APS NEWS

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Executive Board Expresses Concern Over Funding Imbalance In Bush Administration's FY2003 Budget Request

When President Bush unveiled his FY 2003 budget request for R&D in February, no one was surprised at the emphasis on antiterrorist, and on homeland and economic security in the wake of the September 11th attacks. However, many both within and outside of the scientific community have expressed concern at the imbalance of research funding priorities in favor of the biological sciences.

For example, the National Institutes of Health would receive a $3.9 billion increase, larger than the entire research budget of the National Science Foundation, in keeping with the president's campaign budget to double the NIH budget by 2003.

Noting that while funding for biological and medical research continues to increase, funding for physical science remains essentially flat, the APS Executive Board approved a resolution regarding the FY2003 budget request at its meeting on February 23, 2002. The full text of the Executive Board statement is contained in the box at the right.

The Executive Board of the American Physical Society applauds the proposed increased for the NIH and for life sciences generally in the FY2003 Budget Request submitted by President Bush on February 4, 2002. However, the Board expresses great concern about the requested budgetary levels for research in the physical sciences.

The Board notes that in current dollars, support for physical science activities at the NSF would actually decline, and in constant dollars, support for such activities at the DOE Office of Science would remain almost fixed. If implemented, these proposals would further exacerbate the imbalance in the federal research portfolio, raising spending on the life sciences to about 55 cents for every research dollar. As former NIH Director Harold Varmus has noted many times, this continuing imbalance will jeopardize the ability of NIH to accomplish its mission. It will also jeopardize our nation's economic growth and our military defense.

Therefore the Board urges Congress to address the presidential budget deficiencies in their considerations of FY 2003 appropriations bills. The Board further urges congressional oversight committees to hold hearings on the support level for the physical sciences and on the balance of the research portfolio.

Outlook on FY 2003 Budget Bills

By October 2002, thirteen FY 2003 appropriations bills should have been enacted. This deadline is rarely met, and a number of factors make it less probable that Congress will complete it work on time this year. There are several major forces affecting this year's budget cycle. An obvious uncertainty is the pace and scope of future military operations. The state of the economy is also a key factor since it affects the amount of federal tax revenue. Finally, this is an election year, with the seats for all representatives and one-third of all senators at stake. Every action that Congress and the Administration takes will be scrutinized for its impact on the control of the Senate and House. While there will be much talk about reducing the FY 2003 projected budget deficit, it seems almost certain that Congress will pass, and the President will sign, appropriations bills pushing the government back into deficit spending. The budget caps that provided some restraint in previous years have expired.

See ***OUTLOOK*** **on page 3**

Task Force to Weigh Pros and Cons of Topical Groups

Assessing potential impact and weighing the pros and cons of welcoming new topical groups to the Society's infrastructure will be the focus of a newly appointed APS Task Force on Topical Groups. The task force will hold its first meeting in mid-May, and is expected to present its findings at the November 2002 Council meeting.

At its November 2001 meeting, the APS Council passed a "sense of the Council" resolution asking the APS president to appoint a task force to review the status of existing topical groups, and consider the criteria for the approval of new ones. The APS currently has nine topical groups, varying widely in size and activity level, and the number continues to rise. Some work closely with related divisions, while others have considerably less interaction with other parts of the Society.

The official charge to the task force points out that "as new topical groups form, there has been growing concern that they may cause fragmentation in the physics community by isolating physicists in certain areas from the larger community, and by depleting the membership and thus the strength of APS divisions." In addition, adding more units can complicate already squeezed program planning at general meetings, thus lowering the quality of the talks, and require more administrative staff time. "On the other hand, new topical groups can bring new energy and new members to the APS. It allows the

See ***TOPICAL GROUPS*** **on page 6**

APS Establishes Task Force on Countering Terrorism

In the wake of the terrorist attacks of September 11, 2001, and believing that science, and especially physics, has much to offer in countering further attacks, the APS has established a task force on countering terrorism, at the request of the APS Executive Board. The fledgling group will hold its first meeting on May 3rd at APS Headquarters in College Park, Maryland.

"The events of recent months have shaken our nation," APS President William Brinkman says of the rationale behind forming the task force. "The attacks on the World Trade Center and Pentagon, and the anthrax assaults in various locales, demonstrate the need for sustaining the strong partnership between science and government to ensure our national security."

Chaired by Bob Guenther of Duke University, the new task force has been given a very general charge, which reads in part: "The task force

See ***APS TASK FORCE*** **on page 4**

Preposterous Public Lecture Highlights Albuquerque Meeting

MSS—credit to www.marblestreetstudio.com

The latest scientific insights into the strange and wonderful mysteries that abound in our universe will be featured at the upcoming APS April meeting, April 20-24, in Albuquerque, New Mexico.

In addition to an array of invited and contributed technical sessions, there will be a special public lecture and three plenary sessions featuring talks on a broad range of astrophysics, nuclear and particle physics, as well as biological physics. For the first time the meeting also has joint sponsorship of the High Energy Astrophysics Division (HEAD) of the American Astronomical Society. The program will also offer historical sessions, tips on finding jobs in academia, and an insider's look at science policy.

Our Preposterous Universe

On Monday evening, the APS will sponsor a public lecture in connection with the April Meeting, featuring Sean Carroll of the University of Chicago. Carroll will summarize many of the most breathtaking discoveries of the nature of the cosmos uncovered in the 20th century: that the universe is over 10 billion years old, that it is still expanding, and that ordinary objects comprise less than 5% of the stuff of the universe. He will close by outlining the challenges researchers face in the 21st century as we struggle to develop a true understanding of the implications of these discoveries. A reception will follow, sponsored by the University of New Mexico.

[7:30 PM - 9:00 PM, *Kiva Auditorium*.]

Nutty Neutrinos and Other Physics Enigmas

In one of several planned plenary lectures, Helen Quinn of SLAC will describe the changing landscape of

See ***APRIL MEETING*** **on page 3**

Los Angeles Area Fellows Gather

Darlene Logan/APS

In late January, APS held a reception for Fellows of the Society in southern California. In addition to conversation and refreshments, the group heard from APS President William F. Brinkman, Executive Officer Judy Franz, and Education Director Fred Stein. Shown here (l to r) are Fellows Doug Mills (UC Irvine), Bruce Koel (USC) and Emily Carter (UCLA).

Highlights

Members in the Media

"If one were hunting for gold, this would be the map of where not to dig."
—Maria Spiropulu, on results of a search for supersymmetric particles at Fermilab, New York Times, February 5, 2002.

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"We literally spray the liquid lithium on the walls and then it flows through a bottom drain."
—Robert Kaita, Princeton University, on building a fusion reactor with liquid metal walls, ABCnews.com, February 5, 2002.

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"The change in friction you get is equivalent to going from being on ice to dry pavement."
—Victor Petrenko, Dartmouth College, on electronic brakes built into skis and snowboards, New Scientist, February 6, 2002.

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"Water is one of the strangest substances on earth. It has a myriad of properties that make it unique for life and unique for how a ski slides on snow. It's often impossible to predict."
—David Lind, University of Colorado, on the physics of skiing, ABCnews.com, February 8, 2002.

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"The mission proposal is completely new. The idea extends an existing mission concept — the Laser Interferometer Space Antenna or LISA — to much higher sensitivity and into a different frequency range."
—Neil Cornish, Montana State University, on plans to measure gravitational shock waves from the big bang, UPI, February 12, 2002.

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"You should aim to flip the pancake into the air at a speed of 10 miles an hour, which will mean it will take less than .5 of a second to reach the top of its trajectory. If you are lucky, the pancake should now have rotated 90 degrees, at a rate of .55 revs per second. If not, you could be in trouble and have a sticky mass of flying batter spinning through the air."
—Garry Tungate, Birmingham University, Belfast News Letter, February 12, 2002.

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"At the end, you realize most of what you've got in your hand is 75 percent air. This tiny sheet of paper, which has not much strength at all, is able to resist your squeezing very, very well. Why is it as strong as it is?"
—Sidney R. Nagel, University of Chicago, on the physics of crumpling, New York Times, February 19, 2002.

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"A number of very clever people have been chipping away at the problem and I think now we can answer: yes, it would be very difficult but it should be possible without breaking the laws of physics to send probes to the nearest stars."
—Geoffrey Landis, NASA, The Independent (London), February 16, 2002.

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"It is based on the idea that for a short period of time, energy and value of money is conserved. The value of money is conserved when there are transitions between currencies."
—Amador Muriel, Data Transport Systems, on predicting the short term behavior of currencies, Business World (Philippines), February 14, 2002.

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" If the people in the treasurer's office, and their consultants, had been doing the kind of thorough investigating that they claimed to do before investing in anything, then they should have uncovered that there was something wrong in Enron's books, which we now all know."
—Charles Schwartz, University of California, Berkeley, News Hour with Jim Lehrer, February 19, 2002.

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"We know how to make metals that have strength. But we have never been able before to predict whether an alloy, for example, would get stronger and better. This technique will allow us to tailor the strength of materials and take years off the development process because we won't have to rely on trial-and-error."
—Bennett Larson, Oak Ridge National Laboratory, on a new technique for making 3-D images of small samples, UPI, February 20, 2002.

