

## Graphene Experiments Garner Nobel Prize

The Royal Swedish Academy of Sciences awarded the 2010 Nobel Prize to Andre Geim and Konstantin Novoselov of the University of Manchester in the United Kingdom for “ground-breaking experiments” on graphene. In a paper published in *Science* in October 2004, Geim and Novoselov announced that they had been able to for the first time create a sheet of carbon atoms one atom thick.

The remarkable characteristics of graphene hold a tremendous amount of promise for future applications. It is both the thinnest material ever created while stronger than the world’s strongest steel. According to the Royal Swedish Academy of Sciences, “In our 1 m<sup>2</sup> hammock tied between two trees you could place a weight of approximately 4 kg before it would break. It should thus be possible to make an almost invisible hammock out of graphene that could hold a cat without breaking.”

Even with its strength, it is still flexible. It is as good an electrical conductor as copper and better at conducting heat than any other

material. It is almost completely transparent and its hexagonal molecular structure is so dense that not even helium can pass through.

It is thought that graphene could hold the key to many future technologies ranging from transparent touch screens and solar panels to strong composite materials and the hypothesized space elevator.



Scientists had been trying for years to isolate such a carbon molecule because of its amazing theorized structural and electrical properties. However all had been frustrated in their attempts. Many had given up, believing that there was no way such a thin sheet of carbon could be stable at room temperatures.

Geim and Novoselov’s tech-

nique was as novel as it was simple. They stuck a piece of scotch tape on a chunk of graphite and pulled off a thin layer. After repeated attempts, they were able to isolate a flat sheet of carbon one atom thick, the long sought-after sample of graphene.

“We just try to be curious in everything and most importantly, to have fun. So André introduced this habit of Friday evening experiments where you just do crazy things and then some of them sometimes come out, sometimes not, and basically graphene was one of those as well,” Novoselov said in a taped interview.

“My work is my hobby. So some people would call me a workaholic; I don’t consider it this. I just love my work so much so it’s my real hobby,” Geim said in a taped interview.

In the six years since the team published their paper, graphene has become one of the hottest research areas in condensed matter. It’s estimated that over 2500 scientific papers were published in

**PRIZE continued on page 3**

## Hsu, Chudzicki are Apker Award Honorees

Each year APS chooses two recipients of the LeRoy Apker Award for outstanding research by an undergraduate. Usually, one of the recipients is from an institution that grants the PhD degree, and one is from an institution that does not.

The seven finalists for the Award were featured in the October *APS News*. They were interviewed by the selection committee in Washington on September 3. The selection committee then submitted its recommendation to the APS Executive Board, which approved the two recipients at its meeting on September 25.

The 2010 recipient from a non-PhD-granting institution is Christopher Chudzicki of Williams College, who did his research, on “Parallel Entanglement Transfer on Hypercube Networks” under the supervision of Frederick W. Strauch. The recipient from a PhD-granting institution is Chia Wei (Wade) Hsu of Wesleyan University, whose research on “Self-Assembly of DNA-linked Nanoparticles” was done under the supervision of Francis W. Starr.

Chudzicki and Hsu are now pursuing their graduate studies at opposite ends of Massachusetts Avenue in Cambridge, Massachusetts, Hsu at Harvard and Chudzicki at MIT.



Christopher Chudzicki



Photos by Shelly Johnston/APS

Chia Wei (Wade) Hsu

## APS Responds to Member’s Resignation over Climate Change

In early October, a long-time member of APS, Hal Lewis, publicly resigned from the Society over issues having to do with climate change. Lewis, who is an emeritus professor at UC Santa Barbara, addressed his letter of resignation to APS President Curtis Callan, simultaneously circulating it on the Internet. In response to some of the points in Lewis’s letter, APS issued a statement that can be found on the press-release page of the APS website. Callan also sent a personal reply to Lewis in which he expressed his regret at Lewis’s decision, along with his strong disagreement with the substance of Lewis’s complaints against the APS.

Lewis’s specific complaints focus on the recent decisions of the APS Council concerning the 2007 Statement on Climate Change and the ongoing process of formation of a topical group on the physics of climate. Characterizing recent APS decisions, Lewis contends that “It is of course, the global warming scam, with the (literally) trillions of dollars driving it, that has corrupted so many scientists, and has carried APS before it like a rogue wave. It is the greatest and most successful pseudoscientific fraud I have seen in my long life as a physicist.” Concerning the topi-

cal group, Lewis claimed that the petition for creating such a group which he had signed had been arbitrarily rejected by “APS HQ”.

The APS press release rejected Lewis’s characterization of the state of the science, stating:

“On the matter of global climate change, APS notes that virtually all reputable scientists agree with the following observations: carbon dioxide is increasing in the atmosphere due to human activity; carbon dioxide is an excellent

**RESIGNATION continued on page 4**

### Fox Fails at Fact-Checking 101

The October 12 segment of *Fox News’s* “Fox and Friends” featured an erroneous report that mis-identified APS President Curtis Callan as a member who had resigned. (For the non-erroneous version, see the accompanying story.) APS has requested a retraction, and to date *Fox News* has refused.

Correspondent Laura Ingraham said, “Basically what Curtis Callan is saying is that this American physics society, it’s called physical society, has turned into an organization affected by the money flow in science. In other words trillions of dollars he argues is invested in this idea of global warming, and that has clouded what the group itself, what the leadership of the group

**FOX NEWS continued on page 4**

## Physics Stars in Theater, Music and Dance

By Michael Lucibella

Physics has recently taken center stage as performances about the physical sciences have thrived. The performances run the gamut of artistic endeavor, including plays, operas, and dance productions. The different shows focus on a wide array of disciplines in physics and go into different depths of their subjects; however, all prominently feature physics and science.

“The thing for me that has always and continues to be the reason I write about science is because it’s inherently dramatic. There’s abundant character, and inherent plot,” said playwright Lauren Gunderson. “I think on a more existential level, science lets us talk about the biggest ideas, and I think that keeps theater relevant and philosophical, in a way I think people crave when they go to the theater.”

Gunderson has written several plays about physics and physicists. Her most recent production, titled *Emilie: La Marquise du Châtelet Defends Her Life at the Petit Théâtre at Cirey Tonight* tells the complicated story of Emilie du Châtelet, the 18th century French physicist who translated Newton’s *Principia*.

“People are very very interested in this. Those that go into the theater really get excited about



Image courtesy of George Hagegeorge

Dancers in Liz Lerman’s *The Matter of Origins* perform on stage before a large projection of Marie Curie in her lab. The performance also included stage settings using images from the Hubble Space Telescope and the Manhattan Project.

learning more about it. It’s sort of the NPR crowd,” Gunderson said. “There is a great movement of movies and plays about science.”

Gunderson also wrote *Background* about the life of physicist Ralph Alpher, *Leap* which features Isaac Newton, and *Baby M*, which, according to her website, combines maternity, murder and M-theory. Her next major production, set to premiere at the Kennedy Center in Washington, is aimed at a younger crowd. Titled *The Amazing Adventures of Dr. Wonderful and her Dog*, it tells the story of a 5th grade

girl who uses science to solve mysteries. Gunderson was also instrumental in setting up the playwright in residence program at the Kavli Institute for Theoretical Physics in Santa Barbara.

The Liz Lerman Dance Exchange premiered its dance production *A Matter of Origins* at the University of Maryland’s Clarice Smith Performing Arts Center on September 10th. Taking inspiration from her trip to CERN, Lerman created an interpretive dance performance inspired by the physics

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"We know about the expansion of the universe, and we studied that very well, and over and above the motions of galaxies, galaxies move apart due to this expansion, over and above that expansion there are velocities that for historical reasons astronomers call peculiar velocities. And these additional velocities that galaxies have, that aren't due to the expansion of the universe, are due to the uneven distribution of matter in the universe."

**Michael Turner**, University of Chicago, on an as yet unexplained "dark flow" of matter in the cosmos, National Public Radio, September 17, 2010.

"I think it's probably one of the most abused concepts in physics among the public. You should be wary whenever you hear something like, 'Quantum mechanics connects you with the universe' ... or 'quantum mechanics unifies you with everything else.' You can begin to be skeptical that the speaker is somehow trying to use quantum mechanics to argue fundamentally that you can change the world by thinking about it."

**Lawrence Krauss**, Arizona State University, on "quantum quackery," MSNBC.com, September 20, 2010.

"This is something people have difficulty wrapping their minds around, because it doesn't show up in any obvious ways in our everyday lives. It's a very subtle effect, until you're flying close to a black hole or moving close to the speed of light."

**Sean Carroll**, Caltech, on time dilation, National Public Radio, September 23, 2010.

"This technique is really nice because it allows us to measure how things change in time... Obviously people have been doing this with other techniques for many years, but it has proven hard to do at very small time scales."

