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APS Statement on Undergraduate Research Open for Comment

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Corporate Reform for a Stronger APS

Michael S. Turner
APS President 2013

During my presidential year, I have seen firsthand that the APS is a strong and vibrant organization, and that we are facing an array of new challenges–the complex, global issue of open access publishing, funding for basic research in the US, and a more global physics world–as well as the exciting opportunities laid out in our Strategic Plan (http://www.aps.org/about/strategy/upload/strategicplan.pdf).

To successfully meet the challenges and opportunities ahead, we need to increase our organizational excellence (goal four of our Strategic Plan) and achieve our vision of "one APS." The new District of Columbia laws for nonprofit corporations and the announcement by our Treasurer/Publisher Joe Serene that he will retire at the end of next summer have reinforced the notion that our century-old corporate structure needs attention. APS does not comply with the new DC rules and Joe's portfolio has evolved into three full-time jobs–publisher, treasurer, and chief financial officer. In addition, the roles and responsibilities within our governance structure have lost coherence over time.

At its September meeting, on the advice of the Presidential Line, the Executive Board formed an ad hoc Committee on APS Corporate Reform (CCR) to make recommendations on the changes in our governance and leadership structure needed to:

- comply with District of Columbia law for nonprofits;
- address organizational stress and strengthen our effectiveness;
- achieve the goals of our ambitious Strategic Plan;
- ensure that APS remains the pre-eminent physics society.

The CCR consists of the eight elected Council Members who serve on the Executive Board, the members of the Presidential Line and one ad hoc member, Cherry Murray, who is the new Chair of the Committee on Constitution and By-Laws and a former APS President. Our legal counsel, Michael Cutler of Covington & Burling, LLP, and two consultants, Marybeth

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April Meeting Flies South

This year's April Meeting will take place at the Savannah International Convention Center in Savannah, Georgia from April 5 through 8. The annual meeting is expected to attract about 1,200 attendees and feature 72 invited sessions, more than 115 contributed sessions, three plenary sessions, poster sessions and a public lecture. The recipients of many prestigious APS prizes and awards will be honored at a special ceremonial session on Sunday evening.

Saturday's Fred Kavli Keynote Plenary Session, "The Mysteries of Mass," will feature 2013 Nobel laureates François Englert and Peter Higgs speaking about the Higgs field. Rafael Lang of Purdue will review efforts to discover dark matter.

The meeting highlights the latest research from the APS Divisions of Particles and Fields, Astrophysics, Nuclear Physics, and Beam Physics, as well as the Topical Group in Gravitation. In addition, the Forums on Education, Graduate Student Affairs, History of Physics, International Physics, and Physics and Society will be participating, along with the Topical Groups on Energy Research and Applications, Few-Body Systems, Hadronic Physics, and Precision Measurements & Fundamental Constants.

For the first time at the April

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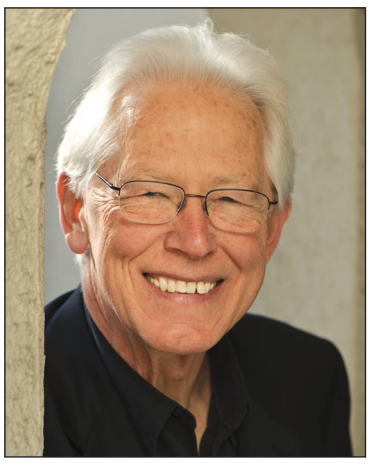
New APS President Sees Opportunity in Changing Times

Malcolm R. Beasley, Sidney and Theodore Rosenberg Professor of Applied Physics at Stanford University, assumed the APS presidency on January 1st, 2014. In the following interview with APS News*, he discusses his goals for the coming year.*

What do you see as the most pressing issues facing the physics community right now?

Support for science. Both the budget and public support are ongoing problems–that is just so clear, and it's such a difficult issue for us now. We have to continue to work at that. I think APS has a large responsibility to work for all physics on that. And I think it has led us to be a little more imaginative than we were in the past. I think the initiative that Mike Lubell has championed, "Science Counts," is a new way to do it, getting a number of societies together and forming an organization that is going to try to reach out to the public in a more effective and professional way. These are, I think, very good things. You just have to constantly work at that.

I think also it's a brave new world in scientific publishing. I like that phrase because it captures the feeling of it all. It is one of the primary goals of APS to publish physics literature, and we are admired for our journals, and that is something that we want to continue to do. But there are all kinds of things going on. The question of open access; open access is a good thing, but it has to be done in a way that does not undermine the financing of the scientific societies. Not just APS, because most societies depend on some income from publications to do the public service things they do, and those are important too. Outreach and some of the services that we can provide our members are all dependent on that kind of income. It's not only the changes that are going on, but we have to make sure our financial model is consistent with those changes.



Malcolm R. Beasley

Of course there is more competition, which is a good thing I suppose; the proliferation of new journals. It's just changing very rapidly. It's so important to us and to the quality of our journals that we just have to keep at this and make sure we do it properly. It's one of those things that is going to take a lot of effort and time going forward.

What other issues might the Society have to address in the year?

There is a big one. The Presidential Line and the Executive Board have come to the realization that if we are to meet all of the responsibilities we have, we need to do an even better job. I think the Society performs very very well, but in these times of rapid change, we have to be as effective as possible. This is one of the goals of the Strategic Plan. It has led the Executive Board and the Presidential Line to form an ad hoc Committee on Corporate Reform to look at the governance and executive structure in APS to see how we might be even more effective than we've been in order to be the leading society that we want to be.

There are other reasons for doing this. We are incorporated in Washington DC and the rules of incorporation are changing. These are sensible changes they are making, designed to improve the excellence of non-profit corporations, and we have to comply with those. So it seems another reason to look at our governance and structure.

Last but not least, Joe Serene, our Treasurer-Publisher, is retiring and so there's a need to look at how that's handled and define the position and hire new people to do it. There is an *APS News* article in this issue that will describe this in more detail. It's also interesting to me that we are not alone. The American Geophysical Union just went through this process, AIP is going though it, and we

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APS Treasurer/Publisher to Step Down

By Michael Lucibella

Joe Serene, APS's Treasurer/Publisher for eight years, announced in November he will retire from the position at the end of August 2014. He is one of three operating officers at APS and helped lead the Society and its journals through some of the most dramatic upheavals in the world of publishing and the economy in recent memory.

"Joe has kept us on firm financial ground as treasurer, and as publisher he has helped to steer us through the turbulent waters of publishing in recent years," said APS Past-President Michael Turner of the University of Chicago. "Joe is recognized in the scientific publishing business as an expert and an innovator, and most importantly for the APS he is someone that everyone trusts and respects."

The position of Treasurer/Publisher is unusual among publishing organizations. More often the positions are separate.

"At a high level, I'm responsible for the budgets and finances of the Society," Serene said, adding that his job as publisher puts him broadly in charge of non-editorial policies of the journals. "I think my job at this point is really two jobs."

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Physical Review Applied Call For Papers

Physical Review Applied, the newest APS research journal, has announced its call for papers. The journal, the first issue of which will be published in early 2014, will be the first APS journal focused specifically on applied physics research.

"There is a large and growing audience of both physicists working on applied topics, and engineers working on important applications that at their heart hinge on physical mechanisms," Troy Shinbrot, editor of the journal, said in a recent interview. "*Physical Review Applied* seeks to be the place to publish, to discuss, and to promote the physics on which these new ideas hinge."

The editors are encouraging scientists to submit their theoretical or experimental work on materials science, surface and interface physics, device physics, condensed matter physics, optics, and any intersection of physics and engineering. The journal will publish both short letters as well as longer journal articles.

The journal was established as a part of the APS five-year strate-

***PRA* continue on page 4**

Members in the Media

"So we are stuck. Life may indeed pop up readily in Earthlike conditions, or it may be a fluke, unique in the observable universe. Because we are a product of this cosmic accident, we cannot conclude that Earth is typical. No statistical evidence can be drawn from a sample of one."

***Paul Davies**, Arizona State University,* The New York Times*, November 18, 2013.*

"This is a landmark discovery–possibly a Nobel Prize in the making."

***Alexander Kusenko**, UCLA, on the recent discovery of 28 neutrinos from outside the solar system by the Antarctic IceCube detector,* The Los Angeles Times*, November 21, 2013.*

"The goal is to try to make a map of the sky in a totally different way….Each time someone has done that, they have found something new."

***Francis Halzen**, University of Wisconsin-Madison on the recent discovery of 28 neutrinos from outside the solar system by the Antarctic IceCube detector,* The Los Angeles Times*, November 21, 2013.*

"I think in order to solve the impending energy needs we might have to go a bit beyond."

***Bobby Sumpter**, Oak Ridge National Laboratory,* FoxNews.com*, November 21, 2013.*

"It's reversible, but not that quickly….There are several chemical steps, but Iran knows how to do them."

