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Are you suffering from high-impact-factor syndrome?

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As a result of a mailing problem at the printing plant, many readers received their copies of the October 2014 issue of *APS News* very late in the month. We regret the lengthy delay, and we are taking action to ensure prompt mailing in the future.

Fusion Research Runs into Turbulence

By Michael Lucibella

A recent Department of Energy (DOE) advisory committee report about the future of U.S. fusion research has drawn strong criticism from academic researchers feeling squeezed by a tightening fusion budget and a shift in U.S. research priorities.

The Fusion Energy Sciences Advisory Committee (FESAC) issued a report written by its Strategic Plan Panel that highlights a number of top-priority science problems to solve in the next decade. The panel identified new facilities to build, but also a number of reductions and closures at existing facilities. More than fifty scientists, including lab directors, have written to the committee expressing their concern about the directions it recommends, and criticizing how the committee arrived at its conclusions.

The report delivered by the committee offers four different potential budget scenarios ranging from "modest growth" at about 4.1 percent per year over ten years to no growth at all. These funding levels were mandated in a congressional charge to DOE's Office of Science for a strategic science plan.

"[They are] not optimistic budget

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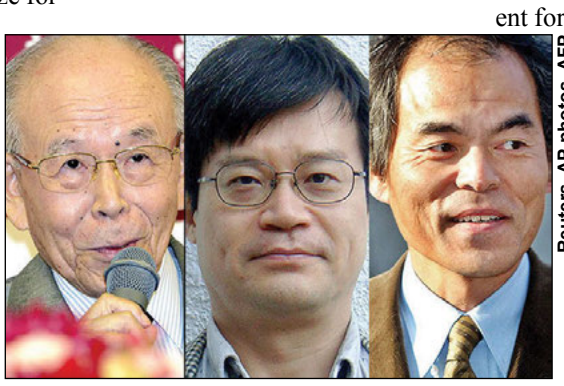
2014 Nobel Prizes for Advances in LEDs and Microscopy

By Michael Lucibella

Physicists received this year's Nobel Prizes for both physics and chemistry—the physics prize for the invention of efficient blue LEDs, and the chemistry prize for surpassing the resolution limit long believed to constrain optical microscopes. The physics prize went to Isamu Akasaki of Meijo University and Nagoya University, Hiroshi Amano of Nagoya University, and Shuji Nakamura of the University of California, Santa Barbara. In announcing the award, the Nobel Committee emphasized that the work done by the physics prize winners launched a revolution in energy-efficient lighting. The chemistry award went to Eric Betzig of the Howard Hughes Medical Institute, Stefan W. Hell of the Max Planck Institute for Biophysical Chemistry, and William E. Moerner of Stanford University for their contributions to the development of "super-resolved fluorescence microscopy."



Reuters, AP photos, AFP

Physics laureates Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura

The Physics of Blue

"Thanks to the blue LED, we can now get white light sources [that] have very high efficiency and very long lifetimes," said Staffan Normark, the permanent secretary of the Royal Swedish Academy of Sciences. "This LED technology is now replacing older technologies."

Red and green LEDs have been around in more or less their present form since the 1960s, but blue LEDs proved much more difficult to fabricate. The difficulties lay in creating high quality gallium nitride crystals and then combining them with other elements to increase their efficiency. It took nearly thirty years of work in basic materials physics, crystal growth and device fabrication to create a marketable blue LED.

Akasaki started experimenting with growing pure gallium nitride crystals in 1974, first at the Matsushita Research Institute in

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Profiles In Versatility

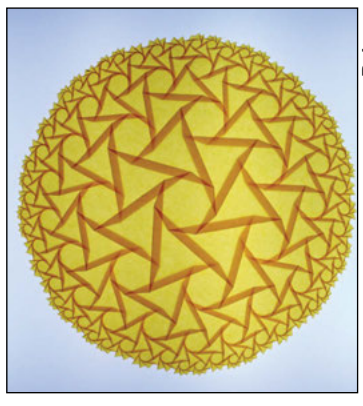
Right Brain, Left Brain: Physicists as Artists

By Alaina G. Levine

The next time you saunter through a museum or gaze casually at a piece of art, ask yourself: Did a physicist make this? It seems lately that one can't peruse a science magazine or website without finding articles about scientists who have turned their love of nature into beautiful works of art. And not surprisingly, physicists are numerous among this population. Whether it is art that is steeped in scientific principles, or pieces whose creation requires scientific and technical knowledge, these physicists are leveraging their expertise to craft truly unique art that gives us the opportunity to question our world in singular ways.

Julian Voss-Andreae is a sculptor with a background in physics. When he was a child, he had a very specific career plan in mind: "First I wanted to be a goldsmith, then a chemist and then an artist," he says. "From early on, art has intrigued me. I was always more interested in the aesthetics and feel of something rather than the intellectual depth of a field."

But the siren call of science could not be overlooked. By the time he was 22, Voss-Andreae had read many science and math books and had become intrigued with quantum physics. He completed undergraduate work in the subject at Edinburgh University, Vienna University, and the Free University of Berlin, and he pursued a PhD in quantum physics. During that time



R. Lang

Robert Lang combines math and origami in "3^7 Hyperbolic Limit, opus 600."

Voss-Andreae realized he was more interested in the aesthetics of nature and expressing what he investigated via painting (and later sculpture), than conducting the research itself. He left Europe and enrolled in the Pacific Northwest College of Art in Oregon, from which he graduated in 2004.

"In art college, I had a tough time conveying my passion; most people seemed to think science was boring and cold," says Voss-Andreae. But that same passion gave him inspiration. "It gave me an idea, a niche for my work," he adds, and in fact, his first sculptures were of protein folds and he has since crafted buckyballs of various sizes. "My teachers said there's no artist who doesn't have a day job," he admits with a chuckle, yet Voss-Andreae has indeed found success–and fulltime work–as a sculptor. His career really took off in 2006 when he partnered with a gallery owner in Idaho who began marketing his works to wealthy collectors with second homes in the area.

Today, almost all of his pieces are commissions and all of them touch science in some way. His most recent project is a pair of sculptures on the University of Minnesota campus, entitled Spannungsfeld, a German word which means "tension field." The sculptures are of two figures sitting on their knees facing each other across a plaza, and if you glance at them head on, they seem to disappear. They call to mind his earlier work, Quantum Man, which produced the same disappearing visual effect.

Paul Friedlander, a self-described "kinetic light sculptor

ARTISTS continued on page 5

Retrial Granted to Jailed Iranian Physicist

By Michael Lucibella

Imprisoned Iranian physicist Omid Kokabee will be granted a retrial after spending more than three years incarcerated in Iran. A branch of the Iranian Supreme Court has agreed to accept Kokabee's appeal and revisit his case, possibly clearing the way for his release within a few months.

"Acceptance of the retrial request means that the top judicial authority has deemed Dr. Omid Kokabee's [initial] verdict against the law," Kokabee's lawyer, Saeed Khalili, was quoted as saying on the website of the International Campaign for Human Rights in Iran. "The path has been paved for a retrial in his case, and God willing, proving his innocence."

Omid Kokabee

Kokabee, a citizen of Iran who at the time was studying at the University of Texas at Austin, was first arrested at the Tehran airport in January, 2011. After spending 15 months in prison waiting for a trial, including more than a month in solitary confinement, he was convicted by Iran's Revolutionary Court of "communicating with a hostile government" and receiving "illegitimate funds" in the form of his college loans. He was sentenced to ten years in prison without ever talking to his lawyer or being allowed testimony in his defense.

Kokabee said in an open letter that the reason for his detention is his steadfast refusal to help Iran's military. Earlier this year, Kokabee received the APS Sakharov Prize for his unwillingness "to work on projects that he deemed harmful to humanity, in the face of extreme physical and psychological pressure."

The recent ruling by Iran's Supreme Court branch is a positive development for the imprisoned scientist. By accepting the retrial, the court effectively throws out his previous conviction and will reconsider both the conviction and the sentence. At present Kokabee is still in prison, but those close to him hope to secure a medical furlough for him because of a recent flare-up of medical issues related to his incarceration.

"In other cases, for instance, the courts have decided that the new sentence would be for time already served," said Elise Auerbach, the Iran country specialist for Amnesty International. "The most important thing is that he gets out of prison and gets the care he needs."

Over the three years of his imprisonment, Kokabee has developed a number of potentially serious health problems due to a lack of proper medical care. Already he's lost four teeth, and four more are in need of emergency attention. He's had heart palpitations and stomach

KOKABEE continued on page 5

Members in the Media

"Any serious discussion of the changing climate must begin by acknowledging not only the scientific certainties but also the uncertainties, especially in projecting the future. Recognizing those limits, rather than ignoring them, will lead to a more sober and ultimately more productive discussion of climate change and climate policies. To do otherwise is a great disservice to climate science itself."

