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—Turkey and Jordan—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-sponsored particle accelerator 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 Bessy-I 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 Flatter, 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 added, “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.

The meeting highlights 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 PROGRAMS continued on page 4

Mid-East continued on page 5

Sorters Set New Records

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 9,360 abstracts, for an astonishing A/S ratio of 56.7.

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Mid-East continued on page 5

APS April Meeting Celebrates Cosmic Rays and More

By Michael Lucibella

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.

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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 of their way to address 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.

“Even 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

**CAPITOL HILL continued on page 4**
“I’m thankful that the world gives us we can solve, but not too easily.”

Frank Wilczek, MIT, on being asked what physics he’s most thankful for, PBS.org, Nov. 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 how he’s asked about physics he’s most thankful for, PBS.org, Nov. 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, Nov. 22, 2011.

“Just another shameless effort to reap the immense financial benefits and patenting of known invention rights. Nowadays, some of his inventions have been successfully liquefied most known gases, except helium. dewar managed to acquire an education, first by known methods confirmed. My helium work arrested by ill health but hope to continue later on.”

Dewar, December 2, 1911.

“When you’re in the middle of problems you can’t just take time off for those hobbies... Once you’ve retired, you have those bursts of energy for all 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.’”

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

“Black holes give off pairs of Higgs bosons, among many other things...They produce these Higgs particles when they collide with each other, and if you put a detector there, you would see them. But the detector would be gobbled up pretty quick by the black hole.”


“This is a burgeoning area of research. By 1845, 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 exposed to very low temperatures.

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New President Ready to Move Forward with Strategic Plan


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 face us both on a national basis and a global basis, and the American Physical Society has been active in the past in explaining the empirical basis or the physics background that helps illuminate decisions on those issues. That ranges all the way from alternate sources of energy, which have been the news recently, to international arms control and related activities. So, for my position component, the American Physical Society can understand studies that help clarify a clearly visible global perspective issue with regard to the major questions that we face.

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

A: One thing that we’ve underlined over the 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.

We’ve now completed a year of study on the strategic plan, and we are about to roll it out to the divisional organizations 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 because if the science funding is not the way to do it, 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 a more focused 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 them. I will mention 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 will have 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 we can meet member expectations, for those members that attend and those who are at the meetings.

Q: How well do you think APS 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 in journal publications, and the APS members have to be the ones that identify what their needs are and sit down with the APS and our journal groups to work on those needs.

We need to be cautious and we need to perform a series of surveys or assessments and we need to communicate to our members the strategy we are going to follow before we move forward.”

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 cut an individual’s legs and back silky and smooth is owed to talented physicists, like Jeffrey S. Parker, who have chosen physics as their professional lobby.

Parker, 39, is a Senior Scientist at P&G and Grooming is considered among the company’s most pressing issues. 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 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 and product development. Parker continued 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.

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Big Fan of Online Talks

I was a little surprised to read your news story “Posting Meet- ing in mathematics.” In my field, high energy physics, posting talks online is a standard practice. For example, the last two meetings of the Division of Particle 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

Incentives Can Re-invigorate US Manufacturing

By Bruce Johnson

A government program called the Independent Research and Development (IRAD) program was very strong and effective until the mid-1990. It allowed industry to work with universities and develop and commercialize products that were in the interest of the government as well as businesses. 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.

Bruce Johnson
Senior Member of APS and a Life Member of International Collaboration

International News

Graduate School: Envisioning a Future of International Collaboration

by Abhishek Kumar

I am really excited to write this article as a graduate student member of APS. I began graduate 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 activities such as the Student Affairs (FGSA) activities as Secretary of the FGSA. Every new cost for doing research fulfilling experience, and I have been fortunate to have had many exciting opportunities to think “outside the box”. Thanks to the APS, I now have a much broader and active view on what it means to be a graduate student. And this experience has given me the opportunities ahead for international scientific collaboration.

In the past months, I had the great honor of leading the Cana- dian-American-Mexican Physics Graduate Student Conference (CAM2011) organizing commit- tee and the journey was a unique experience. In this letter I would 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 beyond the 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 apprehen- sions were soon put to rest once the organizing committee was in place. All of us, the students from Canada, Mexico and the US, the effective members of FGSA and the fabulous staff members at the APS, CAP and SMF served to in- spire 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 the US was well thought out. The US capital, being the nerve center of general policy formulation and science and technology is in particular, nicely com- plemented an important theme of the CAM2011, namely “Poli- cy.” In today’s rapidly changing world, the critical significance of the right kind of scientific poli- cies cannot be overemphasized.

