APS Members Choose Cohen as New Vice President in 2002 Election

In the 2002 general election, APS members have chosen Marvin Cohen, a professor at the University of California, Berkeley, and senior scientist at the Lawrence Berkeley National Laboratory, as the next APS vice president in the 2002 general election. He will assume office on January 1, 2003, becoming president-elect in 2004 and APS president in 2005. The APS president for 2003 will be Myriam Sarachik (City College of New York).

Cohen’s current and past research work covers a broad spectrum of subjects in theoretical condensed matter physics. He is best known for his work with pseudopotentials with applications to electronic, optical, and structural properties of materials, superconductivity, semiconductor physics, and nanoscience. Cohen is a past recipient of the APS Oliver E. Buckley Prize and the APS Julius Edgar Lilienfeld Prize. In 2002 Cohen received the National Medal of Science.

Cohen, who will serve as the chair-elect of the APS Nominating Committee in 2004 and as APS president in 2005, is a past recipient of the APS Oliver E. Buckley Prize and the APS Julius Edgar Lilienfeld Prize. Among Cohen’s current and past recognitions are the National Medal of Science and the Oliver E. Buckley Prize.

While the nation soberly observed a day of remembrance for last year’s September 11 terrorist attacks, the APS Counter-Terrorism Task Force marked the occasion with a meeting at APS headquarters in College Park. Chairied by Bob Guenther of Duke University, the task force was given a very general charge, which includes surveying current activities of the physics community in the area of counter-terrorism, helping physicists find solutions, and encouraging physicists to find solutions. Task force members held their first meeting May 3, 2002. A final report is expected to be presented at the APS Council later this month.

Topical Conference Explores How Physics Can Help Biology

We are posed at a unique moment in time when physics can make important contributions to biology, according to speakers at the topical conference on “Opportunities in Biology for Physicists.”

The bulk of the September 11 meeting was devoted to a series of technology review presentations, detailing the various areas where physics and physicists might contribute to national security. Task force members held their first meeting May 3, 2002. A final report is expected to be presented at the APS Council later this month.

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

Viewpoint...

Scientific Fraud-Lessons Learned

By W. F. Brinkman, APS President

Editor’s note: In late September, the committee headed by Malcolm Beasley of Stanford, charged with investigating allegations of research misconduct at Bell Labs, issued its report. They found clear evidence of fraud by Jan Hendrik Schön, but no evidence of fraud by any of his collaborators. They left open the question of whether some of the co-authors had acted in accordance with their professional responsibilities.

Now that the Beasley committee has issued its report, it is time to consider what we have learned from the experience. I believe that there are three issues that the physics community must examine.

First, since Schön published his research in collaboration with several co-authors, we must carefully consider the responsibility of co-authors to the total content of the paper. This may require formulating new guidelines for our research communities.

Second, we must determine whether the physics community is appropriately alert to the characteristics of research fraud and scientific misconduct in general. This may require formulating new guidelines for our research communities.

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Teaching Introductory Physics with Tales From the Subatomic Zoo
By Desirée Scorsia

While physicists and physics teachers across the country are searching for new ways to teach physics to high school students and college non-majors, Cindy Schwarz, a physics professor at Vassar College, has taken a novel approach to the problem. Schwarz teaches an introductory physics class at Vassar College, named after her, and Oxford is also named after her, and a girl’s college in Cambridge.

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With this article, APS News begins a special feature by James Bardon on the ten most-cited papers published in Physical Review Letters in the last century. The feature begins in 1958. The citation data have been provided, not quite free of charge, by the Institute for Scientific Information (ISI), publishers of the Science Citation Index.

In counting down the coming months to the top-cited paper of all time, our intention is not just a mad desire to menacingly name the Einstein on the local radio station. We want to provide some insight into what makes these papers significant and how they came to be written. Our treatment will be more descriptive than scholarly—space will not permit us to include numerous references nor to branch out to discuss related work in the text.

Even though PRL is the most highly-regarded physics journal, and citations to papers often reflect the measure of a paper's significance, we do not claim that the ten papers to be featured are necessarily more significant than many other papers that have appeared in the literature over the same period of time. But these papers range over many different fields of physics, and their impact has been great. We hope our readers will enjoy finding out more about them.

