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APS March Meeting Heads North to Montréal

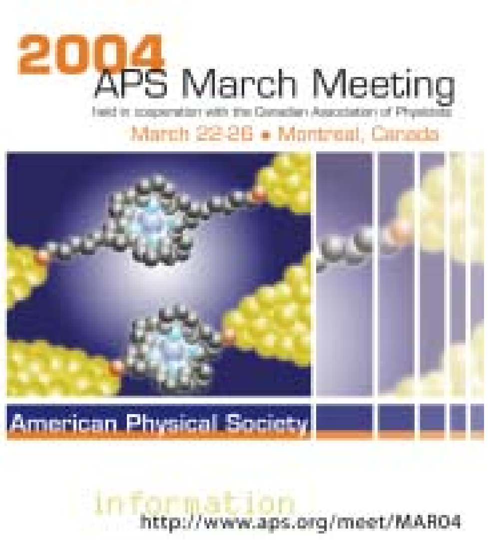
The 2004 March Meeting will be held in lively and cosmopolitan Montréal, Canada's second largest city. The meeting runs from March 22nd through the 26th at the Palais des Congrès de Montréal.

Approximately 5,500 papers will be presented in more than 90 invited sessions and 550 contributed sessions in a wide variety of categories, including condensed matter, materials, polymer physics, chemical physics, biological physics, fluid dynamics, laser science, computational physics, and atomic, molecular, and optical physics.

There will also be forums on Industrial and Applied Physics; Physics and Society; History of Physics; International Physics; Education and Physics; and Graduate Student Affairs, as well as topical groups on Instrument and Measurement Science; Magnetism and Its Applications; Shock Compression of Condensed Matter; and Statistical and Nonlinear Physics.

An exhibit show will round out the program during which attendees can visit vendors who will be displaying the latest products, instruments and equipment, and software, as well as scientific publications related to the research and application of physics.

There will also be several special programs, including a Division of Polymer Physics Short Course on Rheology and Dynamics of Polymers & Complex Fluids, and eight half-day tutorials on specialized topics: magneto- transport; computational cell biology; semiconductor quantum dots; quantum information science; spintronics; opportunities in biological physics; Terahertz frequency spectroscopy at low temperatures; and Java programming using the Open Source Physics Library.



The Society will be organizing a host of special events, including receptions, alumni reunions, a students' lunch with the experts, and an opportunity to meet the editors of the APS and AIP journals.

For those who want to explore, there will be tours of Montréal, highlighting the city's history, cultural heritage, cosmopolitan nature, and European flavor.

APS Honors Two Undergrads With Apker Award

Nathaniel Stern

Peter Onyisi

Two young physicists have been honored with the 2004 Apker Award for their outstanding undergraduate research. The APS presents two Apker awards annually, one to a student from a PhD-granting institution, one to a student from an non-PhD-granting institution. The recipients, who will each receive $5,000, were selected by a committee from a group of six finalists.

Peter Onyisi of the University of Chicago received the award for a PhD-granting institution for his research entitled, "Looking for New Invisible Particles." Nathaniel Stern of Harvey Mudd College received the award for a non-PhD-granting institution for his thesis entitled, "Exchange Anisotropy and Giant Magnetoresistance in Thin Film Spin Valves Containing Ultra-thin IrMn Antiferromagnetic Layers."

Onyisi's research involved searching for evidence of new particles in data from proton-anti-proton collisions at 1.8 TeV, using data collected by the Collider Detector at Fermilab (CDF).

After analyzing photon and

See **APKER RECIPIENTS** *on page 5*

AMS, Biomedical Applications Highlight 2003 DNP Meeting

New techniques for carbon 14 dating and trace element analysis, as well as the application of nuclear particle detectors in the biomedical arena, were among the highlights presented at the annual meeting of the APS Division of Nuclear Physics, held October 30 through November 1 in Tucson, Arizona. The technical program also featured several talks on subjects related to last year's National Research Council report, "Connecting Quarks to the Cosmos," along with presentations on the nuclear physics of supernovae.

Revolutionizing Carbon Dating. A public lecture on Wednesday evening and an invited talk on Thursday afternoon both focused on applications for accelerator mass spectroscopy (AMS), most of which center on its use for carbon 14 dating. According to Walter Kutschera (University of Vienna, Austria), AMS has revolutionized the field by measuring carbon 14 through isotope ratios rather than the classical method of beta counting, increasing the sensitivity almost one million times, which in turn enables researchers to reduce the sample size to milligram amounts, compared with several grams required for beta counting. He illustrated this point with the case of Iceman Oetzi, a well preserved 5200-year-old body found in the central European Alps in 1991.

At a special public lecture, Douglas Donahue (University of Arizona) described his team's studies of artistic artifacts, the populating of the Americas, and the study of Martian meteorites using an AMS instrument. He incorporated a small tandem electrostatic accelerator as one component of a conventional mass spectrometer, giving the ions to be analyzed kinetic energies of millions of electron volts instead of the more

See **DNP MEETING** *on page 3*

Nobel Laureates Past and Present

Photo credit to Darlene Logan

At a recent reception for APS Fellows in the Chicago area, Leon Lederman (left), Nobel Laureate in 1988, chats with Aleksei Abrikosov, Nobel Laureate in 2003, and his wife Svetlana. (Another picture from the same reception appears on page 2.) Abrikosov, for a long time at the Institute for Physical Problems in Moscow and now at Argonne National Laboratory, shares the 2003 Nobel Prize in Physics with Vitaly L. Ginzburg of the Lebedev Institute in Moscow and Anthony J. Leggett of the University of Illinois at Urbana-Champaign (UIUC). They were honored for their work on the theories of superconductivity and superfluidity. In addition, this year's Nobel Prize in Physiology or Medicine recognized an important physics-based technology, magnetic resonance imaging or MRI. This Prize is being awarded to two pioneers in this field, Paul C. Lauterbur of UIUC, and Peter Mansfield of the University of Nottingham, UK. All of this year's laureates will receive their prizes in Stockholm on December 10.

California Physics Departments Face More Budget Cuts in an Uncertain Future

The California recall election was a laughing matter to many, a veritable circus of replacement candidates of dubious celebrity and questionable qualifications for the job. But for physics departments across the state, the ongoing budget woes that spurred angry voters to action in the first place remain deadly serious.

Once the flagship of state-funded education, boasting 44 Nobel Laureates and some of the top research facilities in the nation, the University of California (UC) system is simultaneously facing an enrollment boom and deep budget cuts. The California State University (CSU) system, already stretched thin with its 23 campuses and network of community colleges, is facing similar drastic cuts.

In August, then-Governor Gray Davis approved a particularly stringent 2003-2004 budget, in response to a lackluster California economy that generated a record $38 billion deficit. After the dust settled, the $2.9 billion state funding package for the UC system lost $410 million in cuts, including a $10.8 million reduction to its $259 million general research fund. This comes on the heels of an $18 million mid-year reduction, and last year's 10% budget cut.

The CSU system has been hit just as hard, according to Chris Gaffney, chair of the physics department at CSU-Chico, losing $304 million of its $2.6 billion state funding, while simultaneously being expected to absorb a 4.3% growth in enrollment. Such a large reduction in state funding would have been truly devastating, except for a 32% increase in fees (tuition) this year, raising the yearly cost from $2100 to $2800. These large statewide cuts translated into, among other

See **CALIFORNIA** *on page 6*

Highlights

Fusion Tops DOE Facilities List

Speaking at the National Press Club on November 10, Secretary of Energy Spencer Abraham unveiled the Department's twenty-year plan for the future of science facilities.

The plan lists the 28 major research facilities that should receive priority for near, mid, and far term funding. The number one priority for near term funding is ITER, an international collaboration to build an experiment capable of producing the first self-sustaining fusion reaction.

The list of 28 facilities is reproduced below. In addition, Secretary Abraham's speech appears as the Back Page on page 8 of this issue. The complete report is available at http://www.science.doe.gov/ .

