Opportunity, Growth, and Security Initiative

On top of the proposed federal budget, the president also announced the Opportunity, Growth, and Security Initiative (OGSI), which would add an additional $56 billion to the budget. About $5.3 billion of this would be directed towards various research and development budgets including NIST, NSF and NASA. "[If it were to happen] most of the big science agencies would get a pretty big bump out of that initiative," Hourihan said. He estimated that with the OGSI added on to the president's proposed budget, the increase in overall research and development funding would grow from 0.6 % to 4.5 % over 2013. "That $56 billion dollar plan isn't real. It's posturing," Lubell said. "Nobody's taking that seriously."

On its face, the initiative appears to be a non-starter. Senate Democrats have already stated that they're not going to try to increase the discretionary budget over already agreed-upon spending caps. However the initiative could act as a means for the president to communicate his priorities to Congress. Programs emphasized in the OGSI might get an extra boost when it comes time to appropriate the final budgets for the agencies.

"It wouldn't really be correct to say the OGSI has no chance of passing. Pieces of it could be passed," Hourihan said. "Any increase they grant they have to decrease elsewhere."

America COMPETES

Also controversial on the Hill is the reauthorization of the America COMPETES Act, which ups the funding for various science agencies. Previous versions, first passed in 2007 then narrowly renewed in 2010, called for a doubling of the budgets of NSF, NIST and the DOE Office of Science by 2011 and 2017 respectively. Having missed its targets, the COMPETES Act is up again this year for renewal. It is unclear if any version of this bill will be signed into law.

While the Senate's version is a fairly straightforward continuation of the previous legislation, with the new doubling target date pushed back to 2023, the House is taking a fundamentally different approach. House Republicans split the bill between the Frontiers in Innovation, Research, Science and Technology Act (the FIRST Act), which covers NSF, NIST and the Office of Science and Technology Policy, and the Enabling Innovation for Science, Technology, and Energy in America Act (the EINSTEIN Act), which covers the Department of Energy. The EINSTEIN Act has yet to be formally introduced, but controversy has dogged the FIRST Act even before it was officially revealed.

Under the Senate's COMPETES, funding for NSF and NIST would increase by about 4.9% each year until 2019 when the bill would have to be reauthorized. The FIRST Act approves increased funding for only one year and would raise the agencies' budgets by 1.5%, just below the predicted inflation rate.

However, the most controversial aspects of the FIRST Act are the modifications it makes to NSF's peer-review process. The original version required that all grants demonstrate that the research would benefit the country by contributing to its economic growth or national defense and also identify the staffer awarding each grant. In addition, the bill draft zeroed out all funding for social science research. "The bill itself is highly contentious and unlikely to elicit much support in the Senate," Lubell said. "The reaction to it has been very negative from the science and technology community." Several organizations including the APS, AAAS and the American Society for Biochemistry and Molecular Biology released statements criticizing the bill.

Also in response, Rep. Eddie Bernice Johnson (D-Tex.) introduced a version of the Senate's COMPETES Act into the House, but analysts say that it has little chance of becoming law.

The requirements were softened when the FIRST Act was marked up on March 13 to require grants to have only "the potential" to benefit society, and dropped the identification requirements. It also restored about 60% of the social science research funding. "It tells the Foundation how to conduct business," Lubell said. "This has never been done as far as I know." The revised version also imposes a lifetime limit of five NSF grants a researcher can receive."There are people who say that the real objective is to give younger investigators a leg up," Lubell said. "There are plenty of ways of doing this that are more effective than crippling the peer-review process."

The sharp policy and funding differences between the House and Senate versions of the bill mean that compromise is unlikely. "The Democrats and the Republicans are so completely far apart, it's hard to know what's going to happen there," Hourihan said. "From a funding perspective, it's hard to see where the compromise is going to come from."

