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Physics Central Wins Sci/Tech Web Award

Physics Central, the APS's web site for the public, has been chosen as one of the winners of the coveted Sci/Tech Web Awards for 2003 by the editors of Scientific American.com.

Launched in November of 2000, Physics Central has seen the number of monthly hits to the site continue to rise steadily, with over two million recorded in May 2003.

Physics Central also consistently ranks first or second on both Google and Yahoo! among physics sites.

But despite this popularity, explicit recognition of its merits had eluded Physics Central until *Scientific American* announced the award in May. "We're really excited about this," said Jessica Clark, APS Public Outreach Specialist and the person in charge of Physics Central. "It's great to be working on an award-winning site."

The citation for the award reads: " Translating the often esoteric world of physics to the layperson is no small feat, but this site pulls it off with humor and élan. Learn about faraway galaxies under the rubric 'Twinkle, twinkle, little tadpole,' or get to know a hydrogen isotope called the 'Doo-wop Deuteron.' The site also features excerpts from papers by famous physicists, and the entertaining 'advice' column, 'Dear Lou,' penned by Professor Louis Bloomfield, author of the perennial favorite, How Things Work: The Physics of Everyday Life.

"Physics Central also features a staggering array of links to the best sites for keeping up to date on everything from open-heart surgery to baseball bat dynamics."

More information about the award can be found at www.sciam.com , and of course Physics Central itself is at www.PhysicsCentral.com .

Physics Olympiad Finalists Selected After Week-Long "Boot Camp"

After nine days of intensive training and competition, the five members of the 2003 US Physics Olympiad Team have been selected, along with one alternate. Twenty-four high school students from around the country attended the annual "physics boot camp" at the University of Maryland, College Park, where they worked on their problem-solving and laboratory skills. The finalists will represent the US at the 34th International Physics Olympiad, to be held July 12-21 in Taipei, Taiwan.

The finalists are Timothy Abbott, a senior at Thomas Jefferson High School for Science and Technology in Arlington, VA; Pavel Batrachenko, a senior at John Marshall High School in Rochester, MN; Steven Byrnes, a senior at Roxbury Latin School in West Roxbury, MA; Immanuel Buder, also a senior at Thomas Jefferson in Arlington; and Chintain Hossain, a senior at the Charter School of Wilmington, Delaware. Emily Russell, a senior at Choate Rosemary Hall in Wallingford, CT, was selected as alternate. Almost all are planning on attending Harvard, CalTech, or MIT next year.

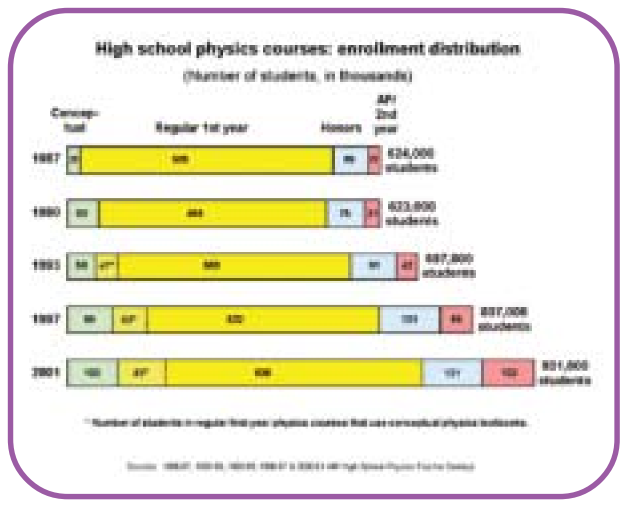
The nine-day boot camp, which began on May 17 and ran through May 25, was jam-packed with seven exams and seven labs, as well as

See BOOTCAMP *on page 7*

Number of High School Physics Students Climbs Toward the One Million Mark

By Pamela Zerbinos

More high school students are taking physics courses than ever before, according to a study released in July by the American Institute of Physics.



The study, which examines the 2000-2001 school year, is the latest in a series of reports issued by the AIP every four years.

The previous study, released in 1999, found that high school enrollment in physics classes had reached 28% in 1997, a post-World War II high. By 2001, that number had climbed to 31%, or 931,000 students.

In addition to the overall rise in enrollment, the physics curriculum has grown more varied over the years as schools have moved away from a one-size-fits-all approach. There has been an increase in conceptual physics classes, which are less math-intensive than their standard physics counterparts. Some regular physics classes also use a conceptual approach, bringing the percentage of students in conceptual classes up to 21% from 18% in 1997. Thirteen percent of students take an accelerated or honors first-year course, and 11% sign up for Advanced Placement or second-year courses.

Another important enrollment trend is the increasing participation of girls, who are now enrolling in physics courses in almost equal numbers to boys, and now constitute 46% of all physics students. However, they continue to be underrepresented in advanced physics courses, and only a quarter of high school physics teachers are female.

The rise in enrollment has crossed racial and ethnic lines as well, with Asians, whites, blacks and Hispanics all reporting increased

See H. S. PHYSICS *on page 5*

"Ionic Waltz", Ultrafast Lasers Highlight 2003 DAMOP Meeting

The best measurement to date testing Einstein's theory of special relativity, ultrafast lasers, and a measurement of the speed of information were among the highlights at the 34th annual meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), held in Boulder, Colorado, May 20-24, 2003. The meeting also featured a special public lecture by magician and professional debunker James Randi.

Waltzing Ions Test Relativity. MIT physicists have improved on the world's most accurate mass comparisons by a factor of 10. They achieved this by performing simultaneous cyclotron frequency comparisons of two ions in a Penning trap. The group used the technique to measure the energy-to-mass conversion in a nuclear reaction, providing a new type of test of Einstein's special relativity.

Lasers That Learn. Ultrafast strong lasers are revolutionizing atomic, molecular and optical physics, according to Philip Bucksbaum of the University of Michigan, Ann Arbor, who discussed new developments in the field. These lasers, which create the shortest pulses of light ever, are able to monitor chemical reactions in progress and control how molecules interact. To achieve their remarkable results, the lasers use "learning loops"—algorithm-based feedback loops that discover and create unusual optical pulse shapes—to control

See DAMOP *on page 3*

INSIDE THE BELTWAY: *A Washington Analysis*

When Scientists Dare to Speak Out

By Michael S. Lubell, APS Director of Public Affairs

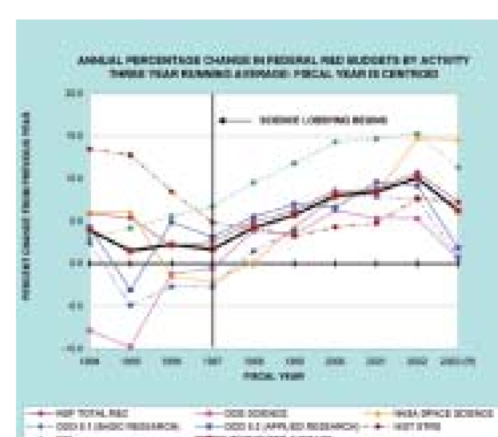
Science may not be the political poster child of 2003, but it isn't on anyone's enemies list either. It just isn't anyone's priority this year. Is it any wonder?

Even the most optimistic economic forecasters concede that the federal deficit will likely crack $400 billion. Gloom-and-doomers claim it could be as much as $600 billion. And that, as the late Illinois Senator Everett Dirksen would have said, "adds up to real money."

When programs compete for scarce resources, politicians do a quick calculation that has two variables. What are the most pressing needs for their district, state and nation, and what actions will most help them get elected?

Senator Pete V. Domenici (R-NM), who chairs the Energy and Natural Resources Committee and the Energy and Water Appropriations Subcommittee, is a perennial advocate for science. He's also one of the savviest readers of Hill politics I know. This is how he sized things up during a

See BELTWAY *on page 7*



MEETING BRIEFS

Texas Section Spring Meeting

The APS Texas Section held its annual spring meeting March 6-8 at Southwest Texas State University in San Marcos, Texas. The conference focused on physics education, and one of the plenary sessions featured a report on the Texas Teacher Preparation Conference, followed by a panel discussion of related issues. A featured plenary speaker on Friday afternoon was Leon Lederman (Fermi National Accelerator Laboratory), who described the Physics First program. Among the special events were workshops on education held both days of the conference, as well as a Friday evening banquet with a lecture by Donald Olson, a frequent contributor to *Sky and Telescope* magazine, on astronomy in art, history and literature.

New York State Section Spring Meeting

The APS New York State Section held its annual spring meeting at the State University of New York College at Geneseo, centered on the topic of the physics of everyday phenomena. Friday afternoon's sessions featured such crowd-pleasing subjects as the physics of baseball and the physics of flying, as well as talks on excimer laser surgery and "digital water." On Saturday morning, participants heard about gleaning interesting physics from everyday materials and the physics of computer components, as well as Hollywood physics (or lack thereof) and the science behind the saxophone. Teaching mechanics on roller blades and exploring the physics behind toys were featured on Saturday afternoon, and Lou Bloomfield of the University of Virginia—author of the online column "Ask Lou" on Physics Central [http://www.physicscentral.com]—gave a public lecture on Saturday night entitled, "How Things Work: From Roller Coasters to Microwave Ovens."

