APS NEWS

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APS Selects 15 New Minority Scholarship Recipients

The APS has awarded Campaign-for-Physics-sponsored Corporate Minority Scholarships to 26 students who are majoring or planning to major in physics. Since its inception in 1980, the program has helped more than 265 minority students pursue physics degrees. Of the 53 applicants, 15 new scholars and 11 renewal scholars were selected. Each new scholarship consists of $2000, which may be renewed once, and each renewal scholarship consists of $3000.

New Corporate Scholar Ryan Dyer, a sophomore of Potawatomi and Choctaw descent, says he plans to major in physics because "Physics is the science that explains all other sciences," and hopes to eventually have a career as an experimental physicist. Simultaneously taking classes at Haskell Indian Nations University and the University of Kansas, Dyer has also found time to work on KU's Radio Ice Cerenkov Experiment (RICE), which seeks to study high-energy neutrinos in cosmic rays as they interact with Antarctic ice at the South Pole. According to David Besson, Dyer's research advisor, the experiment detects these rays through simple radio antennae frozen into the icecap. These antennae measure the radio pulse produced by neutrinos and enable scientists to reconstruct the trajectory and energy of the neutrino.

The potential of superstring theory to fulfill Einstein's dream of unifying the fundamental forces through extensions into higher dimensions of hyperspace is what cemented Corporate Scholar Jeremy Broadnax's desire to study physics, along with the possible existence of wormholes in the galaxy. He is currently attending Abilene Christian University in Texas, which over the last three years, has played a significant role in research collaborations at both Brookhaven and Fermilab to study the structure of the nucleon and its excited states. This year ACU will join the PHENIX collaboration at RHIC to study the gluon structure of the nucleon. These collaborations all provide valuable opportunities for Broadnax to gain hands-on experience in physics research in tandem with his studies.

Corporate Scholar Laura Lopez, who will be attending MIT this fall, recalls being introduced to the wonders of astronomy as a fifth grader on a school retreat to Wisconsin. "I was so fascinated by the vastness of space and the beauty of the sky that I began to read about topics in astronomy and stargaze on my own," she says, an interest which eventually led to the desire to understand the physical laws governing the behavior of celestial objects. She took an astronomy class at Harvard University during the summer of her junior year of high school, and also shadowed a physicist and electrical engineer on the job at Fermilab to learn about job possibilities in this area; she hopes to be an astrophysicist one day.

The APS scholarship program operates under the auspices of the APS Committee on Minorities in Physics, and is supported by funds allocated from the APS Campaign for Physics. Scholarships are awarded to African-American, Hispanic American and Native American students who are high school seniors, college freshmen or sophomores. The selection committee especially encourages applications from students enrolled in institutions with historically Black, Hispanic or Native American enrollment. After being selected, each scholar is matched with an accomplished physicist to act as a mentor. For applications for the 2001-2002 competition, contact Arlene Modeste Knowles at knowles@aps.org. Information can be found at http://www.aps.org/educ/com/index.

2000-2001 Minority Scholarship Recipients

New:
Elliot George Aguilar
David Hector Ayala
Jeremy Phillippe Broadnax
Rosa E. Cardenas
Joel Christopher Corbo
Amado Gabriel DeHoyas
Ryan Dyer
Stephen Andrew Elliff
Diana Grijalva
Laura Ann Lopez
Daniel Ricardo Lowe
William Francis Walker Merrick
Benjamin Isaac Rapoport
Richard Louis Rivero
Reginald Dillard Madison Smith

Renewed:
David Allen Algoso
Michael E. Boctor
Elizabeth Rose Fernandez
Xerxes Lopez-Yglesias
Adam Edward Orin
Elizabeth A. Robbins
Ricardo Enrique Rojas
Aaron Thaddeus Santos
Joao Da Silva Rego Sosa
Martha-Helene Stapleton
Natalia Toro

INSIDE THE BELTWAY

A Washington Analysis

Congressional Science Budget:

Still Time for Last-Minute Action

By Michael S. Lubell, APS Director of Public Affairs

"Alabama casts twenty-four votes for Underwood!" That's how the roll call began at the Democratic National Convention. The year was 1924, and Senator Oscar W. Underwood was Alabama's favorite son. For 102 ballots, the convention remained deadlocked, until John W. Davis of West Virginia emerged as the compromise candidate. Several months later, Davis went down to a resounding defeat at the hands of Calvin Coolidge.

Those were the days was when conventions meant something, when the results were in doubt, and families listened raptly to the radio to find out whom the parties would select as their standard bearers.

Today, the presidential candidates are chosen months before the conventions, making the quadrennial extravaganzas little more than infomercials, carefully crafted to set the stage for the upcoming elections. The same can be said for most of the activity in Washington in a presidential election year. Campaign politics and posturing swamp any wisp of policy making.

Consider what's been happening this year. High on the issues list for Harry and Louise, according to recent polls, are education, Social Security and Medicare. But the odds are nil that Congress and the White House will deal substantively with any of them.

Instead, both political parties are pressing their separate versions of a "Patient's Bill of Rights" and prescription drug reform, with little hope of agreement. And both are hyping tax cuts and defense spending, with Democrats arguing for smaller changes and Republicans pushing for bigger ones.

These are some of the wedge issues, which each party is seeking to turn to its own electoral benefit. And with both houses of Congress now up for grabs, each party is pursuing even the smallest potential advantage.

On such a political landscape, it's no surprise that science has slipped below the horizon. The good news, so far on Capitol Hill, is that neither party is gunning for it. The bad news is that neither party is touting it.

The budget process began last February with great expectations for science. The President submitted a request that featured major

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Dresselhaus Assumes DOE Post

Mildred S. Dresselhaus, Institute Professor of Electrical Engineering and Physics at MIT, and a former President of APS, was sworn in on August 7 as the Director of the Department of Energy's Office of Science. Administering the oath was DOE Secretary Bill Richardson, while the new Director's husband, Gene (center), looked on.

New Look for *APS News*

The American Physical Society has a new logo, and we liked it so much that we incorporated it into a new banner for *APS News*, which debuts at the top of this page.

We have made a subtler change as well, adopting a five-column format instead of the previous four columns.

The columns will be a bit narrower, but this will allow us to fit more stories on a given page.

We hope you approve, and we expect to hear from you if you don't (email: letters@aps.org).

—Alan Chodos, Editor

New Task Force Increases Awareness of Physicists with Disabilities

Most APS members who attend scientific meetings rarely give more than a passing thought to how they would cope with negotiating the multiple parallel sessions and access amenities if their mobility, sight, or hearing was impaired. To help rectify that oversight, the APS has formed a special task force to discuss ways in which the Society can better meet the needs of its disabled members, through increased awareness of the unique difficulties they face, as well as possible intersociety cooperation to facilitate the participation of disabled physicists at conferences and meetings.

Specifically, the Task Force on Physicists with Disabilities is charged with examining steps that the APS could take to help physicists with disabilities function effectively as professional scientists, and to recommend changes in Society policies and procedures that are needed to achieve this goal. In addition, it will also suggest actions that could be taken by others within the physicists community, and seek to publicize these suggestions widely. A final report will be prepared and presented to the

See TASK FORCE *on page 3*

HIGHLIGHTS

World's Top Science Students Gather for 2000 ISEF

Some of the nation's top high school physics students were included in this year's prize recipients at the annual Intel International Science and Engineering Fair (ISEF), part of Intel's multimillion dollar Innovation in Education initiative to help realize the possibilities of science and technology in education. Founded 51 years ago, ISEF is coordinated by Science Service, a nonprofit organization dedicated to advancing the understanding and appreciation of science among people of all ages through publications and educational programs. In conjunction with the American Association of Physics Teachers (AAPT), the APS contributed to the more than $2 million in scholarships and prizes that were awarded.

Jason Douglas, 18, from Cincinnati, OH, was one of three students to win top honors: a $40,000 Intel Young Scientist Scholarship. Young was recognized for a physics project in which he developed a theory to mathematically explain the energy in atoms, entitled "Discrete Electron Density Theory Finite Tensor Solutions to Schrödinger's Equation." Douglas was also one of five students to receive a high-performance mobile computer for Best Use of a Personal Computer Award.

Garrett Young of Branchburg, NJ, was one of two students to receive the Glenn T. Seaborg Nobel Prize Visit Award for his project entitled, "Isolating Plasma Species Initiating Internal Electrostatic Fields for Plasma Heating," in which he devised a method to efficiently increase the temperature of plasma for potential fusion energy applications. Along with his co-recipient, Young will travel to the Nobel prize ceremony in Stockholm, Sweden, this December.

In the "Best Of Category" awards, Michael Hasper of Tallahassee, FL, was honored in physics for his project entitled, "Violin Bridge: Will the Stradivarius Legend Continue?"

Each year the Intel ISEF brings together more than 1000 students from all 50 states and 40 nations to compete for scholarships, tuition grants, internships, scientific fields trips, and prizes. The APS sponsored prizes at ISEF for the first time in 1998. In addition to monetary awards, all winners received a one-year AAPT membership and one-year APS student membership, and a certificate from both societies.

