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APS physics

Meet the New APS President
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APS April Meeting Convenes in St. Louis

Approximately 1200 physicists are expected to attend the 2008 APS April Meeting, to be held April 12-15 in St. Louis, Missouri. The scientific program, which focuses on astrophysics, particle physics, nuclear physics, gravitation and cosmology, will consist of three plenary sessions, approximately 72 invited sessions, more than 100 contributed sessions, and poster sessions. This year the meeting will be held in conjunction with a conference sponsored by HEDP (High Energy Density Physics) and HEDLA (High Energy Density Laboratory Astrophysics).

APS units represented at the meeting include the Divisions of Astrophysics, Nuclear Physics, Particles and Fields, Physics of Beams, Plasma Physics, and Computational Physics; the Forums on Education, Physics and Society, International Affairs, History of Physics, and Graduate Student Affairs; and the Topical Groups on Few-Body Systems, Precision Measurement and Fundamental Constants, Gravitation, Plasma Astrophysics, and Hadronic Physics.

In keeping with the more generalist tone of the April Meeting, ten exciting plenary talks will highlight the technical program.

Numerous special events are also planned for the April Meeting, including a high school physics teachers' day, a student career panel and networking reception, a students lunch with the experts, a "meet the APS journal editors" reception, the presentation of APS prizes and awards, a reception sponsored by the APS Committee on Minorities in Physics (COM) and Committee on the Status of Women in Physics (CSWP), and a special symposium celebrating the 50-year history of *Physical Review Letters*.

The Division of Particles and Fields has scheduled several special invited sessions and is planning evening sessions on the theme "A New Era in US Particle Physics." April Meeting program chair Natalie Roe pointed out that in the next few years, accelerators in the US will be shutting down, the Large Hadron Collider will be turning on, and planning is underway for the International Linear Collider. "It's a time of transition in particle physics," she said.

The abstract submission deadline is January 11; post-deadline abstracts received by February 8 will be assigned as poster presentations on a space-available basis. Early registration closes on February 22.

More information about the April Meeting: http://www.aps.org/meetings/april/index.cfm

Turning 50, PRL Plans a Banner Year

This year, *Physical Review Letters* celebrates its 50th anniversary. Special events as well as special features in the journal and online are planned.

PRL was first published in July 1958 when Editor Sam Goudsmit started the journal as an experiment. It took the brief contributions that would have been published as letters to the editor in *Physical Review*, and collected them in a separate journal in order to make important results available quickly.

"*Physical Review Letters* was the first letters journal, and it is still the best. The 50th anniversary is a great time to look back at the outstanding physics we've published in *PRL*, but also an opportunity for us to introduce some exciting new improvements on which we are working," said APS Editor-in-Chief Gene Sprouse.

50 years PRL moving physics forward

A number of activities are planned for *PRL*'s golden anniversary year, including special sessions and receptions at the March and April Meetings, a symposium and banquet on Long Island in June, and special events at several meetings around the world.

These sessions will include talks on the history and future of the APS journals, as well as talks about the history of the physics that has been published in the journals. At the March Meet-

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Panel Hears Pros and Cons Of Open-Access Publishing

By Calla Cofield

Open Access publishing was one topic of intense discussion at the November meeting of the High Energy Physics Advisory Panel (HEPAP), whose members advise the federal government on the national program in high energy physics (HEP). APS Editor-in-Chief Gene Sprouse addressed the general subject of Open Access and its relation to APS, and Salvatore Mele of CERN described SCOAP3, an Open Access model that is gaining steam in the European particle physics community.

Open Access initiatives began in the biological sciences community, and have been attracting interest in high energy physics. The high energy physics community has for years been making preprints freely accessible on the arXiv (http://arxiv.org), but papers posted there are not peer-reviewed. The purpose of Open Access, said Mele, is to "grant anybody, anywhere, at anytime access to peer reviewed, publicly funded HEP research."

At the HEPAP meeting, Sprouse said that he supports the principle of Open Access, but there needs to be a financially sustainable model.

Open Access programs have been available in different forms for years, and are already the basis of some physics journals. One APS journal, *Physical Review Special Topics–Accelerators and Beams*, is an online-only Open Access journal, funded by a consortium of large labs. *PR-STAB* is not quite recovering its costs, said Sprouse. In effect APS helps to sponsor this journal, but if the same level of loss were to occur in the 25 times larger journal, *Physical Review D*, it would not be sustainable. APS offers another form of Open Access in the journals *Physical Review A-E*, *Physical Review Letters*, and *Reviews of Modern Physics*. Anyone can pay a fee to make the article free for all to read on the APS website. However, only 30 out of about 18,000 papers have been purchased since the program started a year and a half ago.

The *European Physical Journal* has a similar program online. In November 2007, *EPJ* made its *European Physical Journal C–Particles and Fields* open access, to experimental papers only, without cost to the author, although it is still maintaining its regular subscription rates.

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APS Launches New Prize for Industrial Applications of Physics

APS is calling for nominations for its new Industrial Applications of Physics Prize. The Prize was approved by Council last spring, and will be awarded for the first time at the 2009 March Meeting. The selection process for the first Prize will take place in the spring and summer of 2008.

According to the description of the Prize, it is "awarded to an individual, or individuals, for applications of physics in an industrial setting. The purpose of the prize is to recognize excellence in the industrial application of physics, and thereby to publicize the value of physics in industry, to encourage physics research in industry, and to enhance students' awareness of and interest in the role of physics in commercial product development."

John Jaros, 2007 Chair of the APS Prizes and Awards Committee, said "This Prize is designed to attract not only physicists in larger companies, but also the increasing number of industrial physicists working in small companies and start-ups. The emphasis will be on

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Token of Appreciation

Photo by Ken Cole

A new tradition was inaugurated at the APS Council meeting in November, when Executive Officer Judy Franz (right) presented past-President John Hopfield with a bound volume of the minutes of the Board and Council meetings that he chaired in 2006, as a token of appreciation for all the services that he rendered to the Society during his Presidential term.

Council Calls for Reduced Greenhouse Gas Emissions

At its November meeting, APS Council passed a statement on global warming that calls for immediate action to reduce greenhouse gas emissions. The statement also calls for more research to better understand the effects of human activity on the climate. The complete text of the statement follows.

Emissions of greenhouse gases from human activities are changing the atmosphere in ways that affect the Earth's climate. Greenhouse gases include carbon dioxide as well as methane, nitrous oxide and other gases. They are emitted from fossil fuel combustion and a range of industrial and agricultural processes.

The evidence is incontrovertible: Global warming is occurring. If no mitigating actions are taken, significant disruptions in the Earth's physical and ecological systems, social systems, security and human health are likely to occur. We must reduce emissions of greenhouse gases beginning now.

Because the complexity of the climate makes accurate prediction difficult, the APS urges an enhanced effort to understand the effects of human activity on the Earth's climate, and to provide the technological options for meeting the climate challenge in the near and longer terms. The APS also urges governments, universities, national laboratories and its membership to support policies and actions that will reduce the emission of greenhouse gases.

Printing problem for APS News?

We have received complaints from some readers that their copies of the December issue were unreadable. We are asking anyone who had this problem to let us know by sending a message to apsprinting@aps.org. If you wish, you can request a replacement copy in the message and we'll be happy to send one to you.

Members in the Media

"Physicists love to nitpick, so for the 100 in the 10 million people who might watch the show, I try to get it as close to 100% accurate as I can. But if I try to suggest a funny line, there are all sorts of reasons it doesn't work."

***David Saltzberg**, UCLA, consultant for the CBS TV show The Big Bang Theory,* USA Today*, November 5, 2007*

"He played baseball and played it well. He didn't have a Russian accent. He spoke fluent English, American English. His credentials were perfect."

***Stewart Bloom**, Lawrence Livermore National Laboratory, on Soviet spy George Koval,* New York Times*, November 12, 2007*

"This discovery allows us to grasp complex food systems, providing new food science insights for enhancing the physical and functional attributes of food such as flavour, texture and nutrient delivery."

***Raffaele Mezzenga**, Nestlé Research Center, on a model that could help explain the texture and transport of flavors and nutrients in foods,* Food navigator.com*, November 12, 2007*

"What many people don't realize is how easy conservation is."

***Arthur Rosenfeld**, California Energy Commission, on energy conservation,* Boston Globe Sunday Magazine*, November 18, 2007*

"MIT used to be an ivory tower, like the Forbidden City in China."

***Walter Lewin**, MIT, on OpenCourseWare, which makes MIT course materials available online to anyone,* Pittsburgh Post-Gazette*, November 18, 2007*

"People always think that Einstein proved relativity was right. It was a very good concept that he had. Ingenious. But it needs to be verified."

***Gerald Gwinner**, University of Manitoba, on a test of Einstein's theory of special relativity,* The Ottawa Citizen*, November 12, 2007*

"The women started coming up to us, holding their babies, and said, 'Please help us build a school.' I was just amazed that in this remote village with no electricity, no plumbing, no toilets, they were talking about education. . . . I was overwhelmed by their courage and their ability to think in the long term."

***Alan Lightman**, MIT, on building a dormitory for Cambodian university women,* Boston Globe*, Nov.,19, 2007*

"In some ways, the most exciting stuff in space will be happening on the ground."

***Wendy Freedman**, Carnegie Institution, on next generation telescopes,* Boston Globe*, November 5, 2007*

"We found even tiny fragments of double helix DNA can spontaneously self-assemble into columns that contain many molecules. Our vision is that from the collection of ancient molecules, short RNA pieces or some structurally related precursor emerged as the molecular fragments most capable of condensing into liquid crystal droplets, selectively developing into long molecules."