***David Albright**, the Institute for Science and International Security, on Iran converting its enriched uranium into the less dangerous uranium dioxide,* FoxNews.com*, November 25, 2013.*

"I could hear a cat, and once in a while a meow."

***Bruce Weber**, Montgomery College, about his cat Tank who got stuck in his house's walls,* The Washington Post*, December 3, 2013.*

"There's tremendous visuals going on to catch people's attention….There's a fine line between being frantic and appropriately fast, so it's really hard."

***Don Lincoln**, Fermilab, about the Second Annual Physics Slam held at the laboratory,* The Chicago Tribune*, December 9, 2013.*

"It is impossible to say anything in 10 minutes."

***Hugh Lippincott**, Fermilab, on the challenges of condensing his life's research on dark matter into a short talk,* The Chicago Tribune*, December 9, 2013.*

"There are a lot of people who would bet that it's not perfectly round."

***Eric Cornell**, JILA and NIST, on the shape of the electron,* NBCNews.com*, December 10, 2013.*

"The simplest idea for dark matter is that it's a massive neutral particle that used to be in thermal equilibrium when the universe was very hot and dense, and what we have now is the leftover relic abundance."

***Sean Carroll**, Caltech,* NBCNews.com*, December 14, 2013.*

"Take anything I tell you with a grain of salt….I know nothing about the future."

***Joe Incandela**, CERN,* CNN.com*, December 14, 2013.*

"You can endlessly make models of supersymmetry. A good theorist can invent a model in half an hour, and it takes an experimentalist 20 years to kill it."

***Eugene Commins,** University of California, Berkeley,* www.scientificamerican.com*, November 11, 2013.*

This Month in Physics History

January 23, 1952: Alan Turing's house is burglarized

On January 23, 1952, British mathematician Alan Turing returned home to find that burglars had broken into his home. Turing admitted in a letter to a friend at the time that none of the stolen items were irreplaceable, although he expressed an understandable sense of personal violation. It soon became very personal indeed. What should have been a minor annoyance and disruption ended up profoundly changing Turing's life–a life that, until then, had been marked primarily by professional accolades and success.

Turing was born in London in 1912. Although his father, Julius, was a long-standing civil servant based in British India, Turing's parents wished to raise their growing family in England and moved to Maida Vale in west London. They continued to travel extensively, often leaving Turing and his older brother, John, with neighbors; school holidays were spent in the family home in Guildford. The young Alan showed academic promise at a young age, and at 13, began attending the Sherborne school in Dorset. So eager was the boy to learn, that when a strike shut down transport in Britain, he rode his bicycle the 60-mile distance, stopping just once at an inn for the night. That enthusiasm for physical activity stayed with him; he was a gifted long-distance runner, more than capable of the 40-mile distance to London from Bletchley Park during World War II.

Alan Turing

Turing's gifts lay in math and science, but at Sherborne, the emphasis was on a traditional classics education, which led to conflict with a few of his instructors, but on the whole, he flourished intellectually. This was also where he met Christopher Morcom, an upperclassman who became Turing's first love–although his romantic affections were not returned. Morcom died of tuberculosis in 1930. Turing was devastated, and became an atheist, with a resolutely materialistic view of the universe, although he clung to the possibility that some part of his friend might live on. Some have speculated that this loss later influenced his thinking on the potential for artificial intelligence.

Having become interested in science through books by physicists such as Eddington and Einstein, Turing studied mathematics at Cambridge University, where he first encountered the work of American computer pioneer John von Neumann, among other intellectual influences. As a postgraduate fellow, he wrote an intriguing paper outlining ideas that would become features of modern computing. His mathematical gifts and abiding interest in cryptoanalysis snagged him a job with the Government Code and Cypher School in 1938 and eventually brought him to the now-famous Bletchley Park facility dedicated to cracking the German Enigma code, where by war's end he was one of nine thousand employees. His colleagues called him "Prof," and found his quirky eccentricities endearing, such as chaining his mug to the radiation pipes so that nobody would steal it.

Turing worked in Hut 8, the section assigned to cracking naval codes, even heading up his division for a time. Turing made several vital contributions to the cryptoanalytical war effort–including a portable secure voice scrambler nicknamed Delilah–but he is most famous for the Bletchley "bombe": a machine capable of deciphering the settings for the Germans' Enigma machine. More than 200 such machines were in operation by the end of the war, sounding like "a thousand knitting needles" when running.

Once the war ended, Turing worked at the National Physics Lab (NPL), developing early designs for a stored-program electronic computer. Much of his wartime research was classified, however, and Turing felt his achievements were not appreciated because of that continued secrecy. He left the lab in 1948, although the NPL did exhibit a prototype ACE computer in 1950 based on his design.

Turing was resolutely discreet about his private life, although close friends knew he was homosexual. He once proposed to his fellow Bletchley Park cryptologist, Joan Clarke, but broke it off when he realized he couldn't go through with the marriage. (Clarke was purportedly "unfazed" by his sexual orientation when he confessed it.) A few weeks before the 1952 burglary, he had met 19-year-old Arnold Murray, and the two men became lovers. Murray confessed that he knew the burglar when Turing confronted him.

An emotional Murray threatened to tell police about their relationship if Turing reported it–no idle threat, since homosexuality was a criminal offense in Britain at the time. Turing refused to be bullied into silence, although he initially withheld Murray's name and the fact that they were romantically involved. Eventually he was forced to admit the truth, and despite his prominence in British society, found himself on trial for "gross indecency." He pled guilty on the advice of his solicitor and was convicted in March, opting to undergo chemical castration in lieu of imprisonment. His elderly mother, Ethel, absorbed the shock and stood by her son, in sharp contrast to his brother, John, who denounced Turing's "disgusting and disreputable" proclivities.

Turing continued to do research during this

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APS Releases Statement on Undergraduate Research for Member Comment

The APS Executive Board at its November Meeting approved the posting of a statement on undergraduate research for member comment. The statement calls on the country's colleges and universities to "provide all undergraduate physics and astronomy majors with access to significant research experiences."

"At the most basic level what we're saying is every undergraduate should have this kind of experience because it's really foundational," said Paul Cottle, a physicist at Florida State University and chair of the APS Committee on Education. "It's the way you learn how to get things done in a workplace or a real research environment."

The Committee on Education put forward the statement in response to concerns about the classroom emphasis on the theoretical underpinnings of physics, with little or no teaching about how physics is done in the real world. Having undergrads do actual research would offer them a chance to see what physics is really about, committee members say.

The statement is aimed primarily at college and university administrators, public policy makers and legislators–the people who have the most influence on which academic programs a school offers.

"We've just got to keep focusing their attention on how important undergraduate physics research is," Cottle said.

As part of the Society's bylaws, after the APS Executive Board approves any statement, the membership is encouraged to submit comments about it. After all member comments have been received, the APS Panel on Public Affairs will review the responses and consider revising the statement before a final version is put to the APS Council for a vote.

The statement reads in part "The American Physical Society calls upon the nation's colleges and universities and their physics and astronomy departments to provide all undergraduate physics and astronomy majors with access to significant research experiences."

"APS's endorsement of this statement would reaffirm the importance of real-world experiences as a critical component of a physics education," notes Theodore Hodapp, the APS Director of Education and Diversity. He added that, "Many smaller physics programs often must argue for resources to maintain such efforts with their students. This statement provides a valuable piece of ammunition in that fight."

Cottle said also that it was in the schools' own interest to support undergraduate physics research. He called a physics degree extremely versatile, as graduates can go into engineering, science, and finance.

"If you're graduating five [physics majors], those are probably the five most valuable graduates in any given year," Cottle said. "Undergraduate research is the component of that program that really puts physics majors at the top of the heap."

Input will be accepted until January 31, 2014. Members can read and comment on the statement at http://www.aps.org/policy/statements/undergraduate.cfm

Higgs Boson Day

Photo by Michael Lucibella

Congressional representative and APS Fellow, physicist Rush Holt (D-N.J.), speaks at Higgs Boson Day. Organized by the APS Division of Particles & Fields, the November 20 Capitol Hill reception honored the US contribution to the discovery of the Higgs boson. Holt highlighted the work done at Fermilab as well as the contributions to the rest of science made at all the national laboratories. Behind Holt from left to right are representatives Randy Hultgren (R-Ill.), Bill Foster (D-Ill.), and Alan Nunnelee (R-Miss.). Also speaking at the event were Pushpa Bhat of Fermilab, Philip Rubin from the Office of Science and Technology Policy, Ian Shipsey of Purdue, and Joe Incandela, spokesperson for the CMS experiment at the LHC.

Imprisoned Physics Student Declared Prisoner of Conscience by Amnesty International

By Michael Lucibella

Amnesty International has declared Omid Kokabee, the former University of Texas at Austin physics graduate student now imprisoned in Iran, a "prisoner of conscience" and called for his release. The announcement followed a symposium, held at Georgetown University on November 16, about academic freedom in Iran and his ongoing detention.

