The APS has awarded its first maskawa for work on broken symmetries.

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2008 Nobel Prize Goes to Nambu, Kobayashi, and Maskawa for Work on Broken Symmetries

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LaserFest to Celebrate 50 Years of Laser Innovation

The APS has joined with the Optical Society of America (OSA) in planning LaserFest, a multi-year series of events and activities centered on 2010 commemorating the 50th anniversary of the invention of the laser in 1960.

“Every time we give a presentation using a laser pointer, see a laser light show, watch a DVD or benefit from bloodless surgery or laser eye correction, we are profiting from the work of our colleagues who were the founders of this technology,” said APS President Arthur Bienenstock and OSA President Rod Alferness in a joint statement.

When it was first invented, the laser was called a “solution looking for a problem.” Today the laser is used in thousands of commercial applications ranging from barcode scanners to laser surgery, and as a scientific research tool.

The laser resulted not from a single breakthrough by one individual, but from a series of developments. Albert Einstein in 1917 presented the concept of stimulated emission.

The most urgent issues identified by the report are: preventing the spread of nuclear weapons, especially to North Korea and Iran; securing and reducing global inventories of nuclear weapons to prevent them from falling into the hands of terrorists; and engaging Russia in a new strategic dialogue.

It states that a clear statement of policy on nuclear weapons will be needed from the next president.

“Renewed interest in U.S. nuclear policy has been stimulated in the past year through a series of editorials by distinguished scientists and by the appointment of a congressional commission to look into these matters,” said John Browne, chair of the APS Panel on Public Affairs (POPA) subcommittee on national security.

“This report identifies a possible way to bring together disparate views regarding the appropriate role of U.S. nuclear weapons in our 21st-century defense strategy,” said Browne. “We identify the opportunity to pursue a parallel approach that reigns leadership in global nonproliferation through a series of initiatives while continuing to refurbish and update our nuclear stockpile and infrastructure as necessary without creating any new nuclear weapon capabilities.”

There has not been a coherent statement on the role of nuclear weapons for security in a post-9/11, post-Cold War world, the report states.

“Launch a ‘centrist’ approach as outlined by this paper has been lacking, causing our nuclear policy to drift for a decade or more,” said Browne.

In order to re-establish the US role as a leader in nonproliferation, the report suggests several possible steps, including ratification of the Comprehensive Test Ban Treaty. The US should also address the challenge of expanding use of nuclear energy without increasing proliferation risks. Some possible steps include:

Nuclear continued on page 6
hearing of some of glitches. It’s a challenge requiring incredible talent, brain power and coor-
dination to get it running.”

Stevie Giddings, University of California, Santa Barbara, described delays at the LHC, the Boston Globe, September 19, 2008

“I’m a wanderer. I tend to be maybe too curious about too many things. And most of the time I fail in satisfying that curi-
osity. But one curiosity leads to another.”

L. Mahadevan, Harvard Uni-
versity, The Boston Globe, October 6, 2008

“I think one of the differences between the special election and this election is that most people have a much better idea of who I am.”

Bill Foster, running for re-
election to Congress, Associated Press, October 4, 2008

“Theorists say the Higgs is a certainty. I’m an experimentalist; need to see it.”

Hugh “Briq” Williams, Uni-
versity of Pennsylvania, Philadelphia Inquirer, September 22, 2008

“Our entire world as we know it normally relies on the existence of an up quark and a down quark, an electron and a neutrino. You don’t need anything else to make up our universe. We don’t have an idea on the second and third sets exist.”

Anton Zeilinger, University of Vienna, on quantum cryptography; Electronic Business, October 8, 2008

“Real breakthroughs are not found because you want to develop some new technology, but because you are curious and want to find out how the world works.”

Anton Zeilinger, University of Vienna, on quantum cryptography; Electronic Business, October 8, 2008

“Imes’ thesis work involved infrared spectroscopy of diatomic gases HCl, HBr and HF. His main find-
ings were reported in a paper, “Measurements on the near-infrared absorption of some diatomic gases,” published in November 1919 in the Astrophysical Journal. Imes and Randall followed up with some further details in a paper presented at an American Physical Society meeting in November, and a paper in Physical Review.

His work, one of the first applications of high resolution infrared spectroscopy, provided the first detailed study of simple molecules, and opened up the field of studying molecular structure through infrared spectroscopy. Imes analyzed hydrochloric (HCl), hydrobromic (HBr), and hydrogen fluoride (HF) and presented the first accurate measurement of the distance between atoms in molecules.

In addition, the research also provided a verification of quan-
tum theory. Before Imes’ studies, some scientists were not certain whether quantum theory applied to the emission spectra of molecules. Imes’ work showed that quantum theory could be applied to the rotational energy states of molecules as well as the vibrational and electronic energy levels.

In 1919, after a year about completing his Ph.D. Mimes, Imsm relaxed a well-known poet of the Harlem renaissance. The couple lived in New York and was part of the Harlem intellectual so-
ciety. He came into contact with prominent African American intellectuals including W.E.B Du Bois and Langston Hughes.

Imes’ research was recognized as important by colleagues, and was frequently cited, but the only fac-
ulty open positions to Imes were at black colleges and universities, where he felt he was not valued. So after receiving his Ph.D, Imsm left academia to work in industry in the New York region. He worked as a research physicist at Federal Engineers Develop-
ment Corporation for a few years, then at Barrows Magnetic Engineering Corporation, and then as an engineer at the E. A. Everett Signal Supply.

