The government shutdown, ending just as APS News goes to press, had serious but uneven effects on the country’s federal science efforts. All federally operated laboratories were shuttered and employees furloughed, while labs run by contractors remained open. However, experts say that the bigger, longer-term danger to science was not the shutdown itself, but changing attitudes towards discretionary spending on Capitol Hill.

In the short term, the shutdown was disruptive to research labs across the country. Existing experiments were halted and new experiments were delayed. However, it’s unclear what effects the work stoppage will have on the nation’s science output in the long run.

Work at most of the nation’s radio telescopes was suspended, and some labs that were part of medical trials had to be euthanized. The Antarctic research station was put into “caretaking” status, delaying the setup and start of new experiments at the beginning of their busiest research season.

However, not all federal facilities were affected equally. Sixteen of the Department of Energy’s 17 national laboratories are contractor-operated. They remained open, but as a precaution, most labs started restricting employee travel and instituting other cost-saving measures.

“If the shutdown had lasted five days, ten days [or] 15 days, it would have been a disaster for physics. We would have lost a lot of momentum,” said Michael Lubell, Director of Public Affairs for the APS. “But if it had gone on for several months then yes, they would have been affected.”

The legislation ending the shutdown did not provide a permanent solution to the problem. The government is currently funded through the middle of January. If a broader budget agreement is not reached in the interim, another shutdown could be in the offing.

During the shutdown, the National Science Foundation was dark and stopped issuing new grants, but researchers funded by NSF grants could continue to work at their own institutions. The Defense Department’s SHTUTDOWN continued on page 7

By Michael Lucibella

A Public Action of the American Physical Society
In 2000, the Clay Mathematics Institute announced it would award a $1 million prize for the correct solution to each of seven unsolved mathematical problems, collectively dubbed the Millennium Prize Problems. Only one of the seven has since been solved: the so-called Poincaré Conjecture, considered one of the most important open questions in topology. The conjecture was the brainchild of Jules Henri Poincaré, born in April 1854, the son of a professor of medicine at the University of Nancy. A precocious child, Poincaré had received his early schooling from his mother. But in 1862 he entered the local lycée, where he proved an exceptional student, excelling in both the modern and physical education. One of his instructors described him as a “monster of mathematics.” After graduating and his father served in the Ambulance Corps during the Franco-Prussian War. In 1873, Poincaré began studying mathematics at the École Polytechnique, and went on to earn a degree in engineering in 1879. He worked as an inspector for the Corps de Mines while continuing his mathematics education. By 1881, he was studying mathematics at the University of Paris. His thesis, completed in 1879, proposed a new way to study the properties of differential equations. He taught at the University of Caen before taking a position at the University of Paris in 1881. By then he had already earned a reputation as one of the greatest mathematicians in France.

Poincaré, then just 32, was elected to the French Academy of Sciences in 1887, the same year he also won a competition organized by the king of Sweden to resolve the three-body problem on the free motion of multiple orbiting bodies. That work helped lay the foundation for modern chaos theory. Poincaré’s many other contributions to mathematics would later prove seminal to establishing the field of topology, as well as the theory of special relativity.

As the 20th century dawned, Poincaré turned his attention to determining the topological properties of a sphere. Topology concerns those properties of physical objects that don’t change when those figures are shrunk, stretched, or distorted in some way, so that whether there is a knot in a closed curve in space, or whether or not it has a boundary. Poincaré used a two-dimensional sphere—one, two-dimensional sphere—or, topologically speaking, the two-dimensional surface of a three-dimensional sphere—posesses a property known as simple connectivity, such that any given two-dimensional closed surface, regardless of how it is distorted, is topologically equivalent.

Poincaré’s famous conjecture, outlined in a 1904 paper, simply states that the same holds true for three-dimensional spheres as well, or rather, the three-dimensional surface of a four-dimensional sphere. It is usually stated tautly: “Every simply connected, closed 3-manifold is Homeomorphic to the 3-sphere.” It is easy enough to make that statement, but far more difficult to devise a rigorous mathematical proof.

Poincaré died in 1912, from complications following surgery. His legacy would remain unsolved for nearly 100 years. The first claimed proof appeared in the 1930s, by the mathematician J.C. Whitehead, but he later retracted it. Other claims surfaced throughout the 1950s and 1960s, but these, too, were quickly found to be flabbergasted, and were retracted.

Many mathematicians made small steps toward the eventual solution. Cornell University’s William Thurston pointed the way when he suggested exploring the fact that spheres have constant curvature, regardless of dimension. His Berkeley colleague, Richard Hamilton, built on that work and employed a technique called Ricci flow, which treats transforming shapes in a similar fashion. Much like flowing heat smooths out irregularities in the temperature map, Ricci flow can smooth out irregularities in sphere-like shapes.