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"I believe we have made cold anti-matter atoms... but I can't really prove it."
—Gerald Gabrielse, Harvard University, on experiments at CERN to create anti-hydrogen, Sydney Morning Herald, February 22, 2002.

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"I still cannot recover, right now even. Sometimes I think it's a kind of nightmare."
—Yoji Totsuka, University of Tokyo, on the disastrous implosion of phototubes at the Superkamiokande facility, Daily Yomiuri, February 26, 2002.

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"Recognizing the limitations in the budget the department faces, I'll work with the scientific commu-

See *IN THE MEDIA* on page 4

This Month in Physics History

April 1994: Discovery of the top quark at Fermilab

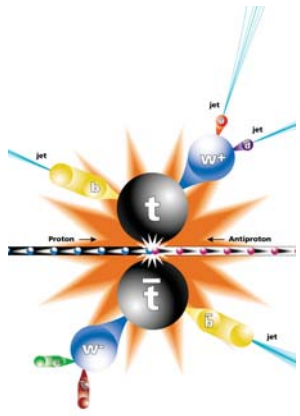
The Standard Model of particle physics holds that all matter is made from a small alphabet of elementary particles consisting of six quarks and six leptons. The heaviest of these, the top (or t) quark, is unstable and can only be detected when it is created artificially, for example in the collisions between the high-energy proton and antiproton beams at Fermilab in Batavia, Illinois. Physicists have been convinced that the top quark must exist since 1977, when its partner, the bottom (or b) quark, was discovered. Little did they know it would be nearly two decades before the top was finally found.

Produced in conjunction with its antiparticle the t-bar, the top quark quickly decays into a variety of daughter particles. The best way to search for the top was to look for its decay into a W boson and the next lightest quark, the b quark. A chief problem is the fact that the energetic b's and W's are also unstable and quickly decay into particle jets that typically emanate from less-interesting background collisions. Identifying the top quark required distinguishing a real top signature from those of background processes that can mimic one.

In 1985, when the Fermilab Tevatron collider was first activated, the search for the top quark was well underway, but early efforts at SLAC and at DESY in Germany proved fruitless. As the 1980s drew to a close, CERN, at that time the most powerful accelerator with energies up to 315 GeV, had failed to find the top quark. Experiments had determined that the mass of the top could be no lower than 77 GeV — beyond the limits of CERN's energy beams.

In the 1990s, the focus shifted to Fermilab and its two main experiments: the CDF and D0 detector collaborations. By the time researchers had begun taking data in 1992, the top mass limit had been pushed up to 91 GeV. Over the course of a decade, both the CDF and D0 collaborations constructed enormous, complicated instruments in order to isolate the top's signature. To do so, the two collaborations sifted through the debris from collisions of protons and antiprotons at energies of 1800 GeV.

After intensive analysis and scrutiny, the final results, made public nearly a year after researchers announced evidence for the quark's detection in April 1994, showed overwhelming evidence for the top quark from both CDF and D0. In simultaneous publications in April 1995, both teams reported a probability of less than one in 500,000 that their top quark candidates could be explained by background alone. The extremely large mass of the top — the current value is 175.6 GeV, similar to the mass of a gold nucleus, which contains 197 protons and neutrons — suggests that it may be fundamentally different from the other quarks. The sheer enormousness of the top's mass makes its decays fertile ground for new particle searches.



The top also has the shortest lifetime among quarks — less than 10^{-24} seconds — and decays as a free particle, the only quark to do so. All other quarks created in such a collision live long enough to pull more quarks from the vacuum and make complicated "jets" composed of many particles. The top's independence has enabled the Fermilab teams to determine its mass to far greater precision than the mass of any other quark.

Since then, Fermilab's Tevatron has been revamped and both the CDF and D0 collaborations have dramatically improved their detectors, resuming collection of data in 1999. The accelerator upgrades have allowed top quarks to be produced at 20 times the previous rate, while detector upgrades have improved the efficiency of identifying top quarks, allowing scientists a more detailed look at the top's characteristics. The groundwork has been laid for the Large Hadron Collider at CERN, which will begin operation in 2006, producing two proton beams colliding at 14 TeV — seven times the energy at Fermilab — generating almost one t-t bar pair per second.

Physicists can now use the top quark to help answer the many remaining questions about matter and the forces that govern the physical world. Chief among these is the Higgs boson, which is proving even more elusive than the top quark. It is the last undiscovered particle in the Standard Model's bestiary. A precise mass for the top quark will help theorists constrain the Higgs mass, improving its chances of detection at Fermilab or the LHC in the next decade.

The discovery of the top quark was not a "Eureka" event . "We discovered the top quark not in one lightning stroke, but over a long period of time, event by event," D0 physicist Nick Hadley (University of Maryland) said at the time of the discovery. "No single piece of evidence, no matter how strong, was enough to let us claim a discovery. We couldn't be sure we had found the top quark until we had seen so many events with the right characteristics that there was almost no chance the statistics were fooling us into making a false claim."

Particular Pastimes:

The Top Quark Game: http://education.jlab.org/topquarkgame/

The Particle Adventure: http://www.particleadventure.org

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OUTLOOK, *from page 1*

The betting is that the Republican-controlled House and the Democratic-controlled Senate will not settle on a final budget resolution this spring. Without this resolution's taxing and spending parameters, the appropriators will have few constraints on the bills they write.

Making this situation even more uncertain are politically infeasible recommendations in the budget request, such as a 7% reduction in Army Corps of Engineers spending, a 30% reduction in highway money, a 9% cut in Navy shipbuilding funding, and changes in veterans' health benefits reimbursement. Relations between Congress and the Administration have been strained by earmarking, with each side angrily claiming the high ground. Finally, while Members of Congress generally concur with the President on war-related matters, members of both parties disagree with the Administration's approach to other defense policies and expenses.

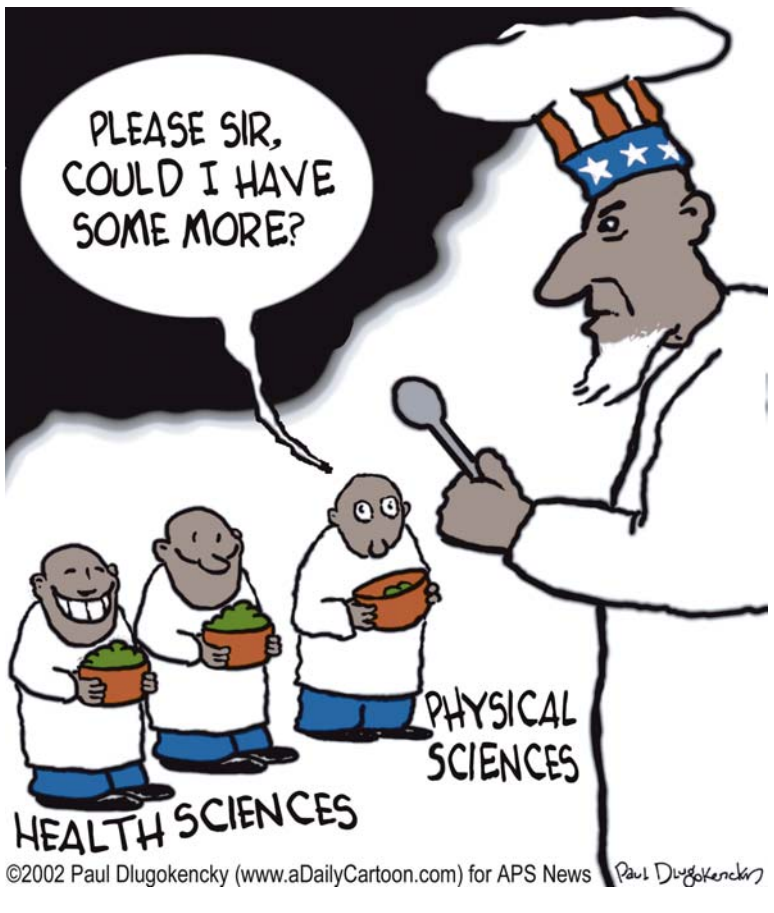
Looking ahead, it is clear that Congress will continue to be supportive of S&T. Larger questions, such as those described above, will impact FY 2003 research funding outcomes. Congress is almost certain to provide NSF with more than the requested 5.0% increase, although the VA budget ramifications are going to be troublesome.

The outcome for NASA is difficult to predict as much will depend on what will be done about space station overruns. Requested increases for DOE physics-related programs range from 1.7% to 6.5%. The DOE appropriations bill also contains funding for popular Army Corps programs so the outcome cannot be predicted. Congress was very supportive of defense S&T last year, boosting it by 11.0%, so it is highly unlikely that Members will agree to the 2.0% cut sought by the Administration.

The 5.1% requested cut in USGS is going to be a hard sell on Capitol Hill, and there is no way that the budget for the Advanced Technology Program will be cut by 41.5%, as the Administration has requested.

These are highly uncertain times, and these outcomes could change. The coming months will be contentious. Budgetary outcomes will depend on the involvement of constituents in the process of determining the federal government's priorities in the next fiscal year, which begins about six months from today.

—Richard M. Jones, American Institute of Physics



APRIL MEETING, *from page 1*

what is known, and not yet known, about CP violation, in light of both the B-factory programs at SLAC and KEK, and the ongoing accumulation of evidence that the mass eigenstates of neutrinos are different from the flavor eigenstates.

