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APS physics

April Prize and Award Recipients
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Chinese Human Rights Advocate Receives APS Sakharov Prize

Physicist Liangying Xu has been awarded the 2008 Andrei Sakharov Prize by the APS for his efforts to promote human rights in China. Inspired by Albert Einstein, Xu has been a lifetime advocate for democracy, free speech, human rights, and academic freedom.

Xu's son, Chenggang Xu, accepted the prize on his behalf at the April Meeting in St. Louis because Xu is in his eighties and not healthy enough to travel. At a session and press conference, Chenggang Xu described his father's lifelong struggles to promote human rights despite persecution.

"Both Sakharov and my father followed the steps of Einstein, not only in physics but also in promoting human rights," said Chenggang Xu. The Sakharov prize is named for the Soviet physicist, dissident and human rights activist Andrei Sakharov.

Born in 1920, Liangying Xu was first inspired by Einstein's views on democracy and human rights when he read Einstein's essays in school. In 1939, Xu enrolled in Zhejiang University to study physics. Troubled by the plight of poor peasants he saw in the countryside, he joined the communist party. After completing his studies, Xu joined the Chinese Academy of Sciences in Beijing, where he has been a historian of science.

In 1957, Xu spoke up against Mao Zedong's repressive government. He was then denounced as an "extreme rightist," forced to divorce his wife, and banished to the countryside. He later reunited with his wife.

While in exile, Xu translated Einstein's political, philosophical and scientific writings into Chinese.

During the Cultural Revolution, the Red Guards, considering Einstein's work anti-Marxist, confiscated Xu's translations and other writings. Xu did eventually get the translations back, and they were published beginning in 1975, as the Cultural Revolution was ending. Soon after, Xu rejoined the Academy of Sciences in Beijing.

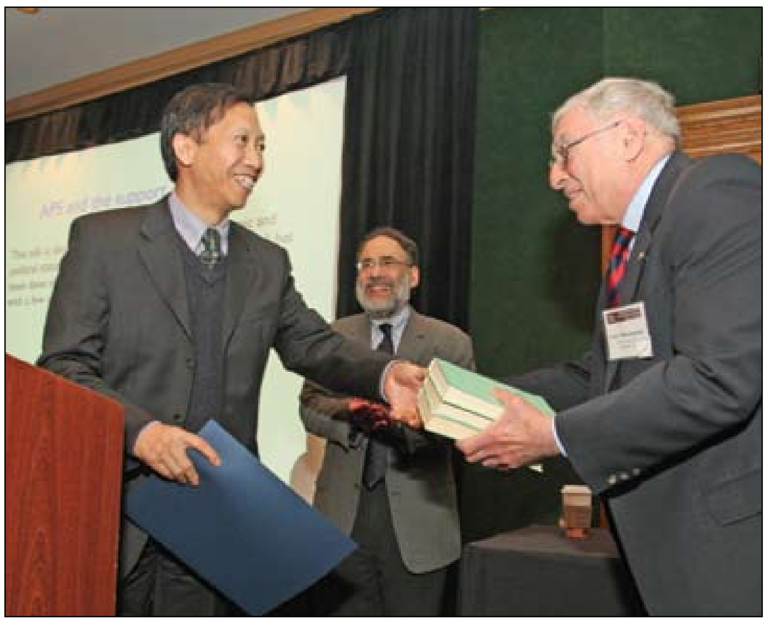

Photo by William Greenblatt

At the ceremonial prize session at the APS April meeting, Chenggang Xu (left) presents APS President Arthur Bienenstock (right) with a copy of the three-volume Chinese translation of Einstein's collected works that was produced by his father, Sakharov Prize recipient Liangying Xu. Looking on is APS Associate Executive Officer Alan Chodos.

Throughout his life, Xu continued to advocate for human rights. In 1981, he cited Einstein on the need for freedom of speech for scientific progress. Xu felt the government was not adequately supportive of basic science, and that more academic freedom was needed both for scientific progress and for human progress.

In 1989, astrophysicist Fang Lizhi wrote an open letter calling for the release of political prisoners. At the same time, Xu and friends wrote an open letter calling for democracy, protection of human rights, and free speech. The letter was signed by prominent dissidents, including many scientists. This and Fang's let-

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Workshop Attendees Get the Lowdown on Politics

About eighty scientists and engineers picked up some pointers on how to run for public office at a recent campaign education workshop in Washington. Organized by Scientists and Engineers for America, the workshop took place May 10 at Georgetown University, and was also sponsored by APS and several other scientific societies.

There is increasing need for scientific input into policy issues, and although scientists may be interested in becoming involved in politics, they tend to be unfamiliar with the campaign process. Speakers at the workshop covered the basics of how to run a campaign, as applied to offices ranging from local school board to Congress.

One question on some participants' minds was how much political experience is needed to run for office.

"None," answered speaker

Photo by Brian Mosley

Dean Levitan makes a point to workshop participants.

Dean Levitan of MHSC Partners, who has managed many successful campaigns. In fact, nowadays people are tired of politicians, and are looking for candidates with a different background, he said. "The American public is starving for a new kind of leadership," said Levitan. Voters "want to know that you're competent and capable, but you don't necessarily need political experience to show that," he said. A scientist or engineer can show that they have expertise on relevant issues.

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Physics of Homeland Security is Focus of NE Section Meeting

By Ernie Tretkoff

Ways in which physics can contribute to homeland security were discussed at the joint APS-AAPT spring New England section meeting, held April 4-5 at the Coast Guard Academy in New London, CT.

Alessandro Curioni of Yale said that some of the same gamma-ray detection technology being developed for astronomy could be used for homeland security. For security purposes, one might want to measure energy, direction, time and polarization of gamma rays. "The same problem is encountered in medical applications, biology, materials science and nonproliferation, and security," said Curioni. Many current gamma ray detectors for homeland security typically just count gamma rays, but don't measure their energy, so it can be difficult to distinguish harmless radioactive materials from dangerous ones.

One difficulty in detecting gamma rays for any purpose is that "there is no good focusing optics for

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APS Flips for PhysicsQuest

By Calla Cofield

It's been said that physicists never do anything the easy way, and the APS Outreach Department is no exception. To randomly select a grand-prize winner for its annual PhysicsQuest contest for middle school classes, APS abandoned the traditional method of drawing raffle tickets, and randomly generated a binary number by flipping a coin. Each of the 1032 eligible classes was assigned an 11-digit binary number in the order they submitted their answers. A coin was flipped for each digit–each heads representing a one and each tails representing a zero.

To make things even more interesting, APS recruited some very special coin flippers–the kids at the American Center for Physics daycare center. The well-behaved youngsters flipped their quarters as best they could (though most simply threw them in the air), and were then told to hold their hands over the coins as the results were recorded. Because most of the numbers (anything under 1024) began with a zero, there was a good chance that a "heads" flip in the first spot would generate a number too large, and all coins would have to be flipped again. It only took two tries to get 00010111100, or, number 188: Jan Aschim's 4th period 8th grade class from Rockford, Illinois. To spare the kids from a whole afternoon of coin flipping, the five runner-up classes were chosen using an online random number generator.

The students in the winning class will all receive iPod Shuffles, along with some fun science gadgets from Educational Innovations. Five runner-up classes will also receive science gadgets for each student and a

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Navigating the Universe

Photo by Brian Mosley

In conjunction with the April Meeting, the APS sponsored a public lecture that took place at the Saint Louis Science Center. The speakers were Joel Primack and Nancy Abrams, and they talked about "The View from the Center of the Universe." They are the authors of a book of the same name. Although he is standing on solid ground, in the picture Primack seems to float through the cosmos as he is captured in silhouette against the backdrop of a video presentation that took the audience through a speeded-up tour of the nearby universe.

Members in the Media

"This is a Nobel Prize-winning result if it is proved. But it needs to be confirmed, and the experiment really has to demonstrate a total mastery of the data. Neither of those criteria have been achieved, and therefore you have to bring a healthy skepticism to the result as it stands."

