APS NEWS

August/September 2001
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Keeping the Promise: Phys Rev Completes Online Archive

The Physical Review Online Archive or PROLA is now complete: every paper in every journal that APS has published since 1893 (excepting the present and past three years, which are held separately for current subscribers) mounted online in a friendly, powerful, fully searchable system. The project took just under ten years from earliest conception to reality.

Bob Kelly/APS

PROLA team at APS Editorial Office in Ridge, NY: Louise Bogan; Paul Dlug; Mark Doyle, Project Manager; Maxim Gregoriev; Gerard Young; Rosemary Clark.

PROLA functions primarily as an infinitely more useful replacement for some 200 feet and 1,600,000 pages of archival APS journals, the early volumes of which are deteriorating. Librarians have welcomed PROLA, noting that *Physical Review* is one of the few physics journals of whose older copies are still in active use. These fragile tomes can get the rest they deserve, while the robust new PROLA versions beam out to researchers' and students' desktops. Because it held the copyrights for individual articles, APS was able to bring the archive back to life and offer it to libraries and individuals in this durable form.

With the completion of PROLA, additional uses for the archive can be explored. The earliest volumes of the journals can be examined at length, in detail and at ease. Historians and biographers can track the expansion of the knowledge of physics that took place over the previous century in *Physical Review*. Research published in *Physical Review* by any particular author or group or institution can be collected and perused with a search of PROLA and a second search of current content. Journalists can access physics Nobel Prize winning papers when these have been published in *Physical Review*, which is very often the case. Hyperlinked citations (to LANL archive preprints and papers in journals of other publishers through CrossRef, in addition to APS) allow examination of influences on significant papers, and forward citations show the impact that these papers had on future research. A simple but sophisticated, intuitive link manager encourages authors, institutions and others to link to APS publications, both current material and PROLA. Authors are also free to mount their *Physical Review* papers on their own sites.

PROLA is composed of scanned images of the printed journals, optical character recognition (OCR) material, and a searchable richly-tagged XML bibliographic database. Each year, another year of this material is added to PROLA from the current subscription content; 1997 was added in January 2001, 1998 will be added in 2002 and so forth. Some ardent readers of *Physical Review* feared that the online conversion and (in some cases) subsequent removal of older hard copy journals from libraries meant the end of pleasant browsing, but in fact, PROLA greatly facilitates casual perusal. By clicking on the Browse button, readers can access the complete *Physical Review* collection from any location, at any

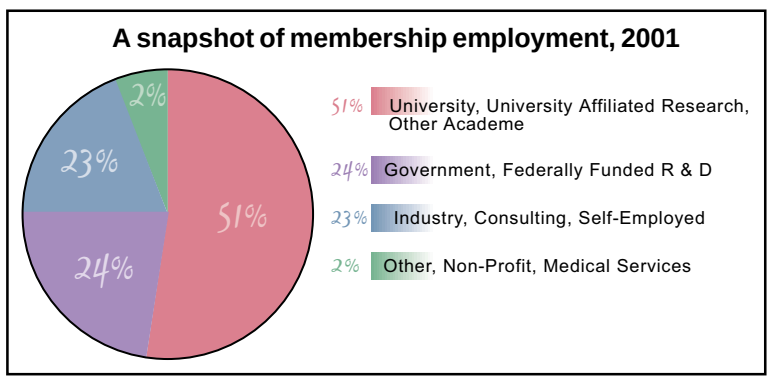
See PROLA *on page 6*

PRL Gets a New Face

Starting in July Phys Rev Letters began featuring pictures on its cover. This is the July 2 issue, showing an image of a Bose-Einstein condensate after free expansion in a magnetic field gradient. Three distinct components are observed corresponding to different spin states.

APS Journals, Services Receive High Marks From Members in Survey

The APS received high marks for its member services in the latest membership survey. *Physics Today*, online journals and meeting information, lobbying and outreach efforts, and *APS News* were among the most frequently cited benefits. In terms of demographics, results indicate a shift back towards employment in basic research and academia among newer members, with increased representation of women and a higher percentage of retirees among the total APS membership.



Since 1990, the APS Committee on Membership has conducted surveys of U.S. members every five years or so to monitor changes in the membership and their professional concerns, in order to update member services and benefits, and to understand changes in membership demographics. This latest survey was performed via the Web for the first time, and Roman Czujko, Director of Employment and Education Statistics for the American Institute of Physics, reports that it performed comparably to paper surveys in the past. "Vigilance in updating email addresses with the Web-based questionnaire resulted in a remarkable 45% response rate, comparable to a 49% response rate in the 1996 paper survey," he says. He believes that continuation of frequent email updates will allow future Web-based studies of membership demographics. This is supported by respondents, nearly half of whom said they preferred to receive email notifications about APS programs and events over any other means.

Demographically, among employed members, those who joined within the last two years are significantly more likely to be doing basic research, and slightly more likely to work in academia than more senior APS members. The number of retired members has doubled over the last ten years. Employed members with temporary visas has risen to 7% of the total membership, compared to 2% in 1996, while the representation of women is up to 9%, compared to 6% in 1996. Most employed members recall joining the Society to keep up with the community of physicists and breaking developments in their fields. However, among student members, the majority were attracted by low dues for students and recent graduates. In fact, most members who joined in the last two years are students, reflecting outreach efforts by the Society to attract more younger members to the APS.

According to the current survey results, most members have very positive responses about the APS, with the majority of respondents finding membership dues reasonable. *Physics Today* continues to receive high marks from APS members, cited by virtually all respondents (96%) as a valuable membership benefit. Other valued benefits among employed physicists and student members were online APS meetings information (86%), APS online journals (79%), and *APS News* (86%). In fact, *APS News* was rated much more highly than the survey conducted five years ago, reflecting, among other things, editorial changes in graphics and style to increase readability and visual appeal.

See Member Commentary *on page 3*

See SURVEY *on page 3*

Movin' On Up

Mike Stephens/APS

In the membership survey, 58% of physicists responding classified APS News as "very valuable" to them, up dramatically from 39% five years ago. An additional 28% rated it "valuable". Enjoying the good news are (l to r): Barrie Ripin, who was editor 1995-1999, and current staff members Alicia Chang, Jennifer Ouellette, Richard M. Todaro and Alan Chodos.

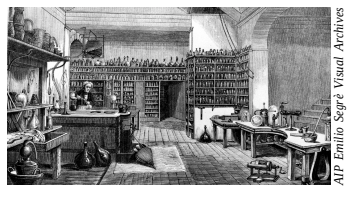
APS Selects 27 as 2001-2002 Minority Scholarship Recipients

The APS has awarded Corporate Minority Scholarships to 27 students who are majoring or planning to major in physics. Since its inception in 1980, the program has helped more than 290 minority students pursue physics degrees. Nineteen new scholars and eight renewal scholars were selected. Each new scholarship consists of $2,000, which may be renewed once, and each renewal scholarship consists of $3,000.

Corporate scholar Julian Holder, a student at Poly Prep in Brooklyn, New York, was drawn to physics through a childhood fascination with how mechanical devices such as airplanes worked,

See SCHOLARSHIP *on page 3*

HIGHLIGHTS



AIP Emilio Segrè Visual Archives

"Members in the Media"

"We think we know most of what exists in our local neighborhood, and there isn't anything which is a good candidate for producing these enormously high-energy particles. So it's a bit of a mystery where these are coming from."

—David Saltzberg, UCLA, on plans to use the moon as a high-energy neutrino detector, Space.com, May 14, 2001

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"Pythagorean mathematics was based largely on deriving relations from whole numbers and using them to describe everything in the universe. To the Pythagoreans, the world order was a number and therefore the generation of a world order was the same as the generation of a number."

—Ian T. Durham, University of St. Andrews, on the origin of the cosmologies of Eddington, Dirac and Milne, Science News, May 26, 2001

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"Imagine that you're in a boat lost at sea. You know that there is an island nearby, but you can't see it because it's just beyond the horizon. Now comes along a storm. Your boat starts to move up and down randomly in response to the waves, so occasionally your boat is high enough for you to look over the horizon and see palm trees. You have now detected, with the aid of the noise of the waves…the presence of this island."

—Frank Moss, University of Missouri, St. Louis, on how noise can help detect a signal, Discover Magazine, June 2001

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"In this experiment, the pressure is the pressure oscillation that accompanies a sound wave. The experiment shows that helium can turn from the liquid state into the solid state very quickly, that is within one oscillation of the sound which is one-millionth of a second."

—Humphrey Maris, Brown University, UPI, June 4, 2001

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"…broken new ground in the way we're doing astronomy."