Unfortunately, this process breaks down at some point, resulting in singularities, requiring topologists to perform a kind of “surgery” on the figure in question by grafting on pieces of other shapes. But even Hamilton wasn’t sure if all possible singularities could be properly handled. The solution to the puzzle was provided by a reclusive Russian mathematician named Grigori Perelman. In November 2002, Perelman submitted a short paper to the arXiv, followed by two more papers. He demonstrated that, indeed, it was possible to repair all such singularities and offered the first rigorous solution to the long-standing conjecture. All indications are that his arguments are correct.

In 2006, news broke that Perelman had been awarded the prestigious Fields Medal, the highest honor in mathematics, for “his contributions to geometry and his revolutionary insights into the analytical and geometric structure of Ricci flow.” Alas, even the increasingly reclusive scholar turned it down, declaring “everybody understood that if the proof is correct, then no other recognition is needed.” It was not the first time he had turned down a prize, having previously declined the 1994 prize for the Poincaré conjecture. The俄羅斯政府 continues to support the culture of mathematics in Russia, and it seems that the work of Perelman has helped to inspire a new generation of Russian mathematicians.

This November in Physics History

—The Editors

This Month in Physics History
POLICY UPDATE

**Fiscal Year 2014 Appropriations and Government Shutdown**

As APS News was preparing to go to press, federal agencies were just getting back to normal. The shutdown occurred when House Republicans insisted that a continuing resolution to keep the government funded be paired with modifications to the Affordable Care Act (ACA), also known as Obamacare. The stage had been set months earlier when the House and Senate had been unable to agree on fiscal year 2014 spending levels. The Senate Budget Resolution contained $97 billion in total budget authority, while the House Resolution contained only $967 billion in total budget authority. Consequently, the new fiscal year began without a single appropriation bill having been passed.

Although the Democratically controlled Senate had reluctantly agreed to a total spending level of $986 billion—which incorporated sequestration levels—Tea Party House Republicans demanded defunding, delaying or significantly altering the President’s signature health legislation as a requisite for a continuing resolution. When the White House and the Senate rejected those demands, and Speaker John Boehner (R-OH) refused to allow the House to vote on a “clean” funding bill, government agencies were forced to shut down.

All non-essential government employees were furloughed, and non-essential activities were curtailed. Furloughs affected more than 95 percent of employees at the National Aeronautics and Space Administration and the National Science Foundation. The National Institute of Standards and Technology and the National Institutes of Health shut down all of their laboratories. The National Science Foundation, however, was able to continue, with a one-third reduction in staff. The U.S. Space Force also continued to operate, providing the public with NASA updates.

Even where research programs were functioning under prior grants, many were hampered by the inability of scientists to access data collected by federal agencies and the impoundment of contractor funds. Senate Democrats and Republicans were striving to achieve at least a short-term bipartisan agreement to avert the predicted upheaval, although House acceptance remained in doubt.

But even though the House accepted a Senate agreement, the impasse will be to postpone resolution of significant disagreements between Democrats and Republicans over defense and non-defense discretionary spending, mandatory spending, tax policies, and sequestration. The government will remain in a partial battle over the nation’s fiscal future a few months down the road.

The Helium Stewardship Act

*After nearly two years of intensive effort by the end user community, including the APS, the President signed H.R. 527, the Helium Stewardship Act of 2013, into law on October 2. P.L. 113-140 ensures that the Bureau of Land Management (BLM) can continue to supply crude helium to the market without interruption. It creates a auction process to determine a market price and to incentivize the private sector to develop additional helium reserves. Moreover, it ensures a steady supply of helium to the research community. Finally, it reserves 3 billion cubic feet of crude helium for federal use; this includes use by federal agencies and federal grantees through the In Kind program.*

While the APS was successful in having Congress include language for membrane R&D to improve helium capture at the wellhead, the future of supply to federal users and federal grantees after the BLM leaves the helium business is not yet clear.

**WASHINGTON OFFICE ACTIVITIES**

**Media Update**

APS member Kenneth Rudinger, a PhD graduate student in the University of Wisconsin-Madison’s physics department, authored an op-ed on Sept. 26 in the Milwaukee Journal-Sentinel. Titled “Government shutdown threatens scientific research,” the piece urges Congress to avoid a shutdown and fully fund scientific research.

As a follow-up to the op-ed, Rudinger was interviewed on Wisconsin Public Radio. Reference to the effect the government shutdown is having on scientific research.

To read the op-ed, click the following link: http://www.wiscontext.com/news/opinion/government-shutdown-threatens-scientific-research-b9b1071432-225419442.html

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**POINCARÉ continued from page 2**

The retardation at APS headquarters in College Park, MD, was on the evening of September 19 by 130 APS Fellows and their guests, who mingled with APS leadership and staff and enjoyed the refreshments at a reception hosted by APS. The Fellows also heard brief presentations from APS President Michael Turner and Executive Officer Kate Kirby, and a panel discussion about the Congressional Science Fellowship Program, celebrating its 40th anniversary (see photo on page 1).