***Richard Gaitskell**, Brown University, on the DAMA collaboration announcement that they have observed evidence for dark matter,* Los Angeles Times*, April 19, 2008*

"I have all the lifetime miles I need. I don't need any more."

***Kevin Lesko**, Lawrence Berkeley National Laboratory, on having to travel to Canada or Japan to conduct research that he will soon be able to do at DUSEL,* Associated Press*, April 27, 2008*

"I don't see anything to suggest this is propaganda. They seem to be working on an advanced machine."

***Houston G. Wood**, University of Virginia, on new photos of Iran's nuclear reactor,* The New York Times*, April 29, 2008*

"Maybe there is a compass in the eye of birds, and a map in their beaks."

***Thorsten Ritz**, University of California, Irvine, on how birds use magnetic fields to navigate,* Washington Post*, May 5, 2008*

"There are at least 15 theoretical models out there, and most of them are pure guesses,"

***Warren Pickett**, University of California, Davis, on a new class of superconductors,* Christian Science Monitor*, May 7, 2008*

"You could drop it."

***Zeina Jean Jabbour**, NIST, on reasons for trying to redefine the standard kilogram, which is still based on a physical object,* Los Angeles Times*, April 17, 2008*

"This is a real geek fest."

***Terry Schalk**, University of California, Santa Cruz, on the Maker Faire in San Mateo, CA,* The New York Times*, May 13, 2008*

"If most of your world is water, you'd better know something about water. If nearly all of the universe is something we know nothing about, we'd better learn everything we can about it."

***Daniel McKinsey**, Yale University,* Argus Leader*, May 1, 2008*

"If you cared about money you wouldn't be a scientist at all, would you."

***John Womersley**, Science and Technology Facilities Council, answering a student concerned about pursuing a career in science, given the funding situation for science in the UK,* BBC News online*, April 9, 2008*

"We'll compare the images we get tonight with all the accumulated images of the same part of the sky on other nights and look for what's there now that wasn't there before. This is how we are going to find killer asteroids and a few million other solar system objects. It will be the greatest movie ever made."

***Zeljko Ivezic**, University of Washington, on the Large Synoptic Survey Telescope,* Discover Magazine*, May 13, 2008*

"I'm typically using several hundred processors. For the biggest projects, the calculations take months."

***Jacques G. Amar**, University of Toledo, on his research on far from equilibrium processes that uses the Ohio Supercomputer Center,* The Columbus Dispatch*, April 29, 2008*

"There are not that many alternatives."

***Klaus Lackner**, Columbia University, on his idea for vacuuming carbon dioxide out of the atmosphere,* Los Angeles Times*, April 29, 2008*

"Our universe will not be affected by what you do in the past."

***Ronald Mallett**, University of Connecticut, on time travel,* The Boston Globe*, May 12, 2008*

"I'm trying to do this without money because I think money corrupts the whole thing,"

***David Maker**, running for Congress,* The Huntsville Times*, May 13, 2008*

This Month in Physics History

June 1798: Cavendish weighs the world

In June 1798 Henry Cavendish reported his famous measurement of Earth's density. A great chemist and physicist, Henry Cavendish (1731-1810) was obsessive, extremely shy, and eccentric. He was known for wearing clothes that were 50 years out of style. He avoided company, especially fearing women. He took walks at night to avoid beings seen by neighbors, and even had an extra staircase installed in his house to avoid meeting his servants on the stairs.

Elements of this odd personality undoubtedly made him a great scientist, capable of dedicating himself to making extremely precise measurements where others would lose patience. He liked to build and rebuild scientific instruments, always trying to improve them. He was extremely methodical, systematically ruling out various sources of error, never satisfied that the work was complete.

Henry Cavendish

Like many scientists at the time, Henry Cavendish was an aristocrat, and had inherited enough money to finance his chemistry and physics experiments. He turned much of his house into a laboratory, dedicating only a small portion of the house to living space.

Among his many experiments, he is most famous for what is now called the Cavendish experiment, which he used to determine the density of Earth.

Newton had published his law of gravitation in 1687, but he hadn't made any attempt to determine the constant G or the mass of Earth. By the 1700s, astronomers wanted to know the density of Earth, as it would make it possible to determine density of the other planets. In addition, as the New World was being explored and territory being claimed, surveyors needed to know the density of Earth. In 1763 Mason and Dixon set out to settle a boundary dispute between Maryland and Pennsylvania. Cavendish wondered how precise their measurements could be. He realized that the Allegheny Mountains would exert a slight pull on their surveying equipment, possibly affecting their measurement, but he didn't know how large the effect would be. This led him and others to wonder about the averaged density of Earth itself.

In 1772 the Royal Society set up a "Committee of Attraction" to determine the density of Earth. Some people had proposed measuring this by finding a very uniformly shaped mountain and measuring how much it deflected a plumb bob. Since gravity is so weak, this would be a tiny effect, but the committee, including Cavendish, nonetheless tried it, using a large mountain in Scotland. They came up with a value for the density of Earth of about 4.5 times the density of water. But they had made assumptions that Cavendish thought unfounded.

He considered the problem for years, until in 1797, at age 67, he began his own experiments. He started with a torsion balance apparatus given to him by his friend, the geologist Reverend John Michell, who had been interested in doing the experiment himself but wasn't able to carry it out before he died. Realizing that Michell's equipment was inadequate to measure the tiny gravitational force between two small metal spheres, Cavendish set about tinkering until he had a more precise setup.

He built a large dumbbell, with two-inch lead spheres stuck to the ends of a six-foot long wooden rod. The rod was suspended from a wire held at the center, and was free to rotate. A second dumbbell with two twelve-inch lead spheres weighing 350 pounds each was then brought near the first so that the large spheres would attract the smaller ones, exerting a slight torque on the suspended rod. Cavendish would then painstakingly watch for hours to observe the rod's oscillations.

This would provide a measure of the gravitational force of the larger spheres on the smaller ones. And since the density of the spheres was known and the gravitational attraction between Earth and the spheres could be measured by weighing the spheres, the ratio the two forces could be used to determine Earth's density.

Since the gravitational force between the spheres is so weak, the tiniest air current could ruin the delicate experiment. Cavendish placed the apparatus in a closed room to keep out extraneous air currents. He used a telescope to observe the experiments through a window, and set up a pulley system that made it possible to move the weights from outside. The room was kept dark to avoid temperature differences in different parts of the room affecting the experiment.

Cavendish relentlessly tracked down potential sources of error. He rotated the spheres in case they had picked up some magnetization. He observed the attraction of the rods without the spheres on the ends. He tried different types of wire to support the apparatus.

After agonizing over every possible complicating factor, Cavendish finally reported his results in June 1798 in a 57-page paper in the Transactions of the Royal Society entitled *"Experiments to Determine the Density of the Earth."* He reported that the density of Earth was 5.48 times the density of water. (The currently accepted value is 5.52).

Others later repeated the experiment, using similar apparatus, and for almost a century no one achieved any improvement over Cavendish's original measurement.

Today Cavendish's experiment is viewed as a way to measure the universal gravitational constant G, rather than as a measurement of the density of Earth. Using updated measuring apparatus but the same basic setup, physics students and scientists today often perform Cavendish's experiment, which is still recognized as one of the most elegant physics experiments of all time.

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After the Particles, it's Power to the People for Physicist-turned-Politico Bill Foster

By Alaina G. Levine

Congressman Bill Foster wants YOU for the US Government.

"It's very important for scientists to inject themselves into the bureaucracy," the freshman Representative from Illinois says, "and for the scientists who choose to do that to be given full respect by the scientists in the academic world."

Congressman Foster (D-IL) can talk. A physicist who worked at Fermilab for 22 years, he propelled himself head first into the bureaucracy earlier this year when he ran for Congress in a special election after the seat in his district (which includes Fermilab) was vacated by House Speaker J. Dennis Hastert.