All solar neutrino experiments to date have observed far fewer neutrinos than theoretically predicted, according to John Wilkerson of the University of Washington, and the reason for this discrepancy is unknown. He believes that data gathered at the Sudbury Neutrino Observatory has solved the mystery, providing direct evidence that the majority of electron neutrinos created deep within the core of the sun change to mu or tau neutrinos by the time they are detected on Earth. Other topics covered in the plenary sessions include a summary of the first results from the Relativistic Heavy Ion Collider; an update on the Sloan Digital Sky Survey; the impact of the cosmological constant on fundamental physics; high-resolution X-ray studies of globular clusters; and universal scaling laws in biology.

[Sessions A1, G1, and M1]

Physics Takes on Terrorism

Since September 11, defense against terrorist attacks has become a major national priority in the U.S., and speakers at a Monday morning session focused on the role of physicists in supporting national antiterrorist efforts. Anthony Fainberg, formerly with the Office of Technology Assessment and now with the DOT's Transportation Security Agency, outlined several ways for physicists to participate, including explosive detectors, sensors, security procedures, technical analyses and decision tools, as well as transportation . Of course, "The tactics of terrorists will change and develop, so it will become necessary to develop ever more sophisticated measures to fight them," says Fainberg. "Technology is part of the answer, but human factors, vulnerability analyses, threat assessment and security procedures are equally important." Building on this theme will be Richard Garwin of IBM and Lawrence Livermore's Donald Prosenitz (See page 8). Livermore's Jay Davis will close the session with a discussion of counter-terrorism contributions from the national laboratories.

[Session O2, Monday, April 22]

Contact Congress

•Saturday, April 20 through Monday, April 22 • NE Exhibit Hall/ACC•

Worried about the slashing of NSF, DoE and NASA funding?

Concerned about the dearth of science literacy in our high-schoolers?

Anxious about where the country's security is heading?

YOU can have an impact on national science policy!! Come write your representatives in Congress to let them know how you feel about science issue of interest to you. The most important letters that a Member of Congress receives are the ones from his or her constituents —**you elect them, and you matter.**

The American Physical Society feels that it is incumbent on all of us to interact with the government, to offer technical assistance where we can, and to remind our Members of Congress that scientists have much to offer the country, in areas of basic science R&D funding, education, and energy policy. We have set up computers in the exhibit hall where you can send a letter to your Senators and Representatives — you can use our template or write own letter on issues that matter to you.

Special Events

FRIDAY, APRIL 19

Play Reading: "Copenhagen"
7:30 PM - 9:30 PM
Grand Pavilion, Hyatt Regency

SATURDAY, APRIL 20

Meet the Editors
3:00 PM - 5:00 PM
Kiva Auditorium Foyer, Convention Center

Welcome Reception
5:30 PM - 7:00 PM
Kiva Auditorium Foyer, Convention Center

Forum on History of Physics Reception
5:30 PM - 7:30 PM
Enchantment A/B, Hyatt Regency

SUNDAY, APRIL 21

Awards Session/Retiring Presidential Address
5:30 PM - 7:00 PM
Ballroom C, Convention Center

Reception: Committee on Minorities/Committee on Status of Women in Physics
8:00 PM - 9:30 PM
Enchantment A, Hyatt Regency

MONDAY, APRIL 22

CSWP Networking Breakfast
7:00 am - 9:00 am
Fiesta I and II, Hyatt Regency

Students Lunch with the Experts
1:00 PM - 2:30 PM
Nambe/Navaho Rooms and Isleta/Jemez Rooms

Student Social Hour
5:30 PM - 7:00 PM
La Cienaga, Convention Center

Public Lecture/Reception
7:30 PM - 9:00 PM
Kiva Auditorium, Convention Center

WEDNESDAY, APRIL 24

Very Large Array Tour
9:30 AM - 5:30 PM
Buses depart from Hyatt Regency lobby

Copenhagen Redux

Recently released documents from the Niels Bohr archive shed new light on the issues raised in Michael Frayn's award-winning play *Copenhagen* — which details the fateful meeting in September 1941 between Werner Heisenberg and Bohr — and should have a significant impact on the debate over the German nuclear fission project during World War II, according to bestselling author David Cassidy, one of the featured speakers at a session on interpreting Copenhagen. He will be joined by Roger Stuewer of the University of Minnesota, who will offer his thoughts on Lise Meitner's and Otto Frisch's interpretation of nuclear fission "as an act of extraordinary creativity."

[Session E9, Saturday, April 20]

Remembering Wigner

This year marks the 100th anniversary of the birth of Eugene Wigner, and speakers in a special centennial symposium will pay homage to one of the 20th century's greatest theoretical physicists. George Marx of Eotvos University in Budapest, will talk about Wigner's early life and work in Hungary, where he wrote the now-famous book on symmetries that garnered him a Nobel Prize. John Wheeler (Princeton University and University of Texas at Austin) will discuss Wigner's changing view of the elementary quantum phenomenon, while Alvin M. Weinberg of Oak Ridge National Laboratory, will detail how Wigner's background in chemical engineering was put to good use during World War II. "With his unparalleled understanding of chain reactors, and his skill and liking for engineering, Wigner can properly be called the founder of nuclear engineering," says Weinberg, pointing to the physicist's 37 patents on various chain reacting systems as evidence.

[Session I3, Sunday, April 21]

Los Alamos, Then and Now

Attendees interested in some local science history may wish to attend a Sunday afternoon session detailing the history of Los Alamos National Laboratory. Former APS President Val Fitch (Princeton University) will lead off with a description of the Special Engineering Detachment, created in 1943 to supply the technical assistance required to develop and construct nuclear weapons. LANL's Francis Harlow will describe the characterization of very complex small-scale processes at the lab, a major focus since its inception in 1943. Harlow's colleague, John Browne, will close with a summary of post-Cold War science and technology at the laboratory, included its much-touted stockpile stewardship program and other research.

[Session K2, Sunday, April 21]

Advise and Consent

Almost every action of modern government has some scientific or technological component, yet most senior officials who set policy and make decisions have little or no scientific training. Hence, science advising has become a career option growing in popularity with many physicists. In a Sunday afternoon session, Peter Zimmerman, chief scientist on the Senate Foreign Relations Committee, will offer insights from his experiences with science advising in the legislative and executive branches of government. He will be joined by Kenneth Heller (University of Minnesota), offering his thoughts on how university physicists can become involved with science policy, and APS Associate Director of Public Affairs Francis Slakey, who will relate some of the Society's battles waged on behalf on physics on Capitol Hill.

[Session K6, Sunday, April 21]

Tracking Down Tenure

Although many young PhD physicists have opted to pursue careers in industry and other more nontraditional areas, there are still opportunities available in academic environments, particularly in small liberal arts colleges, according to two speakers at a Saturday afternoon session on how to find and hold a faculty job. "Liberal arts colleges offer challenging and exciting opportunities for physicists with a commitment to teaching undergraduates at all levels of the curriculum," says Neal Abraham, a professor at DePauw University, who outlined several strategies for successful application for jobs in liberal arts colleges. Peter Sheldon, now a tenured professor at Randolph-Macon Women's College in Virginia, described his career path via a postdoctoral position as a visiting faculty member which, led to his current position.

[Session E5, Saturday, April 20]

LETTERS

Crotchety but Saintly

My wife tells me that as I get older I am becoming more crotchety. This episode is stimulated (and justified) by Alan Chodos's Viewpoint piece in the [*APS News*, February 2002], which castigates some of the science press for their treatment of the un-discovery of the Higgs boson at CERN. I would remind him that "As you sow ye are like to reap". The "discovery" was of marginal statistical significance and the statistical analysis was understandable to all but its creators. But, it received a big play in the press and became the basis of many stories on the agony of the decision to shut down LEP so as to keep the LHC on schedule.

We in the physics world do sometimes make big claims based on marginal data (g-2 of the muon is another recent example), though we are saintly compared to the biomedical community. We should be grateful that the press treats un-discoveries as gently as it does.

Burton Richter
Stanford, California

Vacuous Scapegoating Harmful to Peace

I found Professor Hoodbhoy's opinion piece [*APS News*, February 2002] to be, for the most part, a thoughtful discussion of nuclear proliferation issues. He lost me, however, when urged the United States to engage "with those it grievously harms" without citing specific examples. Certainly neither Pakistan nor the United States have always acted above reproach in the international arena, but vacuous scapegoating does nothing to further the cause of peace.

David Winchell
Upton, New York

Where Tornadoes Really Come From

I presume that Alan Cummings letter about tornadoes in the [*APS News*, January 2002] was tongue in cheek. However, the actual cause of tornadoes is not well known. The fact is that, pace Cummings, the Coriolis effect does not act upon vortices to any appreciable extent. What it does do is cause objects in motion (including air molecules) to deviate to the right (in the northern hemisphere). Cyclonic flow is caused by this deviation of air flowing in to fill a low pressure area, leading to the familiar counter-clockwise rotation.