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**APS Fellows Gather in College Park**

The retardation in the world’s helium supply, but will cause prices to rise. The disruption would have followed the loss of authority to sell helium by the U.S. government and Administration; however, a concerted effort by scientists, led in part by APS, helped pass legislation in Congress.

“It’s a huge win for us and the membership,” said Joidi Liebermann, APS fellow and specialist at APS. “Our membership really stepped up.”

The BLM’s Federal Helium Reserve supplies about 40 percent of all the helium in the United States, and about 35 percent worldwide. Because of legislation passed in 1996, the BLM could sell helium at a fixed price only until the reserve’s substantial debt was paid off. It broke even in September, and had Congress not acted, would have stopped selling its helium come October.

The new law will let the reserve offer its gas at market prices, meaning that costs for customers will go up. Exactly how much prices rise will depend on the market, but it will be less than market experts predicted had the BLM stopped selling its supplies.

Helium is vital to numerous scientific, medical and industrial processes. Welders and microprocessor makers use the inert properties of the gas for manufacturing. Its cryogenic properties are critical for MRI machines, as well as for physicists’ ultra-cold experiments.

In recent years helium short supplies have driven high prices. The low cost encouraged excess consumption, eating into supplies. Scientists have reported that when supplies were totally out of helium. The higher cost should reduce some of the overconsumption and at the same time stimulate more investment.

“The price of helium will go up and hopefully that will encourage more mining and discovering of new helium,” said Moses Chan of the University of California. “The Senate passed its version of the bill by a vote of 97 to 2. The House followed a week later. Because of differences in the House and Senate bills, the Senate had to pass the House version on September 26th. The bill then went to the president for his signature on October 2.

Federal scientists and researchers operating with a federal grant will have access to the “in-kind” program, which offers helium at deeply discounted rates. Some researchers have reported that in recent years as much as 70 percent of their grant money has gone towards procuring helium.

“Four of the biggest helium reserves will be able to provide new supplies, as well as for physicists’ ultra-cold experiments,” said Liebermann. “This is a huge win for physicists, while a huge win for us and the membership.”

**Further Reading:**


Doing Science “Online”

There is an interesting footnote to the article “Lord Rayleigh and the Discovery of Argon” in the August/September APS News. When Rayleigh and Ramsay were working on the problem in their rooms at University College, London, they exchanged results by telegraph—perhaps the first example of scientific collaboration in the digital age.

David R. Lide
North Potomac, MD

APS, AIP Launch Education Policy Fellowship

APS and the American Institute of Physics (AIP) announced in early September the formation of a new policy fellowship that will place PhD scientists at the Department of Education for up to two years. The purpose of the fellowship is to place a PhD scientist within the department to advise on STEM education issues and policy. Organizers hope that the STEM Education Policy Fellowship will help the federal government better promote science, technology, engineering, and math education in classrooms.

“The Department of Education has historically not done very much in STEM education,” said Theodore Hodapp, AIP’s Director of Education and Diversity, adding that there is only one person devoted full time to STEM issues. APS has been trying to establish a fellow at the Department of Education for some time. It has helped support the AAAS Congressional fellowships since 1973, but has had a harder time placing someone at the Department of Education.

“It started with our placing a science student as an intern last summer,” said Tyler Glembo, Government Relations Specialist at APS. “Now we also have a full-fledged program to the success of that...it has now given us the opportunity to take that up to the next level.”

The focus changed last year when the administration announced the formation of the STEM Master Teacher Corps. As the program ramps up, the Department of Education intends to subside as many as 10,000 STEM teachers in four years.

“Because of this STEM Teach-

FELLOWSHIP continued on page 6

ACTIVIST continued from page 1

exile, Altshuler became his big-
gest advocate, organizing peti-
tions and publicity for the scientist turned dissident.

“When Sakharov had his strug-
gle for human rights, Boris Alt-
shuler was much more involved with the Human Rights Committee of the City University of New York, and a member of the selection committee. “He didn’t have the standing of Sakharov. He could easily have been sent to prison for many years.”

The Soviet government at-
tacked Altshuler’s professional career because of his activism. For five years in the mid-eighties the physics professor was demoted to staff junior at the Institute on the urging of the KGB. After the collapse of communism, he contin-
ued to advocate for human rights in Russia. In addition, he estab-
lished “The Right of a Child,” to reform and raise awareness about the country’s troubled foster care system.