Priority	Program	Facility
1	FES	ITER
2	ASCR	UltraScale Scientific Computing Capability
3 (tied)	HEP	Joint Dark Energy Mission
3 (tied)	BES	Linac Coherent Light Source
3 (tied)	BER	Protein Production and Tags
3 (tied)	NP	Rare Isotope Accelerator
7 (tied)	BER	Characterization and Imaging
7 (tied)	NP	CEBAF Upgrade
7 (tied)	ASCR	Esnet Upgrade
7 (tied)	ASCR	NERSC Upgrade
7 (tied)	BES	Transmission Electron Achromatic Microscope
12	HEP	BTeV
13	HEP	Linear Collider
14 (tied)	BES	Analysis and Modeling of Cellular Systems
14 (tied)	BES	SNS 2-4 MW Upgrade
14 (tied)	BES	SNS Second Target Station
14 (tied)	BER	Whole Proteome Analysis
18 (tied)	NP	Double Beta Decay Underground Detector
18 (tied)	FES	Next-Step Spherical Torus
18 (tied)	NP	RHIC II
21 (tied)	BES	National Synchrotron Light Source Upgrade
21 (tied)	HEP	Super Neutrino Beam
23 (tied)	BES	Advanced Light Source Upgrade
23 (tied)	BES	Advanced Photon Source Upgrade
23 (tied)	NP	eRHIC
23 (tied)	FES	Fusion Energy Contingency
23 (tied)	BES	HFIR Second Cold Source and Guide Hall
23 (tied)	FES	Integrated Beam Experiment

Red indicates Near-term
Blue indicates Mid-term
Green indicates Far-term

ASCR = Advanced Scientific Computing Research
BES = Basic Energy Sciences
BER = Biological and Environmental Research
FES = Fusion Energy Sciences
HEP = High Energy Physics
NP = Nuclear Physics

Chicago Area Fellows Convene

Photo Credit: Darlene Logan

APS Fellows from the Chicago area met on October 7 at the 410 Club in downtown Chicago. The reception was hosted by Robert Eisenberg of Rush Medical Center and Leon Lederman, Director Emeritus of Fermilab. The assembled Fellows heard from APS President Myriam Sarachik, Executive Officer Judy Franz, Director of Education Fred Stein, and Director of Public Affairs Michael Lubell. Shown here (l to r) are Wendy Gibson and from Argonne National Laboratory, Wai-Kwong Kwok, Igor Aronson, Paul Fuoss, and J. Murray Gibson.

This Month in Physics History

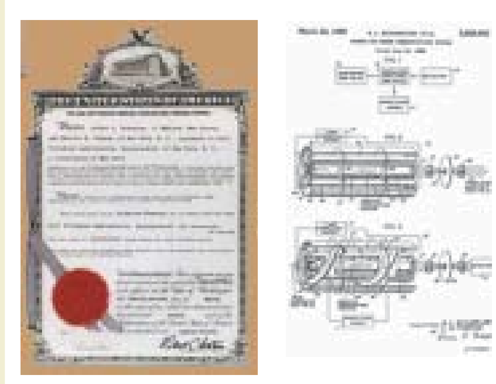
December 1958: Invention of the Laser

Every now and then, a scientific breakthrough occurs that has a revolutionary impact on daily life. One example of this is the invention of the laser, which stands for light amplification by stimulated emission of radiation. Few people realized at the time of its invention that it would prove to be such a useful (and lucrative) device, but the laser ultimately launched a new scientific field and opened the door to what is today a multi-billion dollar industry.

The principle of the laser dates back to 1917, when Albert Einstein first described the theory of stimulated emission, but the practical device has its roots in the 1940s and early 1950s, particularly the work on microwave spectroscopy—a powerful tool for discovering the characteristics of a wide variety of molecules—by physicists Charles Townes, Arthur Schawlow and others, and the subsequent invention of the maser (microwave amplification by stimulated emission of radiation).

After World War II had ended, Townes was intrigued by the possibility of using stimulated emission to probe gases for molecular spectroscopy. As the wavelength of the microwave radiation grew shorter, its interactions with molecules became stronger, making it a more powerful spectroscopic tool. Townes and colleagues at Columbia University demonstrated a working maser in 1953, two years after similar devices were independently invented by researchers at the University of Maryland and Lebedev Laboratories in Moscow.

However, Townes realized that the wavelengths of infrared and optical light, because they were shorter, would be even more powerful tools for spectroscopy, and mentioned the idea of extending the maser principle to shorter wavelengths to Schawlow while visiting the latter at Bell Labs. Schawlow came up with the idea of arranging a set of mirrors, one on each end of the device's cavity, to bounce the light back and forth, thus eliminating the amplification of any beams bouncing in other directions. He



thought that this would enable them to adjust the dimensions so that the laser would only have one frequency which could be selected within a given line width, and that the mirror size could be adjusted so that even slight off axis motion could be damped. He also suggested using certain solid state materials for the lasers.

Charles Townes

Arthur Schawlow

Eight months later, the two men wrote a paper on the proof of concept for their work, published in the December 1958 issue of the *Physical Review* (Vol. 112, No. 6, pp. 1940-1949), and received a patent for the invention of the laser two years later—the same year the first working laser was built by Theodore Maiman at Hughes Aircraft Company. Townes was a co-recipient of the 1964 Nobel Prize in Physics for his fundamental work in quantum electronics that provided the basis of the maser/laser principle. Schawlow's recognition came much later; he shared the 1981 Nobel Prize for his contributions to the development of laser spectroscopy.

While Townes and Schawlow are the names most often associated with the invention of the laser because of their 1958 paper and subsequent patent, numerous others made vital contributions. Perhaps that is why the question of who really invented the laser has proven to be a fairly litigious one, due in large part to the efforts of Gordon Gould, a scientist at Columbia and later with Technical Research Group (TRG), to earn patent rights based on his research notebook. An entry on his initial ideas for the laser was dated and notarized November 1957. Gould fought for decades, and in 1973 the US Court of Customs and Patent Appeals ruled that the original patent awarded to Schawlow and Townes was too general, and did not supply enough information to create certain key components. Gould was finally granted patent rights, receiving his fourth and final patent on lasers in 1988.

Although it was a remarkable technical breakthrough, in its early years the laser did not have many practical applications, since it was not powerful enough for use in beam-based weaponry, and its ability to transmit information through the atmosphere was severely hampered by its inability to penetrate clouds and rain. But it didn't take long for researchers to develop the first laser sighting systems and the first tools for laser surgery.

Today, lasers are ubiquitous in the commercial marketplace, used in CD players, in corrective eye surgery, tattoo removal, industrial assembly lines, supermarket scanners, optical communications, and optical data storage.

Further Reading:

Bromberg, Joan L., "The Birth of the Laser", *Physics Today*, October 1988, pp. 26-33.

"A Laser Patent That Upsets the Industry," *Business Week*, 24 October 1977, pp. 121-130.

Hecht, Jeff, "Winning the Laser Patent War," *Laser Focus World*, December 1994, pp. 49-51.

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Editor .... Alan Chodos
Associate Editor .... Jennifer Ouellette
Special Publications Manager .... Elizabeth Buchan-Higgins
Design and Production .... Stephanie Jankowski
Forefronts Editor .... Neville Connell
Proofreader .... Edward Lee

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Program Committee Prepares for March Meeting

Photo Credit: Alan Chodos

In October the program committee gathered at APS headquarters in College Park to organize the sessions for the March Meeting in Montréal. It's a big meeting, and it's a big committee. Shown here, left to right, are: John Bechhoefer (front), Dan Fleetwood (rear), Zhixun Shen, Denis McWhan, Laurie McNeil, Denis Rousseau, Moses Chan, Charles Clark, Allen Goldman, Sid Nagel, Art Ramirez (rear), Andrea Liu (front, with baby), Don Gubser, Barry Schneider, Paul McEuen, Sue Coppersmith (front), Steve Girvin (rear), Eva Andrei, Peter Schiffer, Mark Robbins, Ray Goldstein, and Nitash Balsara. Not shown: John Wilkins.

Entire APS Journal Collection Licensed By Los Alamos "Library Without Walls"

By Ernie Tretkoff

The APS has agreed to license its entire collection of online journals to Los Alamos National Laboratory. This is the first time the APS has allowed any entity to host the entire collection, which includes *Physical Review*, *Physical Review Letters*, *Reviews of Modern Physics* and *PROLA*.

The move will allow Los Alamos to integrate APS journals into its Library Without Walls, an internationally recognized state-of-the-art, large-scale digital library. Through subscription authentication, library users will be able to access APS journals and other scientific publications all through one site.

Los Alamos was eager to add APS journals to its collection. "This agreement will provide a set of critical physics content that we can richly integrate into our information environment and services," said Rick Luce, Los Alamos Research Library Director. "In addition, it will provide a model mechanism for a standardized distribution of content."

As scientific journals continue to move away from print and towards digital distribution, supporting the large electronic archive becomes increasingly technically challenging. The new licensing agreement makes it possible for APS to work with skilled technical library experts at Los Alamos. "By moving deliberately with a leading technical partner, we hope that a product of maximum usefulness and longevity will be achieved," said Thomas McIlrath, treasurer and publisher of the APS.

APS and Los Alamos will use the Open Archive Initiative protocols to keep the Los Alamos copy synchronized with the APS original version.

Allowing Los Alamos to host APS journals also helps keeps APS journals visible and accessible to both current and new users, said Barbara Hicks, APS Associate Publisher.

"It is especially noteworthy to APS that Los Alamos will offer other libraries and institutions access to the collection through its integrated service." said McIlrath.

GAO Says Current Missile Defense Plan Is Risky

A recent report from the General Accounting Office asserts that the Administration's current missile defense plans are risky given the state of the critical technologies. The report recommends that the Department of Defense explore options to properly demonstrate effectiveness of one of these technologies and establish procedures to help ensure data from the Missile Defense Agency's monitoring system are reliable.

The GAO report, requested by Senator Daniel Akaka (D-HI), senior Democrat on the Senate subcommittee that oversees international security, investigates the maturity of technologies critical to the performance of the Ground-Based Midcourse Defense (GMD) element. Of the 10 critical technologies to ensure an effective midcourse defense system, only two have been demonstrated technologically "mature," that is, tested successfully in a realistic operational environment. Without demonstration of the effectiveness of all of the technologies, says the report, "the agency has accepted higher cost and schedule risks by beginning integration of the element's components before these technologies have matured."