The low pressure area which leads to tornadoes comes from rising air currents, in which the air pressure is lowered by the Bernoulli effect. These rising currents occur in unstable atmospheres (temperature gradient greater than the abiabatic lapse rate, so called, of about 7K/km). When the relative humidity is sufficiently high, water vapor condenses as the air rises, and clouds are formed, so that tornadoes are usually associated with thunderstorms. However, vortices similar to tornadoes can also form in dry air, and are usually referred to as "dust devils."

Whenever the unstable air continues past the freezing level, thunderstorms are likely since the electrical charges responsible for the lightening are formed from friction of ice crystals in the cloud. During my pilot days I discovered this to my dismay while flying the western US where, due to the high elevation, even the bases of ordinary cumulus clouds, even in the summer, may well be above the freezing level. So in the West clouds which would appear to be innocuous in the East could, and did, zap me!

Paul Zweifel
Radford, Virginia

NIH Breakup Won't Work

One of a bureaucrat's first priorities is turf protection. Does Daniel S. Greenberg [*APS News*, February 2002, BackPage] really believe splitting up NIH would increase the efficiency of the administration? Has he any experience in academic politics?

Tom Hahs
University City, Missouri

Insanity Defense

"The Mad Scientist's Love Song" by Gary McGrath [*APS NEWS*, February 2002] has diminishing literary value and was inappropriate otherwise, in my opinion, although I don't believe that he intended to offend. We don't think twice about the slur "Mad Scientist". How would we feel about the disparagement "Sambo Scientist" or "Yid Scientist"? As much as it hurts me to make that comparison, all of these epithets should be recognized as part of a shameful history, not encouraged by our professional class.

Mentally ill children and adults, students and colleagues, are often denied justice, even survival. People today can be jailed or shackled for a no-fault, biological brain disease. These folks, suffering here, now and for a lifetime, we callously label as "crazy." Please let us remind the world that physicists are known not only for their brains, but for their hearts.

Loren Booda
Arlington, Virginia

Improvement Noted

I wish to compliment the editors Schewe, Stein and Riordon who prepared the supplement "Physics News in 2001". It was very understandable — much more than in previous years.

Norman Septimus
Flushing, NY

zero gravity
The Lighter Side of Science

Mad Scientists Give Way to Mad Capitalists

by Joel Achenbach

Incredibly, businessmen are now as scary as scientists. The world of business, like that of science, has suddenly become famous for its horrors and abominations. This is an enormous cultural development.

Scientists — mad, cackling, disheveled, hair flying upwards as though in an antigravity field — have always disturbed our dreams, for they and their hunchbacked assistants are continually inventing things that are dangerous, invasive and certain to culminate in mayhem. Monsters spawned by Science (and its demonic cousin, Technology) have included Frankenstein, the Blob, the H-Man, Godzilla, the Andromeda Strain, Robo-Cop, the Terminator, the Jurassic Park velociraptors and the new Greta Van Susteren.

But no one despises Science entirely, for it also makes life better. Antifungal ointments come immediately to mind. Microwaveable pizza. Beyond those two things I'm drawing a blank but I know the list goes on and on.

The question we all have to ask is, does the invention of, say, the remote control clicker outweigh the risk that an overworked grad student at a high-energy particle accelerator will forget to carry the 2 in one of his calculations and, instead of discovering a new quark, inadvertently destroy the entire universe? It's a close call, obviously.

A similar conundrum is presented by Business, newly revealed as a terrifying enterprise only lightly tethered to morality and decency. Every day we learn of new financial instruments and accounting techniques that, like evil computers in science fiction movies, have turned on their masters. We hear about equity derivative transactions, related party entities, hedge funds, offshore bank accounts, submerged bank accounts, bank accounts hidden inside volcanoes, and so on.

The Enron scandal calls into question the integrity of the entire capitalist system, which previously we assumed was based on honest, straightforward greed. The Enron executives and their accountants, we've learned, have strayed from the American tradition of ripping off the little guy fair and square. Everyone knows that a company is supposed to be deceitful in its ledgers, but it is also supposed to be artfully deceitful. There are standards of dishonesty to uphold. The Enron people violated all these unspoken rules. It's okay to hide the fact that you've lost a million dollars here or there, but when the Enron executives tried to hide a

billion dollars in losses — when their lies involved the B-word — they crossed the line.

Enron was simply too aggressive. Listen to the words of whistleblower Sherron Watkins in her famous memo to Kenneth Lay: "Enron has been very aggressive in its accounting — most notably the Raptor transactions and the Condor vehicle."

Raptor. Condor. These businessmen fantasize themselves as birds of prey. (Notice that they didn't name their financial vehicles "Bunny" or "Otter" or "Mary Poppins.")

The most amazing thing about this case is that Enron officials may never be convicted of a crime. So far they've been charged with nothing, having endured merely the ritual torture of media demonization. Everyone hates them, but they're free to come and go as they please, so long as they keep the paper sacks on their heads.

The problem is that, although they are potentially guilty of wire fraud, securities fraud and racketeering under the RICO Act, they are also potentially guilty of nothing other than being aggressive American business people. Hiding losses in an obscure business partnership, and cashing in millions in stock while your employees watch their 401(k) plans evaporate into nothingness, is apparently legal. It's not even a crime t xes and absurdities of the Enron case once again bring Science to mind, specifically the assurance by Science that things utterly illogical can in fact be true, like light being both a wave and a particle, or the universe having no boundary, or a bowling ball falling to the ground at the same speed as a paper clip.

The standard tale of science gone awry features a tormented genius with no moral compass. He invents something, and he loves this invention more than he loves anything else, even though we, as outsiders, see that it will turn on him. Think, for example, of Dr. Moreau, the exiled vivisectionist of the H.G. Wells novel, piecing together parts of humans and animals to form new, loathsome hybrids. This man, we now suspect, could have risen far at Enron.

Combating corporate evils is a tricky business. If you blow one of these secret partnerships to smithereens, each individual smithereen can regenerate into an entirely new secret partnership. The paramount rule that governs Demon Spawn is that they cannot be killed. They can only be contained. Think of Godzilla: you can take him out with a nuclear device but you know that, eventually, he'll be back. Enron is now in shambles and its executives are less popular than figure skating judges, but someday, in some form, it too will return. Beware the Son of Enron.

Joel Achenbach is a Washington Post staff writer and author of Captured by Aliens: The Search for Life and Truth in a Very Large Universe *(Simon & Schuster, 1999). The above originally appeared on February 19 in Achenbach's "Rough Draft" column. Reprinted with permission.*

IN THE MEDIA, *from page 2*

nity and Congress to establish priorities and them champion them within the department."

—Ray Orbach, new Director of the Department of Energy's Office of Science, UPI, February 26, 2002.

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"There's going to be a great deal of skepticism about this, and there should be. We don't know whether it will work or not."

—John B. Rundle, University of Colorado, on a new way of predicting earthquakes, Los Angeles Times, February 28, 2002.

APS TASK FORCE, *from page 1*

should survey current activities of the physics community in the area of counter-terrorism, help identify physics problems, and encourage physicists to find solutions."

In view of this mandate, APS members who can help with their knowledge or suggestions are urged to contact any one of the task force members.

"The objective of the task force is to identify areas where the physics community can step forward to assist the government in its response to the attack of September 11," said Guenther. "We would like to not only identify technological response to current threats but also how we might reduce future exposure through the development of new technologies,"

The other members of the task force are: Mark Coffey (TRW), Harold Craighead (Cornell), Leonard C. Feldman (Vanderbilt University), William R. Frazer (University of California, Berkeley, *emeritus*), Gerard P. Gilfoyle (University of Richmond), Martin V. Goldman (University of Colorado), Beverly K. Hartline (Argonne National Laboratory), and Paul Wolf (Air Force Institute of Technology).

Focus on Committees

Problems of Women, Minorities Receive Special Attention

By Richard M. Todaro

Michael D. Williams

Barbara Jones

Among the various committees of the American Physical Society, there are two dedicated to increasing the participation of those groups who have traditionally been vastly underrepresented in physics, namely, women and minorities.

The Committee on the Status of Women in Physics is devoted to the twin goals of improving the climate for women who are in physics and improving the academic pipeline through which women enter physics. The Committee on Minorities works on increasing the number of minorities in physics. Minorities include African Americans, Hispanics, and Native Americans, three groups who historically have each accounted for less than one percent of the total population of physics.

The nine-member Committee on the Status of Women in Physics (CSWP) oversees a variety of programs.

The Site Visit Program enlists a team of volunteer women physicists to visit a college or university to assess the climate for women in the school's physics department. Barbara Jones, current CSWP chair, explained that the team consists of current and past CSWP members, as well as other women physicists. "At the invitation of the department, the team spends a day or two at the site and interviews different groups - undergraduate students, graduate students, and the department chair, as well as other members of the school's administration." Students are asked to fill out specially-designed questionnaires ahead of time; to encourage them to express themselves freely, the results of the survey are shared only with the visiting team and the CSWP.

Jones said the three goals of the Site Visit Program are to identify a set of generic problems commonly experienced by women physicists, to intervene to solve many of these problems, and to address problems specific to individual physics departments.

Upon completion of the survey, the team provides a list of recommendations for improvement to the department.

Jones listed several of the generic problems that are often encountered by women in the male-dominated world of physics. Among these are feelings of being "invisible professionally" to their male colleagues. Other women physicists feel that they aren't being treated fairly either in graduate school or subsequently in their professional situations. Another, deeper problem is that some women feel physics is taught in an "aggressive" style that is not conducive to their way of thinking and learning.