**Michael Crommie**, University of California, Berkeley, describing improvements to scanning tunneling microscopes, New York Times, September 27, 2010.

"The genocide in Rwanda is the closest example I can think of for this kind of behavior... It required active measures by a large group of instigators, and quite a bit of time to get started."

**Howard Davidson**, Stanford,

on what a civilization threatening "mind virus" might look like. FoxNews.com, September 29, 2010.

"It's marvelous that carbon wins again. Diamonds may be a girl's best friend but graphene gives an unexpected and a wholly new way to put the electron in carbon country; bringing a whole new range of applications and showing again the strength of the British science base. It confirms at the highest level the excellence of UK physics."

**Marshall Stoneham**, University College, London, on this year's Nobel Prize in physics, USA Today, October 5, 2010.

"The general result of this paper is that, contrary to what some previous studies have suggested, different observers would still agree about the chaotic nature of the universe... Now we establish once and for all that it is chaotic."

**Adilson Motter**, Northwestern University, MSNBC.com, October 5, 2010.

"There's a hypothesis that 4 billion years ago the young sun, like other stars, was far more active than it is now, and solar flares and other storms on the sun's surface were much more powerful and capable of wiping out the planet's magnetic field completely."

**Robert Lin**, University of California Berkeley, The San Francisco Chronicle, October 9, 2010.

"Helium is central to half of my ongoing research and the dissertation work of several students."

**Daniel Lathrop**, University of Maryland, on the projected national helium shortage, The Washington Post, October 11 2010.

"We used to think that the only real threat was from impacts that hit the ground and that the atmosphere would protect us from the small ones... We never really thought about the physics of airbursts. There hasn't been that much research."

**Mark Boslough**, Sandia National Laboratories, on asteroids that could explode in midair, MSNBC.com, October 11, 2010.

"They might have an interesting explanation for the effect, but I don't see how this will help batters."

**Alan Nathan**, University of Illinois, commenting on a recent study finding a curve ball's effectiveness is enhanced by the batter's peripheral vision, USA Today, October 14, 2010.

## This Month in Physics History

### November 11, 1930: Patent granted for Einstein-Szilard Refrigerator

Albert Einstein is best known to the general public for devising the world's most famous equation:  $E=mc^2$ . But his contributions to physics extend over a broad range of topics, including Brownian motion, the photoelectric effect, special and general relativity, and stimulated emission, which led to the development of the laser. Less well known, even among physicists, is his work with Leo Szilard to develop an energy efficient absorption refrigerator with no moving parts.

Szilard was born in Budapest, Hungary in 1898, the son of a civil engineer, and served in the Austro-Hungarian Army during World War I. After the war, he returned to university, studying physics under Einstein and Max Planck, among others. His dissertation was in thermodynamics, and in 1929 he published a seminal paper, "On the Lessening of Entropy in a Thermodynamic System by Interference of an Intelligent Being"—part of an ongoing attempt by physicists to better understand the "Maxwell's Demon" thought experiment first proposed by James Clerk Maxwell in the 19th century.

Szilard had a knack for invention, applying for patents for an x-ray sensitive cell and improvements to mercury vapor lamps while still a young scientist. He also filed patents for an electron microscope, as well as the linear accelerator and the cyclotron, all of which have helped revolutionize physics research. Szilard's most important contribution to 20th century physics was the neutron chain reaction, first conceived in 1933. In 1955, he and Enrico Fermi received a joint patent on the first nuclear reactor.

Einstein wasn't a stranger to the patent process, either, having worked as a patent clerk in Bern as a young man. He later received a patent with a German engineer named Rudolf Goldschmidt in 1934 for a working prototype of a hearing aid. A singer of Einstein's acquaintance who suffered hearing loss provided the inspiration for the invention.

When they met, Einstein was already a world-famous physicist, thanks to his work on relativity, while Szilard was just starting out, as a graduate assistant at the University of Berlin. The impetus for the two men's collaboration on a refrigerator occurred in 1926, when newspapers reported the tragic death of an entire family in Berlin, due to toxic gas fumes that leaked throughout the house while they slept, the result of a broken refrigerator seal. Such leaks were occurring with alarming frequency as more people replaced traditional ice boxes with modern mechanical refrigerators which relied on poisonous gases like methyl chloride, ammonia, and sulfur dioxide as refrigerants.

Einstein was deeply affected by the tragedy, and told Szilard that there must be a better design than the mechanical compressors and toxic gases used in the modern refrigerator. Together they set out to find one. They focused their attention on absorption refrigerators, in which a heat source—in that time, a natural gas flame—is used to drive the absorption process and release coolant from a chemical solution. An earlier version of this technology had been introduced in 1922 by Swiss inventors, and Szilard

found a way to improve on their design, drawing on his expertise in thermodynamics. His heat source drove a combination of gases and liquids through three interconnected circuits.

One of the components they designed for their refrigerator was the Einstein-Szilard electromagnetic pump, which had no moving parts, relying instead on generating an electromagnetic field by running alternating current through coils. The field moved a liquid metal, and the metal, in turn, served as a piston and compressed a refrigerant. The rest of the process worked much like today's conventional refrigerators.

Einstein and Szilard needed an engineer to help them design a working prototype, and they found one in Albert Korodi, who first met Szilard when both were engineering students at the Budapest Technical University, and were neighbors and good friends when both later moved to Berlin.

The German company A.E.G. agreed to develop the pump technology, and hired Korodi as a full-time engineer. But the device was noisy due to cavitation as the liquid metal passed through the

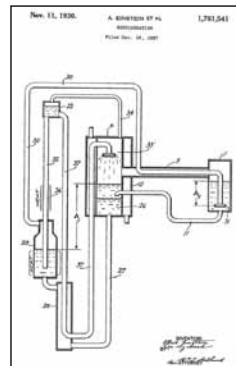
pump. One contemporary researcher said it "howled like a jackal," although Korodi claimed it sounded more like rushing water. Korodi reduced the noise significantly by varying the voltage and increasing the number of coils in the pump. Another challenge was the choice of liquid metal. Mercury wasn't sufficiently conductive, so the pump used a potassium-sodium alloy instead, which required a special sealed system because it is so chemically reactive.

Despite filing more than 45 patent applications in six different countries, none of Einstein and Szilard's alternative designs for refrigerators ever became a consumer product, although several were licensed, thereby providing a tidy bit of extra income for the scientists over the years. And the Einstein/Szilard pump proved useful for cooling breeder reactors. The prototypes were not energy efficient, and the Great Depression hit many potential manufacturers hard. But it was the introduction of a new non-toxic refrigerant, freon, in 1930 that spelled doom for the Einstein/Szilard refrigerator.

Interest in their designs has revived in recent years, fueled by environmental concerns over climate change and the impact of freon and other chlorofluorocarbons on the ozone layer, as well as the need to find alternative energy sources. In 2008, a team at Oxford University built a prototype as part of a project to develop more robust appliances, and a former graduate student at Georgia Tech, Andy Delano, also built a prototype of one of Einstein and Szilard's designs. Yet another team at Cambridge University is experimenting with cooling via magnetic fields. Perhaps this invention won't revolutionize the world, but in its own small way, it might help spare the planet—more than 70 years after Einstein and Szilard first conceived of it.

*Further Reading:*

*Dannen, Gene. "The Einstein-Szilard Refrigerators," Scientific American, January 1997.*



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## Education Corner

A column on educational programs and publications

### Funding for Undergraduates to Attend APS Meetings

A limited number of \$200 and \$1000 travel supplements are available for undergraduate students presenting at the 2011 APS March and April Meetings. Students must submit their abstracts by the meeting deadlines, which are **November 19** for the March Meeting, and **January 14** for the April Meeting. Students will also be invited to take part in **Future of Physics Days**, which include special events that are planned over the course of the meetings to enable undergraduates to meet their peers, share their research results with other physicists, and begin building a network among fellow physicists. For a description of the program and awards, including eligibility requirements, please visit [www.aps.org](http://www.aps.org) Keyword: Future Physics.

### APS Produces Laser Lessons and Kits

In conjunction with LaserFest, APS has produced a series of three hands-on, classroom-tested lessons on the laser, for high school students. The lessons cover the topics:

- What's So Special About Laser Light?
- How Does a Laser Work?
- What Are Some Applications of Lasers?

If your institution is interested in holding a teacher workshop using these activities, APS can provide a limited number of lesson books and kits for workshop participants. These materials are also available on the LaserFest website. For more information, see [www.laserfest.org/reources/lessons.cfm](http://www.laserfest.org/reources/lessons.cfm).

### Minority Scholarship Application Process Begins

APS encourages faculty members and high school teachers to inform their students about the Scholarship for Minority Undergraduate Physics Majors, which provides both funding and significant mentorship to selected underrepresented minority students. Any African-American, Hispanic American, or Native American US citizen or permanent legal resident who is majoring or plans to major in physics and who is a high school senior, college freshman, or college sophomore is eligible to apply. The application for 2011-2012 scholars is due on **February 4, 2011**, and can be found at [www.aps.org/programs/minorities/honors/scholarship](http://www.aps.org/programs/minorities/honors/scholarship).