—Michael Turner, University of Chicago, on the discovery of the most distant quasar yet by the Sloan Digital Sky Survey, Dallas Morning News, June 6, 2001

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"There is definitely a relationship there... If we can tighten that relationship, it should be a useful tool."

—Jim Lattimer, State University of New York at Stony Brook, on a plan to use a lead-208 nucleus as a surrogate for a neutron star, New Scientist, June 9, 2001

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"Physicists in particular have lost a lot of clout, and they've even lost a lot of esteem in the public eye, and I think that's reflected in the fact that they're now being more ignored in their advice."

—David C. Cassidy, Hofstra University, on why the Bush administration pays so little attention to scientists, New York Times, June 17, 2001

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"Not only are we not at the center of the universe, we aren't even made of the same stuff the universe is."

—Joel Primack, University of California, Santa Cruz, TIME Magazine, June 25, 2001

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"Everybody thinks space-time should be an output rather than an input of a final theory."

—Nathan Seiberg, Institute for Advanced Study, New York Times, June 26, 2001

And finally, three quotes from ABC's Nightline, June 18, 2001, on the subject of neutrinos and the first results from the SNO detector:

"Baseballs become footballs because in the world of quantum mechanics that baseball always has a little bit of football in it."

—Art McDonald, SNO, giving a metaphorical explanation for neutrino oscillations

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"We're putting on a pair of bifocals with these detectors. Now we'll be able to see near and far."

Hamish Robertson, University of Washington, on new detectors his group will install at SNO

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"All the evidence points to the fact that we are on a one-way trip, whether you like it or not."

Neil De Grasse Tyson, American Museum of Natural History, on the accelerating expansion of the universe

This Month in Physics History

September 4, 1821 and August 29, 1831: Faraday and Electromagnetism

British scientist Michael Faraday—the man who would contribute so much to our understanding of electricity and magnetism—had relatively humble beginnings. He was born September 22, 1791 the son of a local blacksmith in the area of London now known as the Elephant and Castle. He attended day school and learned the rudiments of reading, writing and arithmetic, but never pursued a more formal education. Instead, at the age of 14, he was apprenticed as a bookbinder for seven years, during which he developed an interest in science, particularly chemistry.

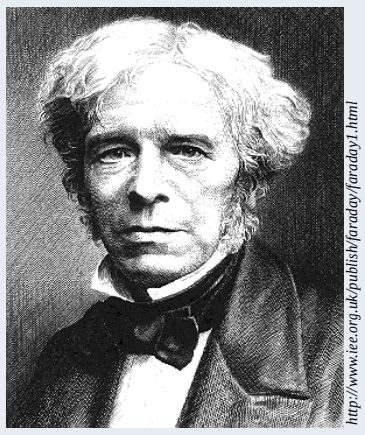
Faraday's natural inquisitiveness led him to read extensively on natural science and perform chemical experiments, even building his own electro-static machine. He also joined the City Philosophical Society in 1810, which was devoted to self-improvement in a group of young men who met every week to hear lectures on scientific topics and to discuss scientific matters. It was here that Faraday gave his first lectures, and also met Humphrey Davy, a professor of Chemistry at the Royal Institution. Davy appointed the young Faraday chemical assistant at the Royal Institution in 1813, thus steering his protégé in the direction of what would become an illustrious scientific career.

In 1820 the Danish natural philosopher Hans Christian Oersted had discovered the phenomenon of electromagnetism, which opened up a major field of scientific inquiry all over Europe. Faraday took part in this effort. On September 3, 1821, he undertook a set of experiments in his basement laboratory at the Royal Institution which culminated in his discovery of electromagnetic rotation—the principle behind the electric motor.

However, in the ensuing decade, Faraday's opportunity for doing original research was severely circumscribed, although he quickly became known as one of the outstanding scientific lecturers of his time. He liquefied chlorine in 1823 and discovered benzene two years later, but he didn't resume his work on electromagnetism until August 1831, when Faraday began ten days of intensive work which had a revolutionary impact. Ever since 1825, he had been wondering whether an electric current passing through a conductor could induce an electric current in a neighboring conductor.

On August 29th, he succeeded in accomplishing this with a six-inch diameter iron ring, around which were wound five coils of copper wire. One coil was connected to the voltaic pile and another to a galvanometer. The moment the current in the battery was active, a transitory current appeared in the galvanometer in the opposite direction. This now-famous induction cell was the first electrical transformer, and modern transformers—some of which have capacities of up to 550 MVA and contain more than 40 tons of copper—are still constructed on the same principle.

Faraday then proceeded to demonstrate that the lines of magnetic force could be cut, and a current induced, simply by rotating a copper disc by hand between the poles of a powerful electromagnet. This is now known as the principle of the dynamo, and soon found practical application in numerous small electric generators. It took several years for such generators to become efficient, but by 1841 power-driven multipolar machines were employed in Birmingham for the electroplating of copper articles, and by 1858 a generator for electric light had been installed in the North Foreland Lighthouse.



http://www.iee.org.uk/publish/faraday/faraday1.html

Michael Faraday

AIP Emilio Segrè Visual Archives; Inset: http://www.the-education-site.com/faraday.html

Michael Faraday's laboratory. Inset image of Faraday's apparatus.

During the remainder of the 1830s, Faraday worked on developing his ideas on electricity, enunciating a new theory of electrochemical action from which were coined many words that are a staple of scientific research today: electrode, electrolyte, anode, cathode, and ion, to name a few. He also worked on a new theory of static electricity and electrical induction which led him to reject the traditional view that electricity was an imponderable fluid. Instead, he proposed it was a form of force that passed from particle to particle of matter.

In the 1840s, prompted by discussions with a young William Thomson (later Lord Kelvin), Faraday conducted a series of experiments that led to his discovery of the magneto-optical effect, today known as the Faraday effect. The mathematical underpinnings of this effect were developed by Thomson and, at his instigation, by James Clerk Maxwell, in whose hands it became one of the cornerstones of modern physics. Faraday continued working in science for two more decades, but chronic ill health eventually took its toll. He died at Hampton Court on August 25, 1867.

Further reading:
http://www.ri.ac.uk.History/M.Faraday (note: case sensitive)

Ludwig, Charles: Michael Faraday, Father of Electronics (1988)

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Physics Students Make Strong Showing at 2001 ISEF

Physics students were among those taking top honors at the Intel International Science and Engineering Fair (ISEF), held in May in San Jose, California. The world's largest pre-college science competition, this year's ISEF recognized more than 800 high school students for their scientific achievements. More than 1,200 students from 38 countries competed for $3 million in scholarships and prizes. The students were judged on their creative ability and scientific thought, as well as the thoroughness, skill and clarity shown in their projects. The APS is a participant in this event, cosponsoring 3 awards with the American Association of Physics Teachers.

The grand prize, the $50,000 Intel Young Scientist Scholarship, was awarded to three students, including Francis Boulva, 18, from Montréal, Québec, Canada, who was recognized for his project, "Galactic Champagne," which demonstrated for the first time that hydrogen bubbles are associated with a particular type of star. His co-recipients were Ryan Patterson, 17, from Grand Junction, Colorado, for a creating a way to electronically translate the American sign language alphabet using a modified golf glove; and Monika Paroder, 17, from Brooklyn, New York, for her two-year study of the protein that catalyzes the transport of iodide into the thyroid and other tissues. Paroder's work could lead to a new approach to diagnosing gastric cancer.

Physics student Mariangele Lisanti, 17, from Westport, Connecticut, won the Glenn T. Seaborg Award for her project entitled, "Conductance Quantization in Gold Nanocontact", which focused on the use of single atoms or molecules to fabricate electronic devices. She and Patterson, her co-recipient for the award, will travel to the Nobel Prize Ceremony in Stockholm, Sweden, in December. Lisanti also won the $5000 prize for best project in her category of physics.

The Intel ISEF has been coordinated for the past 52 years by Science Service, a non-profit organization dedicated to advancing the understanding and appreciation of science among people of all ages through publications and educational programs. Each year a volunteer host committee representing the host city raises funds to sponsor events throughout the fair. For more information on Science Service and the Intel ISEF, see http://www.sciserv.org. Intel's sponsorship of ISEF is part of the Intel Innovation in Education initiative, a global, multimillion dollar effort to help realize the possibilities of science and technology in education. The goal is to prepare today's teachers and students for tomorrow's demands. Intel develops and supports education programs that help meet the needs of students and communities worldwide through improving science, math, engineering and technology education; improving education through the effective use of technology in classrooms; and broadening access to technology and technical careers.

Gene Meieran (extreme left), Intel Fellow and judge, and Carlene Ellis (extreme right), Intel Vice President of Education, with the winners of the $50,000 Intel Young Scientist Scholarship. From left to right: Francis Boulva, Monica Paroder and Ryan Patterson.