Four days after being elected and literally one day after being sworn in, he was asked to cast the deciding vote in favor of House ethics reform. "This had been stuck in Congress for most of the year and passed by a single vote after I joined," he explains. "So afterwards I was being slapped on the back by House leadership saying, 'Bill, this is fantastic–we could not have passed this without you.'"

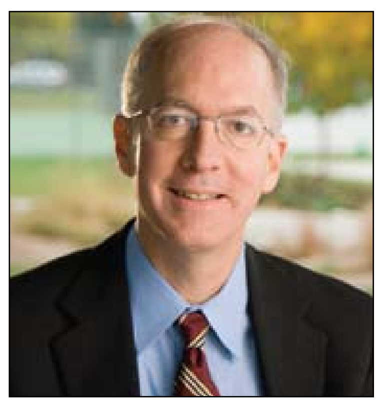
So Bill, 52, got his first reward for having selected a new career in politics–the joy of knowing he made a difference. "Experiences like that make it hard for me to feel useless," he says. He wants to know that he is a "useful cog in the machine," and in just a few short months in office, he has gotten that chance. Recently, he cast a vote in favor of establishing Occupational Safety & Health Administration (OSHA) standards for explosive dust. "As a result of that vote, I am fairly confident that 10 years from now there are going to be many people that are alive because of that vote," he says.

But he has also felt joy from his other career as a physicist, and before that, as a businessman and entrepreneur. At age 19, as an undergraduate major in physics at the University of Wisconsin-Madison, he and his younger brother started a company that now produces about 70% of the theater lighting equipment in the US. After graduating, he ran the firm full-time for a while, and eventually got his PhD in physics at Harvard under the mentorship of Lawrence Sulak.

As a scientist, Bill was driven by his conviction that when he saw the first result of an experiment, he had "looked at something that was only known to the creator of the Universe and me," he says. He had the privilege of experiencing this phenomenon twice in his life. The first was while in graduate school, when he noticed that the proton decay data he was analyzing showed that it was not happening at the rate predicted by a "cadre of Nobel Prize winners."

The second time was when he played a significant role in the experiment that resulted in the discovery of the quark known as Top.

As a team leader and project manager at Fermilab, Representative Foster designed and built vital sections of the equipment that ultimately detected the particle. He ran groups of between five and 200 people doing various projects, from software data analysis of physics events to construction management of the accelerators. His moment of Zen occurred when he "looked at candidates of events that might indicate evidence of the Top Quark,…and I realized that the Top Quark mass was so heavy it could not be discovered at CERN, only at Fermilab," he recalls.



Of course, the Fermilab data did establish the presence of the Top Quark, and as Congressman Foster puts it, "At that moment you get this wonderful feeling of discovery."

As it happened, the skills he honed in physics, particularly his knack for computer programming and general problem solving, have already served him well in politics. Before he ran for Congress, he spent the 2006 election cycle volunteering full time for the campaign of Patrick J. Murphy (D-PA). "For the last two months or so (of the campaign) I camped out in a Ramada Inn across from the headquarters," he says. "I did every possible job for the campaign."

One of the tasks he undertook was writing a computer program that helped determine which homes the campaign staff should visit. Called "Get out the Vote", the program streamlined the campaign because it analyzed which district residents were most likely to react favorably to a knock at their door from a Murphy supporter.

The team "knocked on 240,000 doors in the last 72 hours and we ended up (beating) the incumbent by 1500 votes. It got me a standing ovation from a couple of busloads of volunteers," he says.

With his confidence elevated from the role he played in the win, Congressman Foster turned his attention to his own campaign, which he won in March 2008 with 53% of the votes.

He is certain that physics provides a practical platform upon which to build leaders, especially in politics. His belief is that physicists whose careers involve a diversity of projects and experiences are especially well equipped. "One of the advantages that physicists…have is that they are forced to deal with a wide range of things from the purely theoretical to the hands-on technology to working with groups of people," he says. To have all of those "bits and pieces of experience" when you go in, provides an advantage.

Representative Foster has a few warnings and pieces of advice for physicists who want to throw their hat in the ring, either as an elected official, or as a staff member of Congress or a federal agency. First, you have to have an understanding that "the political system you're going into is something that very smart people have worked on for a very long time, most of them with their hearts in the right place trying to make things better," he says. "The places where you bring a unique perspective are places where facts and numbers can be usefully injected into the debate, which is an increasing fraction of our public debate."

A physicist may tend to spend too much time contemplating "technically interesting things", warns Foster. "The nature of the job here is…you're juggling a very large number of balls and you have to choose a very limited number of issues on which you're going to become an expert."

But he stresses the strategic role

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gamma rays" Curioni said. Gamma rays are highly penetrating, and easily travel several centimeters through dense materials. A detector needs to have large area, large field of view, and large stopping power.

There are several types of interactions gamma rays produce when they hit a material, the most common being Compton scattering, in which a photon transfers some of its energy to an electron. The incoming gamma ray scatters in some detector medium, such as liquid xenon or liquid argon, and both the electron and photon are detected, giving a measurement of the energy of the gamma ray photon, as well as some information about the direction it came from. Compton telescopes are currently some of the most sensitive instruments to detect gamma rays for astronomical uses. Curioni and others are working on building better Compton telescopes. The energy resolution of these instruments is already good, though they could use improved position resolution, Curioni said.

Applying some of these developments to homeland security is the next step. "There is a lot of overlap between fundamental research in particle and astrophysics and applications," Curioni said.

Joseph Schumer of the Naval Research Laboratory talked about ways to monitor cargo for dangerous materials. This is challenging because authorities would want to detect dangerous materials quickly, from far away, and without interrupting commerce.

For radiation safety, time, distance and shielding are friends, Schumer said. "These same things make it hard to find smuggled nuclear materials," he said. Passive detection schemes, which simply detect radiation a material emits, are limited because radioactive materials can easily be shielded by those wishing to conceal them. Current scanners also have trouble distinguishing dangerous materials such as highly enriched uranium from harmless radioactive materials.

Active detection methods, which Schumer and others are working on developing, might work better. Such methods would hit the target container to be scanned with a beam of neutrons, which would induce fission in any fissionable material in the container, resulting in emission of a characteristic radiation that could be detected. This method could detect highly enriched uranium even through light shielding. Schumer called the scheme a "nuclear carwash."

John Luginsland of NumerEX Corporation talked about simulations of directed energy devices. These devices, some of which are still at the science fiction stage, could be used to temporarily or permanently disable electronics without harming humans. A different type of directed energy device could be used for non-lethal crowd control, by creating a painful, though supposedly harmless, burning sensation. Directed energy devices could be non-lethal, could be deployed rapidly, and have selectable effects, Luginsland pointed out. However, the technology is immature and controversial.

Currently Luginsland and others are working on simulations of compact high power microwave devices. Such devices would use relativistic magnetrons, similar to the magnetron in a microwave oven, but much more powerful. Luginsland's simulations, which start from the basic electrodynamics, can suggest ways to improve the devices. Applications require new, compact, high efficiency sources of electromagnetic radiation. Advanced computation is providing new ways to virtually prototype these devices, he said.

Tim Dasey of MIT Lincoln Lab focused on biological and chemical defense. Attacks with biological or chemical weapons such as anthrax would be extremely difficult to prevent, since it's relatively easy for anyone to get hold of the materials and the knowledge to make a biological or chemical weapon. Dasey's talk focused on what could be done in the aftermath of an attack. "The first thing you want to do is to understand what happened," he said.

That requires fast, reliable detectors. With most current detectors, "I can tell there's a cloud of stuff somewhere, but I can't tell if it's biological, and certainly can't tell if it's anthrax," says Dasey.

A basic detection system might have as a first level a trigger detector that would provide some tentative warning of a threat, and perhaps some rudimentary agent classification, but not specific details. Dasey's group is working on making small and inexpensive biological agent warning systems that use ultraviolet laser light to induce fluorescence in amino acids that might be present. The next level of sensing would identify specific agents. There are several potential ways to do this. In one test device, the researchers took living cells and engineered them to respond to certain pathogens that they want to detect. When the pathogen hits the cell, a biochemical reaction in the cell releases calcium ions that could be detected. This method gives results in minutes, but the cells only live for about a week at room temperature.

