APSNEWS
A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY
JANUARY 2012 • VOL. 21, No. 1 • WWW.APS.ORG/PUBLICATIONS/APSNEWS/INDEX.CFM

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Meet The New APS President
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Sorters Set New Records

Photo by Michael Lucibella

Sorters for abstracts submitted to the 2012 APS March Meeting in Boston met at APS headquarters in College Park on December 3 and 4. The 158 sorters tackled a record 8,960 abstracts, for an astonishing A/S ratio of 56.7. In the photo, Steve Hudson of NIST, Andrey Dobrynin of the University of Connecticut and Megan Robertson of the University of Houston debate a fine point of the sorter's art.

APS April Meeting Celebrates Cosmic Rays and More

The 2012 APS April Meeting will be held at the Hyatt Regency Atlanta in Atlanta, Georgia from March 31 through April 3. This year's theme is "100 Years of Cosmic Ray Physics," commemorating the April day in 1912 when Victor Franz Hess accompanied an electroscope into the sky in a balloon and discovered a fourfold increase in ionizing radiation as the atmosphere thinned out.

The yearly meeting is expected to host about 1,200 attendees and will feature 72 invited sessions, more than 120 contributed sessions, three plenary sessions, poster sessions and a public outreach event with the local science center. In addition, the Sherwood Fusion Theory Conference will be co-located with the meeting.

Victor Hess getting ready to measure cosmic rays, Austria, 1912.

The meeting highlights the latest research from the APS divisions of Particles and Fields, Astrophysics, Nuclear, Computational, Plasma and Beam Physics. 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, Gravitation, Hadronic Physics, Plasma Astrophysics, and Precision Measurements & Fundamental Constants.

On Saturday, March 31, there will be a keynote plenary session sponsored by the Kavli Foundation. It will feature Alan Watson of the University of Leeds, Ellen Zweibel from the University of Wisconsin, Madison and Samuel C. C. Ting of MIT, speaking about the last century of research into cosmic rays, plasma physics and cosmic rays, and the International Space Station's alpha magnetic spectrometer respectively.

In addition, the second ple-

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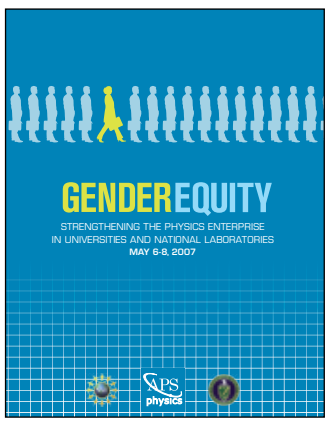
APS Report Stimulates New BA Programs at Michigan Tech

By Michael Lucibella

Michigan Technological University is starting two new physics degree programs aimed at increasing physics literacy and helping train new physics teachers, based in part on recommendations from an APS report.

Located in the northwest part of the state, Michigan Tech is starting up a new Bachelor of Arts degree in physics as well as a B.A. in physics with a concentration in secondary education. In the announcement, provost Max Seel, a physicist and APS member, said that they were following



one of the recommendation's from 2007's Gender Equity report put out by APS in collaboration with the Department of Energy and the National Science Foundation.

"The motivation for offering a B.A. in physics to provide students with a strong foundation in physics but fewer course requirements," said Seel. "It's basically what I think APS said in its gender equity report; to create flexible tracks for physics majors… A B.A. basically offers more flexible pathways."

Seel added that the new programs weren't watering down the science taught in them, but were being offered to give students the opportunity to get a strong background in science, even if they

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Mid-East Accelerator Getting Close to Completion

By Michael Lucibella

SESAME, the long-awaited particle accelerator being built in the Middle East, seems poised to enter its final stages of construction. At SESAME's recent council meeting in Turkey, two countries have fully signed on to help fill in its budget gap, and two more are expected to contribute soon as well. In addition, the organization reports that construction on the accelerator has been moving forward according to plan, and, provided the necessary funding comes through, it is on track to start up in 2015.

"I'd say the outcome was very good technical progress and encouraging news about funding, but nothing final," said Sir Chris Llewellyn-Smith of Oxford University, who is president of the SESAME Council.

SESAME is a UNESCO-spearheaded project to build a 2.5 GeV synchrotron light source in Jordan. When completed, it would be the first such particle accelerator in the Middle East. The multinational coalition to build and run the facility is modeled after the governance of CERN and features nations that have historically been rivals, such as Israel and Iran, collaborating on the project. Much of the buildings, tunnels and radiation shielding has been completed, and the first parts of the accelerator have just been installed. The accelerator itself is in part made up of Germany's decommissioned BESSY1 light source.

"SESAME is on track and the project is very close to reaching an agreement between five countries for 25 of the 35 million needed for completing construction," said Amy Flatten, APS Director of International Affairs, who attended the council meeting.

Until recently, the consortium had been facing a $35 million deficit in the budget needed to complete the project. However, at this meeting, firm commitments from several nations came through, along with pledges from others that will make up the majority of the needed funds. Israel pledged that it would contribute $1 million per year for five years if four other members contributed funds as well.

"As of the beginning of this meeting, Israel has been joined by Jordan and Iran," said Herman Winick, a research professor at SLAC and a member of the Executive Committee of the APS Forum on International Physics. He

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APS Members Advocate For Science on Capitol Hill

Despite cuts to many other agencies, scientific research seemed to be largely protected in the recently passed "minibus" bill funding multiple federal agencies in 2012. The National Institute of Standards and Technology, the National Science Foundation and the science division of NASA all got significant boosts in their budgets. Those who worked with lawmakers on the budget said that input from scientists and scientific organizations was instrumental in getting members of Congress to continue to fund research.

"Throughout the year, APS members played a role in advocating for science budgets," said Michael Lubell, APS Director of Public Affairs. "It's not just APS members; it's cumulative when you look at science, engineering and mathematics across the board."

Brian Mosley, APS grassroots manager, said that reaching out to Congress is important for scientists if they want congressional support of scientific research to continue. He warned that if scientists remain disengaged from the political process, it's easy for the needs of scientific research to get overlooked by lawmakers.

"Elected officials won't go out on a limb on issues that won't affect a large number of their constituents," Mosley said. "We're not the only ones who have to explain why we need to get funding every year."

Every year, APS works to mobilize its members to act and support federal funding of research. Mosley said that emailed alerts are an effective way of engaging the membership. Usually only a handful are sent out per year, but they often generate significant response from the membership. In 2011, two alerts generated 7,685 messages to Congress.

"These are the emails that we send out to APS members when very important legislation comes up on the Hill," Mosley said. He highlighted the alert sent out in February after House Resolution 1 called for major cuts to science funding. "We sent that out to members and asked them to voice their concerns about it."

Similarly, APS operates "Contact Congress" booths at its four biggest meetings. Members attending the meetings can sign a prepared letter in support of science research and address it to their members of Congress. Af-

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Members in the Media

"I'm thankful that the world gives us puzzles we can solve, but not too easily."

***Frank Wilczek**, MIT, on being asked what about physics he's most thankful for,* PBS.org*, November 22, 2011.*

"Physics is the only piece of magic I've ever seen. I'm grateful for real magic."

***Jim Gates**, University of Maryland, on being asked what about physics he's most thankful for,* PBS.org*, November 22, 2011.*

"I'm thankful for the arrow of time, pointing from the past to the future. Without that, every moment would look the same."

***Sean Carroll**, Caltech, on being asked what about physics he's most thankful for,* PBS.org*, November 22, 2011.*

"As the physicist Ron Johnson once said, I'm grateful to quantum mechanics for an interesting life."

***Edward Farhi**, MIT, on being asked what about physics he's most thankful for,* PBS.org*, November 22, 2011.*

"Just another shameless effort to manufacture a false controversy, once again."

***Michael Mann**, Pennsylvania State University, on a recently released batch of hacked emails from climate scientists,* CBSNews.com*, December 2, 2011.*

"It's big enough you can see it…They're sitting on the table, out in plain view. The laboratory isn't particularly cold or particularly hot, it's just your everyday room."

***Ian Walmsley**, University of Oxford, on entangling macroscopic diamond samples,* FoxNews.com*, December 2, 2011.*

"When you're in the middle of your career, you can't just take time off for those hobbies… Once you've retired, you have these bursts of energy for all these things you wanted to do for the last 25 years when you were working. I was just talking to a woman who had just retired. She said, 'I have so many quilt patterns in my head, I am going to just make them until I die.'"

***Elaine Gorham**,* The New York Times*, December 7, 2011.*

"Much of the progress in accelerators comes out of this kind of basic research."

