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Panelists Debate Science and Security

The changing environment for national security includes a number of evolving threats for which the existing infrastructure is ill-equipped to address, according to speakers at a special session on the topic at the APS April Meeting in Washington, DC. The panel included Ernest J. Moniz of MIT, Undersecretary of Energy in the Clinton Administration; John Browne, director of Los Alamos National Laboratory; Charles Shank, Director of Lawrence Berkeley National Laboratory; and John Hamre, President of the Center for Strategic and International Studies and chair of a recently appointed commission

Ernest Moniz

charged with investigating science and security issues at the Department of Energy and making recommendations for reform.

Security systems at the national labs have been in place for many years, and by and large are accepted by the scientific community. Despite the end of the Cold War, all the speakers at the session agreed there is still a very real need for national security, but maintained that the environment has changed considerably in recent years, citing such evolving threats as cyber security and counter-intelligence, and national security policy needs to change with it.

A key question for Moniz is deciding what information to protect, since he believes that, while there is a significant amount of information that is under-controlled, it is dwarfed by the

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Council: Include Science in Standardized Tests

At its meeting on April 27, the APS Council approved a statement dealing with mandated programs of educational assessment. These programs, in which standardized tests are administered to students in various subjects, are an integral component of the Bush Administration's plan for education reform. Where implemented they have usually included only tests of reading and mathematics in grades K-8.

Helen Quinn

The Council emphasized that, where such programs exist, science must be included. The statement points out the importance of good science education, and goes on to say that "assessment influences what is taught, both in terms of hours spent and in the nature of classroom activity." The Council statement also stresses that any testing or assessment should be designed to motivate teaching methods that present science as more than a body of facts.

"Like it or not, mandated tests are a growing part of the educational picture in this country " said Helen Quinn of Stanford Linear Accelerator Center, a member of Council who played a key role in drafting the statement. "Many teachers have told me that they are

See STATEMENT *on page 8*

APS Members Write Congress, Then Drop In

APS members made a strong showing in expressing the scientific community's concerns to their respective members of Congress in March and April. Their efforts were the result of two letter writing campaigns organized at the March and April APS meetings, as well as the annual Congressional Visits Day held in Washington, DC, in early May.

At the APS March Meeting in Seattle, the Division of Condensed Matter Physics and the APS Office of Public Affairs (OPA) sponsored a campaign to encourage physicists to write to their Congressional representatives. The effort was duplicated a month later at the APS April meeting in DC. Conference attendees could sit down at a computer, generate a letter based on sample text, print it out on the spot and leave it to be mailed," said Christina Hood, APS Public Affairs Fellow, who organized the effort. The computer system automatically looked up each individual's legislators based on their APS membership information.

Christina Hood/APS

APS Member Steven Shapiro (left) of Guilford College, visits his Representative, Howard Coble (R-NC) on Congressional Visit Day in May.

Letters on two topics were sent out: those expressing concern at the proposed cuts for research funding in the Bush administration's budget outline, and those calling for an emphasis on science education in the K-12 education reform currently being formulated. "As with running any system for the first time, there were the usual hardware and software problems," said Hood. Specifically, poor software design made it confusing to use, especially for those unfamiliar with Windows, and printer errors slowed down the process considerably.

However, the technical difficulties seemed to have minimal impact on

See HILL *on page 3*

CPU Phase I Report Asks Eleven Big Questions

Eleven key questions at the interface between physics and astronomy form the basis of the Phase I report of the Committee on Physics and the Universe (CPU), which was established by the National Academy of Sciences and is funded jointly by NSF, DOE and NASA. (See the July 2000 *APS News* article at http://www.aps.org/apsnews/0700/070002.html for more details.) Based on discussions and input from the scientific community, as well as the CPU committee's own deliberations, the committee believes these questions address an emerging model of the universe connecting "fundamental physics at the most microscopic scales to the properties of the universe and its contents on the largest physical scales," said Michael Turner (University of Chicago), chair of the CPU study committee, who summarized the report's contents during a special evening session at the APS April meeting in Washington, DC.

The Phase I report recognizes that in order to realize the extraordinary opportunities at hand, a new, cross-cutting approach is required that will draw on the techniques of both astronomy and physics, telescopes and accelerators, and ground-based and

See CPU *on page 6*

Session Analyzes Big Science Projects

Editor's Note: This story was written for APS News by Jordan Raddick.

The Superconducting Super-Collider (SSC) was to be the largest purely scientific project in the history of physics. The cost to build it was estimated at $11 billion. It would have probed energies as high as 40 TeV, and was designed to probe the Standard Model and hunt for the Higgs Particle. But on October 19, 1993, Congress terminated the SSC project. At this year's April meeting of the APS, four speakers discussed why.