***Noel Clark**, University of Colorado,* United Press International*, November 26, 2007*

"You must put yourself in the brain of the bird. We might be surprised, but animals have many types of senses that we just don't share."

***Klaus Schulten**, University of Illinois, on how birds sense magnetic fields,* Chicago Tribune*, November 25, 2007*

"This device could make discoveries that are Earth-shattering. We have an opportunity now to do some worthwhile fundamental science on the ISS, and they're resolutely turning their back on it."

***Steven Weinberg**, University of Texas at Austin, on the Alpha Magnetic Spectrometer,* Washington Post*, December 2, 2007*

"It's like rebuilding your car with pieces and after you think you've put it together, there's a giant piece still sitting on the curb, and it's about the size of the car itself."

***Adam Riess**, Johns Hopkins University, on dark energy,* Baltimore Sun*, December 2, 2007*

"If you have a fixed amount in a grant, and you have to spend it all on helium, you don't have anything left over."

***Reem Jaafar**, City University of New York, on helium shortages,* Wall Street Journal*, December 5, 2007*

"We saw these two scientists, one wearing a porkpie hat and one wearing a fedora, and they had the euphemisms of being 'Mr. Smith' and 'Mr. Jones.' It took us less than an hour to recognize in our physics books that one was Oppenheimer, the great theoretical physicist of our age, and the other was E.O. Lawrence, the great shaker of the nuclear project. We, of course, knew then that they were taking over the school to make a nuclear bomb."

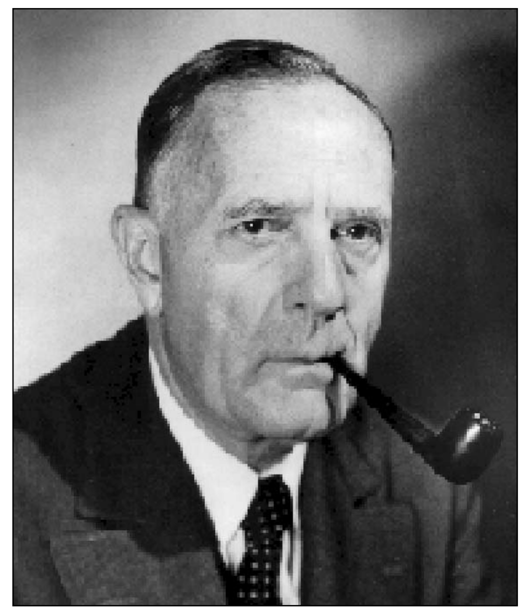
***Stirling Colgate**,* The Albuquerque Tribune*, November 30, 2007*

This Month in Physics History

Edwin Hubble expands our view of the universe

Until the mid 1920s, most scientists thought the Milky Way was the entire universe, and that the universe was static, unchanging. With two discoveries, announced in January 1925 and January 1929, astronomer Edwin Hubble radically changed our idea of the cosmos, showing first that the universe was much larger than previously thought, and second that it is expanding, getting larger and larger all the time.

Edwin Hubble was born in 1889 in Missouri. As a young man, he was tall and athletic, known especially for his talent at boxing, basketball, and track. He earned an undergraduate degree in math and astronomy at the University of Chicago, and then studied law at Oxford on a Rhodes scholarship, following his father's wishes. Hubble returned to the US and joined the Kentucky bar, but quickly decided law wasn't for him. He taught high school Spanish for a year before heading back to the University of Chicago to earn his PhD in astronomy in 1917. After serving in the Army in World War I, he went to southern California to work at the Mt. Wilson observatory, home of the 100-inch Hooker telescope, the largest in the world at the time.



In the early 1920s many astronomers believed that objects then known as nebulae were nearby gas clouds in our own galaxy, and that the Milky Way was the entire universe, while others thought the nebulae were actually more distant "island universes" separate from our own galaxy. Harlow Shapley and Heber Curtis had a famous debate on the issue in 1920 [see This Month in Physics History, April 2000 (available online)].

At Mt. Wilson, Hubble began measuring the distances to nebulae to try to resolve the issue, using a method based on an earlier discovery by Henrietta Leavitt. She had found that a type of star known as a Cepheid variable had a predictable relationship between its luminosity and its pulsation rate. Measuring the period of the star's fluctuations in brightness would give its absolute brightness, and comparing that with the star's apparent brightness would yield a measure of the star's distance.

Hubble found he was able to resolve Cepheid variables in the Andromeda nebula, showing that the nebula was in fact a separate galaxy rather than a gas cloud within the Milky Way. He also showed that the galaxy was much farther away than previously thought, greatly expanding our view of the universe. Hubble announced the finding on January 1, 1925 at a meeting of the American Astronomical Society in Washington DC.

Following the groundbreaking announcement, Hubble continued measuring the distances to far away astronomical objects, measurements that in a few years would lead to a discovery with even more radical implications for cosmology.

It was already known that nebulae appeared redder than they should be. Astronomers, notably Vesto Slipher, had found that the light from most nebulae was redshifted, indicating that most of the nebulae were receding at high speeds. But it wasn't understood why other galaxies would all appear to be moving away from us.

Hubble continued his meticulous astronomical measurements. He collaborated with Milton Humason, who had begun working as a janitor at the Mt. Wilson observatory, then rose to become a night assistant and then an assistant astronomer. Humason observed spectra, while Hubble concentrated on finding distances to various objects.

After collecting enough data points, Hubble and Humason found a simple linear relationship between an object's velocity and its distance from us. Hubble's law, as it is known, indicates that galaxies are moving away from each other at speeds proportional to their distance. Hubble's distance measurements turned out to be incorrectly calibrated, in part because he had failed to realize that there are actually two types of Cepheid variables, but Hubble's law still holds.

Hubble submitted a paper describing the velocity-distance relation to the Proceedings of the National Academy of Sciences in January 1929, and it was published in March (the paper is available online at: http://www.pnas.org/misc/Hubble.pdf). Hubble first plotted the trend using 46 galaxies, but in the next few years continued to collect data for many more galaxies, which added further confirmation.

In his paper, Hubble didn't discuss the implications of what he had found, perhaps preferring to leave the interpretation to theorists. He simply presented the empirical law relating galaxies' distance to their velocity. But others quickly recognized that Hubble's discovery indicated that the universe was expanding and that Hubble's observations provided the first observational support for what later became the big bang theory.

Scientists had been convinced that the universe was static. Einstein had even added a fudge factor known as the cosmological constant into his equations to make them consistent with a static universe. Although physicists Alexander Friedman and Georges Lemaître had independently proposed expanding universe models based on Einstein's equations, they had no data to support their theories, and were largely ignored until after Hubble's discovery. When Einstein saw that Hubble's results showed that the universe was expanding after all, Einstein famously called the cosmological constant the "greatest blunder" of his life.

Hubble became famous for his discoveries, and enjoyed partying with Hollywood celebrities. He continued to work in astronomy, but remained bothered by the fact that he was ineligible for the Nobel Prize because astronomy was not then considered a branch of physics. He later helped build the 200-inch Palomar telescope, and died in 1953, not long after it was completed.

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Washington Dispatch

A bi-monthly update from the APS Office of Public Affairs

ISSUE: Science Research Budgets

As of the deadline for *APS News*, there have been no new official developments with regard to the federal budgets for the key science research accounts (Department of Energy (DOE) Office of Science, National Science Foundation (NSF), National Institute of Standards and Technology (NIST), and NASA Science). However, the $1.4 billion in approved increases for these agencies are in danger of being lost as Congress rushes to finish the FY08 spending bills. Congress will have considered an omnibus bill that cuts $11 billion from the original bills passed in Congress, a bill the President has vowed to veto. For the latest updates on the FY08 bills please go to: http://www.aps.org/policy/issues/research-funding/index.cfm and http://www.aaas.org/spp/rd/approp08.htm.

You may recall, in August, the America COMPETES Act was passed by a wide, bipartisan margin, and it was seen as a positive step for science. As we stated then, the COMPETES Act only authorizes increases for basic research and education, budgets will increase only if appropriators fund the authorizations. It now looks like they will not fund the authorizations.

If Congress does not fund the increases, it will be near crippling for these research accounts. As many APS members know, the science budget has been operating on a continuing resolution for all of FY07, being funded at FY06 levels. The Washington Office is mustering all its resources to meet this serious challenge, but it will need the assistance of APS members. If you have not already done so, visit www.aps.org and click on the "Write Congress" link under "Quick Links;" this will send you to the APS Write Congress site, where you can voice your views on the matter to your Congressional delegation.

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

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ing, invited speakers include Gene Stanley, Charles Slichter and Marvin Cohen. At the April Meeting, invited speakers include Michael Turner and Michael Peskin. *PRL* editors will also speak at these sessions.

In the journal itself, a series of editorials written by *PRL* editors and guest editors will discuss some of the issues associated with publishing the journals, both in the past and today. Alternating with the editorials, *PRL* will print essays on the history of physics covered in *PRL*. Approximately one editorial or essay will appear every other week.

There are several motivations for these activities in celebration of *PRL*'s 50th anniversary, said *PRL* Managing Editor Reinhardt Schuhmann. "It's great for outreach, both to thank referees and contributors, and also to raise the profile of the journal," he said. "I think the main reason to do it is because it's actually very interesting to look back and to think about what issues we were facing in the early days of *PRL*," he said.