***Steven Koonin**, New York University,* The Wall Street Journal*, September 19, 2014.*

"[T]hey made the creative decision that they wanted to have the science right."

***David Saltzberg**, University of California, Los Angeles, on his work as the science consultant on the TV show "The Big Bang Theory,"* The Washington Post*, September 22, 2014.*

"[N]othing is intrinsically wrong with applying scientific language metaphorically to human experience. Metaphors are valuable when our experiences are enigmatic or difficult to capture, when existing words don't fit the situation at hand. Even the incorrect use of technical terms can meaningfully express what we intuit but cannot otherwise say."

***Alfred Goldhaber**, Stony Brook University, on using science metaphors in common conversation,* The New York Times*, September 28, 2014.*

"Unbelievable."

***Isamu Akasaki**, Meijo University, on learning that he was one of the Nobel Prize winners for inventing the blue LED,* The New York Times*, October 7, 2014.*

"We're always tugging and pulling.… Nobody is smart enough to know all this."

***Nick Holonyak Jr.**, University of Illinois, on the decision of the Nobel Committee for Physics to honor researchers for the creation of blue LEDs, but not the researchers who created the first red and green LEDs that laid the groundwork,* The New York Times*, October 7, 2014.*

"We use these individual molecules as tiny light sources now, on structures inside cells.… They're like little beacons, or flashlights. And we use the light from those molecules to tell us where the structure is, in precise detail."

***William Moerner**, Stanford University, on his work that won this year's Chemistry Nobel Prize,* Los Angeles Times*, October 8, 2014.*

"Sure, there is always competition…and we hope to be there first, using the 30-meter telescope before any others."

***Ed Stone**, Caltech, on building the Thirty Meter Telescope,* Los Angeles Times*, October 7, 2014.*

"We're like the mainstream enough to benefit from their superior physics, but we're different enough to address the economic issues facing fusion in general.… Not too alternative, not too mainstream. Maybe it's just right."

***Derek Sutherland**, University of Washington, on securing funding for new fusion research,* NBCNews.com*, October 10, 2014.*

"What we noticed was that when the snake's ascending effectively... the material behind it was in a nice solid state. And when we applied the changes to the robot, we found a similar feature of the interaction, such that the material didn't flow much."

***Daniel Goldman**, Georgia Institute of Technology, on designing a robot based on how snakes move,* BBCNews.com*, October 10, 2014.*

"We have a worst-case scenario, and you don't even want to know.… We could have widespread epidemics in other countries, maybe the Far East. That would be like a bad science fiction movie."

***Alessandro Vespignani**, Northeastern University, on his computer modeling of the spread of Ebola,* Bloomberg News*, October 16, 2014.*

"I, as a matter of principle, do not take pledges because it drives so much of the gridlock."

***Bill Foster**, U.S. House of Representatives, running for reelection in Illinois,* The Chicago Tribune*, October 18, 2014.*

This Month in Physics History

November 10, 1986: Death of Leona Woods Marshall Libby

The Manhattan Project boasted many of the finest minds in physics from around the world in the 1940s, nearly all of whom were men. But there were a handful of women scientists who contributed to the wartime efforts to develop the first atomic bomb. The most recognizable name is Maria Goeppert Mayer, who later won a Nobel prize for developing the theory of nuclear shell structure. Less well known is Leona Woods Marshall Libby.

Born on a small farm in La Grange, Illinois, in 1919, Woods was the daughter of a lawyer and showed much academic promise, graduating from high school at 14 and earning a degree in chemistry from the University of Chicago by the age of 19. Inspired by hearing a talk by Nobel laureate James Franck, she asked to be his graduate student. He agreed but cautioned her, "You are a woman, and you will starve to death"–echoing the advice he had received, as a Jewish graduate student, from his own advisor. Woods opted to work with Robert Mulliken instead. He was not known for lavishing praise on his graduate students, but Woods later recalled two instances when he had told her "that perhaps not all he taught me was wasted," which amounted to a gushing accolade by Mulliken standards.

Wikimedia Commons

Los Alamos National Laboratory

Caption: (Top) Leona Woods Marshall Libby, a member of the University of Chicago reactor team (Bottom): Back row, from left: Norman Hilberry, Samuel Allison, Thomas Brill, Robert Nobles, Warren Nyer, and Marvin Wilkening; Middle row: Harold Agnew, William Sturm, Harold Lichtenberger, Leona Woods, and Leó Szilárd; Front row: Enrico Fermi, Walter Zinn, Albert Wattenber, and Herbert Anderson.

While working on her doctoral thesis on the spectroscopy of silicon oxide molecules, Woods struck up a friendship with Herbert Anderson, a young physicist working in Enrico Fermi's lab; they often went swimming together in Lake Michigan in the evenings. Noting her proficiency with vacuum technology, Anderson hired her once she finished her PhD to measure neutron fluxes with the detectors used by Fermi's group.

"The (Manhattan) project was so secret they had to figure out something to do with a clever woman," her son, John Marshall III, told the *New York Times* decades later. Fermi's wife, Laura, later described Woods as "a tall young girl built like an athlete, who could do a man's job and do it well." Woods divided her time between her work with Fermi and helping her mother on the family farm near Chicago.

When Fermi's nuclear pile went critical under the stands of an abandoned football stadium and made physics history on December 2, 1942, Woods–then just 23–was the sole woman present. She wasn't allowed to handle the graphite blocks, but did help calibrate the detectors by measuring the neutron cross section, using radium-beryllium as a source and a manganese foil. "When do we become scared?" she purportedly asked Fermi after the pile went critical.

In 1943, Woods married fellow physicist John Marshall, shortly after Fermi's team moved to Argonne National Laboratory. She soon became pregnant, hiding her condition from most of her colleagues by wearing baggy denim clothing and arriving at work slightly earlier than usual to discreetly vomit so others wouldn't notice her morning sickness. She gave birth to her son, Peter, in 1944 and returned to work within a few days.

Two years later she and Marshall moved to the nascent Hanford nuclear facility as part of the Argonne team assigned to oversee the powering up of the first reactor, leaving their infant son with her mother. She fended off questions about being one of the very few women on the Manhattan project, but said that she had been provided with a private bathroom in the reactor buildings. They worked in shifts, with Woods-Marshall taking the night shift with Fermi. While the Hanford reactor went critical right on cue on September 27, 1944, a few hours later there was an abrupt drop in power before the reactor shut down completely. "People stood around and stared at each other," Woods later recalled.

Her first thought was that a water leak was to blame, but nixed this explanation when operators succeeded in powering the reactor up during the night, only to have it shut down again a few hours later. It was John Wheeler who recalled that there had been hints of a problem with poisoning via byproducts of the process used to make plutonium for bombs at the Oak Ridge reactor, although the exact isotope had never been definitively established. He and Woods-Marshall calculated the neutron cross-section and determined the culprit was a rare isotope, xenon-135, solving the stalling problem.

"I have no regrets," she later recalled of the atomic bombs dropped on Hiroshima and Nagasaki. "I think we did right, and we couldn't have done it differently.… It was a very frightening time." Her brother had been a Marine on Okinawa, and her brother-in-law was a captain of a minesweeper during the war. "I'm sure these people would not have lasted in an invasion."

Once the war was over, the Marshalls returned to the University of Chicago, where

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Diversity Corner

Fall 2014 *Gazette* now available online
The latest issue of the Committee on the Status of Women in Physics/Committee on Minorities (CSWP/COM) *Gazette* is now available online at http://www.aps.org/programs/women/reports/gazette/index.cfm. To receive a print version of the *Gazette*, free of charge, send your mailing address to women@aps.org

Nominations for the CSWP Woman Physicist of the Month
The CSWP Woman Physicist of the Month award recognizes female physicists who have had a positive impact on others' lives and careers. Each CSWP Woman Physicist of the Month is featured on the Women in Physics website (www.WomenInPhysics.org), announced in the *Gazette* and recognized at a reception at an APS national meeting. To make a nomination for this award, go to the above-mentioned website at http://www.aps.org/programs/women/scholarships/womanmonth/index.cfm

APS Bridge Program Student Application Opens in December
The mission of the APS Bridge Program (APS-BP) is to strengthen physics in the United States by increasing the number of underrepresented minority students who receive doctoral degrees in physics. Senior undergraduate students majoring in physics are encouraged to apply to the APS Bridge Program in order to strengthen their application to graduate school. Underrepresented minorities (African American, Hispanic American, and Native American U.S. citizens or permanent residents) are encouraged to apply. The application process starts on December 1. For more information, visit http://apsbridgeprogram.org/about/students.cfm

2015 PhysTEC Conference
Save the date! The 2015 PhysTEC Conference, the nation's largest conference on physics teacher preparation, will be held at the Marriott Seattle Waterfront in Seattle, WA, next February 5-7. The theme of the Conference is Building Thriving Programs. It will feature a plenary talk by Ron Henderson of Middle Tennessee State University.

