
Tapping wasted energy from inefficient automobiles, homes and businesses is equivalent to discovering a hidden energy reserve that will help the United States improve its energy security and reduce global warming, according to a study released on September 10th by the American Physical Society (APS). The report, Energy Future: Think Efficiency, states that the key to unlocking the efficiency potential is developing policies that will put technology into the marketplace and developing new technologies through applied and basic research in the public and private sectors.

The study panel concluded that increased energy efficiency, particularly in the transportation and building sectors, will help eliminate US reliance on foreign oil and reduce greenhouse gas emissions that contribute to global warming.

Most recommendations addressing high fuel costs focus on either increasing the supply of oil or finding a substitute fuel, but the APS report offers a practical roadmap with short-term and longer-term solutions for reducing demand through cost-effective efficiencies that find public and political acceptance. The report provides a path to 50 percent increased energy efficiency, particularly in the transportation and building sectors, which will help eliminate US reliance on foreign oil and reduce greenhouse gas emissions that contribute to global warming.

It also states that the federal government should broaden its research, development and demonstration programs, particularly in the areas of batteries for conventional hybrid vehicles, plug-in hybrids and battery electric vehicles. The report credits automakers for devoting resources to the development of hydrogen fuel cell and plug-in hybrid vehicles, but concludes that they are not a solution to the nation’s short-term energy needs because they require significant scientific and engineering breakthroughs in several critical areas.

The study also calls on Congress and the White House to increase funding on research and development of next-generation building technologies, including scientists who work on building technologies and supporting associated national laboratory, university and private-sector research programs. Additionally, it recommends that lawmakers develop policies that address a wide-array of market barriers that discourage consumers from adopting investment in energy-efficient technologies, especially in the highly fragmented building sector.

The American people need leadership from the Congress and the next president on this issue, said Nobel Laureate Burton Richter, chair of the study committee and director emeritus of the Stanford Linear Accelerator Center. Both Senators McCain and Obama have outlined plans for improving energy efficiency and defining the important role new technologies will play in our energy future. The next paragraph on page 5

Four APS Members Receive National Medal of Science

Four APS members are among the recipients of the 2007 National Medal of Science, and one APS member is among the recipients of the 2007 National Medal of Technology. The awards honor the nation’s top scientists and inventors.

President Bush presented the medals in a ceremony at the White House on September 29. APS members Mostafa El-Sayed of Georgia Institute of Technology, Fay Ajzenberg-Selove of the University of Pennsylvania, Charles Sligher of the University of Illinois, Urbana-Champaign, and David Wineland of the National Institute of Standards and Technology received the 2007 National Medal of Science.

El-Sayed was cited for his contributions to our understanding of the electronic and catalytic properties of nanoscale systems and materials. Ajzenberg-Selove was cited “for her contributions in nuclear physics that have advanced research into applications including energy generation from fusion, dating of artifacts, and nuclear medicine.” Sligher was cited “for establishing nuclear magnetic resonance as a powerful tool to reveal the fundamental properties of molecules, liquids and solids, enabling the development of numerous modern technologies.” Wineland was cited “for his outstanding leadership in the science of laser cooling and manipulation of ions, that have had multidisciplinary applications.”
**This Month in Physics History**

**October 1958: Physicist Invents First Video Game**

In October 1958, Physicist William Higinbotham was thought to be the first video game. It was a very simple tennis game, similar to the classic 1970s video game Pong, and it was quite a hit at a Brookhaven National Laboratory open house.

Higinbotham was born on October 25, 1910 in Bridgeport, CT and grew up in Caledonia, NY. He graduated from New York University, College of Arts and Sciences in 1932.

Higinbotham spent about two weeks building the device. After a little debugging, the first video game was ready for its debut. They called the game Tennis for Two. Players could turn a knob to adjust the angle of the ball, and push a button to hit the ball towards the other player. As long as they pressed the button when the ball was in their court, players couldn’t miss the ball, but if they hit it at the wrong time or hit it at the wrong angle, the ball wouldn’t make it over the net. Hillinbotham's main concern throughout most of his career was not video games, but nuclear arms control. He helped to founded the Federation of American Scientists and served as its first chairman and executive secretary. Higinbotham died in November 1994, more famous for his video game than his work on nonproliferation.