APS is pleased to announce:

Four New Honors and a Change in the Frequency of the Delbruck Prize

Newly established Fellowship:

Ovshinsky Sustainable Energy Fellowship (Unit: GERA)
Deadline: July 1, 2014
http://www.aps.org/units/gera/awards/ovshinsky.cfm

Newly established Dissertation Awards:

Award for Outstanding Doctoral Dissertation in Laser Science (Unit: DLS)
Deadlines: May 19, 2014 (Fio/LS Conference) and June 1, 2014 (DLS nomination)
http://www.aps.org/programs/honors/dissertation/laser.cfm

Outstanding Doctoral Thesis in Astrophysics (Unit: DAP)
Deadine: August 1, 2014
http://www.aps.org/programs/honors/dissertation/astrophysics.cfm

Richard L. Greene Dissertation Award in Experimental Condensed Matter or Materials Physics (Units: DMP, DCMP)
Deadline: September 1, 2014
http://www.aps.org/programs/honors/dissertation/greene.cfm

A change in frequency:

Max Delbruck Prize
The Max Delbruck Prize in Biological Physics will henceforth be Awarded Annually (Unit: DBIO)
Deadline: July 1, 2014
http://www.aps.org/units/dbp/awards/delbruck.cfm

Correction

In the November 2013 issue of *APS News*, Leslie Kerby, a Blewett scholar, was incorrectly listed as attending the University of Iowa. She is attending the University of Idaho.

APS BRIDGE PROGRAM
Summer Meeting

June 25-27, 2014
American Center for Physics
College Park, MD

The APS Bridge Program Summer Meeting will bring together experts to discuss efforts to increase the number underrepresented minorities (URMs) who receive PhDs in physics. This year's conference will focus on exploring and understanding the role of the MS degree in preparing URMs for PhD programs.

Workshops, panel discussions, and presentations will address topics including

- Establishing relationships among MS-granting and PhD-granting institutions
- Role of Masters' degrees for URM students
- Barriers to student advancement to the PhD
- Mentoring
- Non-cognitive admissions measures.

Who should attend: faculty, students, and administrators interested in increasing the number of underrepresented students pursuing PhDs in physics.

APS BRIDGE PROGRAM physics
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The Back Page

Nelson Mandela's Leadership

by Alfred Z. Msezane and Sekazi K. Mtingwa

Nelson Mandela (July 18, 1918–December 5, 2013) overthrew apartheid in South Africa and liberated non-whites from racial oppression and the constant threat of government-sanctioned violence. The methods and strategies adopted by Mandela in eliminating apartheid are similar to those employed by physicists when addressing complex and challenging problems. In particular he understood the importance of forming national/international collaborations and partnerships, as well as securing adequate funding. Unfortunately, Mandela's problems were made even more complex and difficult because of time-dependent varying perturbing sociopolitical forces.

Through extensive reading, and subsequent application of the knowledge obtained, Mandela discovered that determination and nontraditional thinking were essential to success. The leadership of the African National Congress (ANC), along with Mandela himself, included high-caliber intellectuals. They were educated mainly at English-speaking universities, particularly Fort Hare and later at the University of the Witwatersrand (Wits). In this environment, the ANC leadership creatively utilized dynamic problem-solving and nonviolent response strategies. This creativity was essential to minimize the potential for the slaughter of innocent lives in the struggle against apartheid.

The Treason Trial

In 1948 the Nationalist Party won the election in South Africa for the first time, essentially on the basis of apartheid, and immediately embarked upon the apartheid policy. For instance, the Group Areas Act of 1950 prevented black and colored South Africans from owning land in urban areas. This resulted in the massive forced removal of blacks, Indians and coloreds from cities to new townships at the outskirts of cities, such as Soweto for blacks. In 1955, a massive ANC conference near Soweto adopted the "Freedom Charter." Inter alia, it affirmed that South Africa belongs to all its inhabitants, black, colored, Asian and white, and demanded a non-racial, democratic system of government, as well as equal protection for all people before the law.