New England Section Spring Meeting

The APS New England Section held its annual spring meeting April 11-12 at Williams College, in Williamstown, Massachusetts. Friday afternoon's plenary session focused on quantum bits, with lectures on quantum entanglement, photonic qubits, and how to teach quantum mechanics to computer scientists. The after-dinner speaker for the Friday evening banquet was Harvard University's Richard Wilson, who spoke on the role of physicists in public policy. Saturday featured talks on ultrafast pulses beyond the visible spectrum; terahertz wave sensing and imaging; and ultrashort X-ray pulses. There was also a session on novel approaches to teaching physics to non-majors. In addition, there were a number of workshops offered on Saturday afternoon.

Ohio Section Spring Meeting

That same weekend, the APS Ohio Section held its annual spring meeting at Michigan State University in East Lansing, Michigan, billed as the Ohio-Michigan Conference on Frontiers of Quantum Computing.

Friday afternoon's invited sessions featured talks on quantum computing with individual atoms, followed by a banquet and after-dinner lecture by MSU's Richard Lenski on digital life and evolution. Saturday's program included contributed sessions and a town meeting, followed by invited talks on exponential algorithmic speedup by quantum walk, and quantum computing with electrons on a helium film.

Northwest Section Spring Meeting

The APS Northwest Section held its annual spring meeting May 30-31 at Reed College in Portland, Oregon, drawing attendees from institutions within the Northwest region of the US and Canada. The technical program included both invited and contributed talks in a broad range of subfields, including astrophysics, chemical physics, condensed matter physics, nuclear and particle physics, and physics education. Among the featured topics were recent results from the Sudbury Neutrino Observatory; the role of non-perturbative ray dynamics in micro-optic design; double-well Bose condensates; string theory and gravity/gauge theory duality; recent results from the Microwave Anisotropy Probe; opportunities for scientists in the field of display technology, and an overview of lessons learned about successful physics programs from Project SPIN-UP. Friday evening's banquet speaker was Reed College's David Griffiths, author of three widely adopted physics textbooks.

This Month in Physics History

July 16, 1945: First nuclear bomb exploded

If the radiance of a thousand suns
Were to burst at once into the sky,
That would be like the splendor
of the Mighty One...
I am become Death,
The shatterer of Worlds.
— The Bhagavad-Gita

The atomic age has its roots in the late 1800s, with the early work of Henri Becquerel and the Curies on radioactivity. The work of those who came after revealed that radioactive decay releases an enormous amount of energy compared to chemical processes. However, this release is gradual; thus, the possibility of "atomic energy" existed as a concept, but without any known means of bringing it about, even in theory. That changed in September 1933, when Hungarian physicist Leo Szilard conceived of the notion of using a chain reaction of neutron collisions with atomic nuclei (fission) to release energy much more quickly, a process that could lead to a bomb.

Szilard's insights predated the discovery of fission by six years. That discovery, publicly announced by Niels Bohr in January 1939, came just as Nazi Germany decided to abandon expansion by intimidation and resorted to armed conquest, and Japan invaded Manchuria, leading to the eruption of World War II. In consequence, the US government ramped up development efforts for an atomic bomb under the Manhattan Project. And the culmination of the Manhattan Project was Trinity, detonated at 5:29:45 am on July 16, 1945, at the Trinity site in a central New Mexico desert called the "Jornada del Muerto," or "Walk of the Dead."

To help prepare the instrumentation for the planned Trinity detonation, the so-called "100 Ton Test" was conducted on May 7, 1945, in which 108 tons of TNT stacked on a wooden platform was detonated 800 yards from Trinity ground zero. The pile of high explosives was threaded with tubes containing 1000 curies of reactor fission products. The test allowed the scientists to calibrate the instruments used to measure the blast wave, and gave them some indication of how fission products might be distributed by the explosion. Concurrent with preparations for the Trinity test, preparations were also being made for the delivery of operational atomic weapons to Tinian Island in the Pacific for use against Japan at the earliest possible date.

Robert Oppenheimer (l) with General Leslie R. Groves

On July 14, Gadget, the first atomic bomb, was hoisted to the top of the 100-foot test tower, and the detonators were installed and connected as the final test preparations began. Just before sunrise, Gadget was detonated, vaporizing the steel tower with an explosive yield of 20 to 22 kilotons. The mushroom cloud rose to over 38,000 feet within a few minutes. Several of the observers standing towards the back of the shelter were knocked flat by the blast, and the heat of the explosion melted the sandy soil around the tower to form a mildly radioactive glassy crust known as "trinitite."

The shock wave broke windows 120 miles away and was felt at least 160 miles away, and the blast created a flash of light that was seen over the entire state of New Mexico, as well as parts of Arizona, Texas, and Mexico. A military policeman on hand for the test described the heat as being "like opening up an oven door, even at 10 miles." Another witness to the explosion told of how, even 10 miles away, "there was the heat of the sun on our faces. Then, only minutes later, the real sun rose and you felt the same heat to the face from the sunrise. So we saw two sunrises."

Trinity was not made public until August 6, just after a second bomb, nicknamed "Little Boy", was detonated 1850 feet over Hiroshima, Japan, killing an estimated 70,000 to 130,000 people and destroying a large portion of the city. On August 9th, "Fat Man" was detonated over Nagasaki, killing about 45,000 more Japanese, prompting Japan to surrender on August 14. These were the only nuclear weapons ever to be used in a time of war. Since Trinity, there have been fewer than 1900 known nuclear explosions worldwide.

Today, no one would argue that the successful development of the atomic bomb changed the face of the modern world forever. "In some sort of crude sense which no vulgarity, no humor, no overstatement can quite extinguish, the physicists have known sin," J. Robert Oppenheimer famously observed in the aftermath of the Trinity test. "And this is a knowledge which they cannot lose."

Online Resources:

"LA-6300-H Trinity", by Bainbridge (the authoritative Trinity test report).

Videos, photos, maps and documents on Trinity: http://nuketesting.enviroweb.org

Further Reading:

Rhodes, Richard. *The Making of the Atomic Bomb.*

Szasz, Ferenc M., *The Day the Sun Rose Twice.*

The nuclear bomb when exploding and the hole that it made

APS NEWS

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Number Two

Superconductivity at 93 K in a New Mixed-Phase Y-Ba-Cu-O Compound System at Ambient Pressure

(M. K. Wu et al., Phys. Rev. Lett. 58 (1987), 908), 4171 Citations

This is the ninth in a series of articles by James Riordon. The first article appeared in the November 2002 issue. The articles are archived under "Special Features" on the APS News online web site.

The Chinese Lunar year of the Tiger was drawing to a close on January 27, 1987 as Maw-Kuen Wu and his graduate students, Jim Ashburn and T. J. Torng, toiled in their lab at the University of Alabama in Huntsville (UAH). They were testing the resistivity of samples from a batch of oxide compounds, hoping to find superconducting transitions as the materials were cooled in a liquid helium system. The researchers, along with Wu's colleague and mentor Ching-Wu "Paul" Chu of the University of Houston, had good reason to suspect that their samples might exhibit critical temperatures above the record 23.2 K superconductor discovered in 1973. But in the race to find high-T_C superconductors, the modest collaboration was at best a long shot in a field dominated by teams at IBM, Bell Labs, and Argonne National Laboratory, as well as groups in Russia, China, and Japan. In fact, the equipment that Wu, Torng, and Ashburn had at their disposal in the modest UAH lab was relatively ill-suited for measuring the 93 K critical temperature of the now famous blend of yttrium, barium, and copper oxide (YBCO) that they stumbled across on the eve of the year of the rabbit. "At the time," says Chu, "thermometers in low temperature labs worldwide were seldom calibrated to above 25 K."

In order to quickly confirm the startlingly high transition temperature of YBCO, Wu and his students replaced the liquid helium in their system with liquid nitrogen. At 77 K, the material was indeed superconducting. Just in case some fortuitous impurity had crept into the sample, they whipped up another sample of the YBCO compound. Once again, the sample resistivity fell to zero in the liquid nitrogen.

"We were extremely excited right after we did our first measurement on the sample," recalls Wu, "When the result was confirmed after a second test, my colleagues at the department immediately shared our excitement and gave us all the support we needed. My department chairman immediately supported us with travel funds so that we could fly to Houston to carry out further measurements to confirm the results."

The editors of *PRL* pushed the paper through the review process at a breakneck pace, and it appeared in print barely a month later. The excitement soon spread to the physics community as a whole, and sparked a legendary fervor at the 1987 March APS meeting that led to a marathon high-T_C superconductor session. The *New York Times* dubbed the event "The Woodstock of Physics." The researchers were besieged by the press, public, and other scientists. One inquiry made a particular impression on Wu. "There was a very interesting call from a scientist in Russia," says Wu, "who proposed to use the high-T_C material to create a huge superconducting magnet energy storage device that crossed Alaska and Siberia so that we no longer needed to worry about the energy shortage and consequently, we could then have and enjoy world peace."

While it is startling that the modest Huntsville-Houston collaboration could break what the researchers called in their letter the "technological and psychological temperature barrier of 77 K" for high-T_C superconductivity, Chu explains that it was a logical progression from their previous work.