- Preceding the Conference, on February 5, will be a half-day Learning Assistant Workshop.
- Following the Conference, on February 6-8, will be a workshop on Building a Thriving Undergraduate Physics Program.
- Conference registration will open November 5.
- Faculty from minority-serving institutions are eligible to apply for travel grants.

Conferences for Undergraduate Women in Physics
A new email list will help share news, announcements and deadlines related to the APS Conferences for Undergraduate Women in Physics (CUWiP). To join the list, email women@aps.org with the subject "Subscription to CUWiP email list." CUWiP also has its own LinkedIn page to help connect participants to one another and share news about the conferences. Join here: https://www.linkedin.com/groups/Conference-Undergraduate-Women-in-Physics-4439529

APS Celebrates New and Current Fellows in the Boston Area

In October, APS hosted a reception in Cambridge, MA, for APS Fellows in the Boston area. Shown are Bill Nellis and his wife Carole, and APS President Malcolm Beasley. The event included a program with remarks by Beasley and Kate Kirby, APS Executive Officer.

Darlene Logan

NOBEL continued from page 1

Tokyo, then at Nagoya University. Amano joined Akasaki in the 1980s and helped develop ways to dope the gallium nitride crystals. Akasaki and Amano are members of the American Physical Society.

In 1992, while at the Nichia Corporation in Tokushima, Japan, Nakamura and his collaborators, who were also working on the problem, helped explain how electron irradiation eliminated some of the inefficiencies Akasaki's team had been encountering.

Both research teams were then able to create the gallium nitride alloys needed to produce the junctions between the semiconductor layers that are the building blocks for blue LEDs. Nakamura and his team saw the first efficient blue glow in 1994, and over the following two years, both teams created the first blue lasers. In 1999, Nakamura left Nichia to join the faculty at the University of California, Santa Barbara.

"I am very honored to receive the Nobel Prize from the Royal Swedish Academy of Sciences for my invention of the blue LED," Nakamura said in a press release put out by Soraa, the LED company he founded in 2008. "It is very satisfying to see that my dream of LED lighting has become a reality. I hope that energy-efficient LED light bulbs will help reduce energy use and lower the cost of lighting worldwide."

Members of the Committee for Physics emphasized how the practical uses of the device were the deciding factors behind their choice for this year's prize. "This is really an invention prize, it's less a discovery prize," said Anne L'Huillier, a physicist at the academy and member of the committee. "In this kind of prize we really emphasize the usefulness of the invention."

The researchers' work has already made it into many common electronic devices. Blue LEDs can be found in most touch-screen devices. White LEDs usually use a blue LED to excite a phosphor to emit white light, and can be found in the camera flashes of most modern smart phones.

"We emphasized very strongly the fact that it can be used for white lighting, but we've seen over the years how the invention of the blue light emitting diode was used in the blue laser diodes, used for optical storage, how coming generations of communications will rely on the use of light rather than radio waves, in li-fi rather than wi-fi, in how you can use this blue or UV light to sterilize water," said Olle Inganäs, a physicist at the academy and member of the committee. "There are so many uses of this, and these uses are what I think would make Alfred Nobel very happy.

He added that increasing energy efficiency around the world is one of the most promising applications. "What you see is of course an enormous increase in power efficiency," Inganäs said. "Something like a fourth of our electricity consumption in most industrialized economies goes towards illumination, so these effects, having much more light for much less electricity…[are] really going to have a big impact on our modern civilization."

The three scientists' work built on research begun in the late 1960s at RCA's research labs in Princeton, New Jersey. There, a team led by Herbert Paul Maruska constructed the first dim but functional blue LED in 1972, using a slightly different technique than used to fabricate today's blue LEDs. However, due to budget cuts, many of RCA's labs were shut down before work on blue LEDs could be finished.

HHMI, MPI, Stanford

Chemistry laureates Eric Betzig, Stefan Hell, and William Moerner

Seeing Small

"This year's [chemistry] prize is about how the optical microscope became a nano-scope," Normark said on the following day.

The award is for two similar but distinct techniques that overcome Abbe's limit. First described in 1873, Abbe's limit says a microscope can't resolve objects smaller than approximately half the wavelength of the light used, or about 200 nanometers for visible light. The best microscopes now using the Nobel-Prize-winning methods have a resolution below 10 nm.

Hell developed stimulated emission depletion microscopy in 2000, which uses two concentric lasers to scan a cell's image. The finely focused central laser excites fluorescent molecules in the sample, while the broader outer laser quenches out all other fluorescence. The detector scans back and forth, registering the fluorescent glow to create an image with resolution better than 200 nanometers.

"Light microscopy is very important to the life sciences because the use of focused light is the only way that allows you to see living things; however, the resolution of light microscopy was fundamentally limited," Hell said. "What we have found is that you can overcome this limit. You can see details at much much higher spatial resolution, and that of course discloses how the cell works at the nanometer scale, so that's at the molecular scale."

Though Betzig and Moerner never collaborated directly, their work was instrumental in laying the groundwork for stimulated emission depletion microscopy.

After Moerner was first able to detect a single fluorescent molecule in 1989, Betzig came up with the concept of using overlaid images of individual glowing molecules to create a complete image. The process he outlined in a 1995 paper described shining different wavelengths of light on a cell to get different molecules to fluoresce, and then to record where light spots appeared. This way, when all the images were combined, the discrete spots would resolve themselves into a coherent outline.

However, to make a coherent image, many different colors from unique molecules would be needed, far more than was practical. It wasn't until 2005, when Betzig found a specific protein identified by Moerner that the technique could be put into use. Moerner's protein would glow briefly, and then, most importantly, it turned itself off. A cell stained with this protein could be hit multiple times with a laser pulse and each time a different set of proteins would fluoresce, giving Betzig the constellation of glowing spots needed to create a coherent image.

Electron microscopes have long been able to image objects smaller than 200 nanometers, but that technique severely damages the sample. It can't image living things, and electrons can penetrate only a shallow depth into cells. "It is fluorescence that makes the miracle possible," said Mans Ehrenberg of Uppsala University.

"We can observe E. coli…in all the glory of super resolution without having to kill them, slice them.… and subject them to intense radiation and high vacuum," said Sven Lidin, chair of the Nobel Committee for Chemistry. "They can be studied in real time while they live long and prosper."

Moerner is an APS Fellow and has previously been awarded the Earle K. Plyler Prize for Molecular Spectroscopy and Dynamics and the Irving Langmuir Prize in Chemical Physics for his work. Hell is a member of APS and won the Kavli Prize this year for his work.

INSIDE THE Beltway

Will the Future Mirror the Past?

by Michael S. Lubell, APS Director of Public Affairs

I recently gave a talk at Fermi National Laboratory, and afterward someone asked me whether the outcome of the November 4 elections would have any impact on federal support for science or more generally for science policy. My pithy reply was no. But since the hour was late, I didn't have time to elaborate. I'll take the opportunity to do so here.

I never expect a TV rerun of Masterpiece Mystery to get an Emmy, but if the show is good theater, I find myself watching it again out of the same morbid curiosity that glued me to it the first time. I recognize all the principal players, and I know how the story will end. But I still find it riveting. That pretty much sums up my expectations for post-2014 Washington.

President Obama will still be president, and Republicans will still be running the House of Representatives in 2015 and 2016. And there will continue to be no love lost between them. So no matter which party is in control of the Senate, the next two years will likely be a replay of the past four dysfunctional ones.

The cast will be the same–although the current Senate leaders, Harry Reid (D-Nev.) in the majority, and Mitch McConnell (R-Ken.) in the minority, might be swapping roles. A grayer President Obama will still be pouting in front of his ubiquitous teleprompter; a permanently tanned House Speaker John Boehner (R-Ohio) will be crying whenever the mood strikes him; an ageless House Minority Leader Nancy Pelosi (D-Calif.) will be smil-

FUTURE continued on page 4

Letters

Members may submit letters to letters@aps.org. APS reserves the right to select letters and edit for length and clarity.

Beltway Balance

Michael Lubell, in his Inside the Beltway column (*APS News*, August/September 2014), makes a characteristic inside-the-beltway error in equating the destructive, anti-intellectual populism of the Tea Party with the reasonable concerns about inequality of many of us in the Democratic Party, including Elizabeth Warren, who I am sure would disavow any anti-science bias. Pundits seem to feel duty bound to mention derogatorily some Democrat, having criticized Republican figures, to achieve "balance" when balance there is none.