"The organization considers Omid Kokabee a prisoner of conscience, held solely for his refusal to work on military projects in Iran and as a result of spurious charges related to his legitimate scholarly ties with academic institutions outside of Iran," reads the statement from Amnesty. The organization defines prisoners of conscience as people who are jailed solely for their non-violent political beliefs.

Omid Kokabee is an Iranian citizen who had been pursuing his PhD in optics and photonics at U.T. Austin. When he returned to visit family in Iran over his winter break in 2011, he was arrested at the Tehran airport. After being held for more than a year without trial, he was sentenced to ten years in jail for conspiring with and receiving "illegal funds" from the United States in the form of his student loans. In a 2013 letter from prison, Kokabee said the real reason he was arrested was because he repeatedly refused to work on military projects.

Organizers of the Georgetown event wanted to raise awareness about his imprisonment, and call attention to the problem of academic repression in Iran.

"Science should be conducted free of interference, all kinds of interference. That is the way it works," said panelist Hossein Sadeghpour, chair of the APS Committee on International Freedom of Scientists. "Kokabee is now becoming, whether you want it or not, an icon for science free of pressure [and] free of political influence."

He is incarcerated in Tehran's Evin Prison, where many Iranian political prisoners are said to be held and tortured. Since he was jailed, Kokabee has lost more than 15 pounds and also has been denied medical care for a kidney disease, said panelist Eugene Chudnovsky, one of the co-chairs of the Committee of Concerned Scientists. In addition, prison administrators extended his sentence by 91 days because Kokabee was teaching physics to other prisoners.

His incarceration, however, has not prevented him from continuing to work on theoretical physics. He's written several physics papers based on his past research, including one that was accepted to an international conference, but prison guards wouldn't allow him to attend.

Ellen Hutchison, a student at U.T. Austin, spearheaded many of the efforts through the university to effect his release. She set up the website FreeOmid.org and wrote to the 50 ambassadors from nations on the United Nations Human Rights Council to lobby on his behalf. In addition, her group organized a letter writing campaign directed at the leadership of Iran itself, and the foreign ministers of 25 nations. She also put together a petition at Change.org, which reached 854 signatures.

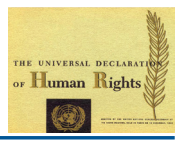
"I made a document with the help of Omid's lawyer, and we documented every trial irregularity from the beginning," Hutchison said, adding that Iran's conduct violated both the Universal declaration of Human Rights and the International Covenant on Civil and Political Rights.

Sadeghpour also criticized the status of academic freedom in Iran. He highlighted how the government of Iran required every undergraduate degree be made up of Islamic studies classes.

"We know that we cannot solve Fourier equations without taking religious studies," Sadeghpour said sarcastically.

The Georgetown event was sponsored by APS, Amnesty International, the Abdorrahman Boroumand Foundation, the International Campaign for Human Rights in Iran, United4Iran, the Committee of Concerned Scientists, Georgetown University Amnesty International and the Georgetown University Science and Human Rights Group.

APS Committee on International Freedom of Scientists



CIFS Briefs: Highlighting the Connection Between Human Rights and Science for the Physics Community

Since its creation in 1980, the APS Committee on International Freedom of Scientists (CIFS) has advocated for and defended the rights of scientists around the globe. In this column, CIFS describes some of the issues that the Committee is monitoring as well as the Society's other human rights activities.

APS Andrei Sakharov Prize

In September, APS awarded its Andrei Sakharov Prize to Boris Altshuler (P.N. Lebedev Physical Institute) and Omid Kokabee (Evin Prison, Tehran, Iran). Altshuler was honored "For his lifelong struggle for democracy in Russia and for his advocacy on behalf of the rights of neglected children." Kokabee was cited "For his courage in refusing to use his physics knowledge to work on projects that he deemed harmful to humanity, in the face of extreme physical and psychological pressure."

CIFS is pleased to report that Kokabee is aware that he has been awarded the Prize.

Amnesty International Event

On November 16, APS co-sponsored an event with Amnesty International and several other organizations that highlighted the plight of Iranian graduate student and APS member Omid Kokabee (see related story on this page). The event "Iran: Silencing Scientists and Squelching Scholarship" was held at Georgetown University. Three APS members—including the chair and a member of CIFS—were among the speakers. During the event, Amnesty International announced that it had declared Kokabee a prisoner of conscience.

As *APS News* readers may know, Kokabee was arrested in Iran in January 2011 after visiting family and trying to return to the University of Texas at Austin, where he was pursuing a PhD. He is currently serving a 10-year sentence after being convicted in May 2012 on charges that he received "illegal earnings" and was "communicating with a hostile government." Kokabee recently confirmed that he has never had access to his lawyer. He has also been denied needed medical care for kidney stones. CIFS continues to advocate on his behalf.

AAAS Science and Human Rights Coalition

Earlier this year, Vikram Singh Prasher (Member-at-Large of the Forum on Graduate Student Affairs (FGSA) and graduate student at the University of Massachusetts, Lowell) was appointed as the APS graduate student representative to the AAAS Science and Human Rights Coalition. Prasher participates in the biannual Coalition meetings, where he is working to increase the understanding among physics graduate students of the connections between science and human rights, as well as to bring the voice of these students to the work of the Coalition. As part of this effort, Prasher is undertaking a survey of APS graduate student and early career members who also are members of FGSA and the Forum on International Physics. The survey asks these members about their knowledge of and interest in human rights.

APS members who are graduate students or early career physicists are welcome to complete the survey, through January 20, at: https://www.surveymonkey.com/s/physics_and_humanrights

We welcome your input!

Letters

Readers interested in submitting a letter to APS News ***should email letters@aps.org***

Supermagnets–Where Did They Come From?

In his November 2013 *APS News* letter Philip W. Anderson cites an instance of a senator's incorrect impression regarding the origin of supermagnet technology. Unfortunately, that incorrect impression is widespread.

For example, an article in the "Phenomena, Comment, and Notes" section of the December 1994 issue of *Smithsonian* states that, "The techniques that made it possible to produce such a magnet [a supermagnet for use in a magnetic resonance medical imaging (MRI) system] were developed at the Fermi National Accelerator Laboratory." Perhaps the author took at face value a FNAL public relations publication of that era entitled, *The Benefits of High-Energy Physics Research*, which contains the statement that, "The underlying magnet technology for Magnetic Resonance Imaging (MRI) came from particle physics research."

That same claim was echoed by the then-director of FNAL at a meeting I attended at that time in Washington, DC. In fact, the true paternity of practical supermagnets must be attributed to Kunzler, Buehler, Hsu, and Wernick [*Phys. Rev. Lett*. **6**, 89 (1961)], then at Bell Telephone Laboratories [see also The Back Page]. They, and others who pioneered supermagnet science and technology, were not high-energy physicists, nor was supermagnet development a significant activity within high-energy physics projects until after definitive proof-of-principal demonstrations had been achieved. At that point incorporation of supermagnets into MRI systems, particle accelerators, and a multitude of other applications could be undertaken with little risk.

Of course, none of this is intended to denigrate in any way the very remarkable accomplishments of FNAL in successfully applying the then-relatively-mature supermagnet technology to the Tevatron on a scale of unprecedented magnitude.

Ted G. Berlincourt
Elk, California

Diversity Census Seeks Clearer Picture of Membership

By Michael Lucibella

The recently formed Diversity Working Group within the APS staff is putting together a "diversity census" about the APS physics community. As part of this effort, members are being asked to update their profiles to include more demographic information.

"[It's] to get a sense of where we are with diversity in regard to the APS structure," said Arlene Modeste Knowles, APS career and diversity administrator and co-chair of the committee. "We have had to work with membership to make changes to the database to collect data and do the census."

Demographic information, including gender, race, and ethnicity, has been a part of membership profiles for more than two years. However, not all members have filled out all of the information. In addition, the profile options are changing. Race and ethnicity, previously one category, is being split into two categories, so members are being asked to fill in both.

"This information will be used to analyze demographics and provide information to members, but individual information won't be shared with third parties," Modeste Knowles said.

The working group was set up in response to the APS strategic plan, and the census will provide a snapshot of the diversity of the physics community. It will look at the demographic makeup of prize and awards winners, fellows, the elected leadership, invited speakers and other groups. The committee hopes to have the census finished by spring of next year, possibly with a preliminary report ready for the February unit leadership convocation.

"Increasing the diversity within the field of physics and working to ensure we are an inclusive organization are very high priorities," said Kate Kirby, the APS executive officer.

Diversity issues have been a major focus of the Committee on the Status of Women in Physics and the Committee on Minorities, and the groups will collaborate on many efforts.

"This group will be working with the existing committees," said Monica Plisch, associate director of education and diversity at APS and co-chair of the working group. "The diversity census is going to complement what the CSWP and COM is doing."