"The prevailing thinking in the field was that superconductivity above 30 K was impossible due to lattice instabilities," says Chu. "However, our [previous] high pressure studies demonstrated that instabilities in the material system known at the time did not have a large negative effect on the transition temperature. In other words, a T_C above 30 must be possible. We decided that one of the best ways was to look at materials where new mechanisms might be in operation. The low electron density state compound of Ba-Pb-Bi-O which has a T_C of [about] 13 K, high at the time, offered the possibility. This was because it did not have any transition metal elements, which was considered necessary for high T_C superconductors. We proposed that the high T_C might be due to a new mechanism. In fact, in the last two conversations I had with Bernd Matthias, the pioneer in high T_C field, right before his untimely death in 1980, we both agreed that the future of high T_C would be in perovskite-like oxides. The positive pressure effect on these and related compounds led us to the YBCO."

Which is not to say that Chu was completely free of doubts. "In spite of all [our] precautionary steps, I still worried about the possibility of artifacts. I still remember [asking] my former students more than once before other labs reproduced the results . . . '*Can there be a phenomenon other than superconductivity that can give rise to the same effect? Please think and think hard*'. Deep in my heart, I was worrying that my superconductivity career would come to an abrupt end if it was an artifact."

Their discovery was, of course, soon verified by groups around the world. In the last sixteen years, compounds related to YBCO have been produced with ever increasing values of T_C, including a mixture of mercury, barium, and copper oxide that makes the transition to a superconductor at 134 K under atmospheric pressure, and 164 K under higher pressures.

Wu suspects, however, that substantial leaps in T_C will require some other, as yet unknown, class of materials. It is a sentiment that is apparently shared by many other physicists—the recent discovery of superconductivity in magnesium dibromide led to a packed session at the 2001 March APS meeting which has been called by some the "Woodstock West" of physics, in memory of the original Woodstock of Physics in 1987. But short of the discovery of room temperature superconductors, it is unlikely that any increase in T_C will generate the kind of excitement that followed the announcement of YCBO. "Back in early 80's," says Chu, "I was joking with Maw-Kuen that if one day we could find superconductor with T_C above 77 K, we should write a paper with only one sentence about the discovery." The published paper is a bit longer than that, but at two and a half pages, it's brief even for a *PRL*.

These days, Chu is continuing his work on basic and applied aspects of high-T_C superconductivity at the University of Houston, the Lawrence Berkeley Laboratory, and in Hong Kong, where he is president of the Hong Kong University of Science and Technology. Wu has also continued to study oxide superconductors, and is now director of the Institute of Physics at Taiwan's Academia Sinica.

DAMOP *from page 1*

the chemical, electronic or physical dynamics of matter.

The Fast and the Furious. At the DAMOP meeting, a group from Duke University presented the results of their experiments to directly test the speed of information. They constructed a medium with anomalous dispersion consisting of a vapor of laser-driven potassium atoms, employing a novel experimental geometry to suppress competing nonlinear optical effects. The group observed a pulse with a smooth Gaussian-shaped envelope that is advanced by as much as 20% with little distortion in comparison to an identical pulse traveling through a vacuum. They were also able to create an alphabet of pulse shapes and explore how each "letter" propagates through the medium to determine the information velocity.

The Ancient Life of Water. Using a new technique, researchers are able to date ancient water up to one million years old, providing vital information for understanding geological processes. The new test uses a magneto-optical trap to analyze a mere 100 microliters of krypton-81 gas. Researchers have collected krypton from the Nubian Aquifer underneath the Eastern Sahara Desert, and presented the dating results of their samples at the meeting.

Better Magnetic Brain Scans. MRI is the best technique we have for precisely mapping the brain. But researchers at the University of Washington and Princeton University have now developed a more accurate device for measuring the tiny magnetic fields in the brain: a new atomic magnetometer with a sensitivity that far surpasses the performance of current SQUID devices. Representatives from the collaboration discussed how the device can be used for improving medical imaging.

Probing Atoms with Telescopes. The best large aperture telescopes with their high-precision instruments are able to probe the properties of atoms and molecules as well as laboratory experiments. An added advantage is that they can perform measurements on particles that are not able to be studied in the lab, such as the atomic nitrogen transitions, which have never been detected in the laboratory and only rarely in the atmosphere. Thanks to the efforts of researchers at SRI International and Vanderbilt University, this technique has been the first to measure certain properties of atmospheric nitrogen and other molecules.

Building a Better Atomic Clock. The most precise measurements of time come from atomic clocks and are critically important for advanced telecommunications and other high-tech applications. However, the most precise atomic clocks are bulky devices. At the DAMOP meeting, two groups presented their progress in making miniature atomic clocks. A group at NIST in Boulder, Colorado, has devised a scheme for ultra-small physics packages for atomic frequency references based on coherent population trapping resonances in alkali vapors. Another group at Princeton University is investigating the advantages of operating a miniature optical atomic clock using the "end" transitions, or connecting states, of rubidium-87 atoms; most traditional atomic clocks are based on the hyperfine transition of Cesium-133 atoms.

What Makes a Good Physics Department? The National Task Force on Undergraduate Physics has just completed a survey of all 759 bachelors-degree-granting physics programs in the US and site visits of 21 leading departments. According to Robert Hilborn (Amherst College), the study reveals that thriving physics departments feature energetic leadership, involvement of most faculty in undergraduate teaching, a challenging but supportive curriculum,

See **DAMOP** *on page 5*

Look Out Below

Photo Credit: Laléna Lancaster

Home schooled students (l to r) Quilla Otto-Jacobs, Kory Otto-Jacobs, and Paul Wiehagen observe the landing of a cylinder that has been launched into the air. The experiment, led by Gary White of the American Institute of Physics, was part of the 6th Annual Student Science Conference held in May at the American Center for Physics in College Park, MD. The conference was co-hosted by the Education Division of the AIP and the University of Maryland's Materials Research Science and Engineering Center. It involved both home schooled and middle school students from the local area and centered on the students' oral presentations of their scientific research under the mentorship of MRSEC scientists.

LETTERS

Readers React to Using Title IX for Women in Science

Debra Rolison's idea [APS News Back Page, May 2003] of using Title IX to alter the gender balance of science, technology, engineering, and mathematics (STEM) departments is sheer lunacy. Rolison conveniently neglects one of the major side-effects of Title IX on college sports—the reduction in programs available to men.

Perhaps Rolison feels that in lieu of hiring more women, STEM departments should simply reduce the number of men. Social engineering does not work. Or is my complaint invalid simply because of my gender?

Andrew Resnick
Cleveland, OH

***

Debra Rolison's essay on using Title IX to discriminate against men in science and engineering is both outrageous and offensive. Title IX sounds innocuous enough at first glance and, if you read only the excerpt used by Rolison, would seem to be gender neutral. But feminist groups and activist courts have interpreted the fine print of Title IX to imply a quota system.

One would think that we would have seen enough failures in social engineering based on quotas and "diversity" initiatives over the last 30 years to last a lifetime but Rolison seems not to have had enough. I have experienced these firsthand as my son was denied opportunities in high school sports because he would have upset the quota balance. I have seen several instances in the corporate world where female employees were promoted over more capable male employees in the name of diversity, and subsequently failed because of inadequate experience and ability. And many competent women dislike anti-male discrimination because, while their advancement may be based entirely on merit, their peers always suspect gender favoritism.

Simply quoting statistics that there are more men employed in science and engineering and suggesting that this indicates a hiring bias is ludicrous. The same logic would say that high school wrestling teams are composed mostly of boys because the coach wouldn't let many girls join the team.

Rolison would do students a great disservice if her ideas were to be implemented. Students want the best teachers and the best researchers available and they don't care whether they are men, women, white or otherwise. Merit should be the only consideration for hiring and promotion, and gender and skin color should never influence the decisions.

Rolison apparently does consider skin color an important factor as she laments the employment of "lily-white" males. This sort of bigoted terminology has no more place in this Society than would the term "pitch-black" female (my apologies in advance).

Rolison would be well advised to alter her approach from "revolution" and "coercion" against the males that she seems to detest so much to an effort to convince young women to join the science and engineering ranks. Her efforts to legislate and litigate her political views onto others do no one any good. And she owes us "lily-white" males a sincere apology.

Kenneth E. Stephenson
Ridgefield, CT

***

I fully agree with Debra Rolinson's viewpoint that time has come to use Title IX like federal legislation to bring more qualified women in STEM departments. I would suggest considering either a redirected reward structure or so called "coercion" to encourage the shift in hiring practices across all academic institutions.

Let me also suggest that while it is critical to take concrete measures to bring gender balance in STEM departments, we should continue to underscore the hiring of ethnically diverse faculty as well.

Although, there are well defined laws against discrimination on the basis of color, age, gender, race etc., what truly goes on in hiring practices is far from being the truth in which racial, ethnic and/or gender bias continues to be used.

Vijendra (VJ) Agarwal
Staten Island, NY

***

Debra Rolison's article suggests invocation of Title IX in order to equalize the number of academic positions open to women. I do not object to her laudable goal, *i.e.*, to give women an equal opportunity to engage in research or other activities within the field of physics, but I do object to the method by which she hopes to do this.

I am currently a PhD student, but before entering graduate school I taught high school in Florida. In that state, and indeed across the country, schools are forced to comply with Title IX by having equally sized and funded sports team for both female and male students.

This sounds good, of course. The problem is that equal numbers of male and female students do not try out for sports. So, because schools cannot get enough female athletes, those schools are forced to down-size the sports programs for males.

If one invokes Title IX to address the predominance of males in professional physics positions, a similar thing would happen if the number of women qualified and applying for such positions did not sharply increase.