Photos courtesy of Intel

Ryan Patterson, 17, of Grand Junction, Colo., demonstrates his sign language translator. Patterson won a $50,000 college scholarship at the Intel International Science and Engineering Fair.

Scholarship, *from page 1*

stimulated by frequent visits to local airports and science museums. He struggled initially in his advanced placement physics course, but persevered and went on to score the highest possible grade on the national AP physics exam, and plans on making physics research a full-time career. Holder further fostered his interest in research by spending two summers at Temple University's School of Medicine, and last summer was a student intern in the Clinic Psychopharmacology Section at NIDA (part of the National Institutes of Health), in Baltimore, Maryland. In addition, he is an avid jazz fan and trumpet player, as well as a gifted athlete.

A childhood interest in methods of communication developed into a fascination with digital communication and the promise of quantum computing for Corporate Scholar Isamaria Hopkins of the Beaumont School in Cleveland Heights, Ohio. She has been an avid science student, and helped found her high school's math and science club, which now regularly participates in science competitions. She is equally active in the drama program, working behind the scenes at most school theatrical productions and writing her own plays for performance. She also volunteers for a variety of community service, including tutoring dyslexic children at a local hospital. Her participation in such non-scientific activities has given Hopkins an appreciation for their value, and also influenced her choice of fields, desiring one "whose scope is not limited to the scientific community and whose purpose is not limited to furthering itself."

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.html.

2001-2002 Scholars

New:

Jose Leobardo Banuelos
Ryan Marciel Camacho
Joy Michelle Chavez
Monique Janelle Cook
Sharon O. Doku
Darnell Reynard Edwards
Julian Breton Holder
Isamaria Fajardo Hopkins
Tyeisha L. Hughes
Lydia Akosua Kwateng
Gasper Magallanes Martinez
Bernice Carla McPherson
Matthew Isaac Pena
Amanda Marie Rice
Libet Santin
Michael Llort Steward
Marcos Steven Vicente
Kendrick Marcell Walker
Brian S. Wiggins

Renewed:

Elliot George Aguilar
David Hector Ayala
Rosa E. Cardenas
Joel Christopher Corbo
Stephen Elliff
Laura Ann Lopez
William Francis Walker Merrick
Benjamin Isaac Rapoport

Survey, *from page 1*

Most survey respondents who attended recent scientific or technological conferences say they did so to present a paper or talk, with a smaller number attending for the informal interaction with colleagues in their field. "Many members are limited by their schedules and travel budget and hence have to be selective in choosing which conferences to attend," says Czujko. The APS March Meeting continues to flourish. Czujko points out that the number of APS members who attended the APS March meeting in the last two years was even higher than usual because of the Centennial meeting in Atlanta in 1999. Respondents cited time, cost and location constraints as primary reasons they do not attend more APS-sponsored meetings, but said that invited sessions in their research speciality would increase their likelihood of attending future March or April meetings.

The Society's online journals received nearly universal positive ratings from respondents for their accessibility and usability, and this year's respondents are twice as likely than in 1996 to have either *Physical Review* or *Physical Review Letters* in their office or on their computers. Two-thirds of employed physicists and more than half of other scientists and students access online journals once a month or more for physics research literature — a dramatic increase from 1996, when only two-fifths of employed physicists used online journals.

Nearly half of the survey respondents rated the APS online journal service as superior to those of other major scientific publishers, and virtually none rated it poorer. However, paper journals are still the most frequently used format of physics research literature. Respondents said they would like to see further expansion in the coverage of the Society's online journal service, with the online archive including all issues ever printed (see article on PROLA, page 1). Some also suggested incorporation of links to online bibliographic databases and other virtual journals, as well as incorporating improved citation cross-referencing and hyperlinks to referenced articles.

Overall, awareness of APS programs has increased since the last survey conducted in 1996. "One of the most important messages received in 1996 was that communication with the members needed to be improved. Over the last five years, a lot of time and effort has gone into making the membership more aware of all the APS programs and services available," says Trish Lettieri, APS Director of Membership. Most APS members are aware of such efforts as "What's New" (76%), the Time Line Wall Chart (65%) created as part of the Centennial Celebration, and the Society's grassroots lobbying efforts (62%). Among policy issues, respondents rated energy (84%), physics-related environmental issues (75%), and the future of the national laboratories and general health of the profession (68%) as top priorities for the APS. Top priorities for the Society's public affairs, education and outreach activities included informing policy makers about physics (92%), educating the public about physics (85%) and lobbying for increased funding for physics (77%), with improvements in various levels of education averaging around 75% in importance.

Member Commentary

Survey respondents were given the opportunity to provide additional comments about the APS, and more than 350 took advantage to comment upon such issues as increasing industrial orientation and fostering ties to other disciplines, as well as increased focus on education and career issues. A sampling of their comments follows.

- "APS does a good job of meeting the needs of a wide range of professional skills in the public and private sectors of the U.S. physics community. Keep it up!"
- "The APS could be more active in helping to establish links between academia and industry, so as to increase the flow of students from high school through the university to industry."
- "Further efforts by the APS to recognize the inter-relationship between physics and other disciplines will enhance the perceived value of physics courses, as well as the reputation of the physics major in industry."
- "It would be nice to have more substantial support for women in the physics community."
- "Much more needs to be done to inform the public about the crucial importance of basic research in the physical sciences."
- "No matter how much I, as an individual, might agree with their statements, the APS Executive Committee has no right to speak for me on political issues such as nuclear weaponry, global warming, teaching evolution in Kansas, and so on."
- "We need a stronger and more vocal lobby, both in Washington and in the media."
- "I think the APS's lobbying for public funds runs the risk of reducing physics to just another pig trying to squeeze in at the public trough."
- "Oink."

LETTERS

Inflation or Flatulence?

In response to A. G. Jackson's letter in *APS News* (June 2001), there already exists a widely accepted, but embarrassing prefix, "peta-". To physicists, it denotes a factor of 10^{15}, but to many Europeans it translates more as flatulence than inflation. For instance, the amount of methane in Earth's atmosphere is approximately 4.85×10^{15} grams, or 4.85 petagrams. That's enough to enhance the greenhouse effect, which seems to raise a big stink politically between us and our friends overseas.

Loren Booda
Arlington, Virginia

Educate Teachers First

The Back Page comments by Rep. Holt (June 2001 *APS News*) correctly identified the problem [science illiteracy] but missed the mark on the solution. Yes we need competent math and science teachers, but why don't we have them? The reason is that teachers come out of our Nation's Colleges of Education where they are taught methodology but virtually no content. Without properly educating the teachers we cannot hope to educate the students.

Michael Gold
University of New Mexico

Defending Oppie

This is with regard to the feature article on Oppenheimer in the June 2001 issue of *APS News*. The description of H. D. Smythe as a congressman at the time of Oppenheimer's memorial service would surely have brought a broad smile to his face. Smythe received many honors during his life but was never an elected official except as President of the American Physical Society in 1957. During the period of interest Smythe was serving as the United States Ambassador to the International Atomic Energy Agency in Vienna. He was appointed to this position by President Kennedy in 1961. Smythe's obituary appears in the May, 1989 issue of *Physics Today*, page 96.

Val L. Fitch
Princeton University

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I initially enjoyed the article about the revoking of Oppenheimer's security clearance but it left me with a bitter aftertaste. The *APS News* was protecting the identity of his despicable enemies. Even after an evocative quote such as "[Oppenheimer's surveillance] was 'supplemented by enthusiastic amateur help from powerful personal enemies", there are no hints given.

Eugen Tarnow
Avalon Business Systems

Editor's Note: APS News received several letters in response to the historical column on Oppenheimer's security hearings. We ruefully acknowledge the misidentification of Smythe as a Congressman. These articles are intended to briefly highlight key milestones in physics history, not to promote specific political agendas. Space limitations often prevent the inclusion of in-depth detail. Readers are encouraged to use the listed references for further reading to explore such topics in greater depth. The complete transcript of the Oppenheimer security hearings can be found online at http://www.yale.edu/lawweb/avalon/abomb/oppmenu.htm.

No Degree for Kelvin

In the legend to the figure accompanying the article "New CMB Measurements Further Support Inflationary Universe" (*APS News*, June 2001), it is said, "The maps depict tiny deviations, on the order of one hundred thousandth of one degree, in the otherwise uniform 2.73 degree Kelvin background."

Since the adoption of the International System of units (SI) in 1960 by the 11th General Conference on Weights and Measures (CGPM), it has been recommended by International Committees (CGPM, IUPAP, IUPAC, ISO, e.g.) that the word "degree" not be used for temperatures on the Kelvin scale, temperatures on that scale to be referred to simply as kelvins.