During that time his work re-
sulted in four patents for instruments for measuring magnetic and electric properties of insulating materials.

It seemed that Imsm found few opportunities to advance in industry, and in 1930, af-
fected by a depression in industry, he returned to Fisk University.

At Fisk, Imsm served as the chair of the physics department. He re-
vised many of his publications and planned a graduate program in physics. Although he didn’t publish any more of his own papers, his Imsm re-
mained active in the research commu-
nity. He corresponded frequently with other research-
ers and educators designing some of his own work in infrared spectroscopy.

Imsm was dedicated to training students, and con-
ducted research with his students at Fisk. Students in his research lab used x-rays and magnetic techniques to study properties of various materials. He sent some of his students to work at the University of Michigan in the summers to learn x-ray techniques. His re-
search lab was described as a “mecca for those who sought an atmosphere of calm and contentment,” by W.E.G Swan in an obituary.

Believing that students should be exposed to the history of science, Imsm also developed a course called “cultural physics,” and wrote a book-length treatise covering the history of science from the Greeks through the eighteenth century.

While on the faculty at Fisk, Imes became in-
volved in a scandal involving a relationship with a white administrator, which, along with other troubles, led to his divorce from his wife. He experienced financial difficulties from which he never fully recovered. By the late 1930s, his health was declin-
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tember 1941. Throughout his career, Imsm was an active member of APS, as well as several other scientific societies.

Reference: Mickens, Ronald. “Elmer Samuel Imsm-Scientist, Inventor, Teacher, Scholar.” In Ed-
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This Month in Physics History

November 1919: Elmer Imes Publishes Work on Infrared Spectroscopy

Elmer Samuel Imes, the second black PhD physi-
list in the United States, and the first to sig-
nap to pre-Imes’ work published his first paper in November 1919. The work produced the first ac-
-
duate determination of the distances between atoms in molecules, expanded the range of applicability of quantum theory, and provided evidence for the exis-
tence of two isotopes of chlorine. His research was cited many times and was soon incorporated into textbooks.

Elmer Imsm was born in October 1883 in Mem-
phis, Tennessee, the son of missionaries. He attended elementary school in Ohio and high school in Nor-
mal, Alabama. He received a bachelor’s degree in sci-
ence in 1903 from Fisk University, a predominantly black university in Nashville, Ten-
nessee.

After receiving his degree, Imsm taught physics and math at the Al-
-
bany Normal Institute in Albany, Georgia. Around 1910, he returned to Fisk, where he continued his own studies in physics and served as an instructor of math and science. He completed his master’s degree in 1915. Fisk didn’t offer any higher degree, so he transferred to the Uni-
-

College of Chicago to complete his PhD.

At the University of Michigan, Imsm worked in the laboratory of his advisor Harrison Randall, designing, building high-resolution infrared spectrometers and detectors.

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In 1919, after a year about completing his Ph.D, Imsm married Nella Larson, a well-known poet of the Harlem renaissance. The couple lived in New York and was part of the Harlem intellectual so-
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Bringing a Sun to Earth: Briefing Explains ITER Fusion Experiment

By Nadia Ramlagan

A September briefing on Capitol Hill was held to drum up support for ITER funding in the Fiscal Year (FY) 2009 budget, in conjunction with negotiations between Congress and the White House on the FY 2008 budget limit $510 million for ITER funding near­ly “zeroed out.”

As a result, ITER-related research received only $10.7 million in funding for FY 2008. This was stored next year, as both the House and Senate appropriations packages for FY 2009 include full funding for US contributions to ITER.

Ned Sauthoff, Director and Project Manager of the US ITER program, presented to the Ridge National Laboratory (ORNL) discussed the science of fusion, the ITER experiment, and benefits to US participation. Representative Rush Holt (D-NJ) also spoke briefly, stressing the importance of participating in the ITER. The ITER project is set to begin operation in 2016.

ITER is an international project that aims to demonstrate the scientific and technological feasibility of fusion energy. In 2006, the United States, countries of the European Union, Russia, South Korea, and India signed an official agreement to build the experiment at Cadarache, in southern France. Built with superconducting magnets, the ITER plant is a fusion power plant that will produce 500,000 megawatts. Each day, a coal fired plant consumes 9,000 tonnes of coal and produces 3500 tons of carbon dioxide, 600 tons of sulfur dioxide, and 80 tons of nitrogen dioxide. In stark contrast, a fusion reactor would consume only 1 ton of deuterium, 3 pounds of lithium-6 (1.5 pounds of tritium), and produce a mere 2 pounds of helium-4 (0.5 pounds of neutrons).

Sauthoff noted. Once pellets enter the plasma they ablate, adding fuel pellets to the plasma core that frequently results in high fusion gain.

“With ITER, research and development will ensure that the US is a future supplier rather than a buyer of fusion technology,” Sauthoff said. ITER’s burning plasma is maintained by injection of frozen hydrogen, deuterium, and tritium pellets into the tokamak. “We call that ‘ducting wire,’ or the superconducting Nb3Sn coils to produce toroidal fields that confine the plasma. The tokamak is a device that allows the plasma to power to solve serious energy resource and environmental problems currently facing the US and the rest of the world.”