Title IX is a Pandora's Box; once opened, the results of having opened it cannot be sealed away. Invocation of a legal excuse to cut funding and downsize programs is the last thing we as physicists, whether male or female, need.

Wallace Callen
Amherst, MA

***

Too bad that the pseudoscientific and racist term "white," wrongly used to describe a kind of human being, has appeared in an APS publication. This is especially true given the rainbow of nationalities and ethnicities represented in American physics.

The logically flawed and incoherently presented article, "Can Title IX Do for Women in Science and Engineering What It Has Done for Women in Sports?" by Debra R. Rolison in May 2003 APS News makes the case against, not for, quotas. If a quota system is instituted to populate the field with people whose minds work this way, it will be the end of physics.

Howard Weisberg
Pacific Palisades, CA

***

Can Title IX do for women in science and engineering what it did for women in sports? Of course it can! All that needs to be done is to follow the examples of collegiate sports, and mimic how they work.

Take chemistry, for example. Let's compare it to the basketball. Most colleges and universities field two basketball teams, one for men and the other for women. All of the men's teams have male head coaches, while many of the women's teams are coached by women, and when coached by men the teams have women as assistant coaches. These are two separate programs. The women students don't compete with the men, either on court, or for scholarships.

We can do something similar for chemistry. We can set up a chemistry department for men, and a separate department for women. The faculty for the women's department will start out with all of the women now on the combined faculty of chemistry, with the goal that as the women's department expands, women will fill faculty slots in that department. Eventually, the faculty in the women's department will be all, or nearly all, women, and they will compete with each other for faculty promotions and other perks independent of the faculty in the men's Chemistry department, and independent of the faculty in any other department at the university.

OK, I agree that the idea doesn't make a whole lot of sense, but it's an example of how Title IX might be interpreted as it has been for sports.

The problem is that Title IX cannot dictate how to accommodate the male-to-female differences, especially in male-to-female competition, which is the major factor in the problems that Debra Rolison wants to fix,. Neither (1) demolition, (2) redirection, nor (3) coercion can be justified on any basis by a reading of Title IX. All Title IX can do is to specify equal opportunity for, and benefits of, programs or activities at least partly supported by federal funding.

I suggest that the concept of the "glass ceiling" at every level that women have been (granted, slowly) breaking has come about as men have worked with female colleagues, much more so than even a generation ago, and male-to-female competition is changing to male-to-female cooperation on joint efforts. As younger men themselves fill positions of responsibility, so will the women who have already proven their capabilities to those men. Does this mean that women will always continue to lag behind, at least a little bit, in, e.g., faculty promotions? Yes, probably so, at least until we elect a woman as president of the United States.

J.K. Dickens
Oak Ridge, TN

ROLISON replies:

I agree with Agarwal that STEM departments need to widen their focus when hiring faculty: talented female and minority scholars should be sought out and recruited—and the departmental environment should be one in which they would be willing to create a career (D.R. Rolison, in *Women in the Chemical Workforce*, National Academy Press: Washington, DC, 2000, Ch. 6). To do any less is to weaken the future effectiveness of the US S&T enterprise.

Surprising that Resnick, Stephenson, Callen, and Dickens have not yet noticed that the business of the US government is social engineering. Would they care to renounce at tax time the mortgage deduction for homeowners or bid farewell to the National Science Foundation—established thanks to an act of Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."—examples both of social engineering in service to specific national goals.

More surprising still is their belief that the S&T enterprise operates as an absolute meritocracy (and yes, I know what the lip-service sloganeering says we do; I'm referring to what we actually do).

One expects scientists to be better natural philosophers than that. And if schools and universities are cutting men's wrestling teams rather than confronting the real issue (the quasi-professional status of men's collegiate football and basketball), that is neither the fault of the women who want access to athletic opportunities nor Title IX for making it possible that they get them.

My thanks to Resnick, Stephenson, Callen, and Dickens for reinforcing my arguments.

Debra Rolison
Arlington, VA

Ed. Note: *The letter by Weisberg arrived too late for Rolison's response.*

Mideast Poses Tough Questions

I agree with Joel Lebowitz, who writes in the April Back Page—"An American Physicist Visits Birzeit University"—that "the scientific perspective" places extra responsibility on scientists to use their knowledge and influence towards bridging gaps between peoples." But by failing to contend with the reality of the Mideast and to distinguish between fact and fancy, this article avoids tough questions and dispenses with rigorous analysis.

The article posits that Palestinians are bereft of opportunities to collaborate and lays out the case of Palestinian physicists against their Israeli counterparts in this regard as it calls upon the international scientific community to step into the breach.

The article tells of Palestinian skepticism of the Israeli academic community sincerity in expressing its eagerness to collaborate because "there are very few Arabs on the science faculties of Israeli universities." To check this, I called Yossi Klafter at Tel Aviv University and Oded Agam at the Hebrew University. They indicated that there are few Arab applicants' with the number being zero in most years. However, they agreed that though Israel does not have an affirmative action program in faculty hiring, they have not heard of a candidate being disadvantaged in the hiring process by his Arab heritage, but rather have witnessed this being taken as a positive factor. They saw it as a promising sign, that the numbers of Arab students at their universities were approaching their proportion in the population in the geographic region from which their respective universities draw their students.

It should be noted that the complaint by some Palestinians scientists that they are shy to push the envelope by interacting with Israeli scientists because they discriminate against Arabs must ring hollow to anyone who has participated in struggles for civil rights.

In that arena, progress is made by confronting and overcoming discrimination wherever it occurs, not by speculation regarding the motives of one's adversary. By the same token, the view put forth "that the settlements would make a viable Palestinian state impossible," is just part of the headlong scramble towards victimhood.

The article notes that Palestinians are not willing to cooperate with Israeli scientists, their nearest scientific neighbors, "for both security and political reasons," and then goes on to recount the hardships imposed by Israel upon Palestinians in response to the current intifada.

But the operative political and security considerations are played out on a very different plane. For a Palestinian physicist to cooperate with his Israeli counterpart would be a form of *de facto* recognition of Israel and would be more likely to expose him to danger from fellow Palestinians, who have not escaped the influence of an educational system that demonizes Israelis, than from Israelis.

See **LETTERS** *on page 5*

The Physics Behind "Bend It Like Beckham"

In the new movie, *Bend it like Beckham*, Jess Bhamra is a British teenage girl of Indian descent who dreams of playing soccer the way her hero, David Beckham, plays it. Among other things, Beckham (who happens to be a real-life soccer player with the Manchester United team in England, and one of the game's greatest athletes) has the ability to kick a ball in such a way that it executes a dramatic, sometimes uncanny, curve through the air. The ball's curve, or "bend" in soccer jargon, can be devastatingly effective against an opposing team's defense.

Primarily, *Bend it Like Beckham* is about the challenges that Jess faces as she struggles with the expectations of her traditional Indian family and with the prejudices of British society. So it isn't terribly surprising that little time is devoted to explaining just what's going on when Beckham bends a ball.

"It's the same physics for soccer balls as for all other curving balls," says Lou Bloomfield, a physics professor at the University of Virginia and author of *How Things Work: The Physics of Everyday Life*. "Bottom line: a spinning ball deflects the air rushing by it and the air responds by deflecting the ball. This effect shows up in volleyball, it shows up in golf. You can really curve a beach ball without too much trouble."

"Curve balls are usually attributed to the Magnus force," says Bloomfield. "When the ball is spinning, the air tends to follow a longer path around one side than the other, because it's dragged along by the ball's turning surface." Air following the longer path bends more sharply, resulting in a dramatic drop in air pressure on that side of the ball. The ball is pushed toward the low-pressure side. A similar drop in pressure over an airplane's wing is the source of lift that supports the plane. "Although a plane's lift is upward, Bloomfield points out, "for a ball lift can be in any direction, depending on the direction the ball is spinning."

While the Magnus force usually gets all the credit when it comes to explaining curve balls, Bloomfield says that another force may be more important to a spinning ball's path— the wake deflection force.

"Most moving balls have turbulent wakes behind them," says Bloomfield. "As it spins, a ball draws the air with it and deflects the wake to one side." The deflection shifts the air stream flowing around the ball and the air stream in turn pushes back on the ball. Both the Magnus force and the wake deflection force tend to push the ball in the same direction, and the two forces combine to lead to the impressive curves produced by skilled players like Beckham.

The key, of course, to bending a ball in a soccer game has less to do with understanding the physics than learning how to put a spin on the ball. Does Jess ever manage to bend it like Beckham? You'll have to watch the movie to find out.

— Inside Science News Service

Why is This Man Smiling?

Michael Barnett of the Lawrence Berkeley Laboratory found himself surrounded by eight US Senators at an event called "Women Making History" in San Francisco in April. He is smiling because he got a chance to thank them for their support for the DOE's Office of Science, and to remind them how important adequate funding for physical science is.

Front row: Barbara Mikulski (D-MD); Michael Barnett; Barbara Boxer (D-CA); Diane Feinstein (D-CA).Back row: Maria Cantwell (D-WA); Patty Murray (D-WA); Debbie Stabenow (D-MI); Blanche Lincoln (D-AR); Mary Landrieu (D-LA).

H. S. PHYSICS *from page 1*

numbers of physics students. Although that signals that traditionally underrepresented minorities have not fallen farther behind, their exposure to high school physics courses remains low.