The four—Herwig Schopper of CERN and the University of Hamburg, Michael Riordan of Stanford University and the University of California at Santa Cruz, Thomas Kirk of Brookhaven National Laboratory, and David Goldston, staff director of the House of Representatives Science Committee, were involved in very different ways in the histories of the SSC and other high-energy physics projects. Schopper was Director-General of CERN, Europe's high-energy research facility, and was involved in hearings of the US Congress and the G7 Economic Summit Working Group on High Energy Physics.

See BIG SCIENCE *on page 2*

Head of NASA Speaks at April Meeting

NASA Administrator Daniel Goldin participated in a special session on "Goals for the New Century and the Scientific Workforce" at the April Meeting. Other speakers were Mildred Dresselhaus of MIT, formerly head of the Office of Science at DOE; Katharine Gebbie, Director of the Physical Laboratory at NIST; and Joseph L. Dehmer, Director of the Physics Division at NSF.

Jessica Clark/APS

HIGHLIGHTS

AIP Niels Bohr Library

Big Science, *from page 1*

Part of the unfinished SSC tunnel near Waxahachie, Texas.

Riordan, in collaboration with Lillian Hoddeson of the University of Illinois, is researching and writing a history of the SSC from its original conception in 1982 until its cancellation in 1993. Kirk worked as a member of the SSC central design group, headed the solenoidal detector design and construction effort during the SSC project and served as deputy SSC lab director for the SSC closeout. Goldston was legislative director to Rep. Sherwood Boehlert (R-NY), at the time a member of the House Science Committee (and now its Chair). Each gave a half-hour talk at the April meeting, then came together for a panel that answered questions from the audience.

The speakers identified several reasons for the SSC's downfall. First, the project's cost estimates increased from $5.9 billion at the start of construction in 1989 to nearly $11 billion in 1993. One main reason was that the aperture of the collider's magnets was increased after design proposals were submitted to Congress. Goldston said that this and later cost increases created the perception that the project was out of control. At a time when Congress was looking for ways to cut the federal budget deficit, a project perceived to be out of control was easier to kill. However, Kirk pointed out that other large-scale physics projects have doubled in cost during their designs, but were able to secure funding for completion. "This number, in my judgment, was not what killed the SSC," he said.

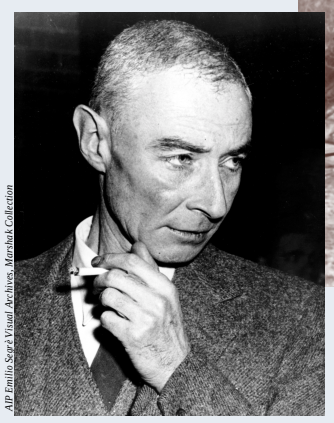
Second, the physics community did not reach consensus about whether the project would advance science enough to justify its cost. After the end of the Cold War, Congress no longer funded basic research aimed at competing with the Soviet Union; scientists needed to offer different justifications for their basic research. Goldston said that Congress was influenced by physicists who worried that the SSC would divert funds from other areas of physics. Schopper emphasized that for large projects to succeed, they must have broad support in the science community.

Third, as Kirk and to some extent Goldston pointed out, the SSC project was badly managed. Kirk said that key SSC managers did not have the technical expertise they needed–for example, the manager who oversaw the team that designed the collider's low-temperature superconducting magnets had no experience with magnets or cryogenics. He also noted that second-level managers turned over too often, destabilizing the project, and that communication between different parts of the project was inadequate. The SSC project had three leaders in Texas who rarely spoke to one another. SSC lab managers were directed by two top leaders who often gave uncorrelated direction. Kirk concluded that a mismatch between the cultures of the scientists, businessmen, and government officials who worked on the SSC hurt the project.

Fourth, the speakers said that the project suffered from a lack of international cooperation. Riordan said that other countries were dubious of the Reagan Administration's claims that the SSC would re-establish the United States as the world leader in high-energy physics. Schopper said that Europe was already committed to building two large colliders at the CERN site in Switzerland, so could not participate in the SSC project. Also, it was not clear to the Europeans and Japanese whether the SSC was an international or national project. In 1992, advisors to then-President Bush suggested that he approach Japanese leaders about participating in the project, but the President did not ask them. Goldston said that in 1987 the state of New York had proposed a site along the US-Canadian border, but the Department of Energy did not seriously consider the site. "This was a signal that the Department was not really interested in international participation in the SSC," he said.