Schuhmann said he had noticed several things that struck him in looking through previous editorials. For instance, on *PRL*'s 25th anniversary, an editorial stated that Sam Goudsmit's "revolutionary idea" had been replacing hot metal type and letterpress printing with "cold" type and offset photolithography. "It's not really what we think of as the revolution of *PRL* now," said Schuhmann. However, while cold vs. hot type is no longer an issue, response to changing technology is always relevant for the journals.

A special website (http://prl.aps.org/50years), to be launched in early January, will also provide additional content and features for the 50th anniversary year. The site will include a timeline highlighting important events in the history of the *Physical Review* journals, with other events included for context. In addition, each week in 2008, the website will feature a few milestone *Letters* from each year of the journal's existence, starting with 1958. These entries will be compiled by former Editor-in-Chief Marty Blume, and will each include a short description of the paper and explain its significance.

Along with these enhancements for the 50th anniversary, some longer-lasting changes are underway with the Journal Innovations Initiative. "We're revamping our journal websites in general," said *PRL* Associate Editor Sami Mitra, who is working on journal innovations as well as the 50th anniversary website.

Bienenstock Highlights Funding, Education, and Journal Viability

Arthur Bienenstock (Stanford University) assumed the APS presidency on January 1, 2008. 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: Four interrelated issues are the most compelling to me. As you might imagine, the first is research funding. For the past 30 years, inflation-corrected funding for physical sciences and engineering research has remained essentially flat, hurting the physics community and the nation in ways we know well. The President and Congress have clearly recognized the need for significant funding increases, but it is not at all clear that appropriations will follow.

Also extremely important is the state of pre-college physics education. Only about one-third of high school physics teachers have a physics or physics education degree. If this situation is to improve, academic physics departments must work cooperatively with schools of education.

If the nation is to have the physicists and physics teachers we need, we must increase the number of physics majors significantly, including the participation of women and underrepresented minorities in these professions. The importance of women to the field is illustrated in part by AIP data that indicate that while the total number of people earning physics bachelor's went from about 5300 in 1972 to about 3700 in 1999 and then rose again to about 5000 in 2004, the numbers for women increased from about 400 to 1200 over the same period. Without the increased participation of women, the decrease from 1972 to 2004 would have been dramatic. Efforts to attract African-Americans and Hispanics have been considerably less successful.

The fourth issue is ensuring that our journals remain viable in the face of movements towards open access. It's vital to maintain the journals' peer review and editing systems. Finding financing for them within an open access system is difficult.

These are all endeavors in which the American Physical Society has been active prior to my becoming President, and my intention is to help push them along.

Q: Do you believe that APS has been on the right track in addressing these issues and serving the needs of the physics community?

A: Yes. I think APS is one of the finest professional societies in the world. It has a mixture of enhancing professional communications though its meetings and its journals and a much broader societal outlook that I think is marvelous.

Q: What areas do you plan to focus on during your presidential year? How will you guide APS efforts in these areas?

A: The four issues discussed in response to your first question will get much of my attention. These issues are not, of course, new and the APS has highly capable staff working on them. Mike Lubell and Steve Pierson of the Washington office deal with federal research funding, Ted Hodapp works on the teacher education and diversity issues, Alan Chodos heads our outreach efforts while Joe Serene and Gene Sprouse are concerned with financial impacts of open access for our publishing. I believe the President's roles are to represent the APS in some of the public aspects of these endeavors, advocate for them within the APS and in the broader community, help to gain additional resources where they needed, and ensure that these issues remain high on the priority list of the busy staff named above.

Arthur Bienenstock

The 21st Century Campaign for Physics and our alliance with the AAPT are particularly important for the education and diversity efforts. Much of my attention will be devoted to ensuring that the Campaign is successful in increasing funding for PhysTEC, PTEC and the Minority Undergraduate Scholarships Program, and that the AAPT relationship is enhanced.

As for the viability of the journals, I think that we should consider a future in which a funding mechanism is developed such that the journals just break even. I've asked APS Treasurer Joe Serene to study the implications of that for the APS' other activities.

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

A: First of all, we have to be advocates on matters that pertain directly to physics research and education such as research and education funding, visas and export control.

In addition, there are broader societal issues where physics can provide special understanding. The Panel on Public Affairs (POPA) has been particularly effective in defining and implementing studies that have had significant policy impacts. The three most recent, for example, *Challenges of Electricity Storage Technologies, Consolidated Interim Storage of Commercial Spent Nuclear Fuel,* and *Nuclear Power* and *Proliferation Resistance* have been well-received in Congress, contributed significantly to the debate and raised the status of our advocacy efforts. Other studies are underway, including one on energy efficiency. Clearly, we should continue on this path.

Q: One of the major activities of APS is publishing the journals. How do you view the health of the journals right now? What do you see as the main objectives for the journals in the near future?

A: We publish the best physics journals in the world at the best prices. We should be proud of them. As I said above, however, I think the biggest issue is how to deal with the increasing forces and opportunities for Open Access. We've got to find a viable financial model. That's going to take a mix of our own planning and influencing public policy. I think it's critical that we maintain a valid editing process that includes reviewing. And that's expensive. Open Access, in the forms that have been suggested so far, hasn't come to terms with that. We've got to find an approach that works.

Q: Is APS doing a good job of serving the needs of its members?

A: As far as I can tell, yes. The meetings and the journals are superb –and the Society keeps trying to improve both.

Q: What do you see as the role of the Society in the international arena?

A: First of all, we must advocate for a return to a situation in which this nation is attractive for international meetings and international facilities. That means constantly working for improvement of the visa policies and practices. In spite of all the improvements that the State Department and Homeland Security have made in the visa systems since the initial reactions after 9/11, there is still a perception around the world that we are not open to visitors–that it is hard to get into this country. Amy Flatten, APS Director of International Affairs, has been working effectively along these lines.

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

A: First of all, because I was asked. Second of all, because so many of the APS goals were consistent with my own goals. I spoke about how research funding has been a constant issue. I've worked on that for 15 or 20 years in one way or another. I have over 30 years of working to increase participation of women and underrepresented minorities. As I said, I recognize the need for improving education at the pre-college level as well as the college level. So the Society's goals are well aligned with my personal goals, and I saw an opportunity to work with the Society to further those goals.

Q: How did you become interested in physics?

A: I went to an engineering school, the Polytechnic Institute of Brooklyn. I was turned towards physics by a graduate student, J. Lawrence Katz, who taught freshman physics. I had other goals at the time–I had expected to be the engineer on a kibbutz in Israel–but physics really got me excited. Then in my senior year, I was offered a research assistantship, and for the first time, I worked on a problem where the answer wasn't known. And I got hooked. Then the excitement of being a physicist just continued through graduate school. I would say the most influential thing was that participation in research as an undergraduate.

Q: Is there a need to attract more people into physics? How can we best do that?

A: Physicists play a variety of roles in the society, including researchers in academia, government and industry, radiation physicists, financial analysts and teachers.

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Letters

Did We Do That on Purpose?

Let's see, here, in Joy of Teaching [*APS News*, November 2007], our Nobel Laureate Wolfgang Ketterle cannot get a (fictional) job teaching, in spite of his prize and his obvious qualifications.

Then in The Curse of Knowledge, Carl Wieman, also a winner of that very Nobel Prize, comments that a deep and clear understanding of the fundamentals of physics, and a deep and clear understanding of how physics knowledge is acquired, are completely orthogonal areas of expertise.

Did you do that on purpose?

Let us also point out that the group of people we need to train to do outstanding physics, and the group of people who need, at the age of 16, to find out that: science is not magic, it is fundamental to our society, and they can make informed decisions about the priority of science–these tend to be orthogonal groups of people, as well.

Christine Platt
Isssaquah, WA

* * * * *

I found it amusing that the November 2007 Back Page article by Carl Wieman, on why professional physicists are generally not good educators, supports the reluctance of a fictitious high school to let Wolfgang Ketterle (with whom Wieman shared the 2001 Nobel Prize) teach their students (in the Lighter Side of Science column of the same issue).

Scott Willenbrock
Urbana-Champaign, IL

* * * * *

Did anyone else note the curious coincidence of the "Zero Gravity" and "The Back Page" pieces in the November 2007 *APS News*? Carl Wieman argues eloquently that physicists don't necessarily know how to teach physics, and as a matter of fact their intuitions about how to do so may be quite wrong. W.R. Marshall pokes fun at a mythical school board for not immediately accepting Wolfgang Ketterle as a high school physics teacher. Doesn't this assume that by virtue of his undoubted abilities as a physicist the Nobel Prize winner automatically would be a good physics teacher? And doesn't this exactly contradict what Wieman is saying? (I confess I have no idea whether or not Ketterle is a good teacher; I am talking about what appears to be an automatic assumption.)

And I have no idea what to make of the fact that Wieman shared the Nobel Prize in 2001 with Ketterle (and Eric Cornell). Am I missing some deep message by the editors of *APS News?*

Fred Kuttner
Santa Cruz, CA

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The November issue of *APS News* contained an important Back Page article by Carl Wieman about teaching and learning physics, and a sarcastic Zero Gravity column by W. R. Marshall making fun of the state requirements for licensing teachers. I hope that readers will pay close attention to the former article and take the latter article with a huge barrel of salt. I personally think that scientists should not be offended by a requirement that they should be taught how to teach and how students learn. As I am preparing to transition from industrial work to high school teaching, I am taking the training offered by a local teacher licensure program. I value the education I am receiving about how to teach and how students learn. I do not assume that because I know my field, I know how to teach it to novices. I think that colleges, universities and private schools should take a lesson from the public schools and require that all professors, lecturers and teachers receive teacher training. As can be seen fromWieman's article, the assumption that a knowledgeable scientist knows how to teach his or her knowledge to others is false.