In a given geographical area, schools that teachers describe as catering to poorer students are considerably less likely to offer physics courses. In schools whose students are described as "much better off than average," 45% of students are enrolled in some sort of physics course; in schools described as "much worse off than average," that number drops dramatically to 22%.

Nearly half of all high school physics teachers majored or minored in physics or physics education while in college, a number that has been slowly increasing. The rise in enrollment has made it possible for more of these teachers to specialize in physics, and now 56% of teachers describe themselves as specialists (up from 48% four years earlier). Along the same lines, the percentage of teachers teaching exclusively physics is up from 19% to 23%, but 48% still teach primarily non-physics courses.

Pay for physics teachers continues to rise at a rate slightly above that of the inflation rate, but is still significantly below the median salary for physics-degree holders who go into other fields. The current median salary for a new physics teacher is $28,000, up $3,000 from the previous study.

The problems teachers cite as keeping them from being more effective have remained largely the same. Inadequate funding for equipment and supplies is the chief concern, with 34% of teachers pointing to it as a serious concern. But this is down from 39% in the 1997 study, and other problems with labs and funding—inadequate space, not enough preparation time—have decreased by a similar amount.

On the other hand, there has been an increase in the number of teachers who cite inadequate mathematical preparation of incoming students as a problem.

"While less effective mathematics instruction may seem the obvious culprit," said Michael Neuschatz, the director of the study, "an alternative explanation may be the fact that enrollment is coming from a broader student base and is therefore more likely to include groups of students traditionally less well-prepared mathematically."

A similar pattern may account for the parallel rise in percentage of teachers who said their students didn't think physics was important. In previous, lower-enrollment years, the students signing up for physics were more likely to be the most enthusiastic about science. With enrollment growing and reaching out to students who might not have signed up a decade ago, the greater variety of attitudes is understandable.

The study is available online at www.aip.org/statistics/trends/hstrends.htm. A limited number of hard copies are available by e-mailing mmcfarl@aip.org.

LETTERS *from page 4*

But mistrust can be overcome by a process of engagement. The focus of help for Palestinian scientists should therefore not be to leapfrog over Israel, but to engage Palestinians and Israelis and scientists from other countries in joint scientific meetings and activities.

Such an effort has been undertaken in the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) project, to be hosted by Jordan and to operate under the auspices of UNESCO. The excellent record of Palestinian and Israeli physicians working together in many Israeli hospitals is another model of engagement for the common good. This has contributed to an increase in life expectancy for Palestinians living in the areas captured by Israel in 1967 from 48 to 72 years between 1968 and 2000.

In conclusion, the problem is not that Palestinians collaborate less than other scientists at comparable institutions, nor that there is purposeful refusal by Israeli scientists to cooperate with them, but that they are not at liberty to interact with Israeli scientists. Curiously, this stance mirrors that of Arab governments who have historically refused to negotiate with Israel. If there is to be peace, and if Palestinian science is to thrive, interaction with Israelis cannot be sidestepped but should be encouraged at every turn.

Azriel Genack
New York, New York

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I commend Joel Lebowitz for taking his time to visit Birzeit University. It takes willpower and a great deal of courage to make this trip during this difficult time, so it is to his great credit that he went there to see things for himself and to listen, and also to try and bridge the gap.

Since Birzeit University is besieged and isolated, and does not enjoy the backing of a recognized country behind it, Palestinian scientists working there face a great deal more difficulty than their counterparts from other universities in the third world or in Israel.

It is therefore heartening to learn that there are people who do care and are willing to reach out. It is also important that we do talk. As a Palestinian scientist working in the USA, I meet many more Israelis here than I do back at home, at least outside of their army uniform. I find it important to take these opportunities to talk, and we usually have good conversations.

My thanks also to APS for publishing Lebowitz's page-long report on his visit.

Dr. Rami A. Kishek
College Park, MD

ERRATUM

In Physics News in 2002 [APS News, February 2003] under the headline "Laser-driven Jets of Carbon and Fluorine" on p. 8, the size of a secondary target was given as 100mm instead of 100 microns. APS News regrets the error.

FitzGerald's Observation Preceded Tesla's

The May 2003 issue, "This Month in Physics History" describes the amazing career of Nikola Tesla and rightly credits him as the father of the world's predominant distribution of electric power via high-tension lines with alternating current. It also credits him with the discovery of terrestrial stationary waves.

The belief that Tesla was the first to envision the Earth as an electromagnetic resonator and presage the very low frequency modes of the Earth-ionosphere cavity (now known as Schumann resonances) has been furthered by myself and others. Recently I have learned better.

Tesla's relevant patent application is dated 1905. In a remarkable paper presented to the British Association in 1893, George F. FitzGerald first observes that the idea of the Earth as a conducting body surrounded by nonconductor is not correct.

He then suggests that the upper regions of our atmosphere are probably fairly good conductors. He models the situation as a conducting sphere surrounded by a concentric conducting spherical shell, which he identifies with the region of the aurora borealis. Presciently, FitzGerald even mentions thunderstorms, the primary source of Schumann resonance signals, as a source of excitation.

What is it about our history that slights Irishmen and Danes?

J. D. Jackson
University of California, Berkeley

PhD Students Should Learn Management Skills

In The Back Page article in APS News, May 2003, Debra R. Rolinson writes that universities need to "stop demanding so much of STEM faculty." I feel very strongly that we need to demand the skills she dismisses and more. Professors need to be managers, mentors, financial planners, and creative leaders. They require strong communication and interpersonal skills, in addition to their scientific vision.

Faculty members are, after all, managing a research enterprise and various employees. They need to be capable leaders for their advisees and for the sake of their research.

Management skills are never taught to PhD students, but they should be. My main complaint about my graduate experience is that managerial and interpersonal communication skills are often lacking in faculty members. In fact, many professors never learn to interact properly with their advisees, making graduate life difficult for students.

Introducing a management or interpersonal communication course to graduate curriculums could help solve this problem. The acquisition of necessary leadership skills could vastly improve the academic experience for both graduate students and faculty.

Rebecca Webber
Evanston, IL

Tesla Gave Us the 20th Century

Thank you so much for your excellent article on Nikola Tesla, (May 2003 APS News) the world's forgotten genius who gave us the 20th Century. Though he was an eccentric, his vision for the future of combat (though it seemed strange at the time and was not accepted by the governments he offered it to) has been in fact realized in a variety of forms including "remote control" missiles, laser weapons (death ray) and EMPs.

Tesla's hope was that these weapons would allow precise pinpointing of military targets/armies and spare civilians. Tragically, this was not the case when his ancestral homeland, Yugoslavia, was illegally and viciously bombed in 1999 using the technology that he basically fathered.

Michael Pravica
Las Vegas, NM

DAMOP *from page 3*

many opportunities for informal student-faculty interactions, flexible programs, career mentoring and a strong sense of community shared by faculty and students.

In a separate session, a group from Colorado College discussed how physics departments have successfully attracted higher participation by women in undergrad- uate programs. The critical factor is a strong female-friendly departmental culture that reaches out to include students in the introductory course.

2003 APS General Election Preview — Members to Elect New Officers, Councillors from 2003 Slate of Candidates

Once again, the APS Nominating Committee has put together an outstanding slate of candidates. The election runs from June 16 to September 1, and most of the voting will take place on the web. Those who are elected will begin their terms in January 2004. Each candidate's biographical information is provided below. Expanded information, including candidates' statements, can be found at: http://www.aps.org/exec/election2003/

FOR VICE-PRESIDENT

JOHN BAHCALL
Institute for Advanced Study

Bahcall has been a professor of natural sciences at the Institute for Advanced Study, Princeton, New Jersey since 1971; he is also a visiting lecturer at Princeton University. He was previously on the physics faculty of the California Institute of Technology. Bahcall received his BA from the University of California, Berkeley, his MS from the University of Chicago, and his PhD from Harvard University in 1961, all in physics. He was a post-doctoral fellow in the Physics Department of Indiana University.

Bahcall and Raymond Davis Jr. proposed in 1964 that neutrinos from the sun could be detected with a practical chlorine detector. In the subsequent four decades, Bahcall has refined theoretical predictions and interpretations of solar neutrino experiments. Bahcall's other areas of expertise include weak interaction theory, models of the Galaxy, dark matter, atomic and nuclear physics applied to astronomical systems, stellar evolution, and quasar emission and absorption lines. His most recent forays outside of neutrino physics have been related to ultra high-energy cosmic rays and to the time dependence of the fine-structure constant. In 1998, Bahcall received the US Presidential Medal of Science for his theoretical work on solar neutrinos and for his role in the development of the Hubble Space Telescope. He also received the first Hans Bethe prize from the APS in 1998. Bahcall served as president of the American Astronomical Society from 1990-1992.

FOR VICE-PRESIDENT

MICHAEL S. TURNER
University of Chicago

Born in Los Angeles, CA, Turner received his BS in physics from Caltech in 1971 and his Ph.D. in physics from Stanford University in 1978. After two years as an Enrico Fermi Fellow at the University of Chicago he joined the faculty. He is currently the Rauner Distinguished Service Professor in the Departments of Physics and of Astronomy & Astrophysics and the Enrico Fermi Institute. Turner's research deals with the deep connections between particle physics and cosmology. He helped to pioneer this interdisciplinary field, and with Edward W. Kolb started the Theoretical Astrophysics group at Fermilab in 1983. Turner has made contributions to inflationary cosmology; the theory of particle dark matter and structure formation; big-bang nucleosynthesis; and dark energy and the accelerating Universe.