### Workshops and Grants for Women Physicists

APS Professional Skills Development Workshops provide women physicists with professional training in effective negotiation, communication, and leadership skills, as well as a special opportunity for networking. One-day workshops are being planned for the March and April meetings. In addition, small grants of up to \$400 are available to assist March and April Meeting attendees who are bringing small children or who incur extra expenses in leaving them at home (i.e., extra daycare or babysitting services). For more information on these opportunities, as well as applications, see [www.aps.org/programs/women](http://www.aps.org/programs/women)

### APS Undergraduate Education Website

The APS website has an improved and expanded the section on Undergraduate Education. Highlights include:

- A variety of statistics on undergraduate physics education in the US. APS-produced graphs are freely available for use, as are the source data.
- Pages for faculty interested in offering research experiences for undergraduates, reforming introductory courses, preparing K-12 teachers, and recruiting more majors.
- Pages for students interested in attending a physics meeting, seeking career information, getting a scholarship, or doing research.

Check it out at [www.aps.org/programs/education/undergrad](http://www.aps.org/programs/education/undergrad)

### AAPT Winter Meeting

AAPT's annual winter meeting will be in Jacksonville, Florida from January 8-12, 2011. The theme is "Celebrating 100 Years of Nuclear Physics (1911-2011)," and highlights will include professional development workshops, featured sessions and speakers, and "A Living History of Madame Marie Curie." For more information, see [www.aapt.org/Conferences/wm2011](http://www.aapt.org/Conferences/wm2011).

### PRIZE continued from page 1

2010 on graphene. Last year at the APS March Meeting, hundreds of abstracts on the subject were submitted and nineteen special focus sessions on graphene were held.

Geim was born in Sochi Russia in 1958. He received his PhD in 1987 from the Institute of Solid State Physics at the Russian Academy of Sciences. Novoselov was born in Nizhny Tagil Russia in 1974. He received his PhD from Radboud University Nijmegen in the Netherlands.

Geim's award also marks the first time that an individual has won both an Ig Nobel prize as well as a Nobel Prize. *The Annals of Improbable Research* awards Ig Nobel prizes to goofy but legitimate scientific research. Geim won an Ig Nobel in physics in 2000 for work on diamagnetic levitation where he suspended frogs in air using magnetic fields. Placing the frog in the magnetic field was another Friday evening experiment.

## Mass Media Fellows Bring Science to the Public

**Editor's Note:** Each year, as part of a program administered by AAAS, APS sponsors two Mass Media Fellows who spend the summer working at a newspaper or other media outlet. In 2010 the APS-sponsored Fellows were Lulu Liu and Lauren DiPerna. Liu graduated from MIT with a major in physics, and DiPerna was a graduate of UC Berkeley in geophysics. They worked at the Sacramento Bee and the Orange County Register, respectively.

### Science Writers Are the Ambassadors of Science

By Lulu Liu

I'm not a journalist. In college I studied physics. I was a searcher of gravitational waves and exoplanets. I was an eager re-discoverer of fundamental laws. I was a reluctant programmer in several languages. But never a journalist.

So while I laid my roots in science and slyly cultivated an interest in writing on the side, it never occurred to me that there may be an intersection, and that this intersection—this land of science and writing—was accessible from my side of the divide.

I'm thankful to the Mass Media Program for this. For one, that with nothing more than a few writing samples in hand and an expression of genuine interest, I was taken seriously as an aspiring writer, despite a resume that provided no evidence.

But more, for its recognition—and the APS's recognition, as a sponsor of this program—that perhaps the discipline of science journalism is an ailing one positioned too close to journalism and too far from science. Surprisingly, I would learn this not from reporters or editors this summer, or even scientists, but from the public.

My first story ran on a Sunday about a week and a half into my internship. On Monday I received my first reader voicemail. He was surprised, the caller said, that I hadn't gotten anything wrong.

Fifteen years ago, the *Sacramento Bee* was the home of a Pulitzer Prize-winning science writer. Now it staffs no science writer at all. The skepticism that greeted me from all sides came unexpectedly.



Lulu Liu

Sometimes it was flattering: a hesitant source would open up once he learned that I had a background in science. But usually, it was derisive. Towards the end of July I wrote what turned out to be a controversial article about the physics of fair rides. I had to explain why, in the classic Gravitron ride, when the floor dropped the riders didn't drop with it. I pointed my finger at "friction" instead of the usual "centrifugal force." *Sacramento Bee* readers grumbled. They "weren't surprised", they said, the so-called science writer would get that wrong. But one commenter leapt

to my defense. Sort of.

Actually, he wrote, the *Bee* writer had it right. Briefly, I felt the warmth of vindication. "Although I doubt [she] understands what [she] originally wrote," he went on.

Science writers are the ambassadors of science yet it's rare, in the traditional media at least, for one to have any kind of scientific training. I suspected this might weaken general trust in science and scientists, but it's done more than that, it's thrown doubt on the mass media's ability to accurately represent this kind of information altogether.

Science journalism today, I report, is much more journalism than science. While the journalism field has warmly embraced science as one of its "beats", the scientific community still fails to consider outreach a legitimate activity for a scientist.

Absent an effective avenue of communication between scientists and the communities they serve, science is just some exclusive club the public is not allowed into, and the scientific truths that come of it seem arbitrary and capricious, no better than a politician's promises. It's my hope that the scientific community continues to cultivate passion and commitment not just in science research but also in science communication.

### A Good Reporter Gets Up Early and Stays Up Late

By Lauren DiPerna

Working at the *Orange County Register* changed the way I told a story. Before, I liked to save the best part for last and digress at least five times; I thought the extra detours were necessary to give a complete picture. Once I understood what Orange County readers needed from a story, however, I let go of the nitty-gritty details and I provide a more streamlined narrative. By the end of the 10 weeks, I realized that simple and concise writing always provides a better story, whether it is for a scientific or lay audience.

The straightforward structure not only helped me engage my readers, but also let me write efficiently. This was an essential tool because sometimes reporting took up 90 percent of my time.

For one story, the drive back from a wildlife rescue center, where I was reporting on a contaminated Albatross, took more time than I had to meet my deadline. My only option was to tell my editor the story over the phone.

These types of situations were the most stressful and exciting. I

liked getting out of the office and reporting on site, but there was always the chance that something might go wrong—horrid traffic or no Internet access. Nevertheless, the extra descriptions enhanced



Lauren DiPerna

my stories and strengthen their local angle—the essential requirement for attracting Orange County readers.

One of my most memorable stories was when I met with researchers at 5 am. I interviewed

them at the beach to add a visual description of them monitoring their experimental oyster reefs. I would have published the article later that day, but the photographer didn't get the images he wanted. The next chance I had to meet the researchers was in two weeks at 3:30 in the morning. It was exhausting, but worth the second trip because the story ended up on the front page.

My commitment to a story sometimes went beyond the publish date. After writing a story about the bizarre mating habits of the grunion—a fish that leaps out of the surf to mate in the moonlight—I felt compelled to see it for myself.

I convinced my roommate to come with me and wait on the beach. The first hour passed with little encouragement. Then just before midnight the grunions appeared, flipping and twisting by the hundreds.

I really enjoyed my time at the *Orange County Register*. It was great to feel like my work had a purpose and see that the public looks forward to reading the daily science section. Thanks APS.

# Letters

## Lost in Translation

The sole purpose of my letter published in the July *APS News* was to clarify the fact that Richard Feynman was over 60 years old and NOT a graduate student in the “mid-eighties,” with no other implication regarding the likelihood of the existence of a graduate student of such an age. John A. Dudek concluded that my comment, in conjunction with the title “World’s Oldest Graduate Student?,” suggests “that it is not feasible (or perhaps possible) to find a 60 year old graduate student.” This interpretation would seem correct, were it not for the fact that *APS News* wrote the headline of my letter, and not I, as he and most readers likely assumed. I have included my own title this time and will do

## Just Too Silly

One reason that I did not respond earlier to Mano Singham’s letter about the word “seminal” is that I thought that it was really too silly to bother with. As a female physicist who suffered some discrimination at the beginning of my career, I find it ridiculous to nitpick about words that really have nothing to do with gender discrimination, on the chance that someone might think they do. Years back I laughed at the Zero Gravity piece about fusion

## The Charm of History

For this regular reader of *APS News*, its greatest charm is the depth of its historical perspective. It is refreshing not only to be reminded in the August/September number of Empedocles’ contribution to our insight into the speed of light, but to be reminded of our roots in ancient Greece and the quest of its greatest

mind in the future to avoid potential misunderstandings. Nevertheless, Dudek should be commended for (unlike Richard Feynman) receiving his PhD in Mathematics at an age so distant from the mean of that demographic.