The tenth paper in our list of the top ten, most-cited Physical Review Letters is the seminal work that instigated serious pursuit of Grand Unified Theories. It was a fun paper,” laughs Howard Georgi when asked about the Unity of All Elementary-Particle Forces. “It was very early, well before we really understood all the pieces. It was just fun finding this way to put them all together.

Progress in particle physics had been relatively slow through much of the 1960s, but Georgi knew he was in the right place at the right time when he accepted a postdoctoral fellowship at Harvard in 1971. Gerard ’t Hooft had just published his proof of the renormalizability of theories with gauge groups and a topological measure of a paper’s significance, we do not claim that the ten papers to be featured are necessarily more significant than many other papers that have appeared in the literature over the same period of time. But these papers range over many different fields of physics, and their impact has been great. We hope our readers will enjoy finding out more about them.

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Phil Skell
Pennsylvania State University
Fred Skell
University of Iowa
David Skone
University of Pittsburgh

Do Your Homework Before Entering UFO Fray

The August/September 2002 issue of APS NEWS contains an interesting article by Lawrence Krauss that deals in part, with his experience in participating in a debate on the problem posed by so-called UFO sightings. Since I have studied this problem for 30 years, I can perhaps offer supplementary advice coming from a different perspective.

Here are my recommendations to anyone invited to take part in such a discussion:

1. Either stay away completely or do your homework first. This is a very complex subject, and doing your homework will not be quick, easy or painless.

2. Do not imagine that training in physics provides you with any relevant credentials that enable you to pontificate on the problem. (Expertise in forensic science would be another matter.)

3. Read the Condon report from cover to cover—preferably from back to front so that you can better judge the extent to which Condon's conclusions and recommendations follow from the work of his staff (E.U. Condon, D.S. Gillmor, Scientific Study of UFOs, Bantam Books, 1969).

4. Learn something about the history of the subject. An excellent summary of the early days of the controversy can be found in The UFO Controversy in America by D.M. Jacobs (Indiana University Press, 1975).


6. Finally, bear in mind that although most scientists treat this subject as a joke, the public does not, and we would do well to treat their concerns with respect.

Peter A. Sturrock
Stanford, California

Imposing ideology is an offense

I’d like to comment on the recent article by Lawrence Krauss in the August/September 2002 issue of APS NEWS. I agree with Krauss that science imposes constraints on what is possible. I agree that greater emphasis should be placed on mechanisms and plausibility than on stories drawn from circumstantial evidence. However, that is precisely the point of the intelligent design advocates whom Krauss is disparaging. Intelligent design is a logical inference based on current knowledge of the limitations of known mechanisms.

I also agree that science is not “fair” in the sense that only those theories that have satisfied the test of experiment can stand. But this principle also readily leads to design inference. It is the lack of experimental evidence that naturalistic mechanisms can generate specific complexity or construct irreducibly complex systems that supports this inference.

Intelligent design and naturalism are both possible inferences that one cannot make from the data and knowledge of science. To simply eliminate one a priori is to impose an ideology. This is the offense that must be avoided. The solution I propose is to teach the methods and data of science without imposing a prior commitment to any ideology, including naturalism. Encourage the relentless pursuit of natural causes, but fairly evaluate and discuss current knowledge of the capabilities and limitations of known mechanisms. Allow for the possibility that naturalism is not a complete description, and this will lead to a more honest evaluation of the evidence and protect the integrity of science.

Mike Kent
Albuquerque, New Mexico

Origin of Life: A Complex Question

A very common debating tactic is guilt by association, or “the grab bag of frauds.” That is, because one cannot be a proper intellect without adopting the entire list of enemies. Lawrence Krauss does this, albeit with a different bag of nuts, in which he includes believers in UFO's and magnetic beads along with those who believe in intelligent design. What better way to discredit the legitimate questions that many people have about the possibility of UFO’s? Most of us have seen at least one UFO and wonder if they are a manifestation of our collective psyche.