GAO was especially concerned that the Cobra Dane radar system will not be tested in an integrated flight test. The Cobra Dane radar system is designed to differentiate between active warheads and decoys or other countermeasures.

Although DOD officials told GAO that they might be able to test the radar in other ways, GAO does not believe that, in the absence of a test where all the components of the system are involved, the more isolated tests will provide the assurance that the radar system would work in a real situation.

The GAO report is the second report this year to come out with reservations about the effectiveness of missile defense as it is envisioned by the Administration. Earlier this year, the American Physical Society released a report of the Study Group on Boost-Phase Intercept Systems for National Missile Defense. The APS report determined that intercepting missiles while their rockets are still burning would not be an effective approach for defending the US against attacks by an important type of enemy missile.

The full GAO report can be found at http://www.fas.org/spp/military/program/track/gao-03-600.pdf under Report Number GAO-03-600.

Candid CAMera

Photo credit: Tom Tierney

The APS Forum on Graduate Student Affairs (FGSA), together with counterparts in Canada and Mexico, organized the latest in a series of joint meetings of the three physical societies, known as CAM meetings. CAM 2003 was the first ever international graduate student meeting, and it took place in Merida, Mexico, October 24-26, organized around the theme "Student Visions for Physics in the 21st Century". Shown here are students chatting informally with Ron Olowin (right) of St. Mary's College, who gave an invited talk on Archeoastronomy in the American Southwest. Attendance at CAM 2003 included 46 participants from the US, 36 from Mexico and 24 from Canada. At the meeting, participants discussed plans for holding the next graduate student meeting, CAM 2005, in the United States.

DNP MEETING *from page 1*

typical thousands of electron volts. This enabled him to use nuclear physics techniques to eliminate sources of background noise, and thus detect trace elements in concentrations of a few parts per thousand trillion.

Cosmic Quarks. The NRC report "Connecting Quarks to the Cosmos" outlined eleven critical scientific questions for the 21st century. Among them was determining new states of matter at exceedingly high density and temperature. This question is related to the central mission of the Relativistic Heavy Ion Collider (RHIC) at Brookhaven, according to W.A. Zajc (Columbia University), who described efforts to recreate in the laboratory states of matter similar to those that existed in the first few microseconds after the Big Bang. He summarized the project's successes to date, with particular attention given to the possibility of connecting this physics to that of the early universe.

Another important question is determining how the heavy elements from iron to uranium were made, part of the broader challenge of understanding the chemical history of the universe, according to Bradley Sherrill (Michigan State University). While a few light elements were created in the first few minutes after the Big Bang, most others were created in the subsequent 14 billion years by nuclear reactions in stellar objects. Sherrill provided an overview of the role of unstable nuclei in the cosmos and the scientific frontiers that can be addressed as scientists come to better understand their properties, and described how scientists measure and model the chemical evolution of the universe.

Kevin Lesko (Lawrence Berkeley National Laboratory) pointed out that of the 11 major scientific challenges outlined in the NRC report, about one half either require deep underground facilities to conduct the research, or said research would be significantly enhanced with such facilities. In fact, a Deep Underground Facility was one of seven recommendations included in the report, and is also a high priority for the Nuclear Physics Long Range Plan. He reviewed the scientific case for a deep underground laboratory, and progress to date in developing one.

ATTA on the Nile. A team of scientists at Argonne National Laboratory is developing an Atom Trap Trace Analysis (ATTA) method for the analysis of two long-lived rare krypton isotopes, making it an ideal method for determining the ages of old ice and groundwater in a range beyond the reach of radio carbon dating. In ATTA, individual atoms of the desired isotope are selectively captured in a laser trap and detected by observing their fluorescence. Zheng-Tian Lu and his colleagues have used the method to date ancient groundwater of the Nubian Aquifier in the Western Desert of Egypt, one of the largest aquifiers in the world. The technique can also be used to analyze krypton 18, a fission product of uranium and plutonium, which can help verify compliance with the Nuclear Non-Proliferation Treaty.

Dual Use Detection. The Detector Group at the Thomas Jefferson National Accelerator Facility focuses on the development and use of nuclear particle detection utilizing gas detectors, scintillation and light guide techniques. While its main function is to provide nuclear particle detector support to the lab, the group has since 1996 applied these and other technologies to the development of novel high resolution gamma ray imaging systems for biomedical applications and x-ray imaging techniques. These include systems for breast cancer detection, brain cancer therapy, and small animal imaging to support biomedical research, according to Jefferson Lab's Andrew Weisenberger.

Nuclear Physics of Supernovae. Because Supernova type II explosions are powerful sources of neutrinos, the detection of neutrinos from a galactic supernova would provide vital information for understanding the explosion, as well as neutrino properties such as their masses and mixing angles. Cristina Volpe of the Institut de Physique Nucléaire in Orsay, France, described how one can determine the initial neutrino spectra, and once the neutrino fluxes are known, can use supernova neutrinos to obtain limits on the less known neutrino mixing angle. Doing so requires a precise knowledge of neutrino-nucleus interaction cross sections, of equal importance for nucleosynthesis studies, and Volpe believes that building a facility for low energy neutrinos would offer the opportunity to perform systematic studies of these interactions.

Viewpoint...

Science High Schools Provide Useful Educational Model

By Howard Greyber

At a time when math and science education nationwide is struggling to keep up with the rest of the world, Stuyvesant High School in New York City turns out well-educated graduates who are accepted easily into most of the top universities in the US.

Prominent graduates include Eric Holder, US deputy attorney general, and Nobel Laureate Roald Hoffman, a professor of chemistry at Cornell University. Two other Nobel laureates—the famous geneticist Joshua Lederberg and the distinguished economist Robert Fogel—also graduated from Stuyvesant. It was not the magnificent new Stuyvesant building (finished in 1993) which promoted these achievements.

When Lederberg, Fogel and Hoffman attended, the school was located in a decrepit, very crowded building on the lower East Side in Manhattan. The library was inadequate, the books tattered, the labs far out of date, and the teachers average. No grassy suburban campus, just dirty concrete sidewalks on a narrow crowded street. Neither were there school buses; students had to use public transportation; most traveled over a dozen miles daily from the outer boroughs.

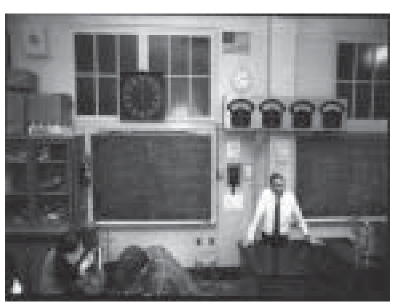
Yet Stuyvesant was regularly tops or very close to the top of high schools in New York State, and in the number of students being awarded the prized New York State Regent's Scholarships for college.

The basic stimulation for achievement came from the creative interaction and friendly competition of a critical mass of bright, intensely curious students, and from the rigid, tough standards, such as the Regent exams, which set challenging goals.

Success in learning mathematics was aided greatly by a longtime custom in New York of forming math teams in all high schools which met and competed against each other. Peer tutoring is a productive technique, well known and used in the 19th century, but unfortunately forgotten or ignored by today's educational dogma. Kids will accept harsh criticism from another kid, which might devastate them if it came from an adult teacher. Such clubs and teams, competing with other high schools in all the academic subjects would help all students achieve.

Research has found that McGuffey's Readers, standard textbooks in the late 19th and early 20th century, use vocabulary three or four grades ahead of those used in textbooks today. Our textbooks have been dramatically dumbed down.

New York City public schools in the 1930s were generally regarded as the best in the nation, but no more. Tracking of students was done back then in every grade, yet today educators oppose tracking. Teachers then were happy to skip brighter kids ahead to a higher grade. Today educators oppose skipping grades. Are not these educators partially responsible for the general drop in student performance? When kids are bored, they tend to misbehave.



The perilous state of elementary, middle and high school public education is obvious to all. Many reports have been issued, such as "A Nation at Risk" in 1983, but while various dubious changes have been adopted, it is fair that impartial markers for academic achievement like SAT and PSAT scores have shown no significant improvement since then. It is a fact that when foreign visitors arrive in America and put their children in our public schools, they discover their children are two or three grades ahead of ours in most subjects.

In science and mathematics one finds that American public high school kids rank last among 16 industrialized nations. [*Ed. note: This refers to results of the Third International Mathematics and Science Study (TIMSS) released in 1998, and can be understood as reflecting the fact that US high-school students take much less science, especially physics, compared to students in other countries. See Michael Neuschatz,The Science Teacher 66, 23-26 (1999).*] Even more shocking is that while Asian children, who excel, do not feel they compare well with other nations, American children think wrongly that they are doing quite well. We badly need capable American workers who know basic mathematics and science for our modern, technology-intensive economy. Expensive private schools for bright kids are springing up costing up to $20,000 per year, per child.