An interesting side note: A woman by the name of Nola Ochs in 2007 became the oldest person ever to receive a bachelor’s degree at age 95. This year, at age 98, she has received a master’s degree in liberal studies with a history concentration. If Ms. Ochs continues her education, she may well become the first centenarian graduate student.

**Edgardo Browne**  
El Cerrito, California

in nail polish remover and could not understand the fuss about possible gender discrimination. This is really ridiculous. As is the fuss over the word “seminal.” The letter about a new word was equally silly.

**Edith Borie**  
Karlsruhe, Germany

**Ed. Note:** the Zero Gravity in question appeared in the May, 2002 issue of *APS News* (available online).

minds into what for millennia was called “Natural Philosophy”—a term which is still preserved in Scottish universities and which recalls and preserves our precious intellectual heritage.

**Lawrence Cranberg**  
Austin, TX

## RESIGNATION continued from page 1

infrared absorber, and therefore, its increasing presence in the atmosphere contributes to global warming; ... On these matters, APS judges the science to be quite clear. ... In light of the significant settled aspects of the science, APS totally rejects Dr. Lewis’s claim that global warming is a ‘scam’ and a ‘pseudoscientific fraud.’”

In his letter, Lewis speculated that Council’s policy positions on climate change must be driven by financial interest, adding that Callan’s own physics department “would lose millions a year if the global warming bubble burst”. The APS press release categorically rejected the notion that APS as an organization is benefitting financially from climate change funding and further pointed out that the vast majority of the Society’s members do not work on climate and derive no personal benefit from such research support. Callan, in his reply, criticized Lewis’s speculation about the role of financial interest in determining the attitude of physicists to climate change as unacceptably disrespectful of the intellectual integrity of his scientific colleagues. He also noted that Lewis’s statement about the reliance of Callan’s department on climate science funding was wrong, as the actual level of such funding was

precisely zero.

In his letter to Lewis, Callan also addressed the issue of the formation of the new topical group, explaining that, far from being rejected, the proposal for a topical group focusing on the physics of climate had met with enthusiastic acceptance and was being implemented (see story in October *APS News*). Callan closed his letter by saying that, while he respected Lewis’s decision to resign, it was a pity that, by doing so, he was cutting himself off from participating in the very APS initiative he had called for.

## FOX continued from page 1

has concluded about the science, which he says is faulty, flawed and frankly needs to be discarded. So he said it’s become corrupting.”

The reports of Callan’s resignation are greatly exaggerated. Curtis Callan, the current president of APS, has not resigned his membership, or his position, nor has he written any letters refuting the science of global warming. Ingraham incorrectly attributed a letter written by Hal Lewis of UCSB and sent to Callan as being written by Callan himself. The letter was clearly addressed to Callan (it begins, “Dear Curt”) and was signed by Lewis at the end. It is unclear how Ingraham, with an accompanying graphic, confused the two. *Fox News* got it wrong.

## SPIN-UP Report Tells How It’s Done

We were pleased to read Sacha Kopps’s The Back Page article (*APS News*, August/September 2010) about the success of the University of Texas at Austin’s efforts to enhance its undergraduate physics program. Almost all of the elements of the Austin activities are in alignment with the common features of thriving undergraduate physics programs described in the Strategic Programs in Undergraduate Physics (SPIN-UP) report published in 2003. (The report is available online at <http://www.aapt.org/Programs/projects/ntfup.cfm>.) Those common features include (1) recognizing that the department “owns” the problem of

recruiting and retaining students in physics (we can’t just blame the admissions office), (2) understanding why our students choose or don’t choose physics as a major, (3) getting our best educators to teach the introductory physics courses (which are the interface between the department and the largest number of students), and (4) building a sense of community among our students and faculty members. As editors of the SPIN-UP report, we encourage other physics departments to follow UT Austin’s lead to find ways to enhance their undergraduate physics program. The SPIN-UP report provides 21 case studies that can

help you get started. If you would like to know what is going on currently in undergraduate physics education in a number of large departments, we suggest reading the report from a SPIN-UP workshop held this summer at Rutgers University that outlines those 17 departments’ activities. The report is available at [http://aapt.org/Programs/projects/spinup/upload/rutgers\\_final\\_report.pdf](http://aapt.org/Programs/projects/spinup/upload/rutgers_final_report.pdf).

**Robert C. Hilborn**,  
Richardson, TX  
**Ruth H. Howes**,  
Santa Fe, NM  
**Kenneth S. Krane**,  
Corvallis, OR



## Ig Nobels Presented in Wacky Ceremony

By Michael Lucibella

Wearing socks over one’s boots in winter can help with traction on icy surfaces. That is the discovery made by this year’s winner of the Ig Nobel Prize for physics.

“We did a piece of lighthearted research actually, and it arose out of a tearoom conversation one icy morning,” said Lianne Parkin, a physician at the University of Otago in New Zealand and lead author of the research published in the *New Zealand Medical Journal*.

“Basically the background to it is that we live in a very steep city in the south of New Zealand, and every year once or twice in the winter it gets very very icy and it’s a real challenge not to fall over and some of our fellow citizens have actually responded to this by putting socks over their shoes in these conditions. And at our tearoom conversation we decided actually there was no good scientific evidence for this practice, so we should probably evaluate it by doing a randomized controlled trial, so we did.”

Held each year just days before the actual Nobel Prizes are announced, the Ig Nobel awards are presented to the best of the year’s seemingly silly scientific research. This year marks the 20th first annual Ig Nobel Prize ceremony.

“They honor something unusual. They honor things that make people laugh and then make them think; and that’s the only quality. It doesn’t matter if it’s good or bad or important or not, but it has to, when you first encounter it, make you laugh and then it has to rattle around in your head for a week or so, so after a week the only thing you really care about is telling your two best friends about it.” said Marc Abrahams, founder of the Ig Nobel Prizes.

The ceremony, held in Sanders Theater at Harvard Univer-

sity, is a joke-filled variety show of science wackiness. This year featured a bacterial opera, author Neil Gaiman describing the odds a life form on the back of a book jacket is a bacterium or a writer (roughly three sextillion to one), and Physics Nobel laureates Sheldon Glashow and Frank Wilczek describing how many bacteria can dance on the head of a pin. Three other Nobel laureates, Roy

dressed as the Emperor from Star Wars stood in.

Alessandro Pluchino and Andrea Rapisarda in the physics and astronomy department at the University of Catania along with sociologist Cesare Garofalo, also at Catania, won in the Management category for their paper “The Peter Principle Revisited: A Computational Study.” In it, the researchers showed mathematically that organizations would be more efficient if they promoted people at random.

Other winners this year included a team from Mexico and the United Kingdom awarded the Engineering Prize for using a radio-controlled helicopter to collect whale snot. The Transportation Planning prize was awarded to a team from Japan and the United Kingdom for using slime molds to find the optimal routes for railroad tracks around Tokyo. Simon Rietveld and Ilja van Beest from the Netherlands won the Medicine Prize

for finding that roller coasters can be used to treat asthma. Manuel Barbeito, Charles Mathews and Larry Taylor from the United States won the Public Health Prize for finding that more bacteria cling to bearded scientists than clean-shaven ones. A team from China and the United Kingdom won the Biology Prize for their research into fruit bat fellatio.

The Ig Nobel Peace Prize was given to a team from the UK who proved that swearing while hurt can actually make it easier for individuals to tolerate pain. The economics prize was offered to the executives and directors of Goldman Sachs, AIG, Lehman Brothers, Bear Stearns, Merrill Lynch and Magnetar; however, like BP, no company representatives were sent to collect the prize.



Photo by Michael Lucibella

Nobel laureates Roy Glauber (Physics 2005) on left and Sheldon Glashow (Physics 1979) on right help sweep up a mound of paper airplanes thrown on stage during the 20th first annual Ig Nobel Prize ceremony.

Glauber, James Muller and William Lipscomb were also onstage to shake the hands of the winners. In addition, Lipscomb participated in the contest to win a date with a Nobel laureate.

Though “bacteria” was the theme of the ceremony this year, physics and physicists featured prominently in several of the awards. The prize given for Chemistry went jointly to Eric Adams of MIT, Scott Socolofsky of Texas A&M University, Stephen Masutani of the University of Hawaii and BP, “for disproving the old belief that oil and water don’t mix.”

“It’s fluid physics. What we would call ourselves is fluid mechanicians. Scott and I in particular study plumes,” Adams said.

## Community Values APS's Education Research Journal

By Gabriel Popkin

Five years after its launch, the journal *Physical Review Special Topics-Physics Education Research (PRST-PER)* has established itself as a significant and valued member of the APS journal family. The open-access, online-only journal began in 2005, and has been published twice a year ever since.