The working group is composed of ten APS employees, selected for two-year terms. Once the census is completed, the working group will also make recommendations to the APS operating officers.

PRA **continue from page 1**

gic plan. An important part of the plan is for the Society to better serve industrial and applied physicists. Journal editors said that *Physical Review Applied* would be an important part of that effort.

Physicists can submit their manuscripts to *Physical Review Applied* through its website, http://journals.aps.org/prapplied

Profiles In Versatility

Physicists Give Renewable Energy the Silicon Valley Treatment

By Gabriel Popkin

Physicists have always loved an energy challenge. In the early 1940s, the world's top minds cracked open the atom's concentrated energy stores; today many of the field's best and brightest hope to harness the vast but dispersed power of the sun and the wind. For some, this means publishing papers on new solar cell materials or rare-earth magnets, and many of these researchers have joined the APS Topical Group on Energy Research and Applications, which has grown to over five hundred members in just four years.

But for other physicists, renewable energy means the chance to see their ideas turned into real, potentially world-changing technologies. And following that dream can mean making the leap from academia's sheltered confines to the rough-and-tumble of Silicon Valley.

"Energy is one of the defining challenges of our time, and I wanted to be in a position where I could personally make a difference," says Kenneth Jensen, one of those physicists who took the plunge and has never looked back. For the past five years, Jensen has worked as an engineer at Makani Power, a wind energy startup company based in Alameda, California ("makani" is Hawaiian for wind). Before entering the world of Silicon Valley startups, Jensen earned his PhD at Berkeley turning carbon nanotubes into tiny radios and mass spectrometers. He enjoyed that work, but five years in the lab was enough; the day after he turned in his dissertation he started working at Makani. "I was tired of academia and wanted to try something else," he says.

Jensen and his colleagues are developing an airborne wind turbine—essentially a small airplane with an onboard generator tethered to a ground-based power station. Makani's turbine can fly at altitudes of up to half a kilometer, where the wind is stronger and more constant than nearer the ground; this is especially beneficial because wind's power density scales as the cube of its speed. The airborne system is also far lighter than a traditional turbine, requiring only 10% of the material. The tradeoff is that the plane has to stay aloft without a rigid tower supporting it, creating a novel engineering challenge.

That's where Jensen comes in. He designs the systems that control the turbine's flight, keeping it aloft and ensuring it harvests as much power as possible. He says he spends about half his time simulating the behavior of the turbine under a variety of wind conditions; the rest of the time he's out testing the plane and seeing how it behaves in the real world. This constant iteration can lead to both frustration and triumph. "Nature is much less forgiving than a computer simulation," he says, "but there's nothing more rewarding than when we get everything right and our system flies."

Although his job title is engineer, Jensen is grateful for his physics background. "I view physics as a way of training the way you think," he says. "I feel pretty confident I can jump into almost any field of engineering–aerodynamics, mechanical, structural analysis, computer science." This versatility is ideal preparation for the work he does at Makani, where, he says, "everybody has to wear a lot of hats."

Photo by Kenneth Jensen
Kenneth Jensen

Photo by Robert Schlatter
Danielle Fong

With funding from Google and the U.S. Department of Energy's Advanced Research Programs Agency-Energy (ARPA-E), Makani has, in the seven years since it was founded, produced several generations of prototypes, each better controlled and more powerful than the last. Still, until earlier this year, the company's future was always shaky, especially after CEO and cofounder Corwin Hardham died unexpectedly at his desk last year. Then, in May, Makani was acquired by Google X, the secretive research lab run by the search giant, which has made some bold wagers on potentially transformative technologies. In fact, Google cofounder and Google X director Sergey Brin was quoted in *The New Yorker* as saying, about Makani, "This is a bet. But we think it's a very good bet."

Makani will benefit from Google's deep pockets, especially as the company seeks to build its first commercial-scale 600-kilowatt prototype in the next few years. The name Google also "lends credibility to what we're trying to do," says Jensen. But while he admits the acquisition gave him a welcome bump in both pay and job security, he says his day-to-day work hasn't changed. He's still the same scrappy engineer, launching prototype turbines off the tarmac behind the old Navy control tower where Makani operates, taking data, designing algorithms, and writing programs that might help the plane fly better–and then launching again.

From Generation to Storage

Generating renewable power cheaply is one of today's great energy challenges, but it is not the only one. Wind and solar have been held back not only by their low energy density but also by their inconsistency–after all, the sun doesn't always shine and the wind doesn't always blow. So no matter how successful Jensen and his Makani colleagues are, they will have to hope someone solves another problem: how to store, on a large scale, the energy they generate to provide reliable backup power when the electrical grid needs it.

Solving this problem is how former physics graduate student Danielle Fong plans to get rich. And she hopes to do this with a technology–compressed air–that has plenty of skeptics, including at ARPA-E, the same agency that funded Makani. Though the Department of Energy balked at funding Fong's idea, some big-name investors have recently gotten behind her company, LightSail Energy, to the tune of tens of millions of dollars. As a result, Fong is now, at the age of 25, one of the most watched energy entrepreneurs in the Valley.

Fong's career has been defined by impatience. Like many entrepreneurs, she found the standard educational path uninspiring, but instead of waiting to drop out of college, she quit school at age twelve. With her parents' support, she took a few computer programming classes and enrolled at Dalhousie University in Nova Scotia. Five years later she graduated top of her class with degrees in physics and computer science, and headed to the Princeton Plasma Physics Lab to help make fusion energy a reality and save the world. But as a graduate student she grew impatient, feeling that the pace of such a large program was too slow. Fong concluded she might wind up spending her career writing grant proposals and advancing through the academic ranks even while fusion power generation remained unrealized and extraordinarily challenging

"Realization dawns on me that fusion, if anything, is the power source of the far future, and it is the near future I worry about," Fong wrote in her online bio.

So after two years, Fong dropped out again. "My interim plan was to leave graduate school, make my fortune, and invest it in what I thought to be the correct energy research," she says. She considered trying to strike it rich on Wall Street, but decided the derivatives being traded there were a fool's game. "There was a giant

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Washington Dispatch

Updates from the APS Office of Public Affairs

POLICY UPDATE: THE BUDGET DEAL

A budget deal between Senate Budget Committee Chair Sen. Patty Murray (D-WA) and House Budget Committee Chair Rep. Paul Ryan (R-WI) has been struck. The budget proposal is a two-year agreement that authorizes discretionary spending for fiscal years 2014 (FY14) and 2015 (FY15). The deal revises spending for defense discretionary and non-defense discretionary categories, increasing spending for each by $22B in FY14 and $9B in FY15 above the caps set by the 2011 Budget Control Act, effectively reversing a portion of sequester cuts. Total spending for defense discretionary in FY14 is capped at $520B and in FY15 is $521B. Total spending for non-defense discretionary is capped at $491B in FY14 and at $492B in FY15. Overall spending is set at $1,012B in FY14, exactly splitting the difference between House and Senate budget plans. The agreement uses a number of offsets for the spending increases, such as increased federal-employee contribution to retirement programs for new hires, rescinding available funds for the Strategic Petroleum Reserve, increasing aviation security service fees, and limiting compensation for government contractors.

The reaction to the budget deal has been guardedly positive among lawmakers and mixed outside the beltway. Indeed, even before the budget deal was reached, conservative think tanks such as Heritage Action had already come out against the deal. And now that a deal has been struck, additional conservative groups are lamenting, with the Cato Institute calling the package a "huge Republican cave-in" and FreedomWorks calling it "a surrender." Rep. Paul Ryan downplayed the actions of conservative think tanks, stating "[g]roups are going to do what they want" and even calling such action "the new normal." House Speaker John Boehner called the outcry from conservative groups "ridiculous."

Speaker Boehner, ignoring outside pressure, brought the Ryan-Murray plan to a vote within days of its release. The plan, H.J. Res. 59, passed 332-94, with 169 Republicans voting for, 62 against and 163 Democrats voting for, 32 against.

As *APS News* goes to press, action is shifting to the Senate, where Majority Leader Harry Reid (D-NV) has said the bill "will have to wait until a series of confirmation votes on presidential nominees" that had been held up by Republicans are completed. The delay will allow proponents time to muster the 60 votes needed for passage.

If the compromise is signed into law, appropriators will have just under a month to implement the budget plan in appropriations language that would modify or replace the Continuing Resolution set to expire on January 15. Exactly how appropriators will choose to spend the additional $45B is uncertain. Moreover, the plan does not deal with the debt ceiling, which will be reached sometime after February 7.

WASHINGTON OFFICE ACTIVITIES

ISSUE: MEDIA UPDATE

Michael S. Lubell, director of public affairs for APS, points out in his latest *Roll Call* column that the Tea Party's political tactics are threatening our nation's scientific enterprise. Read the column: http://bit.ly/1eaCxGl

In other news, a broad coalition of groups, including scientific organizations, businesses and associations, recently held a press conference on the negative impact of sequestration.