A Rayleigh Miscellany

I enjoyed the Physics History column, “Lord Rayleigh and the Discovery of Argon” in the August/September APS News, particularly since Rayleigh is a fa-

vorite of mine. Rayleigh treated everyone well and would have fit the APS Strategic Plan nicely in his encouragement of women and young physicists. The Ray-
leigh-Jeans law mentioned in the article is so-called because the young Jeans (just graduated from Cambridge) pointed out an error in Rayleigh’s comparison of his blackbody equation with that of Planck’s; in Nature, Rayleigh re-

sponds, “I hasten to admit the jus-
tice of this correction.” Regarding the joint credit for the discovery of argon by Rayleigh and Ram-

say, Lady Rayleigh’s journal (16 August 1894) says that Rayleigh says, “RAY is coming in most in-

gly according to scientific etiquette, but did not complain,” and Ray-

leigh went on to co-author the joint publication then, as well. One of my favorite quotes is from Rayleigh’s Nobel lecture on the discovery of argon:

“Argon must not be deemed rare. A large hall may easily contain a greater weight of it than man can carry.

It may not be widely known that Rayleigh’s notebooks, begin-

ning as a student at Cambridge in 1862, reside at the library of the U.S. Air Force Academy, for an interesting reason. Physicists at what is now called the Air Force Research Laboratory used aerial measurements to track the effect of solar activity, but had no data prior to 1950. They learned that Rayleigh’s son, the 4th Baron Rayleigh, had made almost daily measurements from 1920 until his death in 1947. They were able to purchase his notebooks in a lot that included those of more famous father, the final entry be-

ing in March of 1919, shortly be-

fore Rayleigh died. The collection includes many letters, papers re-

tated to invention of the foghorn, the joint credit for the discovery of argon, RAY is sister-in-law (beginning “Caven-

dish Laboratory, April 1888”), and a metal box marked “Unpublished

A large project should properly be
discussion of ideas on topics for Asia-Europe

Asia-Europe Physics Summit Provides a Global Perspective

By William Barletta and Luisa Cifarelli

This past July the Physical Society of Japan and the Japan Society of Applied Physics organized the 12th triennial Asia Pacific Physics Summit under the auspices of the Association of Asia Pacific Physical Societies (AAPPs) in Makuhari, Chiba, Japan. The highlight of the event was an in-depth discussion of developments in physics in the Asia-Pacific region across a range of physics disciplines—condensate matter, high-energy physics, neutron and synchrotron radiation science, plasma science, and computational physics. With respect to broadening participation in physics, sessions also included physics education and the topic of women in physics, AIP/APS also provided an ideal occasion for the third Asia-Europe Physics Sum-

mit (ASEPS), a collaboration be-

tween AAPPs and the European Physi-

ical Society (EPS).

The Asia-Europe Physics Sum-

mit, which alternates between the two continents, is an extended op-

portunity for organizational and intellectual leaders in the respec-

five areas to discuss and exchange ideas in the context of strengthen-

ing collaboration between Europe and the Asia-Pacific region. The goals of the Summit are threefold:

1) To discuss the scientific priori-
ties and the common infrastruc-
ture that could be shared between European and Asian countries in various fields of physics research.
2) To establish a dedicated frame-
work to increase cooperation on Asia collaborations in the next two decades;
3) To engage developing countries in a broad range of physics re-

search.

The public program of ASEPS included a plenary program with speakers from Europe to cover the latest physics results at the LHC, plasmonics that merges photonics with nanotechnology, fiber acceler-

ators, and climate engineering—truly a broad range of topics to excite conference participants. Looking to future developments in physics without borders, ASEPS complemented the plenary lectures with four roundtable discussions that provided an intense exchange of ideas on topics for Asia-Europe cooperation, especially on the timely issue of international stra-

tegic planning for large research facilities worldwide.

Thanks to the initiative of EPS

past-President Luisa Cifarelli, who has also been involved with APS as a member of both the Ex-

ecutive Committee of the APS Fo-

rum on International Physics (FIP) and a member of the APS Committee on National Scientific Affairs (CISA), this year’s Summit included a sig-

nificant US perspective. In Round Table 1, which was moderated by Tsu-

ayuka Nakada, Scientific Sec-

etary for the European Strategy Session of the CERN Council, William Barletta, Past-chair of FIP and the APS Division of Physics of Beams discussed the technologies for both high energy physics and photon science based on his ser-

vice as convener for the Acceler-

ator Capabilities Study in the U.S. DPF Snowmass process and facili-

ties prioritization sub-panel for the U.S. Department of Energy Basic Energy Sciences Advisory Commit-

tee. European perspectives in these areas were given by Mas-

simo Altarelli, Managing Director of European XFEL, and Frédéric Bordry, future CERN Director of Accelerator and Technology; the Asian components concentrated on the possibility of a large linear collider project and were given by Jie Gao, Chair of the Asian Linear Collider Steering Committee and Akira Yamamoto, ILC GDE Proj-

cet Manager, KIK, and Yifang Wang, Director of the Institute of High Energy Physics, Chinese Academy of Sciences. The strategy for the next gen-