**Flawos, Ira. They All Laughed... from light bulbs to lasers: the fascinating stories behind the great inventions that have changed our lives. HarperCollins, 1993.**

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**Members in the Media**

*“It’s not a stable black hole that could collapse the universe. It’s unstable, so it explodes right away.”*  
—Yongsheng Gao, California State University, Fresno, on the possibility of the LHGC producing black holes, *The Fresno Bee*, August 5, 2008

*“We don’t want this to be another Lee Harvey Oswald case where the public says it is never solved to their satisfaction.”*  

*“I sent them because I thought life was nice.”*  
—Greg Landsberg, Brown University, on sending his children to visit Georgia this summer, *Newsday*, August 20, 2008

*“A group of people from all over the world—many with different languages and attitudes. It is essential for scientists to participate in this and try to help the Catholic Church, advise them on their policies.”*  
—Charles Townes, University of California, Berkeley, on the Pontifical Academy of Sciences, Discover, August 18, 2008

*“The bottom line is it’s a wonderful experiment, but it needs to be approached carefully, or you go out of control.”*  
—Robert Grober, Yale University, on sending his experiment to the Hartford Courant, August 21, 2008

*“Consider if you would have a great model to predict the quirks of the world’s economy—would you go and publish it?”*  

*“This was just a hobby that got out of control.”*  
—Robert Grober, Yale University, on sending his experiment to the Hartford Courant, August 21, 2008

*“I personally know a number of people who’ve received the award. To be part of that list of which they are members is a thrill.”*  
—Charles Sliechter, University of Illinois, on winning the National Medal of Science, *Newsweek*, August 27, 2008

*“We have no problem with that process.”*  

*“I personally know a number of people who’ve received the award. To be part of that list of which they are members is a thrill.”*  
—Charles Sliechter, University of Illinois, on winning the National Medal of Science, *Newsweek*, August 27, 2008

*“We have no problem with that process.”*  
Physicist Tilts at Diploma Mills

During the past six months, I've seen something I never thought I would: stories about science on the front pages and op-ed pages of major British newspapers, and scientists interviewed on prime time BBC current affairs programmes. The only problem is that these stories coincide with shortfalls, cuts to grants and potential cessation of support for promising projects. And this is happening despite our academic credentials and to strongly support science. What is going on?

Most scientific research in the UK is funded through research councils, which receive their money from government on a three-year cycle. Although these councils can turn to a number of exceptions, for H-1B visa applications, making

Agreement Lets APS Members Provide Expertise to Industry

One company is looking for innovative technologies to reduce the moisture content of coal. Another company seeks best reuse treatments for use in the process, TekScout can help companies find a variety of solutions and to those selected on the posted challenges receive payment for their work. Each company offers a fee for a specific project, and this fee is based on the proportion of the challenge that they complete. The fee is calculated as a percentage of the full fee, and the percentage is determined by the level of involvement in projects. One company might even pay more than the others, as their needs are more specific.

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Overscience Causes Problems

I appreciated Ron Hira’s thoughtful Back Page in the August/September 2008 edition of APS News, where he accurately captures my experiences and those of my colleagues, and it is wrong to say that work regarding STEM supply and demand.

His comment “to date, our policy discussion about the implications of globalization has relied too heavily on interests of companies and universities rather than being based on any data-driven analysis” was very apt. I recall a very similar statement made in 1990 by an MIT/University of Illinois PhD physicist, who had this friend left science engineering in his 40s and never returned, as far as I know.

In my opinion, the overutilization of STEM over the past 4 decades has been the primary problem for science in this country. When the best talent of the sciences as a profession in their 30s and 40s are either vastly underemployed or unemployed in 2008, so the issue still remains.

I have been grateful for my limited success in science and engineering, and for the opportunity to contribute to the human endeavor in a unique and positive way through scientific discovery and innovation and teaching. I always thought that I was able to accurately capture my experiences as they can to avoid coming in the 27-kilometer ring. The detectors received what seemed, to look back and see how close the caverns. The most impressive “lowering” that I saw was the last slice of CMS, a 1430 ton disk of iron and particle detectors, 52 feet tall. Starting shortly after 6:00 a.m. the equipment didn’t complete its 300-foot journey until about 5:30 that evening.

That day, I guided a film crew working on an artistic document. The director, Peter Mentler, surprised me by saying that it was so slow barely noticeable as we looked on. Looking toward the Alps that night, reflecting on the day, he compared the descent to the speed at which the moon seems to rise.