If the terminology in the article mentioned above were to follow the International Recommendation, the article would read, "on the order of one hundred thousandth of a kelvin, in the otherwise uniform 2.73 kelvins background." Publications of APS should follow International Recommendations on notation and terminology.

Ralph J. Tykodi
S.Dartmouth, Massachusetts

In the Beginning...

In the June issue, you have a box on p. 6 that shows Mike Turner pondering the future of the universe together with a list of the top 11 questions at the Physics/Astronomy Interface. The sixth question asks, "How did the universe begin?" This formulation of the fundamental cosmological question is not neutral, and introduces a bias into the investigation. A more neutral formulation is, "Did the universe have a beginning or has it always existed?" This latter formulation can serve to generate a broader range of ideas with which to tackle some of the other questions, particularly, space-time dimensionality, nature of the dark energy, and proton stability.

Frank R. Tangherlini
San Diego, California

Source of Cat-Powered Monorail Revealed!

Regarding your Zero Gravity article "An alternate theory for perpetual motion" (*APS News*, October 2000), I can reveal the source of the theory: it was me. While writing up my PhD three years ago (and I can't stress strongly enough that it's in an entirely unrelated branch of engineering) I received the first part of the article, the theory of cat levitation using buttered toast, by email from a friend. The chicken tikka masala idea was thought up in five minutes, embellished with a few scientific words and a formula, and sent back to my friend, who has obviously sent it on.

Sadly, I can confirm that, to the best of my knowledge, there was no magazine contest, but I think I may have stood a pretty good chance of winning.

Requests for funding for further research and (you never know) construction of a prototype have proved unsuccessful so far. I have, in any case, abandoned the idea on economic grounds. While I am sure the cat powered monorail would be both cheap and environmentally sound, the resources needed would deprive the United Kingdom of its many curry chefs, making our national dish (and my staple diet) ridiculously expensive.

I was absolutely stunned when I saw my theory resurface for the first time on an Internet message board this morning, and a subsequent search revealed that it is posted on at least 20 sites, including yours, in the UK, USA and Australia.

Julian Griffiths
Manchester, UK

Science Testing Adds to Teachers' Burdens

The Council Statement on including science in educational assessment (*APS News*, June 2001) is certainly well-meaning in drawing attention to the importance of science in school curricula. It also hints at what Helen Quinn makes specific, that testing drives the curriculum. This situation gives short shrift not only to science, but also to all subjects other than the focus of the tests. Those subjects can be social sciences, arts, humanities and even physical education. In fact, good math practices and reading for interest are also downgraded in many instances.

In the last year, aside from my usual physics research, I have been involved in physics education research in elementary schools. I see the remarkable learning that occurs when dedicated teachers are given the opportunity to explore physics intelligently with their young students. Such opportunities are being threatened by state mandated testing that presumes to include science while emphasizing facts. And now Bush's government is requiring more assessment, particularly of reading and math.

It is unfortunate that the APS and other scholarly societies did not speak out against this standardized testing fever before it swept through Congress. The inclusion of science testing in an essentially wrong-headed program may only add to the burden that is already decelerating educational progress.

Gary R. Goldstein
Tufts University

A Reform Agenda for APS Meetings

James Langer's concern about the decline of our general meetings (The Back Page, *APS News*, May 2001) is a courageous effort to address a problem that has actually been in the making since 1966, when the Society surrendered its traditional character of being one big society in favor of being a federation of assorted specialists.

That profound change altered the character of the Society in many ways. The decline in attendance and interest of our general meetings began most conspicuously with what used to be the grand AAPT-APS Joint Meeting, held annually in January in New York City, which has since long faded into oblivion. Langer's recipe for reform is to convene larger meetings. But why should that work, when it is the general meetings that have been persistently moribund? If divisions meet concurrently, will that mean genuine scientific interaction among them?

Rather than prescribe for the ailing patient, I suggest that the patients be given a chance to diagnose their own condition and propose their own remedies. I strongly suggest that at the next general meeting, the problem of general meetings themselves be open for discussion with a series of invited and contributed papers.

Lawrence Cranberg
Austin, Texas

Article Rejection Tied to SSC Demise

The June 2001 issue of *APS News* summarizes the views of four speakers on why the SSC project was terminated. I would like to add a view related to that of Goldston and Schopper. Some time ago I wrote an article to explain on a solid technical level, *but without reference to field theory*, the important ideas of gauge theory and the Standard Model. The prerequisite is only a decent understanding of the Schrödinger Equation and a willingness to learn a very narrow part of group theory and Lie algebra, all self contained in my very short article. In the article I assert that 95% of all living physicists don't understand at all the Standard Model and that the majority of the physics faculty at leading universities also don't understand it. I have no proof those statements are accurate except that nobody has ever challenged them. When my article was refused by the American Journal of Physics the accompanying letter, written by a theorist, acknowledged that the paper was correct if "idiosyncratic" but said there is no use trying to get the majority of physicists to understand the basic ideas of modern particle theory because "the geometric and algebraic imagination that is needed to assimilate these ideas is hard and hence takes time to absorb". If the majority of members of the American Physical Society have little interest in basic understanding of modern particle physics, why should the man in the street underwrite the next multi-billion-dollar SSC project?

Henry R. Lewis
Boston, Massachusetts

Women in Science, or Women Scientists?

As a retired woman physicist, I was very interested in Howard Georgi's Back Page article in the January 2000 *APS News* and the subsequent letters in response. While I agree with Georgi that much progress has been made by women in science in the last 25 years, the situation then was so bad that any reasonable improvement could easily be qualified as "much progress." The situation is still not entirely satisfactory, as one woman graduate student pointed out in response to Georgi's article. She finds the repeated question, "Why are there so few women in physics?" difficult to bear, and like many other young women scientists, considers affirmative action an insult to women's abilities.

The situation differs from one country to another, but the final result is the same: in the highest rungs of the ladder, the ratio of women to men physicists is extremely small. In North America, I think the discrimination process that culminates in this situation begins very early in a girl's life, and is much more cultural than gender related.

Georgi addresses the problem mostly at its latest stage, but provides useful insight into the thinking processes of hiring committees. He establishes five hiring criteria, of which the second seems the most important to me: "Do not define the area of search too narrowly." In order for the ratio of women to men PhD physicists to increase, it will be necessary to follow this principle. Physics will be much more appealing to young women if they see several women physicists on the staff of university departments. In addition to having useful role models, they will also be more inclined

See LETTERS *on page 5*

zero gravity

Feline Physics

Law of Cat Inertia. A cat at rest will tend to remain at rest, unless acted upon by some outside force - such as the opening of cat food, or a nearby scurrying mouse.

Law of Cat Motion. A cat will move in a straight line, unless there is a really good reason to change direction.

Law of Cat Magnetism. All blue blazers and black sweaters attract cat hair in direct proportion to the darkness of the fabric.

Law of Cat Thermodynamics. Heat flows from a warmer to a cooler body, except in the case of a cat, in which case all heat flows to the cat.

Law of Cat Stretching. A cat will stretch to a distance proportional to the length of the nap just taken.

Law of Cat Sleeping. All cats must sleep with people whenever possible, in a position as uncomfortable for the people involved, and as comfortable as possible for the cat.

Law of Cat Elongation. A cat can make her body long enough to reach just about any counter top that has anything remotely interesting on it.

Law of Cat Obstruction. A cat must lay on the floor in such a position as to obstruct the maximum amount of human foot traffic.

Law of Cat Acceleration. A cat will accelerate at a constant rate, until he gets good and ready to stop.

Law of Dinner Table Attendance. Cats must attend all meals when anything good is served.

Law of Rug Configuration. No rug may remain in its naturally flat state for very long.

Law of Obedience Resistance. A cat's resistance varies in proportion to a human's desire for her to do something.

First Law of Energy Conservation. Cats know that energy can neither be created nor destroyed and will, therefore, use as little energy as possible.

Second Law of Energy Conservation. Cats also know that energy can only be stored by a lot of napping.

Law of Refrigerator Observation. If a cat watches a refrigerator long enough, someone will come along and take out something good to eat.

Law of Electric Blanket Attraction. Turn on an electric blanket and a cat will jump into bed at the speed of light.

Law of Random Comfort Seeking. A cat will always seek, and usually take over, the most comfortable spot in any given room.

Law of Bag/Box Occupancy. All bags and boxes in a given room must contain a cat within the earliest possible nanosecond.

Law of Cat Embarrassment. A cat's irritation rises in direct proportion to her embarrassment times the amount of human laughter.

Law of Milk Consumption. A cat will drink his weight in milk, squared, just to show you he can.