eration of large-scale facilities must be driven primarily by an emphasis on the unity of interests of the relevant scientific user com-

munities. Such a view of “big tent science” can make a strong case for

WILLIAM BARLETTA
"...united interests of the scientific user com-

munity..."
**PhysTEC highlighted in NSF report to Congress**

The PhysTEC project was highlighted in the 2014 National Science Foundation (NSF) report to Congress. PhysTEC was one of eleven highlighted projects and the only one related to education. The highlight displayed the map of the 280 Coalition members, with a bar chart of the project, some of which is excerpted here: “Only 35 percent of high-school physics teachers have a degree in physics or physics education... The PhysTEC project seeks to encourage more deeply in teacher education so that every student will have the opportunity to learn physics from a qualified teacher.” For the full Budget Request, visit http://www.nsf.gov/about/budget/2014/pdf/01/14.pdf

**Save the Date: 2014 Physics Teacher Education Coalition Conference**

The 2014 Physics Teacher Education Coalition Conference (PhysTEC) will be held May 19-20 in conjunction with the UTeach Institute Annual Conference in Austin, TX. The PhysTEC Conference is the nation’s largest meeting dedicated to physics teacher preparation, recruitment, and lead future teacher recruitment. The GSU project will focus on course reform, early teacher experiences, and retention strategies. North Carolina State Universitiy (NCSU) will focus on developing a Learning Assistant program and will partner with the NCSU STEM Education Initiative to assist with course reform and LA recruiting. At the University of Cincinnati (UC), PhysTEC students will take courses specifically for licensure candidates such as Modeling Instruction. UC has a goal of increasing the number of new, highly-qualified high school physics teachers to five or more per year. They will use a variety of recruitment strategies, including providing flexible and accessible pathways to licensure for all STEM majors. This is the fourth solicitation for supported sites in four years, and we are really pleased that new institutions continue to step forward with excellent proposals.” The University of Florida will report on Education & Diversity Monica Apker Finalists Meet and Compete in Washington

**PhysTEC 2E now on ComPADRE**

The collection of over 800 interactive Java simulations and associated curricular materials for the teaching of introductory physics is now available on ComPADRE. For a free online book can be used in introductory physics classrooms, from high school to university, as interactive lecture demonstrations, Just-In-Time Teaching exercises, as interactive homework assignments, or as interactive pre-class exercises to “flip” your classroom.

**Report Available on Distance Education and Online Learning in Physics Workshop**

Over 100 participants gathered at APS headquarters in College Park on June 1-2 to learn about the opportunities and implications of distance education and online learning for the physics community. The report on the Distance Education and Online Learning in Physics Workshop discusses the workshop’s major themes, online resources, and next steps for the physics community. It can be found here: go.aps.org/Y5d9r9q

**Mass Media Fellows Learn on the Job**

Ed. Notes: Each year APS sponsors two Mass Media Fellows as part of a program administered by the American Association for the Advancement of Science (AAAS). They each spend ten weeks over the summer working as a science reporter at a media outlet. This year’s Fellows, Elizabeth Case and Jenny Lasater, worked at The Oregonian and the Milwaukee Journal Sentinel, respectively. They write about their experiences in the articles below.

**Apker Finalists Meet and Compete in Washington**

On September 19, while APS Fellows were competing in teacher workshops (see page photo page 3), another group of distinguished physicists gathered in downtown Washington. They were the eight Apker Award finalists for outstanding research by an undergraduate. Seven were interviewed by the Apker selection committee, in order to determine the ultimate recipients of the Award. Two are named as the two Apker Awards each year, one to a student from a research university, and the other to a student from a university not granting the PhD. Photos of the two recipients will appear in next month’s APS News. The finalists were: (1b1 v) N. Maryam Nair (MIT); (1b2 v) Jonathan Hunko (McGill University); (1a1 v) Scott Williams; (1a2 v) Guy Geyer Marcus (Wesleyan); Hao Shi (Rochester Institute of Technology); Anshuman Pal (Penn); and Jeremy Perrin (St. Mary’s College of Maryland).

**Good Writers Keep Their Audience in Mind**

By Jenny Lasater

One of the first pieces I wrote for the Milwaukee Journal Sentinel—a blog post on how loggerhead turtles track their prey—came back from my editor with a note saying, “needs a sentence about loggerheads-how big? where do they live?”

These questions had nothing to do with the science in the story, but everything to do with the context. And that’s where my goal as a science writer begins: making my audience (my readers) needed this information.

But sometimes, I also went too far in the other direction. Several weeks later, I wrote a long blog post on testosterone use as a performance enhancing drug in baseball. That story came back with notes in several places telling me that I was “too far down in the weeds” i.e., giving too many details, ones that didn’t add much to the argument and just made the story drag.