As a result of this and other actions, 156 individuals, including ten women (105 Africans [blacks], 23 whites, 21 Indians and 7 coloreds) were arrested and charged with high treason in 1956. The actual number that stood trial was 30, which included Mandela, Walter Sisulu, Oliver Tambo, and such lesser-known but important persons as Joe Slovo, Ahmed Kathrada, Helen Joseph, Lillian Ngoyi, and Duma Nokwe. Albert Luthuli viewed the treason trial positively; it demonstrated that the resistance was not a matter of race [1]. Importantly, the Treason Trial Defense Fund allowed the defendants to engage eminent lawyers.

It was during the treason trial that Mandela's skills as a brilliant barrister and visionary leader became manifest; he emerged as the ANC's most valued figure and leader. After the Sharpeville massacre (March 21, 1960), the Government declared a State of Emergency and banned the ANC. Without the legal team, Mandela and Nokwe then adopted a strategy that physicists could characterize as entanglement. This was a legal maneuver designed to slow down the trial process considerably, thereby allowing the State of Emergency to expire.

When the trial resumed, the government alleged that the accused intended to replace the existing government with a Soviet-style state. The Crown relied on the expertise of Andrew Murray, Professor of Philosophy at the University of Cape Town. He labeled many of the documents seized from the accused, including the Freedom Charter itself, as communistic. Finally, the defense read a passage that the professor unhesitatingly described as "communism straight from the shoulder" [2]. This turned out to be Murray's own article, written in the 1930s. The three judges found the accused not guilty and acquitted them. Mandela commended the judges for "being decent men." Many of us in South Africa followed the trial religiously and were strongly motivated to continue our education, particularly following the government's defeat with its own laws, to enhance our intellectual capacity (AZM attended Fort Hare, 1960-1965).

Operating underground

Immediately after the treason trial Mandela went underground without even going home; the writing was already on the wall about the authorities' intentions. He then began organizing and operating against apartheid like the Scarlet Pimpernel, that elusive character of the French Revolution. Mandela's statement [2]: "Guide the violence that was inevitable," convinced the executive of the ANC, particularly Chief Luthuli, who was morally committed to non-violence. It was important to Mandela to guide it to save as many lives as possible.

Photo from Wikimedia Commons

"Education is the most powerful weapon...to change the world."

In May, 1961 Mandela made the bold public statement [2]: "If the Government's reaction is to crush by naked force our nonviolent struggle, we will have to reconsider our tactics." Notwithstanding the ANC executive committee's criticism of him, Mandela, demonstrating his superb leadership qualities, responded [2]: "But sometimes one must go public with an idea to push a reluctant organization in the direction you want it to go."

In the 1960s, Mandela, underground and wanted, was tasked with organizing "Umkhonto weSizwe" (The Spear of the Nation), the military wing of the ANC, but the ANC itself still remained committed to the elimination of apartheid through nonviolence. He travelled through Africa to England, studying and advocating for his case. After seventeen months on the run, he was arrested and charged with treason. At the Rivonia Trial, he concluded his defense famously with: "I have fought against white domination and I have fought against black domination. I have cherished the ideal of a democratic and free society in which all persons live together in harmony and with equal opportunities. It is an ideal which I hope to live for and to achieve. But if needs be, it is an ideal for which I am prepared to die." The presiding judge spared him the death sentence, but gave him life imprisonment.

Mandela's Impact on Science and Technology in Africa

In 1990, Mandela came out of Robben Island after twenty-seven years of incarceration and shared the Nobel Peace Prize in 1993 with former president Frederik de Klerk. In 1994, he made history when he became the first black president of South Africa. Part of what made Mandela an outstanding leader is that he had no vengeance in his veins. Of leadership, Mandela wrote "Lead from the back–and let others believe they are in front."