After attack, there are several steps before action can be taken, including figuring out where exactly the attack originated, how large the attack was, who was exposed, and what medical response is needed. Time is crucial in such situations. Cities are developing response plans, and Lincoln Labs is developing simulation-based training tools to help, Dasey said. The researchers are also working on developing self-decontaminating surfaces and a wide variety of other tools to plan for many contingencies.

Even high school students can begin to learn the science involved in homeland security. Lea Beaulieu, a teacher at Joppatowne High School in Maryland, described a new program for high school students in homeland security and emergency preparedness. The program, developed in cooperation with partners in government, higher education, and industry, supplements the standard high school curriculum and is aimed at average students. Some students in the program choose a science track, in which they focus specifically on the science involved in homeland security, learning, for instance, the chemistry and physics involved in detecting dangerous materials and the biology of how the body responds to toxins. They have hands-on lessons using relevant technology such as Geographic Information Systems and chemical detectors. The program began last year, with about 60 tenth grade students. After graduation, the students may go on to college or directly into the job market. "Homeland security is a booming industry," she said. Beaulieu also believes the program will help interest some students in science by showing them important ways science is useful.

Letters

"Easy" Course Would Provide Useful Background

Reading "Conference Takes a Critical Look at Graduate Education" in the March 2008 *APS News*, I recalled being at a similar conference a decade ago ("Chairs' Conference on Graduate Education"). Our conclusions were also similar: that our programs should not be the same as 50 years previous. Since most of our PhDs will have careers in industry, we might emphasize less academic-research oriented courses, start research early, and work for shorter time to the PhD.

However, I'd also like to suggest an "easy," definitely qualitative, course to broaden the physics perspective of young physicists about to leave academia.

Five possible topics:

1. Particle physics
2. Cosmology
3. Foundations of Quantum Mechanics
4. Condensed Matter
5. Some Industrial Applications of Physics

Each of these areas is currently discussed in newspapers, radio/TV, and books for a popular audience. (And number 3 comes up in too much pseudo-science.) The course should include, even emphasize, controversial issues, which do get the most popular attention. Can anyone deny that our PhDs in one of those areas are often unable to discuss the others? In fact, the course would have to be taught by several different people, even lecturers from outside the department.

As a former industrial physicist, I know that the ability to talk about current issues with non-physicist, technical colleagues will benefit the career of a new industrial physicist PhD. Such background would also be valuable for a new instructor at any level.

Bruce Rosenblum
Santa Cruz, CA

Need to Educate Public About Energy

During the early 1970s there was a nationwide shortage of gasoline for our transportation needs. At that time I, probably along with other technology-oriented individuals, was outspoken about the concept to develop new propulsion technology and energy sources to replace the internal combustion engine. This would have required a considerable undertaking, requiring extensive Government support for research projects.

It was the ideal time to start an all-out program to develop practical means of capturing energy from natural existing sources and utilizing them to meet our various needs. Back then, it was already realized that the reserves of oil had a limited supply left and would be needed way into the future for many uses other than energy. These included many manufactured products that require oil as a raw material. We had (have) to conserve oil.

This was contrary to the interest of the various energy industries and therefore no research was funded. Thirty-five years later, we are even more dependent upon the same combustion engine and carbon-based power generation.

It must be acknowledged that more recently some progress, mostly privately sponsored, has been accomplished with solar cells to recovery electricity, as well as with electric and hydrogen cars. But these are in its infancy, and we still don't know which technology is practical for mass usage. It will take many years for new proven technology to be developed and phased in.

Here we are today, with massive environmental problems and minimal newly developed technology on the horizon to meet our energy needs. Grudgingly, the government recently was forced to fund minimal recoverable energy research. But at this rate it would take at least 25-50 years for real change. This country and the rest of the world are captive to the whims of the energy producers and the world energy lobby.

The energy industries' and our government's recent approach is to produce ethanol from corn as a stop-gap measure. For ethanol and biodiesel there are a number of other less-in-demand farm crops to use, as well as fungi and seaweed. This puts ethanol in competition with feed for cattle and humans, and corn syrup production. Now there is a corn crop shortage, causing extensive price inflation. Also remember, it takes considerable energy to produce ethanol.

Where do we go from here? The APS and IEEE have programs to encourage members to educate the public on scientific topics. The possibilities for future energy sources should probably be at the top of the list. The increasing cost of auto fuels and power for our homes is already a major part of the family's budget and will continue to escalate.

What better way to educate the public than through students at all school levels and adults through public television. Through this, both the new generation and the older may realize it is their responsibility to be outspoken and to lobby our elected officials to help get the necessary accelerated research started.

The APS should help set up a member advocacy group to help advance this effort.

Roger Gottfried
East Northport, NY

INSIDE THE BELTWAY:
WASHINGTON ANALYSIS AND OPINION

Science! Who Needs It?

by Michael S. Lubell, APS Director of Public Affairs

When it comes to math and science, American students get failing grades, and they have for quite some time. It used to be a dirty little secret, and it didn't seem to matter much. But it's no longer a secret and it matters a lot now.

Last December, the Program for International Student Assessment released its 2006 math and science test scores for 15-year-olds in countries belonging to the Organization for Economic Cooperation and Development. Of those 30 richest nations in the world, the United States ranked 17th in science and 23rd in math.

That should be a wake-up call for every American politician, but judging by the lethargy in Washington, the message hasn't sunk in. Here's why it should.

For half a century, the United States reigned supreme economically among all nations. We were the greatest innovators, the most productive manufacturers and always on the cusp of the revolutionary discoveries that drove technology. Our standard of living was the highest, and the expectation that our children would be better off than we were was always a dream fulfilled.

But the rest of the world has caught up, and the American aspiration for a better tomorrow is at risk of becoming nothing more than an illusory pot of gold at the end of a rainbow. The dollar has lost its might, the nation's debt has skyrocketed, and the balance of trade is so deeply in the red that the break-even line is almost invisible on the economic horizon.

And what is Washington's response? A lot of rhetoric but precious few dollars and precious few policies that might make a difference! It's not that policy makers don't care; it's that they don't really understand how the science enterprise works–the need for patient nurturing and patient capital.

It's a fair guess that most members of Congress and high-level Executive Branch officials have never taken a chemistry or physics course in college. And when they speak of calculus, they mean political calculus, not derivatives and integrals. Their decisions are generally informed by keen political acumen and either fine legal training or a good brain for finance but rarely by any understanding of even rudimentary principles of math and science.

Corn-based ethanol is a good example. It produces more carbon than it saves, as reported in the February 29, 2008 issue of *Science,* and it generates barely more energy than the non-renewable sources it consumes. Yet lawmakers embrace it as a means of weaning us off imported oil and cutting greenhouse gas emissions. Mandating its use demonstrates either appalling ignorance or pure political pandering. In truth it's probably a combination of the two.

Next November is unlikely to bring us much more scientific enlightenment from the new crop of public servants whom we will elect. Just consider the May 4th edition of NBC's "Meet the Press." Responding to Tim Russert's question about soaring gasoline prices, Senator Barack Obama asserted that we have all the technology we need to deploy a fleet of plug-in hybrid cars. He seemed to suggest that all we required was an enlightened auto industry to act in the public interest, and our energy future would be secure and the global environment, saved.

Would that it were true! But the reality is that we don't have affordable, safe batteries with high enough energy density to make plug-in hybrid cars practical for family use right now. And given the schizophrenic way our government officials treat science, plug-in hybrids may be a long time coming.

We do need more home-grown scientists and engineers to compete in the global economy, but we also desperately need a more scientifically literate populace. Sadly that won't happen until state and local governments wake up to the problem. And it won't happen unless teachers' organizations begin to recognize the size of the crisis and make science a priority.

