Woodstock West: Celebrating the New MgB₂ Superconductors

The excitement was palpable in the Grand Ballroom at the Westin Hotel in Seattle on Monday night, March 12, as physicists, attending the APS March Meeting from around the world, gathered for a marmmoth technical session discussing the discovery and subsequent experimental results of the newly discovered superconducting compound magnesium diboride (MgB₂), first discovered less than two months ago in a laboratory in Japan. Speakers flew in from Japan, Korea, Switzerland, France, the Netherlands and Germany, in addition to numerous speakers from the US. A total of 79 ultra-short (2-minute) papers were presented, with the session running past one the following morning. It was quickly dubbed "Woodstock West," in memory of the so-called "Woodstock of Physics" at the 1987 APS March Meeting where the discovery of high-temperature superconductivity was first announced.

Like many historical breakthroughs in science, the compound discovery was partially serendipitous although this was not the view of the discoverers-- see Members in the Media on page 2. Jun Akimitsu's research group at Aoyama-Gakuin University in Tokyo were attempting to make a chemical analogue of Ca₆, a semiconducting material that becomes ferromagnetic, like iron, when doped with a small amount of electrons. They tried to replace calcium with magnesium, which is directly above it in the periodic table. One of their starting materials was MgB₂, a common compound known since 1953, which had been overlooked by physicists for decades in the search for new superconductors. "It's just that nobody bothered to cool it down and measure its superconducting properties," says David Cardwell of Cambridge University. It was while routinely measuring the properties of MgB₂ before using it as a dopant in high temperature superconductors that Akimitsu's group made the startling discovery that the compound had a transition temperature of about 39K. The highest previous transition temperature for a metallic superconductor -- niobium -- was 20K. Akimitsu's group and several others have already begun to explore whether it may be possible to raise the superconducting transition temperature of MgB₂ further by lacing the compound with other elements.

"Discovery of superconductivity at 39K in the simple hexagonal diboride compound MgB₂ proves that there are still remarkable scientific surprises," says J.D. Jorgensen of Argonne National Laboratory. From a physics standpoint, the chief interest in the compound is the possibility that the old BCS theory which has proven useful for low temperature metallic materials but not for the higher temperature ceramic materials, might still be relevant at 40K, where the MgB₂ material becomes superconducting. "How much this discovery changes the path of materials physics depends on whether...

MgB₂ Session Hits the Web

A thousand people packed into the Grand Ballroom of the Westin in Seattle for the March Meeting post-deadline session on Magnesium Diboride (MgB₂) begun at 8 pm on March 12. Interest was intense, although the crowd had dwindled to perhaps a couple of hundred when the 79th and final paper was presented at about 11:30 am.

In addition to the physicists in the audience and the telepub, attendees of the APS staff members was astonished at a special table in the front of the room, frantically collecting transparencies from the speakers who carried on the podium at the rate of one every 3 minutes, and then photographing the transparencies with a digital camera. Meanwhile, in the back of the room, an audio-visual technician was recor-ding the session both on video tape and on digital audio tapes. All of this information was transported back to APS headquarters in College Park, MD where the images of the transparencies were digitized and were correlated with the various talks. With the aid of special software, the APS information technology specialists then synchronized the transparencies with the audio tapes, using the video tape as reference.

The result of these efforts was posted on the APS web site (http://www.aps.org) in batches as the talks became ready. All the talks were available by March 30. A visitor to the site who has the appropriate RealPlayer software can now click on a particular talk, see an abstract, and listen to the audio, with the relevant transparencies popping onto the monitor as the speaker speaks. This comes close to reproducing the experience of someone in the audience," said Jim Eglin, APS Senior Systems Analyst, who spearheaded the information-technology part of the effort.

A Call to Action on Nanotech Initiative

Announced by then-President Clinton in January 2000, the National Nanotechnology Initiative has enjoyed strong federal support and funding in the first one year of its existence. However, the fledgling program could be in jeopardy because of expected decreases in funding for FY2002, according to the three speakers at a special evening session on the topic at the APS March Meeting in Seattle. Participating in the session were Mildred Dresselhaus, former Director of the Office of Science at DOE, who has since returned to her professorship at MIT, Lance Harvorth of NSF, and James Murray of the Department of Defense. A theme common to all the talks was the need for action on the nanotechnology part of the effort.