Philip Anderson
Princeton, NJ

Corporate Reform Counterpoint

We realize this letter will not be read by many APS members until after the voting on the proposed Constitution and Bylaws has closed; nevertheless we want to express our dismay at the out-of-plain-sight removal of APS members' voting rights from the proposed Constitution and Bylaws. We have all been bombarded by information on the proposed reform of the APS's governance but nowhere in the initial materials was it pointed out that the proposed Constitution and Bylaws allows only the Council of Representatives to propose and vote on future Constitution and Bylaws amendments. Even more dismaying, there is nothing specifying what fraction of the Council is required to approve an amendment (the US Constitution requires three quarters of the States to approve). That and other important definitions (how much time is allowed for councilors to consult their divisions, for example) are to be defined in the Policies and Procedures which have not yet been written, and do not have to be submitted to the members for approval. Compare the current article XIII of the constitution with the proposed article XIV on the APS website for the details.

In the proposed restated Articles of Incorporation of the APS, the Society "shall have one or more classes of members and each class shall have voting rights as set forth in the Constitution and Bylaws." But unfortunately, even though APS claims to be a membership organization, existing for the benefit of its members, we will not have any voting rights on fundamental transactions if the proposed Constitution and Bylaws are passed. An amendment approved in some as yet undefined fashion by some very small fraction of the 50,000 members of the APS could decide to revise the purpose of the APS to, for example, " …support certain agencies of the Federal Government." rather than " …advancing the knowledge of physics." The members would have no recourse to prevent such a revision; there is not even a provision in the proposed constitution for petitions regarding constitutional amendments to be initiated by members.

We understand the need for the APS Constitution and Bylaws to be revised, prompted by recent changes in the statutes governing non-profit corporations in Washington DC, none of which specify how amendments to the constitution are ratified. We have no dispute with the other changes in APS governance reflected in the proposed Constitution and Bylaws; but the insistence of the APS's Committee on the Constitution and Bylaws that all amended articles be voted on together, coupled with the absence of the Policies and Procedures that specify how further amendments to the new constitution be ratified, obliges some of the signers of this letter to vote NO on the whole set. They recommend other members vote no, hoping to avert the situation wherein we lose all of our voting rights in the future.

Fred Buskirk
Carmel, California

Noemie Koller (APS Fellow)
New Brunswick, New Jersey

Rainer Pitthan
Palo Alto, California

Helen Quinn (APS President 2004, APS Fellow)
Portola Valley, California

Burton Richter (Nobel Laureate, APS President 1994, APS Fellow)
Menlo Park, California

Cherrill Spencer
Palo Alto, California

Michael K. Sullivan
Stanford, California

Herman Winick (APS Fellow)
Stanford, California

Response to Buskirk et al. from APS President Malcolm Beasley

In their letter, Buskirk et al. express concern about the process for making future amendments to the *Constitution and Bylaws* if the changes now being voted on by members are adopted. I thank them for their effort in ensuring careful consideration of the changes being proposed for our Society. We all share the goal of creating the best governance structures to meet the challenges of our times and to honor our physics culture.

The APS Council has discussed at various times and at length whether it was better for final approval of amendments to lie with the Council or with the membership as a whole. Council is elected by the members and, by virtue of its deliberations, the Council is well informed on the issues. Voting participation by the APS general membership is typically low (around 15% or less). In the end, Council chose to put final approval in the hands of the new Council after a membership comment period. Details of the amendment and voting process were left to be specified in a *Policy and Procedures* document.

While the new Policies and Procedures have yet to be formally adopted, it may be helpful to consider what is being proposed to the Board and Council at their November meetings by the Policies and Procedures Drafting Committee:

***Amendments to the Constitution and Bylaws (C&BL): "A proposed amendment to the C&BL** may be introduced by:*

a. Recommendation to the President from the Governance Committee;
b. Recommendation to the President by an affirmative vote of a simple majority of the Council members present at a regularly scheduled meeting;
c. Receipt by the President of a petition signed by at least one percent of the total number of members given in the latest membership list of the Society;
d. Receipt by the President of a recommendation by the Executive Committees of two Units of the Society.

The President is responsible for bringing the proposed amendment to the Board and Council for deliberations. After an affirmative vote of a majority of the Board and a majority of the Council to consider the amendment, the amendment shall be distributed to all Society members for an opportunity to submit comments with at least sixty days prior notice of the dates for final vote of the Board and Council. An affirmative vote of 2/3 of the voting members of the Board and 2/3 of the voting members of the Council shall serve to adopt the new amendment. The complete text of the Constitution and Bylaws including any amendments and the date of its adoption by the Board and Council shall be posted on the APS website within 30 days of adoption."

Of course, changes in the *Constitution and Bylaws* and the associated Policies and Procedures are to be expected as we see how well they work. As should be evident, there will be many channels for APS members to express their views and effect change.

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ing her engraved smile; Harry Reid, a boxer in his pre-political life, will be bobbing, weaving, and jabbing at his adversaries whenever they let down their guard; and Mitch McConnell, assuming he wins re-election, will still be sporting his inscrutable Pillsbury Doughboy visage, never revealing a grain of happiness or distress.

It's fair to say that even though the last four years epitomized dysfunction, they were not without drama. The rollout of healthcare reform might not have been as devastating as a category five hurricane, but it held the promise of utterly destroying the White House and its occupant. Of course, in the end it didn't. But that's what made it dramatic.

And then there was the botched attempt by the Bureau of Alcohol, Tobacco and Firearms (ATF) to infiltrate the Mexican drug cartels by selling them 1,400 high-power weapons. ATF's Operation Fast and Furious, which ultimately led to the death of Brian Terry, a U.S. Border Patrol agent, provided enough fodder for congressional critics to hold Attorney General Eric Holder in contempt, a historical first for a Cabinet member.

There were the 50-odd times the House of Representatives voted to repeal Obamacare, or the Affordable Care Act, as it is technically known. Of course the repeal legislation was never going to make it through the Democratic-controlled Senate. And even if it did, the president was going to veto it. So the congressional healthcare dénouement was little more than a fizzle.

The actual drama took place in the edifice behind the Capitol where the Supreme Court holds court. And in the end, the survival of Obamacare came down to the single vote cast by Chief Justice John Roberts. Worries about legacies often trump ideologies.

Of course there were the battles over the budget, which resulted in a series of continuing resolutions, dramatic across-the-board sequestrations, and finally a government shutdown in October, 2013. Science was not unique in being held hostage to the political wrangling, but as an enterprise that unduly suffers from uncertainty and instability, it suffered more than many other national activities reliant on federal support.

Finally, there were the science wars that broke out in the House Science, Space, and Technology Committee. Once a bastion of bipartisanship, the Committee, under the chairmanship of Lamar Smith (R-Tex.), became little more than a reflection of the hyper-partisanship that was plaguing the House at large. Smith, for whom many scientists had expressed optimism–I was one–when he first took the gavel, found their initial exuberance irrationally misplaced.

Smith seemed unable to keep members of the far right at bay as they pursued an agenda that was both anti-science and anti-scientist. Their withering attacks on the National Science Foundation (NSF)–legislatively imposing five-year lifetime limits on grantees and demanding that the Foundation turn over the confidential reviews of 50 already-approved proposals–ultimately led the Committee's ranking member, Eddie Bernice Johnson (D-Tex.), to hold Smith accountable in a letter filled with vitriol the likes of which I have never seen in my two decades in Washington.

The Committee's NSF reauthorization bill contained noxious language. But its energy bill was just as scientifically toxic, forbidding all federal agencies from using the results of any research supported by the Department of Energy in carrying out assessments or promulgating regulations. Of what use is science, anyway, especially when it interferes with ideology?

As the curtain falls on 2014, neither of the Committee's anti-science initiatives stands a chance of becoming law. But when the Washington show resumes in 2015, it's unlikely the Science, Space, and Technology Committee will give up on its assault. Unfortunately, the political dynamics will remain largely the same.

On the budget front, there is also little chance of change. There is no grand bargain in sight, and without it, spending on science will almost certainly remain constrained. The White House and congressional Republicans will continue to duke it out over support for climate research, social science research, and anything that smacks of applications. And, to the continuing distress of congressional appropriators, it's quite possible that continuing resolutions will become the norm–unless of course the government simply shuts down.

APS to Study Sexual and Gender Diversity Issues in Physics

By Michael Lucibella

The American Physical Society announced that it is putting together a new committee to look into issues of discrimination and exclusion in the field of physics based on sexual identity, gender identity, and gender expression. The Committee on LGBT Issues is charged with preparing a report on ways to make the physics community more inclusive to individuals who identify themselves as lesbian, gay, bisexual, transgender, or other sexual and gender minorities. The report is due out by spring of 2016.

The committee plans to start with a survey of physics institutions across the country. "We're interested in understanding the climate for LGBT physicists," said Michael Falk, a physicist at Johns Hopkins University and chair of the new committee. "The first thing we have to do is a lot of fact-finding," Falk said. "We should try to get a measure of how many of us...there [are], where we are,… [and] the issues that LGBT physicists face."

Falk added that he expected to see a lot of variation across the country's physics institutions. "I don't think it's necessarily an easy thing to get a simple picture of," Falk said. "Some places are very welcoming, while other places are very exclusionary."