"In industry, one often finds that proportionally there are more women who come in with just BS degrees. So, of the small number of women who are there employment is often disproportionately weighted toward those who are in a more service-oriented role, " said Jones, who is a research scientist and manager at IBM's Almaden Research Center in San Jose, Calif.

"In physics, for many things that involve being a true leader of your research project, you need a Ph.D.," she said. "If you want to be a technical leader of a project, it is better to have a Master's degree or a Ph.D."

Other programs that the CSWP undertakes include co-sponsoring a summer internship program with IBM for undergraduate female students in physics. Between four and nine students each year are selected as part of the APS/IBM Research Internship for Undergraduate Women by a selection committee that includes one CSWP member. The students spend the summer working at one of three IBM research sites in the United States, including the Almaden site, the Watson Research Center in Yorktown Heights, N.Y., and the Austin Research Laboratory in Austin, Texas.

"A goal of the program is to encourage women to go on to graduate school in their technical field," Jones said. "It has been quite successful."

Twice a year, CSWP publishes the Gazette newsletter which features updates on CSWP activities and programs, book reviews, reports and articles on programs designed to increase the participation of girls and women in science. WIPHYS, an electronic list serve which reaches several hundred subscribers serves as a means to exchange advice and discuss issues of interest to women in physics. Information on both of these programs can be found at http://www.aps.org/educ/cswp/index.html

CSWP encourages nominations for the Maria Goeppert-Mayer Award which recognizes outstanding achievement by a young woman physicist within 10 years of receiving her PhD. Now in its sixteenth year, the MGM Award honors the memory of Maria Goeppert-Mayer by encouraging young women scientists who demonstrate outstanding potential at an early stage and carries with it a monetary award plus a travel allowance to give lectures at four institutions and the March meeting of the APS.

At the APS annual meetings, CSWP sponsors a variety of events including an invited session, a networking breakfast (with FIAP), and a reception (with COM). These events offer valuable opportunities for women to socialize and to network, as well as to hear technical talks.

Like the CSWP, the nine-member Committee on Minorities (COM) seeks to increase the representation in the field of physics of groups that have traditionally been greatly underrepresented. In the case of the COM, those are African Americans, Hispanics, and Native Americans.

COM has its own Site Visit Program to physics departments at academic institutions in order to "assess the climate for minorities in the department, and to make recommendations to improve the climate for minority faculty and students," according to the COM web page (http://www.aps.org/educ/com/index.html).

COM also serves as the selection committee for the American Physical Society's Corporate-Sponsored Scholarship for Minority Undergraduate Students Who Major in Physics. The scholarship program funds 20 to 25 new students each year. As part of the program, the chair of the departments where students are attending identifies a mentor - a faculty member from the department - who is willing to provide guidance and advice to the student. The COM keeps tabs on the students, as well, to ensure their progress through school. This mentoring aspect is viewed as key to retaining minority students in physics.

"The Committee on Minorities recognizes that mentoring minority students is very important in their retention in physics and is taking a hands-on approach to mentoring their minority scholarship students," said Arlene Modeste-Knowles, the outreach programs administrator of the APS Education and Outreach Department.

Modeste-Knowles cited a 1997 APS study showing that 82 of the 164 scholarship recipients completed a physics degree while another 36 completed some other science degree. Thus, fully 72 percent of the degree recipients earned a degree in a hard science.

The COM also bestows annually the prestigious Edward A. Bouchet Award upon a minority physicist who has made "remarkable contributions to physics." Named for the first African American to receive a Ph.D. at an American academic institution, Edward Bouchet earned his Ph.D. in physics from Yale in 1874.

Michael D. Williams of Clark Atlanta University is the new COM chair. "One of the things we have to work at is getting physics profiles up in our respective communities in order to make it appealing," Williams said. "The challenge is to start early enough to capture the interest."

A variety of other CSWP and COM programs help raise the awareness of women and minorities in physics. There are women's and minorities speakers lists, containing 366 and 83 names respectively, who are available to give talks and colloquia at US colleges and universities. The lists are indexed by field and by state. Modest travel grants are provided by APS to fund the program, which is designed to expand the opportunity for physics departments to invite colloquium/seminar speakers who can serve as role models for women and minority undergraduates, graduate students and faculty.

There is also a Roster of Women and Minorities, containing the names and qualifications of over 3100 women and 900 minority physicists. Employers in industry, government, and academia frequently use the Roster to identify names of prospective women or minorities as part of a job search.

Viewpoint...

New Bohr Documents Illuminate 1941 Meeting with Heisenberg

By Gerald Holton

It may be an advantage that, although I knew Bohr and Werner Heisenberg, I was not involved with them except as an admiring scientist and interested historian of science. The current discussions about their encounter in 1941 should not deflect attention from the excellent roles these two giants played in modern science, especially because that meeting changed nothing in history except their old friendship.

As Bohr intended, his remarkable documents (see http://www.nba.nbi.dk) greatly illuminate that meeting with Heisenberg, and show how incomplete and even erroneous many previous speculations and stories are. They also show us Bohr's mind at work, typically going again and again over the same ground as he did when dictating his physics papers never contradicting but constantly bringing in new details, in the hope of completing a complex report.

Therefore his documents should be read with care and compared in detail with the portions of Heisenberg's letter about the same event, published in Robert Jungk's book, *Brighter than a Thousand Suns* (1957 Danish edition; 1958 English edition, pages 102-104).

In Bohr's first and most detailed document , on which I was first consulted in 1985, he starts by offering Heisenberg an excuse, namely, that Heisenberg's memory might have "deceived" him when he wrote to Jungk. In fact, Heisenberg had started his own letter with a disclaimer: "As far as I remember, although I may be wrong after such a long time...." In the most controversial parts of his letter, he wrote, "This talk *probably* started with my question whether or not it was right for physicists to devote themselves in wartime to the uranium problems...." [emphasis mine] In stark contrast, Bohr writes, "Personally, I remember every word of our conversations."

Bohr's first document denies outright that Heisenberg had tried to obtain information from him on details concerning the development of atomic weapons, contrary to what some still like to believe, since Heisenberg had said he was "completely familiar with them and had spent the past two years working more or less exclusively in such preparation"

See *BOHR* on page 6

Copenhagen Cast Meets Protagonists' Progeny

Photo courtesy of Ken Shipp

On March 2, in connection with the play Copenhagen's *Washington DC run, a daylong symposium was held that reviewed the science, the history, and the theatrical aspects of the real events and their artistic representation. Shown here at a reception the previous evening are (l to r): Jochen H. Heisenberg, the son of Werner Heisenberg; Hank Stratton, who plays Heisenberg in* Copenhagen; *Mariette Hartley, who plays Niels Bohr's wife Margrethe; Len Cariou, who plays Niels Bohr; and Vilhelm A. Bohr, son of Aage Bohr and grandson of Niels Bohr. A picture of Werner Heisenberg and Niels Bohr in conversation hangs behind them.*

The three sessions of the symposium were recorded. To order the set of three tapes (about 2 hours each) send a check, made payable to "The Graduate Center", for $35 (this includes postage in the US), to this address: Brian Schwartz, The Graduate Center, 365 Fifth Avenue, New York, NY 10016

Copies of some of the papers presented at the symposium can be accessed at http://web.gc.cuny.edu/ashp/nml/artsci.

APS Extends Free Journal Access and Membership to Argentina

Acting quickly in response to the financial turmoil in Argentina, APS Treasurer and Publisher Thomas McIlrath announced that, for institutions holding subscriptions to APS journals in that country in 2001, the APS will continue on-line access without charge for calendar year 2002.

This move comes in the wake of a report to APS that "due to the virtual bankruptcy of the Argentinian banking system, a decree has been set, on January 1, 2002, by which no holder of an account (be it an individual or a business) is allowed to extract more than the equivalent of US $1000 per month, nor can the holder conduct money transfers overseas."

McIlrath has e-mailed the Argentinian subscribers to APS journals, taking note of the financial hardship and making the offer of free on-line access to the same journals that had previously been accessed via paid subscription. At this point, only five or six institutions are involved. The number of subscriptions in Argentina has declined dramatically in recent years in response to the worsening economic conditions there.

"Helping our Argentinian colleagues in this way is the least we could do," says McIlrath. "We hope that the situation will improve by next year, and that at least some of these institutions will be able to resume their status as paying customers at that time."

In addition, APS is also helping its 102 individual members in Argentina, by extending their memberships for six months beyond the expiration date. In an e-mail to all Argentinian members, Executive Officer Judy Franz stated that "APS does not want a temporary downturn in the Argentinian economy or a freeze on individual assets to be the cause for severing the collegial ties that we all depend upon."

This initiative has been very favorably received, says Trish Lettieri, APS Director of Membership. "There have been a number of responses from our members who are very grateful for APS' sensitivity to the current crisis in Argentina."

BOHR, *from page 5*

That such an atomic weapons program was in progress is no longer in doubt since the release of the Farm Hall papers.

Even C.F. v. Weizsaecker agreed that had been the purpose of the team's work in his autobiography, *Bewusstseinswandel* (Munich: Carl Hanser Verlag, 1988, page 365).