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HIGHLIGHTS

1. Board and Council Minutes Now on the Web
2. Broad or Narrow? Members Debate APS Meeting Structure
3. ZERO GRAVITY
4. The BACK PAGE
5. "A call for major reform of APS meeting"

May 2001
Volume 10, No. 5

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Physics Teachers Gather at March Meeting

Bill Keller, a Washington state high school physics teacher, observes an image under the watchful eye of Leslie Delwiche from the Physics Education Group of the University of Washington. This activity was part of a workshop on teaching physics by inquiry, conducted by Lillian McDermott, the leader of this group.
Galileo Galilei is justly known for many contributions to science, as well as for his pivotal role in the 변경 Under the Inquisition. But among his most memorable adaptations is his invention of the telescope, which with the same purpose, discovered four satellites of Jupiter and resolved the phases of Venus. In the process, he helped lead a revolution in medicine—along with h elsewhere— that conclusively toppled the traditional Aristotelian model in favor of the Copernican system. Historians generally agree that the telescope was a great invention in the Netherlands, with two simultaneously patented applications appearing in October 1608; although its inventor apparently developed a telescope around the same time, attempts to sell it at the Frankfurt Fair. These designs consisted of a combination of lenses, inserted in a tube, able to magnify objects by two or three times their original size. The news of the invention spread rapidly throughout Europe, and samples of the device soon followed. By April 1609, citizen could purchase three-powered spyglasses in local spectacle makers' shops in Paris; within four months, they were also available in Italy. (In fact, this was the first new instrument for "seeing faraway things as though nearby" reached Galileo in May 1609, and he quickly duplicated the invention and constructed his own three-powered telescope the same month.)

"Sometimes our biases can get us into a lot of trouble, and scientific experimentation and new things coming all the time" — Geoffrey Landis, NASA Glenn Research Center, March 14, 2001

"The reason we want to fly an airplane on Venus is because it would be too cool." — Paul Canfield, Iowa State University

"People are working all hours, weekends, its ideas now, and experimentation and new things coming all the time" — David Larbalestier, University of Wisconsin

"Magnesium and boron are all over the earth, and they're cheap as hell." — Paul Grant, Electric Power Research Institute

"People were flying rockets on the moon before they were invented." — Richard L. Fleischer, Space News

"Jupiter never left Galileo, but appeared to be carried along with the planet. Second, as they were carried along, they changed their position with respect to each other and to Jupiter. Finally, there were four of these little stars. By the 15th of June, he had observed all the objects were not fixed stars, but planets in the solar system." — James Jorgensen, Argonne National Laboratory

"To the lay person, this will seem like a low temperature, but to the scientific community it's really not that low." — Robert Cava, Princeton University

"My years of struggling, step by step, and finally it got it. It was never serendipitous." — Jun Akiyama, Aoyama-Gakuin University

"Jupiter was at opposition and closest to the Earth, and hence the brightest planet in the sky in the evening sky," — Curtis G. Callan, Jr., University of California, Santa Barbara

"The telescope; inset of Galileo Galilei." — Adapted primarily from information provided by The Galileo Project (http://es.rice.edu/ES/humsoc/Galileo)


"Toward a physics of the unexpected" — Geoffrey Landis, NASA Glenn Research Center, March 14, 2001

"The telescope, inst of Galileo Galilei." — Adapted primarily from information provided by The Galileo Project (http://es.rice.edu/ES/humsoc/Galileo)

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When Noah Hershkowitz, a professor at the University of Wisconsin (Madison), attacked at a scientific conference, the first challenge he encounters is the hotel. Hershkowitz suffers from multiple sclerosis, is a quadriplegic, and invariably ends up having to ask hotel staff to make numerous accommodations - including extra crumbs furniture or a bathroom door to allow access of his wheelchair, to a larger room in the bathroom, or temporary ramp at the front entrance to enable him to navigate the steps to the lobby. While the regular sessions of a recent APS meeting in New Orleans proved reasonably accessible to him, he was disappointed in the one session it required maneuvering a small flight of stairs, with no wheelchair access available. However, "Since wheelchairs are the wrong height for my receptors when people are standing, I won't be disappointed," he says.

Hershkowitz is not alone in his frustrations. Charlie Siegal, an attorney based in LA who earned a PhD in physics in 1972, suffered from polo as a youth, which limits his ability to use arms and legs, although he generally manages to function without the use of his arms, wheelchair, crutches or canes. Stiff, lengthy passages in airports or hotels, or long walks between meetings, take their toll. Disabled persons also struggle with the lack of electronic hearing aids, raised speaker platforms, thick carpeting, and so on. Addressing these and other obstacles faced by disabled scholars is an objective of the newly formed APS Task Force on Disabilities (see August/September 2000 APS News; both Hershkowitz and Siegal are members). The task force has already suggested a list of the most common difficulties in hotels and conference centers, and is working with the support of the APS and other professional organizations, hotels will be encouraged to improve in this area. And, as Siegal points out, "It is hardly a matter of charity. As an increasing number of people with substantial disabilities move into the workforce, they will demand goods and services to meet their quite specialized needs," he says.

Many concerns can be addressed with accommodations that "are almost free," Siegal says. The physics professor at Carnegie Mellon University (where he attended graduate school) allowed him to use a small lab office to eat his lunch that would allow him to take his car to the college cafeteria. And there are many state and federal laws in place that require more elaborate accommodations, although these are not always complied with.