This Month in Physics History

June 29, 1954: Oppenheimer's Security Clearance Revoked



AIP Emilio Segrè Visual Archives, Marshak Collection

Photo by Ken Bainbridge, courtesy AIP Emilio Segrè Visual Archives, Bainbridge Collection

Above: J. Robert Oppenheimer (left) with Major W.A. Stevens on a trip to select site for Trinity, test site for first atomic bomb. At left: An elder Oppenheimer.

Few would dispute the vital contributions physicist J. Robert Oppenheimer made not just to physics, but to the national security interests of the United States. So it is an odd quirk of history that the former director of Los Alamos National Laboratory and former chair of the General Advisory Committee of the Atomic Energy Commission (AEC) should find himself accused of disloyalty and being a national security risk, sparking a high-profile hearing culminating in the loss of the scientist's security clearance.

Despite his long history of service on behalf of the US government, there was growing suspicion of Oppenheimer by the early 1950s. The physicist had several Communist acquaintances dating back to the 1930s, and had implicated some of his friends as Soviet agents during an inquiry back in 1942—testimony which he later admitted was "a tissue of lies". His outspoken opposition to the development of the hydrogen bomb—accomplished on November 1, 1952—did little to allay suspicions, and the AEC was compiling a mounting file of Oppenheimer's alleged questionable activities. By early December, AEC representatives had removed all secret papers and documents pertaining to the General Advisory Commission from Oppenheimer's Princeton office.

Oppenheimer's troubles were further exacerbated by the onset of the McCarthy Era. A key component of the Republican Party platform in 1952 was the need to rid the Federal Government of "subversives" who had supposedly infiltrated the system, along with an overhaul of loyalty and security programs. Senator Joseph McCarthy's call for a tough anti-Communist drive at that year's convention received a standing ovation. When Dwight D. Eisenhower was sworn in as the 34th US president, McCarthy became chairman of the Senate's Investigations Subcommittee, with broad power to choose investigative targets. Other appointees in the new administration wasted no time in unveiling a new security policy under which a government employee not only had to be judged "loyal" in order to serve the country; his or her background had to be "clearly consistent with the interests of national security."

In December 1953, just four days before Christmas, Oppenheimer was accused of having associated with Communists in the past, of delaying the naming of Soviet agents, and of opposing the building of the hydrogen bomb. A subsequent security hearing by the AEC declared him not guilty of treason but ruled he should not have access to military secrets, and his contract as an AEC advisor—his one remaining link with that body—was terminated. The AEC issued its decision and opinions on June 29, 1954, with a vote of 4 to 1 to revoke Oppenheimer's security clearance, citing "fundamental defects of character", and Communist associations "far beyond the tolerable limits of prudence and self-restraint which are to be expected of one holding the high positions" he had held since 1942. (The complete transcript of the AEC's decision can be found online at http://www.yale.edu/lawweb/avalon/abomb/opp06.htm)

The lone dissenting opinion came from Henry DeWolf Smyth, who concluded "there is no indication in the entire record that Dr. Oppenheimer has ever divulged any secret information," despite nearly 11 years of constant surveillance that DeWolf believed was "supplemented by enthusiastic amateur help from powerful personal enemies. "In his opinion, Oppenheimer was not a subversive of questionable loyalty and moral character, but "an able, imaginative human being with normal human weaknesses and failings."

While the press was almost unanimously favorable to the AEC's majority verdict, Oppenheimer's case became a cause célèbre in the world of science because of its implications concerning the political and moral issues relating to the role of scientists in government. The Federation of American Scientists quickly came to his defense with a protest against the trial, and Albert Einstein and 25 colleagues in Princeton declared themselves "proud to give public expression" to their "confidence in [Oppenheimer's] loyalty and patriotic devotion." Ironically, in October Oppenheimer was unanimously re-elected as director of the Institute of Advanced Study in Princeton, whose board included at least one member of the Commission who had revoked his security clearance.

Once the Communist hysteria began to fade and the Cold War to decline, Oppenheimer began to recover from that painful episode, and he spent the last years of his life developing his concept of the relationship between science and society. In 1963, President Lyndon B. Johnson presented Oppenheimer with the AEC's Enrico Fermi Award. Three years later the physicist retired from the Institute and died of throat cancer the following year. At his funeral, Smyth (now a Congressman) cited Oppenheimer's many contributions to the nation and expressed profound regret at the shabby manner in which the government had repaid that service: "Such a wrong can never be righted; such a blot on our history never erased."