For a complete list of the awards presented at the 2000 Intel ISEF, along with photographs, please see http://www.intel.com/education/isef.

BELTWAY, *from page 1*

increases for myriad research programs, most prominently, a boost of nearly 20% for NSF and 30% for DOE's Basic Energy Sciences.

But within days, congressional budgeteers sent out storm warnings. The President, they noted, by requesting more than $622 billion for discretionary, was breaking the budget cap of $573 billion set in 1997. Unacceptable, irresponsible and illegal, they said.

By the time the Budget Resolutions cleared both Houses in April, Congress had pared the spending plan back to slightly less than $605 billion, still above the cap, but who's to notice.

Appropriators in both houses were steaming. During the process, Senate Chairman Ted Stevens (R-AK) and House Chairman Bill Young (R-FL) had warned the Budget Committees that they would have trouble writing bills with such a constraint. To no avail.

With the economy booming, polls consistently showed that the public had little appetite for cutting spending, if it meant giving up program favorites. What to do?

Still smarting from last year's budget showdown with the White House, Republican leaders vowed to get as many of the thirteen spending bills signed into law as they could. Early on, they targeted Defense, Military Construction, Agriculture, Interior, Transportation and the Legislative Branch.

To assure passage, without risking a presidential veto, they boosted their allocations by short-changing Labor-HHS, which includes NIH, and VA-HUD, which includes NSF, NASA. Science was caught in an allocation squeeze.

When Congress passes Labor-HHS and VA-HUD, it will be largely along party lines. However, off the record, Republican appropriators say they hope that the President will veto both bills. They want money added, but only in the final negotiations, to minimize heat from the far right. They will probably get their wish.

The Energy and Water Bill, which funds most of DOE, is another matter. The budget for Office of Science is in deep trouble. But DOE's stock on Capitol Hill is so low, that Democratic leaders reportedly told the White House to expect an override, if he wields his veto pen. Therefore, no matter how bad the bill looks, the President will swallow hard and sign.

With that prospect, the end game for DOE is the House-Senate conference, scheduled for early September, where differences over spending for defense programs and water projects will be resolved. The inside word is that GOP leaders will add enough money to get agreement. If they heed Senate Appropriations Subcommittee Chairman Pete V. Domenici's (R-NM) pleas, they could include funds to cover the impending cuts to research programs.

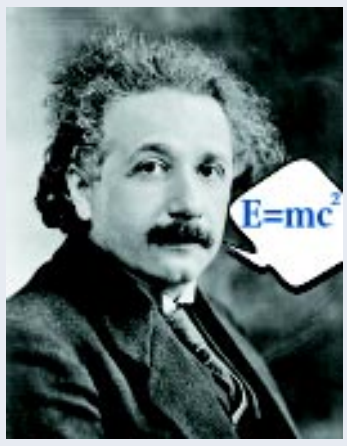
Right now, the science numbers look pretty anemic. But it ain't over until the fat lady sings. Between now and the beginning of September, science advocates still have a shot at making her album a platinum winner – provided they join in with their own chorus.

If you want to take action on science funding, while there's still time…

http://www.aps.org/public_affairs/action/

This Month in Physics History

September 1905: Einstein's Most Famous Formula



Although several renowned scientists published papers bearing on the theory of special relativity prior to 1900 — including Maxwell, Lorentz and Henri Poincaré — 1905 is generally recognized as the birth year of special relativity. That year saw publication of two important papers on the subject, by an obscure patent clerk named Albert Einstein.

Having failed to obtain a university post teaching mathematics and physics, Einstein was working in the patent office in Bern, Switzerland, when he completed an astonishing range of theoretical physics publications, all written in his spare time without the benefit of close contact with scientific literature or colleagues.

In June, 1905, Einstein proposed what we know today as the special theory of relativity. He based his theory on a reinterpretation of the classical principle of relativity, which postulates that the laws of physics must have the same form in any frame of reference. The theory also assumed that the speed of light remained constant in all frames of reference, as required by Maxwell's theory.

But it was later that year, in a paper received by the Annalen der Physik on September 27, applying his equations to study the motion of a body, that Einstein showed that mass and energy were equivalent, a startling new insight he expressed in a simple formula that became synonymous with his name: $E=mc^2$. However, full confirmation of his theory was slow in coming. It was not until 1933, in Paris, when Irène and Frédéric Joliot-Curie took a photograph showing the conversion of energy into mass, in which a quantum of light carries energy up from beneath and converts into mass in the middle, creating two particles which curve away from each other.

Birthdays for August and September:

August 4	William R. Hamilton (1805)
August 8	Paul Dirac (1902)/E.O. Lawrence (1901)
August 12	Erwin Schödinger (1887)
August 30	Ernest Rutherford (1871)
September 22	Michael Faraday (1791)
September 29	Enrico Fermi (1901)

DPP/ICPP Sorters Meeting

On July 27-28, 2000, participants from the APS Division of Plasma Physics and the International Congress on Plasma Physics joined forces in College Park, MD to organize the 1,763 abstracts for the combined 2000 Meeting to be held October 23 - 27 in Quebec City, Canada.

Photo courtesy of Tony Taylor

Left to right: Saralyn Stewart, DPP Administrator; Tony Taylor, General Atomics; Régean Boivin, MIT; Allen Boozer, Columbia University and Program Chair; Keith Matzen, Sandia National Lab.

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Physicist/Mountaineer Summits World's Highest Peak

Physicists often dream of making an indelible mark on their field with brilliant, groundbreaking research, but Francis Slakey, the APS associate director of public affairs and an adjunct physics professor at Georgetown University, recently made a different kind of mark when he summited the world's highest mountain peak in May: Mount Everest, with an elevation of 29,035 feet. Slakey made the excursion as part of the Everest Environmental Expedition, a not-for-profit climbing team whose mission, apart from the climb itself, was to make a significant cleanup of discarded oxygen bottles and other debris that has accumulated at the high base camps over the years since Sir Edmund Hillary and Tenzing Norgay first attained the summit back in 1953.

Unlike the many guided commercial expeditions that cater to the whims of wealthy and frequently inexperienced climbers, the cleanup expedition was unguided, and comprised of highly experienced climbers with decades of experience between them. [Slakey himself has been an avid rock and mountain climber for the last 10 years, having climbed the highest peaks in Europe, Africa, and the Americas.] Jamling Tenzing Norgay, star of the popular IMAX Everest film, served as the official trekking team leader, while Apa Sherpa, who holds the world record for most summits (11) of Everest, served as lead Sherpa.

The expedition's cleanup efforts focused on the climbing route along the Southeast Ridge, used by Hillary and the most popular path to the summit. To help climbers acclimatize to the extreme gains in elevation, four base camps — in addition to the Everest Base Camp located on the Khumbu Glacier at 17,600 feet — are set up at key points along the route to allow the team to climb and sleep progressively higher on the mountain. The cleanup focused on Base Camp II, at 21,300 feet, which is littered with discarded tents, medical waste, plastic packaging and tin cans, and Base Camp III, perched precariously on the Lhotse Face at 24,000 feet, which is littered with shredded tents and other climbing equipment abandoned by previous expeditions.

However, it is Camp IV, at 26,000 feet, that has the dubious distinction of being dubbed "the world's highest garbage dump," strewn with as many as 1,000 empty oxygen bottles, spent fuel canisters, batteries, shredded tents and other discarded equipment. "Because of the harsh conditions, climbers scramble to get off the mountain, and this often means they leave equipment behind," says Slakey. Two previous cleanup expeditions in 1995 and 1998 recovered over 300 oxygen bottles and removed more than a ton of debris from the mountain. This expedition's cleanup crew — comprised primarily of Sherpas — recovered nearly 700 oxygen bottles from the South Col at Camp IV, and removed a half ton of trash from Camp II.

Prior to the actual climb, Slakey and many of his fellow team members met with numerous religious leaders in this

predominantly Buddhist region for blessings and charms to ensure the climbers' safety, including a memorable audience with the "Most Holy Rimpoche of the Khumbu," the Nepalese equivalent of the Dalai Lama. Despite being an avowed atheist, Slakey took advantage of the opportunity to ask the Rimpoche for more personal words of wisdom to sustain him on the climb. His request was duly translated, and the Rimpoche responded: I'll get back to you. "He gave me the brush off," says Slakey, expecting to hear nothing further from the holy man.

But later that afternoon, a young messenger delivered Slakey an amulet inscribed in Tibetan characters — a tremendous honor, according to the natives at base camp. The catch: the inscription was written in an ancient form of Tibetan, and no living person can translate it, including the Rimpoche himself. "So I've got the meaning of life in my hand, and no one has a clue what it says," says Slakey.