While cavern security required an access card, helmet, and closed-toed shoes during that January lowering, I was receiving forecasts of low not wear safety boots by the time I finished as a guide in April, even on the well-traced visitor pathways. By the end of May, they had activated the retina scanners, allowing blue in the access gates.

One of my favorite analogies for 25 years, the ‘wave’ came from Michael Schmitt, of the Universities of Illinois Urbana-Champaign. He thought of it as a car, “built by amateurs around the world.” Having brought all the pieces to one place and assembled the machine, “we’ll turn the knob and let it go.”

Luckily, it has. At 10:26 on the morning of September 10th, the LHC beam physicists breathed their sighs of relief, their cheers as the first bunch of protons went full-circle in the 27-kilometer ring. The detector physicists of that moment saw that everything of currents, classic rays, a blast of data from the single beam hitting the detectors and a homage to close in the vacuum of the beam pipe. With a couple of months to refine calibrations on the detectors and the accelerator itself, everyone at CERN is looking forward to the collisions to follow.

Mission Relevance Enhances Army Research Impact

In his July 2008 Back Page article, Leo Kadanoﬀ makes a compelling case regarding the decline in the nation’s basic research capacity, and he recommends a corrective response that emphasizes education as well as enhanced research support. He argues that the decline has cut across both the private and public sectors, and cites as an example of the decline of government support for defense research the ARO Inversary Symposium of the Army Research Office (ARO), held in June 2001, from which Kadanoﬀ understands there to have been a further fall to support basic research. As the Director of ARO, I can state categorically that is now even more vigilant than the larger community. When this happened repeatedly over 4 decades, it can create an anti-scientific cultural bias that is diﬃcult to erase. I know talented physicists in pieces by amateurs around the world. The probable Army impact doesn’t currently fund any projects in elementary particle physics because the probable Army impact is low compared to other possible investments. This focus on mission relevant research does not mean the ARO programs are not truly basic in nature. For example, ARO Physics programs currently include research on quantum information science, meta-materials and transformation optics, ultra-cold quantum degenerate gases, the physics of strongly correlated matter, novel quantum phases and quantum phase transitions, and behavior at interfaces. Another indication of ARO’s ongoing commitment to basic research is that, for so far this decade, nine individuals have won Nobel Prizes involving research ARO supported prior to their getting the awards.

Scientific advances produced by ARO-funded research, often supported in concert with other agencies, will result in revolutionary advances in Army capabilities ranging from fundamentally new types of sensors, to ultra-secure communications, to very lightweight, strong and multifunctional materials. The impact on civil technology is also very significant. Although ARO’s investments in basic research programs are constrained by Army mission relevance, it is precisely this relevance that accounts for these programs’ extraordinary impact on the nation’s economy and our quality of life.

David Stratton
Research Triangle Park, NC

In the April APS News, we invited readers to submit a physics-related caption for this cartoon drawn by APS News cartoonist Paul Dlugokencky. We then narrowed the field down to five finalists, and let the readers vote for their favorite. Now the votes are in.

Hundred of people voted. The winner is Robert Colliver of Buton Rouge, LA, who submitted the caption, “Partway through their argument, Mary realizes that Albert does not understand the gravity of the situation.” “I honestly entered on a lark,” Colliver said that he had won. “I thought it was funny.” Colliver will receive a print of the cartoon signed by the artist, as well as a copy of the book Physics in the 20th Century and an APS tee shirt.
Profiles in Versatility

He’s havin’ a ball at Ball

By Alaina G. Levine

Carl Gelderloos never stops smiling. Is this Boulder-based PhD physicist in the middle of a perpetual Rocky Mountain high? Or perhaps Carl’s so elated because he has the privilege of doing exactly what he loves to do everyday as a business development leader at Ball Aerospace & Technologies Corporation. His work has led directly to the design, development, and launch of spacecraft and space-based experiments, so one thing is clear: Carl Gelderloos is having a ball working for Ball.

To the outside observer, Carl’s job may seem simple: as Deputy Director of Ball’s Advanced Systems group, Civil & Operational Space Division, he is tasked with submitting NASA requests for proposals for various space missions. He is a project manager, so he diagnoses what NASA “wants” and then works with hundreds, both internal and external to Ball, and often juggles other business-related issues. For example, he has to propose it for a NASA mission and future lunar spacecraft.