Law of Furniture Replacement. A cat's desire to scratch furniture is directly proportional to the cost of the furniture.

Law of Cat Landing. A cat will always land in the softest place possible; often the mid-section of an unsuspecting, reclining human.

Law of Fluid Displacement. A cat immersed in milk will displace her own volume, minus the amount of milk consumed.

Law of Cat Disinterest. A cat's interest level will vary in inverse proportion to the amount of effort a human expends in trying to interest him.

Law of Pill Rejection. Any pill given to a cat has the potential energy to reach escape velocity.

Law of Cat Composition. A cat is composed of Matter + Anti-Matter + It Doesn't Matter.

Editor's Note: In the interest of promoting equality among animal species, APS News invites our readers to submit their own versions of the canine physics. Submissions should be sent to Editor, APS News, One Physics Ellipse, College Park, MD 20740; FAX: 301-209-0867; email: letters@aps.org.

VIEWPOINT…

Congress Needs Scientific Advice

Bring Back The OTA

By Barrett Ripin and Anthony Fainberg

"In politics it often seems that perceptions are facts, and facts are negotiable," asserted Rush Holt in an *APS News* Back Page (October 1999) shortly after his initial election to Congress. Everyone knows that there are many factors influencing the fate of legislation, including facts. Momentous national decisions loom that carry long-term and, perhaps, irreversible, consequences. Many issues are steeped in complex and confusing science and technology issues. To provide for a more rational basis to make such far-reaching decisions, Rep. Holt, on behalf of over 40 cosponsors from both sides of the aisle, introduced a bipartisan bill [H.R. 2148] in June to reestablish the Congressional Office of Technology Assessment, OTA.

True, Congress certainly does not lack sources of information. A myriad of government entities, the National Academy of Science's National Research Council (NAS/NRC), lobbyists and interest groups, expert witnesses and advisors, including physicists, think-tanks, etc. offer information and diverse compelling arguments. Congress's problems are dealing with information overload, minimizing political biases and perceptions thereof, and not knowing what you don't know.

Why is OTA needed, given other respected sources? The NAS/NRC, government agency and other blue-ribbon panels certainly provide valuable perspectives. However, most such studies are undertaken and authored by panels drawn from actively involved experts with various preexisting interests. Resulting reports and recommendations tend to be consensus-driven and are often less than crisp, accommodating rather than contrasting varying interest elements, and, on occasion, leave open questions of objectivity.

As useful as current institutions are, many experts see an essential, if complementary, role for reports marked with OTA's brand of non-partisanship. Members and their staffs and advisors need a source they can trust for critical, impartial analyses that delineate serious issues from fluff, weigh pro/con arguments, and lay out long-term consequences of various options. Even the NAS lacks the mechanisms employed by OTA (many of them by statute) to assure a nonpartisan approach at every stage of a study. Moreover, OTA, whose studies are authored by staff, can be generally less expensive and faster.

OTA was established in the Nixon era to fill the need for independent scientific and technical advice to Congress. The institutional safeguards for bipartisan oversight incorporated by OTA, along with two decades of results, brought a reputation for competent, nonpartisan, technical analyses that was unmatched in government. Other nations rushed to set up similar institutions, which, ironically, still exist.

OTA fell victim to the Gingrich Congress' zeal to make a show of reducing government by axing a few small sacrificial lambs. In addition, many felt it was OTA's independence and credibility that were resented. OTA did enjoy support from most Democrats as well as many Republicans, such as Reps. Weldon (PA), Hyde and Houghton and Senators Stevens, Bond, Grassley and Hatch. OTA survived the conservative House, but was narrowly killed in the Senate. The Conference Committee sealed the demise by only one vote. OTA was closed in 1995.

During its two decades of existence, OTA produced widely-hailed, landmark reports on such diverse topics as nuclear waste disposal, alternative cancer treatments, genetic engineering, infertility, space policy, costs of mitigating the greenhouse effect, office automation, technology and the handicapped. Interested readers can peruse the full set of OTA reports archived at: http://www.wws.princeton.edu/~ota/ns20/pubs_f.html. Would the nation not benefit today with in-hand independent analyses of stem-cell research, energy policy, CO_2 emissions, the relative funding of research in biosciences to other fields, or improved voting technologies, to name a few?

Was OTA ideal and, if reincarnated, should it be a clone of its first life? Clearly not. OTA had a number of real and perceptual problems. In addition, the needs and political landscape have changed over the years. Sometimes, OTA's response time from study inception to report was indeed too slow.

Complaints of poor access by members of the minority party, partisanship in the selection of topics, and analyses undermining political agendas were also heard. Some criticisms simply stemmed from a misconception of the role of OTA, which was to anticipate pivotal topics prior to emergence of pending legislation. Like all attempts to predict the future, such a goal is difficult to achieve.

Independent observers assert that, on the whole, OTA, under Jack Gibbons and its last director, Roger Herdman, went a long way to respond to Congress's real-time needs while maintaining rigor and objectivity.

A revival of OTA, or the functional equivalent, to be successful, will need the strong bipartisan support it used to have. It should incorporate some new procedures that both speed up comprehensive studies as well as assure the best guidance possible for pending legislative action. We think that it is imperative to restore this resource to Congress so that far-reaching decisions are based more on fact than perception.

Barrett Ripin, former APS Associate Executive Officer, has a private consultancy, Research Applied, in Bethesda, MD. Anthony Fainberg was a former Senior Analyst at OTA and a former Chair of the APS Forum on Physics and Society.

Letters, *from page 4*

to consider the field as a viable career option.

I have some reservations about Georgi's fourth criterion: "Ask your informants to list the best minorities and women in the field, even if they do not rate them as highly as the top men." Nevertheless, this criterion might still be necessary, not because women physicists aren't as good as the men, but because hiring committees are still mostly male. Every man will see a woman applicant through his cultural prejudice, which, no matter how slight, will add up in a collective final decision that will usually be biased in favor of a man.

As a woman physicist who has suffered from unemployment and under-employment, I would like to say that if anyone is serious about welcoming women in physics, the first way to prove it is by hiring those women who are now ready to enter the physics job market, and by promoting equitably experienced women physicists. With the cycle thus completed, the wheel of change will be able to start turning. And as a sign of this change the designation "women in science" so often seen might one day evolve into "women scientists."

Luce Gauthier
Montréal, Québec, Canada

Feynman's Large Numbers

The recent flurry of activity in *APS News* (April 2001; June 2001) concerning large numbers was interesting and amusing. It reminded me of my graduate school days at CalTech, when Richard Feynman was teaching senior/graduate mathematical physics around 1964.

He enjoyed describing a contest in which the object was to describe or define the largest number on a 3x5 card using a standard typewriter (this means about 1000 characters, so if one just writes out 9999… the number would be about 10^{1000}). After debating with himself the merits of writing $10^{999\ldots}$ or $1000^{999\ldots}$, etc., he described the hair raiser function [H(N)], which is defined by $H(1)=1$, $H(2)=2^2$, $H(3)=3^x$, where $x=3^3=27$, and so on. H(4) would be 4 to the (4 to the (4 to the 4)), and evaluating H(5) leads to the realm of large numbers.

Feynman's solution was to define H(N) via H(1), H(2), and H(3) on half the card, and then his large number was H(999…) = $H(10^{500})$, as only 500 characters remained. Of course, anyone who knew Feynman also knows that his fun came from showing us how to evaluate H(4) and H(5) on a blackboard without use of a slide rule (handheld calculators didn't appear until after 1970).

In light of the above, I suggest that Feynman's Hair Raiser Function takes precedence over Ottinger's "Gufa" numbers of Cockburn's "Fuga" numbers.

Lorin S. Vant Hull
Houston, Texas

Task Force to Study Prizes and Awards

APS President George Trilling has appointed a task force to review APS Prizes and Awards, and charged it with the responsibility of looking at, among other things, the proliferation of such awards and the criteria for establishing new ones.

The task force will be chaired by Myriam Sarachik, Vice-President of the APS, and has six other members drawn from a spectrum of APS divisions. It is the latest in a sequence of such bodies, the most recent of which was chaired by Mildred Dresselhaus in 1997-1998.

Another element of the charge deals with the relationship between the Society, which oversees and approves the awards, and the individual units that are involved in the selection process. The task force is asked to find "the appropriate balance between the role of the unit involved in that prize or award and the Society's responsibility to ensure adequate uniformity in the selection process."

The complete charge to the task force and the list of members can be found on the web at http://www.aps.org/praw/taskforce/index.html. Members of APS who wish to communicate with the task force are invited to send their comments by e-mail to any of the task force members. The task force will begin meeting this summer and is expected to have its report ready sometime next spring.

The web site also contains a link to the Dresselhaus report of 1998.