Mount Everest has been the subject of increased controversy and debate since the publication of "Into Thin Air," journalist Jon Krakauer's account of the 1996 season that claimed the lives of twelve climbers. The mountain's harsh conditions proved no less dangerous this season — Nepalese officials identified it as the worst weather on record. Many climbers abandoned their ascent due to frostbite, intestinal bugs, altitude sickness, and the like. But after weeks of unstable weather and a highly unpredictable jet stream with winds of 150 MPH at the peak, Slakey and two of his fellow team members grabbed the last possible window of opportunity to make the final push for the summit. The gamble paid off: on May 24, at 10:51am, Slakey stood at the top of the world, albeit buffeted by powerful winds, before beginning the slow descent back to Base Camp IV.

After the hardships of their seven weeks on the slopes of Everest, the expedition unwound at Namche Bazar, a village about four days' trek from Everest Base Camp, where the climbers dined on yak steaks and local hooch, and celebrated to the strains of Santana and the Red Hot Chili Peppers into the wee hours of the morning. Just prior to departing for home via Kathmandu, the team members received a statement of appreciation for their cleanup efforts from the Sagarmatha Pollution Control Committee. In addition, an onsite documentary crew filmed more than 100 hours of footage during the course of the expedition that will eventually be edited down and condensed into a one-hour television special, to air later this year.

Slakey is once again safely ensconced in the Washington office, with just the merest hint of frostbite, and has turned his attention from climbing to such policy issues as ballistic missile defense and climate change. Apart from the immense personal satisfaction of having accomplished a feat that few people on the planet will even have the opportunity to attempt, Slakey returned with a more concrete memento: one of the oxygen bottles used by Sir Edmund Hillary on his historic first ascent in 1953, identifiable by its serial number.

Stranger Than Fiction: The Novelization of Physics

A basic knowledge and understanding of scientific principles is more important than ever in our technologically based society. Yet recent statistics from the AIP indicate that only 28% of high school graduates currently take any physics classes, and only 3% take advanced physics courses. One useful method of engaging student interest in science is through fictional novels and films, which can educate as well as entertain. Such formats also offer a primary opportunity to offset some of the prevailing negative stereotypes of scientists in general, and physicists in particular, according to Aviva Brecher, chair of the APS Forum on Physics and Society, who organized a special session on the subject at the APS April meeting in Long Beach. The session featured two PhD physicists who moonlight as authors of science fiction and mystery novels, respectively.

Gregory Benford, a professor of physics at the University of California, Irvine, has written 20 science fiction novels over the last 30 years, including *The Jupiter Project* and *Against Infinity*, and is a two-time winner of the prestigious Nebula Award. In the last few years, his focus has shifted to Hollywood, where he served as screenwriter for the 8-part TV series "Galactic Odyssey," which describes modern physics and astronomy from the perspective of the evolution of the galaxy. His most recent novel is *Eater*, the plot of which he summarizes as being "about the entrance of a black hole in the solar system with completely unforeseen consequences."

"A certain childlike devotion to the truth is very useful; you should never lose your sense of wonder."

Benford frequently attempts to write about the unknown frontier of science as a means of imparting something of the thrill of scientific discovery to the general reader, even if it means extending a little beyond the boundaries of what is currently known about the universe. "You are enlisting the devices of realism in the cause of the fantastic, because every new discovery is bringing into the human compass a very new thing about the universe, which is genuinely very strange," he says. "A certain childlike devotion to the truth is very useful; you should never lose your sense of wonder."

Now teaching logic and creative writing at Golden Gate University, Camille Minichino spent many years as a researcher at Lawrence Livermore National Laboratory before embarking on a literary career as a writer of mystery novels. Her books feature a female physicist who lives above a funeral home ("this gives her access to bodies") and solves murders on the side, and are frequently set in Revere Beach, Massachusetts, where Minichino grew up. The novels, four of which have been published to date, are a series based on the periodic table of elements, with titles such as *The Hydrogen Murder* and *The Beryllium Murder*.

Minichino says her primary goal in beginning the series was to introduce general readers to real-world physicists, "ones who don't want to take over the world, don't leave the house with two different colored socks on, and aren't social misfits." Her character "sees the world in images of physics," and the novels are peppered with allusions to *Physics Today* and famous physicists.

Questions posed to the authors from the audience focused a great deal on how to break into writing fiction with a scientific theme. Minichino says she struggled, as an unknown author, to find a publisher for her first novel, and decided to sign on with a small publisher with minimal distribution and very little in the way of an advance to gain experience and exposure. "I had a lot of elements to cover, and I needed

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TASK FORCE, *from page 1*

APS Executive Board and Council within a year of the task force's appointment.

The idea for a task force came about through a conversation with Pui-Kuen Yeung (Georgia Tech), an active APS member who is hearing impaired, according to APS Executive Officer Judy Franz, who is currently acting as chair. Yeung was concerned about the lack of access support available at APS and other scientific meetings for scientists with hearing, sight or mobility problems, such as electronic hearing aids and non-carpeted ramps to access speaker platforms. He is one of the members of the fledgling task force, along with Noah Hershkowitz of the University of Wisconsin, who suffers from multiple sclerosis and is wheelchair-bound. The other members of the APS Task Force on Physicists with Disabilities are Ron Armale (Cypress College); Charles Siegal (Munger, Tolles and Olson); J.A. Gardner (Oregon State University).

The various difficulties encountered by disabled members at scientific meetings was the focus of the task force's first meeting by conference call, and Hershkowitz points out that many of those he routinely encounters could be alleviated simply by increased awareness of the presence of disabled physicists. For instance, speakers' platforms are usually raised, with steps for access, posing a problem for those confined to wheelchairs, like Hershkowitz. Some hotels have meeting rooms located at mezzanine levels with no elevator access, forcing those in wheelchairs to gain access through kitchens, back stairways, or service elevators. (Once Hershkowitz's hotel escort got lost attempting to navigate the maze of back passageways.)

"We all need to be a bit more aware of these issues, as well as more empathetic and helpful towards our colleagues who struggle with disabilities," says Franz, adding that input and commentary from the APS membership as a whole on this issue is welcomed and encouraged. And teaming up with other scientific societies could help achieve enough economic clout to cause hotels to pay more attention to the special needs of disabled guests. "Obviously we don't have that many disabled members, but if we combined those from all the societies together, we might reach a sufficient critical mass to make a difference," she adds.

LETTERS

A Slip of the Pen

In his insightful column, Inside the Beltway, June 2000 issue of *APS News*, Michael Lubell suggests that the Republican leaders of Congress will have four choices if faced with a Presidential budget veto — and then goes on to list only three of them. This harmless slip of the pen reminds me of the humorous observation of a former colleague that there are three kinds of physicists: those who can do math and those who can't.

John G Wolodzko
Princeton, New Jersey

"Wrong-Way" Corrigan a Misnomer

Marc Abraham's back-page summary of the top twenty screw-ups for the 20th Century (*APS News*, May 2000) mentions Douglas Corrigan twice. Neither statement is correct. In spite of the myth which surrounds this story, Corrigan's trans-Atlantic flight to Ireland had been disapproved by the U.S. Department of Commerce as unsafe. In those days, a flight plan consisted of getting permission from a government inspector. So he requested instead to fly from Long Beach, California non-stop to Roosevelt Field in New York where he would re-fuel and supposedly return to Long Beach. This was approved, and he departed.

After landing at Roosevelt Field, however, he then proceeded on to his actual destination. To avoid the Department of Commerce inspector, he switched airports to Floyd Bennett Field and took off for Ireland under the scrutiny of a different unsuspecting inspector. Corrigan made the trans-Atlantic flight safely. A fair discussion of this episode can be found in C.R. Roseberry's *The Challenging Skies* (Doubleday, 1966), Ch. 36, "The Great Lindbergh Derby."

If there was a screw-up, it was probably the manner in which the U.S. Government had this man's airplane seized in Ireland so that he could not fly it back to the United States. Contrary to Abraham's remarks, it was the flight plan, not the flight, that "took off (west) for California."

Thomas L. Wilson
NASA, Houston, Texas

Earth Science Can't Ignore Space

In the June 2000 issue of *APS News*, Robert F. Cahalan objected to the inclusion of subjects about solar dynamics and super nova remnants in the subject of Earth Science and Geophysics.

The Earth's environment does not end at 100 km above the surface. Processes that occur in space can have just as dramatic an effect on the Earth's environment as process that occur on the surface. The connection between the Earth and the Sun is very strong, exemplified by the increase in auroral activity in conjunction with the increase in solar activity. The conditions in the Earth's ionosphere are not only directly connected to the conditions in the Earth's magnetosphere, but the ionosphere's very existence is due to the constant bombardment of the Earth by high energy particles from the Sun and other sources outside our solar system. And the very existence of life on Earth is due to the generation of heavy elements by Supernova.

While I agree that important physics is occurring in the study of the processes that occur on or near the Earth's surface, one cannot ignore the effect on the Earth's environment caused by the Sun and its celestial neighbors.