ITER is an international venture, and the US is a part of the ITER Director, so the device is set to begin operation in 2016. As the host country, France is expected to receive about $50 million in proceeds, excluding any costs. Each of the other 5 parties pays roughly 9-10 percent, “but gets approximately 10 percent of the overall costs,” says Sauthoff. France will run the facility and operate the device for the ITER. The device is set to begin operation in 2016. As the host country, France is expected to receive about $50 million in proceeds, excluding any costs. Each of the other 5 parties pays roughly 9-10 percent, “but gets approximately 10 percent of the overall costs,” says Sauthoff. France will run the facility and operate the device for the ITER, which is expected to operate for 10 years.

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Saving Physics in America

Leo Kadannoff wrote an interesting article on physics aspirations and goals on the Back Page of the July 2008 issue of APS News. In the article, he talks about the impression of a decline in US physics research. With the recent funding debacle over the financial crisis at Wall Street, there are some jitters among many physicists. Consequently, America just witnessed Chinese President Hu Jintao travel to Washington and has already passed the US in at least one area of scientific research—namely high temperature superconductor physics.

In the past, US partially relied on the import of scientific talents from other countries to sustain its science and technology. As the retention rate of foreign scientists drops, the US physics work force will weaken unless a local supply of fresh blood is infused into the system. As Ka‑
dannoff has so keenly observed, bet‑
ter physics education will be a stra‑
tegic approach to arrest the decline of US physics.

Good teaching skill essentially underpins a good course, lectures, and discussions. Teaching a course means communicating with the students, paying attention to black‑board presence, answering students’ questions respectfully, and most im‑portantly writing reasonable quiz‑ and exam questions. Students graduate with better skills if the professors can help understand their resources, and the physics teachers can certainly encourage students to work in groups to solve physics problems so that they have a natural setting for mutual-teach. It is, therefore, not surprising to see students undergoing the best training in the US universities.

Assuming that we have the best students undergoing the best train‑ing under the best teachers, there is still a chance that these students will not succeed in finding permanent academic positions due to NSF’s Science and Engineering Indicators in 2008 shows that only 20% of the postdocs get permanent positions (http://www.nsf.gov/statistics/seid/080101). Given the fact that only a small fraction of PhD graduates get postdoc jobs, the overall success rate of all those who enter into vocational physics training is prob‑ably just 5%. Prospective students are often aware of the statistics. Unless the employment problem is resolved, we continue to limit the number of graduate students and postdocs.

Physics education is more than classroom teaching. It also involves apprenticeship training. For quite some time, many graduate students and postdocs have been burned out under the old system. Graduate students and postdocs are utilized to provide labor to sustain the re‑search enterprise. At the same time, they are put in the pipeline to be‑come future competitors against their supervisors for prestige and research money. Shrewd supervi‑sors will provide students the advantage of teaching graduate stu‑dents and postdocs well enough to become future colleagues and not well enough to become future competitors. As funding sources dwindle, these kinds of behavior will certainly increase. If abuses wid‑en, the number of graduate students, and postdocs may further decline to drive the downward spiral of US physics even deeper.

LASER continued from page 1

which was later experimentally validated. The maser, a precur‑ sor to the laser, was developed in 1958 by Charles Townes and independently by Nicolay Ba‑sov and Alexander Prokhorov. Townes and Arthur Schawlow published an important paper on the theory of the laser in Physi‑cal Review in 1958, which led to the first patent for a laser amplifier. The maser invention is credited to their own resources, and the maser is expected to get involved in orga‑nizations. APS and OSA will each con‑tribute their own resources, and are seeking additional funding from NSF and DOE for Laser‑Fest.

Many LaserFest events will take place during 2010, though OSA has already hosted some events. A symposium honoring Theodore Maiman, who died in 2007, was held in San Jose in May at the CLEO/QELS confer‑ence. In October, the Schawlow‑Townes Symposium on 50 Years of Laser Science and Applications that celebrates the 50th anniversary of the publication of the classic paper by Schawlow and Townes (Infrared and Optical Masers, Phys. Rev. 112, 1940, 1958), was held in conjunction with the Frontiers in Optics (FOI)/APS‑DLS Laser Science meetings in Rochester, NY. The symposium featured a presentation by Charles Townes on the early history of the laser.

If Science Were an Olympic Sport

duncan hall

A fictional scene from the future: The Olympic games, London 2012. A new candidate sport is on trial, joining skateboarding, rugby and the abet Olympic games. It is challenging discipline called Science, a sport more ancient than Olympia itself. The crowed awaits eagerly in the all new Elvis Johnson Olympic stadium. It has taken more than 2000 years just to convince the International Olympic Committee that Science is worthy of being an Olympic sport. The big day has fi‑nally arrived but the judges are still arguing about how to award the medals to scientists. Despite all the metrics involved, it’s all very sub‑jective. The games go ahead any‑way, and there are lots of exciting new events:

Triple-jump grant-writing

A massive run-up, then a big hop, long step, followed by a colos‑sal jump. Longest-triple-jump wins all the grant money from the fund‑ing body.

Experiment writing and justice

Contestants wrestle and fight with poorly understood but state-of-the-art technology in order to test hypotheses and perform experiments. Only the most determined con‑testants get results, the winner is the person with the most interesting dis‑coveries.

Impact factor boozing

A typically macho, gruesome, and bloody event. Competing sci‑ents try to publish in the journal with the highest impact factor but of dubious real value. This event often has many casualties and opponents are often beaten until they are unconscious or fall over, or even die. Pub‑lishers usually win this event, rather than scientists.