Bohr then explains his reaction, which was not anger, as some still insist, but fear. After all, the prospect offered by Heisenberg was that of a successful and energetic pursuit by the German team to make an atomic bomb, at the very time when Hitler's armies were having their greatest successes. Even so, Bohr offers Heisenberg again a way out, writing that Heisenberg's description (in his letter to Jungk) of Bohr as being simply shocked by that news was a "misunderstanding... due to the great tension in your mind." Bohr then repeats that his own memory of the conversation was clear, and that his interaction with Heisenberg had been the subject of "thorough discussion" with others. Such discussions must have been numerous, but Bohr's draft refers only to one: "During conversations with Moller, Heisenberg and Weizsaecker sought to explain that the attitude of the Danish people towards Germany, and that of the Danish physicists in particular, was unreasonable and indefensible, since a German victory was already guaranteed and that any resistance against cooperation could only bring disaster to Denmark."

In some of the last documents, Bohr writes that he finds it "incomprehensible" that Heisenberg later claimed to have "hinted" to Bohr that the German scientists "do all they could to prevent such an application of atomic science." That spin of supposed moral qualms is at the center of some of the revisionist writings, such as the book by Thomas Powers, and part of Michael Frayn's Tony-award-winning play, *Copenhagen*, in which the Heisenberg character is even made to utter on stage, "I understood very clearly. I simply didn't tell the others," and later, "I wasn't trying to build a bomb."

In Bohr's last drafts, he also raises a question that had troubled him: "What authorization might have been given to you by the German government to touch upon such a dangerous question."

Perhaps to give Heisenberg another ready excuse, Bohr writes, "During the course of the war, such a wise person as yourself must gradually lose faith in a German victory.... I can therefore understand that perhaps at the end you may no longer have recalled what you thought and said during the first years of the war. " Yet he adds, "But I cannot imagine that during a meeting so boldly arranged as that in 1941, you should have forgotten what arrangements had been made in this regard with the German government authorities."

Thus, when putting Heisenberg's letter to Jungk and Bohr's documents side by side, we see that any tortured attempt to make them seem to be somehow in accord fails, as does the idea that Bohr did not "understand" Heisenberg. Rather, Bohr contradicts and tries to correct every major point in Heisenberg's published account. Earlier, Jungk, in his autobiography, *Trotzdem* (Munich: Carl Hanser Verlag, 1993), had bewailed that he had allowed himself to be used to "propagate a legend," and now "felt betrayed." Bohr would never have used such language, no matter how deeply hurt he may have felt. In fact, one may speculate that Bohr did not send off what he had worked on for so long because even the relatively mild words in his documents seemed to him, in the end, uncharacteristically strong.

Still, there is some irony in the fact that Bohr, who had no reason to hide or misremember anything that happened, did not send his letter, whereas Heisenberg having worked for years on a German nuclear program that resulted in failure , may have had at least some tendency, even if not fully conscious, to misremember, when he did send his letter to Jungk.

Gerald Holton is Mallinckrodt Professor of Physics and Professor of the History of Science, Emeritus at Harvard University. A slightly different version of the above article was distributed at the March 2, 2002 symposium, "The Copenhagen Interpretation: Science and History on Stage," held at the Smithsonian Institution's Museum of Natural History in Washington.

Comments on this article may be sent directly to the author at holton@physics.harvard.edu.

INSIDE THE BELTWAY: *A Washington Analysis*

Too Much Spin Blurs Truth About Budget

By Michael S. Lubell,
APS Director of Public Affairs

Getting information from the Administration is not easy. Getting the truth, it turns out, is even harder. The difficulties start at the top—in the last thirty years, four presidents have resorted to stonewalling. Two of them did it successfully. One failed and resigned. The jury is out still out on the fourth.

In the 1970s Richard Nixon did it with Watergate and bombed. In the 1980s Ronald Reagan did it with Iran-Contra and survived. And in the 1990s Bill Clinton did it with the White House Travel Office, Whitewater and liaisons with Gennifer, Paula and Monica. He, too, survived, but just barely. Now, it's George W. Bush's turn. In the first year of his presidency, he and his administration are off to a good start. Only time will tell whether they make it.

Months ago, Congress requested that the Administration release the names of the corporate executives who met with the Cheney Energy Task Force. The request met with silence, and now the General Accounting Office has filed suit against the White House. The odds are the case will wind up in the Supreme Court, probably several years from now. It's anybody's guess how the court that chose the president will rule.

Last month, Congress requested that Governor Tom Ridge testify on how he plans to direct the $38 billion that the Office of Homeland Security purportedly has under its control. After all, $38 billion is a pretty big number. Ridge has refused, saying that he is not a Cabinet officer. Now Congress is considering whether to endow him with Cabinet status and compel him to appear.

Last fall, the House Science Committee requested that National Science Foundation Director Rita Colwell explain how NSF decides on Major Research Equipment projects and how it sets priorities for them. To date, she has not produced the information. And now the Committee is considering other means to obtain it.

Several months ago, the Defense Department established the Office of Strategic Influence. Its reported role was to plant false stories in the media, with the objective of influencing opinion abroad. Of course, the report itself could have been false, given the office's goal of spreading misinformation. But in early March, Defense Secretary Rumsfeld thought better of his decision and shut the office doors. Or so he said.

But stanching the flow of misinformation, it seems, is not on the agenda of the Office of Management and Budget (OMB). On February 4, amidst much ballyhoo, White House Science Advisor John Marburger announced that the Bush Administration's budget request for Fiscal Year 2003 had the best R&D numbers offered by any president in the history of the United States, totaling more than $111 billion.

What he didn't say was that all the increases were loaded into two accounts: research at the National Institutes of Health (NIH) and development, testing and evaluation at the Defense Department. Back out those programs, and the rest of the R&D budget would be flat or declining.

Budget Director Mitch Daniels, who singled out the National Science Foundation (NSF) as the only stellar agency or department across the broad swath of federal activities, said that the NSF was being rewarded for its good deeds and good management with a five percent increase — a cosmic number in tough times. What he didn't say was that all but 1.5 percent was the result of a transfer of activities from other agencies.

In an era when NIH's annual increases have exceeded NSF's entire budget, restoring balance to the science portfolio is one of the prime motivators for boosting the Foundation's budget. But the Bush plan actually calls for cutting the physical sciences at NSF while increasing its spending on biology. Depending on how you do the accounting, the life sciences across the federal budget would soak up between fifty-five and sixty cents of every research dollar.

Not too long ago, Marburger told the physical science community that its turn would come next year, now that the five-year doubling of the NIH budget has been completed. But two weeks later, he reversed course during his testimony before the House Science Committee. Under questioning about portfolio balance, he said that research budgets should be based on the complexity of the science, and, in his view, biology was still underfunded. A stunned Vern Ehlers (R-MI), who is one of two physicists in Congress, noted that if complexity were the sole criterion, then astrophysics should walk off with the lion's share.

You might chalk up Marburger's response to misspeaking – Washington lingo for a bigtime goof – under fire. But he repeated his statement a few days later in a speech at a meeting of the American Association for the Advancement of Science. Will the real Marburger please stand up.

But the prize for budget misinformation must go to NASA's Space Science program, which OMB said would climb by about a third. Now that's a supernova in this budget year. What OMB didn't say was that Space Science would have to absorb the cost of all space shuttle launches associated with science. (It won't have to pick up the cost of Space Station launches, since there is no science left in that program.) To see how pernicious the accounting is, consider that the latest Hubble launch would have chewed up almost 20 percent of this year's Space Science budget.

As any child who has played with a top knows, when the spinning stops, the object falls. With this year's budget now being spun at a furious pace, it's a good bet this law will catch up to the politicians too.

TOPICAL GROUPS, *from page 1*

APS to welcome and foster new fields of physics," the charge concluded.

Chaired by W. Carl Lineberger (JILA/University of Colorado), the task force is charged with addressing these concerns by considering such specific questions as whether the hurdle for forming a new topical group should be raised, and whether there should be a maximum number of topical groups within the Society at any one time. Members will also consider whether existing topical groups should undergo a periodic review to determine if they are still viable, and if so, what might be appropriate criteria for such a determination. Finally, the task force will consider what rights topical groups should have for invited sessions at APS meetings, and how much administrative support they should be entitled to.

The other members of the task force are drawn equally from divisions and topical groups to ensure balanced representation. They are Beverly Berger (National Science Foundation), John Clarke (University of California, Berkeley), Jeff Lynn (National Institute of Standards and Technology), James McGuire (Tulane University), Peter Meyers (Princeton). and Stuart Wolf (Naval Research Laboratory).

ANNOUNCEMENTS

APS UNDERGRADUATE PHYSICS STUDENT COMPETITION

2002 APKER AWARDS

For Outstanding Undergraduate Student Research in Physics

Endowed by Jean Dickey Apker, in memory of LeRoy Apker

DESCRIPTION

Two awards are normally made each year: One to a student attending an institution offering a Physics PhD and one to a student attending an institution not offering a Physics PhD

- Recipients receive a $5,000 award; finalists $2,000. They also receive an allowance for travel to the Award presentation.
- Recipients' and finalists' home institutions receive $5,000 and $1,000, respectively, to support undergraduate research.
- Recipients, finalists and their home physics departments will be presented with plaques or certificates of achievement. The student's home institution is prominently featured on all awards and news stories of the competition.
- Each nominee will be granted a free APS Student Membership for one year upon receipt of their completed application.