DAR (Light Detection and Ranging), will be the primary instrument used to guide the spacecraft to autonomous rendezvous and docking, to both the International Space Station and future lunar spacecraft. “We’ve been developing the technology internally for several years, but this was the first opportunity we had to propose it for a NASA mission,” says Carl. His team merged state-of-the-art focal plane, laser optic, and electronics capabilities into a compact system that met the low mass and power requirements of the mission. What resulted was a 3-D imaging system that output data at video rates, and the algorithms to convert raw data into images.

Carl’s work is on the “front end,” as he interacts directly with the customer, so while he helps launch Ball’s participation in a mission, he often does not play a detailed role later on as the project unfolds. But what he loves most about his work is his ability and opportunity to express his creativity and bring simplification to any project, a talent and a passion he realized when he was first drawn to physics.

Carl, who is now 41, originally became entranced by physics after “seeing how simple and elegantly a huge variety of natural phenomena could be described by a few simple equations and simple mathematical relationships,” he recalls. “The simplicity and the elegance of it was what really drew me in.”

He received his bachelor’s degree in physics from Hope College in Holland, MI in 1989, and his PhD in nuclear physics from University at Stony Brook in 1994. After a post-doctoral appointment at the University of Colorado at Boulder, he worked for Hughes Space & Communications, and joined Ball Aerospace in 2001.

His assignments at Ball reflect a veritable rainbow of space-related projects. He participated in the design of a mission to Jupiter to explore its moons, developed an earth science project that involved remote sensing in the atmosphere, and designed avionics innovations that control launch vehicles.

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### Focus on Topical Groups

**Topical Group on Magnetism and its Applications**

By Nadia Ramlagan

Permit tantamount to the attention, growth, and inter- est in Magnetism and its Applications (GMA) has experienced over the past decade, last year’s 20th anniversary meeting was held at Fermilab, and we went to Albert Ferr of France and Peter Grünberg of Germany, every few (independent) discovery of giant magnetore- sistance (GMR). “The March meeting was a lot of fun, we sponsored a special reception and lecture to honor the Nobel Laureates and had a huge audi- ence. Both Grünberg and Ferr were able to attend. It was a very successful lecture to GMA people,” says GMA chair William Butler.

Giant magnetoresistance is the change in the electrical resis- tance of a metallic magnetic multilayer structure when an external magnetic field aligns the moments in different layers. The discovery has radically transformed methods of retrieving data from hard disks, im- proved magnetic sensors, and sparked the development of a whole new field of electronics called spintronics.

“Things seem to be coming around,” comments William Butler. In 1995 there was the discovery of about 10% tunneling magnetoresistance (TMR) at room temperatures by Ter- unobu Miyaizaki at Tokyo Univer- sity and Jagadish Moodera at MIT. Starting the following year in 1996, John Slonczewski and Luc Berger independently predicted the phenomena of spin torque, a current source of convert to GMR. “In GMR the relative orientation of the magnetic moment in two layers will in- fluence the current that goes through it. In spin torque, the spin-polarized current can in- fluence the relative orientation of the moment, and you can ac- tually apply a current that will cause the orientation of the mo- ments to switch,” explains But- ler.

In 2001, very high TMR was predicted for magnesium oxide and cobalt iron. This was observed experimentally in 2004, and researchers were able to demonstrate about 1,000% TMR, a huge advancement from the 10% in 1995. Even more recently, there has been a breakthrough using magnetic materials to make spin torque- switched magnetic random ac- cess memory. The largest appear- ance that you have had recently has been to the read sensor for hard drives. There was a lot of publicity talk about GMR and the IPoD connected with the 2007 Nobel Prize because the first important application of GMR was for read sensors in hard drives. Nowadays hard drive read drive sensors use TMR, (tunneling magnetoresistance), using these new materials and great understanding of the statics of thin film memory,” says Butler.

Currently, magnetic oxide research has been receiving a lot of attention. “In fact, the largest number of papers we get at APS are on magnetic oxides,” Butler notes. Magnetic oxides because to a lesser extent generate a lot of exciting phe- nomena. “It’s interesting for the development of a plethora of these (ionic materials), to the atoms all know where they want to be (in contrast to metals where you don’t have well-amorphous fine microcrystallines samples). In the oxides you have the positive and negative atoms want- ing to arrange themselves in a particular structure, and that makes things a little simpler to think about from a geometric point of view,” says But.