Closely related to citation gym‑nastics and fellowships to help us with our students for the rainy days by our supervisors for prestige and money. The multi-disciplinary decath‑lon contest is a pretty high score. If a publisher does not accept

The Lighter Side of Science

the Licence to Publish agreement, then we simply do not publish in that publisher’s journals.

LaserFest is the only commercial organisation that has such a copyright policy, and I would be amazed if the APS had never agreed to use such an agree‑ment for publishing, when an au‑ thor’s employers have had our own company. There is no reason why academic publishers and organisations should not adopt such a position too.

R.I. Taylor

Chester, UK

Contests

Contestants present their work to other scientists and colleagues often using a blunt in‑strument called “PowerPoint,” and opponents seek weak points in pre‑sentation using sharp instruments. Touchdown shot put

Contestants throw camberswoop, heavy, and almost inanimate objects (called “students”) as far as they can. The winner is the person who can throw a student the furthest.

Weightlifting with citations

Contestants write long review papers. The person who can cite the most papers in a single publi‑cation wins. Current world-record unknown but 2,184 references in a single paper is a pretty high score. If you’ve ever written a scientific paper, what is your “personal best?”

The multi-disciplinary decath‑lon professorship

A real test of a wide range of abilities, combining all of the above home countries by age 50. The H-1B visa—which is a form of in‑ dentured servant really doesn’t do that, although it serves the inter‑ests of employers by keeping sala‑ries down.

Several associations like the APS can help by creating op‑tions for those exiting the stem workforce in mid-life. STEM careers are re-trained for the manipulation economy; working as insurance adjusters, investment advisors, creative accountants, mortgage brokers, and in other pro‑fessions requiring numeracy. What is missing are the educational pro‑grams and fellowships to help us make the transition. If a life-long career path were visible, American students might come back to our fields.

Marc D. Levenson

Saratoga, CA

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Saratoga, CA
Mass Media Fellows Describe Their Experiences

Editor’s Note: Each year APS sponsors two mass media fellows, typically graduate students or graduating seniors in physics or a closely related science, who spend eight weeks over the summer working as science journalists in a program administered by AAS. This year’s fellows were Carrie Nugent, who is a graduate student at UCLA and Zoe Back, who received her bachelor’s degree from Princeton last spring. In these articles, the two fellows report APS News readers how they fared in their journalistic debuts.

Sharing the Love in Oregon

By Carrie Nugent

I ran to my editor. “Susan! Lizards! I’d like to write an article about lizards.”

“Okay, Carrie,” she said. “What’s the news about lizards?”

I was at a loss. There wasn’t anything newsworthy that week on lizards. In fact, there are barely any lizards in Oregon, a particularly wet state of America, where I was working for a newspaper, The Oregonian.

As a scientist, I become enamored with an idea for its own sake— but that doesn’t make it news. And newspapers only contain news.

I know, it sounds obvious. But as a non-scientist, I was impressed by an interview-scientist after scientist who would make the same mistake. Seeing how a newspaper works from the inside will undoubtedly improve any future dealings I have with the media. It was also an awesome way to spend the summer.

During the summer at The Oregonian, I didn’t find any news about lizards, but I did drive through the local vet school to exciting memories of an experiment. Teachers offered new experiments and variations. People love science. You love science. Journalists take your work and tell people about it. So be kind to reporters—they’re just sharing the love.

Finding True Love in Carolina

By Zoe Back

I was all about astrophysics for most of my life. I saw myself discovering new stars, spending long nights in the control rooms of great telescopes, and identifying exoplanets. Astronomers dedicated to the obscure aspects of stellar structure or neutrino cosmology. I applied for only one PhD program—because the atmosphere of its astrophysics program, diving into the curriculum head first. But after spending my undergraduate years studying physics, I now work as a science writer, where my ear’s biased failures. I saw volcanoes, Saturn’s rings, and a 30,000-species aphid collection. I met a man who had caught my eye. Science report—AAAS Mass Media Fellowship was thrilled to have someone to help. From them I quickly picked up the basics of reporting science, and of being a journalist.

Unfortunately, I knew nothing of their ground, I knew nothing of their culture, their language, or the public’s understanding of science. My background was in biology. I had a background in hard science and a passion for sharing things with people. Perhaps such a fellowship might reveal something to me.

So there I was, in Raleigh, North Carolina, a city I had never visited, working in the newspaper industry, a medium I had absolutely no experience in.

The Raleigh News & Observer, where I was placed, is a refined news machine. It does not do science, medicine or health report—so I took over all three beats for the personality of an experiment. Teachers offered new experiments and variations. People love science. You love science. Journalists take your work and tell people about it. So be kind to reporters—they’re just sharing the love.

Winding only a science background, I knew nothing of their lingo and craft, but they were eager to help. From them I quickly picked up the basics of reporting science, and of being a journalist.

I was hoping to have an opportunity to stay at the newspaper, but unfortunately the economy of the industry conspired against me, and the paper was unable to hire me.

It’s a tough time to be falling in love with journalism, but at least now I am familiar with some of the difficulties that journalists face.

Still, the AAAS Mass Media Fellowship definitely showed me my “thing.” I love astrophysics and science, but more than doing it, I love to learn about it and tell people about it. I am currently working at an astronomy teacher at a non-profit science camp in California, and I am having a blast.