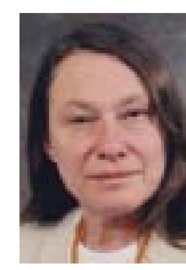
His research has been recognized with the Lilienfeld Prize of the APS. Turner has served on the APS Executive Board, and has chaired the Publications Committee and the Nominations Committee. Other past leadership positions include President of the Aspen Center for Physics, Chair of the Department of Astronomy & Astrophysics at Chicago, and Spokesperson for the Sloan Digital Sky Survey. He is currently the Associate Director of the Center for Cosmological Physics at Chicago. Most recently, he chaired the NRC's Committee on the Physics of the Universe whose report, Connecting Quarks with the Cosmos, was recently published.

FOR CHAIR-ELECT, NOMINATING COMMITTEE

PHILIP H. BUCKSBAUM
University of Michigan

Bucksbaum is an experimental atomic physicist. He earned his BA degree from Harvard University in 1975, and his MA and PhD from the University of California at Berkeley, graduating in 1980. After a year at Lawrence Berkeley Laboratory, he joined the research staff of Bell Laboratories as a post-doc in 1981. He became a member of the technical staff the next year, and remained there until moving to the University of Michigan as professor of physics in 1990. He currently holds the Otto Laporte Collegiate Professorship of Physics, and also directs the National Science Foundation Center for Frontiers in Optical Coherent and Ultrafast Science (FOCUS). Bucksbaum's principal research interest is quantum control of atomic and molecular processes using ultrafast and strong optical fields. He is particularly interested in the control of wave packets in atoms and molecules using far-infrared, visible, or x-ray pulses. This work touches problems in bond-selective laser chemistry, atomic wave packet engineering, quantum information science, ultrafast x-ray science, and high field laser-atom interactions. Service activities include serving as current editor of the *Physical Review's Virtual Journal of Ultrafast Science*, and divisional associate editor for laser science for *Physical Review Letters*. He just completed his term of membership on the APS Executive Board and the APS Council.

FOR CHAIR-ELECT, NOMINATING COMMITTEE



MARY K. GAILLARD
University of California, Berkeley

Gaillard has been a professor of physics at the University of California at Berkeley since 1981, and concurrently a faculty senior staff member at Lawrence Berkeley National Laboratory, where she headed the particle Theory Group in 1985-87. She received a Masters degree from Columbia University in 1961 and a doctorate at the University of Paris at Orsay, France, in 1968. She was a research scientist with the French CNRS from 1964 to 1981, becoming director of research in 1980, and concurrently a research associate at CERN, Geneva, Switzerland. In 1979 she established a particle theory group at LAPP, Annecy-le-Vieux, France, which she directed in 1979-1981. She has served the APS as a member of the Committee on the Status of Women in Physics, 1983-85, and as its chair in 1985, as a member of the Executive Committee of the Division of Particles and Fields, 1990-92, and as a member of the J.J. Sakurai Prize Committee, 1985-87 and 1994. She has also served on the High Energy Physics Advisory Panel (HEPAP) to the Department of Energy, 1991-94, and on HEPAP subpanels in 1983 and 1992, as well as on a number of advisory and visiting committees at universities and national laboratories. She is a recipient of the 1993 J.J. Sakurai Prize.

FOR GENERAL COUNCILLOR

EVELYN L. HU
University of California, Santa Barbara

Hu received a B.A. in Physics from Barnard College in 1969, and her M.A. (1971) and Ph.D. (1975) in physics from Columbia University, working with C.S. Wu. She worked at ATT Bell Laboratories as both a member of the technical staff (1975-1981), and subsequently as the supervisor of VLSI patterning processes (1981-84). In 1984, Hu joined the University of California at Santa Barbara as professor of electrical and computer engineering. Since 1987, she has held a joint appointment in the Materials Department. From 1994-2000, she served as the director of the Center for Quantized Electronic Structures (QUEST), an NSF Science & Technology Center; from 1994-2000 she also directed the activities of the UCSB node of the NSF National Nanofabrication Users Network. She is currently the scientific co-director of a newly-formed California NanoSystems Institute (CNSI), a collaboration between UCSB and UCLA, established by the state as one of four California Institutes for Science and Innovation.

RONALD E. MICKENS
Clark Atlanta University

Mickens was born in 1943 in Petersburg, Virginia. In 1964, he received a B.A. in physics, with a minor in mathematics, from Fisk University, and the Ph.D. in theoretical physics from Vanderbilt University in 1968. He was an NSF postdoctoral fellow at the Center for Theoretical Physics, MIT, during 1968-70. He then returned to Fisk University as associate professor in 1970 and left in 1982, as professor, to take a position as professor in the Physics Department of Atlanta University. He has held visiting professorships and research positions at Vanderbilt University, Joint Institute for Laboratory Astrophysics, and Morehouse College. His research interests include the asymptotics of scattering amplitudes at high energies, the analysis of the mathematical properties of chemical reaction-rate and equilibrium coefficients, nonlinear oscillations, and the numerical integration of reaction-diffusion PDE's. He has served on the following APS committees: Committee on Minorities (1972-1980), Committee on Opportunities in Physics (1988-90), Committee on Membership (1989-90), and Committee on Education (1992-94). He was Chair of the Southeastern Section of the APS in 2001 and served as chair (2002)/vice-chair (2001) of the APS Bouchet Award Committee.

FOR GENERAL COUNCILLOR

ARTHUR P. RAMIREZ
Los Alamos National Laboratory

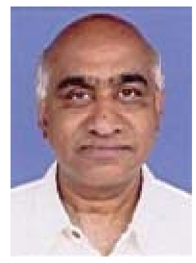
Ramirez was born in 1956 in Amityville, New York. He received his B.S. in physics from Yale University in 1978, and his Ph.D. in physics, also from Yale, in 1984. He worked at Bell Labs from 1984 until 2000, and became a distinguished member of the technical staff in 1999. In 2001 he moved to Los Alamos National Lab and is both leader of the Materials Integration Science Laboratory and co-director of the Institute for Complex Adaptive Matter, a University of California Multi-Campus Research Program. He is presently a member of the Executive Committee of the APS Division of Condensed Matter Physics. Ramirez's research interests in experimental Condensed Matter include low-dimensional magnetism, heavy fermion systems, thermoelectric materials, colossal magnetoresistive materials, high dielectric constant materials, geometrically frustrated systems, molecular electronics, and superconductivity in various systems including molecular compounds, intermetallics, and oxides. He is an ISI Highly Cited Researcher.

ANTHONY ZEE
University of California, Santa Barbara

Born in China, Zee attended high school in Sao Paulo, Brazil, and obtained his undergraduate and graduate education at Princeton University and Harvard University respectively. Since 1985, he has been a permanent member of the Kavli Institute for Theoretical Physics in Santa Barbara, California, and a professor of physics at the University of California at Santa Barbara. The first part of his career was devoted to quantum field theory and high energy physics, but the salient feature of his research has been his interest in many areas of theoretical physics, making his position at the Kavli Institute ideal, since approximately four different areas of theoretical physics are studied intensely every year there. He is also the author of two popular science books for the general public: *Fearful Symmetry: the Search for Beauty in Modern Physics* and *An Old Man's Toy: Gravity at Work and Play in the Universe* (later republished as *Einstein's Universe*.) His second book was nominated for a Pulitzer Prize, and he gives popular lectures to general audiences at various universities in the United States and at a number of institutions around the world. He recently completed a textbook on quantum field theory to be published by Princeton University Press, an effort that reflects his long-standing interest in teaching and in education.

INTERNATIONAL COUNCILLOR

T. V. RAMAKRISHNAN
Indian Institute of Science



Ramakrishnan was born in Madras (now Chennai), India, and grew up in Varanasi where he had his education through his masters degree in physics. He did his Ph.D. (1966) at Columbia University. After a brief period on the faculty at the Indian Institute of Technology, Kanpur, he did postdoctoral research (1968-70) at the University of California, San Diego (La Jolla) before rejoining IIT Kanpur. He was at Princeton University and Bell Laboratories from 1978 to 1981, and has been a professor of physics at the Indian Institute of Science, Bangalore since then. Ramakrishnan's present and past research work covers a broad spectrum of areas in theoretical condensed matter physics. He is best known for his theory of freezing and other phenomena in dense classical systems, for the theory of weak localization of electrons in random media and for the scaling theory of electron localization. His current interests are in strongly correlated electron systems *e.g.* colossal magnetoresistance manganites and high temperature superconductors. He has a long association with the International Centre for Theoretical Physics, Trieste, Italy , where he has been a member of the Scientific Council since 1996.

INTERNATIONAL COUNCILLOR

SUKEKATSU USHIODA
Tohoku University

Ushioda was born in 1941 in Tokyo. He went to Dartmouth College as an undergraduate and then to University of Pennsylvania for graduate studies in physics. He completed his PhD in 1969. He served on the faculty of the Physics Department of the University of California, Irvine before returning to Japan in 1985 as professor of the Research Institute of Electrical Communication, Tohoku University, and presently remains in that position. In addition, he is a Team Leader of the Frontier Research Program of the Institute of Physical and Chemical Research (RIKEN) and a Research Supervisor of the "Innovative Nanotechnology Integration" Program of the Japan Science and Technology Corporation (JST). Ushioda has worked in several areas of experimental solid state physics. His early work included Raman spectroscopy of bulk and surface polaritons, vibrations of surface adsorbed molecules, and surface plasmons. More recently his research interest is focused on the spectroscopy of light emission from the scanning tunneling microscope. Ushioda is currently vice president of the Physical Society of Japan (JPS), and will start his term as president in September 2003. He currently serves on the Review Committee of *Physical Review Letters*.