***Drew Baden**, University of Maryland, talking about technologies from particle accelerators,* The Washington Post*, December 13, 2011.*

"What's most important is that the way we are looking for the Higgs and the way the LHC is looking, are really very different. If one accelerator sees it and one does not, it might be even more exciting."

***Dmitri Denisov**, Fermilab,* Chicago Sun-Times*, December 13, 2011.*

"Occasionally a theorist says that the biggest discovery would be if we don't find it because that would mean that everything we did up to now is wrong…I think it would be great to find the Higgs boson and understand its properties."

***Robert Cousins**, UCLA,* The Los Angeles Times*, December 13, 2011.*

"Black holes give off pairs of Higgs bosons, among many other things…They produce these Higgs particles at their horizons, and if you put a detector there, you would see them. But the detector would be gobbled up pretty quick by the black hole."

***John Gunion**, University of California, Davis,* MSNBC.com*, December 14, 2011.*

"Our group and its partners are showing how massive amounts of data will be handled and transported in the future."

***Harvey Newman**, Caltech, on breaking the record for fastest data transfer,* BBC.com*, December 14, 2011.*

"It's an awful name…It does not convey the particle's true role, that it is the last missing piece of the Standard Model, and that it gives mass to the other particles."

***Michio Kaku**, City College of New York, on the Higgs Boson's "God Particle" moniker,* FoxNews.com*, December 15, 2011.*

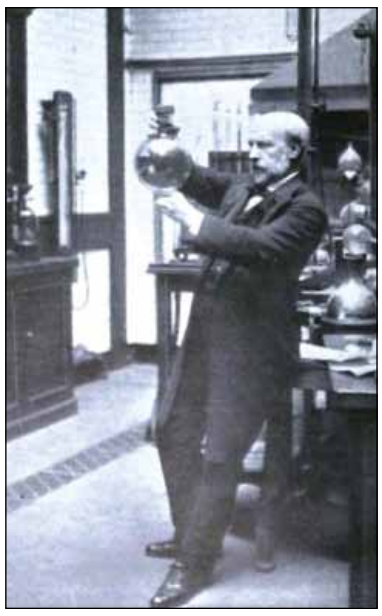
This Month in Physics History

January 19, 1894: James Dewar produces solid air

Scientists have long been fascinated by the different phases of matter, particularly the various temperatures and pressures at which one phase changes into another. Some of the most groundbreaking work in turning gases into liquids and solids was done in the late 19th century by a Scottish chemist and physicist named Sir James Dewar.

The youngest of six boys, Dewar was born in 1842 in Kincardine, Scotland. Orphaned at 15, he nonetheless managed to acquire an education, first attending Dollar Academy, and then studying at the University of Edinburgh, finding a mentor in the chemist (Lord) Lyon Playfair.

He was keenly interested in physics and chemistry, describing several different formulas for benzene by 1867, as well as publishing papers on such varied topics as electro-photometry, the sun's temperature, and the chemistry of the electric arc. By 1875, he had become a professor of natural experimental philosophy at the University of Cambridge, and was elected to the Royal Institution two years later. In 1878, he began a series of studies on the spectroscopy of gases, including their behavior when cooled to very low temperatures.



Dewar (right) holding a dewar (left)

This was a burgeoning area of research at the time. By 1845, legendary physicist Michael Faraday had successfully liquefied most known gases, except for six, which became known as the permanent gases: oxygen, hydrogen, nitrogen, carbon monoxide, methane and nitric oxide. Just two years after Dewar joined the Cambridge faculty, two French chemists, Louis Cailletet and Raoul Pictet, managed to create (independent of each other) oxygen and nitrogen in liquid form by cooling them to just 80 degrees above absolute zero.

Dewar devoted one of his Friday evening lectures at the Royal Institution to this topic, even demonstrating the apparatus Cailletet had used to liquefy the gases. He dreamed of building on that work to liquefy some of the remaining permanent gases. It took more than six years, but ultimately Dewar prevailed in his quest to liquefy air on June 5, 1885.

By 1891, Dewar could produce liquid oxygen in large quantities, and also showed that it and liquid ozone were strongly attracted by a magnet. But his desire to investigate the liquefaction of gases at extremely low temperatures further were hampered by the lack of a means to keep the gases cold enough long enough to study them. The liquefied gases absorbed heat from the ambient air too quickly and evaporated back into a gaseous phase. He tried boxes filled with powdered cork or hay, including one of his wife's own hat boxes.

He also studied the electrical properties of supercooled gases from 1892 to 1895 with Ambrose Fleming. His discovery that cooled charcoal could help create high vacuums, in large part because charcoal was so effective at absorbing gases, particularly at very low temperatures, resulted in a better vacuum.

Dewar came up with the idea of using one glass vessel inside another, the double walls separated by a thin vacuum layer. This kept the liquids cold for longer periods of time and helped revolutionize low-temperature research. Fellow scientist Heike Kamerlingh Onnes called it a "magnificent invention, which may be called the most important appliance for operating at extremely low temperatures."

This was the technological breakthrough Dewar needed to continue his work. He gave a series of six Christmas Lectures in December 1893, concluding on January 8, 1894, in which he liquefied some of the air in the lecture hall for the audience. He showed it could remain in liquid form for a good while if properly enclosed in a "Dewar flask." Two weeks later, he successfully produced solid air at the January 19 meeting of the Royal Institution.

Alas, Dewar neglected to patent his invention, so he did not reap the immense financial benefits when two German glassblowers formed Thermos GmbH and marketed a hugely successful commercial product–a thermal insulated beverage container suitable for storing both hot and cold liquids–based on his design, which they then patented. Dewar lost a court case to reclaim his invention rights.

But his scientific research prospered. Dewar successfully liquefied hydrogen gas in 1898, using a large regenerative cooling machine he built at the Royal Institution. And he kept improving his methods, ultimately succeeding in lowering temperatures to just 13 degrees above absolute zero, a point at which every gas except for helium liquefies.

Dewar very much wanted to make that last achievement, but on his first attempt to liquefy helium, he failed. Helium was scarce at the time, and it seems his helium source was contaminated with neon gas, which freezes at a higher temperature. His experimental apparatus became clogged with ice.

The honor of being the first to liquefy helium eventually fell to Onnes in 1908, relying on the methods Dewar pioneered. Onnes sent a telegram to Dewar on March 5, 1908, announcing the achievement: "Converted helium into solid. Last evaporating parts showed considerable vapor pressures as if liquid state is jumped over." Dewar was gracious in his reply: "Congratulations! Glad my anticipation of the possibility of the achievement by known methods confirmed. My helium work arrested by ill health but hope to continue later on."

Onnes received the 1913 Nobel Prize in Physics for his work. Dewar did not, although he was

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APSNEWS

Series II, Vol. 21, No. 1
January 2012

Coden: ANWSEN ISSN: 1058-8132

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APS News (ISSN: 1058-8132) is published 11X yearly, monthly, except the August/September issue, by the American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, (301) 209-3200. It contains news of the Society and of its Divisions, Topical Groups, Sections, and Forums; advance information on meetings of the Society; and reports to the Society by its committees and task forces, as well as opinions.

Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, APS News, One Physics Ellipse, College Park, MD 20740-3844, E-mail: letters@aps.org.

Subscriptions: APS News is an on-membership publication delivered by Periodical Mail. Members residing abroad may receive airfreight delivery for a fee of $15. Nonmembers: Subscription rates are available at http://librarians.aps.org/institutional.html.

Subscription orders, renewals and address changes should be addressed as follows: For APS Members–Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org.
For Nonmembers–Circulation and Fulfillment Division, American Institute of Physics, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747-4502. Allow at least 6 weeks advance notice. For address changes, please send both the old and new addresses, and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing issues will be honored without charge only if received within 6 months of the issue's actual date of publication. Periodical Postage Paid at College Park, MD and at additional mailing offices. Postmaster: Send address changes to APS News, Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844.

Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Budget and Authorization Environment

Fiscal Year 2012 Appropriations
The November Dispatch reported Congress was set to pass a series of "minibus" bills, wrapping several appropriations bills into one piece of legislation. Only one succeeded, covering Commerce, Justice, and Science; Agriculture; and Transportation/HUD.

To bridge the spending gap, Congress passed another continuing resolution (CR) that kept departments and agencies operating through December 16th. Narrowly averting a government shutdown, the dueling interests settled their differences at the eleventh hour, and passed a catchall bill to fund the rest of the government through the balance of the fiscal year. The list of key science appropriations for FY12 follows.