Further reading:

Stern, Philip M., *The Oppenheimer Case: Security on Trial* (1969).

Michelmore, Peter, *The Swift Years: The Robert Oppenheimer Story* (1969).

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Council Denounces Blanket Polygraphs

In a statement passed at its April 27 meeting, the APS Council revisited the issue of the relationship between national security and science at the DOE weapons laboratories. The statement attacks the idea of blanket or routine polygraphs of laboratory personnel, saying that "the morale of the workforce would be damaged seriously" thereby. The text of the statement follows.

Two years ago, the Council of the American Physical Society issued a statement on *National Security and the Open Conduct of Science*. The Council reaffirms three propositions central to that statement:

There is a "critical connection between US national security and scientific research activities;"

"Effective national security requires the highest standards of vigilance and circumspection;"

And "the science on which [national security] is based must meet the highest standards of excellence."

To maintain the scientific vitality of the weapons laboratories, the Council therefore recommends that:

- Restrictions on scientific interchange of unclassified information be eliminated to the maximum extent possible, including limitations on foreign visitors and on travel by laboratory personnel.
- There be no blanket polygraph testing of personnel at weapons laboratories.

The Council notes that the strength and effectiveness of the weapons laboratories requires a scientific workforce of the highest caliber. The morale of that workforce would be damaged seriously by a program of polygraph testing so routinely applied that it calls into question the integrity of individuals who are devoting their careers to national purpose. As the Council previously noted, morale would also be damaged by "any negative characterization of scientists on the basis of ethnic or national origins." Only by attracting and retaining outstanding scientists can the weapons laboratories continue to perform their critical national security role.

Panel, *from page 1*

amount of information that is over-controlled. "The need to protect also extends to science, not just to classified information," he said, adding, "The national labs perform by remaining at the science and technology frontier," and to do that, employees must engage in exchanges with the broader scientific community, which is increasingly international in scope. Input from the scientists and engineers employed by the national labs as to what security systems they believe might be effective is "essential," according to Moniz, who also criticized the broad-based polygraph programs currently in place, believing the polygraph is most useful in highly targeted areas.

Browne echoed many of Moniz' concerns, specifically the need to put security only in those areas where it is truly needed. He disagreed with the common misconception that science is incompatible with security, but recognized that "there is an inherent tension between the two and we must be careful to maintain the balance." Browne also decried the government's decidedly punitive approach to security crackdowns at the labs in the wake of the Wen Ho Lee controversy, which included travel restrictions, a moratorium on foreign visitors, and cuts in discretionary research funding, as well as polygraph testing.

Shank recognized the inherent tension between scientific exchange and national security, which he attributes in part to a cultural difference. "Scientists want to get information out to their colleagues; security people want to keep information in," he says, advocating more cultural exchanges and interactions between the two groups to bridge "this huge gulf in mutual understanding." And of course, scientists always want to know why something needs to be done a certain way, and the current security environment doesn't always provide them with sufficient rationale for the restrictions imposed.

Hamre said that the commission he heads will be reporting soon, and noted that his remarks were his own opinions and not necessarily those of the commission. He cited the national security policies of the Reagan Era, circa 1985, with its emphasis on protecting only information that has gone through the formal classification review. Like the other panelists, Hamre especially decried the category of "sensitive but unclassified" information, for which there is no consistent definition, and which is often left to the managers, who must enforce the restrictions, to figure out. Shank remarked that it is like pornography—you can't define it but "you know it when you see it."

"There are still many people in the world who want to get their hands on powerful technology for the wrong reasons," Hamre said, but security efforts should be directed at targeted weapons-related areas, not towards controlling scientific exchange.

He also believes the US hasn't invested sufficiently in developing quality security practices at the national labs, pointing to the Las Vegas casinos as an example of the most sophisticated security model in the country, because the casino owners made substantial investments to develop them. Specifically, Hamre recommends the creation of correlated databases and related data mining tools to combat the growing threat of cyber security.

Of course, "There is no defense against willful compromise," according to Moniz. This is why, says Browne, the essence of a national security program should not rely on following a set of rules, but be based instead on the integrity and values of people in the national lab environment.

"We need to do better at defining and communicating threats to national security, [in order to] educate our people so that they understand what they need to protect," he said. "The issue is not about rules and regulations, it's about values and ethics." Concluded Moniz: "A well-placed trust must be the foundation of our national security."

Arms Control Issues Featured at Burton Award Session

Editor's Note: This story was written for APS News by Jordan Raddick.