This summer’s experience allowed me to pursue my interest in science, and how I can make a difference in the public’s understanding of science.

Putting Their Heads Together

By Philip Zechar

Physical sciences research funded by the National Science Foundation and the Department of Energy have often overlapped and university-based research facilities have competed with the national labs for researchers. More recently, competition is a good thing that undoubtedly improves the quality of the research and bolsters US scientific preeminence. However, at least two trends threaten to turn a once-healthy competitive environment into a harmful fight for diminishing resources.

First, the overall resources available for research in the physical sciences have not changed markedly over the last three decades, dropping nearly 50% in the last three decades as a percentage of GDP. Second, the inevitable consolidation caused by the increasing complexity and expense of leading edge research facilities means that the few dollars are fighting for only a handful of bigger and more expensive projects.

University-based research labs have felt this constriction most acutely. For instance, throughout the 1960s and 1970s, there were many university laboratories with accelerators doing leading edge research in nuclear physics: MIT, SUNY, Harvard, Stonybrook, University of Rochester, Ohio University, Notre Dame, Cornell and Indiana University, to name but a few. Today, of the five major facilities that dominate nuclear physics—the Argonne Tandem Linac Accelerator System (ATLAS), Continuous Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab, the Holifield Radioactive Ion Beam Facility (HRIBF) at Oak Ridge National Laboratory, the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory, National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University, and the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory—only two are found on a university campus: the 88-Inch Cyclotron and the NSCL.

While the consolidation of research facilities may be inevitable, the move away from the university-based research facilities is not, and it may not come at a cost to US competitiveness. The 2006 National Academy of Sciences report, Rising Above the Gathering Storm, on how to prosper in the global economy of the 21st century, made the case that our economic future depends on education in science, engineering and math. The report recommended that federal recommendations declares that should “make the US the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers.” This recommendation is undermined by the migration of research facilities out of universities and into the national labs, which are not first and foremost education facilities.

It is a matter of speculation whether an education, particularly a graduate education, that is physically removed from one’s research equipment is any less desirable than an education where the research is done on campus. After all, few ecologists perform their research anywhere near their home institutions. But the pejorative term “suitcase science” has emerged to describe the work of those who perform research. While the consolidation of research facilities may be inevitable, the move away from the university-based research facilities is not, and it may not come at a cost to US competitiveness. The 2006 National Academy of Sciences report, Rising Above the Gathering Storm, on how to prosper in the global economy of the 21st century, made the case that our economic future depends on education in science, engineering and math. The report recommended that federal recommendations declares that should “make the US the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers.” This recommendation is undermined by the migration of research facilities out of universities and into the national labs, which are not first and foremost education facilities.

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Harry and Nancy

Nancy Pelosi and future teacher Michael “Shane” Carey (center) works with underclassman Stephen Bimson and Mark Blanks in an introductory physics class. Perhaps these sites have gained.

In addition, PhysTEC institutions Cal Poly San Luis Obispo, Florida International University, and the University of Minnesota have all received independent Noyce awards during this round of funding, which will also support teachers in multiple science disciplines.

According to NSF Program Officer Mitchell Price, the PhysTEC Noyce award is the first to focus on a specific discipline, as well as the first given to a professional society. Mon- thumb Picture by gay stewart/ university of Arkansas

Photo by Gay Stewart University of Arkansas

The PhysTEC Noyce project will award scholarships to teachers who spend their time teaching “real science,” since it is one of the recipients of the MacArthur Foundation’s “genius grants,” commonly called “genius grants,” MacArthur Fellowship for 2008. Goeppert Mayer (MGM) award in 1999, is among the recipients of the MacArthur Genius Awards.

In 1999, MacArthur awarded $500,000 to Janis Jin of the University of Washington and Margaret Murnane of the University of California, Berkeley, to engage other nations in reducing their nuclear ambitions.

Andrea Ghez, an astrophysicist at UCLA, received a MacArthur “genius grant” in 1999. Ghez shares with Michael Mayor and Robert Wilson the 2005 Nobel Prize in Physics for their discovery of “stellar-mass black holes.”

PhysTEC was founded in 1999 by the American Physical Society (APS), the American Association of Physics Teachers (AAPT), and the American Association of Physics Teachers Educators (AAPT), with the goal of increasing the number of qualified high school physics teachers in the US.

The Noyce scholarships are a significant fraction of schools in the US, not just the most needy. According to Ghez, the University of Arizona, a conservative Democrat who made us adopt “pay-go” rules. You know we can’t increase spending for any program unless we cut something else or raise taxes. There were all sorts of things we just had to put on hold. One of the things closest to my heart is science and innovation, and we just couldn’t do anything about it.

Many schools have been facing the same problems, so we decided to act. We don’t want to lose teaching talent, especially not the best and brightest. As my chief of staff, Nancy Pelosi, once said, “We have an award-winning teacher who has been teaching physics for years, but it is full time, and students don’t get support or have time to work. We should ask our students to choose teaching over higher-paying professions, and then tell them they need to go to school on their own.”

The Noyce program began in 2002, and as of 2007 it had supported approximately 1500 teachers from 91 institutions. For every year of scholarship support teachers receive, they commit to teach for two years in a “high-need” school district, which is defined as any district in which at least a quarter of the students are from families with an average income below 100% of the federal poverty level, or in which at least 25% of students are from families with an average income below 150% of the federal poverty level.