One scintillating facet of American public high school education, shining amid the generally dismal vista, is the outstanding success of high schools of science like Stuyvesant and the Bronx High School of Science. Very few of them exist to serve our huge society of over 285 million people. Where they do exist, like the public North Carolina High School of Science and Technology, they quickly attract interest from the majority of the surrounding high technology companies. High tech companies extend assistance, equipment, visits and offer summer and part-time employment, hoping for fresh, bold ideas from the young people.

My suggestion is to revolutionize American public education, *i.e.*, for our Federal government—in cooperation with the states and local government—to fund and to build 435 high schools of science, like Stuyvesant, over the next seven years, one in each Congressional district and locally controlled. The cost is quite reasonable. Building 63 such public high schools each year, at a cost of $3.8 billion per year, means the total cost to the federal budget is less than $27 billion over seven years — about half the cost of the Apollo Space Project when one corrects for subsequent inflation. The cost could be shared by the Education Department, Commerce Department, National Science Foundation and NASA budgets. It could be called the Second National Defense Education Act.

E.G. Sherburne, Jr. once pointed out, "While many people think that a 'genius' will thrive without any encouragement, studies tell a different story." Each year hundreds of thousands of bright American students of all skin colors are lost to science for lack of the proper challenging education. The high standards of these proposed nearby federal science schools would exert a strong positive influence on all public education, as parents of kids in the feeder elementary and middle schools in the area demand that courses in those schools be improved to give their children a chance to pass the exam to enter the local science high school.

The federal science high schools would provide student tutoring, special facilities and demonstrations to nearby schools. As President John Adams wrote, "The preservation of the means of knowledge among the lowest ranks is of more importance to the public than all the property of the rich men in the country."

A former wartime lieutenant in the U.S. Naval Reserve, Howard Greyber is a PhD astrophysicist, a fellow of the Royal Astronomical Society, and a member of the International Astronomical Union. He lives in Potomac, Maryland.

LETTERS

Don't Make Pancakes with Lumpy Dough

I have a comment with regard to the "Zero-Gravity" article in the October 2003 issue. I'm not certain of the applicability of the measure used by Fonstad, et. al., to human perceptions of flatness.

From the information given in your article, I deduce that a rough estimate of the flatness of a state (requiring zero hours of programming work) is given by 1-(maximum difference in elevation within the state)/(square root of state area). Let's move the selected state one spot to the west and apply that to Colorado.

My Road Atlas lists the highest point in Colorado at 14, 440 ft. The highest point in Kansas, just next to the Colorado line, is a little over 4000 ft., so that's a reasonable estimate of the elevation of the low point in Colorado. This makes the elevation difference just about 2 miles. The state area is 103,730 sq. mile, so the flatness estimate for Colorado is 1-2/sqrt(103730)= 0.995.

By that estimate, interpolating between the verbal descriptions given to the pancake and to Kansas, Colorado turns out to be "pretty damn flat". I'm sure that the Colorado Chamber of Commerce will be surprised to learn this.

Perhaps the pancake is a poor standard by which to judge flatness, or perhaps the dough used by IHOP that day was particularly lumpy. In any case, I suggest that a panel of experts be convened to ponder the question and recommend a response.

Fred Boynton
La Jolla, CA

***

Regarding October's Zero Gravity column, "Scientists Prove Kansas Flatter than a Pancake," my colleagues at Texas State and Arizona State are forgetting one very important factor that is integral to any experiment: multiple trials! They only tested one pancake from one IHOP restaurant. Even my high school physics students know how important multiple trials are. It is entirely possible that another pancake served at another restaurant would exhibit a different degree of "flatness."

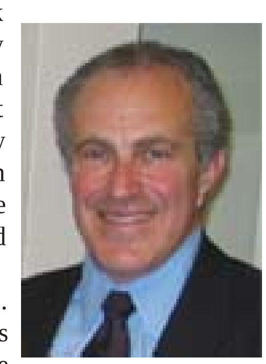
Peggy Grow
Mooresville, IN

INSIDE THE BELTWAY: *A Washington Analysis*

Cold Turkey and a Glass of Bubbly

By Michael S. Lubell, APS Director of Public Affairs

It may not be a hot feast this year, but at least the bird's still on the table. A decade ago, with Congress and the White House focused on deficit reduction, science faced the grim reality of years without Thanksgivings. Back then, about the only upbeat advocate on Capitol Hill was Newt Gingrich, the newly elected Republican Speaker of the House and an unabashed techie.


Michael S. Lubell

Times have changed. Speaker Gingrich is gone, but in his place are more than a dozen members of Congress in each chamber who have science high on their list of priorities.

Count among them "old bulls" like Senators Pete V. Domenici (R-NM), "Fritz" Hollings (D-SC), Barbara A. Mikulski (D-MD) and John Warner (R-VA). Add to the list eight more members of the "Club": Lamar Alexander (R-TN), George Allen (R-VA), Jeff Bingaman (D-NM), "Kit" Bond (R-MO), Majority leader Bill Frist (R-TN), Kay Bailey Hutchison (R-TX), Jay Rockefeller (D-WV), Ron Wyden (D-OR) and presidential contenders John F. Kerry (D-MA) and Joseph I. Lieberman (D-CT).

In the people's House, the leadership may be barren ground for science champions, but not so one level down. Rules Committee Chairman David Dreier (R-CA), Science Committee Chairman Sherwood L. Boehlert (R-NY), VA HUD Chairman James T. Walsh (R-NY) and Ranking Member Allan B. Mollohan (D-WV) and Energy and Water Chairman David Hobson (R-OH) are staunch defenders of the faith. So too are Judy Biggert (R-IL), Nick Lampson (D-TX), Nick Smith (R-MI), Eddie Bernice Johnson (D-TX), Edward J. Markey (D-MA) Michael Capuano (D-MA) and California Democrats Anna Eshoo, Mike Honda, Zoe Lofgren, Ellen O. Tauscher, and Lynn Woolsey. And of course two APS Fellows, Vern Ehlers (R-MI) and Rush Holt (D-NJ).

In truth, these days it's easier to find science protagonists on the Hill than a single antagonist. We should be thankful for that in this holiday season, because the next few years are not going to be easy for budgeteers of any persuasion. Even the White House Office of Management and Budget concedes that the tide of red ink could reach five percent of GDP next year, the tipping point, according to most economists, for public loss of confidence in a government's ability to

See BELTWAY *on page 7*

MEETING BRIEFS

•**The APS New England Section** held its annual meeting October 3-4 at Bates College in Lewiston, Maine. For those who arrived early for the meeting, Thursday evening featured two general lectures, one by William Phillips, 1997 Nobel Laureate in physics, and the other by Lynn Margulis of the University of Massachusetts, Amherst.

• **The APS Ohio Section** held its annual fall meeting October 17-18 at Case Western Reserve University in Cleveland, Ohio, along the general theme, "Physicists Get Down to Business." The meeting was co- sponsored by the American Association of Physics Teachers with the theme of "No Physics Teacher Left Behind." Friday afternoon and Saturday morning sessions featured plenary talks on the physics and business of industry and entrepreneurship by representatives from start-up companies, business schools, and the oil and gas exploration industry. Physics education presentations included the keynote at Friday evening's banquet, by Case Western's James Zull, who spoke of enriching the practice of teaching by exploring the biology of learning, and a talk by James Kakalios (University of Minnesota) on the fantastic physics of comic book superheroes.

• That same weekend, the **APS New York State Section** held its annual fall meeting at Brookhaven National Laboratory around the theme of particle accelerator frontiers and the associated new physics. Friday afternoon featured lectures on new light sources, x-ray sources, and free-electron lasers, followed by a banquet and a public lecture by BNL director Nicholas Samios on the past, present and future of high energy physics and accelerators. On Saturday, the day's sessions included talks on future neutrino physics, the Large Hadron Collider and Spallation Neutron Source, cosmic accelerators and high energy cosmic rays, and high intensity muon physics.

• **The APS Texas Section** held its annual fall meeting October 23-25 at Texas Tech University in Lubbock, Texas, and while it was a general meeting, the program emphasized materials physics. Plenary presentations included talks on applications of condensed matter theory in industry, defects in semiconductors, conduction through molecules, and integrated nanotechnology, as well as a talk by Shell Oil's Jack Hirsch on why physicists are well suited for industry. Friday evening's banquet speaker was Frederick Suppe of Texas Tech, who spoke about philosophy of science. Other invited speakers covered such topics as quantum computing algorithms and electron hole plasmas in gallium arsenide.

• **The APS Four Corners Section** held its annual meeting October 24-25 at Arizona State University in Tempe, Arizona. Invited presentations included such topics as vacuum ultra-violet spectroscopic ellipsometry, multi-photon extreme UV photonics, hyper-polarized gases, protein flexibility and folding, and a continuum theory of movement in interacting cellular systems. Friday evening's plenary speaker was Harvard University's Venkatesh Narayanamurti, who discussed the future of physics in the 21st century.

• **The APS Southeastern Section** held its annual fall meeting November 6-8 at the University of North Carolina in Wilmington, North Carolina. In addition to contributed papers and a Friday evening banquet, there were focused sessions on chiral symmetry in QCD, nanoscience, QCD axial anomaly, and neutron science. Other sessions focused more broadly on biophysics, high energy physics, nuclear and astrophysics, and condensed matter physics.