My editors and I repeated this process many times over the course of the summer, and I got much better at gauging the level of detail that was necessary and appropriate in each of my stories. In the end, these experiences really emphasized for me that good science writing is just as much about understanding your audience as it is about being able to explain the science itself.

What do your readers know, and what will they find interesting? Now, as I slip back into my academic mindset after my “summer vacation” in the newsroom, I am trying to remind myself that these questions aren’t restricted to writing for the general public. Keeping the audience in mind is critical as a research scientist as well. And it’s tricky, because we speak to so many different audiences. Our research groups are a different audience than the attend-...
for cost-effective technical capabilities, that is, a broad scientific research area providing education and training, power efficiency, growth potential of the infrastructure, and flexibility to address evolving scientific priorities and science cases for upgrades and programmatic priorities. Whether for high-energy and superconducting magnets or for neutron and photon beams, the shared technologies of future large-scale facilities must deliver extreme technical and positional precision and stability of particle and photon beams; facilities will generate very large data sets, stressing the importance of both data processing and data storage.

Looking to the issues of policy and cooperation inherent in the next generation of large facilities, Round Table 2 offered perspectives concerning future LHC operations. It featured AMS, CERN, Director for Research and Science Computing at CERN; the next steps toward an International Linear Collider; and the Linear Collider Collaboration, Lyn Evans; and progress toward the FAIR facility at the Helmholtz Centre in Kornon from Sun-Kee Kim, Director of the Institute for Basic Science. Shoji Nagamitsu, AIPPS President and Director at ESRF, was an active participant from J-PARC; Guenther Rosner, FAIR Managing Director for Planning and Construction, progress toward the FAIR facility at GSI Darmstadt, and James Strat, representing the Fermilab Director’s Office, spoke of moving toward a robust design of the LBNF facility.

Large-scale facilities provide the opportunity to address fundamental issues to demonstrate the excitement of forefront science, as well as its economic and societal value to both decision makers and to the general public. Round Table 4 examined the responsibility of large facilities to undertake education and outreach programs and the impacts of such programs in different circumstances and locations around the world. Neil Calder of the Okinawa Institute of Science and Technology (past head of Communication at CERN, SLAC and ITER) emphasized the role that large-scale facilities can and must build trust with the public both by sharing the excitement of the scientific and technological enterprise and by being transparent with respect to issues of facility safety and prudent operation. Education programs based on the technical understanding of large-scale facilities can help to inspire young people to study science and pursue a research career; of particular note is the EPS Young Minds (EPSYM) project which was described by its new Leader Anti- dote of the EPS, Cécile Hagen. This program could be considered for emulation in the US by the APS. Representing the US Particle Accelerator School and the Joint US-CEERN-KEK- Russia Accelerator School, R. Sekhar Chivukula explained that whether as locations for scientific mega-experiments or as giant tens over myriad small devices, the operations of large-scale facilities depend on a confluence of four principles: a) the optimal functioning of trained scientists and technologists to build and operate devices with unprecedented levels of performance; b) a technologically savvy user community, which can provide the science pull for new capability and capacity and can deliver operationally robust, technologically sound results; c) well trained scientists who can inspire and lead high quality scientific staff and manage large technological risks; and d) an engaged public which will be excited by and supportive of the science enterprise. In the face of a widespread lack of unique experimental programs in the technology of accelerator-based science facilities, laboratories with a broad national and international charter have formed alliances with major research universities to provide the core education in science, technology and management skills needed for such laboratories to flourish and to rich programs of scientific research of broad benefit to society. Round Table 3 described the opportunity for a worldwide collaboration of physics societies for the Year of Light under the auspices of UNESCO and the United Nations. The Year of Light would highlight how high technologies have revolutionized society through medicine and communication, and how and why they are major drivers and provide solutions to global challenges in energy and access to clean energy in centralized and developing countries. Though AESPSJ was not expected to demonstrate a broad cross-section of attendees, it did open the door for a very broad engagement by physics societies to build global collaboration. The capacity of physics societies to return on societal investment and to spread the benefits of forefront science to developing countries. These goals are appropriate for programs of strong multi-lateral cooperation of physics societies and exemplify our ideal of open science without secrecy and without borders.

Luis Cifarelli of the University of Bologna, Italy, Past President of the European Physical Society, the Italian Physical Society, and a member of the Executive Committee of the APS Forum on International Physics (FIP) and the APS Committee on International Scientific Affairs (CISA). William Barletta is Director of the US Particle Accelerator School, Department of Physics, Massachusetts Institute of Technology. He is Past-Chair of the APS Forum on International Physics (FIP) and also serves on the APS Committee on International Scientific Affairs (CISA).