In addition, the committee is charged with putting together a list of recommended changes to common policies and practices in

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pains, and he has passed at least five kidney stones. Two of the best treatments for kidney stones are drinking water and exercise, but Kokabee has had little opportunity for either.

"These problems are accumulating, which is common for prisoners in Iran," said Eugene Chudnovsky, chair of the Committee of Concerned Scientists. "They leave prison with permanent chronic conditions."

In August, Kokabee was transferred from the more open, political wing of Evin Prison to a single crowded "temporary" cell without windows, holding about 100 cellmates, with no access to the outside. The cells are dirtier and the food served there is worse than in the political wing, contributing to his health issues. Before being transferred he had been able hold physics classes with other political prisoners, for which he had been reprimanded.

At one point in July, while he was still in the political wing, a number of individuals in mufti were let into the prison grounds by the guards and attacked Kokabee and several other prisoners while they were exercising in the yard. It is unclear if this attack somehow prompted the relocation of Kokabee and a number of other prisoners to their current ward.

The court's decision to retry the case hinges on the fact that Kokabee was convicted under the section of Iranian law that covers interactions with "enemy states." Though there are no formal diplomatic relations between the United States and Iran, and ongoing contact is not particularly friendly, to qualify as an "enemy state," a country has to be at war with Iran.

"Technically, legally, the Iranian government is not in a state of war with the United States," Auerbach said. "It's sort of a technical argument, revolving around a technical point, but it does provide…[an] opportunity to legally void the sentence."

The court's decision comes at a time when international organizations have stepped up pressure on Iran to release Kokabee. Twenty-nine physics Nobel laureates signed a petition calling for his release, which was organized by APS, the Committee of Concerned Scientists, Amnesty International, and the International Campaign for Human Rights in Iran. These four organizations plan to deliver their petitions to representatives of the government of Iran in person.

Amnesty also collected more than 14,000 signatures on a petition calling for his release, and APS sent a letter to the president of Iran asking for leniency. In early October, students rallied at the University of Texas at Austin, holding pictures of Kokabee and calling for his release. "There's been a group on campus called Austin for Omid, and they've been very effective," said Herb Berk, one of Kokabee's physics professors at the university.

Starting in late October, the United Nations will begin its Universal Periodic Review of human rights in Iran. "[The Iranian government] would never have [made] this decision in the absence of a lot of pressure," Auerbach said.

The new Iranian president, Hassan Rouhani, has billed himself as a reformer who wants to strengthen human rights in his country and build ties with the rest of the world. Before traveling to the United Nations last year, he ordered the release of 11 of the most prominent political prisoners in the country. Though Rouhani himself is not coming to New York in October, human rights activists are hopeful that more political prisoners may be released. "If they want to release him, now is the right time," said Chudnovsky.

Still, Iran's human rights record under Rouhani is mixed at best. Since his election in 2013, the number of executions in Iran has increased, and the arrests of journalists and human rights activists have continued. "Overall we have not seen a significant improvement over the last year, since president Rouhani came to office," Auerbach said. "The hardliners are in control of the security apparatus and judicial apparatus of Iran."

Though ultimately the court could still decide against Kokabee, the reopening of the case was a cause for optimism. "To me this is a very helpful sign. It's a sign that the authorities are looking for a way out of this situation," Auerbach said. "I think the stars are aligned at this point. I think the Iranian government wants to make a goodwill gesture."

LIBBY continued from page 2

Woods-Marshall continued her work with the Institute for Nuclear Studies under Fermi, and gave birth to her second son in 1949. She and her husband separated in 1954, and Woods moved to the Institute for Advanced Study in Princeton, and then to Brookhaven National Laboratory, before landing on the faculty of New York University in 1960. Her divorce from John Marshall was finalized in 1966, and she married a chemist, Willard Libby.

By then she had moved to the University of Colorado, although she later joined her husband at UCLA in 1973 as a visiting professor of environmental studies and engineering. There, her research shifted to devising new methods for studying annual changes in temperature and rainfall patterns using isotope ratios of oxygen and carbon in tree rings. The Libbys were both strong advocates for food irradiation, and Marshall-Libby (as she was now known) suggested treating certain fruits, for example, with gamma rays instead of malathion.

Prolific to the end, Marshall-Libby's last paper, on quasi-stellar objects, was published in 1984. She died two years later, on November 10, 1986, from a stroke brought on by anesthesia.

Further Reading:

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ARTISTS continued from page 1

and scientific artist," also has a love of physics which evolved as he "grew up in the space race," he says. With a mother who was an artist and a father who was a physicist at the University of Cambridge, he always envisioned that art and science would be lifelong pursuits but wasn't sure how they would evolve into a vocation. He studied physics in college, but a chance visit to an exhibition at the Hayward Gallery in London gave him a significant push toward art. The exhibit, entitled Kinetics, included pieces that all related to light. "Art is a very personal, experiential thing for the viewer. It moves you," says Friedlander. "I just fell in love with the art at the exhibit. That moment changed my life." He remained in physics to finish his degree and then immediately began his quest as an artist.

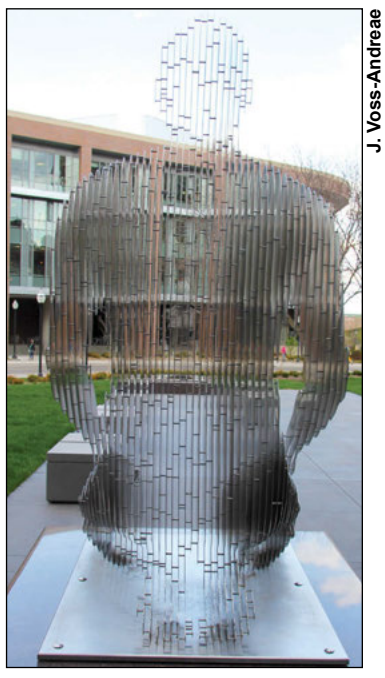
His work, which relies heavily on commissions and a few permanent installations, is also deeply influenced by physics, as all his pieces are focused on light. "When I look at light I have a feeling of being uplifted," says Friedlander, "I feel connected back to my love of the cosmos." His artistic tools are algorithms, computers, and light projectors, which he uses to design intricate figurines and shapes out of light. Naturally, his physics background aids him in thinking through the artistic and logistic problem of aesthetic expression while the physics itself serves as the subject of the art. For example, for his 2012 "Spinning Cosmos" installation in Montevideo, he collaborated with an astrophysicist to better understand spiral galaxies and then created spinning light sculptures which were lit with the astronomical data. The result was captivating: a room filled with rotating spheres of light with boundaries defined by calculations, formulae, and algorithms all describing the fabric of the universe.

Robert J. Lang, an origami artist who works in both paper and metal and who accepts commissions for both commercial and private collectors, is also a physicist who followed a professional artistic career after his formal science studies. Lang received his doctorate in applied physics from Caltech and worked in industry and for the Jet Propulsion Laboratory for almost 14 years, although he had been doing origami for almost as long as he could talk. "It's beautiful and elegant that all you need is a sheet of paper.… It was my passion my whole life," he shares. "I spent nights and weekends on art and the daytime on physics." But in 2001, the passion became too overwhelming and he quit his job at a Silicon Valley telecom firm to focus exclusively on art. "I continued to [do technology consulting] for a few years, but over that time the opportunities to work on origami continued to grow," he says.

Many of Lang's pieces draw directly from nature–for example, he has a whole series of mollusks,

T. Babinec

Physicist Thomas Babinec discovered painting as a creative outlet, as in his work "Terpsichore I."



J. Voss-Andreae

Artist Julian Voss-Andreae uses parallel metal plates to represent human forms in his sculpture "Spannungsfeld."

dinosaurs, and tessellations. But his work doesn't exist in a vacuum; indeed, he counts on and even contributes to the advancement of mathematical knowledge on which origami is based. "It touches many fields," he notes, "including combinatorics, computational geometry, folding theory, circle geometry and computational complexity theory," and he stays abreast of innovations in these subdisciplines as much as he can. In fact, Lang is a regular speaker at the International Conference on Origami in Science, Mathematics, and Education and is the author or co-author of many papers relating to the mathematics of origami folding. He continues to advance the field and wrote a computer program called TreeMaker, which is used to construct highly complex folds, flaps and angles for the origami base (the main part of an origami model) that are more intricate than anything a person can design by hand. "There's a tremendous number of relationships between folds," he describes. "For hugely complicated pieces, we can use mathematical ideas to define interfaces between structures."