"How do you assess something as successful when it didn't work at all?" asked George Lewis of MIT, one of the recipients of this year's Joseph A. Burton Forum Award, given annually by APS to recognize physicists who work towards resolving issues of physics in society. Lewis said that the Army assessed the Patriot missile, used in the Persian Gulf War to shoot down enemy missiles, to be 61% successful. However, analysis of news media footage showed that almost every Patriot missed its target. With President Bush likely to pursue plans for a National Missile Defense system, Lewis said, determining the effectiveness of antimissile missiles is important. "We only have one experience with ballistic missile defense," Lewis said of the Patriot.

Lewis was one of three arms control physicists to receive this award, which was given at this year's April meeting in Washington, DC. All three—Lewis, David Wright, and Lisbeth Gronlund—spoke about arms control issues during the prize session.

Lewis said that the Army classified all data it used in its analysis of the Patriot's performance during the war; however, its methodology was unclassified. Its definition of success required only that the Patriot arrived at its programmed intercept point, and that the missile it was defending against caused no significant ground damage. This methodology allowed the Army to declare the Patriot successful even if the Patriot missed the other missile completely. Lewis said that since the Patriot data were unavailable, it was fortunate that such good video was available for independent analysis. "Physics cannot be classified," he said, in response to a question about how analysis could be done without access to classified data.

David Wright, of MIT and the Union of Concerned Scientists (UCS), spoke about how he used knowledge of North Korea's previous missile tests to estimate the state of that country's current missile program. In 1998, North Korea launched a three-stage missile over Japan in an attempted satellite launch. Japanese Navy vessels knew where each stage of the missile splashed down; Wright used these data to calculate the missile's speed when each stage separated, from which he calculated each stage's thrust. He compared these data to data from previous North Korean missile tests to estimate the current technological level of the North Korean missile program. Since North Korea is considered a primary potential missile threat to the United States, a technical understanding of their missile program is valuable input to the debate over national missile defense. "By doing a relatively simple technological analysis," Wright said, "you can learn interesting things."

The third award recipient, Lisbeth Gronlund from UCS and MIT, spoke about the testing that would be required to gauge the effectiveness of a National Missile Defense system. She said that there is a law that requires new military hardware to be tested thoroughly before it is bought. "This is a rational attempt to make sure the US buys systems that work," she said. However, under President Clinton, the Pentagon decided that rather than consider the procurement decision to be about buying a certain number of interceptors, they would consider it to be a decision to buy a National Missile Defense system, therefore exempting it from the legal requirement. Clinton's plan, which Bush will likely renew, calls for the President to decide whether to purchase the interceptors in 2003, before operational tests begin.

Gronlund said that, according to a leak from a classified document, the Pentagon wanted to have 95% statistical confidence that the National Missile Defense system would be 95% effective against ballistic missiles. To achieve this level of confidence and effectiveness, the system would have to succeed forty-seven times out of fifty tests, and would have to repeat this performance across a wide range of missile approach trajectories, day and nighttime conditions, and enemy countermeasures. Gronlund stated that the military would not be able to conduct all the tests required to obtain the confidence and effectiveness it seeks.

April Meeting Prize and Award Recipients

Left to right: Lisbeth Gronlund, David Wright, George Lewis, Daniel Bardayan, Claude Lyneis, Richard Geller, Mark Wise, Lawrence Krauss (front), Gerald Brown (rear), Claudio Pellegrini, Janet Conrad, Paul DeYoung, Paul Grannis, Mikhail Voloshin, Jorge Pullin, Sunil Golwala, Jens Gundlach. Not shown: John Harte, Nathan Isgur.

Hill, *from page 1*

the response, which was "definitely encouraging," according to Hood. She estimates that about 950 letters were sent out during the March Meeting, addressed to 231 separate legislators, including 74 senators in 40 states. The April meeting, while significantly smaller, nevertheless showed a similar strong turnout with 500 letters sent out to 165 legislators, of whom 61 were senators. In total, some 277 members of Congress were contacted, 85 of whom were senators.

The April meeting culminated with the annual Congressional Visits Day, organized in conjunction with several other DC-based scientific organizations. The event kicked off with an afternoon briefing session, featuring a talk by NASA Administrator Dan Goldin, as well as representatives from the NSF, DOE, NIST, and the Office of Management and Budget. Participants were coached on the proper protocol for Congressional visits and were provided with a summary of the Federal R&D funding structure. Concluding remarks were delivered by Rep. Ralph Hall (D-TX), ranking member of the House Science Committee.