Commerce, Justice, & Science Appropriations:

- NSF (Total) [$6.8B in FY11] – $7.03B
  - ◊ Research and Related Activities (RRA) [$5.56B]: $5.72B.
  - ◊ Major Research Equipment and Facilities Construction (MREFC) [$117M in FY11]: $167M.
  - ◊ Education and Human Resources (EHR) [$861M in FY11]: $829M.
- NIST Core [$578M in FY11] – $622M
  - ◊ Scientific and Technical Research and Services (STRS) [$507M in FY11]: $567M.
  - ◊ Construction of Research Facilities (CRF) [$70M in FY11]: $55M.
  - ◊ NIST Technology Innovation Program (TIP) [$45M in FY11]: $0.
- NASA Science [$4.94B in FY11] – $5.09B. The bill restores funding for the James Webb Space Telescope, per the Senate plan. As you will recall, the House bill zeroed out the program, while the Senate version restored funding while bumping JWST support $150M above the presidential request in order to achieve a 2018 launch. It would also cap the project cost at $8.8B.

Energy & Water Appropriations:

- DOE Office of Science (Total) [$4.84B in FY11] – $4.89B
  - ◊ Advanced Scientific Computing Research (ASCR) [$422M in FY11] – $442M;
  - ◊ Basic Energy Sciences (BES) [$1.68B in FY11] – $1.69B;
  - ◊ Biological and Environmental Research (BER) [$612M in FY11] – $612M;
  - ◊ Fusion Energy Sciences (FES) [$376M in FY11]– $402;
  - ◊ High Energy Physics (HEP) [$796M in FY11] – $792M;
  - ◊ Nuclear Physics (NP) [$540M in FY11] – $550M.
- ARPA-E [$180M in FY11] – $275M
- Energy Efficiency and Renewable Energy (EERE) [$1.80B in FY11] – $1.82B

Labor, Health, & Human Services Appropriations:

- NIH (Total) [$30.69B in FY11] – $30.64B

Defense Appropriations:

- DOD 6.1 (Basic) [$1.95B in FY11] – $2.10B
- DOD 6.2 (Applied) [$4.45B in FY11] – $4.70B

Be sure to check the APS Washington Office's Blog, Physics Frontline (http://physicsfrontline.aps.org/), for the latest news on the FY12 Budgets.

ISSUE: Deficit Reduction Cuts to the Federal Budget (Sequestrations)

Fiscal Year 2013 Budget Cuts
Potential funding cuts will be triggered a year from now in the form of automatic across-the board reductions – technically called sequestrations–mandated by the 2011 amendments to the Budget Control Act (BCA) of 1985. According to the amended BCA, the recent failure of the Joint Select Committee on Deficit Reduction (AKA: the Super Committee) to come to an agreement on a debt reduction plan, will initiate $1.2 trillion in sequestrations over nine years, beginning with Fiscal Year 2013. The effect on science funding is not yet known, since the sequestrations will apply to appropriations bills that have yet to be written. However, once Congress has acted and the bills have been signed into law next year, sequestrations will automatically reduce defense appropriations by 11% and every account in non-defense appropriations by ~8%, effective January 2, 2013. For example, if appropriators choose to increase the National Science Foundation's Research and Related Activities (R&RA) account by 2% in the Fiscal Year 2013 Commerce, Justice and Science (CJS) bill, their action would result in a 6% decrease in the R&RA account at the start of calendar year 2013.

In addition to triggering sequestrations, the BCA amendments mandate caps for overall discretionary spending over a ten-year period beginning with Fiscal Year 2012. Appropriators must adhere to those caps in the aggregate, but they may alter individual accounts to reflect their priorities. As a result, Congress has the ability to increase

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New President Ready to Move Forward with Strategic Plan

Robert L. Byer, The William R. Kenan, Jr. Professor in the Department of Applied Physics at Stanford, and the Co-Director of the Stanford Photonics Research Center, assumed the APS presidency on January 1st 2012. In the following interview with APS News*, he discusses his priorities for the Society during his presidential year.*

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

A: The most pressing issue facing the American Physical Society, which represents a large fraction of the physics community, is communication about physics and the importance of physics in modern society.

Q: How do you mean?

A: Well, we have a number of issues that we face both on a national basis and a global basis, and the American Physical Society has been active in the past in explaining the scientific or the physics background that helps illuminate decisions on those issues. That ranges all the way from alternate sources of energy, which have been in the news recently, to international arms control and related activities. So when there's a physics component, the American Physical Society can undertake studies to help clarify from a physics perspective issues with regard to the major questions that we face.

Q: What are some other issues that you see the American Physical Society having to address in the coming year?

A: One thing that we've undertaken this last year, and it started with Kate Kirby, our Executive Officer, was a long range strategic plan. That plan asked the general question of what are the ways that the American Physical Society can best serve its members, can best serve physicists and the broad community, and best serve society.

Photo by Ken Cole/APS
Robert L. Byer

We've now completed a year of study on the strategic plan, and are about to roll it out to the divisions of the Society as well as the members, and there are a series of statements in that strategic plan which will become our area of focus in the next few years as we begin to implement our strategic plan.

Q: Can you give us a heads up on what some of the strategic plan might contain?

A: One of them is an emphasis on the international community and better serving the Society's international members. The American Physical Society has historically had a large fraction of its membership from outside of North America, and today more than half of the authors of papers in our journals are from outside of North America. We need to engage the international community more fully, and so one of the statements in our strategic plan is to do exactly that, to begin to engage on an international scale, the physics community broadly.

Q: Broadly speaking, what will be your main focus during your presidential year, and what approach will you take towards achieving these goals?

A: It will start with a rollout of the strategic plan, so that the Society at large can become familiar with the elements of that plan, and then we will begin to place emphasis on one or two or perhaps at most three of the key elements of that plan and begin to implement those. I just mentioned international engagement, but "re-imagining meetings" was another statement that came from the planning process. It's an interesting phrase. "Re-imagining meetings." What it means to me is that APS has an opportunity to better serve its members and the community at large by relooking at how the meetings are structured, ways in which we can improve them, ways in which they can meet member expectations, for those members that attend and make presentations at the meetings.

Q: How well do you think the Society is serving its members and are there any areas in which APS programs can be enhanced?

A: APS is one of the largest physical societies in the world, I think second only to the German Physical Society, but we do have a lead role in journals and pub-

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A Smooth and Silky Career

By Alaina G. Levine

The seemingly pedestrian razor blade you utilize every day is really something quite extraordinary. Its components are crafted from advanced composite materials and thin films. Its design draws from novel engineering solutions to reducing friction. And its ability to make anyone's face, legs and back silky and smooth is owed to talented physicists, like Jeffrey S. Parker, who have chosen the personal care industry as their professional playground.

Parker, 39, is a Senior Scientist at Procter & Gamble (P&G)'s South Boston Innovation Center. The materials physicist, who received his PhD from Florida State University in 2003, has been with the company since 2007. He was on track to have a conventional academic career, completing two postdocs, including one at the University of Minnesota's Materials Research and Engineering Center, when fate nicked him.

"I was approached by a P&G recruiter," he recalls. "I wondered what they wanted from me, a physicist." Turns out P&G Beauty and Grooming was expanding its market reach with a recent acquisition of the Gillette Company. They needed physicists and materials scientists who could understand the physics behind blade movement and architecture, in order to design and improve high profile products like Fusion ProGlide Razors, which incorporate many blades. Parker visited P&G's technology center "out of pure curiosity," and realized "there was definitely enough technical challenges to keep my interest," he says. According to Parker, what swayed him to pursue employment with the cosmetics giant was the fact that the consumer problems he would be solving would allow him to flourish as a physicist, the problems would always be fresh and exciting, and there would be plenty of other scientists and resources to aid him in his technical and engineering endeavors.

Jeffrey S. Parker

Once Parker started at P&G, he soon realized there was another advantage to serving as a shaving scientist–it is inherently a multidisciplinary endeavor, which means that he would have the opportunity to learn about different fields. "There's so much overlap [between subjects], you can't just be a physicist," he says.

Parker's role at P&G Beauty and Grooming involves every aspect of research and development for blades and razors, marketed under the Gillette brand. His responsibilities include fundamental and applied research, testing

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Letters

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

Big Fan of Online Talks

I was a little surprised to read your news story "Posting Meeting Slides Online Gains Strong Acceptance" in the October 2011 issue of the *APS News*, since in my field, high energy physics, posting talks online is a standard practice. For example, the last two meetings of the Division of Particles and Fields of the APS, DPF 2009 and DPF 2011, have had all of their talks posted online. I think that at this point in time the merits of posting talks online hardly need to be discussed. I hope that in future April meetings all of the talks will be posted online.