Magnetic oxide materials allow researchers to generate what is called a spin filter effect, in which tunneling occurs through two magnetic layers that are insulators. The relative orientation of these layers have a huge effect on the tun- neling current. “These materi- als are also of extreme interest because they are very difficult to understand. The ordinary tools of band structure that we use are not always reliable when you apply them to these materials, because of the strong electron correlation”, Butler said.

GMA continues to play an important role at the APS March Meeting. This year, for example, the number of poster papers count for 14% (589 papers) of the March Meeting total, similar to the previous year. The group also sponsors stu- dent dissertation awards, a $500 prize and an invited talk at the March Meeting. “We also give awards for outreach. This year we funded a graduate stu- dent who has developed a pro- gram that’s been going out and doing science to primary and mid- dle schools and high schools in science and magnetism activi- ties,” says Butler. As part of its public outreach effort, GMA fully funds an Outreach Program (MINT-SOUP), which has enabled the group to expand magnetism classes for high school and middle school students.

GMA was founded in 1997 by Klaus Butcher and William Butler. “David was really active in working to get the group recog- nized. All of the past chairs have done a good job, and this has been reflected in our grow- ing membership,” says Butler.

By Nadia Ramlagan

University and working on a new experiment for her dissertation.

“In the past four years our family has grown rapidly. Three new babies came into our lives. I was working on my PhD and Jacob is, who is 3. My second child is Owen, who is 2. And we have a little girl, Yeziya who is 3 months old.” Her husband Tim is the co- chief of operations at Jefferson Lab. His job requires him to take unregualated travel shifts need- ed to keep the lab’s accelerator running 24 hours a day 7 days a week. She has no family in the area, it is difficult to arrange child care for their three young children.

“I was really overwhelmed by this situation and so I look 2 years leave from research, I didn’t fin- ish my PhD thesis work. But I re- ally needed the gap. I told my kids I didn’t want to take too long of a leave to keep me from coming back,” she says.

Li received plenty of support from Hampton professors to re- turn to physics. Her current PhD advisor, Cynthia Keppel, told her she could have two of her childern and she encouraged her to apply.

“I am really glad I did that. Things didn’t change in people after I had a child. It seems like when em- ployers offer you a job, you find out you have a young child, they automati- cally prepare themselves for you to not be productive.”

“By the time people, potential employers, whoever they are, they have to try and eliminate the negative bias. But in the end, it’s up to you and your capabilities and knowledge, not your family life. Because if you are someone who wants to have a job done, you will,” she explains.

Born in New Jersey, Janice Guikema received her undergrad- uate degree in physics from Cor- nell University and her PhD from Stanford University, where she used a scanning magnetic micro- scope to study vortices in high- temperature superconductors. She is currently a postdoc in the experimental condensed matter physics group at Johns Hopkins University.

Her research during the scholar- ship year will focus on the properties and applications of graphene, a single sheet of carbon atoms that flakes off of graphite. Since it was discovered a few years ago, graphene has been at the forefront of experimental physics research, mainly because of its novel electronic, optical and mechanical properties. The mate- rial is also free of defects (hardly ever missing a carbon atom), which makes designing very small, stable, graphene structures at room temperatures feasible.

She plans to fabricate a Hall probe sensor out of graphene, to determine if the material is sensi- tive to magnetic fields. “Graphene is a 2-D material and as a result the local behavior of the charge carriers in graphene. “My goal is to add to knowledge about the material and as more women choose to enter physics and very successful, and I think it was really good for me to see someone at a place like Stan- ford having kids and doing all it, have a successful career and

Janica Guikema

Blewett scholarship will involve one or two undergraduates. “I’m realizing now that in terms of your whole life and ca- reering, having a baby is a short time period. That’s why I stepped back, because I don’t want to miss out on my kid. It’s better to not be overwhelmed and feel pulled in all directions. It’s better to have a balance, even if that means not publishing as many papers, as long as you’re still moving forward. And that’s what I am trying to do,” she says.