Erika Harnett
University of Washington

Bias Against Women in Physics Starts Early

I find the discussion in *APS News* about discrimination against women in physics astonishingly superficial. One must look back much earlier than university or graduate school to understand the problem. The striking fact that leads in this direction is the enormous preponderance of successful American women in nuclear and particle physics who were born outside the U.S. Maria Mayer, C.S. Wu. Gertrude Scharf-Goldhaber, Fay Ajzenberg-Selove, Noemi Koller, Sulamith Goldhaber, Juliette Lee-Franzini, Sau Lan Wu, Inga Karliner, etc. Where are the American-born women physicists of comparable stature? There may be a few exceptions, but the asymmetry is still striking.

Subtle prejudices and sociological factors in American culture seem to already be crucial at high school and perhaps even at elementary school levels. Some of the foreign-born women physicists confirm this. One who immigrated from Europe to America when she was in high school said that she was considered peculiar, because "girls were not supposed to be smart." Another said that the best road to success for a woman physicist would be to start her education in Europe and move to the U.S. at a later point in her career. Girls who wanted to be physicists had a much easier time in Europe until they hit a point in the academic ladder where there was real discrimination. At that point they could do much better in the U.S.

It is also true that the ratio of women to men in physics is much higher in France, Italy and Poland than in the U.S. Some of my European colleagues have pointed out that European women seem to do better in Catholic countries than in Protestant ones and immediately present theories for this: Marie Sklodowska Curie as a role model, the importance of the Virgin Mary in the culture, etc.

All of this indicates that while discrimination at the top levels may certainly be present, the basic causes for the asymmetry go much deeper.

Harry J. Lipkin
Weizmann Institute of Science; Rehovot, Israel

Drug Czar Nominated for Flying Pig Award

I am growing weary of the never-ending war against psychics. I think there is a more worthy and socially important target for the war against American ignorance and superstition, namely the federal marijuana policy that equates marijuana with heroin as a substance too dangerously addictive to be medically useful, a position that has been officially debunked by the Institute of Medicine report last year.

The Flying Pig trophy should go to Bill Clinton's drug czar General Barry McCaffrey for being an aggressive promoter of the supernatural evil powers being attributed to this plant and for having ignored, distorted or lied about every major and minor scientific report or publication issued in the last ten years that has undermined the Clinton administration's position on this issue.

Patricia Schwarz
Pasadena, California

Responses to Goodstein's Revolutionary Views on Physics Education

What is crucially missing from David Goodstein's call for a "revolution in physics education" is incentive. The present system amply rewards professors who seldom teach below the graduate level, if that. Pursuit of research grants and the graduate students to man their projects is by now a deeply embedded way of life.

I hesitate to suggest this, but the most direct method of freeing this resource to address Goodstein's agenda, and of re-ordering priorities among faculty at all levels, is to end Federal funding of physics research by teaching faculty. Short of implementing such a drastic solution, elementary thermodynamics tells us the equilibrium state that this system will seek — despite the good intentions of a few errant molecules.

William F. Hall
Thousand Oaks, California

David Goodstein has said things that needed saying and said them very well. The whole concept of physics teaching has been aimed at producing scientists, not people who understand and appreciate physics but are not prepared to practice it. Goodstein feels that the needed transformation in curricula and approach cannot be done by physicists alone. I agree completely. Some kind of collaboration between talented animators, teachers and physicists may have a chance. It is going to require time to change attitudes and money to provide the materials. I hope the NSF in combination with the Department of Education can be persuaded to start such a program.

I have felt the same things that Goodstein presents so clearly for at least 25 years, but have not had the platform to have anyone listen. I sincerely hope that Goodstein's words will enlist enough support in our community to start these efforts on their way.

Robert M. Hill
SRI International

I obtained my undergraduate and graduate degrees in the Netherlands. This seems to be an educational background that has several of the components that David Goodstein proposes in his commentary. Everyone in high school was required to have at least a few years of physics and my high school teachers had a PhD or equivalent. In addition, I started out as a physics major from day one, with hardly any courses outside the sciences. This gave me a head start compared to freshmen in the U.S. system.

However, after five years as a faculty member in physics at an engineering school, I can also see the disadvantages of the Dutch system, making physics even less accessible at the university level. One of the other differences I see between the two systems is the much larger participation of women in physics in the U.S. At AAPT meetings, I get the impression that a larger fraction of our female graduates end up in educational positions, preparing the next generation of college and university students.

As a first step into changing our society, I propose we welcome back these high school and undergraduate institution teachers and show our appreciation for the vital role they play. These people can be invaluable resources to show research university professors how to teach the masses rather than the elite.

As a second step, I think it is time that physicists start to take credit for the innovations that make our culture technologically advanced. As an example, we teach E&M theory in our introductory courses, but we don't show how a microwave works and how to determine 'c' from a tray of puffed marshmallows (a high school demo). Physics is everywhere, but you seem to need to be a physicist to notice that.

Finally, I think we need to get out of our ivory towers more and talk with ordinary people about what we spend their tax money on. It is arrogant and incorrect to assume that our research and interests cannot be made accessible to the masses. Astronomers have an excellent track record in this respect, and I believe that astronomy is by no means easier than other physics topics. The most difficult aspect of this attitude change will be to learn to listen and take our audience seriously, even if they don't 'know physics.'

Mariet Hofstee
Golden, Colorado

In my mind, the June 2000 "back page" article by David Goodstein is right on the money. In my experience, people are eager to know and understand physics: its conceptual content. They are not eager to learn our tools. These don't need to go together. QED by Feynman is an advanced example of communicating the conceptual content of quantum field theory with a bare bones of math tools. And witness the immense success of *A Brief History of Time* and Brian Greene's *The Elegant Universe*.

I, for one, totally agree that it is a major failing of our profession that we have not sought to seriously share the fruits of our labors with everyone. As David Goodsein suggests, they can be placed in the curriculum where one now has humanities. It is a major change in human perception to "make your own" the understanding of the way we tick and our evolution from the Big Bang. It could be expected to have a dramatic impact on our relationship with ourselves and each other. A reduction in superstition is only a beginning.

John Irwin
Simon Fraser University, Burnaby, Canada

I couldn't agree more with David Goodstein's opinion in regards to our physics education. I was trained as a physicist but employed by a chemical specialty company (a materials company). Over the years, I feel the same way as Goodstein, that our college physics education produces physicists as the clones of professors. Worse yet, the publication *Physics Today*, which symbolizes the physics community, is written only for pure physicists such as the college professors. The articles are nearly unreadable for a person who is foreign to the field. They forget that physics is something that everybody has to deal with everyday. In contrast, the American Chemical Society does a much better job in terms of publicizing themselves. In their front door publication, *Chemical & Engineering News*, the articles are more public friendly. One does not need special training to follow the content.

Chih Chang
Hartsdale, New York

LETTERS, *continued*

Is Hydrogen Hazardous? Two Views…

I was both pleased and dismayed to see the little article in the July 2000 *APS News* concerning the role of hydrogen in the Hindenburg explosion. I am pleased because the article makes it clear that the material the ship was made of burned well without need for an accelerant (obvious to most people familiar with fire that have watched the video). I am dismayed because although hydrogen was not the only culprit in the Hindenburg disaster it was a major player. This is not made clear in the article.

Hydrogen is a wonderful fuel. It has the highest energy density of all chemical fuels. It is not significantly more dangerous than gasoline if handled properly, but it is VERY HAZARDOUS!!

I regularly do demonstrations of hydrogen explosions in the introductory chemistry courses I teach. Balloons that have just hydrogen in them do not burn with the classic hot blue flame, but with a yellow flame because they are oxygen starved and do not get as hot. Thus the arguments about the amount of visible light emitted do not exonerate the hydrogen. Hydrogen was definitely a fuel for the fire, but because of the amount in the dirigible much of it had to mix with the air before there was oxygen available for combustion. It is also likely that a hydrogen leak into a region where there was a spark and some oxygen started the fire.

Jonathan Gutow
University of Wisconsin, Oshkosh

Your welcome July correction could even have been headlined "Hydrogen Fire Aboard Hindenburg Probably Killed Nobody." Dr. Addison Bain's splendid research indicates that 35 people — 22 of 61 crew and 13 of 36 passengers — were killed by a diesel-oil-and-canopy fire, plus one fatality on the ground. (Perhaps some jumping out might also have occurred.) However, as the clear, low-emissivity hydrogen flames swirled above the flaming canopy, 41 people rode the dirigible to earth and survived.

The fire in the cotton canopy substrate coated with an aluminized cellulose acetate butyrate dopant — indeed a cousin to rocket fuel — was almost certainly triggered by electrostatic discharge as the craft was improperly flown near a thunderstorm. The hydrogen then contributed to the conflagration, but its combustion probably didn't kill anyone, and the envelope would almost certainly have ignited and burned without it. Nonetheless, the persistent Hindenburg mythology remains an obstacle to public understanding that hydrogen, while hazardous like any fuel, can be substantially safer than gasoline — mainly because it's so buoyant, diffusive, and largely free of radiant heat than can cause burns at a distance.