Participants attended a continental breakfast briefing the next morning featuring remarks by Rep. Sherwood Boehlert (R-NY) chair of the House Science Committee, before departing for the day's scheduled visits. In all, some 40 APS members visited approximately 75 different Congressional offices.

LETTERS

More on Really Big Numbers

After Daddy Cockburn (Zero Gravity, April 2001 *APS News*) told his ten-year old that 10 to the 5th power is ten thousand, Constant Reader was left with serious doubts about all the rest of the numbers. Is an erratum planned?

Constant Reader
a.k.a. Virginia Trimble
Chair, Division of Astrophysics (the unit of APS charged with considering astronomical numbers)

Editor's Note: We're pretty sure it was a typo. That's our story and we're sticking to it.

In the April 2001 issue (Volume 10, No. 4) of *APS News*, page 4, there is a trivial but amusing typo in the "Zero Gravity" column. In the middle of column 2, a father-son dialog is reported: "Dad, what is 10 to the 5th power?" The reply is "Ten thousand"!

Okay, we all know it's one hundred thousand. The irony is that this error appears on the same "Letters" page in which we find the first letter titled "Science Textbooks Riddled with Errors."

The letter, from David A. Lupfer, ends with the admonition, "...Where is the attention of the APS members and directors? We must attack this problem in our own back yard!"

We hear you, David.

Mark Kowitt
Lanham, Maryland

Alistair Cockburn's commentary on really big numbers addresses a need for names for these numbers not only for children but for journalists and media people who have trouble differentiating between million and billion. I applaud his approach and the definition he applies. I have a suggestion, however, concerning the name he chose: "fuga" unfortunately comes within an epsilon of a derogatory term for a person involved in a sex act, as pronounced by a person with a Boston accent.

I suggest that 'fugar' be avoided as well, since that just exacerbates the pronunciation problem. Perhaps 'gugar' might work, and it has the sound of science-fictionish technobabble that seems to be appreciated, as in "Captain, we are within gugar-10 of the asteroid!". Other combinations might also be used, such as 'fugoo', although this sounds more like a Chinese dinner than a number. Personally, I favor 'fugol' since it suggests the already familiar googol. In any event, my thanks to Alistair for an entertaining and useful commentary. I await his commentary on adolescent number crunching.

A. G. Jackson
Dayton, Ohio

I found the Zero-gravity article by Alistair Cockburn in the April 2001 edition of *APS News* very interesting and humorous. I also have two small children who enjoy playing the I-know-a-number- larger-than-you-do game. It appears however, that in defining the Fuga-number, either the typesetters missed the equations or Dr. Cockburn has not arrived at a largest number scenario. In the article, Fuga-number is defined as "that number raised to that number that number of times." The example of Fuga-3 is given as $((3^3)^3)$. This would be, using the included parentheses, $(27)^3$=19,683, or 3^9. However, a much larger number could be obtained if the order of the parentheses were reversed. I therefore propose another larger number, which I will call Gufa-number. Let's define Gufa-number as "that number raised that number of times to that number". Gufa-3 could then be written as $(3\text{^}(3^3))$, and Gufa-4 would be $4\text{^}(4\text{^}(4^4))$. Switching the order of paranthesis makes Gufa-3 = 3^{27}, or 7,625,597,484,987, a number considerably larger than Fuga-3. Therefore, as our children will eventually say, "My space commander rules a Gufa-fuga-gar-googolplex of stars!

Michael B. Ottinger
Missouri Western State College

Centrifugal Forces Spawn New APS Units

Editor's note: This is the second of two articles by Jordan Raddick focusing on centrifugal tendencies within APS and the physics community. Last month's article dealt with issues related to meetings; this article concerns the formation of new APS units.

In last month's Back Page article of *APS News*, outgoing President James S. Langer wrote about "centrifugal forces" within the Society. He worried that APS was becoming decentralized. In the past five years, four new topical groups have formed, and some physicists have talked about forming even more in the future. The groups' organizers say that the new groups offer a home for research areas not adequately represented within the present structure of APS, or for emerging research that requires interdisciplinary collaboration. Judy Franz, APS Executive Officer, thinks new topical groups can bring added vitality to APS if they reach outward into new areas and attract new members to APS.

Last November, about 50 physicists interested in the strong interactions gathered on the outer banks of North Carolina for a workshop called *Key Issues in Hadron Physics*. The workshop set research goals for the community and created a list of research projects and recommendations to distribute to other physicists. On the meeting's day off, Eric Swanson, of the University of Pittsburgh, asked participants to hold a special session discussing how to increase hadron physics's visibility in the physics community at large. "[The community] needs an identity," Swanson said. Today, with nuclear physicists concentrating on the atomic nucleus and particle physics pushing on to higher-energy phenomena such as the Higgs particle, "hadronic physics… should have split off to form its own niche in physics. It hasn't done that yet," Swanson said. Swanson said that the community sometimes has difficulty presenting its case to funding agencies. "Because we don't have a niche, people tend to think that we don't exist," he said.