The scientific community can also contribute to improving access for disabled persons in more long-term, even creative ways. "I would like to see APS groups and members work together to help disabled persons become more involved in the physics community," Siegal says. "It would be encouraging to address issues of people with disabilities, says Siegal. The scientific and non-scientific community might do to lower or erase the "centrifugal forces" within APS — forces that tend to divide the society into specialized research areas rather than uniting it to represent physics as a whole. Interaction between different research areas is a "very practical necessity," Langer said — "even if one's own field is in condensed matter physics requires knowledge of algorithms studied in computer science, or researchers for physics was high, researchers started several smaller meetings focusing on more specific topics. Attention at the general meetings, especially the January meeting, dwindled. "It just got smaller and smaller," said Judy Franz, Executive Officer of APS. As early as 1968, the meeting left its traditional New York venue and began traveling about the country. In 1992, the January meeting was discontinued altogether.

Today, some people are afraid that the same fate could befall the April Meeting, which used to be held in Washington every year, but now moves around the country, with a tendency of divisions to concentrate their efforts in stand-alone, small meetings. The issues the meetings create are complex and defy easy solutions.

According to a 1996 Battelle study, corrosion costs the US an estimated US$25 billion per year in infrastructure maintenance, and up to a third of this cost can be prevented with the proper anti-corrosion measures. Whereas traditional techniques provide month-to-month information on surface corrosion activity, SQUDS can provide hour-by-hour pictures of surface corrosion occurring at microscopic rates. (SQUDS can detect corrosion rates as small as 70 millimicrons per year in aluminum, Wicks says.) The Vanderbilt team studied corrosion in aircraft lap joints, pieces of overlapping metal fastened with rivets or spot welds. While aluminum did not increase corrosion appreciably in the lap joints, they determined that distilled water increased it significantly, presumably by activating dried chemical deposits within the metal. Contrary to common wisdom, however, salt water did not increase corrosion appreciably compared to distilled water. The researchers envision the SQUDS as a lab tool that can provide advice on aircraft maintenance and the effectiveness of various anti-corrosion compounds.

Helene Grossman of LBRYC-Berkley demonstrated the use of SQUDS to perform faster and more accurate analysis of small levels of bacteria, viruses, or other proteins and chemicals in biological or industrial samples. In the SQUDS technique, one adds magnetic particles to the sample of interest. The particles become labeled by specific antibodies or other binding compounds attached to them. In addition, the particles are superparamagnetic, which means that they line up with an applied magnetic field even for a short time after the field turns off. Exposed to an applied field, the sample, particles which attack to the microorganism or molecule of interest stay aligned longer than on the laboratory bench (because the nation's capital). The meeting focuses on particle, nuclear and astrophysics, and attracts attendees from other disciplines. While the March meeting typically attracts over 5,000 attendees, April meeting had recently had fewer than 1,000, "a smaller than some of the divisional meetings," Siegal says. Attendance has been declining partly because government funding for travel expenses has declined in recent years, with particular restrictions affecting DOE grants that fund participants in DOE-supported projects (see APS News, April 2000). The meeting is now too small to feature an "international convention center," Langer said, so it would be replaced farther on the calendar from the March meeting. Langer worked with the Divisions of Astrophysics, and it is "a small community meeting together with it." A "large number of the senior leadership of [DOE] was in favor of the new arrangement," Franz said. But the divisional membership as a whole voted the idea down. The April APS general meeting remained in April, and AQSD continued to hold separate meetings.

Broad or Narrow? Members Debate APS Meeting Structure

When Noah Hershkowitz, a professor at the University of Wisconsin (Madison), attacked at a scientific conference, the first challenge he encounters is the hotel. Hershkowitz suffers from multiple sclerosis, is a quadriplegic, and invariably ends up having to ask hotel staff to make numerous accommodations - including extra crumbs furniture or a bathroom door to allow access of his wheelchair, to a larger room in the bathroom, or temporary ramp at the front entrance to enable him to navigate the steps to the lobby. While the regular sessions of a recent APS meeting in New Orleans proved reasonably accessible to him, he was disappointed in the one session it required maneuvering a small flight of stairs, with no wheelchair access available. However, "Since wheelchairs are the wrong height for my receptors when people are standing, I won't be disappointed," he says.

Hershkowitz is not alone in his frustrations. Charlie Siegal, an attorney based in LA who earned a PhD in physics in 1972, suffered from polo as a youth, which limits his ability to use arms and legs, although he generally manages to function without the use of his arms, wheelchair, crutches or canes. Stiff, lengthy passages in airports or hotels, or long walks between meet-
The Last Word on Science, Religion, and Creationists

Adrian L. Melott's letter in the March APS News is a reply with misrepresentations of my January letter. Big Bang cosmology is the precursor for many of my arguments. Inevitably, with the question of the origin of man, it is hard to understand how a cosmological theory developed by man cannot claim the theory is encased by the man. Theories proposed by man, even the elusive TOE, cannot bring anything into being and only a Creator can do that—even quantum vacuum fluctuations do not bring the vacuum into existence. I am an evangelical Armenian who believes that man was created in the image of God and thus has the ability to choose morality and deception. In science we have the ability to choose the nature in which we believe God to be active. For me, creation is a mark of the divine, and thus for me science and faith are not at odds. I don't want to gloss over.