Amory B. Lovins
Rocky Mountain Institute

Y2K Bug Really a Screw-Up

Hugh Porter's assertion that "most 'turn-of-the-century readers' would agree that (the Y2K computer bug) didn't really have any effect at all" is specious. It cost the world $500 billion to successfully fix this bug that computer scientists have known about since the 1960s because it wasn't seriously addressed until the 1990s. It deserves to be listed among the "Top Twenty Technological Screw-ups of the 20th Century."

Richard Klein
Falls Church, Virginia

VIEWPOINT…

End the Embargo

Something interesting is happening out there in the solar system, but I'm not allowed to tell you what it is. The scientists who made the discovery have submitted a paper on the subject to *Nature*, and that august journal has a strict embargo policy forbidding any public release of the information before it appears in print in their magazine. Were I to reveal what I know, *Nature* would reject the paper automatically, irrespective of its scientific merits.

Both *Science* and *Nature*, the twin titans of periodical scientific publication, adhere to this absolutist position, which has been the occasion for controversy in the past. For example, in 1996 at a joint meeting of the APS and AAPT, a speaker had to decline the opportunity to answer some questions about his work at a press conference immediately after his talk, because the work was also described in a paper that had been submitted to *Science*. Phillip F. Schewe of AIP's Public Information Division commented at the time that this "amounts to an act of extortion: forego a press conference or possibly forfeit your paper in *Science*." There are many other examples of bizarre consequences of these embargoes, some of which you can read about in a series of articles in (of all places) *Science*, vol. 282, pp. 860-869 (1998).

The policy of the *Physical Review* and *Physical Review Letters*, on the other hand, has long been the opposite of that of *Science* and *Nature*. David Lazarus, then editor-in-chief of the APS, wrote in a 1984 editorial in PRL: "It is the expressed policy of the Society to encourage widespread and timely dissemination of the results of research in physics to the public at large, particularly in view of the fact that much research is funded by public agencies. Accordingly, newspaper, television, and radio accounts of research—even if prepared by the research team as news releases—are not to be counted as inhibitions against acceptance of papers for our journals."

This policy is even more relevant today than when Lazarus enunciated it. One of the important lessons of the intervening years is how essential it is for scientists to communicate what they do to the general public, a process that both improves the health of the scientific enterprise and enriches the life of the nation. In addition to its flexible policy on research publication, the APS is actively promoting public awareness of physics through its office of Public Information, the activities of its media coordinator, and its new web site (soon to be launched) aimed at bringing the importance and excitement of physics to the public.

In this context, the embargo imposed by *Science* and *Nature* is clearly outmoded and counterproductive. But in the absence of meaningful opposition, the editors of these journals will continue to flex their muscles in the uncritical belief that the embargo enhances the value of what they publish. It is time for the scientific community to inform them otherwise. —*Alan Chodos*

DPF Honors French-Vietnamese Physicist

In July, the APS Division of Particles and Fields presented a certificate of appreciation to Jean Trân Thânh Vân of the Laboratoire de Physique Théorique et Hautes Energies de l'Université de Paris XI in Orsay France, in recognition of his many valuable contributions, both to particle physics and to international understanding. Presented to Vân during a ceremony in Paris, the citation praised the physicist for "35 years of the Rencontres de Moriond, which since 1966 have promoted lively discourse and warm friendship among scientists from the entire world;" recognized "the intellectual and human values that animate the Recontres de Blois, founded in 1989;" and expressed the DPF's admiration for "the visionary devotion that inspired the Recontres du Vietnam in 1995." The citation concluded, "Our congratulations and heartfelt thanks for his creative and sustained service to particle physics, international understanding and the humane aspects of science."

Photo courtesy of Chris Quigg

Jean Trân Thânh Vân

Reader Questions Phys. Rev. Standards

I am struck by a combination of statistics which were published in the May 2000 issue of *APS News*. The number of pages published annually in PR and PRL have now reached nearly a hundred thousand, and an astounding twelve thousand abstracts were presented at APS meetings. This could be construed as a positive development if the number of American physics researchers, undergraduate majors, graduate students, or government funded programs were growing at a similar rate, but all of these measures are comparatively flat. Although the globalization of physics helps explain some of the increase, the majority has to be attributed to greater "productivity" from existing researchers. Based on numbers given in the issue, the acceptance rate of the flagship APS journals is now well over 50%.

Surely the quality of the articles submitted cannot be increasing so dramatically. Has sympathy to the maxim "publish or perish" caused editors to accept papers of increasingly narrow scope? Do researchers increasingly feel compelled to try the most prominent journals first, rather than those targeted to a more specific audience? Is concern for showing gains in a field which has been stagnant in size, influence, and finances for the past thirty years driving the explosive increase in the number of papers and presentations? I don't know the answer to these questions. But whatever the reason, the sharp rise in page count and number of abstracts implies either a lowering of standards or the publication of increasingly specialized material.

Every discipline needs forums where major advances of general interest to its practitioners can be described. PRL, PR, and the APS meetings should serve this role, promoting "the advancement and diffusion of physics" by highlighting the most significant work in the field, leaving developments of a more incremental nature to more specialized journals and conferences. If APS decides that its journals and conferences should publish all discoveries which advance physics, even if the material is incremental and highly specialized, this crucial role will inevitably go unserved.

Scott Calvin
Hunter College

Editor-in-Chief Martin Blume Replies:

Dr. Calvin's letter makes a number of points that can be illuminated by a further perusal of the statistics of our publications. *Figure 1* shows the total number of manuscripts submitted to our journals for each year since 1983. The yearly numbers are broken down according to the part of the world from which the manuscripts originated: blue for the United States, red for western Europe, and gold for the rest of the world. The Figure shows that most of the growth of *Physical Review* has come from papers submitted from outside the United States. Indeed, since 1993, there has even been a decrease in U.S. papers. I hesitate to give an interpretation to these statistics, as most of the explanations I have come up with in the past have, on closer examination, turned out to be wrong. That said, I venture that the strong reputation of our journals, together with an increased ease of electronic communication, has led researchers around the world to submit their best work to us. Another factor could be the revolt by librarians around the world against price increases by publishers. The APS journals have been among the least costly, and this, coupled with the quality of the work presented, has increased their reputation.

Figure 2 shows a measure of the yearly acceptance rate for submitted papers. Contrary to Dr. Calvin's hypothesis this rate has declined slightly, from about 65% to below 60% in the last decade, and is well below the 75% rate in the good old days of the sixties. This varies across the different sections of *Physical Review* and is, as expected, lowest for *Physical Review Letters*, where it stands at about 40%. I don't believe that these statistics support Dr. Calvin's explanations for the May 2000 *APS News* figures.

Editor's Note: With regard to the question about meetings, it has long been APS policy that any member is entitled to submit an abstract and be scheduled for a contributed talk. The organizers decide when and where the talk will be given, but not whether.

Figure 1: Physical Review and Physical Review Letters Submissions

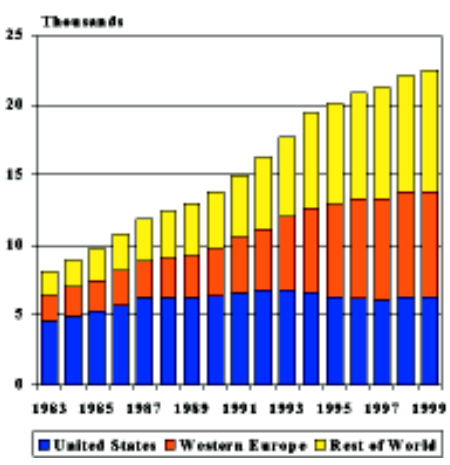
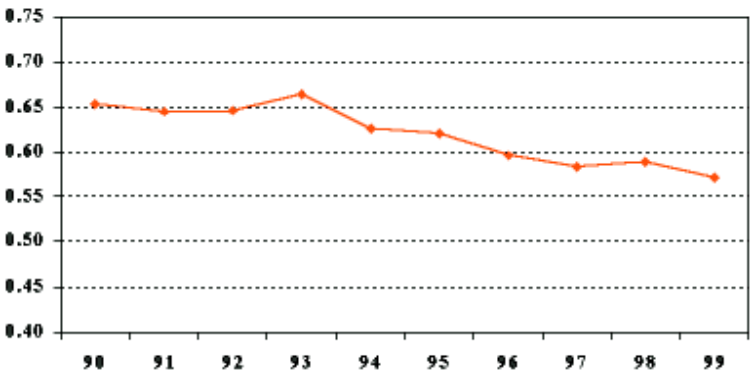


Figure 2: Physical Review and Physical Review Letters Published/Received



INTERNATIONAL DESK

APS Fosters Closer Ties with Physicists in Cuba and Africa

The APS has been taking steps in recent months to form closer ties with physics communities in Cuba and various African nations. In April, Victor Fajer Avila, president of the Cuban Physical Society (CPS), attended the APS April Meeting in Long Beach, CA, to meet with society officers on a proposed exchange program between Cuba and the U.S. A standard reciprocal membership agreement was signed as a result of Fajer's visit. APS hopes to initiate an APS-CPS exchange program in 2001 and is currently seeking funds for it. Both CPS and APS will compile lists of senior physicists willing to participate. Joint sponsorship of pan-American physics workshops in Cuba were also discussed as a way to further facilitate scientific exchange.