FELLOWSHIP continued from page 4

er Corps, there is interest from the Department of Education in having a science policy fellow,” Hodapp said. “This is a unique opportunity to come in at the ground floor when the Department of Education is just starting to think about STEM issues.” The deadline for the 2014 fellowship has passed and the first fellow should be announced later this fall. For more information visit: http://www.aps.org/policy/fellowships/stem.cfm

WRITERS continued from page 5

department-wide seminar or a public lecture.

I’m still learning how to navi
gate this, as an academic. But I know that I don’t want to be that speaker at a conference who loses half the audience because she didn’t give enough background, and then throws in so many irrel
evant details that the other half of the audience tunes out. As I go forward, I will look back at my summer in the newsroom and remember how critical it was to think about the readers in order to write a compelling, infor
mative, and accessible news story. And I’ll ask myself two questions: What does my audience know? And what will they find interesting?

FELLOWSHIP continued from page 4
MUSK continued from page 1

to think about any problem—it’s a generalized problem-solving method that can be applied to the economic world as well as the physical world.

L: Having studied math and physics myself, I always found the physical world to be a problem like a bifurcation tree and think about things 4 or 5 or 6 moves ahead. Do you have this as an aspect of your business, or do you just go with the flow of the engineering field where it just falls into a lot of different interests and tomes? M: Yeah, in general you always want to try to think about the future, try to predict the future. You’re going to generate some error between the series of steps you think will occur versus what actually does occur and you want to try to have the error that way that I think about it. And also think about it in terms of probability streams. There’s a lot more variability associated with certain outcomes and you want to make sure that you’re always the house. So things like what will you do in the way you think they’ll occur, but if you calculate it out correctly over a series of decisions you will sometimes end up with innovative solutions for things that are going to occur in a good and then a broad range of engineering courses and then some degree of specialization in an engineering field where it falls into the various interests, and then other classes, courses, parts of other courses courses are helpful so you at least know the terminology. You can probably do it with one university course, [although] you hate accounting. It’s worth it to have some business courses but you don’t need too many. And I would say this if you’re an MBA, I’d say no MBA needed. An MBA is a bad idea.

L: Why?

M: It teaches people all sorts of wrong things.

L: What do you mean?

M: They don’t teach people to think in math schools. And the top MBA schools are the worst. They just teach people that you must be special, and it causes people to close down their feedback loop and not rigorously examine when they are wrong.

L: But you must hire MBAs, right?

M: I hire people in spite of an MBA, not because of one. If you look at the senior managers of your company, you’ll see very few MBAs there.

L: Interesting. If you were sitting on an airplane and we were traveling at 5000 feet and somebody said oh hi, what do you do? What would be your answer?

M: I do engineering. I do aerospace engineering and automotive engineering. Most of my time is spent doing that.

L: How much time do you spend on engineering problems as opposed to dealing with the business side of things?

M: Most of my time [50%] is spent in engineering meetings with my teams. I have meetings all the time with the technical teams at Tesla and SpaceX every week. The last few months I have had to spend proportionally more time on some business activities, reengineering the service and sales process at Tesla. Not top my favorite thing to do, but it needed to be done.

L: Do you share technologies between the companies?

M: We’re trying to do more of the sharing. There’s no particular reason that it shouldn’t all just flow through me. It’s quite helpful to have the synthesis of rocket technology and automotive technology because I see things that people that are just in one of those industries don’t see.

L: Can you give me an example?

M: Cars are really primitive, from a structural standpoint compared to rockets, because in order for a rocket to get to orbit you have to be incredibly mass efficient, so the first stage of our rocket is 95% propellant by mass fraction. That means only 5% of the first stage is engines, electronics, wiring, airframe, and everything else. Which is really a ludicrously low number. So I’m using to extreme mass optimization in the rocket arena, and then you look at most cars: Cars have all sorts of mass in places that don’t do any good and often not enough in places that are important, and almost all cars are made of steel which is way too heavy weight. Model S is the only all-aluminum car made in North America. Since it has a very heavy battery pack, you have to offset that mass somehow. So I’m much lighter rest-of-car. So in order for the Model S to get the range it has, we have to conserve non-pack mass and that meant going to an all-aluminum body and chassis. There’s a lot more we can do on the

ANNOUNCEMENT

Professional Skills Development for Women

Professional Skills Development for Women for Physicists

March 2, 2014, Denver, CO

April 4, 2014, Savannah, GA

Application Deadline: December 6, 2013

Application Deadline: January 3, 2014

Who may apply: Women postdoctoral associates and women faculty in physics. Each workshop will have one session aimed at postdocs and one session aimed at women faculty.

First consideration will be given to applications received by the deadlines. Women are encouraged to apply for financial support to help offset travel costs.

Details: www.aps.org/programs/women/workshops/skills/

Professional Skills Development for Women for Physicists

Professional Skills Development for Women for Physicists

Defence Advanced Research Project Agency (DARPA) has recently announced a new program to fund advanced research on multi-year grants. The program, called the "Professional Skills Development for Women for Physicists," is aimed at providing training opportunities for women in the physics field.