Gil Paz
Detroit, MI

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ter the end of the meetings, hard copies of the letters are printed and physically delivered to the lawmakers to whom they are addressed. Last year, 2,378 such letters were sent to Capitol Hill.

Opportunities are also provided for APS members to personally visit the offices of their congressional representative. In 2011, the Society organized about 100 such meetings with members of Congress or their staff. This often included members of Congress from states that have large physicist communities, like California, Illinois, New York and Texas, as well as states that aren't known as much for having large populations of scientists such as Kansas, Idaho and Washington.

Though the budget for 2012 featured increases for federally supported science, advocates are worried about the budget in 2013. After the failure of the so-called Super Committee to reach an agreement on deficit control, the federal non-defense budget is looking at a likely 8 percent cut across the board next year. Many are worried that without an increase in advocacy, science funding may take a major hit.

"If the science community takes a back seat, then the federal budget for science will also take a back seat," Lubell said.

Both Mosley and Lubell said that while the level of participation from the scientific community has so far been encouraging, they hoped to see more in the upcoming year. Already they're planning on actions to mobilize researchers in the hopes of insulating scientific research from cuts as much as possible.

"I think we have ample data that shows that scientific discovery and innovation are the things that drive the American economy, and they're also key for national security, defense and energy security," Lubell said. "It's extremely important for the [scientific] community to organize itself and deal with office holders, and tell them it's not just for us personally; it's for the good of the country."

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don't necessarily want to go into physics as a career. "This B.A. degree has nothing to do with less rigor, but to create more job opportunities."

APS's 2007 Gender Equity report focused on crafting ways to offset the gender imbalance in physics. In 2006, women received only 18 percent of physics PhDs awarded that year. One of the recommendations of the report was to "[m]ake it easier to enter a physics program after the first year to allow for late starters or those with lower initial preparation in mathematics."

Seel said that he hoped the flexible options offered by the B.A. program would encourage more women to enroll in the physics program.

"I think anything that offers more flexibility in the physics degree plan opens more doors to more students," said Monica Plisch, Assistant Director of Education and Diversity at APS. "The B.A. allows them to switch [majors] and still finish their degrees in four years."

The secondary education track in the physics B.A. that will also be offered is to directly address the need for more high school physics teachers. Recent studies have shown that more than half of high school teachers teaching physics do not have a degree or minor in physics or physics education.

"We need more good teachers in high schools. Having a B.A. option should exactly help that too," Seel said. "It will open up more flexible paths for people who are trying to get a good foundation in physics, a good background in physics, but don't want to stay in the field of physics their whole lives."

Michigan Tech announced its new physics programs on December 9th, along with two new masters programs and a new PhD program. The new degrees are pending approval from the academic affairs officers of the presidents' council of the State Universities of Michigan, the state's academic oversight board. Seel said he expected them to approve the new programs around January 20th.

Incentives Can Re-invigorate US Manufacturing

By Bruce Johnson

A government program called the Independent Research and Development Program (IRAD) was very strong and effective until the mid-1990s. It allowed industry to recover costs for doing research and development that was in the interest of the government as well as business. As a Technical Director I was responsible for many IRAD projects while working for several major US corporations. This was a win/win program for both the federal government and business because it nourished new product development and manufacturing in the USA.

After decades of outstanding contributions to our economy, the federal government cut back IRAD programs, and there was uncertainty about the long-term commitment to support them. In this atmosphere, the great research laboratories, for example those run by GE, Bell, RCA, Westinghouse, ITT and many others, were shut down, and key new product development at US corporations either disappeared completely or declined to the low levels that we have today. Foreign countries subsequently picked up the R&D and manufacturing work that we either gave them through outsourcing or let them have outright.

This industrial IRAD work was supported by R&D cost recovery, not a bailout, for business to perform or extend the required fundamental research, and then develop and manufacture new products, US products. Not only did the large corporations benefit, but the smaller feeder industries that made parts and components also flourished.

Congress should seriously revisit this program, look at how it would enhance US business and the US economy, and make it part of new economic legislation moving through Congress at this time.

Unlike the investment and banking industries, industries that manufacture products in the US, for not only US but world markets, need long-term incentives to develop new products and markets. This kind of dedicated support will result in continued economic growth for US manufacturing. The present mindset in Congress, to simply cut spending and not increase taxes, misses the most important part of finding ways to improve our economy. These efforts are just wasting time as our economy continues to suffer.

Our chief economic advisers do not understand what needs to be done to strengthen US industries. Getting people to simply spend more money, like buying more Chinese doo-dads at Wal-Mart, does not strengthen our economy. We must provide world markets with value-added products made here in the US.

University and government research programs do not meet these needs because they are not directly linked to US manufacturing. Industry will not do the required R&D to create major new products for manufacturing in the US on its own initiative, with only occasional short-term and uncertain tax cuts, etc. There must be a structured and long-term government managed plan, like the original IRAD program, to accomplish this manufacturing resurgence effectively.

The rebirth of manufacturing in the US can and should be nurtured and sponsored by the federal government. We need to utilize our innovative skills and put new life into a results-proven government program, one that can guarantee strong growth, stability, and a means to reduce our lopsided negative balance of international trade. Its successes were key to our past innovation and market leadership.

A renewed IRAD stimulus program, coupled with manufacturing, along with similar ideas put forth by Andrew Liveris, CEO of The Dow Chemical Company, in his book "Make it in America, The Case for Re-inventing the Economy" are necessary if the US economy is ever to be re-strengthened. This is a matter that requires the urgent attention of Congress for the good of the US economy.

Bruce Johnson is an independent consultant. He was Technical Director for ITT Night Vision, and he held similar positions with other major corporations, including RCA Electro-optics & Devices, Bendix Research Laboratories & Litton Electron Devices. He is a Senior Member of APS and a Life Fellow of the Institute of Electrical and Electronic Engineers.

Graduate School: Envisioning a Future of International Collaboration

by Abhishek Kumar

Happy New Year 2012! I am really excited to write this article as a graduate student member of APS. I began graduate studies in the US after completing my undergraduate studies in physics in India, with the notion that graduate school is about doing well in courses and assignments, learning new skills and consequently carrying out research work–the usual drill. In my first semester I became a member of APS and got involved in the Forum on Graduate Student Affairs (FGSA) activities as Secretary of the FGSA. Ever since, it has been a very fulfilling experience, and I have been fortunate to have had many exciting opportunities to think and act, quite often out of the box. Thanks to the APS, I now have a much broader and active view on what it means to be a graduate student in the United States and the opportunities ahead for international scientific collaboration.

In the past months, I had the great honor of leading the Canadian-American-Mexican Physics Graduate Student Conference (CAM2011) organizing committee and the journey was a unique experience. In this letter I would

Abhishek Kumar

like to share my experience with CAM, how immensely satisfying and revealing an experience it has been and how it has helped me realize that graduate training goes way beyond lab research. Admittedly, it was a little daunting at first. Having been a participant in CAM2009, I knew expectations would be high, which meant that the task at hand wasn't going to be easy. However, my apprehensions were soon put to rest once the organizing committee was in place. All of us, the students from Canada, Mexico and the US, executive members of FGSA and the fabulous staff members at the APS, CAP and SMF served to inspire and encourage each other. The commitment and earnest efforts of the organizing team really gave wings to my ideas and propelled me to think higher and higher for the CAM2011.

FGSA hosted the CAM2011 in Washington DC at the end of September last year and the choice of city was well thought out. The US capital, being the nerve center of general policy formulation and science and technology in particular, nicely complemented an important theme of the CAM2011, namely "Policy." In today's rapidly changing world, the critical significance of the right kind of scientific policies cannot be overemphasized. Keeping this in mind, we boldly experimented with the scope of CAM to organize two panel dis-

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Middle Tennessee State University Takes on Physics Teacher Preparation

By Gabriel Popkin

Middle Tennessee State University (MTSU) has not traditionally been a powerhouse of physics teacher preparation. In fact, Ron Henderson, the MTSU physics department chair, wrote in a recent article that "over the past fifteen years the number of students that completed a major in physics and became endorsed to teach high school physics has totaled, well, zero."