Thomas Wofford
Albuquerque, NM

Biblical Narrative Leads to Progress

In the October *APS News*, a letter by Mike Strauss was given the heading "Biblical Creation Has Lots of Wiggle Room." "Wiggle room" means "room to maneuver, latitude" and has a negative connotation. I would use a more positive heading, for instance "Biblical Narrative on Creation encourages us to be Free." Free to study the cosmos without having to worship the sun or the moon or the earth. Free "to till and keep the Garden of Eden." Many scientists have been inspired by this freedom to investigate the universe. Of course in a long history opinions have been modified, sometimes drastically. That is also true for physics and astronomy; but there we always call the change from older to newer concepts, "progress" and not "wiggling."

Piet Van der Laan
Eindhoven, Netherlands

Physics Olympiad is of International Interest

I enjoyed your report on the Physics Olympiad [*APS News*, October 2007], but, as many APS members don't reside in the US, or do but have strong international links, I think it would be of wide interest to publish a table showing the medal outcomes for all the participating countries.

Bob Dewar
Canberra, Australia

Editor's Note: *American media are often criticized for focusing too narrowly on American Olympic athletes, and we may have fallen into the same trap. However, there were 37 gold medal winners, 46 silver, and 51 bronze, while 81 participants received honorable mention, so there was scarcely room for us to do them all justice. Interested readers can scan the complete tables at http://www.ipho2007.ir/Results/results.asp.*

Physics Majors Enjoy Broad Career Choices

In regard to the article and letters in recent issues of *APS News* about increasing the number of physics graduates:

Why do we need more physics graduates? Certainly not because there are want ads in the paper that read "Wanted–physicist" or letters in the personal columns that start "Looking for that special someone, must be able to solve Schrodinger equation." We all agree, there are very few job descriptions outside of national labs and academia for physicists. That is unlikely to change any time soon and there is little APS can do about it. However, how many technical and scientific jobs are filled by physicists?

Surprisingly, quite a few! Most physics majors wind up doing work that falls outside of the traditional realm of a physics course of study. I'm not talking about physics majors in disguise as chemists, materials engineers, laser jocks, or such. I'm talking about people trained as physicists doing very non-physics related work: doctors, lawyers, economists, etc.

Does the fact that a number of our students wind up not doing physics mean we need to change our curriculum to meet and foresee their needs? No! A physics degree is one of the most challenging courses of study. It attracts students by virtue of its intellectual and mathematical rigor and it is precisely that sort of training that make a physics major a very attractive commodity to any potential employer. Certainly, we should try to pull in modern developments into courses where possible. Physics is an evolving discipline, but we should not sacrifice the intellectual rigor of the physics discipline to simply boost numbers. That would dramatically undermine our field by populating it with less qualified and poorly trained people calling themselves "a physicist".

One of the more impressive (and least known) statistic that points to the success of physics majors going on to non-physics related graduate studies is that physics majors consistently out-perform chemistry and biology majors on the MCAT exam. So, want to increase your chances in going to Med School? Be a physics major. Want to increase your chances in going to law school? Be a physics major.

Eric Bittner
Houston, TX

Ed. Note: APS News *has been running a series of articles, "Profiles in Versatility," that highlights people trained as physicists who have pursued a wide variety of careers. These can be viewed online at www.aps.org/publications/apsnews/features/profiles.cfm.*

More Trained Teachers Won't Solve The Problem

I have been thinking about the recent "traffic" in *APS News* triggered by Leo Kadanoff's "On the Responsibiliities of APS," first printed last August and reprinted in October. As someone who has been actively involved in science education outreach since 1979, when I entered graduate school, I believe that education is an important part of the mission of the APS. However, I am perplexed by the call to double the number of physics undergraduate majors while guiding them toward teaching ("...and a wide variety of other occupational goals"). It is true that many physics teachers in public high schools are not principally trained as physics teachers, and many are, as a consequence, ill-prepared to teach the subject. But this has less to do with a lack of available, qualified candidates than it does with the reality in most schools that there are too few students taking physics to justify full time physics teachers. Consequently, schools often wind up using chemistry or other science teachers to cover the small number of physics classes. I personally know of several excellent physics teachers who were not trained initially to teach physics, although each has invested a significant amount of effort to learn the subject since being assigned to teach it. And I know many qualified physicists, some with advanced degrees, interested in teaching high school physics who cannot find full time career positions because full time, public high school physics teaching positions simply don't exist even in many of our best high schools.

I wonder if APS and the AAPT have considered this reality before deciding to push for a doubling of physics undergraduates to expand the ranks of qualified high school physics teachers?

Rick Moyer
San Diego, CA

Two-phase Approach to Energy Independence

With reference to Byron Dorgan's Back Page, December 2007 *APS News*: I believe the Senior Senator has a reasonable handle concerning the effect of Global Oil Supply Strategies on our national security. A dual phase approach seems warranted to handle the two major issues:.

1. Phase 1 Energy Independence Technology: Time is running out on our ability to survive as a Nation with global oil supplies managed by people with interests oposed to our interests. We do have a substantial reserve of coal in our country. The technology to convert that fuel to liquid form has been available for decades. A crash program of R and D and pilot demonstrations to perfect oil-from-coal technology could give us breathing time as we avoid the potential blackmail of the oil producers and threats from those who do not wish us well. Stressing alternative-fuel source development programs that are directed to the short term objective of threat avoidance is not the desired way to manage our magnificent planet, but without an effective international body to oversee duel distribution our options at national survival are very limited .

2. Phase 2 Energy Technologies: Development of conservation and extreme efficiency devices is progressing but is taking a very long time. As the interim independence program proceeds, the share of funding shifts into the Phase 2 efforts and gradually we reduce the carbon fuel dependence.

To use a phrase currently in vogue in television: "I am NOT smarter than a 5th term Senator" but I do not see the national leadership placing the proper priorities on the urgency required our survival.

Jerome Eckerman
Potomac, MD

Michelson's Polish Roots

Not only out of national pride but also in keeping with historical evidence, I would like to correct a mistake in "This Month in Physics History" in the November *APS News*. Albert Abraham Michelson was born in 1852 in Strzelno, a small and very old town, which at that time was occupied by Prussia during the partitioning of Poland; he was born neither in Germany, as stated in the article, nor in Prussia, as is commonly written in his biographies on the Internet. He was born to a Jewish-Polish family; his father was a Jewish merchant from the nearby town of Inowrocław, and his mother, Rozalia Przyłubska, was the daughter of a Polish merchant in Strzelno.

For his whole life Michelson was proud of his Polish roots. Many years after his death his daughter, Dorothy Michelson-Stevens, asked the Nicolaus Copernicus University in Toruń (birthplace of Copernicus, thirty miles from Strzelno) to identify the place of her father's birth, the name of which she knew only in a misspelled version. In the local archives in Strzelno it was found that Michelson indeed was born there. The members of the Toruń chapter of the Polish Physical Society then decided to commemorate this finding with a plaque, written in Polish, which states: "In this town, on December 19, 1852, Albert Abraham Michelson was born; Professor at the University of Chicago, Nobel Prize Laureate. With his famous experiments on the velocity of light he started a new era of development of physics. This plaque, which salutes this great physicist, was funded by the Polish Physical Society."

Lidia Smentek
Nashville, TN, and
Toruń, Poland

Workshop Brings Inspiration, Information to New Faculty

More than 80 new physics and astronomy faculty attended a workshop held November 8-11 at the American Center for Physics in College Park, MD. The annual New Faculty Workshop, hosted by the American Association of Physics Teachers in conjunction with APS and the American Astronomical Society, helps new faculty understand how students learn physics and how that knowledge can be used to improve teaching methods.

The workshop, now in its 12th year, is designed for faculty in the first few years of their first tenure track appointment at a four year college or university.

Small-group sessions and discussion allowed participants to exchange ideas. The workshop "gives them the opportunities to explore what people have done," said Toufic Hakim, AAPT Executive Officer.

The workshop featured several large group sessions on topics such as research in physics education, peer instruction, interactive lecture demonstrations, assessment and evaluation, helping students develop problem-solving expertise, and getting students to prepare for class.

Photo by Ken Cole

Mario Belloni of Davidson College leads a breakout session on teaching and modeling using physlets and open source physics at the 2007 workshop for new physics and astronomy faculty.

Participants also attended small group workshops on topics including active learning with real time physics; Physlets and Open Source Physics; digital libraries; tenure matters and time management; problem solving; and Quantum Interactive Learning Tutorials. Additional small group sessions focused on introductory physics, upper level physics, and astronomy. Separate sessions were also held for faculty from bachelor's, master's, and PhD granting institutions.

Speakers included Lillian McDermott, Peter Shaffer, and MacKenzie Stetzer (University of Washington), Eric Mazur (Harvard University), David Sokoloff (University of Oregon), Ronald Thornton (Tufts University), Edward Prather (University of Arizona), Karen Cummings, (Southern Connecticut State University), Evelyn Patterson (U.S. Air Force Academy), Ken Heller (University of Minnesota), and Jim Stith, (American Institute of Physics).

Workshop participant Tatiana Toteva of Randolph College in Lynchburg, VA said the workshop gave her new "enthusiasm for teaching." "While I am really impressed with the effectiveness of the methods that were presented, it is really the enthusiasm of the presenters, and how much they care about their students' learning, that inspires me to follow in their footsteps," said Toteva.