Media outlets, including the following, picked up the story:
Reuters: Companies, academics say budget cuts threaten US competitiveness: Read story: http://bit.ly/1h6PheK
Bloomberg: Coalition of industries and advocates fight sequestration: Read story: http://bloom.bg/190LAW6

ISSUE: PANEL ON PUBLIC AFFAIRS

POPA would like to welcome its newest members who will begin their service in 2014.

2014 POPA Vice Chair: Bill Barletta; Members: Robin Cote, Michael Marder, Bill McCurdy, Stephen Pratt, James Wells.

The POPA report *Renewing Licenses for the Nation's Nuclear Power Plants* has been publicly released and can be viewed on the POPA Reports website, along with two other reports completed by POPA in 2013 (*A Technical Review: The Domestic Nuclear Detection Office Transformational and Applied Research Directorate R&D Program*; *U.S.-Russian Nuclear Reductions After New START: Summary of a Workshop Exploring Next Steps*). http://www.aps.org/policy/reports/popa-reports/index.cfm

The APS Statement on K-12 Physics Education was approved at the November 2013 Council meeting and can be found on the APS Statements website. http://www.aps.org/policy/statements/13_1.cfm.

A proposed APS Statement on Undergraduate Research was approved by POPA and the APS Executive Board. It is now posted on the APS website for review by membership, through Friday, January 31st, 2014. Visit http://www.aps.org/policy/statements/undergraduate.cfm to read and submit your comments.

A template for study proposals can be found online, along with a suggestion box for future POPA studies: http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm.

http://www.aps.org/policy/opa/index.cfm

Changing of the Guard at *APS News*

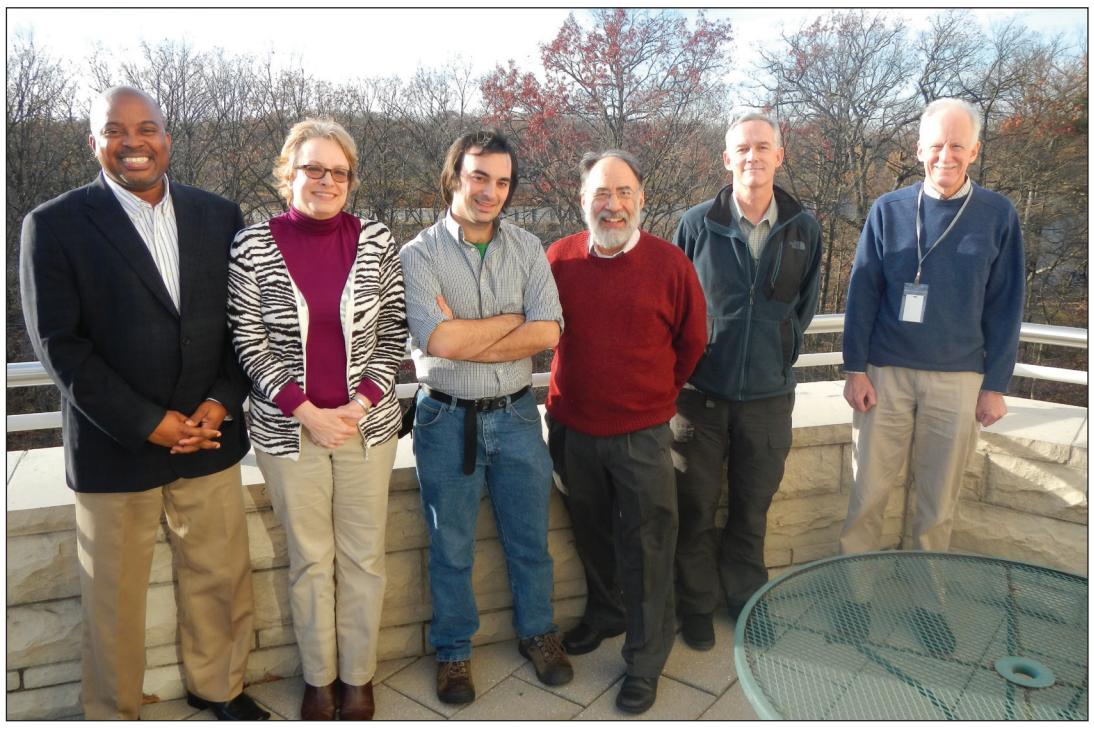


Photo by Joe Ignacio

Alan Chodos, Associate Executive Officer of APS and editor of *APS News*, has announced his retirement at the end of this month. Alan has been at the editorial helm since the March 2000 issue, and has introduced a number of new features, including the popular "This Month in Physics History." Taking over from Alan as *APS News* editor will be David Voss, founding editor of the APS publication *Physics*, which launched in 2008, and former senior editor of *Science*. David has worked in research journal publishing since 1986, and has written for a number of publications including *Science*, *Nature*, *New Scientist*, *Physics World*, *Technology Review*, and *Wired*.

(L to R): Kerry Johnson (art director), Nancy Bennett-Karasik (design and production), Mike Lucibella (staff science writer), Alan Chodos (outgoing editor), David Voss (incoming editor), Ed Lee (proofreader).

New Alternative Energy Fellowship Established

By Michael Lucibella

APS has created a new fellowship for young scientists exploring promising research into alternative energy. The Executive Board voted in November to establish the Stanford R. Ovshinsky Sustainable Energy Fellowship using a donation from the family of the late physicist.

Winners of the annual award will receive $15,000 and a travel allowance to receive the award at an APS meeting. The award will be given to young physicists who are within ten years of receiving their PhD. The award committee also will have an eye towards researchers who show an entrepreneurial interest in bringing their research to market.

"It's such a pressing issue," said Rosa Ovshinsky, Stanford's widow and chief technical advisor of China Bridge LLC. "We really need to develop those kinds of carbon-free energy technologies."

Stanford Ovshinsky was an inventor who specialized in developing energy and information technology. He founded Energy Conversion Devices in 1964, which ultimately yielded more than 400 patents in amorphous film nano-structures. This research led to the invention of rewritable CDs and DVDs, as well as most modern silicon solar panels. In 2006 he left ECD and founded two new companies, Ovshinsky Innovations LLC to pursue information technology and Ovshinsky Solar, which specializes in alternative and renewable energy research. Ovshinsky passed away in 2012.

"He was such an extraordinary person, just a great human being, and I really wanted to do something in memory of him that was meaningful," Rosa Ovshinsky said. "He deserved to have some kind of legacy."

The Topical Group on Energy Research and Applications will likely issue a call for nominations sometime in mid-2014, with the first fellowship awarded in 2015.

REFORM continued from page 1

Fidler and Cate Bower of Cygnet Strategy, LLC, are assisting the CCR. Cate and Marybeth recently led the American Geophysical Union through a successful corporate reform process.

At the November Executive Board meeting, the CCR laid out the timeline for the corporate reform process. I briefed the Council on the activities of the CCR, and the Council passed a resolution that allows us to continue to use our current Constitution and By-Laws until our new structures are in place.

Critical to the success of this process and fundamental to the culture of our Society is member input. Our consultants have already conducted 11 interviews, with 30 more planned for the next month. The first set of interviews included our Operating Officers and the Presidential Line members; the next set will involve a broader range of individuals, including past leaders of the Society, members of Council, senior staff, and leaders of other organizations that interact with the APS. At the February Leadership Convocation, the CCR will meet with Unit Leadership and Committee Chairs to seek their input as well. The CCR and I invite your thoughts, input and questions via email (president@aps.org).

The CCR will share their initial recommendations with the Council and the Committee on Constitution and By-Laws at their April meetings and revise them in accord with that input. The legal documents based upon these recommendations and drawn up by our legal counsel will be presented to the Executive Board and Council in June, with a special Council meeting later in June to approve them in their final form. The last step in this process is a membership vote on our new corporate structure, scheduled for fall 2014.

Once the new structure becomes clearer, we will begin the searches for the individuals who will carry out the functions that Joe Serene has been doing.

Your new President, Mac Beasley, will be giving you regular updates on the progress as well as continuing to seek your input.

In initiating this process, the members of the Presidential Line were of one mind in their belief that we must change to meet the challenges and opportunities ahead. This is not the first time the APS has changed–100 years ago we took over the *Physical Review* and since have transformed it into the suite of leading physics journals in the world. Twenty years ago we moved from New York City to College Park and increased our national prominence and influence. My Presidential Line colleagues and I are confident that this change too will make our Society stronger and more effective in its enduring mission to advance and diffuse the knowledge of physics.

Michael S. Turner is the Bruce V. & Diana M. Rauner Distinguished Service Professor, and Director of the Kavli Institute for Cosmological Physics at the University of Chicago. He assumed the APS presidency for his one-year term on January 1st 2013.