But that is changing fast, thanks to concerted efforts by Henderson and his colleagues, and a little help from the Physics Teacher Education Coalition (PhysTEC). PhysTEC is a project led by APS and the American Association of Physics Teachers (AAPT), with the goal of improving the preparation of future physics teachers. In 2010, MTSU became a PhysTEC funded site, joining 19 other such sites the project has funded since 2001. And in December, MTSU graduated its first physics teacher in over a decade and a half: Hilary Kakanis.

Kakanis, who majored in physics with concentrations in astronomy and teaching, says she will soon be licensed to teach physics and math, and is in the process of seeking a teaching position. Like many physics teachers, however, her path to the profession took a few twists and turns along the way. Kakanis' original dream was to be a planetarium director. "I've always loved talking about space," she says. "I would love to live in a planetarium."

But at a meeting with a planetarium director, Kakanis learned there were only around a thousand planetariums in the entire western hemisphere, meaning the job market might be tight. So around the end of her sophomore year at MTSU, seeking to position herself for her dream career, she decided to pursue physics teaching. She then learned about the great need for physics teachers, and that she was good at it. "When I started teaching, I got a whole lot of positive feedback," says Kakanis. "People said I made the subject approachable, and I made them want to listen."

Kakanis's timing was good: the MTSU Physics Department had recently received an award from the National Science Foundation's Noyce Scholarship Program, which funded the final two years of Kakanis's education; the department was also in the process of adding a concentration in physics teaching. In addition, the university had become a replication site of UTeach, the highly successful science and math teacher preparation program at the University of Texas at Austin; this provided resources for reforming the teacher certification program.

With support from PhysTEC beginning in 2010, MTSU was able to reform existing physics education courses and begin launching new ones. Kakanis took the department's first offering of "The Teaching of Physics," which introduces students to inquiry-based teaching practices that are specific to physics, and she was inspired to see that other physics majors were also becoming interested in teaching. "I'm really excited about programs like PhysTEC and Noyce that are encouraging young people to get into teaching," she says.

MTSU physics faculty and PhysTEC project leaders expect that Kakanis will be the first of many program graduates who go out and teach in the nation's high-need schools. "MTSU is rapidly becoming a leader in physics teacher education," says Monica Plisch, Associate Director of Education and Diversity at APS, and PhysTEC project co-director. "They are poised to help meet a great need for well-prepared physics teachers in Tennessee."

Photo courtesy of Ron Henderson, MTSU

Hilary Kakanis with fellow MTSU future teachers Paul Turner (left) and Dylan Russell.

Henderson adds, "Hilary will embody what the physics education community has learned about good physics instruction."

For now, Kakanis, who has lived in Tennessee since she was nine, is planning to take her skills to another place where they are also badly needed–Texas. New standards in that state require that all students take physics in order to graduate high school, and Texas universities are not prepared to supply the teachers needed to teach these students. Kakanis hopes to teach ninth graders in a "Physics First" class, also known as the "Inverted Curriculum," where students take physics before chemistry and biology.

"I like the idea of Physics First," she says. "Usually when kids get to high school, they hear 'physics' and start to freak out because they hear it's a senior-level class and everybody flunks it. With Physics First, you're getting the kids when they're still fresh and new, and have never done anything like that before.

"I want to catch them when they're young!"

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cussion sessions on "Science and Policy" and "Science for Diplomacy." The response was overwhelming. The discussions offered an open forum to freely explore the important role of scientists in policy making and it significantly increased our appreciation for the obstacles faced by the experts. By engaging with the issues of how science affects policy making and, in turn, how policy can influence the development of science, it neatly brought out the social aspects of doing science. For me personally, the panel discussions were an eye-opener and changed my idea of serving the cause of science, especially physics–which was doing lab research and publishing research papers. In today's interconnected world, alternative scientific career paths ought to be considered as respectable as scholarly research and publishing when one measures them against their ability to solve modern society's pressing problems.

Last month's *APS News* featured an article on CAM2011, so I won't discuss how the conference fared in terms of meeting the expectations of the participants and the organizers. Rather, I shall describe the lessons I have learned as a CAM2011 participant and as an organizer. These are simple sounding "values" which I have termed broadly as courage, co-operation and communication. They may sound nebulous in their meaning, but I would like to think of them as mantras.

The 3C's:

Courage: It is always easy to break the ice when meeting new people if one takes the initiative and starts a conversation related to her or his field of interest. This requires not only an eagerness to learn but courage to think out of our personal scientific box, our comfort zone. We should remember that the sharp boundaries between the disciplines and the sub-disciplines are constantly getting breached even as, admittedly, more and more sub-disciplines are branching out. The ability and the courage to "break through to the other side" will have a great bearing on the future of science and society. The informal and convivial atmosphere at CAM2011 was exactly what was needed for my fellow graduate students to start talking and communicating with one another.

Co-operation: Any social endeavor needs a fair amount of co-operation for it to succeed and science is certainly no exception. We must also recognize that no plan of co-operation could succeed if we do not take a broad and unselfish view of science and its potential. Co-operation would go a long way in paving the path for multilateral international collaboration as it would be a win-win situation for all parties involved. It would compensate for the cultural and political differences between the scientists and, ultimately, help to bridge the differences between peoples and nations.

Communication: It is very important to communicate new developments and scientific advancements not only to scientists but also to non-scientists. This is much needed in order to counter anti-scientific rhetoric which flourishes in an atmosphere of scientific illiteracy. I did not observe any obstacles in communication among the participants at CAM, even though they were from very diverse backgrounds. This came naturally to CAM as, being graduate students, all participants were on the same footing. It fostered an atmosphere full of rich possibilities for future collaboration.

In light of rapid changes around the globe in general and scientific advancements in particular, we, the graduate students, will have to play a major role in shaping things to come not only by performing high-quality research but also by providing efficient and able leadership. We have to go the distance by inculcating in ourselves the required skills and values and inspiring our colleagues to do the same. CAM2011 did well indeed by "catching them young." Its task is well cut out for the future. The APS Staff members and CAM2011 Committee deserve many kudos and I personally owe them sincere thanks for this unique educational experience which I will always cherish. I thank all the invited speakers for kindly accepting our invitation and the participants for making CAM2011 a great success. We value their constant encouragement. Lastly, on behalf of the organizing committee, we are extremely grateful to Amy Flatten and Michele Irwin for gently guiding us in the planning stages of the CAM2011 and for seeing us through to its success. Once again, I wish you all a very happy and peaceful year ahead.

Abhishek Kumar is a graduate student in the physics department of the University of Massachusetts Lowell. He served as the 2011 International Officer for the APS Forum on Graduate Student Affairs.

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added that Turkey is close to getting its contributions passed by its parliament, and Egypt is also likely to contribute funding. Though only four instead of five countries have made firm pledges, Winick said that "It is expected that Israel is going along with this."

Funding from Turkey had been delayed after it was found that their membership had never been formally approved by their parliament. A bill authorizing their membership in SESAME has passed through all the relevant parliamentary committees and is awaiting approval from its General Assembly.

Egypt's contributions have been on hold because of the recent government changeover. The new interim government has expressed interest in supporting the project, and while the SESAME Council was meeting, the country named a new science advisor who will spearhead the process.

Palestine and Pakistan have also expressed interest in contributing funds, and are currently working out what that contribution will be.

The US and the European Union have supported the project since its inception and will likely contribute the remaining $10 million in funding that member nations haven't pledged. Representative Rush Holt (D-NJ), who is himself a physicist and APS member, has been leading the effort urging the US State Department to contribute to SESAME.

Other advances and milestones were reported to have been reached as well. The accelerator's 22 MeV electron pre-injector has reached full energy and been fully shielded. Work installing the 800 MeV booster synchrotron contributed from Germany is continuing, and plans for the outer storage ring have been finalized. When all funding is secured, the project will be able to start ordering magnets and beam lines.

If the funding from Turkey and Egypt comes through by early next year, as is expected, Winick said that the project is on track to come online with its first four working beam lines by 2015.

"I think there is optimism," Winick said, adding that despite many delays, the project looks close to being able to move towards the next stages of construction. "SESAME is still hanging in there. We have a site and a building courtesy of Jordan."

In order to help prepare scientists in the region, APS has teamed up with other national scientific societies to send Middle Eastern physicists to training opportunities around the world.

"APS had started a travel program to fund opportunities for scientists in the Middle East to attend training opportunities, users' conferences, etc." Flatten said. "The efforts of APS and the other national scientific societies were recognized by several speakers for initiating the program…We got a lot of expressions of goodwill."

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science funding relative to other accounts. But it will do so only if lawmakers believe the rationale is compelling.