For some, the workshop was an eye-opening experience. Workshop participant Barry Zink of the University of Denver said, "I traveled to DC having already taught a year of calculus-based introductory physics, with what I felt were reasonably good results, and good evaluations from students… I felt the teaching part of the job was probably most under control. The New Faculty workshop convinced me that I was wrong, I probably hadn't taught my students much either! Though it might seem hard to imagine, this was a positive thing, as I feel I came away with many ideas on how to improve my students' understanding of physics that I can implement in the limited time available," said Zink.

Although professors may not be able to make significant changes in the way they teach based on one short workshop, "we planted the seed," said Hakim. He has noticed that over time, workshop participants are coming in more aware of the newer teaching methods, having been exposed through others who have adopted those methods. "The effort that we've put in for the last 12 years is starting to pay off," said Hakim.

ITER, ITER Everywhere at 2007 DPP Meeting

The International Thermonuclear Experimental Reactor (ITER) currently under construction is the next big step in achieving fusion energy. As such, it is fueling many new advances in plasma physics research that are relevant to magnetic confinement, including methods to suppress plasma instabilities and periodic bursts, as well as control losses due to leakage. Such advances were among the highlights of the 49th annual meeting of the APS Division of Plasma Physics (DPP), held November 12-16 in Orlando, Florida. With more than 1500 physicists in attendance, it is one of the largest divisional meetings of the Society.

Plasma antenna

This year, the DPP reprised its popular Plasma Sciences Expo on November 15-16, an outreach program designed to engage the local Orlando community with plasma physicists via lively hands-on demonstrations. Participants created arcs of lightning, observed their fluctuating body temperature on a special monitor, manipulated a glowing plasma with magnets, and learned how to confine a plasma in a fusion device by playing a video game. Local teachers attended morning and afternoon workshops about plasma science on Tuesday, November 13, gleaning tips on how to bring the study of plasma into their classrooms. Throughout the week, plasma scientists also visited local schools.

Other technical highlights included the latest research on plasma wakefield accelerators, plasma-based antennas, new models for how magnetic reconnection may drive the solar wind, and using plasmas as an amplifying mechanism in lasers. In addition to the plasma education program and the official DPP banquet, the annual DPP soccer match took place midday on Wednesday, November 14, pitting teams from the East and the West against each other.

Controlling Plasma Bursts. Recent experiments at the DIII-D tokamak fusion research lab at General Atomics in San Diego, California, used controlled chaotic magnetic fields to demonstrate that the theory of magnetic island overlap can be used as the basis for designing specialized magnetic coils that will eliminate large periodic bursts of plasma in future fusion reactors. Such bursts can cause significant erosion of the material surfaces in tokamak power reactors, so eliminating them is a critical step toward making fusion power a reality. Described as "small archipelagos in a chaotic magnetic sea," these magnetic islands essentially create an escape route that relieves plasma pressure gradually, preventing plasma eruptions.

In related work, new computer simulations of experiments at the Alcator C-Mod tokamak at MIT are shedding light on why filling the chamber with a dense cloud of gas (such as neon, argon, or krypton) as a disruption begins can re-

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INTERNATIONAL News

...from the APS Office of International Affairs

Shaping the Future of Physics in South Africa

Simon Connell, Nithaya Chetty, and Harm Moraal

This is the first article in a two-part series focusing on the expanding physics scene in South Africa. The second article will present growing opportunities for international collaborations in physics in South Africa.

Notable South African contributions to physics have been made in the past. With the advent of democracy in 1994, new opportunities arose due to the several-fold broadening of the participation in the science system. As the previous system wound down by the turn of the millennium, physicists had become concerned with declining levels of funding, the red-shifting of the age profile of productive scientists, and the poor appreciation of the role of physics in society and for development by the public.

The South African Institute of Physics (SAIP), a learned society established in 1955, together with the Department of Science and Technology (DST) and the National Research Foundation (NRF) initiated a project in 2001 which came to be known as "Shaping the Future of Physics" (SFoP). The four most recent generations of SAIP Council Presidents in particular contributed hugely to this enterprise. The time scales were long to ensure community buy-in via a solid foundation based on individual, regional and national consultation processes. The process was guided by South Africa's National Research and Development Strategy. A core feature was a carefully selected panel of four international and three local recognized experts, who were in session for two weeks from April 19, 2004.

This International Panel (IP) produced a forward-looking and comprehensive 110-page report (see www.saip.org.za/ShapingTheFuture.html) in April 2004. One of the panelists, Jim Gates (University of Maryland), was later to write "The report of the IP … may be one of the most consequential activities of my life." The report made fourteen recommendations as part of a strategy to revitalize South African Physics. It currently is the most significant driver shaping the agenda of the SAIP and will be so for some years to come.

The SAIP solicited comments on the report from the stakeholder community. These comments were processed and synthesized, and by July 2005 a set of mini-business plans to guide the implementation of all fourteen recommendations was submitted to the DST. In some cases, the implementation has been dramatic, and directly attributable to the SFoP process. In others, the recommendations were interdisciplinary in nature, and so are linked to other initiatives. Here the SFoP has catalyzed and stimulated positive developments.

Meanwhile a non-numbered recommendation for the establishment of a full-time SAIP secretariat with a permanent address was treated more urgently and separately. A crowning glory of the process is that this secretariat, in a fixed office in the newly constructed DST governmental building in Pretoria, started operating on January 1, 2008. The inaugural position of Executive Officer has recently been filled, and an office assistant and marketing coordinator are to be appointed. This office will greatly facilitate the SAIP's mission to be the voice of physics in South Africa.

A new targeted program of quality improvement in secondary-level education has been established. It involves annual workshops for university lecturers who train secondary school teachers in physics. This is supplemented by a program for the development of resource material for teacher training in specific areas.

The IP was specifically concerned about financial barriers and challenges of integration of students of different cultures in undergraduate and graduate education. Of relevance here is a short-term financial support program for Women in Physics. Specific programs, such as theoretical physics, nano science, astronomy, and programs based at National Facilities, have benefited from much improved bursaries. However, the much-too-small (post) graduate bursaries for general university programs is still a crucial shortcoming that is high on the agenda of the NRF. There are several inter-institutional programs and specific recruitment drives at the honors level. These lead to a very significant crossing of demographic barriers. The composition of the postgraduate student membership of the SAIP has now evolved to reflect the racial demographics of the country.

To promote the marketing of physics in industry, a new program by the Applied Physics group of the SAIP is developing an electronic database of industrial physicists to attract students to the ap-

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Salt Lake City Hosts 2007 DFD Meeting

Physicists specializing in fluid dynamics research are interested in a wide range of problems, from the morphodynamics of rivers and microfluidic arrays to the collective swimming patterns of microorganisms and how certain insects can walk on water. Those were just a few of the technical highlights at the annual meeting of the APS Division of Fluid Dynamics, held November 18-20 in Salt Lake City, Utah.

Microfluidic Shock Waves. An important technique for micrlofluidic lab-on-a-chip assays is capillary electrophoresis, and researchers are always seeking to improve the sensitivity of this technique. The best way to do this is to include an online sample preconcentration method. At Stanford University, Juan Santiago and his colleagues are developing methods to concentrate ions into small volumes using isotachophoresis (ITP), in which sample ions are injected between the high-mobility co-ions of a leading electrolye and the low mobility co-ions of a trailing electrolyte.

Applying an electric field causes sample species to segregate and focus into a series of narrow zones. "We use ITP to create sample ion concentration 'shock waves' in microchannels," says Santiago. "These concentration waves can be integrated with on-chip electrophoresis for high-sensitivity assays." The ultimate goal is to develop novel on-chip ITP assays which expand the design space of microfluidic devices.

Flowing Like a River. The flow of water over sediment or bedrock can create a wide range of beautiful patterns, from dunes and sand bars to alluvial fans and canyons. According to Gary Parker (University of Illinois), the key to the formation of these morphologies is an interaction between the fluid flow and the erodible boundary of the sediment and bedrock. "The flow changes the boundary via differential erosion/deposition, and the boundary changes the flow by offering a modified bed boundary condition," he says.

Parker studied turbidity currents: bottom-hugging currents driven by the presence of sediment in suspension, which makes the water in the flow heavier than the ambient water. By simplifying the fluid mechanics by ignoring all temporal terms except the one describing the evolution of the boundary, he found that a single mathematical formulation provides an explanation of the features formed by swift fluid flow in mountain bedrock streams, gullies, steep alluvial river flows, and in the deep ocean.

A Bug's Life. Researchers in MIT's Department of Mathematics are looking to the world of arthropods–insects and spiders –for insights into better, biologically-inspired approaches to water repellency and fluid transport on a very small scale. MIT's John Bush described his group's work on water-walking arthropods and their ability to survive when submerged by virtue of a thin air bubble wrapped along their rough exteriors. "The diffusion of dissolved oxygen from the water into the bubble allows it to function as an external lung, and enables certain species to remain underwater indefinitely," he said. They have also explored how such arthropods use their tilted flexible leg hairs to generate thrust, glide, and leap along a free surface, like water.

Swimming With Microorganisms. Since the 1980s, there has been much interest among fluid dynamicists in the collective behavior of swimming microorganisms in suspension. The cells are denser than the water in which they swim, giving rise to unusual bioconvection patterns. Even more interesting structures form in concentrated suspensions of bacteria, for example, and the prevailing hypothesis is that such structures emerge from purely hydrodynamic interactions between cells. Timothy Pedley of the University of Cambridge described one such model "in which cells are represented as inertia-free 'spherical squirmers,' whose behavior is dominated by near-field hydrodynamics."