At the conference, attendees decided that to bring visibility to their field, they should form a new APS topical group in Hadron Physics. "A topical group seemed like the easiest way to achieve our goals without making a lot of people upset," Swanson said. Swanson, along with Alex Dzierba of Indiana University and Bill Zajc of Columbia, formed an ad hoc committee to examine forming a topical group.

According to the Article VIII of the APS constitution, a proposal for a new topical group begins when at least 200 APS members petition the APS council. The council then votes on whether to approve the group. The hadron physics topical group committee set up a web page (http://fafnir.phyast.pitt.edu/topical/) with a petition and has collected over 200 signatures.

When the group's organizers approached the Division of Nuclear Physics (DNP), the leaders of DNP were skeptical for many of the reasons that Langer brought up in his back page. "Initially, I was against it, because it looked to me like it would be an effort that would essentially balkanize the nuclear physics program, which is a very diverse program," said Joel Moss of Los Alamos National Laboratories, Chair of DNP.

At the same time, physicists who study soft condensed matter, i.e., condensed matter in liquid or gaseous states, have felt similarly squeezed between the

See FORCES *on page 7*

Visual Incongruities?

Concerning the photographs of four of the participants in the 2001 APS Lead-Scientist Institute on page 3 of the latest *APS News* (Volume 10, No. 4): How exactly were they able to weigh the items mentioned in the article when their hands were located so as to prevent the proper operation of the spring balances? In particular, in the bottom picture the spring was completely inoperative. Perhaps the Editor should have been a little more careful in choosing a photograph to illustrate the article.

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Edward Lee of the APS Education Department replies: It does appear in these photos as if the participant's fingers are pushing down on the spring during the measurement, which indeed would prevent the proper operation of the scale. However, the spring is actually *inside* a thin-walled, clear plastic tube, so the participant is holding the tube, not the spring.

Time of Flight Beats the Competition

It is gratifying to see William Stephens' 1946 invention of the time-of-flight mass spectrometer recognized by *APS News*[1]. However, one might extend the comment "...yet the technology is generally unknown among the educated public" to point out that it is also unknown to most physicists, in spite of its origin in nuclear and atomic physics. It may surprise your readers to know that there were almost 300 papers involving time-of-flight mass spectrometry (TOFMS) presented at the most recent annual conference of the American Society for Mass Spectrometry. They may also be surprised to learn that commercial versions of the most sophisticated TOFMS instruments (actually quadrupole/TOF hybrids), which cost ~0.5M$ each, are selling briskly at a rate exceeding 30 per month, primarily for the study of biomolecules. Such instruments have in fact become essential measuring tools in the emerging field of proteomics[2,3].

The author has done a good job of describing the present technology in the limited amount of space available, although he or she fails to mention the most recent advances (collision cooling and orthogonal injection). However, the final paragraph gives an impression that is considerably out of date and is seriously misleading. The reason for the present popularity of time-of-flight instruments has little to do with "lack of access [to] sophisticated magnetic sector machines", or "lower cost". Rather, it is because of the fundamental advantages of TOF instruments, particularly for the study of biomolecules. These include:

- Effectively unlimited *m/z* range;
- Almost complete absence of truncating elements such as slits, as well as "simultaneous" observation of the whole *m/z* range without scanning, thus giving greatly increased sensitivity for most applications;
- Considerable improvements in TOF mass resolving power R and mass accuracy ÿm. The commercial versions of the hybrid machines mentioned above have R >10,000, and $\triangle$m/m < 10ppm or $\triangle$m < 10mu.

For the above reasons, sales of magnetic sector machines for biological applications have plummeted almost to zero, and it has been difficult even to *give away* used four-sector spectrometers, million-dollar instruments that represented the state of the art only ten years ago.

Interested readers may wish to read personal accounts of these developments[4,5] or consult review articles that summarize some of the most recent progress[6-8].