• Finally, the **APS California Section** held its annual meeting November 14-15, co-hosted by the University of California, Berkeley, and Lawrence Berkeley National Laboratory. Friday's program featured workshops and a tour of LBNL, and Friday evening's banquet was followed by a lecture by Andrei Linde of Stanford University, co-recipient of the 2002 Dirac Medal for Theoretical Physics, on inflation, dark energy and the fate of the universe. On Saturday morning, there was a plenary session with invited lectures on the future of physics education, antimatter, followed in the afternoon by general research and education sessions.

Homeland Security Programs Need Best Scientific Talent, Says DHS Undersecretary

In late September, Charles E. McQueary, Under Secretary for Science and Technology in the Department of Homeland Security, spoke to the DOE Facilities Caucus about the role that he intends the Department of Energy national laboratories to play.

"Our programs require the mobilization of the nation's premier science and technology talents from academia, private industry, and the Federal government," said McQueary. In addition to the Homeland Security Advanced Research Projects Agency, which will fund extramural programs from universities and the private sector, DHS "will also tap into the Federal government's research community where the Department of Energy national laboratories play a prominent role." McQueary complimented lawmakers on ensuring that DHS would have an "equal footing" at the national laboratories with everyone else. "It's not going to just be, 'oh, now we're not doing anything else, we have time to do this.' "

The Directorate plans to engage both the large and small laboratories. "The larger labs can accommodate many needs, but smaller labs have expertise in certain critical areas," he said, "We will need a mix of both types of labs, and will match their capabilities with our requirements as needs arise."

The DHS currently has more than $114 million in funding in place within the national laboratory system to support its work, and McQueary expressed his desire for the laboratories to compete for extramural funding as well. Effective tech transfer is key, he stressed.

One of the persistent questions about DHS is the relative funding emphasis on basic versus applied research. At the DOE Facilities Caucus briefing, McQueary said that in the early stages, the emphasis would be on applied research, with only about 10-15% of research dollars going to "forward-looking" research. "If S&T is going to be long-term relevant," he said, "We must make some scientific 'hits.' "

Once S&T has shown that homeland security research can and will work, the percentage going to higher-risk, longer-term research will increase. "In the end, we need both evolutionary and revolutionary research," McQueary said.

McQueary's briefing to the DOE Facilities Caucus was very timely, as the next day, President Bush signed the FY 2004 DHS appropriations bill with a large increase for the Science and Technology Directorate. Further information about DHS and its programs can be found at www.dhs.gov.

zero gravity
The Lighter Side of Science

The 2003 Ig Nobel Prizes

The 2003 Ig Nobel Prizes, honoring achievements that first make people laugh, and then make them think, were awarded at Harvard University's historic Sanders Theatre in October before 1200 spectators in a ceremony filled with lab coats, opera singers, paper airplanes, ducks, and both the spirit and flesh of Murphy's Law.

The event was produced by the science humor magazine *Annals of Improbable Research*.

The 2003 Ig Nobel Prizes

ENGINEERING PRIZE

The late John Paul Stapp, the late Edward A. Murphy, Jr., and George Nichols, for jointly giving birth in 1949 to Murphy's Law, the basic engineering principle that "If there are two or more ways to do something, and one of those ways can result in a catastrophe, someone will do it" (or, in other words: "If anything can go wrong, it will").

PHYSICS PRIZE

Jack Harvey, John Culvenor, Warren Payne, Steve Cowley, Michael Lawrance, David Stuart, and Robyn Williams of Australia, for their irresistible report "An Analysis of the Forces Required to Drag Sheep over Various Surfaces."

MEDICINE PRIZE

Eleanor Maguire, David Gadian, Ingrid Johnsrude, Catriona Good, John Ashburner, Richard Frackowiak, and Christopher Frith of University College London, for presenting evidence that the brains of London taxi drivers are more highly developed than those of their fellow citizens.

PSYCHOLOGY PRIZE

Gian Vittorio Caprara and Claudio Barbaranelli of the University of Rome, and Philip Zimbardo of Stanford University, for their discerning report "Politicians' Uniquely Simple Personalities."

CHEMISTRY PRIZE

Yukio Hirose of Kanazawa University, for his chemical investigation of a bronze statue, in the city of Kanazawa, that fails to attract pigeons.

LITERATURE PRIZE

John Trinkaus, of the Zicklin School of Business, New York City, for meticulously collecting data and publishing more than 80 detailed academic reports about specific annoyances and anomalies of daily life, such as:

What percentage of young people wear baseball caps with the peak facing to the rear rather than to the front;

What percentage of pedestrians wear sport shoes that are white rather than some other color;

What percentage of swimmers swim laps in the shallow end of a pool rather than the deep end;

What percentage of automobile drivers almost, but not completely, come to a stop at one particular stop-sign;

What percentage of commuters carry attache cases; What percentage of shoppers exceed the number of items permitted in a supermarket's express checkout lane; and

What percentage of students dislike the taste of Brussels sprouts.

ECONOMICS PRIZE

Karl Schwoerzler and the nation of Liechtenstein, for making it possible to rent the entire country for corporate conventions, weddings, bar mitzvahs, and other gatherings.

INTERDISCIPLINARY RESEARCH PRIZE

Stefano Ghirlanda, Liselotte Jansson, and Magnus Enquist of Stockholm University, for their inevitable report "Chickens Prefer Beautiful Humans."

PEACE PRIZE

Lal Bihari, of Uttar Pradesh, India, for a triple accomplishment: First, for leading an active life even though he has been declared legally dead; Second, for waging a lively posthumous campaign against bureaucratic inertia and greedy relatives; and Third, for creating the Association of Dead People.

BIOLOGY PRIZE

C.W. Moeliker, of Natuurmuseum Rotterdam, the Netherlands, for documenting the first scientifically recorded case of homosexual necrophilia in the mallard duck.

APKER RECIPIENTS *from page 1*

missing energy events for evidence of supersymmetric particles or particles lost to extra dimensions, Onyisi observed no deviation from the Standard Model, and as a result placed new limits on contributions from new physics.

Onyisi published these results in *Physical Review Letters* in 2002. He also authored a number of internal CDF notes on his research and presented his work at the April APS meetings in 2001 and 2003.

Onyisi received his BA in physics and applied mathematics in June 2003, and is now a graduate student in physics at Cornell University with an NSF Graduate Research Fellowship.

Stern investigated the magnetic exchange interaction between nanoscale antiferromagnetic films and ferromagnetic films.

Though these structures are the basis for magnetic sensor and magnetic storage devices, the exchange interaction is not fully understood.

Stern demonstrated that magnetic exchange biasing occurs with antiferromagnetic film thicknesses that are substantially less than was previously thought possible, showing that existing theories are inadequate to explain the interaction.

Stern published his research in the *Journal of Applied Physics*, and presented at several conferences. He received his BS in May 2003, and is now pursuing graduate studies in physics at the University of California, Santa Barbara with the support of a Hertz Fellowship and an NSF Graduate Fellowship.

APS Members Capture Array of Honors

By Ernie Tretkoff

Several APS members have recently received recognition for their work, including the Enrico Fermi Award, China's International Scientific Collaborations Award, the MacArthur Fellowships, and selection by MIT's Technology Review as "Bold Young Innovators."

Fermi Awards

The Enrico Fermi Award was presented on October 22 to John Bahcall, Raymond Davis, and Seymour Sack. The award, administered by the Department of Energy, recognizes scientists for their lifetime achievements in the development, use, or production of energy (broadly defined). The Fermi award has been given annually since 1956. Past recipients include John von Neumann, Ernest O. Lawrence, Hans Bethe, and Edward Teller.

John Bahcall accepts the Fermi Award.

Bahcall and Davis, both APS Fellows, received the award for their work on neutrino physics. They received a medal and shared with Sack a $187,500 honorarium. The citation reads: "For their innovative research in astrophysics leading to a revolution in understanding the properties of the elusive neutrino, the lightest known particle with mass."

Bahcall was recently elected APS vice president, and will begin his term in January 2004.

Davis, a research professor at the University of Pennsylvania, was the first to directly detect solar neutrinos, and his work has helped determine that electron neutrinos from the sun and can oscillate into other flavors on their way to Earth. He was awarded the Nobel Prize in Physics in 2002.

Seymour Sack was recognized for his contributions to national security in assuring the reliability of nuclear weapons.

China's International Scientific Collaboration Award

Joe Hamilton of Vanderbilt University received the International Scientific and Technological Collaborations Award of the People's Republic of China—the highest award the Chinese government bestows on foreign scientists. He was honored in Beijing on September 22 in a ceremony presided over by China's Minister of Science and Technology.

Hamilton's award recognizes his efforts bridge the gap between Chinese and American scientists. Since the 1970's, Hamilton has collaborated with Chinese scientists and encouraged them to publish their work in international journals. His research has included studies of nuclear structure in high spin states, nuclei far from stability, and explorations of the fission process.

MacArthur Fellows

Two APS Fellows, Deborah Jin and James Collins, have been awarded 2003 McArthur Fellowships. The MacArthur Fellows program provides unrestricted funds to outstanding individuals who demonstrate exceptional talent, creativity, and promise in any field.