In the past, the scientific community has been able to rely on a few congressional champions to provide continued federal support for research and education, but the political and fiscal landscape has changed substantially. Budget constraints will require scientists to weigh in if they want to see sustained federal funding. The ability and efficacy of the scientific community's speaking out about program cuts proposed earlier this year was clearly evident in November when Congress restored Fiscal Year 2012 funding for NSF, NIST, and NASA Science during final House-Senate negotiations on the appropriations bill covering CJS. But with the federal budget tightening in the coming years, the community will have to step up its efforts if it wants to achieve comparable positive results.

During the next year you will have ample opportunity to contact your representatives in Congress and impress upon them why science funding is important. Doing so through visits, phone calls, and letters will let them know their constituents care about these issues. APS will alert you throughout the year about advocacy opportunities and when advocacy will be most effective. If enough voices combine together, Congress will hear the message.

ISSUE: POPA

Since early May 2011 there has been considerable legislative activity associated with the Energy Critical Elements report: most recently the Chair of the study, Robert Jaffe, provided a briefing to Congress (November 29th) and testified before the U.S. House of Representatives' Subcommittee on Energy and the Environment (December 7th).

POPA is currently considering two new studies: (1) reductions of non-strategic nuclear weapons, a joint workshop in partnership with the center for Strategic & International Studies (CSIS); (2) science-backed education standards.

At its last meeting, the APS Executive Board approved the revised proposal for an educational component associated with the Direct Air Capture Technology Assessment presented by the POPA Subcommittee on Energy & Environment.

If you have suggestions for a POPA study, please send in your ideas electronically by visiting http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm.

ISSUE: Media Update

To persuade the now-defunct Joint Select Committee on Deficit Reduction to maintain robust federal support of science funding, APS members wrote op-eds and were quoted in an editorial in several newspapers in Ohio, Michigan, and Massachusetts.

John Mergo, a graduate research assistant at Cornell University and an Ohio native, wrote an op-ed titled, "Congress must protect our nation's sciences" for the *Chillicothe Gazette*; the piece appeared in the paper on Nov. 11th. [http://www.chillicothegazette.com/apps/pbcs.dll/article?AID=2011111110310]

Former U.S. Rep. Vernon Ehlers wrote an op-ed on Nov. 12th for the *Grand Rapids Press* titled, "Retain robust federal support for scientific research." [http://www.mlive.com/opinion/grand-rapids/index.ssf/2011/11/retain_robust_federal_support.html]

APS Executive Officer Kate Kirby and Smithsonian physicist Hossein Sadeghpour were quoted in an editorial in *The Republican,* which stated that scientific innovations have fueled economic growth in the U.S.The paper published the editorial on Nov. 16th under the headline, "Research funding must remain steady." [http://www.masslive.com/opinion/index.ssf/2011/11/editorial_research_funding_mus.html]

Log on to the APS Web site (http://www.aps.org/public_affairs) for more information.

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nominated several times. But he did garner many other awards and honors in his lifetime, including many prestigious medals from scientific societies. He was knighted in 1904.

While serving on a government committee on explosives in the late 1880s, Dewar and a colleague, Frederick Abel, developed cordite, a smokeless gunpowder.

The outbreak of World War I interrupted Dewar's research program into the properties of elements at low temperatures, and he lost several key staffers as a result. Dewar never rebuilt his program, even after the war ended, devoting his attention primarily to studying surface tension in soap bubbles, and to measuring infrared radiation in the atmosphere with a thermoscope of his own design.

Dewar remained active as a scientist until the very end, refusing to retire from his position with the Royal Institution. He died in London on March 15, 1923. But his work in low-temperature gases, and particularly his invention of the Dewar flask, proved seminal to the field of cryogenics.

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lications, and that's been a traditional area of excellence for us. So we will continue to innovate in our journals and our publications. The recent online journal *Physical Review X* is a good example of that. We will also continue to make sure that the journals continue to reach and serve the broader international community that's now the majority of our authors of the journal papers. So that's one area of real concern to serve members. The second area is to improve communications between the American Physical Society administrative structure, both the volunteer groups as well as the executive and officer group in Washington DC and our members. We can do this by direct services that directly enhance a member's reason to join the APS, and a set of indirect means that generally enhance the meaning of physics to a broader group of people, from students, to minorities who participate in physics, to educational and outreach activities. These are examples of what we will do in the future to enhance communication and service to our members.

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

A: The APS traditionally has taken a proactive role in public policy, and I think that we expect to continue to do that. Our office in Washington DC is in direct support of public policy as it's implemented in Washington DC. We have traditionally divided that into two aspects. One is to inform the public more carefully what science, particularly physical science, has to say about pending public policy decisions. An example of that is the POPA study of energy critical elements. If we're going to revise and modernize and improve our sources of energy in the future, the questions asked "Are there elements that we acquire from the Earth, for example, from mining, that are in short supply that may prevent us from reaching our long- term goals?" That study was well received by Congress and led to immediate action with regard to how we preserve those energy- critical elements so that we can move forward within the boundary of an Earth that isn't infinite but has finite resources.

Q: What do you see as the Society's role in international issues?

A: The tradition in science from 100 plus years ago is that science is international, and that all society benefits from basic research and science broadly. In the physical sciences, that held true because the international community that worked in particle physics and high energy physics, really drew strength from scientists from all over the world for a discipline that required an enormous investment of resources. So as we move forward, the question I think about a lot is "How does the American Physical Society best serve and represent physics on the international scale through collaboration?" It is collaboration we want to enhance, for example, holding joint meetings or jointly sponsored meetings in collaboration with other societies. We already have collaboration in publications, and we can certainly involve members of the broader international community in the leadership positions of the American Physical Society.

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

A: Education and outreach is our future and we need to find ways to not only continue our efforts in education and outreach, but to broaden them. Part of the strategic plan recognized that there are opportunities to go beyond what we've done in the past and make further progress in directions of both education and outreach. Collaboration with our fellow societies that represent minority physicists is something that we already have talked about and have discussed and I think that's something that will come about and we will find ways to support those societies that represent minority scientists and engineers. In physical sciences at least, we have made slow and steady progress in involving women in the physical sciences. I think we can do better, and we will continue to work to bring a better balance in representation in the physics community. In education per se, reaching teachers matters because teachers amplify contact with future students. APS programs already in place can be extended to increase our reach to prepare teachers for teaching science at the K though 12 grade levels.

Q: How is it that you personally first became interested in physics?

A: It's interesting because everyone that gets involved in science has a story to tell. In my case I grew up with a real passion for astronomy and wanted to be an astronomer. One of the last things I did before I headed to college was to go meet with a very famous astronomer at Caltech and ask him about my plans to study astronomy. His words were directly to me, "No you don't young man, you want to study physics," and I didn't understand exactly what he meant at the time so I asked him and he said "Well, if you study physics, which gives you a broad perspective of science, and you later decide that you want to go into astronomy or astrophysics you can do so." And I followed his advice. I went off to Berkeley and majored in physics and that gave me indeed a much broader perspective of what the possibilities were and twenty and thirty years later by happenstance I got involved in astrophysics projects, called the LIGO project for ground-based gravitational wave antennas, the LISA project for space-based gravitational wave antennas–exactly the kinds of things that I could never have imagined as a high school student, but physics has enabled me to participate in and contribute to.

Q: What have been some of your career highlights?

A: Again, luck plays a role in these sorts of highlights. By good luck my faculty member at Berkeley, then a young assistant professor, Sumner P. Davis, allowed me to work in his laboratory, just gratis, as an undergraduate student. That opened the door and opened my eyes to a whole set of possibilities of doing physics beyond the undergraduate experience. By even better luck, Sumner P. Davis recommended that I interview with a small company in Mountain View, CA because they were working on this new kind of widget called the laser. So I went down and interviewed and discovered the very first day I was there "Wow, here's a whole new way to make light and a whole new set of possibilities to use light." By luck I worked for the world's first laser company for one year before going back to graduate school. Working for Spectra Physics was a huge learning experience about how a small startup company and Silicon Valley worked. It wasn't called 'Silicon Valley' at the time but the stories about the Varian brothers and Hewlett and Packard were being discussed. I returned to graduate studies in Applied Physics at Stanford where by good luck I was assigned to work with professor Stephen Harris in the rapidly developing field of nonlinear optics. Today nonlinear interactions and devices that we once thought were impossible to demonstrate or construct are commonplace in our commercial products, and serve the science community broadly.

Q: Why did you choose to run for the APS presidential line?