I'm wondering why the letters to APS News have become a literary discussion group about works of fantasy. Yet another piece of evidence that science is not about physics. I'm not against people inventing elaborate fantasy worlds such as Lord of the Rings and the like, but I do wish we would keep things in perspective. I'm interested in mythology, legends, repeatedly saying, "God is in the gap." Historically, one of the current crop of creationists, Phillip Johnson, a UC Berkeley criminal law professor, has tried to equate something he calls theistic science. In short, he wants scientists to look for something he calls theistic science. In my opinion, the whole idea of "argument from ignorance" and "refutation" is scientifically fallacious. What is science? The only definition that makes sense is "the ability to check the accuracy of revealed truths." I believe that "Man shall not live on bread alone" but must also use revelation in our search for understanding.

The local rabbi has pointed out that Genesis can be read about 70 different ways because, in the original Hebrew text, no words are repeated. There is nothing to imply that anything we know about the intelligent designer is in privatization. They are promoting the concept of an ultraconservative fundamentalist Chris-

Keyworth's SDI Comments are "Deja Vu"

George Keyworth (Back Page, February 2001) devotes a quarter of his remarks which, at worst, is a rehash of旧 material. Tolkein wrote a ridiculous and irrelevant claim that Ronald Reagan was a strategic thinker, but then tops even that by stating that SSI is "effective in the long run because it's stature countering force-deterrence to its more stable alternative..." This is particularly so if one accepts that SSI as a research program, SSI never produced any functional "defense." For as future weapons, Keyworth piece is Regan's SDF speech all over again, full of exaggeration. And we vaguely promises "digital defense" will result from displacing the nuclear weapon. The absurdly "digital defense" must be taken as the hallmark of the odor. The use of "digital defense" must be taken as the hallmark of the odor of science.

Budget Bombs! By Michael S. Lubell, APS Director of Public Affairs

Storm flags began flying last Feb-

uary when President Bush released his budget blueprint. Although short on specifics, one Administration's first funding go-round set a som-
bale tone for a community that had its share of business, including, as

the SFF and the DOE's Office of Science received impressive increases.

For Fiscal Year 2002, however, the Bush Blueprint called for reductions in

the research accounts for DOE, NASA and NSF, which D. Allan Bromley, sci-

cenarians to former President Bush, strongly criticized in a March 9 New-

York Times Op-Ed (reprised in late

months APS News). While the Office of Science and Technology Policy (which

is science as well as for the history of art.

The March 2001 issue of APS News contained a letter from Mat-

then about David Hockney's observation that some early artists ap-

Keyworth's letter in the March APS News is a reply with mis-

representations of my January letter. Big Bang cosmology is the pre-
A Modest Proposal: Recruit Undergraduate Majors

by Carl Wieman

Over the last several years I have visited the physics departments at many of themajor research universities. A consistent theme at essentially all of them is the desire for more good graduate students, particularly those fluent in English. A sign of this discontent is how much effort is now being invested in faculty recruitment.

Most of these same institutions where there are such intensive efforts to recruit graduate students are also putting a lot of time and effort into recruiting undergraduate majors in physics. I would like to propose that all physics departments with PhD programs should commit to putting at least 10% of the faculty time and money that they have currently spent on graduate recruiting into such undergraduate recruiting. The shrinking number and the much more dramatically shrinking fraction of undergraduate students that are choosing to major in physics and the potential of economics (which they do in droves from the physical sciences) suggests that a major factor for students switching to other majors is the lack of advice and counseling (and implicitly just contact) from faculty. According to the departmental reviews carried out by the National Task Force on Undergraduate Physics Education, departments that have been unusually successful at attracting physics student contact and recruiting of students by faculty.

Of course increasing the number of majors at one's own institution is unlikely to have much direct beneficial impact on one's own graduate program because few physics majors stay at the same institution for graduate school. So, strictly from the perspective of enhancing the graduate program, the optimum strategy of each department is to spend all of its resources on recruiting grad students, while counting on everyone else dividing their recruiting resources between graduates and undergraduates. Unfortunately, all PhD granting departments seem to have come to this same conclusion, producing the dismal outcome we see at present. Clearly the best interests of all would be better served if every such research department agreed to put this modest fraction (10%) of their recruiting resources into increasing the number of undergraduate physics majors. In this case the words of Benjamin Franklin apply nicely. "We must all hang together, or assuredly we shall all hang separately."

Carl E. Wieman is a Distinguished Professor of Physics and Fellow of JILA at the University of Colorado. Although he is a member of the APS-AIP: National Task Force on Undergraduate Physics education, this letter represents his personal opinion and not necessarily that of the Task Force.