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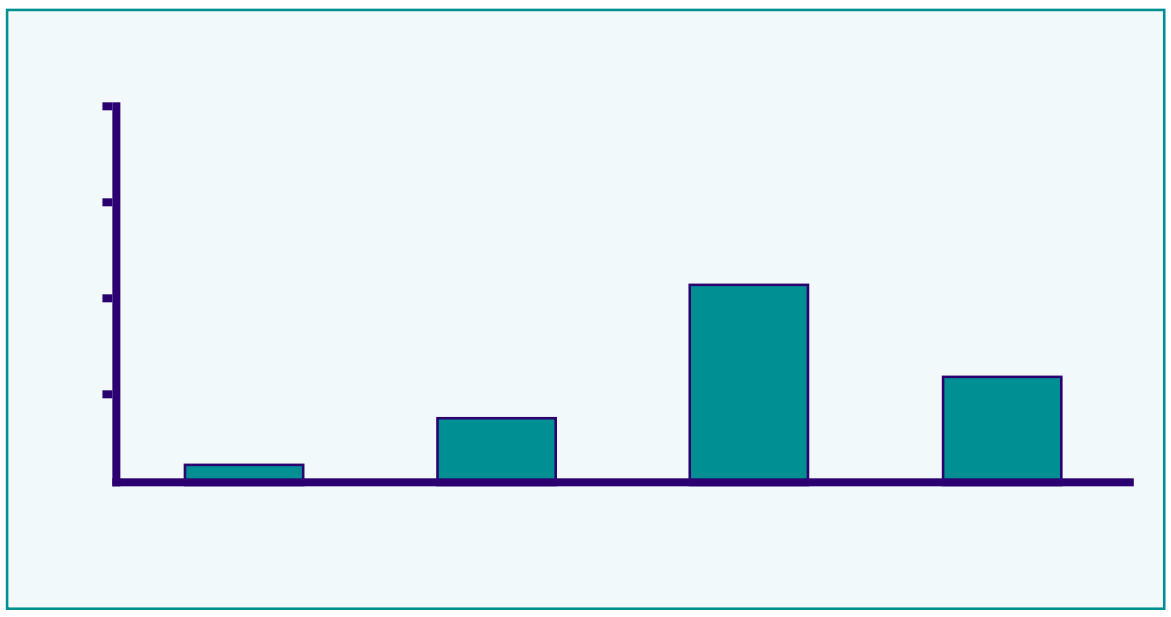
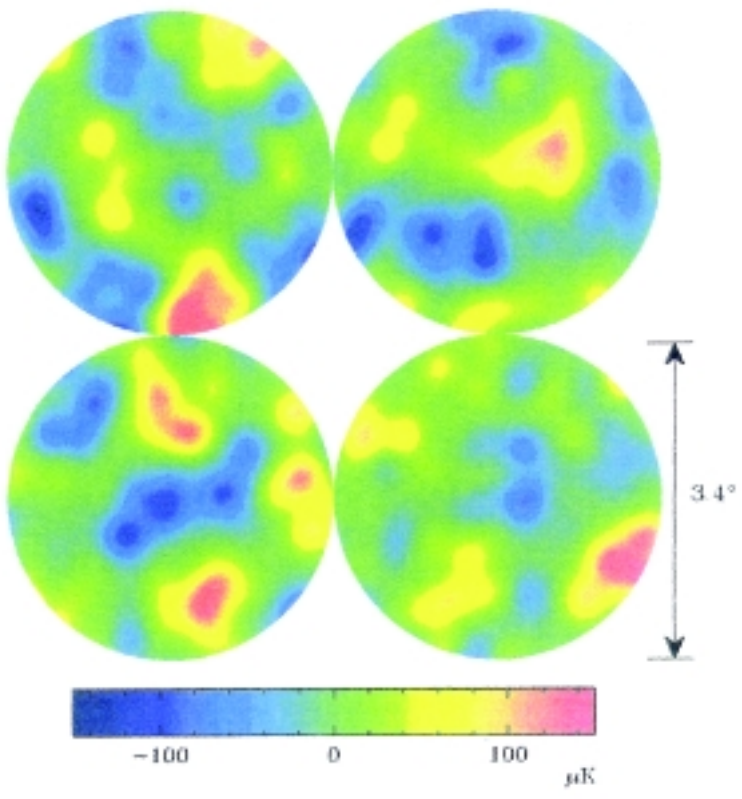
Which One is the Odd Fellow?

Photo courtesy of Martin Blume

Four APS Fellows spoke about electronic publication at the ICSU-UNESCO Conference in Paris in February. Fellows are, from left to right: Stephen Berry, Professor of Chemistry, U. of Chicago; Sir Roger Elliott, Oxford University and Chairman of ICSU Press-Conference Chair; Paul Ginsparg, Los Alamos National Laboratory, founder of the e-print archive; Martin Blume, APS Editor-in-Chief.

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