BEASLEY continued from page 1

had a briefing from the president of the Canadian Physical Society at the Council meeting last week and they're going through this all for the same reasons we are. So I think it's a time in the history of scientific societies that we are examining our governance in light of all the changes going on, and it'll be a good thing.

What do you think will be your main focus and what will you do to achieve your goals?

I will have to manage this corporate reform and work with Executive Officer Kate Kirby on the Strategic Plan and to do it on the timescale that we're thinking, in a year. That's going to take a very large effort. However you simply cannot fail to pay attention to public support and funding for science and these publication issues. It's a very large agenda; I don't see how you can avoid dealing with all three of those.

How would describe how your presidency will be guided by the Strategic Plan?

The Strategic Plan is done. It's really in the proper scheme of things, now for Kate and the other operating officers to implement the plan and she is doing that. There are a number of task forces that have been formed. One on early career physicists, one on development and there are ongoing ones now looking at the meetings. That is really now properly part of the executive responsibilities and I just want to do everything that I can do to help Kate and the operating officers.

How well do you think the Society is serving its members, and are there any areas where you think the APS could enhance its programs?

I think in general we serve our members very well. They seem to think we do. There are always ways to improve and we want to do that. We're trying to listen more, see what they want and how they feel we serve them best or where we can do things better. That's just good communications. There is one task force formed looking at how to improve the meetings for the members. There are some new elements that we have not been so conscious about, and we are working very hard on these this year. One is to reach out to the early career members. Their career opportunities are different than has been typical over the last several decades. This leads us to the reasons that we want to reach out more to industrial physicists–are we serving them well? I think we want to look at serving our members in general, but I think the particular focus on early careers and industrial physicists are two very important foci for our efforts to serve our members better in the coming year.

What do you see as the Society's role in public policy?

I think that APS is admired for the degree to which we advocate for physics, largely through our Washington office, and we need to continue to do that. What's interesting about it is that the issues where physicists and the APS intersect with public policy and the imperatives of the nation are changing substantially. For example, some of the areas that we are looking at, take climate change or energy issues, are not pure physics issues. There are a lot of other elements to them. We probably will be working with other societies as we have in the past to deal with these broader, more complex issues. There has even been POPA activity that is involved internationally. So I think these are new aspects of how we reach out, which I think are healthy and good, and we need to learn how to do them as well as we possibly can. I see the agenda for our public policy as broadening and getting more complex, in the sense that these issues are not just physics focused.

What do you see as the Society's role on international issues?

We are an international Society in many ways. As you may know, two-thirds of our papers are from abroad. I think twenty to twenty-five percent of our members are from abroad, and we welcome that. They are telling us that they like this Society. We are the American Physical Society, but obviously we do things that are of value internationally and we want to do more of that and to be an effective participant in the leadership of physics internationally, and working with other physical societies. Our international office is working hard to make those connections. Everybody agrees there needs to be more interaction internationally between the various societies. Looking forward the important thing is to begin to reduce those to concrete things to do. There will be a task force which is going to look at those kinds of issues, and I'm sure they'll come up with some very good and challenging recommendations. I think it's very very important.

In recent years, APS has been increasing its focus on education and outreach. What do you think of these efforts and how will you guide them?

I think the APS has been a leader in defining programs and implementing them successfully. There are the PhysTEC and the Bridge programs, which are the principle ones now. I think the needs are very great and I think the imagination of the membership and certainly the staff in APS is strong in thinking of things that can be done usefully. The question is finding the resources to do that. I think that more can be done, more should be done, and we will find the resources to do that, both through government funding and development.

How did you first become interested in physics?

High school physics–I just liked it. I took chemistry as a junior and physics as a senior and I just liked physics better. I always had an interest in technology, and when I went to Cornell I started out in mechanical engineering but I found I liked the physics courses better. I shifted over into what they called engineering physics at the time. It was marine boot camp for physics and certain parts of engineering. I enjoyed that; it was wonderful for me and had a huge impact on me. I went on and got my PhD in physics and have worked in various applied physics departments over my years. I have combined the two interests in science and technology by working on parts of physics that are potentially interesting for technology. I'm more interested in science that appears interesting for major applications and technologies. I'm not myself involved so much with trying to solve the particular problems of today's technology; it's more future looking. That's been a great thing for me. I've enjoyed it immensely.

Why did you choose to run for the APS Presidential Line?

I have to start with an anecdote I really like. When I was elected, one of my colleagues said to me "Well Mac, running for the President of APS is the kind of thing that you want to lose by one vote." I guess I'm glad they miscounted by one vote and I was elected.

Physics has been good to me and I'm not a young man anymore, so it's time to pay back. I have, for whatever reason, gained a lot of administrative experience over the years and been part of reforming departments and schools and universities. I think it's appropriate and I value bringing that experience to serve the APS. It is a great organization and I firmly, firmly believe that no field can really thrive if it isn't well managed. The management can be in the background and quiet if that's the way it should be, but you need somebody worrying about the overall health and doing the right things, and APS has been very good about doing that over the years. I just hope I can also do some good while I'm at it.

I just think that the overall reality right now, and of my presidency therefore, is to rally and adapt to this brave new world we're in, not only in publishing but also in support of science. Change is upon us, it's a good thing and my desire is to bring in the best people to deal with those issues and keep APS as a model of a scientific society.

SERENE continued from page 1

Serene's role as Treasurer/Publisher has expanded since he joined APS. "He's just changed the way we do publishing significantly, and that's why the job of publisher has grown tremendously in the last several years," said Kate Kirby, the APS executive officer.

In addition, Serene helped launch two new journals, *Physical Review X*, the first all open-access journal for APS that covers all fields of physics, and *Physical Review Applied*, which sent out its first call for papers in December. In addition, he helped with the online publication *Physics,* which was launched in 2008 and publishes commentaries aimed at a broad audience about physics discoveries. "It's part of our charge to diffuse the knowledge of physics," Serene said.

Over the same period, the emergence of new open-access requirements has rocked the publishing world as a whole. Serene helped put APS at the forefront of open access policies as the journals became "hybrids" in which authors have the option of buying open access rights for their papers.

Recently, Serene has been working with the organizers of the Clearinghouse for the Open Research of the United States (CHORUS) to fulfill new government requirements for Open Access. In February, the Office of Science and Technology Policy announced it will soon require all papers funded by the federal government be available for free to anyone one year after publication. "Joe has really taken a leadership role in responding to the OSTP mandate," Kirby said.

Serene's departure comes at a time of reorganization within the Society. A recently formed ad hoc Committee on Corporate Reform is in part looking at whether the position he held should change. Though the committee has not yet made its recommendations, it is likely that the positions of treasurer and publisher will be split. "I suspect we will need at least two people to carry out Joe's current responsibilities," Turner said.

In the coming months, the committee will meet to assess the future of the position. "The Ad Hoc Committee on Corporate Reform will have to face the question of how to divide Joe's present responsibilities, or at least the process by which that will be done," said Malcolm Beasley, a physicist at Stanford and the new President of APS. "Once the needed new positions are defined, any searches will be carried out as we normally do; a search committee that recommends candidates. Given the importance of the searches, we will want to have truly blue ribbon committees."

The formation of the corporate reform committee was not brought about by Serene's retirement. Nonetheless, the timing of his retirement will play a role in its recommendations. "It was just a catalyst, perhaps, to establish a more aggressive timeframe," Kirby said.

It is likely also that the person or people who will ultimately step in to take on Serene's responsibilities will have some kind of background in physics as well as finance or publishing.

"In the past, APS has always found it valuable to have physicists in the leadership of the Society, and I suspect that may still be the case," Kirby said. "It's valuable to have people who really know the community that makes up our membership."

Looking back at his time at APS, Serene said that he was proud of his contributions to the Society. He was unwilling to take all the credit for changes at the organization, but said he was glad to play the role he did.

"I think this is a much more coherent and cohesive organization than when I got here," Serene said. "I think a lot of good and positive things happened while I was here."

TURING continued from page 2

stressful period, producing a fascinating paper on a possible reaction-diffusion mechanism for some patterns in nature, spurred by his interest in the prevalence of Fibonacci numbers in the structure of plants. But the hormonal treatments took a heavy physical toll, and his conviction severely limited his ability to travel, even for professional reasons. He also lost his security clearance, and thus was unable to continue his cryptography research.

On June 7, 1954, a cleaner found Turing's body in his home, with a half-eaten apple nearby. The coroner ruled his death a suicide by cyanide poisoning, although this remains a controversial finding. His mother insisted her son's death was accidental; Turing often ate an apple before bed. He also used cyanide in his home experiments and she had warned him about being careless in handling the poison in the past.

The laws used to convict Turing were not revoked until 1994, and on September 11, 2009, Prime Minister Gordon Brown made a posthumous apology for the mathematician's treatment, in response to a petition signed by thousands: "We are sorry. You deserved so much better."