And then there's Thomas Babinec, a postdoctoral fellow at Stanford University, who is still in the early phase of incorporating elements of applied and engineering physics, art, and business into his life. Unlike the other physicist-artists above, he was drawn to art only very recently: While a postdoc at Stanford, he ventured into an art store to buy a painting kit with a mission to produce art for his apartment walls. But he "discovered a special creative and expressive space with the brush," he says, and found he couldn't stop with just a few canvases. Initially he painted only for himself, but after sharing some of his abstract paintings with friends he began getting commissions and requests to sell his pieces. At the same time, he was taking a short course "Stanford Ignite," at the Stanford Graduate School of Business. So he launched The Art Experiment, a small hobby enterprise that allows him to combine elements of technical, aesthetic, and financial value creation. "I started painting because it was something that made me smile and because it provided a tool to look inwards while I was figuring out myself and my career," he says. "Now, I am always smiling."

These physicists count themselves as fortunate to be able to use both the right and left sides of their brains in their professions. But does their physics knowledge ever impede their artistic endeavors? "It radically changes your perception," says Voss-Andreae, noting how when he first started studying electromagnetism, "I couldn't look at light reflecting off a puddle and not see the underlying workings of E&M." However, "I am trying to transcend the purely reductionist view," he notes. "I'm trying to make myself richer by thinking of the wonder of just looking at something and not having to figure out the physics behind it but at the same time still be in awe of everything."

Alaina G. Levine is the author of Networking for Nerds *(Wiley, 2015) 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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the physics community that affect LGBT physicists.

The committee grew out of LGBT+ Physicists, a group founded by Elena Long of the University of New Hampshire. She formed the small, informal forum in 2009 after finding few resources available for LGBT individuals once they completed their academic training. "There was really an entire lack of resources at the time," Long said. "I thought I would just start collecting them."

The group started meeting at the APS March Meeting, beginning in 2010. In 2012 the APS Committee on Minorities and the Committee on the Status of Women in Physics donated an invited session with 5 speakers to the group to present and discuss issues faced by LGBT physicists.

"APS and the LGBT+ Physicists group have been working together for a number of years," Long said. "We've kind of been building this relationship with APS from the start…. We're working to make the field of physics better and more inclusive."

FUSION continued from page 1

scenarios. That had a significant restraining impact on the committee's deliberations," said Steven Zinkle, University of Tennessee, who is the vice chair of the FESAC. "That required some pretty severe tradeoffs to be made to keep within that range of budget scenarios."

The report prioritizes a number of initiatives for the U.S. program, in particular finding materials that can withstand the heat and radiation of long-burning plasmas and finding ways to control "transient events" in confined plasmas that can disrupt containment. "We felt it was important to pick a few of the most important areas where the U.S. has competencies and would have a big impact for where fusion is going [globally]," said Zinkle.

Part of the budget squeeze is the result of a congressional requirement that the U.S. contributions to ITER, the giant tokamak being built in the south of France, not be cut. The current budget for Fusion Energy Sciences is $504 million, with nearly $200 million of that being set aside as a contribution to ITER.

The report recommends shuttering MIT's Alcator C-Mod tokamak; keeping both the DIII-D at General Atomics and the NTSX-U at the Princeton Plasma Physics Lab running for at least another five years; and then, depending on available funding, running one or possibly both for five more years. In addition, it recommends gearing up to develop a plan for a Fusion Nuclear Science Facility (FNSF, the successor to ITER), a plasma physics computational simulator, and a neutron radiation facility.

The report drew swift criticism from a number of members of the fusion sciences community. Most prominently, fifty researchers from institutions across the country signed an open letter saying the report contains "major flaws" and "glaring deficiencies," including concerns about the FESAC's process for drafting the report and its recommendation that somewhat refocuses the U.S. program away from fundamental plasma science.

"It proposes a rather dramatic shift in the program to much more of a technology and engineering focus," said Martin Greenwald, a scientist at MIT. "That's all work that needs to be done, but it needs to be done in the context of a viable energy program."

Miklos Porkolab, director of MIT's plasma science and fusion center, said also that it was too early to refocus efforts on the more applied sciences that the report emphasizes. "Our approach up to now was to have a physics-based program in fusion until we have a concept that would work, then switch over to an engineering program. We're not there," Porkolab said.

However, Zinkle disputes how big of a shift in focus the report recommends. "The vector is changing by about 10 or 15 degrees from the current path…not a 90 degree change," Zinkle said. "We need to start exploring in a broader scope—all the fusion energy sciences, not just the plasma science activities."

At MIT, where both Porkolab and Greenwald work , the closure of the Alcator C-Mod in 2015, would be a big setback for the fusion community. The Alcator C-Mod has been one of the top research facilities for high-magnetic field and high plasma pressure since opening in 1991. "We tried in the report to emphasize that it has a tremendous science impact," Zinkle said. "In order to be responsive to the charge [to FESAC], we imposed some very difficult recommendations."

This isn't the C-Mod's first brush with closure. The tokamak was shut down briefly at the end of 2013 after the president's budget eliminated funding for the machine, only to be restarted in February after a successful effort by local congressmen to include $22 million for it in the 2014 Congressional Omnibus spending bill.

The FESAC report recommends shuttering the facility and redirecting its scientists and technicians to other areas to maintain their expertise. "It's not clear how much money you save," said Porkolab. "If you shut the facilities down, and maintain key staff, you're only going to save about 10 million dollars."

The report does recommend the construction of several new facilities. The report calls for FNSF to bridge the knowledge gaps left by ITER on the way to a full-fledged demonstration fusion power plant.

"It is not a clearly defined facility. It's nowhere close to having [initial project approval]," Zinkle said. "Now is the time to be developing the science basis for what that facility might be."

However, this recommendation has also drawn criticism from members in the fusion community. "We're concerned about that because at the moment there's not a clear consensus as to what this facility would do in a fusion development context," said John Sarff of the University of Wisconsin, Madison. "The budget scenarios, even the most optimistic ones, are not sufficient to get the necessary fusion technology pieces in place to launch the FNSF."

The report's recommendations for the plasma simulator and the neutron radiation facility drew criticism as well, though more for how the recommendations were arrived at. Though not laid out explicitly in the report, it is widely presumed that like many other similar facilities, these two new machines would be located at a national laboratory, likely Oak Ridge.

Scientists were critical because the subgroup of FESAC preparing the report included scientists from national laboratories but not academic labs with fusion programs because of concerns over conflict of interest.

"Historically we haven't worked that way. When you put panels together you get experts from the field," Greenwald said, who was a member of the committee for 12 years and chair for six. "It was always understood and you try to balance those [institutional] interests and…as much as you can, get people who can rise above those parochial interests."

When it came time to adopt the final report, half of the twenty voting members of the entire FESAC committee, both from academic labs with fusion programs and from national labs, were required to recuse themselves from the final vote. The final report was adopted by a vote of six to three in an online meeting of the committee. Other similar reports issued by DOE advisory panels do not usually take such a strict line about conflicts of interest.

"It was a little bit surprising," Zinkle said. "My understanding is that the general council at the Office of Science…provided guidance on the conflict of interest that was a much more narrow interpretation than would be the case for National Academies committees, for example."

The timeline was also of concern to the scientists. The 77-page draft was released publicly only the day before the full committee met on September 22. Because of this late release, the committee opted to delay a vote on its adoption until October 10. "If you get the report on Sunday night for a meeting on Monday morning, you're not in a position to read a long report and give it some thought and formulate your own questions and positions," Greenwald said.

The relatively short time period was the result of its original congressional charge. The panel's work needed to be finished in order to be included in a broader strategic plan for the DOE's Office of Science in January. "The panel definitely would have preferred to have a longer period," Zinkle said, adding that the chair of the panel twice asked for extensions but was turned down each time.

Zinkle said also that the panel was restricted by the original congressional charge to look only at the four budget options. He said they were not asked to articulate a broad view of the potential future of fusion physics research, which is what a number of scientists say they would have liked to include, but rather to look at the lineup of budget options. "If we had larger budgets, our recommendations would have been different," Zinkle said. "It's not an open-ended strategic plan on fusion sciences in the coming decade."

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marginally informative or useless. Relying on HIFS leads to poor decisions, and the worse and more frequent such decisions are, the more they reinforce the HIFS-induced incentive structure. As physicists, we should know better. We know data must be treated with respect and not be pushed to disclose information it doesn't have, and we know that just because a number is objective doesn't mean it is meaningful or informative.

Even more pernicious than applying HIFS to individuals is the influence it exerts on the way we practice physics. Social scientists call this Campbell's law: "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." [4] This social-science law is nearly as ironclad as a physical law. In the case of HIFS, there will be gaming of the system. Moreover, our research agenda will change: If rewards flow to those who publish in HIF journals, we will move toward doing the research favored by those journals. No matter how highly you think of the editors of the HIF journals, they are independent of and unaccountable to the research community, they do not represent the entire range of research in the sciences or in physics, and their decisions are inevitably colored by what sells their magazines.

What to do?

It is far easier to describe and diagnose HIFS than to come up with effective measures for dealing with it. I give a list below, but the list consists mainly of appeals to conform to best practices for conducting and evaluating research. Though I believe that scientists have better-than-average ability to recognize and adhere to best practices, I appreciate that high-minded admonitions have little effect unless they are aligned with incentive and reward structures. When departments are being assessed on the basis of number of publications in HIF journals and junior scientists think their job prospects are tied to such publication, HIFS is not going to go away by asking everybody to play nice. We need ideas for changing the incentive structure. My one idea in this regard is the last item in the list.