According to Robert Beichner, the journal's editor, *PRST-PER* was founded to fill a gap in APS's coverage of current physics research. "The number of people doing research in physics education was growing rapidly, and there was pent-up demand for a publication venue in the PER field."

Eugenia Etkina, a Rutgers Science Education professor and frequent contributor to the journal, echoes this sentiment, writing in an email, "If it were not for this journal, many people would have had zero opportunity to publish their research. My professional life has become incredibly easier and ten times more productive since *PRST-PER* began."

The growth of the journal's article view and downloads is testament to its increasing popularity and visibility. Article views increased from around 24,500 in

2008 to nearly 34,000 in 2010, while pdf downloads increased from around 8,400 to over 26,000, according to statistics furnished by the APS Editorial Office.

Daniel Kulp, Editorial Director at the APS Editorial Office, notes that the journal achieved an impact factor of greater than 1 in 2008, its first year of eligibility. The impact factor is a frequently used, although sometimes controversial, method of ranking journals; it is calculated by dividing the total number of citations that papers in the journal received by the number of papers published in the journal, over the previous two years. *PRST-PER's* impact factor in 2008 was 1.781; in 2009, it was 1.237.

Kulp says that while the significance of the impact factor can be hard to interpret, it can be a useful measure in gauging community acceptance of a journal. "The fact that *PRST-PER's* first factor was 1.7 indicates that the physics education research community has accepted the journal, and that people find the articles useful."

Part of the reason *PRST-PER* articles are frequently cited may be the open-access format of the journal, which requires no subscription or registration. This makes it avail-

able to teachers whose schools are not likely to purchase institutional subscriptions.

In addition, Kulp says, the journal is becoming more widely known, and papers are being submitted by a wider range of authors, including more international authors. Moreover, says Beichner, "the field of *PER*, and the journal's impact on it, continue to grow. Of all the academic disciplines, physics is clearly recognized as the leader in studying the teaching and learning of the subject matter. I believe our journal plays a major part in building that reputation."

Another important benefit of the journal is the status it bestows upon physics education research, notes Beichner. "Having a journal in the *Physical Review* family is certainly helpful to researchers trying to make their case for tenure or promotion."

Noah Finkelstein of the University of Colorado at Boulder, also a frequent contributor to the journal, agrees. "As a premier journal in the discipline of physics, *PRST-PER* has helped establish physics education research as an accepted field—a sub-discipline of physics that is significant, scholarly, and an area of growth within physics."

## Physics Lags in Minority Representation

Two recent studies have found that despite some gains, African Americans and Hispanics continue to be underrepresented among physics students and faculty members. The reports highlighted gains made overall by minorities in academia, but Hispanics and African Americans continue to be a disproportionately small part of the physics community.

The American Institute of Physics' Statistical Research Center issued the two reports tracking minority enrollment in colleges. The research collected data from surveys of nearly 800 universities as well as information compiled in the Integrated Postsecondary Education Data System run by the National Center for Education Statistics under the Department of Education. The data covered up to the end of the 2008 academic year.

Currently African Americans make up 12.4 percent of the United States population, while they earn 9 percent of all bachelor's degrees and only 2.9 percent of physics bachelors degrees. Similarly, Hispanics comprise 15 percent of the United States population, while

making up only 8 percent of overall bachelors degrees and 4.7 percent of physics bachelors.

Over the span of a dozen years, Hispanics have nearly doubled the number of physics bachelor's degrees from about 115 in 1996 to 229 in 2008. African Americans have over the same time fluctuated between about 180 and 130 with 144 earned in 2008.

During the 2005-2006 academic year, the most recent data available, African Americans made up 3.6% of all PhDs awarded, but less than 1% of physics PhDs.

Long-term trends show that over the last 30 years the number of African Americans earning PhDs has increased overall. The 1990s saw a peak of Hispanics earning physics PhDs with a decrease between 2001 and 2006.

Minorities remain similarly underrepresented among physics faculty. African Americans over the last eight years have seen significant increases in the number of university faculty but remain less than 3 percent of the faculty at bachelor's degree granting institutions and 1.2 percent at PhD grant-

ing institutions. More than 85 percent of physics departments have no African Americans among their faculty. The number of Hispanic faculty members has similarly increased overall, yet nearly 80 percent of physics departments have no Hispanic faculty.

The study did highlight that the number of minority students receiving bachelor's degrees overall has increased dramatically over the last decade. While the total number of degrees awarded increased by 32 percent over the last ten years, Hispanic women have made the biggest gains, earning 75 percent more bachelor's degrees than a decade ago. Hispanic men in 2008 earned 59 percent more degrees than in 1998. African American men increased their share by 51 percent over the same time while African American women rose by 45 percent.

African Americans have tended to go into fields such as business and management, psychology and computer science, while Hispanics have gravitated towards education, psychology and engineering.

followed by a stint at Montclair State University in March and then to Arizona State University in April in conjunction with its Origins Institute.

The moral and ethical issues that go along with physics discoveries are also ripe fodder for the stage. The famous 2005 opera *Dr. Atomic* written by John Adams and Peter Sellars highlighted the ethical conundrum felt by Robert Oppenheimer and other members of the Manhattan Project as they labored to produce the atom bomb. Similarly, an earlier work dealing with the morality of physics and physicists is Michael Frayn's 1998 play *Copenhagen*, about Niels Bohr and

Werner Heisenberg's mysterious meeting in Denmark in the early days of World War II. The performance is an examination of what exactly transpired between the two physicists and launches into a philosophical discussion over the morality of scientists and the atomic bomb. Though Bohr and Heisenberg are two of the most famous physicists in history, the play is not about their scientific discoveries.

"There's very little physics in the play itself," Frayn said. "I have absolutely no understanding of physics whatsoever."

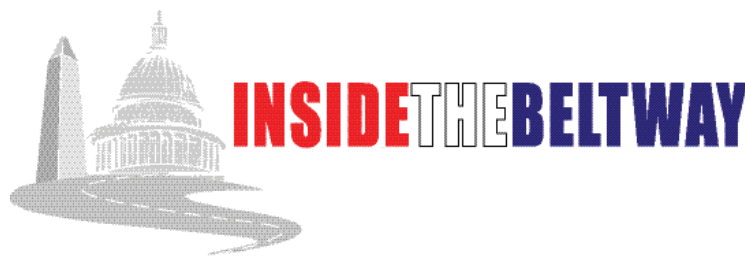
Instead, the play focuses mostly on what Heisenberg might have said to Bohr about Germany's at-

## Fellows Meet in Back-to-Back Bay Bashes



Photo by Darlene Logan

This photo, taken at a Fellows' reception in late September on the Stanford campus, shows (l to r) UC Santa Cruz physicists Peter Young and Steven Ritz fraternizing with Nan Phinney of SLAC. On page 6 of this issue is a photo from another Fellows' reception held the following evening at UC Berkeley.



## The Task Ahead

by Michael S. Lubell, APS Director of Public Affairs

When Barack Obama swept into office nearly two years ago, he was supposed to be the first post-partisan president. He hasn't been. When he beat John McCain by more than a two to one margin in electoral votes, the Earth was supposed to quake. It didn't.

And when Republicans were reduced to 40 seats in the Senate and 178 seats in the House of Representatives in the 2008 election, pundits said the GOP was headed for the grave. If, indeed it was—and I never subscribed to that forecast—it has risen like the mythical Phoenix in less than 24 months.

The resurgence of the Republican Party, if nothing else, has proved that democracy is still alive in America: our nation is not heading for one-party government or a state-run economy, as some conservatives had warned as they watched the 2008 returns roll in. That's the good news.

The bad news is the gridlock that has plagued Washington for the last two years will probably get substantially worse in a Congress that is equally divided. It's hard to see how the dysfunction that is synonymous with the Senate—where one member can stall legislation by placing a secret hold on the proceedings or where 41

members can prevent a bill from being debated at all—will suddenly transform itself an aura of good feeling.

And the House, where the majority party has the power to relegate the minority to little more than a cast of picadors who stick barbs into the bull in the pulpit, will likely remain as undemocratic as ever, even if the party in charge owes its control to but a handful of members on the fringe.

Washington may well continue to dither under a cloud of partisanship, but the problems our nation faces will not wait for another, brighter day when elected officials worry less about future elections and more about reaching consensus on momentous decisions that will determine our nation's future.

Little more than five years ago, responding to a set of ominous research and development benchmarks assembled by the Taskforce on American Innovation, Congress called on the National Academies to develop a blueprint for future economic growth and global competitiveness based on science and technology. Then, Democrats and Republicans had a shared concern about the course of our nation was plying. Their call to the Academies

**TASK continued on page 7**

**THEATER continued from page 1**  
of beginning of the universe.

"I got very much into the poetry of the mind. I think these physicists are incredible poets, in the sense it's both concrete and abstract at the same time," Lerman said.