The program is open to women who have a Ph.D. in physics or a related field. Women who are currently enrolled in graduate school or who have completed their Ph.D. within the past five years are eligible to apply.

The program provides funding for one year, with the possibility of renewal for a second year. The program covers the cost of tuition, fees, books, and travel to workshops and conferences.

Applicants must submit a detailed proposal outlining their research and training goals, as well as their career plans. The proposal should also include a description of the workshop or conference they plan to attend, along with a budget for travel and lodging.

Applicants will be notified of the results of the review process by January 31, 2014. The program will begin on March 2, 2014, in Denver, CO.

More information about the program and the application process can be found at www.aps.org/programs/women/workshops/skills/.
At Los Alamos: Learning to Love the Bomb
By Jeremy Bernstein

A
fter I got my PhD from Harvard in 1955, I needed a job and a friend made
a suggestion: on the campus there was a rather modest cyclotron, simple enough
for graduate students to operate. Then there was a position open for a “house theorist.” My
friend recommended me and I got the job, but after two years my appointment was over and I had
to look for a new job. I applied to the Institute for Advanced Study in Princeton and was accepted for autumn 1957. This
left me with time for a test. Sometime in mid-1957, I learned that Los Alamos and Los Alamos weapons laboratories
were actively recruiting. Ken Bainbridge, chair of the Har
vard physics department, called me into his office and asked
if I would like a summer job at Los Alamos. He said he
would recommend me. Los Alamos for me had an almost mystic quality—some extra money would come in handy
when I got to Princeton. I spoke to a Los Alamos recruiter, who told me that I could have the job if I was able to get
the relevant security clearance. In 1947 the Atomic Energy
Commission introduced a Personnel Security Questionnaire
to determine levels of clearance. The levels were “P,” “S,” then “Q.” A person with Q clearance was entitled to
information about nuclear weapons on a “need to know” basis. I had to supply the FBI with a list of everywhere I’d
lived for the last ten years. I was rather worried about a
good-old-boy sub who was to be delivered to the Daily Times and
spoke of the “bosses.” Either they over-
looked her or she decided she was harmless because I got my clearance.

I arrived at the guard station at Los Alamos and was fit-
ted out with credentials. I discovered that I was sharing an
office with Ken Johnson, whom I had known since gradu-
ate school. It soon became clear that no one had any work for us, so we were free to do whatever we wanted. I had come
with a problem of how to determine the parity of the pi zero
using aspects of its two photon decay. I was stuck on the
mathematics, so we decided to do it together. Ken was a
great mathematician and he proved results with a high
degree of generality. We wrote a paper and submitted it
to Carson Mark, the director of the theoretical division, to see
if we could publish it with a Los Alamos imprint. Mark
was pleased: he wanted Los Alamos to have a reputation as
something other than a bomb factory.

Of course, it was a bomb factory. Los Alamos and Liver-
more were churning designs for devices small enough
to fit into intercontinental missiles. These were being tested
above ground in Nevada in a series that was called Oper-
ation Plumbbob. We used to have afternoon tea—something
Oppenheimer had introduced during the war—and I’m sure
there are still basic to quantum field theory. In the middle of August,
I felt the experience had made me part of the secret world. If
you like, I had learned to love the bomb.

Over the next years I came to realize how foolish I had been.
The Plumbbob series, to which Smoky and Galileo belonged, were the biggest and longest series of tests ever done
in the continental United States, 29 in all. The highest explosive yield was Hood, the test that took place on 5 July
—the equivalent of 74 kilotons of TNT. The Nagasaki bomb
was about 20 kilotons. Smoky was the second highest, with
44 kilotons. Plumbbob, however, was the highest. The explosive yield was about 306 kilotons—something like a tenth of
the yield of one hydrogen bomb released about 58,300 kilotons
of energy. The explosion in more than thirty years and the number of peo-
ple who have seen a nuclear explosion in more than twenty miles of the
explosion. This fallout was distributed all over the United States and is estimated to have caused about 32,000 cases of thyroid cancer. Twelve
hundred pigs were exposed to the explosions in blast-effect
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the yield of one hydrogen bomb released about 58,300 kilo-
tons of energy. The explosion in more than thirty years and the number of peo-
people who have ever seen one is dwindling. For most people,
nuclear weapons are an abstraction. Perhaps there should
be one more explosion in the desert of Nevada to remind us.

Jeremy Bernstein is a former member of the New York
Tribune editorial board, former president of the American
Philosophical Society, and a visiting scholar at the High
Street School in Cambridge, Massachusetts. Bernstein
His latest book is "Love the Bomb: A Personal History of the
Nuclear Age" (W.W. Norton & Company, 2013).