Further Reading:

Hodges, Andrew. *Alan Turing: The Enigma*. New York: Simon and Schuster, 1983.

Levin, Janna. *A Madman Dreams of Turing Machines*. New York: Knopf, 2006.

Turing, Alan. "On Computable Numbers with an Application to the Entscheidungsproblem," *Proceedings of the London Mathematical Society*, 2d series, 42 (1936-37): 230-265.

Turing, Alan. (1952) "The Chemical Basis of Morphogenesis," *Philosophical Transactions of the Royal Society of London B* 237 (641): 37-72.

ANNOUNCEMENTS

Childcare Grants Available

What: Small grants of up to $400

Who is eligible: parents/caregivers who plan to attend the APS March or April Meeting with their small children or who incur extra costs to bring them along or leave them at home. Preference is given to early career applicants.

Deadline:
January 3, 2014 (for March)
January 31, 2014 (for April)

Details at:
www.womeninphysics.org

APS Congressional Science Fellowship 2014-2015

All Application Materials Must Be Submitted Online By Close of Business on January 15, 2014 (5:00 PM EST).

THE AMERICAN PHYSICAL SOCIETY is currently 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 2014 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.

APPLICATIONS 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.

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

Reviews of Modern Physics

Colloquium: Beta-delayed fission of atomic nuclei
Andrei N. Andreyev, Mark Huyse, and Piet Van Duppen

Nuclear fission splits a heavy actinide nucleus such as uranium or plutonium into two lighter nuclei, called fission fragments. Mass distributions of fission fragments in actinide nuclei are typically strongly asymmetric. Recent studies of low-energy beta-delayed fission of very neutron-deficient nuclei in the lead region established a new region of asymmetric fission. The data and their interpretation demonstrate the extent to which, more than 75 years after the discovery of nuclear fission, we are still learning about this nuclear decay of fundamental importance to society.

http://link.aps.org/doi/10.1103/RevModPhys.85.1541

http://rmp.aps.org

Biruni Award Nominations

Application Deadline: 7 February 2014

The Iranian-American Physicists Network has put out a call for nominations for its "Biruni Award" for graduate student research. The organization is looking for senior level graduate students of Iranian descent in either a masters or PhD program in the United States. The organizers hope to highlight research excellence among students of Iranian descent.

www.irapnetwork.org

APRIL continued from page 1

Meeting, APS will host pre-meeting workshops. Members can register to attend the Friday courses free of cost. Carolyn Sealfon from Princeton University is organizing a STEM (Science, Technology, Engineering, and Math) education workshop for participants to learn some of the latest interactive classroom teaching techniques. Also on Friday, researchers from Duke University will host a course on photonuclear reactions at the High Intensity Gamma-ray Source.

Astrophysicist Neil deGrasse Tyson, director of the Hayden Planetarium in New York, will open Monday's plenary session. Also speaking are Naoko Kurahashi Neilson from the University of Wisconsin-Madison, talking about the discovery of neutrinos at the IceCube detector at the South Pole, and Suzanne Staggs, who will share her research into the polarization of the cosmic microwave background.

Tuesday's plenary will feature talks centered on the 100th anniversary of the discovery that the beta-decay spectrum is continuous. Hamish Robertson from the University of Washington will review a history of beta decay in subatomic physics. Wick Haxton from the University of California, Berkeley will give an update on the search for neutrinoless double-beta decay. Looking ahead, Sheldon Stone of Syracuse University will offer some insights into ways weak decays can provide a window into new physics.

Stefan Gillessen of the Max Planck Institute for Extraterrestrial Physics will deliver a Saturday evening public lecture about the black hole at the center of the Milky Way galaxy.

The meeting will host a number of events aimed especially at students. New for the April Meeting is Saturday's graduate school fair. Undergraduates will have a chance to meet with recruiters from about a dozen schools at a reception that afternoon. Also on Saturday, as part of the Future of Physics Days events, a panel of graduate students will answer undergraduates' questions about continuing their education. Undergraduate students will present their research at one of two Saturday oral sessions or the afternoon's poster session, and there will a special award brunch on Sunday for the top undergraduate presenters. Undergraduates are invited to apply for travel grants for up to $1000 to attend the meeting.

On Sunday the Forum on Graduate Student Affairs will sponsor a career panel aimed at graduate students who are thinking about non-academic careers, featuring speakers from both industry and finance. Graduate students can also get some one-on-one time with researchers at Sunday's Lunch with the Experts.

Exhibitors, including publishers and other vendors, will have booths set up around the hotel to display their products.

Meeting attendees will be able to stop by the APS Contact Congress booth to send letters to their elected officials about the importance of continued Congressional support for scientific research.

ENERGY continued from page 4

reality gap between what people thought they were doing and what were actually doing," she says. (Lehman Brothers tanked soon afterward.)

So instead she headed west, couch-surfing in Berkeley, California while meeting fellow entrepreneurs and investors. She tried to launch a half dozen startups and failed. Then she fell in love with the idea of a compressed air vehicle, and found two business partners (one of whom also has a physics degree) to go in on it with her. LightSail Energy was born.

Storing energy by compressing air is actually an old idea that has never quite gotten up to speed. The main problem is that pressurized air gets really hot; that heat is then easily lost to the environment, and the re-expanding cold air returns little of its original energy. Fong decided to try solving this problem by applying some old-fashioned thermodynamics and taking advantage of the large heat capacity of water. She developed a method to spray water into air as it is compressed; the water, which absorbs the heat of compression, is then separated from the air and held in insulated tanks. Later, when the energy is needed, hot water and compressed air recombine, returning most of the energy that was packed away.

Fong and her team presented their plan to the venture capitalist Vinod Khosla, who steered them away from cars and toward the electricity grid. With that course change and some seed funding, they were off and running. They now use stacked shipping containers to hold compressed air, and they plan to make their entire system modular, so it can plug in wherever it is needed—at a wind farm, say, or a solar generating station. When power is available to be stored, an electric motor drives an air compressor; when power is needed, the process is reversed and the motor becomes a generator. LightSail's goal is for its system to return 70% of the energy it stores, which would more than double the efficiency of previous compressed air systems; her team is "inching toward" that target, says Fong. Already the company has generated a lot of interest among potential customers—so much, in fact, that its vice president of business development spends almost half his time on engineering. The only thing they're missing, says Fong, is something ready to sell. "Our main limiting factor…is that we don't have a product yet."

But with solid backing from Khosla, Bill Gates and others, Fong is optimistic, and her company is growing. So if you're looking for a job with Fong, here's a hint: learn some physics. "By the time you've got your degree in physics, you're really a force to be reckoned with," she says. "People that you hire with a physics background, you can expect them to be able to figure a bunch of different things out, to do research, and not crap out on you if they encounter a hard problem."

And that's good, because one of the few certain things about the quest for renewable energy is that it's a damn hard problem.

Gabriel Popkin is a science writer in Mount Rainier, Maryland.

The Back Page

We Need Undirected Research

By Byron Roe

Undirected research, for me, is a misnomer. What some call "undirected" is actually research driven by an individual's own excitement, curiosity and unique ideas, and it is not just random tinkering. The research can be basic or applied, within a large program or outside of the mainstream. It is not directed at some preordained final result, but is rather self-directed.

Undirected research carries enormous intellectual interest. We want to understand who we are, what we are made of, what is the universe, what is it made of, and how did it start and evolve? A very eloquent statement was made by Robert Wilson in his testimony to Congress in April 1969 to support the building of Fermilab: "[T]his new knowledge has all to do with honor and country but it has nothing to do directly with defending our country except to help make it worth defending."

At the same time, undirected research has immense practical importance. While research in physics is a good example, the same kind of argument can be made for other sciences. To me it is clear that during the past century, every twenty years or so, something so spectacular is found that it makes major changes to world society as a whole. Often, the discovery is not anticipated in advance, even by the experts working in the field. Sometimes it is not appreciated by experts or funders even right after it is discovered. This has profound consequences for the support of undirected research by society and for the importance of diversity of research directions.