Fluids in the Classroom. A critical element in introductory fluid mechanics courses is teaching students to realize that mathematical models don't always model the real world very well. According to Arizona State University's Ronald Adrian, one effective way to teach them the difference is to have them model a simple experiment, then run it and compare the results of the model with the experimental results. "It would be even better if these experiments were simple enough that students could do them at home, rather than have a canned two-hour lab course," he says. He is collecting such experiments for use in undergraduate or even K-12 classes, in hopes of building "a community of educators that want to move beyond the traditional mathematical exercises for homework."

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While various Open Access programs are being tried on a small scale, CERN has conceived a large-scale OA project called SCOAP3, which it is pursuing vigorously.

SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics) is a type of Open Access that relies on a consortium made up of national governments around the world. Funding would come from contributions from government agencies, laboratories, universities, and private companies. The consortium would cover the cost of maintaining peer-review journals in particle physics, and thus make the papers freely accessible to the public. Libraries would cancel their journal subscriptions and contribute to the SCOAP3 consortium instead. SCOAP3 would apply to all publishers, both commercial and not-for-profit.

At the HEPAP meeting, Mele, the project leader for Open Access at CERN, listed various countries in North America, Europe, and Asia that have already expressed support for the project. He confirmed that 25% of the necessary funds to run SCOAP3 have been pledged, with at least 15% more on the way. Mele said the goal is to have SCOAP3 operational in time for the first papers from the Large Hadron Collider.

The majority of articles in high energy physics are published in just six peer-reviewed journals. Since a large portion of research in HEP is published in *Physical Review D* or *Physical Review Letters*, an initiative such as SCOAP3 would strongly affect APS.

While supporting the principle of Open Access, Sprouse explained that APS has concerns about the sustainability of SCOAP3. With *Physical Review* journal prices already set at near cost, any fluctuation in funding could cause major tremors for APS. Sprouse emphasized that SCOAP3 would have to show not only that the financial support is there, but also that it will continue. There is large pressure on library budgets, and SCOAP3's request for voluntary contributions will be competing with real needs to get other journals, and there will be no loss of access to the OA journals if the libraries stop contributing.

"[APS] has a responsibility to publish good physics in all fields and to do this we have to remain financially viable. The prospects for long term support must be strong," said Sprouse.

Several questions about SCOAP3 were raised at the HEPAP meeting. One potential issue with the SCOAP3 plan is that large publishing companies with high journal prices might not see an advantage to switching to SCOAP3 if it means receiving less money. Mele believes that publishers who do not join the SCOAP3 initiative, if it is launched, will see a significant decline in their readership.

Audience members also raised the question of whether universities and colleges in the US will be inclined to contribute funds to SCOAP3 if they have free access available. Mele says that if SCOAP3 contribution costs are set significantly lower than subscriptions to journals, he believes smaller universities will want to contribute to the Open Access system they are benefiting from.

Audience members also expressed concern that in many national governments, federal funds are not easily re-directed. Mele agreed, but reemphasized the support that governments have already shown.

There is also worry that while SCOAP3 might force large publishers to lower the price of HEP journals, they will simply increase the price of other journals, and that SCOAP3 will have no real impact on inflated journal prices overall. While APS journal prices are relatively low, some libraries have complained about high prices charged by large for-profit scientific publishers.

Sprouse said he is open to SCOAP3 if it can be shown to be sustainable and reversible. "If these conditions are met we'd be open to OA on our site," he said. For now, APS will continue its current Open Access offerings and its efforts to keep subscription prices down.

Council Remembers Wolfgang Panofsky

Photo courtesy of www-conf.slac.stanford.edu

At its November meeting, APS Council passed a memorial resolution on the death of Wolfgang K. H. "Pief" Panofsky, founding director of SLAC and APS President in 1974. Panofsky died in September at the age of 88. The text of the resolution follows.

The Council of the American Physical Society notes with great sadness the death of Wolfgang K.H. Panofsky of Stanford University. He leaves a legacy of research in particle physics, the accelerator he built, and his work for nuclear arms control and international peace. He was Director of the Stanford Linear Accelerator Center from its inception in 1961 until his retirement in 1984. He received both the National Medal of Science, in 1969, and the U.S. Department of Energy's Enrico Fermi Award, in 1979. He was a Fellow of the American Physical Society and served as its president in 1974. Dr. Panofsky was on the President's Science Advisory Committee during the Eisenhower, Kennedy and Johnson Administrations. Influenced by his work on the Manhattan Project, he was involved with the Atmospheric Test Ban Treaty during Kennedy's tenure and the Anti-Ballistic Missile Treaty in 1972. Following his retirement, he participated in the National Academy of Science' Committee on International Security and Arms Control, serving as its chairman from 1985 to 1993. The Council expresses its deep appreciation for his participation in the work of the Society and conveys its sincere sympathy to his family and many friends around the world.

Meeting Briefs

The weekend of October 19-20 was a busy one for APS regional sections, five of which held their annual fall meetings during that time. To wit:

• The **APS Texas Section** held its annual fall meeting at Texas A&M University in College Station, Texas. Harvard University's Dudley Herschbach kicked off the meeting with a talk on Einstein's theory of specific heats, followed by Stanford University's Douglas Osheroff, who discussed how advances in science are made. Other invited topics included the physics of diving (in both English and Spanish), industrial physics, new prospects in high energy and nuclear physics, and film absorption on carbon nanotube bundles. Fred Jerome and Roger Taylor were the after-dinner banquet speakers, with a presentation on Eintsein's views on race and racism. The talk was followed by a trip out to the Texas A&M Observatory so attendees could participate in some night sky observations.

• The **APS Ohio Section** held its annual fall meeting at Miami University of Ohio in Oxford, Ohio, organized around the theme of doing front-line research with undergraduate students. Invited speakers included Elizabeth McCormack of Bryn Mawr, who discussed student learning and development in photo-physics research, while MU's William Rauckhorst talked about how he is creating a research–rich curriculum at that institution. Rainer Grobe discussed undergraduate physics research at Illinois State University, and Bethel University's Richard Peterson rounded out the invited talks by discussing student and faculty perspectives on advanced laboratory experiences. Following Friday evening's banquet, Susan Marie Frontczak performed her one-woman drama, "A Living History of Marie Curie."

• The **APS Northeastern Section** held its annual fall meeting at the University of Connecticut in Storrs, Connecticut. The technical program focused on the theme of carbon in the 21st century and featured invited talks on carbon nanotubes, fullernes and graphene, as well as presentations on the physics of music and global warming.

Friday evening's banquet speaker was Harold Kroto of Florida State University, who spoke about architecture in nano-space. The meeting was held in conjunction with the UC-Storrs Institute of Science Bio-Nanotechnology Conference, which was held just prior to the kickoff of the NES meeting, and featured talks on carbon nanotube FET-based biosenors, CNT interactions with biological systems, and using CNTs to better amplify cancer biomarkers for ultra-sensitive immunodetection.

• The **APS Four Corners Section** held its annual fall meeting at Northern Arizona University in Flagstaff, Arizona. In addition to plenary talks on such topics as quantum key distribution, the history of Lowell Observatory, and quantum mechanics and the equivalence principle, there were numerous invited talks on subjects ranging from gravitational waves, path integral simulations for nanoelectronics, and helium in metals, to meteors, single molecule electronics, and polar oxide interfaces. Friday evening's keynote banquet speaker was William Stoeger of the Vatican Observatory, who dis-

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plied fields.

The public understanding of physics is to be addressed by the marketing coordinator in the new SAIP Office. Components of the program include a mobile Physics Pavilion and an annual conference to promote linkages between physicists active in outreach and the science centers. There was a very strong and successful participation in the World Year of Physics in 2005.

A new South African Research Network was announced in March 2007 by the Minister of Finance. It is hoped this will also facilitate implementation of a National Research Digital Library.

Several new flagship projects are established or envisaged. The Southern Africa Large Telescope of the SA Astronomical Observatory already has international acclaim, and it is supported by a highly successful inter-institutional National Astronomy and Space Science Program for postgraduate training. The KAT/MeerKAT/SKA suite of new astronomical projects has received a tremendous financial boost. The new National Institute for Theoretical Physics, headquartered in the Stellenbosch Institute for Advanced Studies and with regional facilities in Johannesburg and Durban, is now a reality. A program to promote science at synchrotrons has been underway for several years. The Pebble Bed Modular Reactor program is dramatically increasing its linkages with research and teaching institutions. The SA-CERN consortium program will promote access to the CERN facility. A new well-resourced Research Chair Program, as well as a Centres of Excellence scheme by the DST has increased the capacity of the universities and other research institutions to attract back to our shores South African physicists working abroad. This is supplemented by various equipment and mobility programs.

The Shaping the Future of Physics project was conceived at a time of great concern about the state and future of physics in South Africa. This process has greatly contributed to the current state of significant optimism, based on tangible outcomes on many the concern areas as described above. It will still take time, however, to address the shortfall of younger experienced physicists. Efforts must be intensified to recruit, educate and retain physicists in South Africa, building on our achievements and growing the collaborative networks locally and internationally. All these initiatives are undertaken in the most positive climate for the recognition of the role of science, and the strongest financial support from the government in many decades.

Nithaya Chetty is at the School of Physics, University of KwaZulu-Natal, and is the current SAIP president; Simon Connell is at the School of Physics, University of the Witwatersrand, and SAIP president-elect; Harm Moraal is at the School of Physics, North-West University, and a recent SAIP past-president.