Physicists Honored with Innovation Awards

Two APS members were among the recipients of the 2001 Discover Magazine Innovation awards for their respective work in detection of land mines and a new technique for printing inorganic chips. Physicists were also honored for work in the development of a combined optical and magnetic resonance microscopy imaging technique, and for a new propulsion method for spacecraft that transforms an eight-inch magnet into a potent plasma power source.

Richard Craig, a physicist at Pacific Northwest National Laboratory in Richland, WA, received this year's $100,000 Christopher Columbus Foundation Award for his development of a timed neutron detector (TND) of plastic land mines, which elude conventional metal land mine detectors. His inspiration came when he attended a seminar on land mines at a nuclear technology conference in Crete, and learned that roughly 26,000 people die each year from accidentally triggering land mines, a third of them children. Craig's TND is essentially a souped-up weedwhacker, with the ends and motor lopped off and the addition of sophisticated hardware. The heart of the system is a small amount of the isotope californium 252, which emits neutrons as it decays. When the neutrons collide with the nucleus of a hydrogen atom, they slow down as they return to the TND, triggering a screen alert that a hydrogen source—most likely a mine—has been located.

Joseph Jacobson of MIT's Media Laboratory in Cambridge, MA, has focused his efforts on faster, cheaper alternatives to the current expensive, labor-intensive microfabrication process for computer chips. He has demonstrated a new technique using a "nanotectic" liquid that is part nanometer-scale crystal, part solvent. When the liquid is applied to a flexible base such as plastic, the solvent evaporates, leaving the crystal nanoparticles to form structures capable of conducting electricity. Thus far Jacobson and his team have built simple transistors, and they believe logic chips could be achieved within four years. Their most exciting development to date is the achievement of an operable MEMS motor, but Jacobson foresees a day when logic chips can be embedded in such everyday items as index cards, wallpaper and even wearable computers in clothing.

Marburger Nominated as OSTP Director

In June, President Bush announced his intention to nominate John H. Marburger to become the new Director of the Office of Science and Technology Policy. Marburger is currently the Director of the Brookhaven National Laboratory and President of Brookhaven Science Associates. The nomination has drawn praise, including positive words from the previous OSTP Director, Neal Lane.

President Bush's lack of a science adviser has been a growing source of concern within the S&T community. There is speculation that the Administration's FY 2002 budget request for R&D might have been higher had there been a science advisor. There is also concern that policies with a large science component, such as global climate change, stem cell research, and national missile defense are being formulated without the input of a science advisor. Senior level S&T appointments also await the guidance of this advisor.

Marburger has a PhD in Applied Physics from Stanford University, and a BA in Physics from Princeton University. Before coming to Brookhaven, he was President of the State University of New York at Stony Brook. Marburger also served as the chairman of Universities Research Association, which runs Fermilab, from 1988-1994.

Brookhaven National Laboratory was much in the news when Marburger became its director in 1998. A tritium leak in its High Flux Beam Reactor attracted considerable media attention, resulting in a call to close the reactor by local groups, a senator and a representative. At a late 1997 press conference, as incoming director, Marburger remarked that the laboratory failed to communicate adequately with the local community. The Secretary of Energy closed HFBR in 1999. Marburger has been praised for the way in which he reestablished communication with the lab's neighbors.

John H. Marburger

The Senate nomination hearing is not expected until September. In discussing the announcement, Floyd Kvamme, the co-chair of the President's Council of Advisers on Science and Technology (PCAST), said that Bush was "looking for somebody with broad experience and an appreciation of practical science issues." Marburger describes himself as a lifelong Democrat. In an interview with the New York Times, Marburger declared, "If there's any subject that should be bipartisan, it's science."

—Richard M. Jones, AIP Public Information

Ramavataram Fellow Completes Year in US

Mahantappa Jogad, a professor of physics at the Sharanabasaveshwar College of Science in Gulbarga, Karnataka, India, recently completed his tenure as the 2000 recipient of the APS Ramavataram Fellowship. A distinguished scholar and award-winning teacher with 22 years of experience in India, Jogad's area of scientific expertise is thin films, polymers, and glass and glass-ceramics.

The Ramavataram Fund was established in 1983 through donations from family and friends of K. Ramavataram, an Indian-born teacher and researcher in nuclear and molecular physics. The fund's aim is to improve undergraduate physics teaching in India by allowing Indian physics teachers to visit institutions in North America, to observe and study teaching methods. K. Ramavataram was a professor of physics at l 'Université Laval in Québec at the time of his death in 1977. The fund provides about $5K of stipends to each recipient, with the host institution in the US and other grants providing other financial support as needed.

Jogad, who received a Fulbright Fellowship for the same academic year, split his tenure between three institutions in the US: Michigan State University, the University of Nebraska, and the University of Missouri. While here, he conducted experiments on fusion heat and melting points of solids, as well as dielectric studies of glass-ceramics and polymers, presenting a paper on glass-ceramics at the 2001 APS March Meeting in Seattle and submitting two papers for journal publication. Jogad also learned new teaching methods using a computer interface to take back with him to India.

PROLA, *from page 1*

time, to browse idly or with purpose.

Non-subscribers can view the abstracts and tables of contents, and can purchase individual articles they want to see.

The PROLA project took shape in the early and mid-1990s, when the Naval Research Lab was engaged in a cooperative research and development agreement with APS to scan images of *Physical Review* for an electronic library initiative, and a Los Alamos National Lab group was converting *Physical Review* legacy typesetting data into a searchable archive. Then the World Wide Web appeared on the scene and the result was a cooperative APS-NRL-LANL agreement in which the NRL images were delivered to the Los Alamos PROLA group and integrated into a search engine for delivery via the Web. PROLA moved to the APS Editorial Office in 1998, under the direction of Mark Doyle, a young physicist who came to APS in 1996 from LANL, where he had worked with Paul Ginsparg on the pre-print archive. Doyle added many new features and considerable sophistication to PROLA, which he launched online at the end of 1998, with *Physical Review* from 1985 to 1996.

APS contracted with APEX ePublishing Data Services to rekey the front matter and references for the rest of the archive and to scan in the pages. Progress back into the archive was slow at first because of the amount of material involved, but picked up speed rapidly, reaching completion in May of this year. Enhancements expected by the end of the year include rescanning of the 1985-1996 material to a higher standard, and a *Physical Review* search engine that will include PROLA and current content. Feedback and suggestions for enhancements are invited as more researchers make use of the archive and encounter occasional problems in scanning quality or links. APS members are invited to browse PROLA and get subscription information by going to http://prola.aps.org/, or the new PROLA mirror at Cornell University (see above side-bar).

APS officers and staff at the Editorial Office take great satisfaction and pride in the completion of PROLA and the warm reception it has had in the research and library communities. "I give much credit to my predecessor Ben Bederson and to [Journal Information Systems Director] Bob Kelly, who conceived of and pushed the project forward, and above all to [Products and Services Manager] Mark Doyle who took over as the project manager and made PROLA happen," said Marty Blume, APS Editor- in-Chief.

Physical Review Comes Home to Cornell

Building on an effort to ensure uninterrupted and enduring access to its journals, the APS has entered into an agreement with Cornell University Library, in which the Library will maintain a mirror copy of APS journal archives. The mirror will be accessible to anyone on the Internet in accordance with the APS's pricing policies.

"Last year the APS took an important first step by agreeing to archive our content with the Library of Congress. This agreement with Cornell represents another major step forward in making concrete our commitment to round the clock electronic access to this archive via the Physical Review Online Archive (PROLA). We expect to take further steps in the future to improve international access while continuing to work with the library community to secure the archive's long term future," says APS Journals Product Development Manager Mark Doyle.

The visible mirror at Cornell consists of the newly completed PROLA, comprised of back issues from 1893-1997 of the following journals: *Physical Review* Series I and II, *Physical Review* A-E, *Physical Review Letters*, and *Reviews of Modern Physics*. The new mirror will also serve as a backup to current content in the event that the APS's primary servers are not available.

"This is a particularly appropriate partnership for Cornell University Library because *Physical Review* was established at Cornell University in 1893," commented Carl A. Kroch University Librarian Sarah Thomas. "I am delighted to welcome Physical Review back to Cornell in its electronic form. Through this agreement, Cornell University Library and the APS will be working together to archive and to provide access to PROLA, the primary record of research in the physical sciences."

ANNOUNCEMENTS

PROPOSED AMENDMENT, APS BYLAWS

Regarding How Units Vote on Bylaw Amendments
First Vote Approved by Council April 27, 2001

The APS Constitution and Bylaws Committee has reviewed the process of unit bylaws amendments. It has determined that several units allow voting on proposed bylaw amendments at their annual meeting. The committee feels that this practice is unfair for those members who cannot attend an annual meeting and recommends the following changes in the APS Bylaws on this matter. To comment on this, please contact Ken Cole by e-mail (cole@aps.org), or by mail (One Physics Ellipse; College Park, MD 20740).