The first act moves from the inside of Marie Curie's lab to the Large Hadron Collider, then out through the Hubble Space Telescope to the edge of the Universe. The second act moves the audience members into several small rooms with tea and chocolate cake to discuss the issues raised in the first act with other audience members and a physicist moderator. The performance is heading next to Wesleyan University in February 2011, fol-

tempts to create an atomic bomb, a subject long debated by historians.

"The intention was not to write a play about science or a moral tract or even a moral or ethical examination. It was to write a story about why humans do what they do," Frayn said. "If you are to make any moral judgments on anyone, you have to understand their actions."

This is a sharp contrast to Lisa Randall's 2009 opera *Hypermusic Prologue* which premiered at the Centre Pompidou in Paris in June. The opera focuses on the concepts of extra dimensions as one of the protagonists travels into five dimensional space. Randall, a professor of theoretical physics

at Harvard, was first contacted by the Spanish composer Hector Parra who wanted to turn the concepts in her book, *Warped Passages*, into an opera. She said that Parra was a driving force to include as much physics in the production as possible.

"In some sense there's a lot of [physics], more than I would have put in," Randall said, "There's quite a bit, but it's not explained so I don't think people are necessarily going to understand it all."

Randall added, "I think there's a lot of excitement about doing something like this. I think people want to see more about art and science put together."

## APS Holds Fellows Reception at Berkeley



Photo by Darlene Logan

In late September, APS hosted back-to-back receptions for Fellows in the Berkeley and Stanford areas, thereby making it unnecessary for either group to make the onerous trek across the bay. Both receptions were very well attended. In this photo from the Berkeley reception, APS President Curtis Callan (2nd from left) shares a moment with (l to r) Berkeley physicists Carl Haber, Stuart Freedman, and George Trilling. Trilling served as APS President in 2001. A photo from the Stanford reception appears on page 5.

## NRC Deals With Application Surge, Proliferation Threat

By Michael Lucibella

In a recent speech, the Chair of the Nuclear Regulatory Commission emphasized the importance of maximizing the safety and security of nuclear power plants. Currently, the Commission is inundated with the most construction applications in three decades.

Speaking at the Brookings Institution in Washington, NRC Chair Gregory Jaczko said that one of the biggest challenges facing the agency is the large number of applications for new power plants. When he first took the post he expected to see one or two new applications; however, the agency is currently considering 13 applications, down from a peak of 18.

"It's a significant change for the agency to have this many applications in front of them," Jaczko said.

He added that he felt the agency was properly prepared to address the swell of applications and had increased the size of its staff accordingly.

There has been a big push on the part of the Obama administration to encourage the development of nuclear power as a viable alternative to fossil fuels. It increased loan guarantees for new nuclear power plants from \$18.5 billion authorized in 2005 to \$54 billion. Despite this push, only one plant has completed the licensing process and begun construction. Jac-

zko said he was more concerned with having an effective approval process rather than with the number of plants built.

"I think our focus is: If there are plants, they are safe. How many there are is up to the utilities," Jaczko said.

He emphasized that the 1979 accident at Three Mile Island in Pennsylvania was a turning point for the nuclear power industry. Since then, with the exception of the one currently under construction, no new nuclear power plants have been built. As a result of the accident, the agency worked to establish better management to implement regulations at plants.

"I think fundamentally those improvements led to an improvement in safety," Jaczko said. "The issue of a safety culture is an important issue for the agency."

Though no major accidents at facilities have occurred since Three Mile Island, Jaczko cautioned against institutional overconfidence at power plants.

"We need to be wary of the view that just because it hasn't happened in the past, it can't happen in the future," Jaczko said. "The core of that is instilling the right safety culture in every facility."

Another concern over nuclear safety is the potential misuse of the technology for the proliferation of nuclear weapons. The start of construction by General Elec-

tric of a plant in North Carolina to enrich uranium using a new process called SILEX has attracted such concerns. The Separation of Isotopes by Laser Excitation uses lasers to purify nuclear fuel by ionizing the atoms of the U-235 isotope. A charged plate then collects the charged uranium atoms. It is thought that this method would require less energy to enrich nuclear fuel than the existing method using centrifuges.

Experts have raised concerns that a SILEX facility could be easily concealed from surveillance satellites by an unfriendly nation and used to create fuel for nuclear weapons. In March, Francis Slakey, a professor at Georgetown University and APS's Associate Director of Public Affairs, co-authored a letter in *Nature* calling for the NRC to conduct a proliferation risk assessment for any domestic company looking to license the technology. Jaczko said that the NRC was still considering the matter.

"At this point the commission really hasn't made a decision about this," Jaczko said.

He added that he thought that the current system in place was working well.

"The question is whether you really can control the information and the material," Jaczko said, "I believe our approach to these two questions is adequate."

NRC continued on page 7

## Research Exposes Danger of Boring Environments

By Eric Betz and Michael Lucibella

With funding from the Nuclear Regulatory Commission, scientists are enthusiastically studying bored people. The goal of the research, being conducted at MIT's Humans and Automation Laboratory—or HAL—is to find out what effect a static and sterile environment has on nuclear power plant operators.

"The NRC wants to tell you that their environments are sterile and if you have a sterile environment people won't get distracted," said HAL director Missy Cummings. "I actually think they will, and it will be worse than if these people had the ability to amuse themselves."

Cummings is among those studying the effects of automation and believes keeping workers engaged and making decisions is key to preventing mishaps. She says increased automation in places like power plant operating facilities has reduced people's skills and eaten away at situational awareness.

"There are a lot of tasks today... that are becoming more and more automated," said Nancy Cooke, science director of the Cognitive Engineering Research Institute, who is separately studying the impacts of boredom. "They're called vigilance tasks."

Cooke says these involve scenarios where people are required to pay close attention over long periods of time, a situation common in power plant control rooms. The problem arises when an operating environment is automated to the extent that boredom sets in. It's then exacerbated in a team environment where individuals can distract each other.

Much of the research in the past has focused on people's reactions to emergencies where many things are happening at once. Cummings is focusing on the opposite—long bleak stretches of nothing that are punctuated by brief events.

"Technology is starting to change our world so much that we don't really recognize the behavioral impacts on it," Cummings said. "When plants are up and running at

full power there is absolutely nothing happening and these guys are bored out of their minds."

Speaking for the NRC, Sean Peters, chief of the Human Factors and Reliability branch of the agency, denied that power plants are currently boring. He said the agency is more interested in addressing potential future problems as the NRC considers how much automation to include in its next generation of designs.

"Boredom is not being identified as an issue at the current generation of nuclear plants," said Peters. "The research is really exploratory; we're looking into it to see if it is an issue for future plant designs."

The Humans and Automation Lab plans to test an unusual solution that teenagers have been using to combat boredom for years: video games. Using MIT students as guinea pigs, HAL is conducting a series of experiments to determine how best to keep people engaged in the task at hand.

Participants will be told to operate a nuclear reactor simulation in three different scenarios: the first will be to replicate the current sterile environment of a plant control center with no allowed distractions of any kind; the second will be anything goes, participants can bring cell phones, laptops and reading material to amuse themselves as they choose; and third, the simulation will be bundled with a video game about operating a nuclear power plant that the subjects can use to entertain themselves.

The researchers expect that those playing the video game will perform better than those forced to work in a sterile environment, because the distraction might serve to keep them engaged.

This may make it sound like video gamers would be the ideal people to run nuclear power plants, but previous studies have shown this is not the case. In her research on boredom in simulated unmanned aerial vehicle operation, Cummings found that hard-core

DANGER continued on page 7

## APS Meeting Briefs

The **Northwest section of APS** held its annual meeting at Whitman College in Walla Walla, Washington from September 30 through October 2. Thursday's opening lecture by Barry Barish of Caltech highlighted the work of LIGO in its search for gravitational waves. Twelve plenary sessions were held over Saturday and Sunday: Rory Barnes from the University of Washington updated attendants on the search for habitable planets outside the solar system. David Atkinson from Pacific Northwest National Labs described efforts to improve explosives detection. Valery Milner of the University of British Columbia described new methods of ultrafast spectroscopy. During the Friday evening's banquet, geologist Kevin Pogue of Whitman College spoke about the intersection of geology and wine-making over a sampling of local wines.

The joint **63rd Annual Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas** was held from October 4 through 8 in Paris, France. The Tuesday evening session featured four speakers weighing in on the history and future of plasma processing and collision physics. On Wednesday morning, the winner the Will Allis prize, Mark Kushner of the University of Michigan, spoke about his research into hybrid plasma models. Stephane Mazouffre of ICARE, described current research and development into plasma thrusters. Jae Koo Lee of the Pohang University of Science and Technology highlighted how plasmas could be used in medicine, specifically for treating cancerous growths.