New Membershhip Booth Debuts

The new APS membership booth debuted at the March Meeting in Seattle. Kathleen Hajdu of the Membership Department explains the many benefits of membership to an interested passer by.

The Latest on Carbon Nanotubes

A carbon nanotube integrated circuit, with a thousand nanotubes acting like transistors, has been devised by Phaedon Avouris of IBM. Nanometer-wide tubes made of carbon, much thinner than the transistors currently used, have become of great interest in electronics. Avouris described how, in a novel batch of nanotubes, one can shut out the metallic nanotubes (with a surge of voltage) while leaving the semiconducting ones intact for use as circuit elements.

Other nanotube highlights from the same meeting:
- David Tomank of Michigan State reported that experimental measurements of nanotube heat conductivity went as high as 3000 watts/m°K, almost as high as that of diamond. He predicted that nanotube performance would reach levels of 6000 watts/m°K. The ability to conduct heat will come in handy for future circuits needing to dispose of lots of heat from tight places.
- Mathieu Kociak of the CNRS in Aix, University of Paris-South, announced the first observation of superconductivity in nanotube ropes. This represents the first observation of superconductivity in a system with such a small number of conducting channels, said Kociak, referring to the meager material substrate over which the supercurrent must flow, namely the aggregate of essentially two-dimensional surfaces of nanotubes. The researchers hope to raise the transition temperatures, presently only 300-400 mK, through judicious doping.
- Jason Hafner of Harvard reported using single nanotubes (with diameters of 1.4 nm) as detectors on a novel scanning electron microscope. Not only does this narrow the probe profile, resulting in greater spatial resolution when imaging a variety of biomolecules (such as immunoglobulins) but, when used to seek out specific molecules on a sample surface, the nanotubes can serve as a kind of Raman microscope. Hafner referred to this approach as "chemical force microscopy" (CFM).
- Finally Masako Yudasaka of the NEC Lab in Japan reported on the enormous pressure that arises when C60 molecules are coaxed inside nanotubes, an arrangement called "peapods". The force on the C60 is only a nano-Newton, but by dividing this force across the tube, one arrives at a pressure of 1 gigapascal. In other words the buckyball can act like a piston for facilitating novel forms of far-field chemistry. Yudasaka also described her work with nanotubes that flare out like cones (typical size: 2 nm small diameter, length of 50 nm, and opening angle of 20 degrees). These "nano-horns" might be useful for absorbing gases (replacing other forms of activated carbon in filters).

Rattle in Seattle Creates Earthquake Art

Two weeks before the onset of the APS March Meeting in Seattle, the city was rocked by a magnitude 6.8 earthquake, cracking sidewalks, toppling building facades, and even cracking the capital dome in Olympia. Fortunately, major structural damage was less than expected, since the quake was located about 30 miles below the surface. The meeting took place without a hitch. But further north, in the sleepy settlement of Port Townsend, Mother Nature offered striking visual evidence that earthquakes have an artistic bent as well.

A local shop called Mind Over Matter displayed a hanging pendulum, featuring a pointed weight at the end of a long wire suspended over a tray of sand. The vibrations of the quake produced an intricate, rose-like shape in the sand. "You never think about an earthquake having an artistic effect," said store owner Jason Ward. "But in the middle of all that chaos, this fine, delicate art- work was created.

The Earthquake Rose. Scientists believe the rose-like shape at the center of the pattern were formed during the quakes most intense trembles.

The pendulum offered a less precise reading of the multidimensional tremors of the quake, it preserves two features of the earthquake waves in particular. The "flower" in the center records the surface movements associated with the higher frequency waves that arrived first. But not all were in tune: the outer larger amplitude oscillations record the lower frequency waves that arrived later. Sadly, the earthquake Rose is no more. Shop owner Jason Ward had intended to take a mold of the pattern. But before this could be done, this three-year-old son accidentally kicked the pendulum — and erased the sand's design. At least Ward still has the photographs.

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Meteorological and Climatological News

Aiming to detect cancers early, safely, and inexpensively, Britton Chance of the University of Pennsylvania and his colleagues have created "molecular beacons," tiny capsules that are opened by specific biochemical activity related to a tumor.

At the APS March Meeting, Chance described molecular beacons designed to detect cancers early, safely, and inexpensively. His team has created "molecular beacons," tiny capsules that are opened by specific biochemical activity related to a tumor.

At the APS March Meeting, Chance described molecular beacons designed to detect 1-2 mm sub-surface breast tumors inexpensively and without ionizing radiation. Injected into the body, the capsules remain sealed until opened by specific enzymes associated with breast cancer. The beacons then fluoresce near-infrared light in response to light being focused from a small device outside of the body. The device then detects the signal from the beacons. (The beacons emit near-infrared light so that some of it gets through the body.) The device is designed to cost only several thousand dollars, Chance said, and is based on off-the-shelf CD and cell-phone technology. The molecular beacon has successfully been tested in mice, and human tests are planned. The technique does not require uncomfortable compression of the breast, as does the currently used mammogram.