In June, Irving Lerch, APS director of international affairs, and Bernd Crasemann, chair of the APS Committee on International Scientific Affairs (CISA), participated in workshops on physics teaching and engineering, and applied physics in engineering, held in Havana in June at the Superior Politechnical Institute. The Cuban physicists who met with the APS representatives reported that the largest immediate need was for access to scientific journals; improving Internet access would enable more Cuban physicists to access journals electronically, and in the meantime APS provided CD-ROMs for the 1998-1999 issues of *Physical Review* and *Reviews of Modern Physics*.

Their trip also included a visit with Rolando Perez Alvarez of the University of Havana, who chairs the Cuban National Committee to IUPAP. According to Perez, there are about 2,000 physicists in Cuba at all educational levels and in all areas of employment. However, only about 1,000 of the country's physicists are engaged in research, and of these, only 200 hold doctorates. The number of students enrolled in physics programs has declined from a few hundred per year to a few tens, reflecting a marked lack of job opportunities in the field. In addition, the quality of the students is declining, and poor economics have severely hampered university programs, which must often rely on equipment donations.

In May, Kennedy Reed (LLNL), a member of CISA, and Samuel Adjepong, a physicist and the vice-chancellor of the University of Cape Coast (UCC) in Ghana, West Africa, visited several U.S. institutions and agencies. This was part of a continuing APS initiative to increase interaction between the American and African physics communities. Reed and Adjepong met when Reed was a visiting scientist in Ghana in 1997 and 1999.

Adjepong's itinerary began in New York City with a meeting, together with Lerch and Reed, at the Carnegie Foundation, which recently announced it would join three other foundations to form a "Partnership to Strengthen African Universities". The partnership hopes to encourage the development of projects that will be sustainable after the period of foundation support ends.

Reed and Adjepong next went to Newark, NJ, for meetings at the New Jersey Institute of Technology (NJIT) and at Rutgers University's Newark campus (RU-NC). The result was the signing of a formal agreement between these universities and UCC, establishing a Physics Scholar Exchange Program to provide opportunities for students and faculty in each institution to work and study in each other's physics departments. Among other specifications, the agreement calls for offering selected courses through programs of the African and New Jersey Virtual Universities. Anthony Johnson (Chair, NJIT Physics Dept.) and Earl Shaw (Chair, RU-NC Physics Dept.) were instrumental in developing the plans for this exchange program.

Reed and Adjepong traveled to Huntsville, AL, to visit Alabama A&M University (AAMU) and meet with AAMU President John Gibson. At AAMU a memorandum of understanding was signed establishing a program of collaborative research and student and faculty exchanges between UCC and AAMU. Like the agreement signed in Newark, this one also includes plans for use of the Internet and distance learning in the collaborations. While in Huntsville they went to the University of Alabama where they met with President Frank Franz and university officials, and also visited Raytheon Corporation.

The itinerary ended in Washington, DC, where Reed and Adjepong participated in high-level meetings at the National Science Foundation and the National Academy of Sciences, and also went to the World Bank to discuss recent developments in the African Virtual University. "This visit was an important step in our continuing efforts to promote scientific links with Africa," Reed said, adding that "such collaborations and exchanges can help physicists in Africa become more strongly coupled with global research and development, and will enable them to more effectively employ science and technology for addressing the critical needs of developing African nations." He concluded "These collaborations can also open new channels for African scientists to use their training and talent to contribute to the advancement of science."

Left to right: Kennedy Reed, LLNL; UCC Vice-Chancellor Samuel Adjepong; AAMU President John Gibson; Ravindra Lal, AAMU.

Victor Fajer Avila (center) president of the Cuban Physical Society, meets with Bernd Crasemann (left) and Irving Lerch of the APS in Havana.

International Physicists visit the White House

On June 6, 2000, participants of the first meeting for the International Union of Pure and Applied Physics (IUPAP), Working Group on Women In Physics were honored with a private tour of the West Wing of the White House. The meeting was hosted by Judy Franz of APS at the American Center for Physics. Beverly Hartline of LANL, one of the group members, arranged for the tour.

Left to right first row: Judy Franz, American Physical Society, Nandini Trivedi, Tata Institute of Fundamental Research, India; Elisa Molinari, University of Modena, Italy; Yosr Gamal, National Institute for Laser Enhanced Sci., Egypt; Ling-An Wu, Chinese Academy of Sciences, China; Katharine Gebbie, NIST; Marcia Barbosa, Universidade Federal do Rio Grande do Sul, Brazil. Second row: Beverly Hartline, LANL; Erika Ridgway, APS; Jackie Beamon-Kiene, APS; Herwig Schopper, CERN, Switzerland; Barbara Sandow, Freie Universität, Berlin-Germany

RHIC Facility Begins Operations with a Bang

On June 12th, a long-awaited milestone in high energy physics was achieved as Brookhaven's Relativistic Heavy Ion Collider (RHIC) produced its first collisions to kick off what many consider to be one of the most important experiments yet envisioned in modern science. Several world-class researchers were on hand to witness gold ions — with energies of 30 GeV per nucleon — colliding to generate a fireworks display of roughly 1,000 symmetrical particle tracks. The first images generated from the collisions can be seen online at http://www.rhic.bnl.gov/STAR/. Scientists expect that the upcoming Quark Matter Conference, to be held this January in Long Island, NY, will provide one of the first major venues for discussion of the first collisions and other prospective RHIC results.

The RHIC facility is focused on the production and study of the quark-gluon plasma (QGP), a hypothetical hot, dense soup of single quarks and gluons last believed to exist naturally in the first millionth of a second after the Big Bang. By smashing together sufficiently dense bunches of heavy nuclei at sufficiently high energies, scientists expect that the nuclei will dissolve into a similar soup of free quarks and gluons, yielding valuable insights into the early universe, as well as the matter we observe today.

Previous accelerator facilities have not been able to create a verifiable QGP because they cannot attain the high energies required, although recent experimental results at CERN have provided signs of an exotic form of nuclear matter that might be a QGP. However, "Discovering the QGP will be like a murder trial without a smoking gun," says Xin-Nian Wang of Lawrence Berkeley Laboratory. "It has to be a conviction beyond a reasonable doubt. We have to convince ourselves that the signals we see are caused only by the formation of the QGP and nothing else."

Producing collisions 10 times more powerful than those at CERN, the RHIC facility currently boasts four advanced detectors — BRAHMS, PHENIX, PHOBOS and STAR — for the study of particles produced by the collisions. The eventual goal is to achieve energies of 100 GeV per nucleon in each of the two heavy-ion beams. "By means of extraordinarily high energy nuclear collisions, RHIC will act as a giant pressure cooker, producing temperatures and particle densities tens of thousands of times greater than exist now even at the center of stars," says Brookhaven physicist Tom Ludlam.

In addition to creating the QGP, other research goals for the RHIC facility include colliding protons at high energies to make what should be the first definitive measurement of the contribution of gluons to the proton's spin. Researchers also plan to search for violations of such fundamental physics symmetries as parity and charge-parity that would occur because of the strong nuclear force. (In contrast, previously the non-conservation of P and CP have come about only because of the weak nuclear force.)

—Reported by Inside Science news team

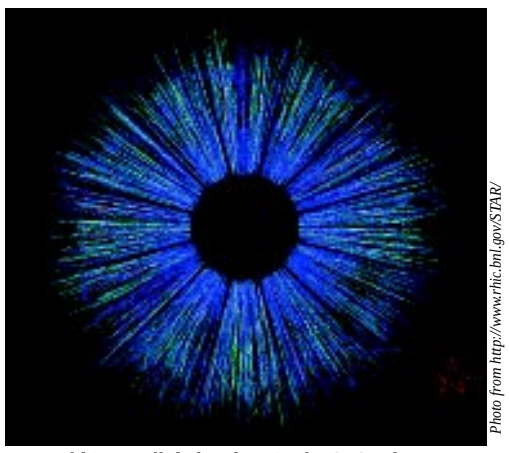


Photo from http://www.rhic.bnl.gov/STAR/

Two gold ions collide head-on in the STAR detector.

ANNOUNCEMENTS

YOU ARE INVITED TO ATTEND THE 2000 ACADEMIA-INDUSTRIAL OUTREACH WORKSHOP AND THE INDUSTRIAL PHYSICS FORUM

When: *WORKSHOP: November 5 • FORUM: November 6-7*
Where: *San Diego, California*

Why:

- To learn about industrial applications of physics from the perspective of one of the world's leaders in commercializing applications of fission and fusion.
- To spend three days interacting with leaders in industrial physics.
- To stimulate interaction between academia and industry.
- To learn about the technical and workforce needs of industry so that you can mentor your students about opportunities in the private sector.
- To expand your perspective on the potential industrial applications of your research.
- To promote novel programmatic ideas for department revitalization.