M. Hildred Blewett was a par- ticle accelerator physicist whose dedication to physics prompted her to leave almost all of her money to APS after her death in 2004, at age 93. Her intent was to help women overcome some of the many obstacles they face in the field by providing financial assistance in the form of scholas- tribs. Born in Canada, Blewett began her career at General Elec- tric (GE) in Schenectady, New York in the 1940s, a time when women physicists were scarce. While at GE, Blewett de- veloped a method of controlling magnetic field in factory chimneys. In 1947 she moved to Brookhaven National Laboratory, where she and her then husband John Blewett relocated. She later worked at Argonne National Laboratory, and then at CERN in Switzerland. She retired from CERN in 1977 and relocated to Vancouver.
FUNDING continued from page 3
announced on our website (www.
STFC.ac.uk). STFC has imple-
mented a restructuring plan which will see substantial cuts in administra-
tion staff and tight squeezes on fa-
cility spending. Partly in response to the unhappiness caused by re-
duction in support some of our members have thanked us pub-
litically that this will not happen.

While tempers are still high and the consequences are still playing out, there are already a num-
ber of lessons to be drawn from all this. The first is that a research pro-
gramme can be squeezed, but the process is very painful and damag-
ing. Relationships were frayed over the past six months which may take years to repair. The second is that a science case is not a business case. STFC Council did not question the need for the Linear Col-
lider; they questioned the wisdom of investing in R&D towards it, given their assessment of its fund-
amental value and potential contribution and indeed its overall likelihood of go-

ing ahead.

The third lesson is that even when the overall climate for sci-
ence seems good, one cannot as-
sume that everyone will gain. Government support for R&D has pri-
tarily been focused on how to make sure that our facilities have the most up-to-date and advanced equipment to do a measurement. The experiment was taking place inside a large elec-
tron magnet that was turned off. The night of the interview, somebody threw a switch and the electromagnet came on,” Carl describes, chuckling. “There was enough iron in the electromagnet to accelerate it at a LOT and it smashed into little tiny pieces. That was the end of the experiment. I gathered the pieces together into a box and showed the next day for the in-
formal job interview with the guy’s experimenters. I’m sure they were a lot more impressed.”

“...I was certainly a tough start to the interview,” Carl jokes, and al-
though it ended up not working out, “I’m really happy to reveal an experience that I suppose.”

After his post-doc he consid-
ered a career in academia, but for-
tunately had an opportunity to look at industry. “My realization was that I could study a lot of the same prob-
lems in industry (as in academia) with a different approach, but often-
times with a much larger budget” he says. “It was an epiphany for me that the supposed confines of a car-

er in industry were much less than I supposed.”

Laterly, however, he only occas-
ionally does physics calculations. He gets his statistics from his labora-
tory. Between doing integrals, which has increased over time, is inversely related to how much he categorizes himself as a physicist. He jokes that he’s been a won-
derful career choice for me. I began studying physics with no thought of what the employment picture was; it was from a perspective of pure enjoyment,” he says. “I found it in-
tellectually fascinating and that was sufficient in and of itself. Studying physics opened lots of doors... In industry I have been able to par-
ticipate in projects and do things and play with very, very large toys to an extent I never dreamt possi-
ble. From my perspective I haven’t found a downside (to studying physics).”

No wonder. Considering Ball is the 15 largest employer of physi-
cists in the US (according to the American Institute of Physics), has undoubtedly been able to reap the rewards of the company’s philosophy that allows physicists to focus their skills in many different areas. Carl contributes by seek-
ing out and hiring physicists at all lev-
els.

In the end, Carl’s attraction to physics and mathematics go back to about simplicity, creativity, and fun. Carl himself is a simple guy. He likes space, he likes physics, and he likes how he can use his sci-
tific training to simplify and solve business and technical problems for his customers. With goals that can only be simply achieved with a physics platform, can you blame him for smiling all the time?

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levine.com.

MEDICAL continued from page 1

tiple applications in modern phys-
ics.

In addition, ASP member C. Grant Wil-
son of the University of Texas at Austin was awarded the 2007 National Medal of Technology. He created novel lith-
ographic imaging ma-

terials and techniques that have enabled the

ELECTIONS continued from page 1

“I am very honored that my colleagues have chosen me to be the next president of the APS,” said Barish. “I plan to work vigorously on the many areas that are critical to physics including: improving funding for research in the physical sciences, broadening participation in our science, and improving opportuni-
ties for international partner-
ships.”