The molecular beacon was designed to work with nanotubes, which are many possible ways and represent his personal opinion and not the National Task Force on Undergraduate Physics Education.

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AIP Report Identifies Strongest PDM Programs

A new report from the American Institute of Physics (AIP) identifies 22 US schools with the strongest professional master's degree (PDM) programs in the country, helping high school teachers devise educational programs that address the needs of students who are technologically skilled and have an especially strong demand for skills that address the unique needs of industries.

The report, co-authored by Roman Czyzko of AIP, identifies schools that were doing a good job of preparing high school students for the workplace. The report, which was supported by the Sloan Foundation, defines PDM programs as those that address the current needs of industries, providing both fundamental knowledge and specialized skills. The complete report, including the list of the 22 best PDM programs, can be found at http://www.aip.org/professionalmasters/ profmsh.htm.

Report co-author Roman Czyzko, who heads AIP’s Employment and Education Statistics Division, explained: "I was interested in compiling such a study to identify schools that were doing a good job of preparing high school students for the workplace," he says. In addition, students must be prepared to work on scientific and industrial settings, according to Jim Stith, director of AIP’s Physics Resource Center, ranging from technical professional and industrial engineering companies to analysts in financial firms. "Their education must provide the foundation that enables them to quickly assess problems in diverse situations and allows them to formulate solutions," he says.

PDM programs are needed because industries are incented to demand for employees with scientific and technological skill who are also able to work outside of an academic setting. "The US economy has been growing at an unprecedented rate, driven by a large extent by technological innovation, and this has resulted in an especially strong demand for employees with scientific and technological skills. "Physics skills are superb preparation for employment, but they are more valuable and useful if accompanied by the broader set of skills needed to be a successful employee," says Bernard Khoury, executive director of the American Association of Physics Teachers. In fact, the growth of PDM programs "is a clear indication that universities are acknowledging this employment reality."

Of course, master’s degree programs come in a variety of shapes and sizes, according to Czyzko. While some are focused on only one specialization, many have multiple specializations, some have a general track along with a specialized focus, and still others offer only a general academic degree.

Nevertheless, the report found that successful PDM programs have a combination of features that fall into four general categories: bridge building (connecting the physics department to the world outside academia); programmatic emphases (drawing on the expertise of physicists by way of input from other disciplines at the university); research experiences (internships or other off-campus work experiences based on a collaboration with a corporation or government laboratory); and non-technological emphases (classes that address the unique needs of students in areas like oral and written communication, and team work).

In addition to the 22 strongest PDM physics programs, the report also lists 17 other strong PDM programs and 22 new programs still to be evaluated. The University of Arizona is among the latter, having recently initiated a professional master’s degree program, in industrial and applied physics. Launched last year and sponsored by the Sloan Foundation, the program educates students to work in interdisciplinary teams on complex problems involving rapid changing science and technology and to gain proficiency in computational techniques. Students also learn how to talk to other scientists outside their scientific mission at all levels, and to understand business and legal issues associated with their scientific projects. The university has parallel PDM programs in applied biosciences and mathematical sciences.

MEETING BRIEFS


The APS New England section held its annual spring meeting at Middlebury College in Vermont in March, in conjunction with the corresponding geographical section of the American Association of Physics Teachers. Friday afternoon’s program centered on the theme of chaos, complexity and self-organization, and featured talks on nonlinear dynamics and emergent systems. Thomas Moore of the New England College discussed keynotespeaker at the banquet that evening, summarizing lessons he learned about rerouting the introductory calculus-physics course at Pomona. In addition to assorted topics in general physics, Saturday morning’s program focused on chaos, complexity and self-organization in the high school and collegiate classroom. In addition, two general interest invited talks were given outlining ideas that helped shape physics, and applied chaos to ship dynamics and wave propagation.

APS New York Section, April 6–7, 2001, Yorktown Heights, New York

The APS New York Section held its annual spring meeting at the IBM T.J. Watson Research Center, organized around the theme of the physics of self-organized nanostructures, including nanocrystals, nanowires and nanotubes. Each of the three half-day sessions — two on Friday and one on Saturday morning — consisted of an introductory tutorial followed by a series of topical presentations by such luminaries as the field as Lynn Boother of Oak Ridge National Laboratory; IBM’s own Frances Ross; Leonid Torebek of the University of Rochester; and Alexei Ekinov of Nanocrystal Technology. Louis Brus of Columbia University was Friday evening’s banquet speaker, summarizing current trends in nanomaterials.

APS Ohio Section, April 20–21, 2001, Kent, Ohio

The APS Ohio Section held its annual spring meeting at April 2001 at Kent State University. Friday afternoon’s session featured talks on membrane protein structure, solid state NMR, and the dynamics of heme proteins determined by synchrotron Mössbauer scattering, followed by a tour of the university’s Liquid Crystal Institute. Thomas Weber, director of the NSF’s Division of Materials Research, gave a public presentation following the evening banquet, outlining NSF initiatives in information technology research, nanoscale science and engineering, and biomolecular science.