Consider some examples

Nuclear energy. In 1917, Ernest Rutherford and his technician, William Kay, set up an experiment in which they hit nitrogen atoms with alpha particles. In a long series of exhausting tests, they showed that the collision liberated the nucleus of a hydrogen atom. Rutherford had achieved the transmutation of one element into another. Surprisingly, there was very little interest in either the scientific or popular press when he published his results in 1919. (www.mosi.org.uk/media/33871092/ernestrutherford.pdf)

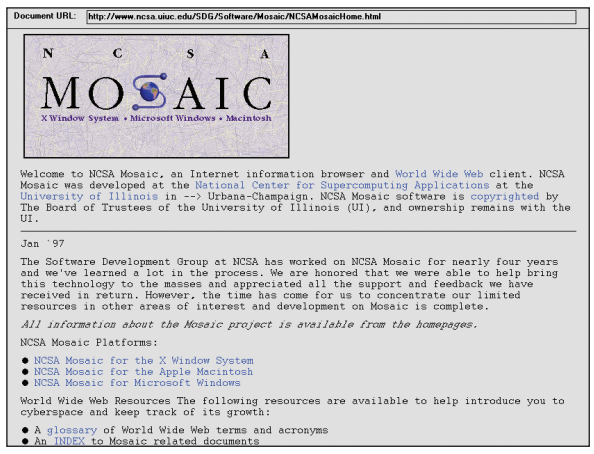
Rutherford's work was driven by curiosity. In 1933, he noted at a scientific meeting and later in the journal *Nature* that "These transformations of the atom are of extraordinary interest to scientists but we cannot control atomic energy to an extent which would be of any value commercially, and I believe we are not likely ever to be able to do so." (www.aip.org/history/mod/fission/fission1/02.html)

In 1939, Otto Hahn and Fritz Strassmann bombarded uranium with neutrons and claimed that they had produced an atom chemically similar to barium. Lise Meitner and her nephew, Otto Frisch, explained this as the uranium nucleus splitting into two roughly equal halves with the emission of several neutrons. Scientists quickly saw the potential importance of this work. This exothermic reaction with the emission of more neutrons was the basis for the chain reaction which gave rise to nuclear power and bombs. Within six years the first atomic bomb ended World War II.

All of this work taken together was responsible for nuclear power, nuclear weapons, and extensive medical and industrial uses for radioactive elements. It is (in spite of the disaster at the Fukushima nuclear power plant) likely that some form of nuclear power will be an essential part of the power needed for the future of humanity. [(e.g., read *Sustainable Energy Without the Hot Air*, David J.C. MacKay (2009))].

Lasers. In the late 1950s optics was considered a backwater field by many in physics. The development of lasers and non-linear optics rejuvenated the field. This began when Charles Townes joined the Columbia University faculty in 1948. In 1951 Townes conceived the idea of the maser (microwave amplification by stimulated emission of radiation). Early suggestions of this possibility were also made by Nicolay Basov and Alexander Prokhorov, as well as by Joseph Weber. Both Niels Bohr and Isadore Rabi (a Nobel prize winner in the field and chair of the Columbia University Physics Department) told Townes he was wasting his time (*The Guardian UK*, May 4, 2005). In 1953, Townes and colleagues built a working maser. According to the *Wikipedia* biography of Townes, even just a few months before the first successful experiment, Rabi and Polycarp Kusch urged him to stop, insisting the research was just a waste of money.

Four years later, Charles Townes and Arthur Schawlow, then at Bell Labs, began a serious study of the infrared- and later the visible-light laser ("light amplification by stimulated emission of radiation"). The concept originally was called an "optical maser." In 1958, Bell Labs filed a patent application for their proposed optical maser; Schawlow and Townes submitted a manuscript of their theoretical calculations to the *Physical Review*, published that year in Volume 112, Issue No. 6. In 1957 Gordon Gould noted his ideas for an optical maser. In 1958 additional papers appeared by Schawlow and Townes and by Prokhorov. In 1960, Theodore Maiman invented the ruby laser, considered to be the first successful optical or light laser.



Credit: National Center for Supercomputing Applications/University of Illinois Board of Trustees.

Screenshot of Mosaic, the first web browser.

As we all know, today lasers are everywhere. DVDs and price tags are read by lasers. Lasers are used for printing documents from computers. Lasers are now ubiquitous in surveying instruments. Lasers are used to cut materials in industry and are used in eye surgery. These are only a sampling of the extensive uses for lasers within our modern world.

High-field superconductors. The first report of fabricating a wire that stayed superconducting when subjected to a large magnetic field occured in 1961. [J.E Kunzler, *et.al*. "Superconductivity in Nb_3Sn at high current density in a magnetic field of 88 kilogauss," *Phys. Rev. Lett.* **6**, 89 1961).]. This work was the culmination of work at Bell Labs by Bernd Matthias. Shortly after the article appeared, John Kunzler described their results at a University of Michigan colloquium which I attended. He related the following anecdote concerning the discovery: When he first found that their material remained superconducting in a field of several kilogauss and seemed to be able to go higher, his boss at Bell Laboratories was quite skeptical and said that he would give him a bottle of good scotch for every kilogauss above 5 kilogauss that he found it would go. The boss welshed at about 72 kilogauss.

High-field superconductors are now used in MRI and in small cyclotrons in hospitals, in the magnets of most large particle accelerators, and are being developed as possible lossless power transmission lines. There is research in using them for magnetically levitating trains (to remove friction).

The world-wide web. Email and the TCP/IP protocol had been known for some time. Various networks in the United States and abroad made it possible to exchange email world wide. However, the development that really sparked the internet was the development of the HTML markup language. In 1989, while working at CERN, Tim Berners-Lee invented a network-based implementation of the hypertext concept. By releasing his invention to public use, he ensured the technology would become widespread. For his work in developing the World Wide Web, Berners-Lee received the Millennium technology prize in 2004. The immediate purpose of his work was to enhance communication between physicists working on experiments at CERN and their colleagues at their home institutions. I was on sabbatical working on a Large Electron-Positron Collider experiment (LEP) experiment at CERN at that time, and this was an unexpected development even to many of us working at CERN. This was not a direct result of a particle physics experiment, but was a direct result of the instrumentation for the experiment. Cutting edge experiments also often generate new cutting edge technology.

As we all know, the internet has made a revolution in the way we communicate with each other. The physicists who designed LEP had no idea that their work would lead to Facebook, Twitter, and Amazon.

What might have been: muon-catalyzed fusion. A result which came close to having a profound effect is muon-catalyzed fusion. When a negative muon is trapped in an atomic orbit around a deuterium-hydrogen molecule, the orbit is very small. The deuteron and proton are pulled close together and have a chance to fuse into helium-3 and emit a gamma ray releasing about 5.5 MeV of energy. Andrei Sakharov and Frederick Frank predicted the phenomenon of muon-catalyzed fusion before 1950 and Yakov Zel'dovich studied the phenomenon of muon-catalyzed fusion in 1954. However, it became well known only when Luis Alvarez and colleagues were analyzing the outcome of some experiments with muons incident on a hydrogen bubble chamber at Berkeley in 1956. This turned out to be apparently not quite practical for power production, but if the muon had had a slightly longer lifetime, it would have been the practical path to controlled fusion reactors.

A cautionary tale: the personal computer

When I was an undergraduate at Washington University in St. Louis, I was fortunate to be taught first-year physics by George Pake, who was chair of the department. Professor Pake later became the Chancellor of the University and afterwards President of the American Physical Society. Jack Goldman, the chief scientist at Xerox, saw the future of Xerox to be digital and hired Pake as Vice-President in charge of research.

At Xerox, Pake assembled a stellar team of remarkable computer scientists. Within a few years they had invented the personal computer. They invented the mouse, the ethernet for transferring information between computers, the personal printer, which used normal paper rather than the computer paper of the time, and the software "Smalltalk" to make all this work. Unfortunately there was a serious lack of communication between the scientists, who didn't explain it well, and middle management, who simply didn't see the importance of the work. Management did like the printer and adopted that, but didn't see the point of the rest.

Since they didn't appreciate what had been done they didn't see the point of keeping it all confidential, and a few people were shown the effort. One young man who came, Steve Jobs, then went back to Apple and used most of these innovations for the MacIntosh computer. This sad story (for Xerox) is well described in the book *Fumbling the Future: How Xerox Invented, then Ignored, the First Personal Computer*, by Douglas K. Smith and Robert C. Alexander (1988)

Conclusion

How can we foster a resurgence of undirected research? Based on past experience, such exploratory effort may well continue to be extremely important in the coming century. Since we often do not anticipate the discoveries in advance and they do not come every day, we should broadly support undirected research. Furthermore, this support should be increased, not decreased. Five and ten year plans for a field are necessary. However, it should continually be recognized that new results may mean the old plans need to be substantially revised.

We have been fortunate that most of these developments have occurred in the United States in the past century. As world-wide science keeps advancing, this will not always be true. However, even if something new is developed abroad, we can participate in the fruits of the result if we have a strong scientific effort in that area. This happened with the development of the HTML markup language. We must be sure that we do not narrow down our efforts too much to specific, currently popular items.

The loss of the great industrial laboratories for basic research (Bell, RCA, Westinghouse, Ford, Xerox, etc.) has hurt basic research. Part of the problem has been the disconnect of the laboratories and management as spectacularly illustrated by Xerox, and also by the continuing trend of industries to look at the profits for the next quarter, rather than for long-term growth. It would be very useful for science, for the industries, and for the country to rebuild that effort, but keep better watch for discoveries which can produce profits. Rebuilding these labs would add considerably to the diversity of support, and go a long way towards reinvigorating scientific research.

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