In his candidate’s statement, Barish pointed to the “erosion of support for physics research” as one of the central issues fac-
ing APS. “We all understand the importance of a great country be-
ing at the forefront of basic sci-
ence and the various ways our participation in international efforts are important to maintaining a positive image regarding science and the im-
portance of support to maintain a vital physics research enterprise.”

With the nominating committee, Kirby will work to recruit “an ex-
cellent and diverse slate of candi-
dates” to serve in APS leadership positions and on its numerous committees.

Marvulava received her PhD in 1997 from MIT. After a post-
doc at Caltech, in 2002 she joined the faculty at MIT. She works on experi-
mental gravitational wave detec-
tion and precision measure-
ment at the quantum limit. She has been involved in experimental activity and in the LIGO Lab-
oratory over the past fifteen years, including design and implemen-
tation of interferometric sensing and control systems, commission-
ing of the initial LIGO detectors, study of quantum effects in future GW detectors, use of squeezed quantum states of light to en-
hance GW detector performance, and measurement of quantum be-

havior of macroscopic objects.

In her candidate’s statement she identifies two important is-

sues she wants to work on as an APS councillor: science funding-
ness, both in its classical and quantum aspects, including the role of physicists and physicists in shaping our society; the dearth of women and under-represented minorities in physics; mentorship and recognition of physicists in the early stages of their careers.

Pullin’s research interests cen-
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Recruiting and Retaining Minorities into Your PhD Program

By David J. Ernst

What is the best way to recruit minority students into a PhD program and to maximize the number of PhD's each year who are African-American or Hispanic? This is the question that is put to you when you decide to recruiting and retaining students in general. My personal experience is one that had a focus on domestic minorities as well as students from Latin America. This article is also directed toward the top few elite institutions, although many of the thoughts here could possibly be useful to them. The very elite institutions already receive a great number of applications from students who, on paper, look absolutely excellent. The question is how to select the “best” when the evidence to distinguish between perfect applicants is very limited. Here, the interest is in a Research I institution that wants to increase the number of high-quality students applying, in how to identify the “best,” and then in how to retain as many as possible all the way through to receiving a PhD.

Before starting the process of recruiting and admitting, one must define what one means by “best.” Simply having the computer rank the students by grades, by general GRE’s, by physics GRE scores, or a combination of these, does not yield my definition of best students, if the best students are defined as those who will complete the PhD degree and be the most successful both in and outside of academia. An individual who is out of academia where the majority of your students are headed; a student who gets rich in industry and donates money back to your department is indeed a great success. My experience tells me quite clearly that numbers are not a very reliable indicator of this long term view of success.

The students of interest here are not the students who have the very high numbers, are energetic, curious, hard-working, likable, and work well with others. Most departments admit students who are less than perfect in some aspect and nobody bats a thousand in only selecting students who maintain a perfect record to receive a PhD. The question is how do you determine, in the real world, who are the best to admit and how do you increase your efficiency by increasing your success rate? Given the need for US citizens by some individuals and the fact that they don’t belong to the “elite” within the US in science and engineering, all should be interested in identifying and recruiting the “best” students from among a pool whose size is insufficient to meet our national needs.

You wish to recruit minority students into your program. What is the first thing you should do? You have to go out and meet the students. Minority students on average, much more people oriented than the average American. They rely on personal contact, on knowing the person. You have to become a PhD, get a job, and quickly move to Mexico that to do business with someone, you first have to establish a relationship, a friendship. Getting to know and be a part of the Mexican American community. Personal relationships are very important to people in a community where you rely heavily on each other. Given this culture, it is most important that the recruits feel like they are a part of something larger than themselves. They must be made aware that they are a part of something larger; a student who gets rich in industry and donates money back to your department is indeed a great success. My experience tells me quite clearly that numbers are not a very reliable indicator of this long term view of success.

The NSBP/NSHP meeting is an interesting combination of physics, optics, etc, in addition to the traditional physics subdisciplines. If you wish to meet minority students, attend these meetings, get a booth at these meetings. Will that be sufficient? No. You need to meet and actively engage with the students at the meetings. Get involved, be a judge, organize a session, and definitely participate in all the mentoring activities that are organized at these meetings. Get involved in the organizations themselves, since the recruiter who is on the inside has an advantage over the recruiter from the outside. You also need to attend each year. Meeting them more than once can have a significant effect.