A: I was nominated. However, after being nominated I met with the former APS presidents at Stanford University and had a chance to talk with each of them. The list of former APS presidents included among others Burt Richter and Artie Bienenstock, for example. They gave me the background to better understand the American Physical Society, better understand what would be expected in the four year term that extends from vice president, president elect, president and past president, and also the appreciation for the amount of time commitment that it would take. For example, I learned from Artie Bienenstock that I should be prepared for a lot of travel and for extensive interactions. I asked him if I should take my sabbatical leave the year I serve as President, if elected, and he said by all means. I have followed his advice and beginning January 1, 2012, I am on a sabbatical leave from Stanford for one year. I think I can contribute to the APS through the strategic planning process. I hope, with the assistance of our very capable staff and our volunteers, both at the Executive Board, and the Council level and in the various units, that we will continue to grow a very successful American Physical Society.

ANNOUNCEMENTS

Varied Research Featured at Fluid Dynamics Meeting

The APS Division of Fluid Dynamics held its 64th annual meeting in Baltimore, Maryland from November 20 through 22. Over 2,400 physicists attended more than 2,000 presentations on topics covering all aspects of fluid physics. Researchers offered new insights into wind turbine designs, mechanical heart valves, what happens at the instant an explosion detonates, and even the physics of wine swirling.

Building better wind turbines was featured in four focus sessions and a total of 36 presentations on how researchers are using fluid dynamics to better harness energy from wind. One research team at Caltech, led by John Dabiri, has been adapting the way schools of fish swim in the ocean to improve the efficiency of wind farms. Dabiri said that the way fish draft off each other smoothes the flow of water through the school, letting each fish expend less energy when swimming than if it was by itself. Dabiri's experiments in a remote part of Los Angeles County have shown that arranging wind turbines like a school of fish cuts down on turbulence and can improve efficiency of the farms.

Volatile fiery explosions are dramatic, but powerful concussive detonations can be much more damaging. Researchers have long studied how a slow burning fiery deflagration can turn into a powerful detonation in enclosed spaces. At the meeting, researchers showed that detonations can also happen in an unconfined area. Alexei Poludnenko and his team, at the US Naval Research Laboratory and Sandia National Laboratories, showed that it was possible, under the proper turbulent conditions, for a detonation to happen in an unenclosed space. The conditions they described are similar to theoretical models of the interiors of white dwarf stars, which offer a possible explanation for the cause of type 1a supernovae.

The shapes of heart valves have gotten much scrutiny of late, and Marija Vukicevic of the University of Trieste showed that some of their inherent asymmetries might hold the key to better blood flow out of the heart. She and her research partner Gianni Pedrizzetti, also from the University of Trieste, built valves where one flap was as much as 70 percent bigger than the other, which more closely resembles the valves in a human heart. After tests in a silicon aorta model, the team found that blood flowed more smoothly in the asymmetrical valves, rather than the industry standard symmetrical valves.

The physics of how swirling a glass of fine port helps release its floral scents was calculated for the first time by Mohamed Farhat from the École Polytechnique Fédérale de Lausanne in Switzerland. Using high-speed video, he recorded the propagation of waves in wine while swirling wine at different speeds and briskness. He found that for each glass shape there is an optimal "shaking diameter and rotation speed" to get the most oxygenation which releases the wine's character. He said also that the research can find industrial use in biopharmaceuticals manufacturing where large machines have to swirl vats of biological matter to culture growing cells.

Julian Hunt, a fluid physicist at University College, London and a member of Britain's House of Lords, encouraged physicists to get more involved with public policy debates. He said that scientists have a lot of expertise to offer on important issues facing the world, and wanted to see more researchers and scientific organizations speak up and take an active, engaged role in pushing science-based solutions to issues like energy, climate change and natural disaster response.

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nary session, this year's Nobel Prize session, will be on Monday, April 2, and will feature 2011 laureates Saul Perlmutter of Lawrence Berkeley National Laboratory and Adam Riess of Johns Hopkins University talking about their discovery of the accelerating universe. Rounding out the session will be Frank Wilczek of MIT, who shared the Nobel Prize in 2004 for the discovery of asymptotic freedom in the theory of the strong interactions.

The third plenary session is planned for Tuesday, April 3. Krishna Rajagopal of MIT has been invited to talk about his work on the quark-gluon plasma, what he describes as "the most liquid of liquids." Zheng-Tian Lu from Argonne National Lab will discuss how single atom traps can be applied to climatology and non-proliferation. Judith Curry from Georgia Tech will talk about the recent Berkeley Earth Surface Temperature project.

Atlanta's Fernbank Science Center, in collaboration with the APS outreach department, will host a public outreach event during the meeting to get people excited about the 100th year of cosmic ray science.

The recipients of many of APS's prestigious prizes and awards will be honored at a special ceremonial session on Sunday evening, which will also feature the retiring presidential address by Barry Barish of Caltech, who served as APS President in 2011.

On Sunday, graduate students are invited to Lunch with the Experts. Graduate students can sign up to dine with well-known experts in a field that interests them, in an atmosphere of informal discussion. The list of topics will be available on the April Meeting website in early February, and signups, on a first come, first served basis, will be at the registration booth at the meeting.

Exhibitors from a range of publishers and other vendors will have booths set up around the hotel to display their products.

Meeting attendees will have the chance 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.

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and developing products, and collecting feedback to improve the quality of his designs. He contributes to the marketing of products, providing the lay-person-friendly language for packaging and advertisements that properly communicate the product's value. He also consults with the production department to ensure they can scale up the design as they produce it in a plant. "It's one thing to make it once, and quite another to make it a billion times," he says.

Parker is further charged with claims support, an important division in any consumer products company. For every razor that a firm claims "will give you a 45% cleaner shave," there is a claims support unit that clarifies the accuracy of such a statement before it is used in promotions. Parker assists claims support in testing the current shaving products for their strength, accuracy, friction reduction, and overall shaving comfort.

Here's a fun fact to keep in mind while you are gliding that razor across your precious, precious face: the blades used for shaving are some of the most sophisticated and sharp cutting surfaces on the planet. In particular, "Fusion blades are thinner than a grain of sand, and the blade tip radius is smaller than a brain cell or the wavelength of visible light," describes Parker. "This level of ultra-high precision engineering is amongst the highest in the consumer goods industry."

The physicist has been instrumental in advancing the Fusion ProGlide line of products, which currently utilizes five blades in its razors. Parker's expertise has helped him analyze and improve on cartridge geometry, how the razor pivots on the handle, and how the blades themselves move. In his quest to make the profile of the razor as thin as possible, Parker helped employ an advanced diamond-like carbon (DLC) coating to the steel along the blade edge. This extreme hardness material (more than 10 times the hardness of the underlying steel) enhances each individual blade's strength and allows the blades to stay sharp even after many uses. Another proprietary coating, Polytetrafluoroethylene (PTFE), is also applied to the blade, which significantly cuts down on friction, he explains. But the DLC coating is especially important to the ProGlide's architecture because it ensures that the blades in the razor can remain thin, delivering significant reduction in "hair cutting forces", and thus a more preferred consumer experience (i.e., fewer toilet paper pieces applied to your bloody face).

Parker concludes that his work for P&G is not as dissimilar from academia as he would have expected. "When you get down to it, the science is completely the same," he explains. "It's the same tools, methodologies, and thought processes, just applied differently." He still delves into surface morphology, he still measures and analyzes electrostatic forces, and he still uses many of the same instruments that he did when he was a postdoc, such as an atomic force microscope.

But one area that he still finds perplexing is how to find technical solutions for consumer problems, when the consumers are not exactly sure what they want in the first place. "The needs of the customer can be hard to define," he concedes. For example, in a focus group, consumers might indicate that they want a shaving lotion that is more "creamy." But there's just no scientific training that can help Parker and his colleagues understand exactly what "creamy" means to different people in terms of the physics, mathematics and materials expertise that goes into crafting shaving lotion.

But the haziness of certain aspects of his job doesn't take away from the high level of satisfaction he gets from working in the private sector. "In academia you never get to see a commercial for your work on TV or your item on a shelf," he says. "People want to buy P&G products because of the science and engineering we put into them."

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The Back Page

Ten Mistakes for Physicists to Avoid

by James D. Patterson

Ed. Note: *In 2004, James D. Patterson wrote an open letter to* Physics Today[1] *containing advice to the next generation of physicists. With several more years of accumulated wisdom, he presents some further ruminations in the article below.*

Montaigne said "... you never talk about yourself without loss: condemn yourself and you are always believed: praise yourself and you never are."[2] Nevertheless here is an update of a paper in which I discuss mistakes I have made. I suspect Montaigne is right, but I have long been retired so my loss is minimal, and is possibly compensated by gains of those who will consequently avoid my errors.