Keeping this in mind, we had experimented with the scope of CAM to organize two panel dis-
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many physics teachers, however, had taken a few twists and turns along the way. Kakanis’s 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. Considering the job market might be tight. So around the end of her sophomore year at MTSU, seeking to position herself for a stronger chance of pursing 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 told me how they were having a hard time with physics teaching. In this situation, the universal goal of improving the preparation of the next generation of teachers had become a replication site of ideas. I’ve been a 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 PhyTEC, beginning in 2010, MTSU was able to reform physics education courses and begin launching new ones. Kakanis took the lead in developing 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 PhyTEC and Noyce that are encouraging young people to get into teaching,” she says.

MTSU’s physics faculty and PhyTEC project leaders expect that Kakanis will be the first of many program graduates who will break the ice when meeting new students. “MTSU is rapidly becoming a leader in physics teacher education,” says Monica Plusquellic, Noyce Program Chair, and Diversity and the Physics project co-director. “This is not only a great need well-prepared physicists and, being graduate students, all participants were on the same footing. It fostered an atmosphere full of rich possibilities for future collaborations.

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 high-quality teaching. We have to go the distance by including in ourselves the required skills and values and inspiring our students. For the students of CAM2011 did well indeed by “catching them young.” Its task is well cut out for the future. The APS Staff members and leaders of the 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 look forward to the next stages of construction.

Egypt’s contributions have been held back because of the current 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 on what that contribution will be.

The US and the European Union have supported the project since its inception and will likely continue the remaining $10 million in funding that member nations have not pledged. Representing nations haven’t pledged. Representing the next generation of scientists and engineers.

Ahsibhek 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.

ADDENDUM continued from page 1

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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. Working 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 beams 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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http://www.aps.org/publications/apnews
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science funding relative to other authorities. 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 support. The ability to do so depends on how well Dewar’s grand plan plays out. A2

During the next year you will have ample opportunity to contact your representatives 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 science. APS will alert you throughout the year about advocacy opportunities and when advocacy will be most effective. If enough voices combine, Congress will hear the message.

ISSUE: POPA

Since early May 2011 there has been considerable legislation activity associated with the Energy Critical Elements report. Most recently the Chair of the science committee, 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 U.S. Strategic and International Studies (CSIS); (2) science-based 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 your ideas electronically to APS@popa.org or submit your suggestions/suggestions/index.cfm

ISSUE: Media Update

To persuade the now-defunct Joint Select Committee on Deficit Reduction (the supercommittee) to undertake a report on science funding, APS members wrote op-eds and were quoted in an editorial in several newspapers in Ohio, Michigan, and Massachusetts.

Jonger Mago, a graduate student at Cornell University and an Ohio native, wrote an op-ed titled, “Congress must protect our nation’s science.” It appeared in the Columbus Dispatch on November 10th. (See http://www. columbusdispatch.com/apps/pbcs.dll/article?AID=110111110310)


Log on to the APS Web site (http://www.eps.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.

Dewar was asked about a government committee on explosives in the late 1880s, Dewar and a colleague, Frederick Abel, developed nitroglycerine, 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. And so we’re left with his memoirs of his own design.

Dewar remained active as a scientist until the very end, focusing on the construction of the Royal Institution. He died in London on March 27, 1923. But his work in low-temperature gas cells, and particularly his invention of the Dewar flask, proved seminal to the field of cryogenics.

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of the Dewar flask, proved semi-
The APS Division of Fluid Dynamics held its 64th annual meeting in Baltimore, Maryland from November 20 through 22. Over 2,400 attendees registered for 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 each other smoothes the flow of water through the school, leading each fish to expend less energy when swimming than if it were 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 improve the efficiency of the farms.

Various types of fish are dramatic, but powerful con- servative 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 meet- ing, researchers showed that detonations can also happen in an unconfined area. Alexei Po- ladnicev and his team, at the US Naval Research Laboratory and Sandia National Laboratories, showed that it was possible, un- der the proper turbulent condi- tions, for a detonation to happen in an unconfined space. The con- ditions they described are similar to those of drag-reducing models of white dwarf stars, which offer a possible explanation for the cause of type Ia 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 asymme- tries might hold the key to better blood flow out of the heart. She and her research partner Gianna Pedrizzetti, also from the Uni- versity 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. Af- ter testing in a silicon aorta model, the team found that blood flowed 70 percent bigger than the other.