The **Joint Fall Meeting of the Ohio-Region Section of the APS and the Appalachian and Southern Ohio Sections of the AAPT** was held at Marietta College in Marietta, Ohio on October 8 and 9. The plenary speakers included past Blewett Scholarship recipient Janice Wynn Guikema from Johns Hopkins University describing the potential for graphene to be used as nanoscale magnetic sensor. On

Saturday morning Maher Dayeh of the Southwest Research Institute showed the work of IBEX in its mission to map the far reaches of the solar system, following Friday night's planetarium show also about the discoveries of the IBEX satellite. Mark Eriksson University of Wisconsin-Madison presented on how future quantum computers could be dependent on silicon and germanium quantum dots for processing.

The **New York sectional meeting** was held at Hofstra University in Hempstead, New York on October 15 and 16. Brookhaven labs were a large presence at the meeting, with Raju Venugopalan and Mei Bai each hosting a talk about recent experiments at RHIC that created quark-gluon plasma. Author Marcia Bartusiak from MIT spoke at Friday's banquet about her book *The Day We Found the Universe* which tells the story of how Edwin Hubble discovered that the Milky Way was only a single galaxy in the universe. Daniel Wolf Savin from Columbia University described his lab work to understand the formation of the first hydrogen molecules.

The **Four Corners section** met at Weber State University in Ogden, Utah on October 15 and 16. At Friday's banquet Author Chris Cokinos of Utah State University read from his recent book "The Fallen Sky" chronicling the history of meteorite hunters. John Elwell from the Space Dynamics Lab at Utah State University described some of the results from the recent all-sky survey by the Wide field Infrared Survey Explorer. Jennifer Heath from Linfield College shared her work on improving the efficiency of emerging solar cell technology. Constance Walker from the National Optical Astronomy Observatory described her work at raising public awareness about light pollution around the world and called on the researchers present to also get involved.

## ANNOUNCEMENTS

## Professional Skills Development Workshops For Women Physicists

Improve your negotiation skills and learn to communicate your great ideas to colleagues.

**Who may apply:** Women postdoctoral associates and women faculty in physics. Each workshop will have one session aimed at women postdocs and one session aimed at women faculty.



**When:** Sunday, March 20, 2011,  
Dallas, Texas\*

Friday, April 29, 2011,  
Anaheim, California

**Deadlines to apply:**

December 10, 2010 (for March) / January 10, 2011 (for April)

First consideration will be given to applications received by the deadlines. Workshops will be limited in size for optimal benefits. Women of color are strongly encouraged to apply.

Participants are eligible to receive a stipend to help cover the cost of travel and up to two nights lodging.

Details at <http://www.aps.org/programs/women/workshops/skills/>

**These workshops are funded by a grant from the National Science Foundation**

\*Pending NSF Funding

## Reviews of Modern Physics

Recently Posted Reviews and Colloquia

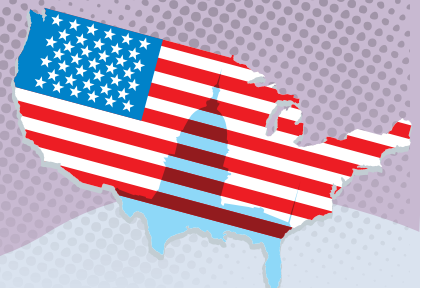
### Vortices in quantum droplets: Analogies between boson and fermion systems

H. Saarikoski, S.M. Reimann, A. Harju and M. Manninen

Vortices are ubiquitous in classical and quantum fluids. In quantum fluids, vortices typically form regular arrays, a unique signature of quantization. One might expect that bosonic and fermionic fluids would display very different vortex properties but this review of the many-body physics of small particle systems reveals unexpected similarities. Systems of interest include atomic Bose-Einstein condensates and degenerate fermionic systems, quantum Hall states in a 2D electron gas, and quantum dots in strong magnetic fields. The major sections of the review are on many-body wave functions, computational many-body methods, and single-component and multicomponent quantum droplets.

<http://rmp.aps.org>

## APS Congressional Science Fellowship 2010-2011



**THE AMERICAN PHYSICAL SOCIETY** is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

**QUALIFICATIONS** include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be U.S. citizens and members of the APS.

**TERM OF APPOINTMENT** is one year, beginning in September of 2011 with participation in a two week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

**A STIPEND** is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

**APPLICATION** should consist of a letter of intent of no more than 2-pages, a 2-page resume: with one additional page for publications, and three letters of reference.

See <http://www.aps.org/policy/fellowships/congressional.cfm>.

**All application materials must be submitted online by January 14, 2011.**

### NRC continued from page 6

He added that it was the suppliers, not the reactors, who were the biggest source of concern about proliferation. The suppliers of nuclear fuel are more decentralized and as a result are becoming more

of a focus for the NRC as they are working to overhaul oversight generally of the entire fuel cycle.

"It's more of a challenge on the enrichment side," Jaczko said.

### DANGER continued from page 6

gamers were among the worst scorers. The reason appears to be that the virtually continuous stimulation provided by video games is an environment too far removed from the long hours of nothing involved in operating an unmanned aircraft. Cummings half-jokingly sug-

gests that these types of scenarios might be an ideal place for the aging workforce. "Maybe they'd operate these systems with more patience than the rest of us," she said. "Maybe we should weed out people based on their love of Halo."

voted for it—this, despite the backing of the U.S. Chamber of Commerce and National Association of Manufacturers, both bulwarks of a pro-business Republican agenda.

As for the Senate, the Democratic leadership's focus on election-year wedge issues, such as immigration and gays in the military, relegated COMPETES to the backburner or no burner at all. Without any sense of urgency, the bill hasn't even received floor consideration.

While Washington spends its time on partisan nastiness, the rest of the world is moving ahead

without us. China, India, and Germany are poised to take over where we've left off.

And with dozens of newbies who have scant knowledge about science, innovation and competitiveness preparing to take their seats in the 112th Congress in January, we have a monumental task ahead of us. We need them to understand that science and technology drive the American economy and that federal neglect of research and development will relegate our nation to second-class status in the 21st-century world.

### Membership Benefit Highlight:

## What is *APSIT* and how could it benefit me?

Each year, a majority of APS members receive a letter in the mail from **APSIT, the American Physical Society Insurance Trust**, offering a range of insurance products. APS is the original society of the Insurance Trust, established in 1969, to provide early and mid-career members with a convenient source for high quality insurance coverage at an affordable price.

### APSIT offers six insurance products:

- term life
- 10 year level term life
- disability income
- personal accident
- hospital indemnity
- long term care

Insurance plans are underwritten by the New York Life Insurance Company and administered by Herbert V. Friedman, Inc. Both in terms of the coverage offered and the low-cost premiums, APSIT products are very competitive with other providers and are worth consideration. APS believes that the Society's continued participation in APSIT is a benefit to our members and encourages everyone to learn more about the products.

[www.apsitinsurance.org](http://www.apsitinsurance.org)

## Childcare Grants Available

**What:** Small grants of up to \$400

**Who is eligible:** parents/caregivers who plan to attend the APS March or April meeting with their small children or who incur extra costs to bring them along or leave them at home. Preference is given to early career applicants.

**Deadline:** Apply by **January 17, 2011** (for March) or **February 17, 2011** (for April)

**Details at** <http://www.aps.org/programs/women/childcare.cfm>

These grants are made possible by funds from the Elsevier Foundation and the American Physical Society.

Grants are also available for the November Division of Plasma Physics meeting in Chicago.

Apply by **October 8, 2010** at <http://www.aps.org/units/dpp/meetings/dpp10/services.cfm>.



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mies was a bipartisan clarion.

In less than half a year, a committee chaired by Norman J. Augustine, retired CEO of Lockheed Martin, completed its signature report, *Rising Above the Gathering Storm*. In stark language, the document laid out the steps policy makers needed to take to prevent the United States from being relegated to a has-been nation. The report led to the Bush Administration's "American Competitiveness Initiative" and the House Democrat's "Innovation Agenda."

The two plans found common ground in the America COM-

PETES Act of 2007, which called for substantial increases in investments in science research and education. Congress passed the three-year authorization bill with large bipartisan majorities, and President Bush signed it into law. But that was in August 2007 when Democrats and Republicans still made an occasional show of working together for the good of the nation. No more.

Last month the Augustine Committee issued a dire forecast in an Academies reprise. *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*

warns that in science and technology the United States is now positioned far worse than it was just five years ago. Support for key federal agencies has lagged, and policies to improve science teaching and increased industrial R&D have failed to materialize.

And what began in 2007 as a joint effort to reinvigorate America's science and technology proficiency has now fallen victim to partisan sniping and hubris. When the House finally passed the America COMPETES Reauthorization Act of 2010 last May 28, only 17 out of 177 Republicans

# The Back Page

## New Worlds, New Horizons in Astronomy and Astrophysics

by Roger Blandford and Donald C. Shapero

Every ten years the astronomy community mounts a major effort to define a scientific program for the next decade. The surveys build community consensus around a set of priorities for major projects in the field. They have been remarkably successful over the last 50 years in promoting the implementation of these high-priority initiatives on the ground and in space.