I would suggest that the mechanism of the UFO’s, whether real or a manifestation of our collective psyche, does not matter much to anyone who believes in the possibility of UFO’s. If such entities exist, why do we not see them? Something must be happening in the universe if not the universe as we know it, then perhaps an area that science is not aware of.

Krauss says that he would ask a creationist whether he believes in UFO’s. Those who believe in intelligent design would say, “I don’t believe in a physical mechanism for origin of life, the same way I don’t believe in UFO’s.” I haven’t ever seen one.” When a quantitatively naturalistic mechanism for the origin of life comes along, it will, like a picture of a UFO, be compelling. Until then, it is simply a working hypothesis.

Physicists stand to lose face if they continue to say that our understanding of the biophysics of the origin of life is just as well established as other physical theories such as quantum mechanics. But in view of the lack of progress of biological origin of life on the earth, we may just end up casting doubt on our credibility, which is not a positive power for the political or religious establishment. Astronomy, physics, biology, and climate science have had their day. It’s time for a new direction.

Fred Skiff
Philadelphia, Pennsylvania

FRAUD, from page 1

require an effort on the part of the APS to help educate the community finally, we must determine whether the scientific process worked effectively in revealing the fraud in Schon's research. It is possible that the fraud was only exposed because of the influence of outside forces. I'll consider each of these in turn.

In the case of co-authors, the responsibility, the Beasley committee said that it could not find clear ethics statements on this issue. They cited no references to the American Psychological Association's code of ethics, the Deutsche Forschungsgemeinschaft, a quasi-governmental German research agency, that fully states: "Authors of scientific publications are always jointly responsible for their content. A so-called honorary authorship is not admissible.

As the Beasley report points out, this is not a workable policy. In most fields of physics, some of the authors who are widely accepted as responsible for the paper, the authors whose names appear on a paper must be willing to share responsibility for the paper.

No journal that I know of has a policy where responsibility is apportioned. Indeed, I believe that "apportioned responsibility" is not a workable policy. Nevertheless, it is clear that the physics community must develop a guideline that successively defined the responsibilities of co-authors. At a minimum, this guideline should state that when the authors have contributed to the results, there may be co-authors who should not be held responsible, there is always a senior author who must take responsibility. I should also point out that this current interest in the responsibility of co-authors is not simply a result of the recent controversy in the recent issue in the most recent criticism in the research that led to the claim of the discovery of element 118. I believe this means that the breadth physics community should work together on this issue. The second aspect of this is that these cases of fraud raise is whether the physics community is appropriately alerted to the characteristics of research fraud.

The current cases of fraud were cut-clear but there are many more complex and subtle examples that scientists should be aware of. Being sure to give proper credit is one example. The responsibility of researchers regarding the materials that they obtain in the review process and the co-authorship discussed above are others. I believe that the APS should encourage physics departments to foster discussion of these issues among their graduate students.

I am reminded of the time R.E. Peierls was asked why he recommended Klaus Fuchs for work at Los Alamos in the Manhattan project. Peierls responded that morals were never discussed in his field, that his field was an aesthetic one, that one was supposed to have the same high standards. I believe that we need to do better than that.

The cases that are being proclaimed as the scientific process worked. That is, people accepted every idea while experts were extremely suspicious of the published results and did not believe them. It is true that most of the community was wary of the results as they seemed to have either pushed the limits of what is physically possible or had seemed impossible. The current cases of fraud are cut-clear but until people outside the subject area actually pointed out examples of apparent fraud most practitioners thought the authors might be wrong but did not think in terms of fraud. This rather innocent attitude is anathema, and unless we can beat this to death, the community seems so necessary.