The WORKSHOP is designed to be an interactive meeting focused on stimulating relationships between academic and industrial physicists, sponsored by AIP Corporate Associates, Project Kaleidoscope, the Society of Physics Students, the APS Committee on Careers and Professional Development, and the National Task Force on Undergraduate Physics:

The theme of the FORUM is *Physics, Energy, and Defense – Synergistic Interactions*, hosted by GENERAL ATOMICS in conjunction with the APS Forum on Industrial and Applied Physics:

Advanced physics is a key tool for energy and defense research. The meeting will explore the interactions between research in physics and advances in energy and defense technologies, using the example of R&D performed at General Atomics. For example, the program includes talks on:

- Physics, Energy, and Defense in the 21st Century
- Controlled Fusion
- Acceleration – From Particles to Aircraft
- Turning Physics into Technology
- The Defense R&D Workforce
- Addressing Public Concerns about Energy and Nuclear Power R&D
- Underwater Ocean Acoustics
- LIGO
- The Small World Problem in Networking
- Intersection Between Biochemistry and Materials Science

For complete program information for the Workshop and Forum, and to register online, go to: http://www.aip.org/aip/corporate/general/meeting.html

For more information, contact Liz Dart at **Ldart@aip.org** or (301) 209-3034

A Word to the Wise

The Psychology Lab at Yale University is conducting a study on wisdom. They are hoping to identify and promote wise thinking. Scientists have been identified as people who are likely to be wise. They are looking for scientists to participate in the study by filling out a questionnaire which takes about 20 - 30 minutes and will donate a small sum of money to the charity of each participant's choice. Contact Frank Connors at (917) 538-3995.

JOB ANNOUNCEMENT

- Are you an independent, creative thinker?
- Personable? Passionate about physics?
- A good communicator?
- Interested in using your scientific credentials to address social and political problems?

The APS Washington Office is hiring.

Contact us at: (202) 662-8700 or opa@aps.org.

At the April 2001 Washington meeting of the American Physical Society, the Forum on the History of Physics will once again sponsor contributed paper sessions on the history of physics. The length of each talk will be 20 minutes, followed by 4 minutes of discussion. Members of the Society are encouraged to contribute papers on any aspect of the history of physics. Contact information:

Allan Franklin
University of Colorado Dept. of Physics
Campus Box 390
Boulder, CO 80309-0390
phone: (303) 492-8610 • fax: (303) 492-2998
e-mail: Allan.Franklin@Colorado.edu

FICTION, *from page 3*

to get started," she jokes. After the first two books were published, she found moving to a larger company much easier. "It's a lot like getting that first job; you need to persevere and withstand a certain amount of rejection," she says.

In contrast, Benford began writing short science fiction stories, and when one was nominated for an award, he quickly drafted a two-page outline fitting the story within the context of a full-length novel, and promptly landed a contract. While admitting it is harder today to break into the field than it was in 1969, he still recommends a similar approach, rather than submitting a full-length manuscript. "There's nothing more daunting (for an editor) than opening up a manuscript and finding an entire novel inside," he says. "Remember there's another human being on the other side of your submission."

VIEWPOINT…

A Personal Account of the Los Alamos Cerro Grande Fire

by Benjamin Gibson, LANL

The Cerro Grande fire began on the night of May 4th, while I was having dinner in Santa Fe with a DNP colleague, Ed Hungerford (University of Houston), and his wife. The fire was apparently started intentionally by the National Park Service as a "prescribed burn" on Bandelier National Monument property high in the Jemez Mountains, to the west of the Laboratory and to the south of the Los Alamos "ski hill." It was reportedly intended to clear a mountain meadow of small trees which were encroaching.

The fire blew out of control and was declared a wildfire early on May 5th. However, the real disaster occurred sometime on May 6th, when a "back burn," set to contain the original fire, reportedly blew out of control in the high winds that often blow through the mountains at that time of the year. By May 7th, the fire was burning furiously to the west of Los Alamos National Laboratory, raging through the trees within a few hundred yards of Camp May Road, which leads up the edge of Los Alamos Canyon to the ski area, and along East Jemez Road, which borders the Lab to the west. An evacuation of the Western Area of Los Alamos was announced that evening, terminating a meeting which I was attending in the evacuated area. As I drove home, the flames were 25 feet high in the trees south of Camp May Road, and the slurry bombers were hard at work. The winds subsided overnight, so that the fire was contained south of the canyon, and the situation was stable until the high winds returned on Wednesday.

Los Alamos was evacuated on Wednesday afternoon, May 10th, when the fire jumped the fireline at Camp May Road into Los Alamos Canyon. The canyon separates the town site and the Laboratory, although the fire was much farther west than the bridge over the canyon, and there was no danger to evacuees crossing the bridge. Baranca Mesa and North Mesa communities were evacuated to the north through Rendia Canyon across pueblo property. Horses and livestock on North Mesa were part of the evacuation. It was later reported that the evacuation of Los Alamos had taken only 4-1/2 hours instead of the estimated 11 hours prior to the call; moreover, the TV reports marveled at the silence in which it was accomplished — no automobile horns honked. As a result of the Los Alamos evacuation, our community of White Rock grew in population from its normal 7,000 residents to a population of 14,000, as many from the town site sought shelter there. The fire had burned north through Los Alamos, but then the swirling winds blew the rear of the fire southeast across Lab property in the direction of White Rock and Santa Fe. About 1:00 a.m. the call came to evacuate White Rock. We spent three hours packing my car with pictures, papers etc. before beginning the drive to Albuquerque. From there we were TV spectators as the local channels provided 24-hour coverage of Los Alamos burning.

A firestorm (flames 100 feet high) roared through the western edge of the Los Alamos town site the evening of May 10th, driven by wind gusts of up to 50 mph. The forest (mostly ponderosa pine) exploded in flame, spreading firebrands up to 1/4 mile in advance of the wind-driven fire front. More than 202 town site structures were burned to the ground in the intense heat, and 405 families lost their homes. The burned structures lay primarily along the streets which border the forest — in the Western Area and the Northern Community, to the west of Diamond Drive (which goes over the bridge).

Some homes were saved by a handful of people who defied the evacuation order and remained behind to battle the fire with garden hoses, spraying the falling embers and burning pine needles with water. The Laboratory lost 39 temporary structures — people's offices and labs and storage. The fire burned some 30% of the 43 square miles of Laboratory property. At the plutonium site, which was sandwiched between fires on the north and south, the wind in the center of the firestorm was measured to be in excess of 85 mph. Aluminum wheels on automobiles and aluminum accelerator parts stored outside were turned into aluminum puddles. The fire reportedly burned over the top of the Lab emergency fire center twice, as the winds switched directions. Nothing in the main TA-3 area, nor anything at TA-53 (LAMPF, now LANSCE) was burned. However, the western edge of the town site did have all the appearance of a war zone, with homes in ashes except for chimneys and foundations, charred trees, and hulks of burned cars and trucks dotting the landscape.

Jim Thompson/Albuquerque Journal; inset photo by Ken Cole/APS.

A home in Los Alamos, NM burns. Inset photo of Benjamin Gibson.

Residents were allowed back into White Rock on the 14th. Parts of Los Alamos were re-occupied the next day. The Lab, schools, did not reopen, except for maintenance and safety inspections, until the 22nd. Restoring power to some Technical Areas took longer.

The Cerro Grande fire consumed some 48,000 acres, and it smouldered in the Jemez Mountains, with smoke plumes rising on windy days, until the summer monsoon rains came. However, the rains produced new threats in terms of potential flooding. (The earth was turned into glass beads in some mountainous areas, where the fire burned particularly intensely.) Helicopters were still dropping 1,000 gallon buckets of water on hot spots in the mountains into June.

Benjamin F. Gibson is Secretary-Treasurer of the Division of Nuclear Physics.

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National Missile Defense – Too Important to Rush

By Senator John F. Kerry, (D-MA)

As we approach the deadline for President Clinton's National Missile Defense (NMD) deployment decision, both the Congress and the Pentagon have focused intensely on the effectiveness of the proposed technology. I have grave concerns that we are sacrificing careful technical development of this system in order to meet the artificial deadline of the planned Initial Operating Capability (IOC) in 2005. Moreover, even if the system works as planned, I am not convinced that it will provide the most effective defense against the developing missile threat.

"We should focus our research efforts on developing a forward-deployed boost-phase intercept system."

The Administration has proposed a limited, ground-based hit-to-kill system to protect all fifty states against small-scale attacks by ICBMs. The system will be deployed in 3 phases, with a target completion date of 2010. The completed system will include 200-250 interceptors, deployed in Alaska and North Dakota and complemented by a sophisticated array of upgraded early-warning radars and satellite-based launch detection and tracking systems.

My first question about this proposed NMD system is, will the technology work as intended?

That is, will it function at the most basic level? Will it be operationally effective against real world threats? And will it be reliable over time? I do not believe that the compressed testing program and decision deadline allow us to draw definitive conclusions about these three fundamental elements of readiness.