QUALIFICATIONS

- Students who have been enrolled as undergraduates at colleges and universities in the United States at least one quarter/semester during the year preceding the **JUNE 14, 2002** deadline.
- Students who have an excellent academic record and have demonstrated exceptional potential for scientific research through an original contribution to physics.
- Only one candidate may be nominated per department.

APPLICATION PROCEDURE

The complete nomination package is due on or before **JUNE 14, 2002** and should include:

1. A letter of nomination from the head of the student's academic department.
2. An official copy of the student's academic transcript.
3. A description of the original contribution, written by the student such as a manuscript or reprint of a research publication or senior thesis (unbound).
4. A 1000-word summary, written by the student, describing his or her research.
5. Two letters of recommendation from physicists who know the candidate's individual contribution to the work submitted.
6. The nominee's address and telephone number during the summer.

FURTHER INFORMATION

See **http://www.aps.org/praw/apker/descrip.html**

DEADLINE

Send name of proposed candidate and supporting information by **JUNE 14, 2002** to: Dr. Alan Chodos, Administrator, Apker Award Selection Committee; The American Physical Society; One Physics Ellipse, College Park, MD 20740-3844; Telephone: (301) 209-3268, Fax: (301) 209-3652, email: chodos@aps.org.

Call for Nominations for 2002 APS Prizes and Awards

Members are invited to nominate candidates to the respective committees charged with recommending the recipients. A brief description of each prize and award is given in the March 2002 *APS News Prizes and Awards* insert, along with the addresses of the selection committee chairs to whom nominations should be sent. Please visit the Prize and Awards page on the APS web site at http://www.aps.org under the Prize and Awards button for complete information regarding rules and eligibility requirements for individual prizes and awards.

PRIZES

Will Allis Prize for the Sudy of Ionized Gases
Hans A. Bethe Prize
Biological Physics Prize
Tom W. Bonner Prize in Nuclear Physics
Oliver E. Buckley Condensed Matter Physics Prize
Davisson-Germer Prize in Atomic or Surface Physics
Dannie Heineman Prize for Mathematical Physics
Polymer Physics Prize
Frank Isakson Prize for Optical Effects in Solids
James C. McGroddy Prize for New Materials
Lars Onsager Prize
George E. Pake Prize ***(April 1, 2002 Deadline)***
W.K.H. Panofsky Prize in Experimental Particle Physics
Earle K. Plyler Prize for Molecular Spectroscopy
Aneesur Rahman Prize for Computational Physics
J. J. Sakurai Prize for Theoretical Particle Physics
Arthur L. Schawlow Prize in Laser Science
Prize to a Faculty Member for Research in an Undergradate Institution
George E. Valley JR. Prize
Robert R. Wilson Prize

AWARDS

LeRoy Apker Award ***(June 14, 2002 Deadline)***
Joseph A. Burton Forum Award
Maria Goeppert-Mayer Award
Joseph F. Keithley Award for Advances in Measurement Science
Leo Szilard Lectureship Award

MEDALS AND LECTURESHIPS

David Adler Lectureship Award
Edward A. Bouchet Award
John H. Dillon Medal

DISSERTATION AWARDS

Outstanding Doctoral Thesis Research in Beam Physics Award
Nicholas Metropolis Award for Outstanding Doctoral Thesis Work in Computational Physics
Dissertation Award in Nuclear Physics

NOMINATION DEADLINE IS JULY 2, 2002, UNLESS OTHERWISE INDICATED.

Distinguished Traveling Lecturer Program in Laser Science

The Division of Laser Sciences (DLS) of the American Physical Society announces the expansion of its lecture program in Laser Science, and invites applications from schools to host a lecturer in 2002.

Lecturers will visit selected academic institutions for two days, during which time they will give a public lecture open to the entire academic community and meet informally with students and faculty. They may also give guest lectures in classes related to Laser Science. The purpose of the program is to bring distinguished scientists to colleges and universities in order to convey the excitement of Laser Science to undergraduate and graduate students.

The DLS will cover the travel expenses and honorarium of the lecturer. The host institution will be responsible only for the local expenses of the lecturer and for advertising the public lecture. Awards to host institutions will be made by the selection committee after consulting with the lecturers. Priority will be given to those institutions that do not have extensive resources for similar programs.

Applications should be sent to the DTL committee Chair Rainer Grobe (grobe@ilstu.edu) and also to the DLS Secretary-Treasurer Richard Freeman (rrfree@ucdavis.edu). The deadline for application for visits in Fall 2002 is **April 30**.

Detailed information about the program and the application procedure is available on the DLS-DTL home page: http://physics.sdsu.edu/~anderson/DTL/

Lecturers for the 2002-2003 Academic Year:

Rober Byer, Stanford University.
Lee W. Casperson, Portland State University.
Eric Cornell, University of Colorado.
Jim Kafka, Spectra Physics.
Marsha Lester, University of Pennsylvania
Christopher Monroe, University of Michigan.
Luis A. Orozco, State University of New York at Stony Brook.
Carlos Stroud, University of Rochester.

Now Appearing in RMP...

The articles in the April 2002 issue of *Reviews of Modern Physics* are listed below. For brief descriptions of each article, consult the RMP website at http://www.phys.washington.edu/~rmp/current.html. *George Bertsch, Editor.*

Reactor-based neutrino oscillation experiments – *Carlo Bemporad, Giorgio Gratta, and Petr Vogel*
Information and computation: classical and quantum aspects – *A. Galindo and M. A. Martfn-Delgado*
Colloquium: The physics of charge inversion in chemical and biological systems – *A. Yu. Grosberg, T. T. Nguyen, and B. I. Shklovskii*
Grain boundaries in high-*Tc* superconductors – *H. Hilgenkamp and J. Mannhart*
Electronic excitations: density functional versus many-body Green's-function approaches – *Giovanni Onida, Lucia Reining, and Angel Rubio*
Modern optical astronomy: technology and impact of interferometry – *Swapan K. Saha*
Single-bubble sonoluminescence – *Michael P. Brenner, Sascha Hilgenfeldt, and Detlef Lohse*

Reviews of Modern Physics *University of Washington; Physics/Astronomy B428; Box 351560; Seattle WA 98195; email: rmp@phys.washington.edu • phone: 1 (206) 685-2391*

FULBRIGHT AWARDS

The following Fulbright awards are viewed as among the most prestigious appointments in the Fulbright Program. Lecturing is usually in English. Candidates must be US citizens and have a prominent record of scholarly accomplishment. Consult CIES Web site http://www.cies.org/cies/us_scholars/DisChairs/ for information about application procedure and current updates. To apply, send a letter of interest (up to 3 pages), c.v. (up to 8 pages) and a sample syllabus (up to 4 pages) to Daria Teutonico, Fulbright Distinguished Chairs Program; Council for International Exchange of Scholars; 3007 Tilden Street, NW; Ste. 5-L; Washington, DC 20008-3009 (phone 202/686-6245). Materials must arrive on or before the May 1 deadline.

CANADA: FULBRIGHT-SIMON FRASER UNIVERSITY CHAIR IN AIRBORNE REMOTE SENSING:

Grantee will conduct research in area of specialization and conduct occasional graduate seminars. Specialization includes airborne remote sensing research in an applied environmental context. Open to junior or senior faculty. Center for Scientific Computing, Simon Fraser University. Four to nine months. www.sfu.ca

ITALY: NAPLES CHAIR IN PHYSICS:

Grantee will offer one course in signal analysis techniques for gravitational wave detection and conduct tutorials for students. Opportunities for collaborative research are available. University of Naples, Federico II. Three months, starting October 2003, March 2004 or May 2004. www.unina.it

APS Washington Office Summer Internship

Applications are now being accepted for the 2002 Summer Internship. The opening is for a ten-week summer internship during the period of June 3 to August 30, 2002 (specific dates negotiable).

More information about the position can be found at http://www.aps.org/public_affairs/intern-summer.shtml

Visit *APS News* Online

http://www.aps.org/apsnews/

The Nuclide Chart 2002 - Strasbourg

will be available in June 2002, in booklet form of 44 pages of A4 size. Ground states of 2915 isotopes and 740 isomers are included up to element 116 with mass defects, $T_{1/2}$, J^{π}, energies of emitted gamma rays and particles, thermal neutron x-sections, etc. **The cutoff date is June 2002.**

The price for the chart is $ 7.00 plus postal charges. The entire proceeds will be donated to research on Leucodystrophies. Author of the chart is M.S. Antony.

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CORRECTION

The November 2001 APS News reported that Enrico Fermi had developed the first nuclear reactor at the University of Chicago. This is misleading. Fermi started working on nuclear fission and building an atomic pile while still at Columbia University as early as 1939. The first chain reaction was, however, achieved in Chicago in 1942. APS News regrets any confusion that may have resulted from its report. We thank W. W. Havens, Jr. for a communication on this subject.