The APS's Panel on Public Affairs Subcommitte on Ethics is currently examining these cases, and I believe that forth new suggestions as to how the Society and its members should address all these issues in the near future. It is clear that we need to develop new policies particularly with respect to the role of co-authors. I believe that we need to take a hard look at what we know as fraud and how we inform this process continues.
The Craft of the Improbable Science Writer: The Art of Rejection

By Steve Nadis

Editor’s Note: Apparently, the Annals of Improbable Research has a very high rejection rate—higher than most of the "serious" science journals such as Nature and Science. The following is an example of how far certain would-be authors go to try to get their work published in AIR. Improbable science writers are, by and large, a hardened lot. They have to be to keep doing what they do. In the course of their work, they’re constantly sending out proposals to heartless editors and getting most of their entries sent back (along with a form letter addressed stamped envelope) for me, about the only thing that’s not being rejected these days are my proposals for AIR (sorry—just a temporary lull.)

Rejection letters assume various forms, depending on how they come onto themselves. Here are some recent examples, just to give you a feel for the genre:

Dear Mr./Mrs./Ms. ____,

Thanks for giving us the opportunity to read 'Sex and the Silicon Cell.' I’m afraid it is too unspeakable, as well as trivial.

Note the infinite variety, elaborations used in the process were beyond the scope of this letter, and some had real merit. But the process is much faster than that. Sometimes, they’re so comitee and apolgies, I actually feel sorry for them. An editor from [a prominent magazine] once told me he has been swamped with rejection letters carefully and learn from the rejection letters. It has been an extremely difficult process, reports that the Cook-

As I write this, I find myself wondering how much of the "serious" science journals and human welfare. "I love physics and I say."

And: Thanks for sending us 'Wetlab Zombies.' I’m afraid it is too monstrous. Sometimes, they’re so comitee and apolgies, I actually feel sorry for them. An editor from [a prominent magazine] once told me he has been swamped with rejection letters carefully and learn from the rejection letters. It has been an extremely difficult process, reports that the Cook-

In that instance, I committed a serious breach of the improbable science writer code. I lost my temper.

Sure, sometimes the process is enough to test anyone’s mettle. But the seasoned professional realizes that such immediate outbursts will never advance his career, nor will they advance the cause of improbable science education to which he has devoted every waking second of his conscious life.

Rather than sitting back and waiting for rejection, the industrious takes the offensive. "If at first you may not want to do it for a good reason, because the editor may not really understand your work."

After grave deliberation, I have decided not to submit my neurological tissue, "The Man with the Eye and One Nose." In fact, I have decided not to write it. Even so, my story might not have been right for your magazine, nor you for it. Regrets..."

Of course, emissaries of the improbable science editorial establishment are not the only ones who are often told "no." Sometimes, they’re so comitee and apolgies, I actually feel sorry for them. An editor from [a prominent magazine] once told me he has been swamped with rejection letters carefully and learn from the rejection letters. It has been an extremely difficult process, reports that the Cook-

At times like these, I (as would any other responsible improbable science writer) often send back soothing notes to the poor rejector and ease my own conscience. "Thanks for giving us the opportunity to read 'Sex and the Silicon Cell.' I’m afraid it is too unspeakable, as well as trivial."

"This process is much faster than that. Sometimes, they’re so comitee and apolgies, I actually feel sorry for them. An editor from [a prominent magazine] once told me he has been swamped with rejection letters carefully and learn from the rejection letters. It has been an extremely difficult process, reports that the Cook-

"That's OK. I say."

In fact, I have decided not to write it. Even so, my story might not have been right for your magazine, nor you for it. Regrets..."

Dear Mr./Mrs./Ms. ____,

"I found your story on 'Isotopes at the Sushi Bar' intriguing, as well as disconcerting. It has been an extremely difficult decision, one that I’ve grappled with over many sleepless nights. But I finally realize that when there is so much debate and so much soul-searching, the answer, ultimately, has to be no. Sorry you had to be the victim of my learning process."

"If at first you may not want to do it for a good reason, because the editor may not really understand your work."

"Sorry, I don’t do racquetball, tennis, wallball, or squash. Improbable science writers, I’m told, are supposed to write about what they know. For me, that happens to be the thermodynamics of volleyball. Such is life."

"If at first you may not want to do it for a good reason, because the editor may not really understand your work."

To wit: After grave deliberation, I have decided not to submit my neurological tissue, "The Man with the Eye and One Nose." In fact, I have decided not to write it. Even so, my story might not have been right for your magazine, nor you for it. Regrets...