The Noyce program also funds the training of teachers in the sciences, and provides opportunities for high school teachers to earn a master’s degree in a science field. We are especially excited that the PhysTEC Noyce project will help provide scholarships to teachers in the underserved communities where they are needed the most.

MGU Recipients Achieve MacArthur Trifecta

Andrea Ghez, an astrophysicist at UCLA, received a MacArthur “genius grant” in 1999. Ghez shares with Michael Mayor and Robert Wilson the 2005 Nobel Prize in Physics for their discovery of “stellar-mass black holes.”

Ghez uses ground-based telescopes to study the positions of stars and planets, and then tell them they need to go to school on their own.

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More information about PhysTEC can be found at www.PHYSTEC.org.
The number of physics bache‑
lor’s degrees has increased for the second year in a row, accor‑
ding to a recent report from the Ameri‑
can Institute of Physics Statistical
Research Center.
The report, released in Sep‑
tember, is based on an annual sur‑
vey of physics departments in the
US. This year’s report contains data on the class of 2006, the
most recent year for which data are
available.
According to the re‑
port, 5373 bachelor’s degrees were awarded, five percent more than the previous year, and 47% more than in 1999.

Some of the increase in phys‑
ics bachelors is accounted for by
the increase in college age popula‑
tion and the number of potential students of all ages attending college, the report notes. Efforts to improve the undergraduate experience in physics majors and efforts to in‑
crase number of physics bachel‑
or’s degrees may also be having an
effect, but that is difficult to
measure, the report says.

Though numbers are increas‑
ing, physics bachelor’s degrees represent only one third of one percent of all bachelor’s degrees, and only about 2% of all bach‑
elor’s degrees in the natural sci‑
ciences, mathematics, and engi‑
neering.

About 15% of physics bach‑
elor’s eventually receive a PhD in
physics. A bout a third of physics bachelor’s degree recipients
immediately enroll in physics grad‑
uate programs. Physics PhD production was also up, with 1380 physics PhDs awarded in 2006. This is an in‑
crease of 11 percent from the year before and 26 percent from 2004. It amounts to 3% of all PhDs con‑
ferred in the United States.

The report also noted that there are 760 departments that offer a physics degree, and 187 of those offer a PhD as the highest degree. During the 2005-2006 academic year, 378,000 students took an in‑
trodutory physics course.

In the fall of 2006, there were 2976 first year graduate students in physics PhD pro‑
grams. International students continue to make up a substantial portion of new physics graduate students, making up more than 40 percent of first year students in the fall of 2006. However, this proportion is decreasing; as of 1999, sixty percent of first year physics graduate students were foreigners five years ear‑
ier. The proportion of physics PhDs awarded to foreigners in 2006 was 57 percent, down from a high of 60 percent the year be‑fore. Similar to recent years, for‑
gotten students made up only 7 per‑
cent of physics bachelor’s degree recipients.

The proportion of women among physics bachelor’s degree recipients was the same as the previous year, 21%, and is still among the lowest in the natural sciences and engineering. Women earned 17% of physics PhDs in 2006. As in previous years, un‑
underrepresented minority contin‑
tue to make up only a very small portion of physics degree recipi‑
ents. Historically black colleges and universities (HBCUs) still produce more than half of the African American physics bach‑
elor’s degree recipients.

The report, and more infor‑
mation from the AIP Statistical Research Center, is online at aip. org/stats.

Physics Bachelor's and PhDs Continues to Trend Upward

ANNOUNCEMENTS

Job Fairs

Looking for a job? Looking for the ideal candidate? Don’t miss these opportunities!

APS Division of Plasma Physics

Let the APS/DDP Job Fair do the work for you!

Date: November 17-19, 2008
Place: Hyatt Regency Reunion Hotel
For more information contact Alix Brice at 301-209-3167 or at abrice@aip.org

APS March Meeting Job Fair

Date: March 16-17, 2009
Place: David L. Lawrence Convention Center, Pittsburgh, PA
Register today at: http://www.aps.org/careers/employment/jobfair.cfm

Professional Skills Development for Women Physicists

Do you want to improve your negotiation skills? Do you have great ideas that you want to communicate to your colleagues?

If so, the Committee on the Status of Women in Physics invites you to attend one of the workshops entitled “Professional Skills Development for Women in Physics.” These workshops will:

• Coach women in key skills that are needed to enhance their careers.
• Provide training in persuasive communication, negotiation, and leadership presented by experienced professionals, with an aim towards increasing the influence of female physicists within their own institutions.
• Provide a special opportunity for networking among participants.

Workshops in 2009 will each have one session aimed at women post-docs in physics and one session aimed at tenured or tenured faculty in physics. Workshops will be offered on Sunday, March 15 (Pittsburgh) and on May 1 (Denver) in association with the APS national meetings.

The deadline to apply for the March workshop is December 5, 2008; the deadline to apply for the April workshop is January 5, 2009. First consideration will be given to applications received by the deadlines. Women of color are especially encouraged to apply.

Workshops will be limited in size for optimal benefits. Participants are eligible to receive a stipend to help cover the cost of travel and up to two nights lodging.

Details at www.aps.org/workshops/women/workshops/index.cfm

VIEWPOINT continued from page 5

act with the diverse leaders in their society and potentially diminishing the influence of female physicists within their own institutions.