The elimination of apartheid positioned Mandela to unleash a force that accelerated science and technology on a trajectory that changed forever his country and others in Africa. He made political moves that were based upon the same critical thinking skills that make an excellent physicist. He analyzed how leaders in other countries addressed problems, and carefully determined the path forward. The "political physicist," Mandela, was not perfect. Many believe that he did not act swiftly and decisively enough to curtail HIV/AIDS. Notwithstanding that, soon after leaving office, Mandela founded the Nelson Mandela Foundation, whose major thrust being to educate the public about HIV/AIDS, prevent new infections, and provide for the treatment of AIDS.

One of the greatest achievements realized by the momentum for science and technology generated by Mandela was the selection of South Africa and Australia as the two major sites for the international Square Kilometre Array (SKA). It will be the world's largest radio telescope and one of the biggest scientific projects ever to be carried out. His administration recognized that Southern Africa had the geography and environmental indicators necessary for leadership in astronomy. His Minister of Arts, Culture and Technology, Baldwin Ngubane, successfully promoted the multinational SKA project for Southern Africa. Philemon Mjwara, the current Director General of South Africa's Department of Science and Technology and one of the creators of the African Laser Center (ALC), ensured South Africa's successful bid for the SKA.

With the support of MIT, one of us (SKM) helped to establish the ALC, a virtual center, comprising over thirty laboratories throughout Africa that seeks to enhance laser science and engineering in both research and training, thus contributing to Mandela's vision for science to be the driver of innovation for the whole of Africa. Closely connected to the ALC is the US-Africa Advanced Studies Institute, created by one of us (AZM), which brings graduate students, postdocs and senior researchers to Africa periodically to learn about the latest developments in optics, photonics and atomic physics.

Mandela's vision promoted South Africa's participation in the Higgs boson discovery at CERN's Large Hadron Collider; establishment of the National Institute for Theoretical Physics, headquartered at Stellenbosch University, with regional nodes at Wits and the University of KwaZulu-Natal; creation in 2007 of the African University of Science and Technology in Abuja, Nigeria, the first of a series of Nelson Mandela Institutions; Namibia's bid to host the southern hemisphere portion of the international Cherenkov Telescope Array, which will be the world's largest gamma ray telescope; and the development of South Africa's rapidly growing synchrotron light source user community. For the last item, the government recently approved the community's Strategic Plan, and also (1) approved the development of a more detailed business plan and (2) signed a formal medium-term arrangement with the European Synchrotron Radiation Facility.

In 2007, Francis Allotey of Ghana convened the final international planning meeting for the new African Physical Society (AfPS) during the 2nd US-Africa Advanced Studies Institute held at iThemba LABS in Cape Town. Subsequently, in 2010, the Laser Atomic, Molecular and Optical Sciences (LAM) Network's President Ahmadou Wagué of Senegal organized a joint meeting of the LAM Network, ALC, Edward Bouchet Abdus Salam Institute (EBASI), which fosters African and African-American partnerships, and the (US) National Society of Black Physicists (NSBP). That meeting launched the AfPS with Allotey as its first President. At the recent LAM 10 Conference in Senegal, 2014, Wagué attributed to Mandela the establishment of the LAM Network.

Indeed, Mandela's triumph over apartheid and vision for science and technology are embodied in his statement: "Education is the most powerful weapon which you can use to change the world."

Alfred Msezane, professor of physics at Clark Atlanta University, is a Fellow of the Institute of Physics, National Society of Black Physicists (US), American Association for the Advancement of Science, and APS. Educated in South Africa, Canada and the US, he has co-authored over 300 peer-reviewed research papers.

Sekazi Mtingwa is Principal Partner at Triangle Science, Education & Economic Development, LLC and President of INCREASE, an organization whose goal is to increase the utilization of facilities at US national laboratories by faculty and students from African-, Latino- and Native-American-serving colleges and universities.

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2. Nelson Mandela, *Long Walk to Freedom: The Autobiography of Nelson Mandela* (Little, Brown and Company, 1994).

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