Fusion research is dramatic, but successful con- servative detonations are amongst the highest in the con- struction character. He said also that the physics of how swirling waves in wine while swirl- ing 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 tools that he can find industrial uses in biopharmaceutical manufactur- ing where large machines have to swirl vats of biological matter to culture growing cells.

Varied Research Featured at Fluid Dynamics Meeting

**Shape coexistence in atomic nuclei**

Kris Heyde and John L. Wood

The phenomenon of nuclear shape coexistence manifests itself in the presence of close-lying nuclear states with dif- ferent geometrical arrangements. Examples of coexistence are elongated fission isomers in actinides, alpha cluster structures such as the Hoyle state in carbon essential for the nuclear reaction of carbon burning in magic nuclei that provide stringent tests of nuclear par- adigms. This review presents an overview of theoretical frameworks, summarizes experimental evidence, and pro- vides guidance for future developments.

**Reviews of Modern Physics**

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and developing products, and col- lecting feedback to improve the quality of his designs. He contrib- utes to the marketing of products, providing the lay-person-friendly language for packaging and ad- vertisements that properly com- municate the product’s value. He also consults with the production department to make sure they can scale up the design as they pro- duce 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 di- vision in any consumer products company. For every razor that a firm claims “will give you a 45% cleaner shave,” there is a claims support team that clarifies the ac- curacy of such a statement before it is used in promotions. Parker as- sists claims support in testing the current shaving products for their strength, accuracy, friction reduc- tion, and overall shaving comfort.

Here’s a fun fact to keep in mind while you are gliding a razor across your precious, pre- cious face: the blades used for shaving the face are, much more sophisticated and sharp cutting sur- faces on the planet. In particular, “Fusion blades are thinner than a grain of rice, de- signed to shave the outer layer of hair, and optimized for cutting through more of the keratin in the outer layer of the skin, resulting in less irritation.” Describes Parker. “This level of ultra-high precision engineering is amongst the highest in the con- sumer goods industry.”

The physicist has been instru- mental in analyzing 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 ra- zor pivots on the handle, and how the tapes move in and out. In his quest to make the profile of the razor as thin as possible, Parker helped employ an advanced dia- mond turning machine (DLC) coated tool to the steel along the blade edge. This extreme hardness material (more than 10 times the hardness of the diamond hardness) enhances each individual blade’s strength and allows the blades to stay sharp even after many uses. Another proprietary coating, Polytetrafluoro- ethylene (PTFE), is also applied to the blade, which significantly cuts down on friction, he explains. But the DLC coating is also vitally important to the ProGlide’s archi- tecture because it ensures that the blades in the razor can remain thin, delivering significant reduc- tion in “hair cutting forces”, and thus a more preferred consumer experience (i.e., fewer toilet pa- pers applied to your bloody face). Parker concludes that his work for P&G is not as dissimilar from academia as he would have ex- pected. “When you get down to it, the science is completely the same,” he explains. “It’s the same tools, the same processes, just applied differ- ently.” He still delves into surface morphology, he still measures and analyzes electrostatic forces, and he still uses many of the same in- struments 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 techni- cal solutions for consumer prob- lems, when the consumers are not exactly sure what they want in the first place. “The needs of the cus- tomer can be hard to define,” he concludes. For the Fusion ProGlide 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 un- derstand exactly what “creamy” means to different people in terms of the physics, mathematics and materials expertise that goes into crafting shaving lotion. But the barriers of certain as- pects of his job doesn’t take away from the high level of satisfac- tion 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 the products because of the science and engineering we put into them.”

Alaina G. Levine is a science writer and President of Quantum Success Solutions, a science ca- reers and professional develop- ment consulting enterprise. She can be contacted through www.alainalevine.com.

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Ten Mistakes for Physicists to Avoid
by James D. Patterson

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 Feinl 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 answer to the definition of a concept that 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 in one year. This is one of the few programs he required, but without enthusiasm, and I lost some control over others and more importantly, some of their respect. Being strong seldom means being angry.

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 inadvertently worked every problem in Kittel’s solid state book, and passed the basic exam the first time. He focussed 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) I tended to a more qualitative approach. One student began coming to a more qualitative approach. One student began coming to my office to ask me 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 unambitious to go 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, 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 the other student 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 been able to think of a better way to deal with it.

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 success 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 and was able, after digesting 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 something was wrong with the way he did it, that he had made some mistake. 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. A later in my career, another college professor 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

I also tried to do too much too soon as a teaching assistant. I quickly became bored and tried introducing material from other courses. Some failing students (including me) were recommended to try a more qualitative approach. One student began coming to my office to ask me 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.

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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