For now we can only hope that scientists redouble their efforts to reach out to the public and to lawmakers at all levels of government and establish the case for research and education. It won't be easy, but, hey, the physics caucus in the House of Representatives just increased 50 percent when former Fermilab employee Bill Foster won a special election in Illinois' 14th congressional district this past March. If we could just get one more Foster to win every month for the next few years, at least in Washington science might get the attention it deserves.

zero gravity
The Lighter Side of Science

The Other Side of Science

"Dark Matter": Music and Lyrics by Jonny Berliner

Editor's Note*: Jonny Berliner is a UK-based singer/songwriter. His debut album, "Friend for All Seasons," will be released shortly on his own label, MCM Recordings. He has also appeared on BBC network television and BBC local radio. You can find out more about his work at http://www.jonnyberliner.com, and listen to the musical track for "Dark Matter" online at http://www.null-hypothesis.co.uk/science//item/geek_pop_jonny_berliner.*

When you look up in the sky at night you're seeing a mystery
The physicists are in a twist 'bout the forming of the galaxies
It's a very heavy issue, it's an issue of gravity
It's a dark, dark matter

There needs to be a substance that we're just not detecting
But it's hard to find material that just ain't reflecting
But maybe it's our theories just need some correcting
It's a dark, dark matter

So what does it feel like and how does it smell?
If you had some in a bucket, well how would you tell?
Can you sit on it, or sculpt it, or eat it as well?
It's a dark, dark matter

We haven't got a clue what this stuff consists of
It's not made from any particle that there is a list of
And now it's really pissing all the cosmologists off
It's a dark, dark matter

So what does it feel like and how does it smell?
If you had some in a bucket, well how would you tell?
Can you sit on it, or sculpt it, or eat it as well?
It's a dark, dark matter

We've found that finding evidence is fairly demanding
It's stretched us to the limits of our understanding
And then it opened up a can of worms
About why the Universe is still expanding
It's a dark, dark matter

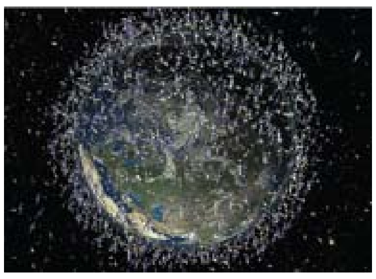
Space Debris Still a Growing Problem

China made global headlines in January 2007 when it used an anti-satellite (ASAT) missile to destroy one of its old weather satellites orbiting 537 miles above Earth, but national security wasn't the only critical issue at stake. China's ASAT missile test created the largest amount of space debris in history, making the threat much more severe, according to several speakers at a session on the growing problem of space debris at the APS April Meeting in St. Louis.

Space debris has long been cause for concern. In the mid-1990s, the United Nations deemed it a significant enough risk to implement mitigation measures aimed at reining in the proliferation of space debris. (New updated measures were re-introduced in June 2007.) Mitigation held the density of space debris to constant levels throughout the 1990s, but in recent years, the number of fragments has begun to climb again. There are now more than 150 million pieces floating in space, most measuring less than 2 inches across.

Space debris mostly consists of a mix of discarded objects: spent rocket stages, defunct satellites, fragments from explosions of various space equipment, paint flakes, dust, even the occasional glove, camera, or jettisoned garbage bags. Most of these are at low enough altitudes that they drift through space for awhile between re-entering the atmosphere, often burning up in the process.

However, the greatest concern is debris that results from explosions, such as when rockets or spacecraft with unspent fuel collide with other objects, thereby producing a great number of fragments. According to Geoffrey Forden, an MIT physicist, the Chinese action produced more than 2300 pieces larger than a golf ball, and over 35,000 pieces larger than 1 centimeter. We are in danger of a runaway escalation of space debris, he said.



An artist's rendering of orbiting space debris around Earth, courtesy of the European Space Agency.

The density of debris is fast approaching supercriticality, according to David Wright of the Union of Concerned Scientists, which maintains a satellite database tracking all those bits of debris. This situation could result from the destruction of an orbiting object into many smaller fragments of debris, initiating a chain reaction as that debris collides with other satellites in nearby orbits, breaking them into fragments in turn and compounding the problem further.

At high altitudes, the debris can stay in orbit for decades, accumulating to the point where there is a much higher risk of collisions with satellites. In fact, it may already be too late: Wright cited a 2006 study by NASA's Orbit Debris Program that found certain parts of space particularly the 900 to 1000 km band, or Lower Earth Orbit (LEO) have already reached supercritical debris densities. NASA estimates that an active satellite in LEO will collide with a piece of debris larger than 1 centimeter every five to six years.

With their high speed in orbit, even fairly small pieces of debris can damage or destroy satellites in a collision, said Wright. Orbital speeds in LEO are typically greater than 7 kilometers per second, 30 times faster than a jet aircraft, and the relative speed of a piece of debris approaching a satellite in an intersecting orbit may be 10 km per second or higher, said Wright.

Pencils in Parallel

Photo by Ed Lee

At the APS Teachers' Day in St. Louis, held in conjunction with the 2008 April Meeting, 63 physics and physical science teachers gathered for a day of talks, workshops, and networking. In the photo, Christine Stewart, who teaches at the Govenor French Academy, investigates diffraction with a variable slit system constructed with two pencils and rubber bands (developed by Cornell's Center for Nanoscale Systems Institute for Physics Teachers).

PHYSICSQUEST continued from page 1

$100 gift certificate to Educational Innovations.

PhysicsQuest is an APS activity kit given free of charge to middle school classes who request it. An activity book and small set of supplies help students perform classroom experiments that have a different theme each year. Results from carefully conducted experiments help the students solve a physics-themed mystery. This year's PhysicsQuest mystery focused on Marie Curie and the secret classes she took in Russian-occupied Poland. Women were not allowed to attend the local university, so Curie met with professors and other female students in secret.

This year's experiments involved temperature, heat and energy. They included measuring temperature by touch vs. with a thermometer; using dye to observe the speed of molecules in cold water vs. warm water; creating your own bulb thermometer to show the change that materials undergo with temperature change; and measuring the creation of heat through energy release by rubbing your hands together, or adding yeast to hydrogen peroxide. The experiments showed students the importance of precision instruments and the effects of heat and energy on materials. Each class had to submit a correct set of answers to be entered into the drawing.

Photo by James Riordon

As described in the accompanying story, Shachi Mahajan flips her coin to help find the PhysicsQuest grand prize winner.

The very surprised Ms. Aschim said the students were proud of their victory, walking around saying "We really did something!"

Students are supposed to solve the PhysicsQuest problems on their own, which Aschim says was a challenge for some students. "At first it was hard for them because they were so used to me helping them. Some were slower than others, but they just sat and worked through it. I liked to hear them talking back and forth trying to work out the problems," she said.

For more information about PhysicsQuest, visit http://physicscentral.com/physicsquest/.

FOSTER continued from page 3

scientists do play in managing, improving and advancing our nation. "The best starting point for any debate on public policy is the facts and the numbers," he argues. "There's plenty of time afterward to inject opinion, biases, and visions for the future, but the times we've gotten ourselves into trouble as a country were when we didn't pay attention to what the real facts were." And of course, it is a platform of numerical truths that serve as the "the starting point for debates for whether or not our system can improve," he says.

Congressman Foster wants to inspire other scientists to serve their country as he has. He offers that a first step for both emerging and established physicists is to seek a fellowship (such as the Congressional Fellowship Program in which APS participates) that affords scientists the opportunity to spend a year or two in DC working for the feds.

"I want to encourage [scientists] to get involved," he says. "It is a tremendous amount of work, but most scientists I know already work very long hours. So far, it has been as rewarding as anything I've done in science, and I encourage them to take a shot at it. If they are serious about it, I'd be happy to give them advice and practical assistance in getting involved in politics."