Deborah Jin, 34, is a NIST physicist, a fellow of JILA, and a faculty member in the physics department at the University of Colorado, Boulder. Her research group was the first to create a degenerate fermi gas, uses laser cooling and magnetic trapping techniques to explore the properties of super-cooled fermions. In 2002 the APS awarded Jin the Maria Goeppert-Mayer Award, which is given to an outstanding young woman physicist.

James Collins, 38, is a biomedical engineer at Boston University. His theoretical and experimental research has explored the mechanisms regulating biological systems, especially how noise affects biological signals.

Technology Review "Bold Young Innovators"

Seven APS members are among the "100 Bold Young Innovators," in the October 2003 issue of MIT's *Technology Review*. This is the third year the magazine has named 100 scientists and engineers under 35 whose work is at the cutting edge of computing, biotech, the Internet, nanotech, or other fields. Among this year's winners are the following APS members:

Daniel Gottesman, 33, a research scientist at the Perimeter Institute.

Xiangfeng Duan, 26, a scientist at the Palo Alto-based start-up company Nanosys.

Jordan Katine, 34, a researcher at Hitachi Global Storage Technologies in San Jose, CA.

David Muller, 35, an engineering physics professor at Cornell University.

Yasunobu Nakamura, 35, a researcher at NEC Fundamental Research Laboratories in Tsukuba, Japan.

Ainissa Ramirez, 34, a mechanical engineering professor at Yale University.

Peidong Yang, 32, a chemistry professor at the University of California, Berkeley.

APS-led Teacher Preparation Program Adds Another Participating School

By Ernie Tretkoff

The Physics Teacher Education Coalition (PhysTEC), which aims to improve the science preparation of future K-12 teachers, continues to grow. California Polytechnic State University, San Luis Obispo, recently became the seventh participating university in the project.

The APS, in cooperation with the AAPT and the AIP, established PhysTEC in response to national reports calling for improved science teacher preparation. The program is funded by grants from the National Science Foundation and the US Department of Education.

The PhysTEC program encourages collaboration between physics and education departments at participating Primary Program Institutions to create a curriculum that emphasizes student-centered, inquiry-based, hands-on learning. As part of the program, physics departments work to restructure their introductory courses to emphasize active learning. A key component of the PhysTEC program is a full-time Teacher-in-Residence, a local high school physics teacher who aids the departments in course revisions and helps coordinates mentors for novice science teachers.

"What we want to do is produce teachers that are better prepared to teach," said physics professor Chance Hoellwarth, who leads Cal Poly's PhysTEC project.

Hoellwarth also emphasized the importance of the Teacher-in-Residence. "It gives us the other side of the coin. It facilitates building up connections with teachers, and gives us real-world experience." The Teacher-in-Residence will also help develop a mentoring program for student teachers.

Though the university and local K-12 schools are affected by the recent California budget cuts, Hoellwarth said he expects the PhysTEC project will continue as planned.

As a whole the university is not offering as many classes, so students may take longer to graduate. Also, cuts at the elementary and secondary school level may mean fewer master teachers will be available to mentor new student teachers.

"It's not entirely clear what will happen," said Hoellwarth, "There are a lot of factors going on."

Currently eight future science teachers are participating in the physics program at Cal Poly. Hoellwarth points out that the program's small size makes it less vulnerable to cuts. "We don't have a huge number of student teachers, so you can kind of absorb any effect." Cal Poly can design the program it wants now, then expand when it becomes possible, said Hoellwarth.

Cal Poly's participation in PhysTEC is supported by an APS fund-raising campaign. With this campaign PhysTEC plans to continue to expand, adding one or two new institutions a year for several more years. The six other Primary Program Institutions already participating in PhysTEC are the University of Arizona, Ball State University, Oregon State University, University of Arkansas, Western Michigan University, and Xavier University of Louisiana.

CALIFORNIA *from page 1*

things, the CSU Chico physics department's operating budget being slashed by 20%. "It's part of a trend that's been going on for a number of years: an ever decreasing percentage of the state's general fund has been devoted to higher education," says Gaffney, adding that the current troubles "are really exacerbating the problem."

The situation is only going to get worse, with a projected $8 billion state budget shortfall for next year, that may rise to $14 billion with governor-elect Schwartzenegger's promised recision of the car tax. The various institutions in the UC and CSU systems are responding to the expected shortfalls in numerous ways. At Berkeley, the physics department's budget was slashed 5% this year, according to department chair Christopher McKee. To absorb the cut, several staff positions have not been filled, straining an already overworked staff, and several courses have been eliminated, primarily duplicate sections of required courses. There are also a handful of non-required upper division courses being taught less frequently, "because we just don't have enough faculty and lecturers to cover them," says McKee.

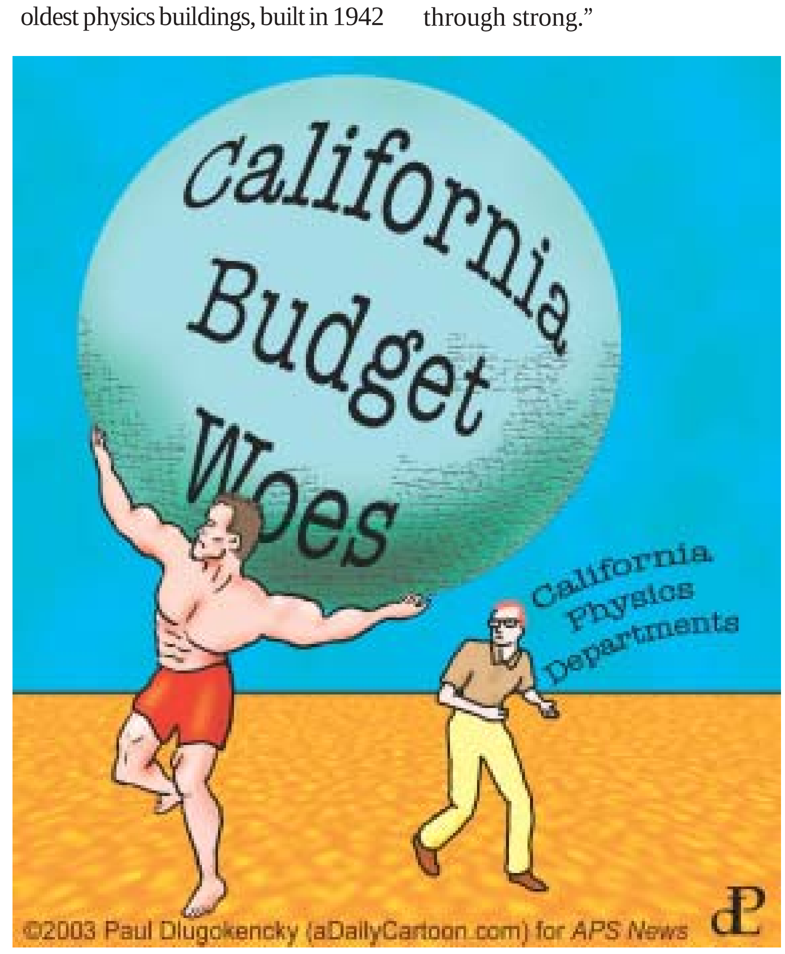
An outside review panel recently concluded that Berkeley's physics department was in a state of "genteel decline," losing six of about 50 tenured professors over the last four years to top-notch private universities like Harvard, Cornell and Caltech. The department also suffers from aging facilities. The newest of its physics buildings is 40 years old, and while the university has been investing heavily in life sciences facilities and programs, physics spending has lagged. More potential physics graduate students are declining enrollment after being accepted into the graduate program. Meanwhile, part of the Berkeley tuition increase will go to a scholarship fund to benefit economically disadvantaged undergrad students.

McKee concedes that there have been problems in the department, but cites several positive actions as a result of the panel report. The Berkeley administration allocated $12 million to renovate one of the oldest physics buildings, built in 1942 and slated for a seismic retrofit next year. And the department has successfully hired several junior faculty members to fill positions vacated by retirements and faculty wooed away to other institutions. "The most important mark of how well the department is doing is our ability to attract the best and brightest of the young up-and-coming physicists," says McKee. "By that score, we're still doing extraordinarily well."

Other campuses haven't fared so well. On August 1, UC Riverside eliminated 18 of its 135 state-funded technical research slots, although many of the ousted staff members have been shifted to soft money for the time being. Barry Klein, vice chancellor for research at the University of California, Davis, told *Science* magazine that his institution expects to lose 72 faculty slots and 28 staff positions over the next three years. CSU Chico has eliminated its only physics course for nontechnical majors, eliminated elective courses ["That which is not required is forbidden, " Gaffney ironically notes], and increased class sizes of the surviving courses.

These developments are particularly worrisome to Gaffney, since the CSU system's primary mission is undergraduate education and training future high school teachers. "It's a 19th century industrial model: punch out the students at a cheaper rate per unit cost," says Gaffney. "In my view, it degrades the whole educational process."