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cussed the mutually beneficial interaction of science and religion in contemporary society. The meeting also featured a tour of the historic Lowell Observatory.

• Finally, the **APS New York State Section** held its annual fall meeting at Skidmore College in Saratoga Springs, New York, organized around the theme of geographical and astrophysical perspectives on the structure and formation of planets. Speakers addressed such topics as impact craters on Venus and Mars, shock waves in protoplanetary disks, terrestrial and planetary radio emissions, and meteorites as evidence for solar system formation. Friday evening's banquet was followed by a public lecture featuring Robert Zubrin of Pioneer Astronautics, author of *The Case for Mars*, who spoke on the prospects for human travel to the "Red Planet" within the next 10 years.

• Daring to be different, the **APS California Section** held its annual fall meeting the following weekend, October 26-27, at Lawrence Berkeley National Laboratory (LBNL). Invited speakers included Steve Chu and George Smoot, both Nobel laureates and both affiliated with LBNL, who spoke about the promises and challenges of biofuels and cosmology, respectively. Donald Glaser of University of California, Berkeley, discussed how noise helps vision, while UC Santa Barbara's Walter Kohn spoke on solar power, and Hope Ishii of Lawrence Livermore National Laboratory gave a talk on comet dust.

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innovation and cutting edge technology, and it is not necessary for the work recognized by the Prize to have already achieved commercial success."

In order to encourage a broad spectrum of nominations, the selection process has been divided into two parts. Preliminary nominations are due by April 1, for which the nominator need only submit, via a web-form, a single document of no more than 1000 words, with an optional supporting letter of up to 500 words from a second individual. Self-nominations are encouraged.

The selection committee will review the preliminary nominations, and choose a small number of finalists, who will be invited to submit more elaborate nominations by July 1. From among these finalists, the committee will recommend the recipient to the APS Executive Board.

The Prize consists of a certificate and a $10,000 stipend. It will be given biennially, alternating with a pre-existing prize of the same name given by the American Institute of Physics. The AIP prize has traditionally gone to physicists in larger companies, and emphasizes commercial impact. Both the APS Prize and the AIP Prize are supported by grants from General Motors.

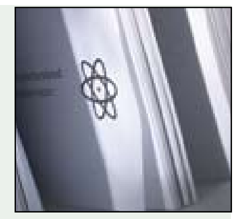
More information about the Prize can be found at http://www.aps.org/programs/honors/prizes/industrial.cfm.

ANNOUNCEMENTS

Inside Inside the Beltway

Readers of "Inside the Beltway" in the December *APS News* may have noticed that the first five and a half paragraphs were, inadvertently, repeated. We apologize for any confusion this may have caused.

Manhattan Project Session at the April 2008 APS Meeting



On **Sunday, April 13, 2008 at 10:30 AM** there will be a session devoted to the Manhattan Project, particularly Los Alamos during the war years 1943-45.

There will be two invited talks, by Val Fitch, who was a member of the Special Engineering Detachment, U.S. Army, and Cynthia C. Kelly, who is President of the Atomic Heritage Foundation, and Editor of the just-published book *The Manhattan Project*.

Los Alamos alumni of that period are invited to attend the session, and to participate in a panel discussion (space permitting) that will take place after the two invited talks. Those alumni whom we have not yet contacted are urged to email one of the session organizers: Ben Bederson, ben.bederson@nyu.edu or David C. Cassidy, chmdcc@optonline.net, or write to Ben Bederson, Physics Department, 4 Washington Pl., New York NY 10003. Contributed papers concerning that period are also welcome.

Now Appearing in RMP: Recently Posted Reviews and Colloquia

You will find the following in the online edition of *Reviews of Modern Physics* **at http://rmp.aps.org**

Spins in few-electron quantum dots

R. Hanson, L.P. Kouwenhoven, J.R. Petta, S. Tarucha and L.M.K. Vandersypen

This review describes experiments on single-electron spins confined in quantum dots, which are nanometer-scale boxes defined in a semiconductor host material. Explanations of the underlying physics and the discussion of electrical characterization and manipulation of single and double quantum dot systems containing one or two electrons enable a comprehensive understanding of single spin dynamics in a solid-state environment.

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move the plasma's heat and protect the device's walls from damage. The new simulations show that injected neon gas does not penetrate deeply into the plasma, and yet the cooling of the surface leads to instabilities that destroy good magnetic confinement in the plasma center. As a result, the plasma's heat is conducted rapidly from the center to the surface, where it is absorbed and then radiated by the neon. More detailed simulations should determine whether the gas injection technique can also prevent the formation of intense beams of high-energy electrons that are sometimes generated during disruptions.

Plasma in a Bottle. Fusion researchers build magnetic bottles to keep their 100 million C plasmas hot and dense by keeping them away from contact with the cold surrounding walls. A tokamak confinement device (donut-shaped magnetic bottle) is particularly effective, but all such devices experience leakage, degrading fusion performance. Plasma physicists at MIT are studying the physical mechanisms that drive such losses, and have found that fusion plasmas tend to build up pressure in their boundary to a critical value, spilling material sporadically outside their magnetic container–a dynamical behavior akin to avalanches, which occur when snow piles up on a mountainside. This provides strong evidence that electromagnetic turbulence plays the key role in regulating the plasma's leakage through the surface of the bottle.

Catching a Plasma Wave. Plasma wakefield accelerators (PWFAs) can double electron energy in just one meter, compared to full-scale accelerators such as the one at Stanford Linear Accelerator Center (SLAC), which requires about two miles to achieve similar energy levels. That's the latest finding of a collaboration of scientists from SLAC, the University of California, Los Angeles (UCLA), and the University of Southern California (USC). They also discovered that electrons from the plasma can be trapped in the wake and exit the plasma in a bunch, resulting in very high energies and brightness.

The SLAC/UCLA/USC collaboration is now preparing its next experiments, which will focus on demonstrating the acceleration of an electron bunch with a narrow energy spread. The researchers also hope to demonstrate the acceleration of positrons to high energies in plasma. Taken together, these advances could one day contribute to the miniaturization of future linear colliders.

Plasma-Amplified Lasers. Researchers from Princeton University, Princeton Plasma Physics Laboratory, and the University of California, Berkeley, have experimentally demonstrated an ultrashort pulse laser system using a plasma as the amplifying medium, which can support much stronger electric fields and is less vulnerable to optical damage than the standard chirped-pulse-amplification method. The plasma-based laser achieved an unprecedented pulse intensity amplification of 20,000 times in a plasma length of just 2 millimeters, accompanied by very effective pulse compression: from 500 to 90 femtoseconds in a single pass, reduced further to 50-60 femtoseconds in a two-pass version of the experiment. Further improvements to the energy transfer efficiency are currently underway, bringing this compact, tabletop plasma laser system close to becoming a practical device.

A Mighty Solar Wind. Scientists believe magnetic reconnection is the primary mode by which the solar wind couples to the terrestrial magnetopshere, driving phenomena such as magnetic storms and aurorae. The theory of 2D reconnection is well-developed and has been successfully applied in lab-based plasma experiments and fusion devices, but is not suitable for application to systems like the Earth's magnetosphere. The 3D theory of magnetic reconnection is less well developed. John Dorelli of the University of New Hampshire described his latest magnetosphere MDH simulation results. He has used this approach to identify two qualitatively distinct types of reconnection phenomena: steady separator reconnection involving plasma flow across magnetic separatrix boundaries, and time-dependent reconnection involving a global change in the topology of the magnetic field.

"Smart" Plasma Antennas. Igor Alexeff of the University of Tennessee maintains that plasma antennas are just as effective as metal antennas, and in addition can transmit, receive and reflect lower frequency signals while being transparent to higher frequency signals. When de-energized, they electrically "disappear." New technologies include a novel technique to reduce noise, and a method of opening a plasma window in a plasma microwave barrier on a much smaller time scale (microseconds, compared to milliseconds). Alexeff reports testing an intelligent plasma antenna that is garnering strong commercial interest. The method involves finding a radio transmitter by creating an azimuthally-rotating plasma "window" in a circular plasma barrier surrounding an antenna. When located, a computer locks onto the transmitter. Once the transmitter is de-energized, the plasma window begins scanning again.

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In many of these roles, there is a significant shortage. If we are to attract more people into physics, we must work to improve physics education at the pre-college and college levels and increase the number of students participating in undergraduate research experience programs. I'm really pleased to see the expansion of the undergraduate research experience. I have become convinced that we must increase our cooperation with the American Association of Physics Teachers (AAPT) to make this happen. PhysTEC, PTEC and the New Faculty Workshops are all highly regarded programs. We must reach more people with them as the 21st Century Campaign increases our resources for that purpose.

The Back Page

The Highest Aim of the Physicist

By Henry A. Rowland

***Editor's Note**: Henry A. Rowland, one of the few great 19th-century American physicists, was born 160 years ago. He was the first President of the American Physical Society, and the following is adapted from his presidential address, delivered at the second meeting of the Society on October 28, 1899. In some sense, it is a statement of the founding principles of APS. Of course, a lot has changed in more than 108 years. For example, readers may find the exclusive use of the male pronoun by Rowland grating. But one must remember that he was speaking in the language of 1899. His discussion of the impotence of the physician in the face of mortal illness is particularly poignant, because he knew he was dying of diabetes, a disease to which he succumbed less than a year and a half later. The treatment of diabetes by injection of insulin would not be discovered for another 20 years.*

The complete text of Rowland's address is available at www.aip.org/history/exhibits/gap/PDF/rowland_aim.pdf.