Saturday morning featured an additional invited lecture on the collapse mechanism in lung surfactant systems, and scanning near-field infrared microscopy of single living cells.

APS West Section, April 29–30, 2001, San Francisco, California

The APS West Section held its annual spring meeting at the IBM T.J. Watson Research Center, organized around the theme of the physics of self-organized nanostructures, including nanocrystals, nanowires and nanotubes. Each of the three half-day sessions — two on Friday and one on Saturday morning — consisted of an introductory tutorial followed by a series of topical presentations by such luminaries as the field as Lynn Boother of Oak Ridge National Laboratory; IBM’s own Frances Ross; Leonid Torebek of the University of Rochester; and Alexei Ekinov of Nanocrystal Technology. Louis Brus of Columbia University was Friday evening’s banquet speaker, summarizing current trends in nanomaterials.
Visa, from page 1

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 Nanotech, from page 1
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The nanotechnology Initiative is intended to support long-term nanoscale R&D leading to potential breakthroughs in such diverse areas as materials and manufacturing, nanoelectronics, medicine, the environment, energy, chemicals, biotechnology, agriculture, information technology and national security. The ability to work at the molecular level is leading to unprecedented understanding and control over the development of new materials and technologies. Nanotechnology has the potential to revolutionize the way we live and work; in medicine, and technology, and the National Institutes of Health.

Visa, from page 1

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NOMINATIONS

The George E. Valley Jr. Prize of the APS


The first prize will be awarded for outstanding research in any field of physics to an individual who is under the age of 30 at the time of nomination. The prize carry with it a cash award of $20,000. Details can be found on the APS web site at http://

Web Session, from page 1

talks from the APS Centennial meeting in 1993 had been posted on the Web, but the work had been contracted to an outside firm. Using APS resources to put talks from APS meetings on the Web had been under active consideration, but the idea received a sudden shot in the arm when the Mfg. session was scheduled. “We wanted to provide this service to the condensed matter and mathematical physics communities,” said session chair Jonathan Bagger, APS Public Outreach Specialist, who was in charge of getting the digital pictures of the transparencies. The talk had the enthused support of the chair of the session, John Clarke of Berkeley and George Crabtree of Georgia Tech. “It has just come to our attention that the experiment has worked out,” Crabtree said. “It’s a great idea.”

“Thanks to everybody at APS for all their efforts,” said Clarke.

The next step will be to post the plenary talks from the just-concluded April Meeting, which should be a more typical exercise than the Mfg. session. “The format in these emerging fields is likely to change the way almost everything — from vaccines to computers to automobile tires — is designed and made,” she said. Examples of specific applications include the use of giant magnetic-resistance in magnetic storage applications; nanostructured catalysts; drug delivery systems; nanoelectromechanical systems; reinforced polymers; molecular electronics; biotechnology in the interests of national security; and water purification.

The initiative includes a series of nanotechnology research centers, expected to be specified role in the development and use of specific tools, and in promoting range of exhibits characteristic of traditional models and theories cannot alone explain, and hence, “Development and specification and desalinization. “The combination of massive tax cuts
lead to a put a squeeze on the NSF expects to fund additional centers. The DOE has already received funding from the NSF for design of the centers, and Dreweslaus reported that final design could begin as early as 2002 if new funding can be obtained with construction expected to begin sometime in 2003. The NSF currently funds about 600 nano-related research projects involving roughly 2500 faculty and students.

“However, to make this initiative a success, we need the same level of funding increases that we’ve been seeing this past year,” said Dreweslaus, APS Executive Officer Judy Franz, who moderated the session, praised the lobbying ef
forts of many members last summer, and noted that the Congressional representatives
 joins of several other scientific and engineering societies. Their action was rewarded handsomely: the federal science budget increased about 15%, compared to an expected decrease before the letter-writing campaign began.

The NSF nanotechnology Initiative increased from $270 million for FY2000 to $423 million for FY2001, according to Haworth. The NSF received the largest share of the FY2001 budget for the initiative ($150 million), followed by the Department of Defense ($110 million) and the DOE ($93 million). Other agencies with an interest in nanotechnology are the NASA, the Department of Commerce, and the National Institutes of Health.

Currently, the current outlook for federal science funding doesn’t look quite so rosy. The change in Administration has brought a corresponding change in many major policies, and, said Franz, “The combination of massive tax cuts and substantially increased defense spending is going to put a squeeze on the NSF budget.” --- not just the Nanotechnology Initiative, but science funding across the board.

Beltway, from page 4

$500 thousand or 4.2 percent. Apart from the NSF’s Basic Energy Sciences, as well as the Department of Energy’s Advanced Energy Research Program, increases for DOE, NASA and NSF science.