BELTWAY *from page 1*

meeting in his office a few weeks ago.

For most members of Congress, this year's priority items are defense, homeland security, health, education, jobs, and enduring infrastructure items, such as highways, water projects, courthouses and prisons. If any money is left over, science could be a beneficiary. But with federal red ink flowing at historical highs this year, go find a spare nickel.

Domenici did have some advice for scientists: fight like hell—my words, not his, but the import is the same.

Without question, the battle will be incredibly tough, so it's fair to ask how successful scientists are when they lobby. Not long ago, D. Allan Bromley and I tried to answer the question by examining the changes in the funding landscape during the last decade, when scientists across disciplines first became engaged in the political process. Our analysis, to be published in *Issues in Science and Technology* (The National Academies and the University of Texas at Dallas, Summer 2003), reveals that the impact was dramatic.

The accompanying figure tells the story graphically. It shows a three-year running average of the percentage changes in the federal budgets for key science agencies, starting with Fiscal Year 1995 and ending with the Fiscal Year 2004 Presidential Request. Lobbying began in earnest in 1997, and until this year, it drove the percentages up in a compelling manner: it had an impact on budgeting.

But since September 11, 2001, defense spending has soared, federal revenues have skidded and deficits have reached historic proportions. On this new Washington landscape, is it possible for science to avoid the budget ax, even if the community speaks out strongly?

The arguments for federal funding are compelling: science drives technology, creates jobs, stimulates economic growth, saves lives, enables the military and defends the homeland. What more could any politician want!

But one key ingredient is missing. Science simply doesn't win elections. At least, that's the perception. The reality is that scientists and engineers could be a potent voting bloc—if they chose to be. With their families they constitute more than 10 million voters. That's enough to sway many elections.

Consider the Presidential results from 2000. In twelve states the margin of the victor was less than five percent. In six states it was one percent or less. In four states fewer than 6,000 votes separated George W. Bush and Al Gore; in two states, fewer than 600.

If scientists and engineers want to make science and engineering electoral priorities, they have it in their power to do so, if they dare.

BOOTCAMP *from page 1*

classes and lectures delivered by prominent scientists. Topics covered in the lectures included microchip fabrication, how scanning probe microscopes can advance nanoscience, and how observations of the Sun from space are providing scientists with new views of the Sun.

Hailing from 14 different states, the 24 students—five of them female—competing in the boot camp were selected from a pool of more than 1,400 students who were nominated by their high school physics teachers to take the Olympiad physics exams. "These students are inspiring," said Bernard Khoury, executive officer of the American Association of Physics Teachers, which co-sponsored the competition along with the American Institute of Physics. "Each year I am more amazed at what these teenagers have already accomplished, and what they will accomplish in the future.

In addition to the usual round of scholarships, academic awards and other medals and honors won by each of the students, this year's group boasts a published poet, a budding politician, and a student who speaks six languages fluently and taught himself physics from course material found on MIT web sites when he was just 10 years old.

While in the Washington, DC, area, the 24 students took photos at the Einstein statue at the National Academy of Sciences. They also toured the National Air and Space Museum and met with officials of NASA and other federal agencies at a special reception in the Rayburn House Office Building on May 20. The reception was co-sponsored by the only two physicists in the House of Representatives, Vernon Ehlers (R-MI) and Rush Holt (D-NJ), both of whom spoke briefly, highlighting the importance of science education and wishing the students luck. It was followed by a ceremony featuring remarks by the DOE's Peter Faletra and Norman Neureiter, science advisor to Colin Powell. Also on hand was John Mather of the NASA Goddard Space Flight Center, who highlighted [in his keynote address] the upcoming next-generation James Webb Space Telescope, currently under development.

But it wasn't all work for the participating students. They played frisbee—in the mud, thanks to the constant rain—and various card games, and formed friendships that they hope will prove to be lasting ones. For most, the experience was more fun than onerous. "When I first got [to the camp], I was really scared that I would be in a camp full of boring and esoteric people who would do nothing but study all day long," one participant e-mailed shortly after returning home. "I'm glad I found myself wrong. This week ruled! We all had so much fun."

Physicists Tell Batting Coaches To Get A Grip On Grip Advice

Some good news for players and batting coaches: physicists say they shouldn't worry about a player's grip on the bat as it connects with the ball. The sharp-eyed baseball fan will notice that some batters, like David Justice, remove one of their hands during their swing—sometimes against the advice of batting coaches. But now physicists are telling coaches and players alike to rest easy. New research shows that the released hand has nothing to do with how fast the ball leaves the bat.

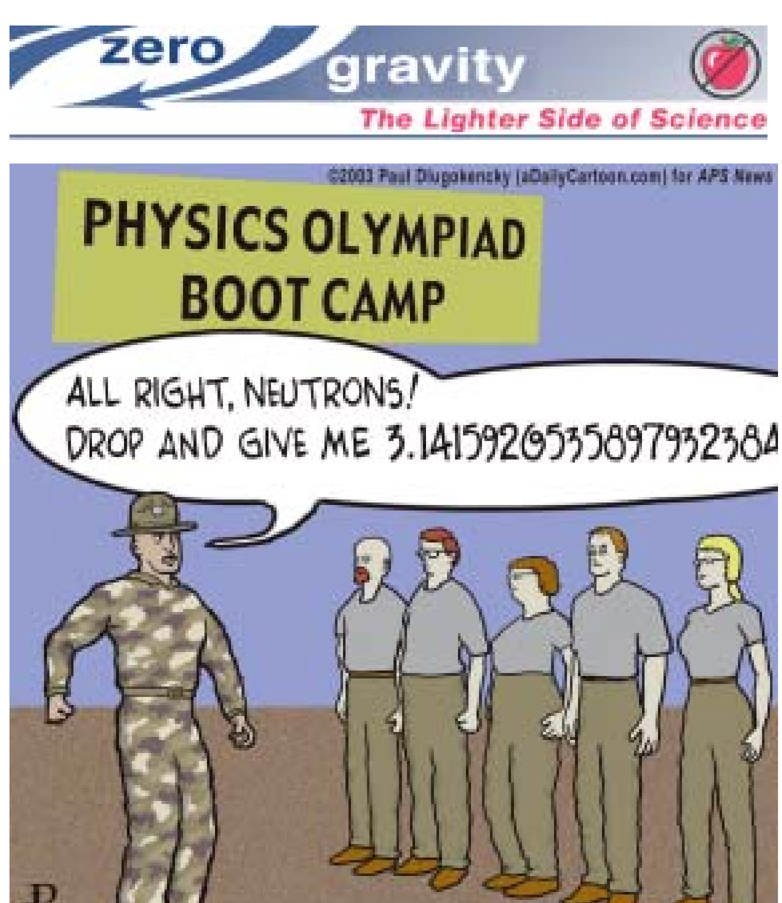
In research published recently in the American Journal of Physics, University of Illinois professor of physics Alan Nathan says the grip on the bat during contact with the baseball does nothing to affect the power delivered to the ball. Nathan says that even if the hitters were to let go of the bat right before contact, the batted ball would have the same speed and trajectory. "Just prior to the collision with the ball, the bat is already at its maximum speed," says Nathan, "There's nothing that the hands can do to affect the ball at this point."

The hands do play an important role during the actual swing prior to the actual contact, as they help transfer energy generated in the large muscles of the body to the baseball bat. This muscle power propels the bat to the high velocity needed to transfer a lot of momentum to the ball and send it on its way. But during the bat-ball contact time, the grip does nothing to affect the ball's final velocity or trajectory.

There are several reasons for this, Nathan explains. First, the bat exerts a force on the ball that can easily reach eight or nine thousand pounds. The force can be so large, many times the weight of the batter, because the ball is in contact with the bat for only about one thousandth of a second.

Nathan also points out that the collision between bat and ball creates a vibrational wave in the bat. The wave originates at the collision point and ripples down to the hand. The wave itself, since it absorbs energy from the baseball, can affect the exit speed of the ball. But by the time the wave hits the hand, the ball is already separated from the bat, and there's nothing that the hands can do to alter this vibrational wave.

—From Inside Science News Service, a joint effort of the American Institute of Physics and the APS.



The Back Page

Farsighted or Foolish? The 20th Anniversary of A Nation at Risk

By Gerald W. Bracey

Twenty years ago, after a bitter dispute among White House insiders, Ronald Reagan officially accepted *A Nation At Risk: The Imperative for Educational Reform*, a report delivered to Reagan by secretary of education Terrel Bell through his National Commission on Excellence in Education.

The report played big in the media—28 articles in the *Washington Post* alone—but it had more use as a political tract. The White House moderates, especially James Baker and Michael Deaver, thought the report contained many issues on which Reagan could campaign. Indeed, the commissioners soon came to feel they had been used to further political ends, notably Reagan's reelection in 1984. For his part, Bell in later years noted that the report stole the education issue from the Democrats and that Reagan's speeches about the importance of education served as cover for his cuts in welfare, aid to dependent children, Medicaid and other social programs.