- *Renew your commitment to effective scientific communication.* When writing a research paper, first decide on the style and format you think most effective for communicating to the audience you want to reach, and only then think about a journal that publishes the style you have adopted and reaches your desired audience. If you are a mentor, teach this approach to your students and postdocs. When they ask, "How can we get this paper into *Nature Physics* or *PRL*?" your reply should be, "How can we most effectively communicate our results to the research community?"
- *When evaluating candidates for positions, promotions, and prizes or awards, commit to a technically informed evaluation of each candidate's entire record.* Object when HIFS is introduced as a proxy. Should you lack the technical background to judge the relevant research accomplishments, say so and find ways to obtain expert opinion–letters of recommendation are, of course, a traditional way of doing that–rather than falling back on HIFS as a proxy.
- *When writing letters of recommendation, write a technically informed evaluation of a candidate's capabilities and impact, including a description and evaluation of important research contributions*. Do not fall back on HIFS as a proxy for research potential or impact. If you are a mentor, assure your students and postdocs that your letter for them will focus on accomplishments and contributions, not on the journals they have published in.
- *Educate administrators that the HIF shortcut, though not devoid of information, is only marginally useful*. For any scientist, junior or senior, an evaluation of research potential and accomplishment requires a careful consideration of the scientist's entire record. A good administrator doesn't need to be taught this, so this might be a mechanism for identifying and weeding out defective administrators.
- *If you are a senior or mid-career scientist who advertises yourself by categorizing your publications in terms of HIF journals, stop doing that.* This only invites others to value and use HIFS. If you want to draw attention to the citation record of your publications, set up a Web of Science Researcher ID and/or a Google Scholar profile, and let the record speak for itself.
- *Help the public-relations people at your institution to identify and publicize important research contributions, independent of where they are published.* Object if your institution uses publication in HIF journals as a filter to determine which research contributions are important enough to be publicized.
- *Take a look at the San Francisco Declaration on Research Assessment (DORA) [5] which is aimed directly at combating HIFS.* Consider adopting its principles and signing the declaration yourself. DORA comes out of the biosciences; signing might help bioscientists put out the fire that is raging through their disciplines and could help to prevent the smoldering in physics from bursting into flame.
- *Include in ads for positions at your institution a standard statement along the following lines*: "Number of publications in high-impact-factor journals will not be a factor in assessing research accomplishments or potential."

Adopting this final recommendation would send an unambiguous message to everybody concerned: applicants, letter writers, evaluators, and administrators. Making it a commonplace could, I believe, actually change things.

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4. D. T. Campbell, "Assessing the impact of planned social change," *Journal of MultiDisciplinary Evaluation* 7(15), 3 (2011); originally published as Paper #8, Occasional Paper Series, Public Policy Center, Dartmouth College, December 1976.
5. http://am.ascb.org/dora/

ANNOUNCEMENTS

APS Congressional Science Fellowship 2015-2016

All application materials must be submitted online by close of business on January 15, 2015 (5:00 PM EST).

The American Physical Society is accepting applications for the **Congressional Science Fellowship Program.** Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

Qualifications include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be members of the APS.

Term of Appointment is one year, beginning in September of 2015 with participation in a two-week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A Stipend is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

Application should consist of a letter of intent of no more than two pages, a two-page resume with one additional page for publications, and three letters of reference.

APS physics

http://www.aps.org/policy/fellowships/congressional.cfm

Reviews of Modern Physics

Colloquium: Biophysical principles of undulatory self-propulsion in granular media
Daniel I. Goldman

Motion is a distinctive feature of life at every scale, ranging from the microscopic scale of molecular motors to the macroscopic scale of animals. The study of animal locomotion such as swimming and flying raises many natural physics questions, since the mechanics of the fluid medium determines the best strategies for motion. These questions become more difficult for granular media, since our understanding of the basic physics of granular media is still emerging. This Colloquium reviews recent progress in understanding the physics underlying a locomotion strategy of a desert dwelling lizard, the sandfish.

http://dx.doi.org/10.1103/RevModPhys.86.943

http://journals.aps.org/rmp

2015 Brazil-U.S. Exchange Program

APS physics

SBF SOCIEDADE BRASILEIRA DE FÍSICA

The American Physical Society is now accepting applications from U.S. applicants for the Brazil-U.S. Exchange Program.

Through the **Brazil-U.S. Physics PhD Student and Postdoc Visitation Program**, PhD students and postdocs can apply for travel funds to pursue a breadth of opportunities in physics, such as: 1) attend a short-course or summer institute; 2) visit with a professor in his/her field of study; 3) work temporarily in a lab; or 4) any other opportunity that the applicant and host deem worthy of support. Grants are for up to USD $3,000.

The **Brazil-U.S. Professorship/Lectureship Program** funds physicists in Brazil and the U.S. wishing to visit overseas to teach a short course or deliver a lecture series in the other country. Grants are for up to USD $4,000. Professors from the U.S. who will travel to Brazil are invited to include an option to bring a U.S. PhD student from their department on the trip.

Deadline for U.S. applicants traveling to Brazil: Friday, 14 November 2014.
Application information: www.aps.org/programs/international/programs/brazil.cfm
Information for Brazilian applicants: www.sbfisica.org.br/v1/

Program sponsored by the Sociedade Brasileira de Física (SBF) and by APS.

2015 India-U.S. Travel Grants

Physicists, physics PhD students, and postdocs in India and the United States can apply for travel grants to pursue opportunities in the other country.

The APS-IUSSTF Professorship Awards in Physics funds physicists in India or the United States wishing to visit overseas to teach short courses or provide a physics lecture series delivered at a U.S. or Indian university. Awards are up to U.S. $4,000.

Through **the APS-IUSSTF Physics PhD Student and Postdoc Visitation Program**, U.S. and Indian PhD students and postdocs may apply for travel funds to pursue a breadth of opportunities in physics, such as: 1) attend a short-course or summer institute; 2) visit with a professor in his/her field of study; 3) work temporarily in a lab; or 4) any other opportunity that the applicant and host deem worthy of support. Grants are up to USD $3,000.

This program is sponsored by the Indo-U.S. Science and Technology Forum (IUSSTF) and administered by the American Physical Society (APS).

APS physics

IUSSTF Indo-US Science and Technology Forum

Application Deadline: Friday, 14 November 2014
Application information: www.aps.org/programs/international/honors/us-india-travel.cfm

APS NEWS online: http://www.aps.org/publications/apsnews

APS physics

中国物理学会 Chinese Physical Society

Now accepting applications!

U.S.-China Young Physicists Forum

for Graduate Students in Condensed Matter & Materials Physics

February 28 - March 1, 2015 in San Antonio, TX (before the APS March Meeting 2015)

Space is limited! **Apply by November 21, 2014**

The U.S.-China Young Physicists Forum will combine scientific sessions with career development and networking opportunities. The forum will focus on condensed matter physics and materials physics graduate students. Through special topical and technical sessions, it will provide participants with:

- networking, scientific, and social events with leaders in condensed matter physics and materials physics, and VIPs from APS and CPS;
- plenary physics sessions with senior scientists from the United States and China;
- student parallel sessions, poster sessions, and a networking reception for participating graduate students;
- career development discussions on publishing in peer-reviewed journals and careers outside of academia.

Travel Costs: For those already attending the March Meeting, there should be no additional travel expenses beyond two extra nights in a hotel. (Some financial assistance may be available. See application website above)

go.aps.org/us-china-ypf

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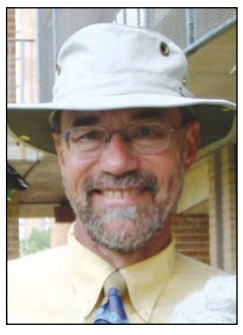
High-impact-factor syndrome

By Carlton M. Caves

Carlton M. Caves is a Distinguished Professor in Physics and Astronomy and Director of the Center for Quantum Information and Control at the University of New Mexico. He is a Divisional Associate Editor at Physical Review Letters. *He currently works on research topics drawn from the no-longer-emerging field of quantum information science.*



You are surprised to find that you have been tasked with evaluating minor-league pitchers eager to get into major-league baseball. You interview applicants, collect information, and observe their performance. But, being a physicist, you know next to nothing about evaluating pitching skill, so to make your life easier, you fix on a single figure of merit, the pitcher's heat (fastball speed). Although you have access to each applicant's fastball speed, you elect to rank the candidates in terms of the average speed of all the pitchers on an applicant's current minor-league team. Using this as a proxy for individual pitching ability, you assemble a pitching staff. As the season wears on, your pitchers are drubbed in game after game. You see the general manager approaching with a frown on his face, and...the alarm goes off.