And to ensure more physicists are empowered to work for the people, Congressman Foster says that he is "seriously talking to the physics community and the scientific community at large to encourage you to send your best and brightest students into the federal bureaucracy," and, he requests, "salute them when they do choose that career path."

Alaina G. Levine can be reached through her website at www.alainalevine.com.

New Ways Suggested to Probe Lorentz Violation

Lorentz invariance, a basic building block of relativity, holds that the laws of physics remain the same for observers traveling at constant speeds relative to each other, or rotated with respect to each other. Some theoretical models, called standard model extensions, have predicted violations of Lorentz symmetry. At the April Meeting, several theorists reported on ways Lorentz violation might turn up in various experiments.

"All of known physics depends on Lorentz symmetry," Matt Mewes of Marquette University said in a press conference at the April Meeting. If that symmetry is not exact, there will be some small defects in everything else. He likened Lorentz symmetry to a building block on which much of the rest of physics rests. If the Lorentz symmetry block was slightly chipped, the whole structure on top of it would lean slightly. So by making very precise measurements of many different physical phenomena, one could expect to see evidence of Lorentz violation.

One way to look for Lorentz violation is in the cosmic microwave background polarization, Mews suggested. Recent experiments have measured the polarization of the CMB at different positions in the sky. An unexpected twist in that polarization would indicate a breakdown of relativity. Mews, in collaboration with Alan Kostelecky of Indiana University, analyzed data from the CMB experiment BOOMERANG, looking at many different parameters. They found that the results hint slightly at a potential unexpected twist in the polarization. Future experiments will be needed to verify this. The CMB polarization is a good way to look for relativity violations because the longer light travels, the more chance it has to undergo this slight rotation, said Mews. No other light has traveled further than the CMB.

Jay Tasson of Indiana University described another way to look for violations of general relativity. Torsion is a warping of space and time in addition to the curvature of spacetime that Einstein's general relativity predicts. Such a warping, predicted by some alternative theories of gravity, would cause particles' spins to precess. A University of Washington experiment used a large number of electron spins to detect these effects. A complementary approach by a Harvard group used microwaves emitted by a helium-xenon maser to measure changes in the spin orientation of neutrons. Tasson and Kostelecky used these measurements to determine limits on 15 of the 24 quantities that would describe torsion. So far, no evidence of torsion has been observed in these extremely sensitive measurements, Tasson reported.

Still another place to look for Lorentz violation is by searching for tiny variations in the moon's orbit about the earth. Quentin Bailey of Embry-Riddle Aeronautical University described how researchers looked at data from a laser ranging experiment that bounced lasers off mirrors placed on the moon by astronauts. The scientists used that data to measure parameters that would reveal any deviation from general relativity. In addition, another experiment, performed at Stanford, tracked the gravitational force felt by atoms very accurately, looking for tiny deviations from what general relativity predicts. These experiments are all very sensitive, to several parts in ten billion. All measurements were consistent with general relativity, Bailey reported.

Although no solid evidence of Lorentz violation has been found so far in any experiment, there is still room for ever more sensitive experiments to search for the effect, the researchers said.

25th Anniversary Commemoration

Photo courtesy of Darlene Logan

On April 12, in conjunction with the April Meeting in St. Louis, APS hosted a dinner to commemorate the 25th anniversary of the establishment of the J. J. Sakurai Prize, which is awarded for outstanding achievement in theoretical particle physics. The Prize is named for Jun John Sakurai, who died in 1982 at age 49, at the height of a brilliant career as a researcher, teacher and textbook author. Sakurai was Professor of Physics at UCLA at the time of his death.

The dinner guests included (l to r): Alexei Smirnov, one of the recipients of the 2008 Sakurai Prize; Lincoln Wolfenstein, the 1992 Sakurai Prize recipient; Leo Stodolsky (Max-Planck-Institut für Physik, München); Noriko Sakurai, widow of J. J. Sakurai; Harold Ticho (UCSD, emeritus); Marie De Jesus, Chair of the science department at Thomas Jefferson High School in St. Louis, which J. J. Sakurai attended; APS Director of Development Darlene Logan; APS Treasurer/Publisher Joseph Serene; and Daniel Sternheimer (Université de Bourgogne).

Focus on APS Topical Groups

Focus on APS Topical Groups: Group on Plasma Astrophysics

By Calla Cofield

The APS Group on Plasma Astrophysics (GPAP) bridges two bodies of physics that are deeply and intricately linked. Astrophysics offers new examples of plasma physics phenomena not seen anywhere else, and many of the most important questions in astronomy and astrophysics have plasma physics at their core. Finding answers to these questions will require astrophysicists with an up-to-date knowledge of plasma physics, and the group aims to create a community where that knowledge can be shared.

APS has a Division of Astrophysics (DAP) and a Division of Plasma Physics (DPP), but the two fields are large and there is a need for specific focus to be given to the overlapping areas found in plasma astrophysics. GPAP's current chair Steven Spangler of the University of Iowa says that one of group's goals is to increase the interaction between these two divisions.

In addition to participating in the April Meeting, GPAP hosts a mini-symposium at the annual meetings of the DPP. The symposium offers GPAP members the chance to discuss the issues that are central to the advancement of the field. The symposium also informs plasma physicists about applications of their discipline to astronomical objects. Last year's symposium was on momentum transport in laboratory and astrophysical plasmas. Among other things, momentum transport in plasmas can explain how matter orbiting in the accretion disks around black holes can transfer its angular momentum outward and spiral into the black hole. Previous symposium topics have included shock acceleration in space, astrophysical explosions, and the dynamics of magnetic flux tubes in space.

One of the most visible, and magnificent, examples of plasma astrophysics phenomena is the northern and southern lights. The auroras are theorized to be the result of a process called magnetic reconnection, in which plasmas containing magnetic fields are pushed together and the fields cancel, converting a portion of their energy into fast electrons which enter the upper atmosphere and cause the air to glow during the auroras. Magnetic reconnection may also be the driving force behind solar flares and coronal mass ejections, both of which can impact life on Earth. Plasma astrophysicists are also searching for evidence of magnetic reconnection in accretion disks and around black holes.

In the past ten years, scientists have created the first laboratory results clearly showing magnetic reconnection occurring. However, there is controversy over how the onset of this process occurs, how it proceeds, and exactly how the charged particles and electromagnetic fields in plasma interact with each other. "Plasma astrophysicists need to remain in close communication with basic plasma physicists to be aware of the current understanding of magnetic reconnection, as well as limitations to this understanding," says Spangler.

GPAP was formed in 1999, with key leadership from Amitava Bhattacharjee, then of the University of Iowa, and now of the University of New Hampshire. GPAP's 381 members are involved in active discussion about ways to advance the field of plasma astrophysics. Their current aims include improving relations with other APS units, primarily the DPP and DAP, and other scientific societies, including the American Geophysical Union and the American Astronomical Society.

Physicists Adopt Complementary Approaches in Dark Matter Search

Physicists are adopting a varied range of complementary approaches in the experimental search for the elusive dark matter. According to speakers at the APS April Meeting in St. Louis, these approaches include using liquid noble gases as a detecting medium; solid state devices incorporating germanium and silicon crystals cooled to cryogenic temperatures; and resurrecting the relatively old technology of bubble chambers in the search of searching for dark matter.

The two leading contenders for dark matter are massive astrophysical compact objects (MACHOs) and weak interacting massive particles (WIMPs). The former would be black holes, neutron stars, brown dwarfs, and other celestial objects that emit little or no radiation and therefore escape detection. WIMPs would be an entirely new type of matter that almost never interacts with regular matter, making them even more difficult to detect than MACHOs since they only interact through the gravitational and weak nuclear forces.