In a country where the doctrine of the equal rights of man has been distorted to mean the equality of man in other respects, we form a small and unique body of men, a new variety of the human race, as one of our greatest scientists calls it, whose views of what constitutes the greatest achievement in life are very different from those around us. In this respect we form an aristocracy, not of wealth, not of pedigree, but of intellect and of ideals, holding him in the highest respect who adds the most to our knowledge or who strives after it as the highest good.

Let us cultivate the idea of the dignity of our pursuit, so that this feeling may sustain us in the midst of a world which gives its highest praise, not to the investigation in the pure etherial physics which our society is formed to cultivate, but to the one who uses it for satisfying the physical rather than the intellectual needs of mankind. He who makes two blades of grass grow where one grew before is the benefactor of mankind; but he who obscurely worked to find the laws of such growth is the intellectual superior as well as the greater benefactor of the two.

The progress of every science shows us the condition of its growth. Very few persons, if isolated in a semi-civilized land, have either the desire or the opportunity of pursuing the higher branches of science. Even if they should be able to do so, their influence on their science depends upon what they publish and make known to the world. A hermit philosopher we can imagine might make many useful discoveries. Yet, if he keeps them to himself, he can never claim to have benefited the world in any degree. His unpublished results are his private gain, but the world is no better off until he has made them known in language strong enough to call attention to them and to convince the world of their truth.

Thus, to encourage the growth of any science, the best thing we call do is to meet together in its interest, to discuss its problems, to criticise each other's work and, best of all, to provide means by which the better portion of it may be made known to the world. Furthermore, let us encourage discrimination in our thoughts and work. Let us recognize the eras when great thoughts have been introduced into our subject and let us honor the great men who introduced and proved them correct. In choosing the subjects for our investigation, let us, if possible, work upon those subjects which will finally give us all advanced knowledge of some great subject. I am aware that we cannot always do this: our ideas will often flow in side channels: but, with the great problems of the Universe before us, we may sometime be able to do our share toward the greater end.

What is matter; what is gravitation; what is ether and the radiation through it; what is electricity and magnetism; how are these connected together and what is their relation to heat? These are the greater problems of the universe. But infinitely smaller problems we must attack and solve before we call even guess at the solution of the greater ones.

When it comes to exact knowledge, the limits are far more circumscribed. How is it, then, that we hear physicists and others constantly stating what will happen beyond these limits? Take velocities, for instance, such as that of a material body moving with the velocity of light. There is no known process by which such a velocity can be obtained even though the body fell from an infinite distance upon the largest aggregation of matter in the Universe. If we electrify it, as in the cathode rays, its properties are so changed that the matter properties are completely masked by the electromagnetic.

It is a common error which young physicists are apt to fall into to obtain a law, a curve, or a mathematical expression for given experimental limits and then to apply it to points outside those limits. This is sometimes called extrapolation. Such a process, unless carefully guarded, ceases to be a reasoning process and becomes one of pure imagination specially liable to error when the distance is too great.

It is a curious fact that, having minds tending to the infinite, with imaginations unlimited by time and space, the limits of our exact knowledge are very small indeed. In time, we are limited by a few hundred or possibly thousand years: the limit in our science is far less than the smaller of these periods. In space, we have exact knowledge limited to portions of our earth's surface and a mile or so below the surface, together with what little we can learn from looking through powerful telescopes into the space beyond.

In temperature our knowledge extends from near the absolute zero to that of the sun, but exact knowledge is far more limited. In pressures we go from the Crookes vacuum still containing myriads of flying atoms, to pressures limited by the strength of steel, but still very minute compared with the pressure at the center of the earth and sun, where the hardest steel would flow like the most limpid water. In velocities, we are limited to a few miles per second. In forces, to possibly 100 tons to the square inch. In mechanic rotations to a few hundred times per second.

All the facts which we have considered, the liability to error whatever direction we go, the infirmity of our minds in their reasoning power, the fallibility of witnesses and experimenters, lead the scientist to be specially skeptical with reference to any statement made to him or any so-called knowledge which may be brought to his attention. The facts and theories of our science are so much more certain than those of history, of the testimony of ordinary people in which the facts of ordinary history or of legal evidence, or of the value of medicines to which we trust when we are ill, indeed to the whole fabric of supposed truth by which an ordinary person guides his belief and the actions of his life, that it may seem ominous or strange if what I have said of the imperfections of the knowledge of physics is correct.

How shall we regulate our mind with respect to it? There is only one way, and that is to avoid the discontinuity of the ordinary. There is no such thing as absolute truth or absolute falsehood. The scientific mind should never recognize the perfect truth or the perfect falsehood of a supposed theory or observation. It should carefully weigh the chances of truth and error and grade each in its proper position along the line joining absolute truth and absolute error.

The ordinary crude mind has only two compartments, one for truth and one for error; indeed, the contents of the two are sadly mixed in most cases. The ideal scientific mind, however, has an infinite number. Each theory or law is in its proper compartment, indicating the probability of its truth. As new fact arrives, the scientist changes it from one compartment to another so as, if possible, to always keep it in its proper relation to truth and error. Thus, the fluid nature of electricity was once in a compartment near the truth. Faraday's and Maxwell's researches have now caused us to move it to a compartment nearly up to that of absolute error. So the law of gravitation within planetary distances is far toward absolute truth, but may still need amending before it is advanced farther in that direction.

The ideal scientific mind, therefore, must always be held in a state of balance which the slightest new evidence may change in one direction or another. It is in a constant state of skepticism, knowing full well that nothing is certain. It is above all an agnostic with respect to all facts and theories of science, as well as to all other so-called beliefs and theories.

Yet it would be folly to reason from this that we need not guide our life according to the approach to knowledge that we possess. Nature is inexorable; it punishes the child who unknowingly steps off a precipice quite as severely as the grown scientist who steps over, with full knowledge of all the laws of falling bodies and the chances of their being correct. Both fall to the bottom and in their fall, obey the gravitational laws of inorganic matter, slightly modified by the muscular contortions of the falling object, but not in any degree changed by the previous belief of the person.

Natural laws there probably are, rigid and unchanging ones at that. Understand them, and they are beneficent: we can use them for our purposes and make them the slaves of our desires. Misunderstand them and they are monsters who may grind us to powder or crush us in the dust. Nothing is asked of us as to our belief: they act unswervingly and we must understand them or suffer the consequences. Our only course, then, is to act according to the chances of our knowing the right laws. If we act correctly, right. If we act incorrectly, we suffer. If we are ignorant, we die. What greater fool, then, than he who states that belief is of no consequence provided it is sincere.

An only child, a beloved wife, lies on a bed of illness. The physician says that the disease is mortal; a minute plant called a microbe has obtained entrance into the body and is growing at the expense of its tissues, forming deadly poisons in the blood or destroying some vital organ. The physician looks on without being able to do anything. Daily he comes and notes the failing strength of his patient, and daily the patient goes downward until he rests in his grave. But why has the physician allowed this? Can we doubt that there is a remedy which shall kill the microbe or neutralize its poison? Why, then, has he not used it?

The answer is ignorance. The remedy is yet unknown. The physician is waiting for others to discover it, or perhaps is experimenting in a crude and unscientific manner to find it. He is employed to cure but has failed. His bill we cheerfully pay because he has done is his best and given a chance of cure. Is not the inference correct, then, that the world has been paying the wrong class of men? Would not this ignorance have been dispelled had the proper money been used in the past to dispel it?

Such deaths some people consider an act of God. What blasphemy to attribute to God that which is due to our own and our ancestors' selfishness in not founding institutions for medical research in sufficient number, and with sufficient means, to discover the truth. Such deaths are murder.

Thus, the present generation suffers for the sins of the past, and we die because our ancestors dissipated their wealth on armies and navies, in the foolish pomp and circumstance of society, and neglected to provide us with a knowledge of natural laws. In this sense, they were the murderers and robbers of future generations of unborn millions, and have made the world a charnel house and place of mourning where peace and happiness might have been. Only their ignorance of what they were doing can be their excuse, but this puts them in the class of boors and savages who act according to selfish desire and not to reason and to the calls of duty. Let the present generation take warning that this reproach be not cast upon it, for it cannot plead ignorance in this respect.

This illustration from medicine I have given because it appeals to all. But all the sciences are linked together and must advance in concert. The human body is a chemical and a physical problem, and these sciences must advance before we can conquer disease.

But the true lover of physics needs no such spur to his action. The cure of disease is a very important object and nothing can be nobler than a life devoted to its cure. The aims of a physicist, however, are in part purely intellectual: he strives to understand the Universe on account of the intellectual pleasure derived from the pursuit, but he is upheld in it by the knowledge that the study of nature's secrets is the ordained method by which the greatest good and happiness shall finally come to the human race.

Where, then, are the great laboratories of research in this city, in this country, nay, in the world? We see a few miserable structures here and there, occupied by a few starving professors who are nobly striving to do the best with the feeble means at their disposal. But where in the world is the institute of pure research in any department of science with an income of $100,000,000 per year? Where can the discoverer in pure science earn more than the wages of a day laborer or cook? But $100,000,000 per year is but the price of an army or of a navy designed to kill other people. Just think of it, that one percent of this sum seems to most people too great to save our children and descendants from misery and even death.

But the 20th century is near–may we not hope for better things before its end? May we not hope to influence the public in this direction?

Let us go forward, then, with confidence in the dignity of our pursuit. Let us hold our heads high with a pure conscience while we seek the truth, and may the American Physical Society do its share now and in generations yet to come in trying to unravel the great problem of the constitution and laws of the Universe.

APS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org