BYLAWS CHANGE

ARTICLE VIII – DIVISION, TOPICAL GROUP, FORUM AND SECTION CONCERNS

3. *Revision of Division, Topical Group, Forum, or Section Bylaws.* A Division, Topical Group, Forum, or Section shall submit proposals for the revision of its Bylaws to the Council for its approval, subject to review by the Committee on Constitution and Bylaws. FOLLOWING COUNCIL APPROVAL, COPIES OF THE PROPOSED BYLAWS REVISIONS SHALL BE DISTRIBUTED TO ALL MEMBERS OF THE DIVISION, TOPICAL GROUP, FORUM OR SECTION WHO THEN SHALL VOTE ON THE PROPOSED REVISIONS BY PAPER AND/OR ELECTRONIC BALLOT, AS THE EXECUTIVE COMMITTEE SHALL DESIGNATE.

National Academy of Sciences

The National Academy of Sciences is accepting nominations for the **Arctowski Medal**, a prize of $20,000 and a $60,000 award to an institution of the recipient's choice to further research in solar physics and solar-terrestrial relationships. The award is presented every three years for outstanding contributions to the study of solar physics and solar-terrestrial relationships.

The National Academy of Sciences is accepting nominations for the **Arthur L. Day Prize and Lectureship**, a prize of $20,000 awarded every three years for new contributions to the physics of the earth. In addition, the recipient will deliver (a series of) lectures at an institution other than his or her own.

The National Academy of Sciences is accepting nominations for the **Robertson Memorial Lecture**, a $10,000 prize presented every three years; the 2002 field is low-temperature physics. In addition, the recipient is invited to lecture on his or her work and its possible international implications.

CALL FOR NOMINATIONS

All nominations will be accepted through August 31, 2001

For more information contact:

National Academy of Sciences
Awards Program; Rm NAS 185
2101 Constitution Avenue, NW
Washington, DC 20418
Phone: (202) 334-1602
Fax: (202) 334-1682
e-mail: awards@nas.edu
http://national-academies.org/nas/awards

There is still time to vote in the APS Election Vote by September 1, 2001 at http://www.gosbs.com/apselection

New Programs Push Business Education for Scientists

by Richard M. Todaro

A plan by the University of Florida to introduce a new Master of Business Administration (MBA) geared specifically toward scientists and engineers is the latest example of an ongoing effort by academic institutions to expand the scope of their business education programs.

The move by the University of Florida brings it into line with other universities that have instituted Masters degree-level programs in business education for scientists and engineers, and it reflects a growing sense that such training is necessary in today's high-tech economy.

The University of Florida's new executive MBA degree program is intended specifically for scientists and engineers who "feel they need a business degree in order to further their careers" in research laboratories or private industry, according to Erik Gordon, Director of MBA Programs in the University of Florida's Warrington College of Business.

The program, which will take 20 months to finish, is referred to as an executive, as opposed to a standard, MBA because it is geared toward people who are otherwise employed full-time and hence can only commit a few days a month to participating in the class.

Gordon said significant numbers of scientists and engineers are finding that they need a business education to compete.

"The genesis of the new program is that I and our MBA Programs have strong ties to several of the science departments and to the engineering school at UF (University of Florida)," Gordon stated.

"For better or worse (and I have mixed feelings about this), it appears that a decent number of scientists and engineers, mainly in industry but also a few in academe, feel that they need a business education in order to further their careers, presumably in management of larger laboratories or because they are moving into positions such as Chief Scientist or Chief Technical Officer at large or start-up companies."

Other schools around the country have instituted or are instituting masters-level business programs for scientists and engineers. Besides MBA degrees, which are intended for those with at least a few years of real-world experience, many business schools offer Masters of Science (MS) degrees, for students who want to learn business graduate school basics even though they may lack job experience.

Cornell University instituted its "Twelve-Month Option MBA" in 1995, aimed specifically at scientists and engineers. The program was created following a comprehensive survey of 500 of the Forbes 1000 companies by the university's Johnson Graduate School of Management.

In the survey, two-thirds of the senior managers polled agreed that a "cultural divide exists between employees with technical training (such as those in research and development positions) and those without (such as those typically found in sales and marketing positions) and that this cultural divide is a significant problem."

Alan G. Merten, former dean of the Johnson School, stated at the time, "Professionals who combine scientific or other technical knowledge with business training could become the so-called 'gold-collar' workers, a new generation of business elite with several distinct areas of expertise."

Just this past fall, Case Western Reserve University in Cleveland inaugurated a new degree called a Masters of Science in Physics - Entrepreneurship Track. The degree is part of the Physics Entrepreneurship Program.

Run by the physics department in collaboration with the business school, the program was created as the result of surveys of alumni that found there was a need for such a program.

"[In 1993-94] we began surveying our alumni and found that many had become entrepreneurs," said program director Cyrus Taylor. "The feedback we got from alumni was that they felt their physics background and thinking as a physicist had been extremely important…but there were many lessons they had to learn in the school of hard knocks."

In addition, the department brought in physicists-turned-entrepreneurs as guest speakers and sought out their advice.

The business school part of the program is overseen by Robert Hisrich, chair of the Division of Entrepreneurship in the Weatherhead School of Management at Case Western.

Hisrich said there are plans to recreate versions of the Physics Entrepreneurship Program in the chemistry, biology, and mathematics departments, among others. Each will offer its own MS degree.

In addition, Hisrich oversees the Technology Entrepreneurship program, which is run jointly with the university's engineering school and offers yet another MS degree. In this program, an engineering professor and a business professor jointly teach each course in order to help students navigate in both worlds.

"The goal is to produce engineers who have an understanding of the relationship between engineering and business and who have a much better capability of being involved in a company. I think the marriage between science and entrepreneurship is a perfect one," Hisrich said.

Brian Schwartz, a vice president for research and a professor of physics at the City University of New York, said the new University of Florida program and the Case Western programs already underway represent "a continuation of ideas that are in the wind."

Under a National Science Foundation grant, Schwartz developed three career-related courses for doctoral science students.

"These courses were designed to help such students enhance skills they ordinarily don't get in graduate school, such as resume-writing, communication skills for a non-scientist audience, and business and economic skills of how the world of high technology operates," Schwartz said.

He said that physics graduate students should take at least some business courses and have two career paths in mind – an ideal one and a more practical one.

"My advice to many physics graduate students who are interested in business [is] to take a course or two in the school of business, or even audit a course or two," Schwartz said. "I tell students to have two career paths in parallel simultaneously. One is their fantasy, and the second is one that they are interested in and that offers perhaps better employment opportunities."

The University of Maryland, College Park is another school that offers students either the option of an MS degree or an MBA degree with a specialized concentration in an area of interest to people with science or engineering backgrounds.

Erik Gordon said Florida's new program will focus on scientists and engineers who want to work in businesses "driven by science or technology" rather than "trivial marketing tricks or financial wizardry that fill many MBA programs."

He said the program's curriculum is being modified to incorporate topics such as intellectual property management and innovation, while the core MBA courses are being directed "to include applications relevant to science or technology-driven operations."

"Of course, they (students) will get the core marketing, finance, etc., if only to know how to defend against it."

Although specific numbers of slots for particular disciplines have not been allocated, Gordon said his office is expecting scientists in physics, chemistry, and biology, and engineers in electrical and chemical engineering to take part in the program. Others expected include individuals in material science and the medical device industry.

"We expect it to be one of our most interesting programs. We are already getting inquiries not only from the U.S. but also from Asia and Europe," Gordon said. "The program will meet one weekend per month, so it would be a long flight from Tokyo but I would not be surprised if we have someone from Japan."

THE BACK PAGE

The View of Physics From High School

By T. K. Rogers

I tell my high school physics students, if they become overexcited watching televised football, to work physics problems for relaxation. I'm kidding of course. In reality, I consider physics far more exciting than football. Yes, I am a nerd but I do greatly admire football's support system. It begins in preschool, has ample resources, and involves thousands of enthusiastic paid and volunteer workers. It teaches teamwork, but ultimately it insures a quality supply of about 1500 professional NFL players to entertain us. It's a model of success.

By contrast, our physics training system barely functions, doesn't begin until middle school, receives modest resources, involves a relatively small number of paid workers who are sometimes unenthusiastic, and has no emphasis on teamwork. Nevertheless, our physics system plays a major role in maintaining our supply of about 18,000 physicists and 1.8 million engineers (who should be viewed as applied physicists) and is a prerequisite for our supply of about 600,000 physicians and about 1.9 million computer professionals. Our system's ultimate purpose is no less than insuring the technological leadership our standard of living is based on. Yet, it not only lacks football's cultural standing, but doesn't even produce enough professionals for high-growth areas such as computer engineering.