Reversing the Administration’s pro-
cut policies depends upon the science community and the public to do more to contribute to scientific and engineering education, and the White House as a whole. Currently, politicians are subjected to more pressure from lobbyists, and substantially increased defense spending is go
As readers of APS News know, I’ve been taking every opportunity to promote the major functions of the American Physical Society. Therefore, our core rationale is to maintain the health of the physics community. I see a major problem emerging here. Our traditional journals, which were absolutely critical for maintaining the size and vitality of the community, are in serious trouble. We cannot continue to be effective in this role. Its statements and actions depend on the APS community, APS members and non-members alike, depends on the APS as the effective representative of physics. Simply stated, physics no longer make sense for most of us.

The APS is by far the world’s leading publisher of scholarly physics journals. Unlike the APS, however, large-scale changes are feasible. We have a highly professional meetings department, led by Donna Baudrau, that has gained valuable experience in organizing large events such as the Centennial celebration in Atlanta and the immensely complex March Meeting. With accomplished and well-staffed meetings department, we stand much firmer. Our efforts need not be as large as those of the APS. We can organize unit meetings, including their principal event, including their special importance for young physicists.

The major bright spot in this picture is the March Meeting, which focuses on condensed-matter physics and related subjects, and is attended by about 5,000 people every year. There are roughly issues and papers on related topics, presented in about 20 parallel sessions spread over five days. This meeting is organized jointly by a group of APS units whose lead- ers get together each year in the fall to select invited speakers and sym- posia. Throughout my career, although my research interests have shifted over the years, the APS March Meeting has remained a fixed point on my professional cal- endar. I know that a large fraction of the most active people in my ar- eas of interest will be there, and that their colleagues will bring papers that had not just in my current specialty, but in many other areas where relevant ideas may be emerging.

The March Meeting is big, but it may not yet be big enough. I think we need to bring back more indus- trial physicists, FIAP and other units and topical groups are working hard to do so. I also like to see more active participation by the Division of Fluid Dynamics and, more gener- ally, more aggressive efforts by many units to include sessions in far-flung interdisciplinary areas of condensed-matter physics, biology, complex systems, and the like. If our units continue to work together con- structively in these efforts, we’ll be in very good shape.

Now for the bad news. The other major general meet- ing is the one we hold in April, and I seldom went to the April Meeting until I joined the presidential line. In the spring of 2000, however, I had official responsibilities at the meet- ing in Long Beach; and my concern about what I saw was a major part of my motivation for writing this article. The April Meeting has de- clined to less than one quarter the size of the March Meeting. Most of the other units that are participating in the meeting have limited their own separate meetings elsewhere and at other times. Fortunately, I have the opinion that I saw last April seemed to use this meeting as a principal profes- sional activity in the way that many of us use April Meeting. For many physicists came to give their invited talks or receive prizes and then left as soon as possible. There were essentially no commercial exhibitors. There were some excellent special symposia; the organizers had done a good job. There were still some plenary sessions as well as other in- vited sessions of general interest. I listened, for example, to accelerator physicists talking about new design involving lasers and plasmas, but was keenly aware that there were were no opportunities for the young physicists to present to participate in the discussions. The audiences seemed small compared to what I would have ex- pected for comparable sessions in March.

As bad as it may seem, the pos- sible demise of the April meeting isn’t the only serious threat to the APS as the centrifugal forces that are af- fecting many of our units. Not only have many APS units been holding separate meetings but, in some cases, the barriers between these units ap- pear to be growing despite clear needs for bringing people together. Last year, for example, the Division of Laser Science (DLS) expressed in- terest in combining its meeting with the Division of Plasma Physics (DPP) and, so far as I know, nothing has hap- pened. Such an interdisciplinary field, one of wide-ranging importance, is under stress because of funding crises in its area of fusion research. I think it might be enormously important for the DPP to take advantage of the strengths of the APS in broadening its horizons.

For some years, the Division of Computational Physics (DCOMP) has met in conjunction with the March Meeting. But these sessions are relatively small and, one hopes, for comparable sessions in March. The APS meetings must be visibly the most important and exciting events of the year. They need exposure to fields beyond their immediate area of specialization, and they also need to talk with people who might offer them jobs. That’s what happens at the March Meeting, where recently I have been seeing not just large numbers of young people, but also large num- bers of professors competing for their services. I think that all our units ought to be providing the same opportunities for young physicists.

There are yet other advantages of large meetings. The March Meet- ings are big enough to attract substantial numbers of commercial exhibitors, whose presence adds greatly to the professional content of the meeting. The March Meeting is also big enough to provide an effective fo- rum for discussing general issues such as the status of scientific elec- tronic publication, or trends in education. A year ago in Minneapo- lis, about 2,000 people attended a special session on the proposed fed- eral initiative in nanoscience and technology. The speakers — all key players in the field — found a useful forum for engaging a large fraction of the relevant scientific community in the national debate.

In my opinion, it is their special importance for young physicists. Like the APS, both publish research journals. Unlike the APS, however, 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.

James S. Langer was President of APS in 2000.