My main reason for writing another article is that I have new reflections on mistakes already considered as well as some new ones to discuss. I will get to all those in a moment, but first some preliminary observations.

What is judged a mistake depends on objectives. A dean once told me he wanted me to be a success. That sounded good. Of course his definition of success was different from mine, so there remained an unresolved conflict. I think for him it meant more and larger grants. For me success meant time to do and teach the physics that I found interesting. Naively, I thought this would lead to a better world. However, I am not sure the current culture of seeking more (of something, I am not sure what) is an improvement. Being stubborn, by refusing to go in the direction you are pushed, may not always be wrong. You may be happier. There is nothing wrong with loving your field and making personal sacrifices to stay true to it. Fairly late in my career, I was a department head and was not aggressively pushing the department to seek as many outside funds as was desired by the university. An official in charge of university research wanted to get me fired, but I felt there was an imbalance in the emphasis on grants and I opposed him. I did endure a couple of very uncomfortable years in consequence.

An academic career is no longer necessarily the path of many physics majors. Most current PhD graduate students will not go on to become university professors. There are not that many available positions. Many don't want to anyway. There are other alternatives. I spent several summers in industry and national labs. In some cases I applied for more permanent positions outside academia. One mistake I made was in my résumé. I would list degrees earned, papers published, positions held and very little else. I don't think I even listed grants awarded. For industrial résumés you should list the assignments you have had and what you achieved with them. Another aspect was pointed out to me by Jim Fergason, an inventor of the twisted nematic liquid crystal display. He was irritated by scientists who never gave any thought to possible uses of their ideas. Obviously this mindset is not attractive to industry.

Now for my list of mistakes. Most of my career was in colleges and universities; nevertheless many of the mistakes are universal. (Parenthetically I note two other short papers about universities and teaching.[3])

1. Moving ahead before being ready

At the University of Missouri-Columbia, where I got my bachelor's degree, I was more interested in getting good grades than in mastering the subject. I did not understand, as colleague Lyle Feisel advised, that my job (to learn the subject matter) was more than my assignment (to get good grades). When I went to the University of Chicago to start graduate school, I was advised to take some senior undergraduate level courses first. I refused and went ahead with the regular graduate program. This was ill-advised. When I took the feared "basic" exam at the end of the second year I failed, partly because my grounding in fundamentals was insufficient. For example in the oral part, I could not give an adequate definition of what it meant to say that two waves were spatially coherent.

Some failing students (including me) were recommended to try again the following year, but I elected to finish my PhD studies at the University of Kansas. Perhaps another mistake was I was not willing to gamble that I would pass on the next attempt.

I also tried to do too much too soon as a teaching assistant at Chicago. When I was assigned to conduct a recitation section for the quarter on optics (using Sears' optics book) I quickly became bored and tried introducing material from Sommerfeld's optics book. Not only did this not help the students, I doubt that I understood what I was doing. Towards the end of the quarter the attendance in my section dropped to zero. This episode still haunts me.

2. Losing focus

In my formative years. I should have practiced solving problems efficiently. I spent more time reading than working problems. I "knew a little bit about a lot of things," but I didn't know enough about how to apply the fundamental ideas of physics. A friend studiously worked every problem in Kittel's solid state book, and passed the basic exam the first time. He focused on the physics, what it really meant, and how to use it to analyze phenomena.

3. Not making fundamentals a working part of memory

I began to understand the importance of memorization when I took a group theory course taught by Prof. William Scott at the University of Kansas. A myriad of definitions were used in the derivation of results. The math graduate students knew these definitions and followed the lectures with ease. I didn't and struggled. On a more elementary level, it bothers me when students don't know simple things like the value of the sine of 30 degrees. The point of physics is not memorization, but knowing the fundamentals without constantly looking them up greatly facilitates communication.

4. Not focusing on physical ideas while obsessing over the mathematics

Experiment is the heart of physics. Many feel if you can't measure something, the concept has no meaning. Connecting ideas with experiment, and reducing them to their essential physical core is hard, it takes time, and for this it is often useful to talk to people and gather essential crumbs, one by one. In courses and even in research (for example on the statistical mechanics of magnetic systems described by the simple Heisenberg Hamiltonian) I tended to avoid experimental results. This once cost me a job when in the interview I was asked how I had interacted with experimentalists. I had no answer. It was a mistake for me not to consider realistic materials upon which experiments could be done and ideas could be tested.

5. Not fitting goals to abilities

We all would have liked to be Feynman, but there was only one. I wanted to work on advanced problems in theoretical physics before I was ready. I finally settled on more applied problems in solid state physics, but for a while I felt I was demeaning myself. I fluffed an opportunity to establish myself in semiconductors in the early days at Hughes Products, where I worked two summers in the fifties. The first summer I followed directions and wrote a report on crystal growth, but the second summer I tried to go my own way into more basic (I thought) areas. The report I produced was good neither by my standards nor by theirs. It was too early in my career and very unrealistic to go off on my own. As I matured, I realized I would be lucky to find problems in solid state that I could help with, and that all physics is intriguing when you begin to really understand it. Even today, despite the fact that I have written texts on solid state physics,[4] I cannot say I have mastered anywhere near all the important ideas in that field.

6. Ignoring personal life

Like many physicists, I was shy around people. This caused difficulties, even in physics. A physics meeting in Rolla, Missouri began with a social gathering for the attendees. For reasons of insecurity I didn't go. The next day when I gave my talk its validity was questioned. There was a good rebuttal, but I was too nervous to think of it. The chances are if I had attended the social gathering, in the course of informally talking about my work, the same question would have arisen and I would have dealt with it better. After I got married, at the relatively late age of 38, my wife helped me immeasurably in feeling comfortable in a social setting, whether related to physics or not. I should have sought more balance in my personal life at an earlier stage.

7. Using secondary sources

It takes work to track down results in professional journals, but looking things up only in texts often results in less complete and sometimes less clear answers. Of course the scientific literature is consulted for research, but it is also useful for classroom lectures. For example, the Quantum Hall Effect originally was hard for me to understand. Then, I discovered a review paper[5] and was able, after digesting it, to read the original literature. Texts may be handy, but shortcuts to grasping physics are few.

8. Always rejecting authority

I have a problem accepting authority. Perhaps I cannot easily put myself in others' shoes. This trait has led me to cause trouble often for no real reason. I constantly interrupted a lecturer (who in fact was a good scientist) in my junior electricity and magnetism course, using the excuse that the text or his lectures or both had errors. Maybe they did, but that hardly made either unique. In any case, I was arrogant about it. Once he got so irritated he threw down the chalk and left the room. I shamefully admit now, I felt victorious. Later in my career, a college president encouraged the faculty to learn about computers. It was the early days, and he was leading us in the right direction. I wrote the few programs he required, but without enthusiasm, and with minimal effort. By resisting direction, I lost a chance to mature and be guided by someone with superior experience and knowledge.

9. Letting anger rule behavior

In mid-career, I went to Florida Institute of Technology and was assigned to teach a class in advanced undergraduate mechanics. Because of my predilections the class tended to be rather mathematical. At Florida Tech there were both physics and space sciences students. My lectures seemed to be appropriate for the former but the latter were used to a more qualitative approach. One student began coming late. I lost my temper with him and started to lose control of the class. Later I became department head there. There was one faculty member who did not publish much and was stuck at the associate professor level. He began to blame me and verbally attacked me in one department meeting. Again I lost my temper. This led to problems in the department which eventually reached the Dean's ears. I had a rocky path for a while. In both cases when I lost control of myself, I lost some control over others and more importantly, some of their respect. Being strong seldom means being angry.

10. Not keeping in physical shape

In the late 70's I got invited by Prof. Gerald Jones to Notre Dame for a year as a visiting professor. I arrived fat and tired. I had wanted a dog for some time and got one. I began taking him for walks and also watching my diet. Physical discipline led to losing weight and also helped increase my mental organization. The year went quite well in research, teaching, and life. I discovered that letting things go slack in one area often leads to slackness in other areas including physics.

So there you have a representative, if not exhaustive, set of suggestions. If you are a young person, just getting started, I hope they prove to be of some use.

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3. J. D. Patterson, *Am. J. Physics* 54, 201(1986), and 58, 423(1990).
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5. H. Stormer, *Rev. Mod. Phys*. 71, 875 (1998).