In high school the discrepancy between physics and football is sharply defined. Football rules. One doesn't even need football skill to bask in its glow. Virtually everyone participates. There's the cheerleaders, band, and booster club, not to mention the fans. By comparison, the physics program often consists of a single class limited to a few nerds. Frequently, the class is taught by a person with marginal qualifications. According to a 1997 survey conducted by the American Institute of Physics, only 22% of individuals teaching physics were physics majors. An additional 17.6% were math or engineering majors, leaving a balance of 60.4% with marginal backgrounds. This would be scandalous in any other area of study.

The marginal qualifications of physics teachers are no surprise. Bachelor's degree physics majors can get 40% higher salaries, and engineering majors 70% to 80% higher starting salaries, than teachers. By contrast, an industry-bound bachelor's degree chemistry or biology major gains only a 10% starting salary premium over teachers (*Occupational Outlook Handbook*, Bureau of Labor Statistics, http://stats.bls.gov/oco/oco1002.htm). Second grade, PE, and AP Physics teachers with the same years of experience get the same salary even though the rigor of their training and industry marketability differs greatly. In K-12 all teachers are considered first and foremost supervisors of students. While this may be necessary, it's generally not a source of fulfillment for physics-trained people. Since physics is usually not a required course and doesn't appeal to typical students, over three times as many students take biology as physics in high school. Budgets are set on a per-student basis. Small enrollments give physics teachers smaller equipment budgets even though their equipment costs can actually be higher. In general, K-12 teaching is a one-size-fits -all world which isn't particularly inviting to physics-trained people.

"...our physics training system barely functions, doesn't begin until middle school, receives modest resources..., and has no emphasis on teamwork."

Remedies for our physics training system often focus on the lack of qualified teachers and encourage physicists and engineers to become teachers as a second career. Most states already have programs to address areas with teacher shortages. These give new teachers on-the-job training without compelling them to acquire education degrees. Unfortunately, the programs don't address many of the problems facing physics teachers due to low physics class enrollments. Physics teachers frequently end up teaching more non-physics than physics classes. Other classes can be anything from low-level physical science to study skills. Rigorous classes like AP Physics are often canceled, which prevents teachers from gaining the experience needed to polish their physics teaching competencies. Finally, rigor is frequently reduced in order to maintain enrollments by attracting students with marginal physics backgrounds.

The root problem with our K-12 physics training system is that it's often treated as a single course for a handful of high school students instead of a comprehensive system intertwined with our culture. Early physics training is often weak. To make matters worse, there are few best-selling books and ETV programs dedicated to presenting basic concepts. It's no wonder physics seems incomprehensible to many students. They often receive little physics input until high school and then are asked to absorb it all at once.

Fixing physics training will require a paradigm shift. Physics training needs to begin in kindergarten using toys for teaching elementary concepts such as force, inertia, and momentum. We also need to face the fact that the endpoint of physics training may not be a career in cutting-edge research, but more likely a profession in engineering, computer science or medicine, involving mostly mundane physics-based technology. We need to devote more effort toward making mundane physics exciting. High school physics needs to be seen as a key to a well-paid profession, attainable by any reasonably bright individual.

A paradigm shift in physics training will require legislation. The legislation should address high school teacher qualifications by overhauling critical needs programs to bolster economically strategic classes like physics. These programs should close some of the salary gap between industry and strategic teaching jobs. The legislation should limit the number of different subjects strategic teachers can be assigned in order to prevent them from dissipating their efforts. It should protect strategic classes like AP Physics from cancellation. The legislation should also provide economic incentives for lower grade teachers to improve their physics competency in order to improve the physics training infrastructure.

AP Calculus exemplifies how to set up an infrastructure for a rigorous class. It has successfully moved a college level class into high school partly by moving a high school class (Algebra I) into middle school. The training and selection process begins in early grades with capable students accelerated toward AP Calculus. As a result, AP Calculus has the highest number of participants for all scientific or technical AP subjects: 171,418 students took an AP Calculus exam in 2000, compared to 15,634 who took the calculus-based AP Physics Mechanics exam and 30,967 who took the algebra based AP Physics exam (College Board: http://www.collegeboard.org/ap/subjects.html).

Physics training changes would carry a price tag, but there are compelling economic incentives. According to remarks made by Senator Orrin Hatch to the Senate Judiciary Committee on March 9, 2000, "... a shortage of high-tech professionals is currently costing the U.S. economy $105 billion a year (http://www.senate.gov/~judiciary/3920ogh1.htm)." Business leaders have repeatedly solicited legislation to expand the number of temporary permits which allow foreign nationals to fill billions of dollars worth of technical jobs. These jobs are mostly in computer-related areas but often require some level of physics background. The jobs are not filled by Americans because qualified Americans aren't available. An improved K-12 physics training system would more than pay for itself by helping reduce dependence on foreign technical workers.

While Senator Hatch's statements about high-tech professional shortages were made during a business boom, the long-term need for technical employees is undeniably increasing. Recent blackouts in California made Americans painfully aware of a developing energy shortage. Whether addressed by building power plants, drilling for more oil, conserving resources, or creating alternatives to fossil fuel, energy solutions are going to require a massive number of new engineers and computer professionals. We also stand at the threshold of a developing biotechnology industry. This will increase the number of biological/medical scientists required to develop and manufacture new products. A similar thing happened in the drug, petroleum, and chemical industries that caused an increase in jobs for biological/medical scientists, geologists, and chemists respectively. However, for every new science job there was on average one job created for an engineer and half a job created for a computer professional. The day could come when even foreign workers cannot satisfy America's need for high-tech professionals.

While computer science majors may not seem closely related to engineering majors, it's important to consider the two together because they attract students from a common pool of qualified individuals. Marketability often determines which path a student will take. I've frequently seen students struggle with deciding between engineering and computer science during their senior year in high school. Even after graduation from college, engineering majors sometimes switch and become computer professionals.

Without legislation, high school physics reform won't occur. I once interviewed for a physics teaching job with a principal who had just cancelled her school's AP Physics class. She remarked that students could get what they needed from other subjects such as AP Calculus and AP Statistics. I produced charts and graphs from my brief case while explaining that physics was a vitally important subject with a distinctly different emphasis from calculus and was mostly unrelated to statistics. Not only did I fail to get the job but I failed to influence her. One of the more progressive principals I know has told me he knows nothing about physics and doesn't want to learn. Although he says it in a good-natured way, it's clear he doesn't consider physics a basic element of education. The administrators who allocate resources for physics classes simply aren't willing to make the sacrifices needed for a quality physics program. It will take both additional resources and outside influence to alter this situation.

Legislation alone can't raise the cultural status of physics. However, there's light on the horizon and the FIRST robotics competition is one of the bright spots. Its founder Dean Kamen used sporting events like (surprise, surprise) football as a model for the competition. In it, teams supervised by volunteers from industry are given six weeks to produce a robot out of two trunks full of unrelated parts such as wheelchair wheels and electric drill motors. The robots then compete against other robots in a game which is kept secret until the robot building begins. Like football, there are numerous ways for students to participate. I've seen teams show up at competitions with everything from bagpipes to marching bands. The national competition is held at Disney World and is three days of nonstop action. This year it had 20,000 participants, having grown from about 15,000 the previous year and, yes, it does teach teamwork and sportsmanship.

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Competitions are most effective when integrated into classroom activities and school cultures. The first high school robotics team pep rally I attended was a disaster in the conventional sense. The robot was supposed to dramatically break through a cloud of smoke as it drove around demonstrating its capabilities while cheerleaders jumped and shouted. The kid running the smoke machine got carried away. The robot was barely visible. Many of the robot's functions failed to work and the cheerleaders stood in silence. Yet, it generated incredible amounts of interest.

Physics training may never reach football's status, but we could do better. Those of us with physics or engineering backgrounds need to not just seek legislative solutions but also find ways of making physics activities entertaining and accessible to the average person. We need to make being a physics nerd look desirable. Our future physics training system will benefit greatly if we can raise its standing in our culture.

T. K. Rogers has a Bachelor's Degree in Mechanical Engineering from Arizona State University and a Master of Business Administration Degree from Clemson University. He practiced engineering in industry for about 18 years before becoming a teacher in 1993. He currently teaches physics, statistics, and computer science at Southside High School in Greenville SC. He and his sons maintain a web page devoted to promoting physics, technology and lifelong learning at intuitor.com.

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.