The UC system also has a newly appointed president, physicist Robert Dynes, formerly chancellor at UC San Diego. Dynes has said that his foremost concern is maintaining the university's quality— even if that means restricting enrollment instead of admitting all eligible students. "We cannot continue to grow in student body and shrink in budget. It's unstable," Dynes told the Contra Costa Times in August when his appointment was announced. Above all, Dynes is trying to maintain an historical perspective. "There have always been problems," he told the Los Angeles Times in June. "The University of California has faced different challenges at different times, and it has always come through strong."



ANNOUNCEMENTS

APS Membership Department News

New Member Benefit for 2004 –

APS will offer a new journal benefit to members in 2004. APS Member Article Packs will be available for $50, allowing members 20 APS journal article downloads (*excluding PROLA and RMP*). This is a considerable savings on single APS article downloads. *Look for more information in your 2004 Renewal Packet*.

In addition, APS members can already purchase AIP Journal Packs at a 50% discount on https://store.aip.org/articlepacks/.

2004 APS Member Directory –

Members will be contacted at the end of the year and asked to request either a paper or cd-rom copy of the 2004 Directory. Members will have to notify APS of their choice by February 23, 2004, to receive one of the available versions. Online directory access is always available at http://www.aps.org/memb/enter-directory.html.

APS Bulletins –

Starting in 2004, the APS Membership Department will no longer be processing orders for APS Bulletins. The paper version will be distributed onsite at meetings to attendees. Open access to all APS Bulletins (current and archived) will be available online at http://www.aps.org/meet/.

301-209-3280 ´ membership@aps.org

APS Council and Committee Position Nominations

VICE-PRESIDENT; GENERAL COUNCILLOR (2); NOMINATING COMMITTEE; Vice-Chairperson-Elect • Members; PANEL ON PUBLIC AFFAIRS; Vice-Chairperson-Elect • Members

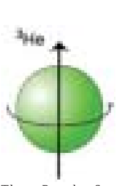
Please send your nominations to: American Physical Society; One Physics Ellipse; College Park, MD 20740-3844; Attn: Ken Cole; (301) 209-3288; fax: (301) 209-0865; email: cole@aps.org. A nomination form is available at **http://www.aps.org/exec/nomform.html**.

DEADLINE: JANUARY 31, 2004

Physical Review Focus http://focus.aps.org

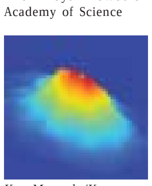
Down-to-earth accounts of hot research from the *Physical Review* journals—ideal for college physics majors and researchers interested in work outside their specialty. Write to **join-focus@lists.apsmsgs.org** to get weekly e-mail updates.

Some recent *Focus* stories:



The Royal Swedish Academy of Science

Nobel Focus: Helium Impersonates a Superconductor
Anthony Leggett's complete theory for atomic pairing in a superfluid won him one-third of the 2003 Nobel Prize in Physics.



K. Matsuda/Kanagawa Acad. of Science and Tech

Travels of An Exciton
Researchers have generated the first direct images of the motion of a single exciton, a particle that is essential to modern electronics.

W. Jäger/Univ. of Alberta

The Slightest Splash of Superfluid?
Just seven helium atoms are enough to produce resistance-free flow, the hallmark of superfluidity.

Prize & Award Nominations

Otto Laporte Award
DEADLINE: 02/10/04
Established as an APS award in 1985, but existed as a division lectureship prize for twelve previous years. The award is to recognize outstanding contributions to fluid dynamics and to honor Otto Laporte.

Purpose: To recognize outstanding research accomplishments pertaining to the physics of fluids.

Fluid Dynamics Prize
DEADLINE: 02/10/04
Established in 1979 with support from the Office of Naval Research.

Purpose: To recognize and encourage outstanding achievement in fluid dynamics research.

Marshall N. Rosenbluth Outstanding Doctoral Thesis Award
DEADLINE: 04/01/04
Established in 1985 (originally as the Simon Ramo Award) and endowed in 1997 by General Atomics Inc.

Purpose: To provide recognition to exceptional young scientists who have preformed original thesis work of outstanding scientific quality and achievement in the area of plasma physics.

ERRATUM:

The wrong web address was given in the story "Revolutionary Breakthroughts Needed for Hydrogen Economy" in the November issue of *APS News*. We are sorry for any confusion this may have caused.

The correct web address is: www.sc.doe.gov/bes/hydrogen.pdf.

APS Mass Media Fellowship Program

Applications are now being accepted for the 2004 summer APS Mass Media Fellowships. In affiliation with the popular AAAS program, the APS is sponsoring two ten-week fellowships for physics students to work full-time over the summer as reporters, researchers, and production assistants in mass media organizations nationwide. Information on application requirements can be found at **http://www.aps.org/public_affairs/massmedia/index.html.**

Serious consideration of candidates will begin December 15, 2003.

APS SEEKS HEAD OF MEDIA RELATIONS

The APS anticipates an opening for a media relations professional to promote physics in the popular media. Based at APS Headquarters in College Park, MD, this position will develop and coordinate all media relations for APS.

Responsibilities include working as part of a team that identifies physics news stories, locates press contacts in the physics community, and pitches the stories to the national media.

Opportunities to travel exist.

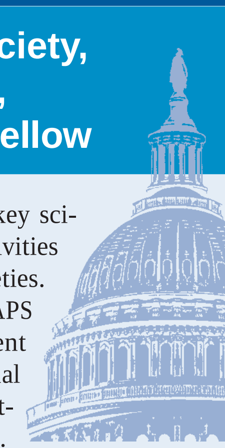
The qualified applicant will have at least a bachelor's degree in science, and preferably additional scientific work experience (physics a plus).

Considerable experience interacting with the media is necessary. Excellent oral and written communication skills are required. Competitive starting salary and outstanding benefits package offered. Visit our website at: www.aps.org.

To apply, send cover letter including salary requirement, resume, and contact information for three professional references via e-mail, fax or conventional mail to:

American Physical Society
One Physics Ellipse
College Park, MD 20748-3844
Attn: Joe Ignacio, Director of Human Resources
E-mail to: personnel@aps.org
Fax to: (301)699-8144

American Physical Society, Washington Office, Senior Science Policy Fellow



Responsibilities: Craft and advocate for key science policy issues. Develop grass roots activities for one of the nation's largest scientific societies. Organize congressional visits programs, "APS Alerts," and letter-writing campaigns. Represent APS Washington Office at selected APS national and divisional meetings, APS committee meetings and science advocacy coalition meetings.

Requirements: Excellent verbal, writing and interpersonal skills. Hill experience desirable. Science PhD strongly preferred.

Salary: Commensurate with experience.

For more information, please contact the American Physical Society, 529 14th Street, N.W., Suite 1050, Washington, DC 20045, Attn: Michael Lubell, opa@aps.org (202) 662-8700 [voice], (202) 662-8711 [fax].

Now Appearing in RMP: Recently Posted Reviews and Colloquia

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

Colloquium: Theories of Scanning Probe Microscopes at the Atomic Scale
—Werner A. Hofer, Adam S. Foster, and Alexander L. Shluger

Scanning probe microscopes have revolutionized the study of the structure, physics, and chemistry of surfaces. The complexity, detail, and accuracy of the images produced by atomic scale probes are remarkable, but the quantitative meaning of the patterns is not always clear. This review explains the use of theoretical simulation tools in conjunction with the applications, especially the balance of what can be learnt by the use of simple models and full electronic simulations.

Also Recently Posted:

Hamiltonian Theories of the Fractional Quantum Hall Effect
—Ganpathy Murthy, and R. Shankar

Present Status of Inclusive Rare B Decays
—Tobias Hurth

BELTWAY *from page 4*

make good on its IOU's.

In this nasty fiscal climate, it's hard to see how any part of the discretionary budget—of which, these days, science has become a significant element—will escape unscathed. But so far, science is not on the chopping block. And with Congress chock full of believers, it may well stay that way, provided the community keeps hammering home the same message that built up the ranks of Hill champions during the last ten years.

From my perch, ten stories up in the National Press Building, three blocks from the White House and a mile or so from the Capitol, these are the themes that will resonate in a time of fiscal crunch, as we enter the run-up to the 2004 election. The sciences—especially the physical sciences— along with engineering are the job engines of the 21st century economy. The sciences—especially the physical sciences—are the generators of American wealth. The sciences—especially the physical sciences—are key to securing our safety at home and serving our military needs abroad. The sciences—especially the physical sciences—will pave the road to energy independence.

But is it responsible for lawmakers to bump the science budget up by a billion dollars or so when the nation faces a deficit of $500 billion? Fair question to ask. But not a tough one to answer.

First, consider how much worse a deficit of $501 billion is than one of $500 billion. The financial markets won't even notice. The difference is in the noise.

Second, without substantial economic growth, largely driven by innovation, the deficit will become structural. Tax increases are not an option—except for political masochists. Social Security and Medicare are the third rail of politics—they won't be touched. And the discretionary budget, including defense, would have to be cut by 90%—that won't happen either.

Investing in science is clearly the best bet for growing the economy and fighting our way back to fiscal sanity. So pull the cork on a bottle of bubbly and toast the champions of science. They deserve it.