After 3 unsatisfactory tests, it is still unclear whether this system will function at a basic level, under the *most favorable* conditions. The first test in October 1999 is hailed as a success, because the interceptor did hit the target. But the Pentagon has conceded that the interceptor had initially been confused and drifted off course, ultimately heading for the decoy balloon and possibly striking the dummy warhead only by accident. The second test in January 2000 failed because of a sensor coolant leak. The third intercept test on July 8 failed when the launch vehicle and the exo-atmospheric kill vehicle (EKV) failed to separate.

On the second issue of whether the system will be operationally-effective, we have very little information to go on. We have not tested the system against targets launched from unanticipated locations, or over the long distances and high speeds at which it must function in an operational environment. In the June 13 report of the Independent Review Team (IRT), retired Air Force General Larry Welch urged the Pentagon to expand the test envelope to better reflect operational conditions.

Finally, the question of reliability is best answered over time and extensive use of the system. Any program in its developing stages will run into technical glitches, and this program has been no different. This doesn't mean the system won't *ever* work properly, but that we need more time to work the bugs out.

Two independent reviews have reached a similar conclusion about the risks of rushing this system to deployment. In February 1998, the IRT under General Welch characterized the truncated testing program as a "rush to failure." The panel's second report recommended delaying the decision to deploy until 2003 at the earliest to allow key program elements to be fully tested and proven. The most recent Welch report found that meeting the current 2005 deployment target date remains "high risk."

The concerns of the Welch Panel have been reinforced by the Defense Department's office of operational test and evaluation, which in February 2000 decried the "undue pressure" being applied to the NMD testing program. The Coyle Report warned that rushing through testing to meet artificial decision deadlines has "historically resulted in a negative effect on virtually every troubled DoD development program."

"It is still unclear whether this system will function at a basic level, under the most favorable conditions."

My second major concern about this system is whether it offers the most appropriate and effective defense against the likely threat. The 1999 National Intelligence Estimate (NIE) that addressed the ballistic missile threat concluded that the same nations developing long-range ballistic missile systems could develop – or buy – countermeasure technologies by the time they are ready to deploy their missile systems.

An ICBM releases its payload immediately after boost phase, and if that payload consists of more than simply one warhead, an exo-atmospheric interceptor will have more than one target to contend with after boost phase. In his testimony before the Armed Services Committee on June 29, Lt. General Ronald Kadish, Director of the Ballistic Missile Defense Organization, admitted that the downside of the proposed mid-course intercept system is that "it is quite easy to generate decoys in this phase."

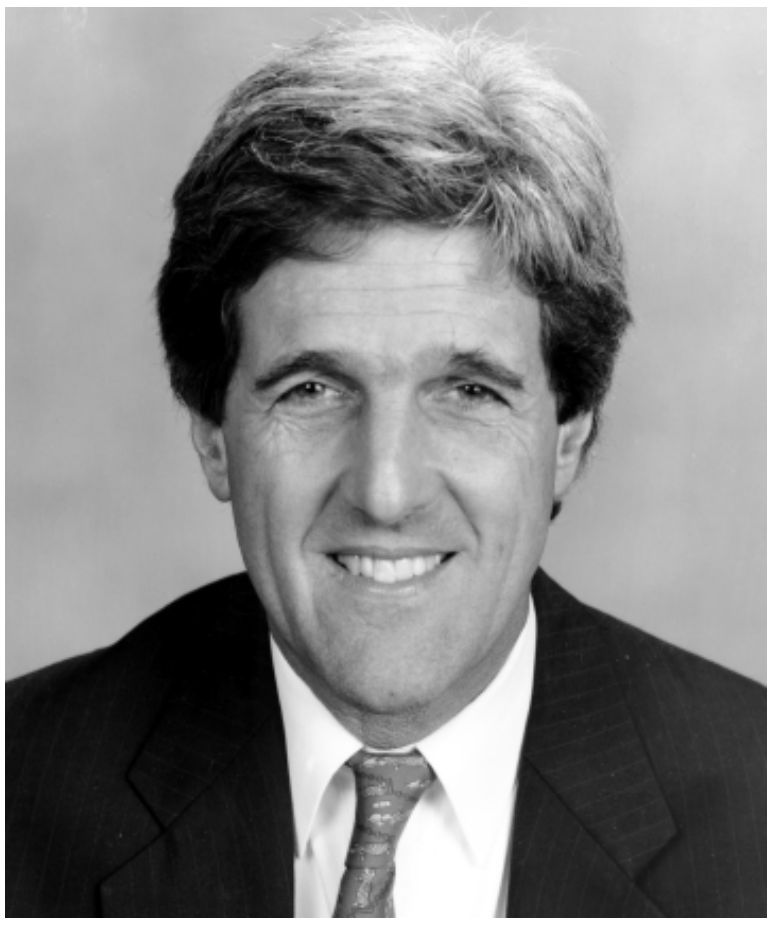
But while acknowledging that countermeasures pose a "major discrimination challenge," General Kadish also said he is confident the proposed NMD system will be able to successfully discriminate between warheads and the decoys likely to be available when the first phase of the system is deployed. The scientific community has questioned this confidence, concerned that even the fully-equipped, fully-deployed system, functioning effectively and as intended, could be defeated by some relatively simple countermeasures.

The Union of Concerned Scientists recently published a very thorough technical evaluation of three countermeasures that would be particularly well-suited to overwhelming this system: chemical and biological bomblets, anti-simulation decoys, and warhead shrouds.

Chemical and biological weapons are deployed in small submunitions, rather than one large warhead, because doing so allows an attacker to disperse the agent over a larger area to maximize its effect on the targeted population. An attacker would likely pack up to 100 submunitions of chemical or biological agent into each warhead, effectively creating 100 mini-reentry vehicles, each one lethal. And our limited system, intended to have a maximum of 250 interceptors, would have to shoot down every one of those bomblets to avoid catastrophe.

Second, using anti-simulation countermeasures, an attacker could disguise the nuclear warhead to look like a decoy by placing it in a lightweight balloon and releasing it along with a large number of similar, but empty balloons. By painting the balloons with a surface coating or by changing the shape of the balloon so that it is not a perfect sphere, an attacker can use the laws of physics to bring the equilibrium temperature of all the balloons into the same range, making it very difficult — if not impossible — for the radar suite of this system to distinguish between the empty balloons and the balloon containing the warhead. Alternately, by covering the warhead with a shroud cooled by liquid nitrogen, an attacker could reduce the warhead's infrared radiation by a factor of at least one million, making it incredibly difficult for the NMD system's sensors to detect the warhead in time to hit it.

These technologies are not unsophisticated. But I have yet to hear one person explain why a nation with the technological capacity to develop a long-range ballistic missile program should suddenly be considered technologically incompetent when it comes to deploying these relatively straight-forward countermeasures.



"I have yet to hear one person explain why a nation with the technological capacity to develop a long-range ballistic missile program should suddenly be considered technologically incompetent when it comes to deploying these relatively straight-forward countermeasures."

The debate over countermeasures raises serious questions about whether this system is the best response to the likely threat. I don't believe it is.

I believe we should focus our research efforts on developing a forward-deployed boost-phase intercept system. Such a system would build on the current technology of the Army's land-based Theater High Altitude Area Defense (THAAD) and the Navy's sea-based Theater-Wide Defense systems, to provide forward-deployed defenses against both theater ballistic missile threats and long-range ballistic missiles in their boost phase. This approach could also be more narrowly targeted at specific threats, and it could be used to extend ballistic missile protection to U.S. allies and to our troops in the field.

The key advantage to the mobile, forward-deployed missile defense system is that, rather than having to create an impenetrable umbrella over the entire United States territory, it would only require us to put an impenetrable lid over the much-smaller territory of a potential adversary. The technological challenge of containing North Korea, Iraq or Iran is much more manageable than the challenge of defending half a continent.

And a system targeted at specific threats would be much less destabilizing than a system designed only to protect U.S. soil. It would reassure Russia that we do not intend to undermine its nuclear deterrent and enable Russia and the U.S. to continue to reduce our strategic arsenals. It would reassure U.S. allies that they will not be left vulnerable to these missile threats and that they need not consider deploying nuclear deterrents of their own. In short, this alternative approach could do what the proposed NMD system will not: it could make us safer.

We do not now have the technology to deploy a boost-phase system. Without much faster intercept missiles than are currently available, the Navy Theater-Wide system will not be able stop high-speed ICBMs, even in their relatively slow boost phase. The THAAD system, which continues to face considerable challenges in its demonstration and testing phases, is being designed to stop ballistic missiles, but it has not been tested against targets with speeds approaching those of an ICBM.

Secretary Cohen has argued that we should not pursue the boost-phase technology, because it can not be ready in time to meet the 2005 IOC deadline. Given the challenges we are facing with the current NMD system, and the technological and strategic advantages of the boost-phase system, I believe we can afford to take the time to explore the full range of options before us. The decision on whether and how to deploy a U.S. national missile defense is too important to rush.

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