Shaking off the nightmare, you chuckle to yourself that no pitching scout would use a single measure of performance when many skills enter into effective pitching, and even if he did, it would never occur to him to evaluate an individual pitcher in terms of the average strength of the pitching staff the pitcher belongs to.

Later that day, you participate in a meeting to discuss applicants for a position at your institution. You find that much weight is given to the number of citations accumulated by an applicant's publications, and that extra weight is assigned to publications in high-impact-factor (HIF) journals, mainly *Nature*, the *Nature* suite of specialty research journals, and *Science*. You comment that heavy reliance on citation numbers strikes you as a peculiarly one-dimensional way to evaluate candidates. Moreover, taking a measure, the impact factor (IF), that was designed to rate journals, and applying it instead to individual papers within that journal, i.e., judging a research paper by the company it keeps–this, you point out, is an elementary category error. Some good-natured ribbing ensues–how long have you been asleep?–and you are informed that publication in HIF journals is *prima facie* evidence of research prowess and, in any case, is what your higher-ups want to see.

This is a caricature, to be sure, but if you think it's only a nightmare, like the pitching-scout dream, you need to wake up. Increasingly, scientists, especially junior scientists, are being evaluated in terms of the number of publications they have in HIF journals, a practice I call *high-impact-factor syndrome* (HIFS). Take a look at a recently posted widget [1] that an early-career scientist can use to calculate a probability of his/her becoming a "principal investigator." The four most important factors in upping that probability? *Be male. Be selfish* (insist on being first author). *Be elite* (from one of the top 10 institutions in the Academic Ranking of World Universities [2]). *Publish in journals with high impact factors.* Though each of these deserves an article, here I consider only the last.

I've talked to enough people to learn that HIFS is less prevalent in physics and the other hard sciences than in biology and the biomedical sciences and also is less prevalent in North America than in Europe, East Asia, and Australia. For many readers, therefore, this article might be a wake-up call; if so, keep in mind that your colleagues elsewhere and in other disciplines might already have severe cases. Moreover, most physicists I talk to have at least a mild form of the disease.

What is journal impact factor?

Suppose you want the 2013 IF for *Physical Review Letters*: Take all the papers published in *PRL* in 2011 and 2012; the standard (two-year) 2013 IF is the average number of citations accumulated by these papers in 2013, in a list of ``indexed journals'' maintained by Thomson Reuters. Its Web of Science indexes over 8,000 science and technology journals and issues an annual report, called the Journal Citation Reports (JCR), which lists IFs and other measures of journal impact. In particular, you will also see five-year IFs, which are computed using a time horizon of five years instead of the two years for standard IF. For a given journal, IF (five-year IF) is the average annual citation rate for papers that are on average 1.5 (3) years old.

The Table, taken from the 2013 Journal Citation Reports, gives 2013 IFs and five-year IFs for several journals of interest to physicists, along with a few other journals for comparison. Even this limited set illustrates several points. Journals of record, which seek to publish all significant research in a discipline, are quite different from magazines that cherry-pick what their editors consider to be the most important or most significant articles in all of science or in a particular discipline. Papers in different disciplines, with varying numbers of researchers, accumulate systematically different numbers of citations. Different kinds of articles garner different numbers of citations—if you want to jack up your own citation count, write a good review article for *Reviews of Modern Physics*. Some journals publish a mix of article types, including primary research articles, reviews, and semi-technical summaries. Comparing a physics journal to one that publishes in all disciplines or comparing a journal that publishes primary research articles with one that publishes a mix of article types is the proverbial apples and oranges. Invidious comparisons based on IF are a source of concern for the health of the APS journals, which are rightly a pride of our discipline [3].

Journal	2-year IF	5-year IF
Nature	42.351	40.783
Nature Physics	20.603	20.059
Nature Photonics	29.958	32.342
Nature Medicine	28.054	26.501
Nature Geoscience	11.668	13.930
Nature Communications	10.742	11.023
Science	31.477	34.463
Cell	33.116	35.020
Reviews of Modern Physics	42.860	52.577
Physical Review Letters	7.728	7.411
Physical Review A	2.991	2.729
Physical Review B	3.664	3.564
Physical Review C	3.881	3.551
Physical Review D	4.864	4.046
Physical Review E	2.326	2.302
Physical Review X	8.385	-
New Journal of Physics	3.673	3.678

What is HIFS?

HIFS is the practice of using number of publications in HIF journals as a proxy for assessing research accomplishment or potential. This is often done for institutions or for units within institutions, and it is also increasingly used for evaluating individuals, in decisions on hiring, promotion, funding, and prizes and awards. I concentrate here on its application to individuals, although some of its consequences are driven as strongly or more strongly by the practice of applying it to units such as physics departments.

Do you have HIFS? Here is a simple test. You are given a list of publications, rank-ordered by number of citations, for two physicists working in the same sub-discipline. All of the first physicist's publications are in *PRL* and *PRA*, and all of the second's are in *Nature* and *Nature Physics*. In terms of the citation numbers and publication dates, the two publication records are identical. You are asked which physicist has had more impact. You cannot decline to participate by saying you need more information. Any reasonable assessor would indeed insist on gathering additional information, for example, by reading some of the papers, but by excluding additional information, we isolate the effect of IF on your judgment. If you have even the slightest inclination to give the nod to the second physicist, you are suffering from HIFS. Given just the specified information, I would come to the opposite conclusion about the two physicists: The first physicist's record is more impressive because the citation record has not received the artificial boost of publishing in the high-visibility *Nature* suite.

Where did HIFS come from?

I think HIFS can be traced to the rise of formal assessments of the collective research impact of institutions, departments, and other units within institutions. These assessments strive for objectivity, partly because objectivity seems like something to be strived for and partly because the scope of the assessment is large enough both to make objective measures informative and to make subjective evaluations difficult to assemble and to interpret uniformly across institutions or units. The number of published papers seems an obvious objective metric, but not all papers are created equal. Citations might be brought in to measure the impact of a paper, but since these assessments are meant to be snapshots, the citation record is generally too recent to be very informative. Publications in HIF journals are then weighted more heavily than other papers because these papers have more potential for substantial impact, as measured, for example, by future citations. HIF thus emerges as a mildly informative tool for assessment of departments and larger entities, although those in charge of these assessments often misread "mildly informative" as "wildly informative."

With HIF accepted as an objective component of unit-wide assessments, it is only a short step to applying it to individuals. Surely, it is said, if the department needs publications in HIF journals for its own assessment, it should hire and value most highly those people who have demonstrated the capacity to produce those publications. As science becomes broader and researchers more specialized, we all become less equipped to assess the contributions of our colleagues, and this increases the temptation to adopt a shorthand proxy like HIFS. Administrators, even more distant from particular research areas and thus weaker on the technical expertise needed to assess individuals, welcome the convenient and objective HIFS proxy, especially since it is free of the explicit and implicit biases that plague subjective evaluations.

Middle-career and senior scientists, sensing a need to secure their reputations, opt to aim their research at what they think can be published in HIF journals. Junior scientists, highly attuned to the direction the wind is blowing, get the message that their job and funding prospects are tied to publication in HIF journals. Students and postdocs ask their mentors, "Don't you think we can get this paper into *Nature*?" Some mentors lead the charge, and others acquiesce; motives range from personal advancement to the desire to help mentees get a job. And so it goes: A structure of incentives and rewards entrenches itself.

What are the consequences?

Suppose you are evaluating a middle-career or senior scientist for a promotion or for a prize or award. Focusing only on the citation record is very narrow indeed, since it ignores many factors that enter into a scientist's impact, yet it is also true that research articles are an important part of a scientist's record. For middle-career and senior scientists, with dozens to hundreds of publications, citation counts, readily available from Web of Science or Google Scholar, are a rough-and-ready measure of the influence of a scientist's research, when the citation record is calibrated to the scientist's particular field of research. Giving extra credit for publications in HIF journals is, however, precisely the category error alluded to above: The paper citation counts are all the information available from citation data; giving extra credit for publications in HIF journals, i.e., for the company a paper kept, makes no sense.

In the case of junior scientists, the situation is more complicated. Their publication records are thinner and more recent. The focus shifts from evaluating accomplishment to trying to extract from the record some measure of potential. It is probably true that there is a correlation between publication in HIF journals and potential, but it is a weak correlation that is confounded with questions of multiple co-authors and influential supervisors and their style of publication. Yet, even if you think publication in HIF journals is informative, it is not remotely as instructive as evaluation of the full record, which includes the actual research papers and the research they report, plus letters of recommendation, research presentations, and interviews. When HIFS intrudes into this evaluation, it amounts to devaluing a difficult, time-consuming, admittedly imperfect process in favor of an easy, marginally informative proxy whose only claim on our attention is that it is objective.

At some scale between unit-wide and individual assessments, HIF goes from being mildly informative to being

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