The current survey, organized under the auspices of the Board on Physics and Astronomy and the Space Studies Board of the National Research Council, was recently released in preliminary form (National Research Council 2010). Following in the footsteps of its five predecessors, it recommends a prioritized program of activities for the 2012-2021 decade, and it lays the foundation for the decade after that. But unlike previous surveys, it reprioritized any project recommended in a previous survey that has not been realized. And, responding to concerns about cost growth of major projects, the survey engaged the Aerospace Corporation to assist it in assessing the technical readiness and appraising the likely cost of the large projects. The recommended program fits within plausible budget scenarios based on input from the agencies supporting research in this field. As a result, recommended priorities reflect an executable balance of scientific promise against cost, risk, and readiness. The international context also played an important role in the committee's deliberations, and many of the large projects involve international collaboration as well as private donors and foundations.

An important feature of the surveys is extensive consultation with and input from the scientific community. To plan the survey and assist in making the decision about when to initiate it, the Board on Physics and Astronomy convened a group of researchers at the National Academies' Keck Center. The result was the foundation of a proposal to NASA, NSF, and DOE to launch a new survey, dubbed Astro2010. The Survey Committee, formed in 2008, created 9 panels involving 123 members of the astronomy and astrophysics research community at universities and government laboratories to provide science assessments and to establish priorities within defined areas of ground-based and space-based research. The Committee issued a request for information to elicit proposals for projects to be prioritized, which resulted in the submission of over 300 white papers that provided broad community input to the panels. More details on the process may be found at <http://www.nationalacademies.org/bpa>.

The Committee found that astronomers' overall view of the universe has changed dramatically in the last decade. Hundreds of planets of startling diversity have been discovered orbiting distant suns. Black holes, once viewed as an exotic theoretical possibility, are now known to be present at the center of most galaxies, including our own. Precision measurements of the primordial radiation left by the big bang have enabled astronomers to determine the age, size, and shape of the universe. Other astronomical observations have also revealed that most of the matter in the universe is dark and invisible and that the expansion of the universe is accelerating in an unexpected and unexplained way. Recent discoveries, powerful new ways to observe the universe, and bold new ideas to understand it have created scientific opportunities without precedent.

The growing intersection between physics and astronomy figures prominently in the new discoveries and insights about the universe. The physics underlying many astronomical phenomena is becoming clearer. At the same time, the cosmos is proving to be a laboratory for the exploration of basic questions in general relativity, particle and nuclear physics, and atomic, condensed-matter, and plasma physics.

The science objectives chosen by the survey committee for the decade 2012-2021 are:

- Searching for the first stars, galaxies, and black holes;
- Seeking nearby habitable planets; and
- Advancing understanding of the fundamental physics of the universe.

These three objectives represent unprecedented opportunities now becoming within our capability to explore. The discoveries made will surely lead to new and sometimes surprising insights that will continue to expand our understanding and sense of possibility, revealing new worlds and presenting new horizons, the study of which will bring us closer to understanding the cosmos and our place within it.



The Astronomy and Astrophysics Survey Committee

The identification of these science priorities played a seminal role in the process: the organizing principle for construction of the project priorities was to provide a balanced portfolio of capabilities to address these science objectives.

This report recommends a program that will set the astronomy and astrophysics community firmly on the path to answering some of the most profound questions about the cosmos. In the plan, new optical and infrared survey telescopes on the ground and in space will employ a variety of novel techniques to investigate the nature of dark energy. These same telescopes will determine the architectures of thousands of planetary systems, observe the explosive demise of stars, and open a new window on the time-variable universe. Spectroscopic and high-spatial-resolution imaging capabilities on new large ground-based telescopes will enable researchers to discern the physical nature of objects discovered at both shorter and longer wavelengths by other facilities in the committee's recommended program. Innovative moderate-cost programs in space and on the ground will be enhanced so as to enable the community to respond rapidly and flexibly to new scientific discoveries. Construction will begin on a space-based observatory that employs the new window of gravitational radiation to observe the merging of distant black holes and other dense objects and to precisely test theories of gravity in new regimes that we can never hope to study on Earth. The foundations will be laid for studies of the hot universe with a future X-ray telescope that will search for the first massive black holes, and that will follow the cycling of gas within and beyond galaxies. Scientists will conduct new ground-based experiments to study the highest-energy photons emitted by cosmic sources. At the opposite end of the electromagnetic spectrum, radio techniques will become powerful enough to view the epoch when the very first objects began to light up the universe, marking the transition from a protracted dark age to one of self-luminous stars. The microwave background radiation will be scrutinized for the telltale evidence that inflation actually occurred. Perhaps most exciting of all, researchers will identify which nearby stars are orbited by planets on which life could also have developed.

Realizing these and an array of other scientific opportunities is contingent on maintaining and strengthening the foundations of the research enterprise that are essential in the cycle of discovery—including technology development, theory, computation and data management, and laboratory experiments, as well as, and in particular, human resources. At the same time, the greatest strides in understanding often come from bold new projects that open the universe to new discoveries, and such projects thus drive much of the strategy of the committee's proposed program. This program requires a balance of small, medium, and large initiatives on the ground and in space. The large and medium elements within each size category are as follows:

**In Space:** (Large-scale, in priority order) Wide-Field Infrared Survey Telescope (WFIRST)—an observatory designed to settle essential questions in both exoplanet and dark energy research, and which will advance topics ranging from galaxy evolution to the study of objects within our

own galaxy. The Explorer Program—augmenting a program that delivers a high level of scientific return on relatively moderate investment and that provides the capability to respond rapidly to new scientific and technical breakthroughs. Laser Interferometer Space Antenna (LISA)—a low-frequency gravitational wave observatory that will open an entirely new window on the cosmos by measuring ripples in space-time caused by many new sources, including nearby white dwarf stars, and will probe the nature of black holes. International X-ray Observatory (IXO)—a powerful X-ray telescope that will transform our understanding of hot gas associated with stars and galaxies in all evolutionary stages. (Medium-scale, in rank order) New Worlds Technology Development Program—a competed program to lay the technical and scientific foundation for a future mission to study nearby Earth-like planets. Inflation Probe Technology Development Program—a competed program designed to prepare for a potential next-decade cosmic microwave-background mission to study the epoch of inflation.

**On the Ground:** (Large-scale, in priority order) Large Synoptic Survey Telescope (LSST)—a wide-field optical survey telescope that will transform observation of the variable universe and will address broad questions that range from indicating the nature of dark energy to determining whether there are objects that may collide with Earth. Mid-Scale Innovations Program augmentation—a competed program that will provide the capability to respond rapidly to scientific discovery and technical advances with new telescopes and instruments. Giant Segmented Mirror Telescope (GSMT)—a large optical and near-infrared telescope that will revolutionize astronomy and provide a spectroscopic complement to the James Webb Space Telescope (JWST), the Atacama Large Millimeter Array (ALMA), and LSST. Atmospheric Cerenkov Telescope Array (ACTA)—participation in an international telescope to study very high energy gamma rays. (Medium-scale) CCAT (formerly the Cerro Chajnantor Atacama Telescope)—a 25-meter wide-field submillimeter telescope that will complement ALMA by undertaking large-scale surveys of dust-enshrouded objects.

These major new elements must be combined with ongoing support of the core research program to ensure a balanced program that optimizes overall scientific return. To achieve that return the committee balances the program with a portfolio of unranked smaller projects and augmentations to the core research program, funded by all three agencies. These elements include support of individual investigators, instrumentation, laboratory astrophysics, public access to privately operated telescopes, suborbital space missions, technology development, theoretical investigations, and collaboration on international projects.

This report also identifies unique ways that astronomers can contribute to solving the nation's challenges. In addition, the public will continue to be inspired with images of the cosmos and descriptions of its contents, and students of all ages will be engaged by vivid illustrations of the power of science and technology. These investments will sustain and improve the broad scientific literacy vital to a technologically advanced nation as well as providing spin-off technological applications to society.

The Committee and I are deeply grateful to the astronomy and astrophysics community for its commitment to a gigantic effort and broad involvement as well as a willingness to support the community consensus. That support was essential to producing the report and it will continue to be essential in implementing the shared vision that the report recommends.

*Roger Blandford, who chaired the Committee for a Decadal Survey of Astronomy and Astrophysics, is the Peihong and Adele Chen Director, Kavli Institute of Particle Astrophysics and Cosmology at Stanford University. Donald C. Shapero is the Director of the Board on Physics and Astronomy of the National Research Council.*

National Research Council. *New Worlds, New Horizons in Astronomy and Astrophysics*. Washington, DC: National Academy Press, 2010 (prepublication version)