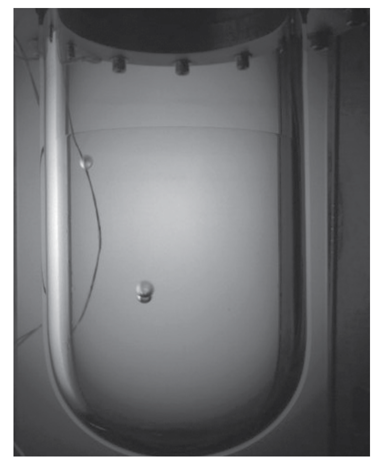
Therefore, physicists searching for dark matter are going deep underground, using Earth as a natural shield to filter out the background noise from radiation emitted by other particles, such as neutrinos and cosmic rays. WIMPs seem to share certain qualities with neutrinos, which also only rarely interact with other subatomic particles, so many neutrino experiments can be modified to search for WIMPs.

Tom Shutt of Case Western Reserve University is spearheading the Large Underground Xenon (LUX) experiment, housed in the abandoned Homestake gold mine in Lead, South Dakota, in the very same cavern where physicist Ray Davis conducted his seminal solar neutrino experiments in the 1950s. Noble gases are excellent scintillating materials for the purpose of detecting collisions between atoms and WIMPs because they block the passage of many radioactive particles that could interfere with detecting dark matter signals. LUX will use xenon, the heaviest noble gas, which liquifies at -108 degrees Celsius.

The detector will have both a large pool of liquid xenon, and a layer of the gaseous version just above it. Should a WIMP strike a xenon atom, it will emit a flash of light, which will be recorded by photosensitive detectors. Electrons will be bumped off the atom at the time of impact, and pulled through an electric field out of the liquid and into the gaseous layer, emitting a second flash of light when they encounter the gaseous xenon atoms.

Those two flashes of light will comprise a telltale "signal" for a collision between a xenon atom and a WIMP, as opposed to another type of particle, such as a neutrino or cosmic ray. The signal will be different in part because a WIMP should strike the nucleus of an atom, whereas cosmic rays or neutrinos would strike the electrons orbiting the nucleus. This will change the "recoil" behavior and thus comprises a unique signature.

The Cold Dark Matter Search (CDMS) collaboration has moved its experimental headquarters to the Soudan Underground Laboratory, an abandoned iron mine 700 meters below ground in Eli, Minnesota, according to Jodi Cooley of Stanford. The site also houses the Main Injector Neutrino Oscillation Search (MINOS) facility. As cold as it gets in Minnesota during the winter, joked Cooley, it's still not cold enough for the cryogenics of their experiment.



A bubble chamber dark matter detector at the Chicagoland Observatory for Underground Particle Physics experiment at the University of Chicago

The germanium and silicon crystals they use in their detectors are the size of hockey pucks, cooled down to about 50 milliKelvins. When a WIMP passes through a crystal, it sets off tiny vibrations whenever it bumps into an atom, which can be detected via a layer of tungsten-aluminum metal. Of course, the detector also picks up vibrations from other sources as well, so the team uses lead and copper for additional shielding to further reduce background noise.

In March, Cooley's team announced new results they say set an upper limit on certain key parameters, thereby excluding several of the numerous theoretical models that have been proposed for where the dark matter signal would likely be seen. Cooley said it is the best upper limit achieved thus far, and that any model predicting values above that (a mass of 60 GeV/c^2 and a size of 4.4 x 10^{-44} cm^2) could be safely excluded "because we would have seen it." The detectors are currently being upgraded to conduct even more sensitive experimental measurements in 2009.

Juan Collar at the University of Chicago is taking a very different approach, using bubble chambers to search for dark matter in his Chicagoland Observatory for Underground Particle Physics (COUPP) experiment, located 350 feet underground in a tunnel on the Fermilab site. Bubble chambers were nearly extinct in high-energy physics labs before Collar put them to use in the COUPP experiment. However, "This is not your daddy's bubble chamber," he insisted.

COUPP's bubble chamber detector is a glass jar filled with a liter of a fire-extinguishing liquid (iodotrifluoromethane). When a WIMP hits an atomic nucleus, it triggers an evaporation of a small amount of that liquid, producing a tiny bubble. The bubble is initially too tiny to see, but it grows, and that growth can be recorded with digital cameras. Once the bubble reaches about 1 millimeter in size, the COUPP scientists can study the images for telltale statistical variations between photographs. Ideally, this will enable them to distinguish whether a bubble resulted from background radiation, or from a dark matter particle.

Like the CDMS collaboration, Collar's group has succeeded in placing some fundamental limits on certain predicted properties for WIMPs. Next on the agenda is to increase the bubble chamber detector's sensitivity by increasing the amount of liquid from one liter to around 30 liters. Collar has also just installed a new germanium-based compact neutrino detector in the sewers of Chicago, renting this unusual lab space from the city. The design has been modified to detect WIMPs.

Several days after the APS April Meeting, the DAMA-LIBRA collaboration in Gran Sasso, Italy, announced confirmation of a controversial earlier experimental result of a statistically significant signal of the sort one would expect from the collision of WIMPs with the detector. DAMA-LIBRA is an upgrade of a 2000 experiment producing what the Italian scientists believed to be a "clear" signal for dark matter (WIMPs).

Other physicists disagreed, arguing that the original findings were probably a systematic error stemming from the high degree of background noise associated with DAMA's particular experimental approach: looking for a tiny signal variation in a sodium iodide detector over the course of one year. The tiny variation is believed to be due to the orbital motion of Earth through the cosmic dark matter background. Subsequent experiments at a French underground experiment called EDELWEISS and at CDMS failed to confirm DAMA's original results.

Collar and many other scientists say that the latest DAMA-LIBRA results, while intriguing, still must be confirmed by other dark matter searches using complementary approaches before scientists can definitively conclude that this is indeed a direct detection of dark matter. "There is no perfect dark matter detector out there," Collar said, and each approach has its own strengths and weaknesses.

"We all weigh in from different directions," and then compare results, according to Shutt. That includes upcoming experiments at the Large Hadron Collider at CERN, which will look for missing energy in its collisions as a possible signal for direct detection of the dark matter.

April Meeting Prize and Award Recipients

Photo by William Greenblatt

Front row (l to r): Lillian C. McDermott, Ronald E. Mickens, Gerald Holton, Pierre Goldschmidt, Vicky Kalogera, Friedrich K. Thielemann, Arthur M. Poskanzer, H. Eugene Stanley. Back row (l to r): George Cassiday, Peter Shaffer, Jedrzej Biesiada, Nikolai Tolich, Michael R. Brown, Lyndon R. Evans, Alexei Smirnov, Soon Yoon Chang, James Trefil, Pierre Sokolsky, Pavel Podvig, Matthew Becker, Chenggang Xu. Individual pictures and biographies for most of these recipients can be found in the Spring *APS News* Prize and Award insert, available online with the March 2008 issue.

ANNOUNCEMENTS

CORRECTIONS

In the March *APS News*, in the Focus on the Topical Group on Gravitation on page 5, we placed one of the LIGO labs in the wrong state. The two LIGO laboratories are in Louisiana and Washington State.

In the April *APS News*, we incorrectly identified one of the people in a front-page photograph with the headline "Money Matters". The person on the right is DPB secretary-treasurer Stan Schriber.

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**

CODATA recommended values of the fundamental physical constants: 2006

Peter J. Mohr, Barry N. Taylor and David B. Newell

This review of the fundamental constants provides recommended values and their associated uncertainties, updating the last review of 2002. Since that time, new data and methods have led to a significant reduction in the uncertainties of many previously recommended values. For example, the uncertainty of the fine structure constant α has been reduced by nearly a factor of five and the one of Planck's constant $\hbar$ by over a factor of three. The outlook and suggestions given for future work will certainly spark several ambitious experiments from various groups.

WORKSHOP continued from page 1

Levitan went over the elements of how to run a campaign, including budgeting, finding campaign staff, and targeting voters. Participants also took home a "campaign handbook" with more information.

Joe Trippi, who as a campaign manager for Howard Dean's 2004 campaign made pioneering use of the Internet, described how the Internet has changed political campaigns and is continuing to do so. Howard Dean's campaign was the Wright brothers; Obama's campaign is the Apollo project, he said. The Internet has created new ways to reach people and get them to donate. Internet tools such as social networking sites are now "important even for the most local race," he said.