Any students who were in first grade when *A Nation at Risk* appeared and who went directly from high school graduation into the work force have now been there almost nine years. Those who went on to bachelor's degrees have been on the job for nearly five years. Despite the dire predictions of national economic collapse without immediate education reform, our national productivity has soared since those predictions were made. What, then, are we to make of *A Nation at Risk* 20 years on?

The report's stentorian Cold War rhetoric still commands attention: "If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war" (pg. 5).

By contrast, the report's recommendations were banal. They called for nothing new, only for more of the same: more science, more mathematics, more computer science, more foreign language, more homework, more rigorous courses, more time-on-task, more hours in the school day, more days in the school year, more training for teachers, more money for teachers. And even those mundane recommendations were based on a veritable treasury of slanted, spun, and distorted statistics.

Stop worrying so much about the Red Menace, the booklet said. The threat was not that our enemies would bomb us off the planet, but that our friends—especially Germany, Japan, and South Korea—would outsmart us and wrest control of the world economy.

The commission members tightly yoked the nation's global competitiveness to how well our 13-year-olds bubbled in test answer sheets. The theory was, to be kind, without merit. Nevertheless, it became very popular in the late 1980s, when the nation slid into the recession that would cost George H. W. Bush a second term. One then heard many variations of "lousy schools are producing a lousy work force and that's killing us in the global marketplace." The economy, however, was not listening to the litany and came roaring back.

During the years after the publication of *A Nation at Risk* , critics of the schools not only hyped the alleged bad news but also deliberately suppressed good news—or ignored it when they couldn't actually suppress it. The most egregious example was the suppression of the Sandia Report. Assembled in 1990 by engineers at Sandia National Laboratories in Albuquerque, the report presented 78 pages of graphs and tables and 78 pages of text to explain them. It concluded that, while there were many problems in public education, there was no systemwide crisis.

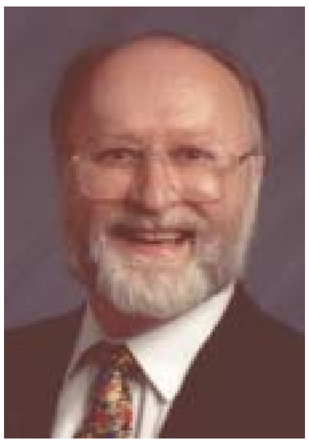
Secretary of Energy James Watkins, who had asked for the report, called it "dead wrong" in the *Albuquerque Journal*. Briefed by the Sandia engineers who compiled it, Deputy Secretary of Education and former Xerox CEO David Kearns told them, "You bury this or I'll bury you." The engineers were forbidden to leave New Mexico to discuss the report. Officially, according to Diane Ravitch, then assistant secretary of education, the report was undergoing "peer review" by other agencies (an unprecedented occurrence) and was not ready for publication.

Lee Bray, the vice president of Sandia, supervised the engineers who produced the report. I asked Bray, now retired, about the fate of the report. He affirmed that it was definitely and deliberately suppressed.

There were other instances of accentuating the negative in the wake of *A Nation at Risk*. In February 1992, a small international comparison in mathematics and science appeared. America's ranks were largely, but not entirely, low, although actual scores were near the international averages. Critics would hammer the schools with this international study for years.

Five months after the math/science study, another international comparison appeared, this one in reading. No one knew. American 9-year-olds were second in the world in reading among the 27 nations tested. American 14-year-olds were eighth out of 31 countries, but only Finland had a significantly higher score.

While *A Nation at Risk* offered a litany of spun statistics about the risks the nation faced, its authors and fellow believers presented no actual data to support the contention that high test scores implied competitiveness—only the most circumstantial of evidence. The arguments heard around the country typically went like this: "Asian nations have high test scores. Asian nations, especially Japan, have experienced economic miracles. Therefore, the high test scores produced the economic good times." Thus the National Commission on Excellence in Education—and many school critics as well— made a mistake that no educated person should: they confused correlation with causation.



Gerald W. Bracey

The "data" on education and competitiveness consisted largely of testimonials from Americans who had visited Japanese schools. I once asked Paul George of the University of Florida about the difficulty of gaining entrance to any less-than-stellar Japanese schools. George has spent years in Japanese schools of various kinds. His reply was succinct: "Look, there are 27 high schools in Osaka, ranked 1 to 27. You can easily get into the top few. You would have a much harder time getting into number 12 or number 13. Not even Japanese researchers can get into number 27."

The proponents of the test-score theory of economic health grew quiet after the Japanese discovered that the emperor's palace and grounds were actually not worth more than the entire state of California. Japan has foundered economically now for 12 years. The government admits that bad loans from banks to corporations amount to more than 10% of its Gross Domestic Product. Some estimate the size of the bad loans as high as 75% of GDP.

The case of Japan presents a counterexample to the idea that high test scores ensure a thriving economy. But there is a more general method available to test the hypothesis put forth in *A Nation at Risk*. I located 35 nations that were ranked in the Third International Mathematics and Science Study (TIMSS) eighth-grade tests and were also ranked for global competitiveness by the World Economic Forum (WEF), the Geneva think tank. Among these 35, the US was number one in competitiveness in 2001. Among all 75 countries that the WEF ranked in its 2001-2002 report, the US was number two, trailing Finland. The rank order correlation coefficient between test scores and competitiveness was +.19, virtually zero. If five countries that scored low on both variables were removed from the list, the coefficient actually became negative.

A Nation at Risk fabricated its case for the connection between education and competitiveness out of whole cloth, but to make its case for the dire state of American education, it did provide a lot of statistics. Consider these:

1. "There was a steady decline in science achievement scores of U.S. 17-year-olds as measured by national assessments of science in 1969, 1973, and 1977" (pg. 9). Maybe, maybe not. The National Assessment of Educational Progress (NAEP) was not originally designed to produce trends, and the scores for 1969 and 1973 are backward extrapolations from the 1977 assessment. In any case, the declines were smaller for 9- and 13-year-olds and had already been wiped out by gains on the 1982 assessment. Scores for reading and math for all three ages assessed by NAEP were stable or inching upward. The commissioners thus had nine trendlines (three ages times three subjects), only one of which could be used to support crisis rhetoric. That was the only one they reported.

2. "The College Board's Scholastic Aptitude Tests demonstrate a virtually unbroken decline from 1963 to 1980" (pg. 8-9). This was true. But the College Board's own investigative panel described a complex trend to which many variables contributed. It ascribed most of the decline to changes in who was taking the test—more minorities, more women, more students with mediocre high school records, more students from low-income families. All of those demographic changes are associated with lower scores on any test. It would have been very suspicious if the scores had not declined.

3. "Average achievement of high school students on most standardized tests is now lower than 26 years ago when Sputnik was launched" (pg. 8). But in order to examine trends in test scores over time, one needs a test that is referenced to a fixed standard where each new form is equated to the earlier form. At the time, most companies that produced standardized tests did not equate them from form to form over time. Instead, they used a "floating norm." Whenever they renormed their tests, whatever raw score corresponded to the 50th percentile became the new norm. Only the Iowa Tests of Basic Skills (ITBS, grades 3-8) and the Iowa Tests of Educational Development (ITED, grades 9-12) were referenced to a fixed standard and equated from form to form, beginning in 1955.

It is instructive to examine what the nation was experiencing during the 10 years of falling test scores from 1965 to 1975. The Civil Rights Act of 1964 was passed, and 1965 opened with the Watts riots in Los Angeles. The decade also brought us the Black Panthers, the Symbionese Liberation Army, Students for a Democratic Society, the Free Speech Movement, the Summer of Love, Woodstock, Altamont, Ken Kesey and his LSD-laced band of Merry Pranksters, the Kent State atrocities, and the 1968 Chicago Police Riot. Martin Luther King, Jr., Robert Kennedy, and Malcolm X were all assassinated. The nation became obsessed with and depressed by first the war in Vietnam and then Watergate. "Recreational drugs"—pot, acid, speed, Quaaludes, amyl nitrate—had become popular. If you remember the Sixties, the saying goes, you weren't there.

Under these conditions of social upheaval, centered in the schools and universities, it would have been a miracle if test scores had not fallen.

Alas, we must recognize that good news about public schools serves no one's reform agenda—even if it does make teachers, students, parents, and administrators feel a little better. Conservatives want vouchers and tuition tax credits; liberals want more resources for schools; free marketers want to privatize the schools and make money; fundamentalists want to teach religion and not worry about the First Amendment; Catholic schools want to stanch their student hemorrhage; and home schooling advocates want just that. All groups believe that they will improve their chances of getting what they want if they pummel the publics.

It has been 20 years since *A Nation at Risk* appeared. It was false then and is false now. Today, the laments are old and tired. "Test Scores Lag as School Spending Soars" trumpeted the headline of a 2002 press release from the American Legislative Exchange Council. Ho hum. The various special interest groups in education need another treatise to rally round. And now they have one. It's called *No Child Left Behind*. It's a weapon of mass destruction, and the target is the public school system. Today, our public schools are truly at risk.

Gerald W. Bracey is an associate for the High/Scope Foundation in Ypsilanti, Michigan, and an associate professor at George Mason University. His most recent book is **What You Need to Know About the War Against America's Public Schools** *(Allyn and Bacon/Longman, 2003). The above was adapted from an article in the April 2003 issue of* **Phi Delta Kappan**. *Reprinted with permission.*

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