THE BACK PAGE

Physics, Homeland Security and the Justice System

By Don Prosnitz

"Murderous organizations have increased in size and scope; they are more daring, they are served by the more terrible weapons offered by modern science, and the world is nowadays threatened by new forces which, if recklessly unchained, may some day wreak universal destruction."[1] Much has changed since Major Arthur Griffith, a British police officer, made this prediction in 1898. Griffith's concern was dynamite—now we have nuclear explosives. Poison gas was an emerging threat at the end of the nineteenth century — now we worry about genetically engineered pathogens. But one thing Griffith knew even then has not changed. He and his fellow police officers were responsible for protecting the British homeland against terrorists.

For more than a decade there has been continuous debate as to whether or not terrorism could become a serious threat to the fundamental security of the U.S. The discussions had been academic and confined to the traditional national security community: the military, the intelligence agencies, think tanks, and a small portion of the scientific community. Debates over whether it was necessary to protect civilians from unconventional delivery of weapons of mass destruction (e.g., nuclear bombs in cargo containers) centered on the difficulty of constructing the weapons and the perceived irrationality of causing mass civilian casualties. Unfortunately, that debate is over. Terrorists have executed mass casualties attacks and the ability of individuals to construct effective biological weapons is now proven. Major Griffith's fear has become a reality.

How hard is it to protect the U.S. against terrorists? Numbers help. The unspeakable events of September 11 were executed by 19 terrorists. These terrorists entered the U.S. hidden among 510 million entry "events" per year, 330 million of which were foreign. It is believed that one individual out of a population of 290 million executed the anthrax attacks. A terrorist dedicated to causing mass casualties or disruption to our economy can choose from among thousands of targets in the United States. Terrorists are distributed throughout the country and buried in a nearly indistinguishable background of legitimate activities. The intelligence community can provide important information and predictive analysis with respect to potential targets. But detection and prevention in this country fundamentally requires a distributed system, one with "sensors" (human or otherwise) dispersed nationwide. The only institution with the required characteristics is the U.S. justice system, composed of federal, state, local and tribal law enforcement agencies. "It's going to come down to some street cop who sees something that doesn't look right–because of his training and intuition and information."[2] Protecting the infrastructure is his daily mission.

What is the United States criminal justice system? Most physicists have little knowledge of the justice system in America. This $146B enterprise is composed of 16,600 state, local and tribal police agencies, 69 federal agencies with law enforcement authority, over 16,000 federal, state and local courts, and almost 5,000 detention facilities. There are nearly 780,000 sworn law enforcement officers and a total of 2.2 million employees within the criminal justice system. Its size is comparable to the national security system ($275B, 1.4 million active duty personnel, and 2.2 million total personnel.) The national security system is designed for deterring relatively large, identified targets operating overseas. The criminal justice system is designed to deter and prosecute individuals and small groups distributed throughout the U.S.

> *"The real threat to our social order is continuous, unpredictable terrorist events. This strategy truly instills fear in the populace."*

The military has a long history of seeking out and receiving scientific and technical advice. Law enforcement (with the exception of case-specific forensic help) does not. Traditional technical support to law enforcement consists of adapting technologies developed for other, principally military, applications. Like receiving hand-me-downs from your older sister, this strategy leads to technologies that may be serviceable, but are out of fashion, don't fit, and are far from optimum. They may be too costly, require too much infrastructure support, not match operating procedures, or fail to adequately consider the constitutional rights of citizens or the liability of police officers.

Why hasn't the justice system and law enforcement received significant support from this country's scientists? Primarily, there was a lack of significant dialogue between practitioners. How often did police chiefs discuss their long-term needs with the NSF or DOE? The National Academies has a panel on Science and the Law, but until recently its focus had been almost entirely on how to keep "junk science" out of the courtroom, not on promoting research into new investigative or forensic capabilities. The American Association for the Advancement of Science has a similar panel with similar objectives, which has recently begun to examine future forensics needs. The National Institute of Justice attempted to foster interactions, but only reached a small segment of the scientific and technical community.

The events of September 11 and the anthrax attacks changed the relationship between law enforcement and the technical community. NSF was immediate in offering support and the Academies rapidly facilitated interchanges between the country's scientific talent and federal law enforcement. Law enforcement was encouraged by the overwhelming support, and the technical community was surprised and intrigued by the challenges faced by our justice system. We must not become complacent and let this newfound cooperation die.

Cooperation, no matter how well intended, will fail if there is no financial support. Although the criminal justice system is a least half the size of the national security system, and equally important in providing for the safety and well-being of the populace, it receives 1/100 of the R&D support provided to national security missions. With no financial support, there can be no directed research and eventually the technical community will seek other problems to solve.

The President's 2003 budget does include substantial support to equip first responders, including state and local police agencies. Vaccine research is also a high priority. The need to utilize existing, off-the-shelf technologies is immediate and urgent, but as we look to the future, we must also provide research dollars to develop technologies to help law enforcement counter tomorrow's threats. "It is a well-known fact that no other section of the population avail itself more rapidly and speedily of the latest triumphs of science than the criminal class. "[Inspector John Bonfield, 1888[3]] If there is no research investment in law enforcement technologies now, the "criminal class" will outpace our investigative and protective capabilities and the needed tools will not be on the shelf when we need them.

What are some of the needs and how can the physics community help?

The process of preventing terrorists from entering the United States begins overseas. For each visa application, a "name check" is performed against a central database that exceeds 10 million names. Transliterations, misspelling, and data entry errors must all be accommodated for each search–nearly 75,000/day. Efficient multi-cultural pattern matching is required.

At INS ports of entry, an inspector has 10 to 15 seconds to grant or deny a foreigner entry into the United States. New decision support systems, potentially enhanced by biometrics, are required. Is there a way to positively confirm the identity of all individuals in a passenger vehicle or bus in 30 seconds? Can game theoretic analysis and deterrence provide inspection strategies that don't require 100% identification checks?

Unattended sensors, explosive material detectors, and rapidly deployable intrusion detection systems can help harden vulnerable facilities. Finding and eliminating vulnerabilities of buildings to explosive, biological or chemical attacks through high fidelity simulations and creative use of advanced materials will further reduce casualties. Inexpensive instrumentation–the smoke alarm is a good benchmark–to detect human, plant and animal pathogens in time for effective medical intervention is critical to almost all protective measures.

True prevention, however, is only achieved by identifying and apprehending terrorists before they strike. Criminal investigation has often been described as pulling on a thread and watching the sweater unravel. Techniques to help find the key thread and links between threads need to be enhanced. *Coplink*, an NIJ- and NSF-funded effort at the University of Arizona to develop link analysis tools for Tucson police investigators is an example of the type of programs needed.

Tucson has 1.8 million incident records and 60,000 mug shots. Phoenix has ten times as many records. The scale of a national link analysis capability is forbidding, but must be considered if we are to stop a distributed terrorist threat. This necessitates sifting an enormous amount of data, some of dubious validity, for unusual, exceeding rare patterns–precisely the signal-to-noise problem that the high-energy physics community is experienced at solving. Models based on Bayesian analysis and complexity theory could suggest new investigative avenues. Similar tools would aid CDC epidemiologists. Law enforcement currently deals with 10s of Terabytes, a fraction of the 10s of Petabytes high-energy physicists must analyze. The physics community has long participated in international data sharing and may be able to suggest architectures and methodologies for analyzing and sharing multinational law enforcement information.

The real threat to our social order is continuous, unpredictable terrorist events. This strategy truly instills fear in the populace. Classic criminal investigation is the only method of stopping such a campaign. New methods of obtaining and identifying trace chemical and biological elements from a crime scene are sorely needed. Are there technical clues that law enforcement has not traditionally considered? Techniques used in our finest research laboratories need to be affordable, validated, and available to the forensics community. Results need to be obtained in days, not months. An enormous amount of evidence resides on electronic media, but forensic analysis takes much too long. Current federal backlogs can exceed a year. Unanticipated leads on terrorists may long have lost their value by the time analysis takes place. As storage media get larger, the problem will only get worse.

Don Prosnitz

Any discussion of how physicists can help protect the homeland without considering privacy policy is incomplete. Protection of citizens' privacy is at the nexus of virtually all use of technology by law enforcement. Physicists have played significant roles in the policy decisions on major national security issues—nuclear deterrence and missile defenses are two prime examples. If physicists wish to have a similar role in homeland security, they must educate themselves on privacy laws and be able to intelligently discuss the use of subpoenas and search warrants. They must understand the difference between Title III wiretaps and trap and trace orders. Designing technical solutions that don't respect privacy will not help, and arguing that all potential solutions violate privacy without understanding existing legal and policy protections marginalizes our contributions. If we take the time to understand the justice system as it actually operates, we can help make the country more secure while enhancing privacy.

Solving hard, complex problems is fundamentally what our training as physicists is all about.

References

1. Walter Laqueur, *The Age of Terrorism* (Boston, 1987), 313.

2. Chief Robert Olson, *The Washington Post* (February 12, 2002), A9.

3. Tom Standage, *The Victorian Internet* (New York, 1998), 105.

Dr. Donald Prosnitz is the Chief Science and Technology Advisor for the Department of Justice, a position to which he was appointed by then Attorney General Janet Reno on 1999. He is on leave from the Lawrence Livermore National Laboratory, where he held the position of Chief Scientist of the Nonproliferation, Arms Control and International Security Directorate.