There are two APS meetings that now have special un-ion meetings, the Nuclear Division meeting and the April Meeting. There are two section meetings, the meeting of the Southeastern Section of the American Physical Society (SESAPS) and the Texas Section of the American Physical Society (TSAPS) that have strong involvement of NSBP and NSHP in their organization. Any meeting with undergraduate participation is good for recruiting. Be sure to give recruiting some priority, be a judge, get involved. Don’t give your “to be famous paper” and not take the time to search out students and let them know what your program has to offer. Don’t wait for the students to come to you; do your best to seek out the students.

You must also recruit for the entire department. Far too often, faculty are looking only for the student who will work with them. If all faculty recruit for the entire department, the probability becomes large that a student with an interest in your work will be identified by someone and they will become a part of your program. The question then becomes how do you get support for your program, how do you decide whom to admit? I am not able to describe in a quantitative way those things that influence me to support a student for admission. Great work habits, curiosity, an ability to work in a group situation, and communication skills are some of the things to look for in addition to having the mental ability to work on complex problems. I, and my partners at Fisk and Vanderbilt, rely on intuition, on spotting a combination of traits in the students that convince us that the student can and will succeed. It is difficult to convince physicists of something that is so unscientific, but, having done the experiment over many years and many students, the results prove that a careful use of one’s intuition can be quite reliable.

The student needs to be one whose numbers might not indicate that the student will succeed. Those you find with great numbers don’t really need any extra support. Fight to get this student admitted and when the student’s performance far exceeds the expectation predicted by numbers, you have made the first significant step. Do tell the student that they are breaking new ground and that they are laying a path for others. Let the subsequent students know that they are maintaining a precedent and that their success is very important to you and the department. The challenge and the realization that they are part of something larger is a great motivator.

Some students will enter the system and move on quite smoothly on their own. But you have identified students who did not look perfect on paper. This may translate into “they may not be the perfect student.” Constantly push them through the system. Not all undergraduate degrees provide an adequate background to survive your program’s course requirements. For these students, you must provide the opportunity to allow the student to fill in background. Remember, the goal is the long-term success of the student, not instant production of research for an advisor. If you recruit students who are at risk, you must provide the opportunity to make sure the student takes appropriate courses.

Another common situation is simply that the student is not good at juggling the academic demands along with the demands of life in general. Some students may only participate in the everyday situation they face is sometimes needed. The students may require very hands-on proactive mentoring. This is not easy to provide. First, it takes time. Second, stu-

About five years ago, the Fisk-Vanderbilt Masters to PhD Bridge Program was started (see http://www.vanderbilt.edu/gradschool/bridge). This program is based on the thoughts put forward above. It has the advantage that the students do not have to make the transition from their bachelor’s degree to the Research I PhD program, but can start in the Master’s program at Fisk University and then end up in the Vanderbilt PhD program. The student, with the permission of the Vanderbilt PhD program, can take courses in the Master’s program and then end up in the Vanderbilt PhD program that is, in my opinion, more student-oriented than most, with an intense mentoring program to help along the way.

Having a formal program in place has many advantages. The recruiting is done by a group, the mentoring is done by a group. Having a program means we were able to get support–real money, tuition waivers, staff support from the universities involved. Originally, the program got extra money added to grants whose focus was research. Once in place and with a track record, the program can become the focus of a grant while continuing to be a positive addition to a number of other grants. Money is needed for a program, and money helps gain support from your fellow faculty and the administration. Having your university not only support the program but feature it and brag about it helps gain support from your fellow faculty and the administration. Having your university not only support the program but feature it and brag about it helps gain support from your fellow faculty and the administration. Having your university not only support the program but feature it and brag about it helps gain support from your fellow faculty and the administration. Having your university not only support the program but feature it and brag about it helps gain support from your fellow faculty and the administration.

David Ernst is a Professor of Physics and Astronomy at Vanderbilt University; an Adjunct Professor at Fisk University; the President and a co-founder of the National Society of Hispanic Physicists; a member of the American Physical Society’s Division of Nuclear and Particle Physics of the National Society of Black Physicists. He is also the Chair-Elect, Southeastern Section of the APS, a member of the Council of the APS, a member of the Liaison Committee for Underrepresented Minorities of the American Institute of Physics.