The question of the DOE’s role in providing research facilities is explicitly raised, declaring that it will not consider any edu‑

ation of scientists,” it has declared the goal of “training the next genera‑

stark contrast to the DOE’s stated

will not consider any edu‑

The migration of new facilities to the national labs is in part due to a shift in nuclear physics fund‑

ning from the NSF to the DOE. In constant dollar terms, the NSF nuclear physics budget has de‑

clined in the last 20 years while the DOE’s component of com‑

bined budgets allocated to nuclear physics has increased from 85% in 1989 to 90% in 2006. As the DOE picks up more of the nuclear physics re‑

esearch task, it must choose to allocate its resources between uni‑

ersities and the national labs, and as evidenced by the list of major physics facilities, the trend is clear.

The question of the DOE’s role in providing research facilities is nothing new. In a 1992 report, delivered to the senator President Bush by then director of the Of‑

ice of Science and Technology Policy, D. Allan Bromley of Yale, the issue of the federal laborato‑

ories is explicitly raised, declaring that “because federal support for

research intensives universities is affected by agency commitments to nuclear physics research, some believe there is now an urgent need to reexamine the roles of the more than seven hundred federal labora‑

tories.”

Sixteen years later, this question of national policy has not been ad‑
dressed and again manifests itself in the current competition between a university and the DOE. The re‑

aining, fully university-based nuclear physics facility among the five major facilities, the NSCL, is competing with Argonne for the contract to build the next gen‑
eration rare-isotope laboratory; the Facility for Rare Isotope Beams (FRIB). All parties agree that this competition should be decided on the merits of each proposal, but in stark contrast to the DOE’s stated goal of “training the next genera‑

of scientists,” it has declared that it will not consider any edu‑
cational benefits that might result from integrating FRIB into MSU when evaluating MSU’s proposal.

The Renewing the Promise re‑

port went on to address directly the different merits that should be considered for federal funding. “It is far reaching implications of making all federal basic research support available for merit-based competi‑
tion by universities, federal labora‑
tories, or industry. Merit review in this case should include, as addi‑
tional criteria, potential long-term contributions to education, well‑
being, national security, and edu‑
cation.”

Many of our top research uni‑

versities are under tremendous financial pressure and when they compete for federal dol‑
ars, if their biggest asset, the edu‑
cation of our future scientific lead‑
ers, is not to be considered, can we expect to “make the United States the most attractive setting in which to study and perform research?” US universities will not remain magnets for talent if the most pow‑
ertful tools to perform research are located elsewhere.

Philip Zucker is a partner, and

Chief Risk Officer, of EQX Part‑
ners, L.P. of Stanford, CT. He holds

a PhD in nuclear physics from

Michigan State University.
The Back Page

The Future of Science: Building a Better Collective Memory

By Michael A. Nielsen

When Robert Hooke discovered his law of elasticity in 1667, he didn’t publish it in the ordinary way. Instead, he built it up into a 137-page collaborative manuscript. He revealed this two years later as the Latin at tensio, sic vis, meaning “as the extension, so the force.” This ensured that if someone else made the same discovery, Hooke would have the right of first publication. In 1693, the manuscript was published. This secrecy faded because the great scientific advances in the time of Hooke and Newton motivated wealthy patrons such as the institution beginning subscription service. Because the public benefit derived from scientific discovery was the basis for the law of human progress, this system has changed surprisingly little in the last 300 years. The Internet offers us the first major opportunity to reverse this trend of centralization, to create a collective long-term memory that is the basis for the sciences. We are currently saddled with a web developer. In the early days few established scientists achieved human knowledge into a single source. In fact, Wikipedia’s creation statement to warm a scientist’s heart: “Imagine a world where every single human being can freely share in the knowledge of every single human being.”

Wikipedia isn’t really science. It’s not if you take it for a genuine cultural change towards more openness in science, a social good shared by all people, both scientists and non-scientists. Having a way to view online viewing tools as a way of expanding the range of scientific knowledge that can be shared with the world. A successful example is the physics preprint arXiv, which lets physicists share preprints of their papers without the support of the grants that pay for publication. More radically, the internet can also change the process and scale of creative collaboration, using social software such as wikis, online forums, and similar tools. I believe that such tools and their descendants will change collaborative scholarship more over the next 20 years than it has changed in the past 300 years. Yet, with the exception of email, scientists currently appear puzzlingly slow to adopt many online tools. This is a consequence of some major barriers deeply embedded within the culture of science.

Two Failures of Science Online

Inspiried by the success of Amazon.com’s review system and similar sites, many organizations have created comment areas where scientists can share their opinions of scientific papers. But these sites have been failures, and they are designed for the wrong kind of collaboration. The basic Na-"ut" story is no different than Nature’s 2006 failure of open commentary on papers being peer reviewed at Nature. To date, none of these sites have succeeded.

The problem is that while thoughtful commentary on scientific work is needed, for other scientists, too, there are few incentives for people to write such comments. Why write a comment when you could be doing something more “useful,” like writing a paper or a grant? Furthermore, if you criticize someone’s paper, there’s a chance that person may be an anonymous referee in a position to scuttle your next paper or grant application.

Contrast this with the approximately 1500 reviews of Pokemon you’ll find at Amazon.com. We have a ludicrous situation where popular culture is open enough that people want to exchange questions and ideas. It will bake in metrics of success and failure, the exchange of questions and ideas. It will achieve cultural change via the top-down strategy that’s been successfully used by the open access (OA) movement. The goal of OA is to make scientific research freely available online to everyone in the world. In April 2008 the National Institutes of Health mandated that every paper written with the support of their grants must eventually be made open access. This is the scientific equivalent of successfully storming the Bastille.