The Back Page

Energy Department Releases 20-year Plan for New Facilities

By Spencer Abraham

Ed. Note: *On November 10 the Department of Energy released its 20-year plan for new facilities. Twenty-eight facilities were listed in order of funding priority. The list appears in this issue on page 2. Below we reprint the speech that Energy Secretary Spencer Abraham delivered at the National Press Club in Washington. Due to space constraints, the text has been somewhat abridged. (Elisions are indicated by asterisks.) The full text, and other information about the 20-year plan, can be found on the DOE web site at http://www.science.doe.gov/*

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I am pleased to announce the Department of Energy's 20-year plan for building the scientific research facilities of the future. It is our plan to keep the United States at the scientific frontier.

Nothing of this scope has ever been attempted by our Department, or indeed by any other science agency in government. We are not only planning two decades out, but we are prioritizing our facility needs across all fields of science supported by the Department of Energy.

In the 21st Century, the health and vitality of US science and technology will depend upon the availability of the most advanced research facilities, not only because science today is so complex, but because science now requires that chemists, physicists, biologists—that all fields of science—work together. The facilities we propose today will bring the sciences under one roof and give researchers the tools they need to work their wonders.

Let me discuss the way we made our decisions and give you some flavor of the enormous benefits we see flowing from these new projects. The process we followed was transparent and interdisciplinary. The Associate Directors of our six science divisions—Basic Energy Sciences, Fusion Energy Sciences, High Energy Physics, Nuclear Physics, Advanced Scientific Computing, and Biological and Environmental Sciences—were asked to list in rank order the major facilities necessary to maintain world scientific leadership in their programs over the next 20 years.

Some 46 facilities were identified in this process. This list was then submitted to the respective programs' Advisory Committees, which are composed of top scientists from universities, industry, and our laboratories. We asked these committees to analyze the scientific importance of each proposed facility and to add or subtract as they saw fit. The appetite for new facilities grew, and a total of 53 new projects were recommended.

Then came the hard part.

The Director of our Office of Science, Raymond Orbach, reviewed these proposals, ordered them across disciplines, and recommended 28 be considered for funding over a 20-year planning horizon. This may appear unilateral, but the selection was informed by the best minds in all the affected fields. And, frankly, the alternative of decision by committee was not acceptable, because committees—despite their best efforts—are notorious for delivering compromise documents that too often settle on the lowest common denominator.

Spencer Abraham

This effort has been endorsed by the directors of our science laboratories, who understand the importance of modern facilities for future scientific discovery.

In addition, the Task Force on the Future of Science at the Department of Energy, which was established at my direction and is chaired by Dr. Charles Vest, President of MIT, has praised this effort in its recent report. It is gratifying that this effort has received support from those who understand the enterprise of science best.

This list of facilities is driven by science and the Department of Energy mission, nothing else. Our criteria were straightforward: which facilities are most important for Department of Energy science over the next two decades, taking into account whether the prospects for construction were in the near, mid, or far-term?

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We believe this list of 28 facilities outlines to an important extent the future of science in America and indeed the world. These facilities cover the critical areas where discoveries can transform our energy future, boost economic productivity, transform our understanding of biology, and provide revolutionary new tools to deal with disease. They can make major and necessary contributions to national security and give us the ability to understand matter at its most fundamental level.

They can also do something else. They can surprise us.

The unexpected benefits of work at these research facilities will lead us in directions we cannot even imagine. And we are looking down the road far enough to the time when facilities that are now under construction, such as the Spallation Neutron Source, will need enhancements. That is the purpose of this list: to look into the future and to be prepared. And as with all our existing facilities, any new projects we undertake will benefit a wide spectrum of scientists and will profit from close cooperation with other agencies.

So, let me now profile some of our top priorities and a set of facilities that not only represent tremendous opportunities, but demonstrate the breadth of the science encompassed by the Department.

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First on our list is fusion. The prospect of a limitless source of clean energy for the world leads with our commitment to join the international fusion energy experiment known as ITER. This is a Presidential priority with enormous potential. Successful negotiations among the international partners will lead to the first-ever fusion science experiment capable of producing a self-sustaining fusion reaction. If we reach agreement, ITER will be our top facility.

Next on the list is our desire to regain global leadership in areas of supercomputing that many believe we have lost. Japan's new Earth Simulator machine is a remarkable achievement. It has the computing power of the 20 fastest US computers combined. The Japanese are to be congratulated for launching a new era in scientific computing, but the US must be part of this era.

We can create new computer architectures that can boost computing power by 100 times over current machines. Such an achievement will give scientists the ability to simulate complex reactions as never before and give industry the ability to virtually prototype everything from new aircraft engines to super-efficient auto bodies, thus saving hundreds of millions of dollars. Scientific computation deserves the kind of serious attention we believe our facilities list gives it.

We will also look at advancing our lead in light sources. The Linac Coherent Light Source would provide x-ray brightness that is 10 billion times greater than current light sources. That would allow researchers, for the first time, to create real-time images of chemical reactions at the atomic scale, leading us to far greater understanding of how our bodies work, indeed, how virtually all materials are put together.

The Department of Energy launched the human genome project nearly 20 years ago in our effort to understand how radiation affects cells at the most fundamental level. The Protein Production and Tags Facility can help us build on these discoveries and make a huge contribution to our Genomes to Life Program. We are now taking the insights from that project to create microbes that do everything from making hydrogen, to sequestering carbon dioxide, to accelerating environmental clean-up. The Protein Production and Tags Facility will join the Molecular Machines Facility to help create a facility to mass-produce tens of thousands of proteins a year, code them by their DNA, and make them available to researchers around the country. Using current methods, it is virtually impossible for us to understand the thousands of proteins that make up the microbes we want to put to work for our energy mission. But these facilities, together, will speed this process dramatically, and give energy and medical science powerful new tools.

The Rare Isotope Accelerator can help us understand how everything from the cosmos to heavy elements was formed. It would allow our scientists to learn how the chemical elements that make up the world around us were developed, help us develop new nuclear medicine techniques, and improve our ability to model the explosions of nuclear weapons. This project would be a major addition to the Department's nuclear physics program and make a major contribution to stockpile stewardship.

The Joint Dark Energy Mission, a space-based probe to be developed with NASA, will help us understand one of the greatest mysteries in science today—why the universe is expanding at an accelerating rate. By placing a new wide-angle telescope in space, researchers will be able to see farther back in the evolution of the universe to help unravel this strange thing called dark energy—a force that is apparently working against gravity to speed up the expansion of the universe.

As we look out into this expanding universe, we are also thinking of how best to understand the materials that make up our day-to-day world. A new generation of electron microscope can help us study how atoms combine to form materials, and how materials respond to external factors such as electric fields. This new instrument, the Transmission Electron Achromatic Microscope or TEAM, will help us design lighter, more efficient materials for everything from automobiles to advanced fuel cells.

In addition to launching new projects such as these, we are also planning important upgrades to existing facilities. Improvements to our energy sciences computer network, what we call ESnet, which links researchers around the country to our laboratories and research facilities, will allow us to accommodate the huge demand for this network. ESnet puts the power and capability for our investment in light sources and accelerators literally at the researcher's desktop.

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And upgrades to facilities, such as the Continuous Electron Beam Accelerator, would essentially create new facilities by applying advanced technology to our current stock of powerful research machines. The upgrade to this accelerator, located at Thomas Jefferson Lab, will double its power and apply advanced computing power to help us explain the properties of one of the strangest particles yet discovered—the Quark.

From the very large, with new pictures of how our universe evolved, to the very small, with insights into the structure of the nucleus, the facilities we are proposing will secure American preeminence in science for the better part of the 21st Century.

What I have discussed is just a snapshot of the detailed roadmap we have drawn for our major science projects over the next two decades. *** I can't tell precisely how or when the projects and research I've discussed today might uncover deep mysteries of science or deliver immediate practical benefits. But that's the beauty of science. It can have so many unexpected outcomes.

But even if we knew our search for Dark Energy or our particle physics research would have no direct impact on our everyday lives, we still would want to go forward, because we want to know why the universe and our planet act the way they do. We do basic research to understand. And many times that's justification enough. But we also want to go forward because that is what a great nation does. It explores. It attempts to know and to understand.

Some people have told me it would be hard to explain why the Department of Energy's basic scientific research is so important. I haven't found that to be the case. Everyone understands that investments in science produce benefits for our lives.

And I think everyone is curious. Discoveries like Dark Energy lead to deeper mysteries that, themselves, compel us to continue our search—even when we know the search is not in any normal sense practical.

To be sure, no one knows what field of science, or what potential new science machine, will produce the next big discovery. But we can be certain of one thing. There will be a big discovery. A solitary genius, or a group of scientists from a half dozen fields working together, will take some step, apply some test, seek some insight, that will inevitably lead beyond their expectations to a result as unexpected as it is wonderful.

All we are doing is giving them the tools, and the freedom, to work these mysteries out. And we don't insist on results on some time scale, and basic research doesn't work that way. We expect only that science will employ the traditions of inquiry and curiosity that extend in a straight line from today's Nobel Prize winner directly back to Aristotle.

I believe the blueprint we have presented will allow that tradition to grow and prosper. And it will provide the foundation for the next generation of scientists to work their wonders.

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