Workshop participants learned how to craft a message and communicate with the media. When communicating with the media and the public, a candidate needs to have a clear, concise message, and needs to keep repeating that message, said Kevan Chapman, communications director for physicist and congressman Vernon Ehlers (R-MI). Scientists tend to want to go into the details and nuances of their point, but in a campaign, they need to focus on the outcome of any policy they are advocating, not the finer points.

In a roundtable discussion with scientists who had successfully run for office, Louis Lanzerotti, chair of the AIP governing board and former school board member and former mayor of Harding Township, New Jersey, said that "scientists and engineers can really contribute a lot to local issues." He gave an example of a question that came up in his district–the possible installation of artificial turf on athletic fields. This raised safety and environmental issues that a scientist could help analyze. Lanzerotti said he got started in politics by sitting in on school board and town meetings, and by staying visible in the community and making contacts.

Nancy Cline, a civil engineer and public works director for the town of Addison, Texas, and Board of Trustee member for Carrollton-Farmers Branch Independent School District, also pointed to the need to get involved in the community. "When I ran, I ran against three opponents who had never been to a school board meeting," she said.

Some participants wondered whether it helps to be a scientist, since most voters don't relate to academic science. David "Doc" Westerling, a civil engineer and town moderator in Harvard, Massachusetts said that being a scientist "is both a liability and an asset." There's a risk of being perceived as elitist, but he found that the nickname "Doc" resonated with people, and he was perceived as honest. Lanzerotti said that the local paper reported "rocket scientist runs for town council," and that helped his campaign. Cline pointed out that her work as a civil engineer,–"roads and commodes," as she called it—connected to things people were familiar with, and that probably helped her get elected.

A parallel session presented advice for students, and participants and speakers networked after the workshop.

Participants generally said they found the workshop useful. For instance, APS member Hina Ayub, currently a physics graduate student, hopes to eventually run for a local office such as school board. "I want to start small," she said. Before the workshop, she hadn't known how much work goes into even a small campaign. "It does seem a bit overwhelming," she said. Nonetheless, at the end of the workshop, she and others said they felt encouraged, having learned a lot about how to run for office and where to get help.

PRIZE continued from page 1

ter served as inspiration to the students who gathered in Tiananmen Square in 1989 to protest against the Chinese government and to call for democratic reforms. (Xu did not attend the demonstration due to a recent heart attack.).

Xu continued to appeal for human rights, and has written several letters calling for democracy, civil rights, and protection of dissidents. These letters resulted in several periods of house arrest.

Xu is currently free to travel, but is old and sick. He and his wife are working on a long book on the history and theory of democracy.

In a press conference at this year's April Meeting, Zuoyue Wang, a historian at California State Polytechnic University, Pomona, a former student of Xu, talked about Einstein's' influence on Xu. The scientist's sense of social responsibility inspired him. Einstein's words, "The State is for the people, not the people for the State," particularly impressed Xu.

It is especially appropriate that APS awards the Sakharov prize, said Wang, because "APS has been leading the fight for human rights." APS was one of the first scientific organizations to take an interest in the freedom of scientists.

Xu's son said that there are currently no restrictions on pure science in China, to his knowledge, but people in China do have to be careful about what they say and write. Most censorship in China is self censorship, he said.

In response to a question about whether we should engage Chinese scientists or boycott them to protest China's human rights violations, Chenggang Xu said he and his father encourage involvement. "Fighting for democracy and human rights is going to be long term," he said. The best thing to do is educate and engage the Chinese people, Xu believes.

Major Accelerators Closing in on Elusive Higgs Particle

The game's afoot! Particle physicists at Fermilab's Tevatron and CERN's Large Hadron Collider (LHC) are closing on the last remaining undiscovered particle in the Standard Model: the Higgs boson, thought to pervade the vacuum of space, interacting with particles to give them mass. According to various speakers at the APS April Meeting in St. Louis, physicists are fast approaching the energies and luminosities required to detect the Higgs particle.

Fermilab's Tevatron is reaching its performance peak, with energies quite sufficient to create a particle in the expected energy range for the Higgs: between 114 GeV and 190 GeV, according to current theoretical calculations. The primary issue is luminosity, or the density of the beam particles that collide per second, and the Tevatron recently set a record high luminosity of $3.1 \times 10^{32}/cm^2$, raising hopes that the accelerator might beat the long-awaited LHC to the punch.

Brian Winer of Ohio State University said that the "most Higgs-like Higgs event" observed to date at the Tevatron involved a proton-antiproton collision in April 2005 that produced a fireball which then decayed into a W boson and a Higgs particle. The Higgs in turn quickly decayed into a bottom-antibottom quark pair with a combined mass of 120 GeV.

However, this does not constitute "discovery" of the Higgs, since it is just one event. The Tevatron would have to find a substantially larger number of candidate events than would be expected from the usual noise of background events that could mimic the Higgs signature. According to Winer, only time and further luminosity improvements will tell whether enough Higgs events have been collected to constitute a statistically significant "discovery." Fermilab physicist Dmitri Denisov estimated that when the CDF and D0 collaborations begin to wrap up in 2010, luminosity would probably be twice what it is now, and as much as 4 to 8 times more data would have been analyzed.

Should Fermilab fail to uncover the Higgs, the LHC's higher collision energy is expected to produce an abundance of the elusive particle. Official estimates from CERN's leadership indicate the cool-down process for the LHC's magnets should be complete by mid-June, with the first beam injection occurring two months later. Although the accelerator is designed to produce proton beams at 7 TeV, initially the LHC will produce beams at a much lower 5 TeV.

Abraham Seiden of the University of Santa Cruz presented a timeline plotting the data to be collected at the LHC as a function of time, pointing out where key expected discoveries are most likely to be made. Potential milestones include discovery of the Higgs particle around 2009, assuming it is around 200 GeV in mass. Should the Higgs be closer to 120 GeV in mass, the chart indicates discovery around 2011, since it is harder to detect at that lower energy because it decays into a key signature involving photons that is very similar to other decay signatures.

LHC data should also provide evidence for supersymmetry in 2009 if the energy scale for supersymmetry breaking turns out to be 1 TeV. Should the appropriate energy scale be 3 TeV, that discovery would more likely show up much later, around 2017. If there are extra dimensions of space, scientists might be able to detect them when energy scales reach 9 TeV in 2012. Evidence for a new type of Z' force, assuming it exists, is unlikely to be observed until at least 2019.

The Back Page

Physicists and Copyright- How to give away your birthright for what?

By W. G. Unruh

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A Response from APS

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Our record is strong. When the arXiv was formed APS responded positively, by integrating it into our submission process and providing a mirror site to improve service, and we have continued to collaborate with arXiv for over fifteen years. APS has been a leader in "Green" Open Access, by allowing authors to post the final APS-published version of their papers on their own and their institution's websites, immediately upon publication. Unlike a number of other major scientific publishers, we have never had an embargo on the distribution of research results, either before or after publication.

Recent developments in online publishing raise important and legitimate copyright issues, particularly about reuse of published materials. Some of these issues have complex ramifications, and are under active discussion by the Publications Oversight Committee of APS (a volunteer committee of APS members). We thank Professor Unruh for bringing these issues to the attention of a wider audience.

Unfortunately, his presentation of these legitimate issues is muddied by a number of claims that, frankly, we find preposterous, and because many readers of *APS News* have transferred copyright to APS, we must comment on Unruh's more extreme examples. The basic question is this: when you, as an author, transfer copyright to APS, what rights do you retain to reuse your article or parts of it in lectures, in other publications, and for teaching? Although our copyright agreement is relatively simple and straightforward, any legal document requires interpretation, and we provide this in a series of frequently asked questions (FAQ) on our journals website: http://forms.aps.org/author/copyfaq.html, to which we will refer in our replies to Unruh.

Here are Unruh's alleged examples of copyright violations, and relevant APS policy.

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