The adoption of the OA system was achieved by subvi‑ dentizing scientists who published their discoveries in journals. This same subsidy now inhibits the adoption of more effec‑ tive technologies. The OA movement’s success demonstrated that it is possible to change the incentives of science. OA was a success because it’s right for open access. This is the scientific equivalent of successfully storming the Bastille.

Open Science Culture

The value of openness has been understood centuries ago by many of the founders of modern science; indeed, the journal system is perhaps the most open system for the transmission of knowledge that could be built with 17th century media. The adoption of the OA system was achieved by subvi‑ dentizing scientists who published their discoveries in journals. This same subsidy now inhibits the adoption of more effec‑ tive technologies. The OA movement’s success demonstrated that it is possible to change the incentives of science. OA was a success because it’s right for open access. This is the scientific equivalent of successfully storming the Bastille.

The second strategy is bottom-up. It requires that the people building the new online tools also develop and boldly evangelize ways of measuring the contributions made with the tools. As an example, since 1991 physicists have been uploading their papers to the physics preprint arXiv, often at about the same time as they submit to a journal. The arXiv is not refereed, although a quick check is done by arXiv moder‑ ators to remove crank submissions. In many fields, most papers appear on arXiv first, and many physicists start their day by seeing what’s appeared on the arXiv overnight.

After the arXiv began, a service for particle physics called SPIRES-HEP extended their citation tracking to include both arXiv papers and conventional journal articles. As a result it’s now possible to search on a particle physicist’s name, and see how frequently all their papers, including arXiv preprints, have been cited by other physicists.

SPIRES-HEP has been run since 1974 by the Stanford Linear Accelerator Center (SLAC). SLAC’s metrics of cita‑ tion impact are both credible and widely used by the particle physics community. When we have committees that wish to evaluate candidates in particle physics, often people have their laptops out, examining and comparing the SPIRES-HEP citation records of candidates. The result is a small but genuine cultural change towards more openness in science, achieved using the bottom-up strategy.

The Problem of Collaboration

When doing research, subproblems constantly arise in un‑ expected areas. No one can be expert in all areas. Most of us instead stumble along, picking up the skills necessary to make progress towards our larger goals. We have a small but great group of trusted collaborators with whom we exchange ques‑ tions and ideas when we are stuck. They may point us in the right direction, but rarely do they have exactly the exper‑

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thead of more efficiently allocated under existing practices for collaboration. An efficient collaboration market would enable Alice and Bob to find this common interest, and exchange their know‑ how, in much the same way eBay and Craigslist enable people to exchange goods and services. However, in order for this to be possible, a great deal of mutual trust is required. Without such trust, there’s no way Alice will be willing to advertise her questions to the world. Let’s compare this situation to the apparently very diff‑ erent problem of buying shoes. Alice walks into a shoe store, with a $20 bill and a list of what she wants: she wants to buy shoes. She wants to buy some shoes. She wants to buy some shoes. As you walk in and out of the store, Alice hands over the shoes, Alice hands over the money, and everyone walks away happier after just nine months. This rapid transaction takes place because there is a trust in‑ frastructure of laws and enforcement in place that ensures that if either party cheats, they are likely to be caught and punished.

If shoe stores operated like scientists trading ideas, first Alice and Bob would need to get to know one another, maybe go for a few beers in a nearby bar. Only then would Alice say, “You know, I’m looking for shoes.” Af‑ ter a pause, and a few more beers, Bob would say “You know what, I just happened to have some shoes I’m looking to sell.” Every working scientist recognizes this dance; I know scientists who worry less about selling their house than they do about exchanging scientific information. Economically, it’s been understood for hundreds of years that wealth is created when we lower barriers to trade, provided there is a trust infrastructure of laws and enforcement to prevent cheating and trade un‑ cleaned goods. However, in the 17th century, when the world was created, it is to concentrate on areas where we have a com‑ parative advantage, and to avoid areas where we have a comparative disadvantage.

For example, an analogy for trade in ideas. Indeed, even were Alice to be far more competent than Bob, both Alice and Bob benefit if Alice concentrates on areas which she has a greatest comparative advantage, and Bob on areas where he has less comparative disadvan‑ tage. Unfortunately, science currently lacks the trust infra‑ structure and incentives necessary for such free, unrestricted exchange of questions and ideas.

An ideal collaboration market will enable just such an exchange of questions and ideas. It will be in making in markets of contribution so participants can demonstrate the impact their work has had. They will have their work shared, flash‑ stamped, and signed, so it’s clear who said what, and when. Combined with high quality filtering and search tools, the event will be an open culture of trust that gives scientists a real incentive to source problems, and contribute in areas where they have a great comparative advantage, fun‑ damentally changing how science is done.

Michael Nielsen is working on a book about the future of science. For information about the book, see http://michaelnielsen.org/blog/?page_id=467. In a past note, he suggested the project was 70% complete and was the author of more than 50 scientific papers. The above article is adapted from an essay appearing on his blog, based on a keynote talk at the New Communication workshop, San Diego, June 26 and 27, 2008. The full version can be found at http://michaelnielsen.org/blog/?p=448.