"That’s OK. I say."

"Don’t feel bad. I realy is trivially swamped with manuscripts and can only accept a tiny fraction of what we receive. I know. For me, that happens to be the thermodynamics of volleyball. Such is life."

Electronic Voting a Hit with APS Members

The 2002 APS general election was the second year that the Society offered members the option of voting electronically, with 87.9% of those voting opting for the electronic method. Several members also took the opportunity to offer their comments on the electronic voting process. The feedback was overwhelmingly positive, with members praising the ease and convenience of electronic voting, and noting the particular benefit to overseas members and those on sabbatical leave.

A few people experienced technical difficulties in navigating the site, and some had trouble remembering their assigned ID codes, but most echoed the comments of one commentator who observed, "This process is much faster and easier than submitting our ballots ourselves in a hectic, fast-

paced environment to respond to the election with minimal voting time." (Or, as one veraciously inclined member phrased it: "Like, totally awesome, dude!")

There were some sugges-
tions for improvement. Several people decried the lack of descriptions on the site for each of the positions up for election, and one member suggested adding streaming audio files of all candidates discussing their respective mission statements and priorities for the Society.

Concern about on-line se-
curity was also a major issue, and several members objected to the use of "cookies" in the electronic voting process.

Ken Bennitt, the APS adminis-
trative staff member in charge of organizing the election proce-
ses, used in the process were temporary and used only to improve online security by ensuring that votes were being cast from the same computer on which the login was autho-

ized. Once voting was com-
pleted and the user had left the secured Website, the cookies were deleted.

The Society hopes that the availability of electronic voting will lead to much wider partici-
patation by APS members in the APS election process, although to date the gains have been modest. The number of e-mailcasts totaling 8.8.638 ballots cast out of a possible 42,701 members eli-
bile, which was a postion of 12.49.701 ballots returned, up slightly from last year’s 23.

But Ken Bennitt, the APS adminis-
trative staff member admitted, "I may not have voted but for this convenience," while another, "the more I vote, the less excuse for not voting."

Conrad was born in 1963 in
Flat Panel Medical Imaging
By R. A. Street

X-ray imaging for medical diagnosis is another Boeings"discovery"of x-rays in 1895, but it has taken 100 years to replace x-ray film with a digital imaging technology. Digital imaging has the benefits of immediacy in acquiring the image, electronic storage, retrieval and transmission, and enables image enhancement and computer-assisted diagnosis.

X-rays are not easily focused, however. The image on the film depends on the quality of the image intensifier, with effort by a film technician to make the mask as large as the object to be imaged. For human medical diagnosis, the size must reach 17"x17", well beyond the capability of a conventional silicon chip. Previous approaches include image intensifier vacuum tubes and laser scanned storage phosphor.

Hydrogenated amorphous silicon (a-Si:H) transistors and sensors, deposited on glass substrates and patterned into devices by photolithography, provide a compact, fully stand-alone digital x-ray images. These are manufactured with the same large area processing technology that is used for liquid crystal computer displays.

The flat panel x-ray detector is a pixel array, comprising up to 10 million pixels, with pixel size from 50 to 500 microns, depending on the application. The application determines if the image is needed for a TV monitor, CD-ROM, digital photography, or medical imaging. The essential materials are a sensor that absorbs x-rays and creates a corresponding electric charge, a capacitor to store the charge, and a readout addressing that organizes the read-out of the signal to external electronics, which amplify, digitize and display the image. Each pixel contains one addressing transistor, and a single row of pixels is activated simultaneously to form a common gate contact. The rows that make up the array are addressed in sequence to read out the whole image.

The x-ray image is more than just transistors, and involves a combination of material science, semiconductor physics, imaging science, device processing and electronics design. A-Si:H transistors and sensors make the detectors possible. The Si:H transistor is fast enough to operate a detector at video rates. Its large (10⁷) on-to-off ratio is needed to hold charge on the pixel readout circuits. Since the signal is stored on the sensor capacitance, low leakage is a must. Amorphous silicon is the important property of high resistance to radiation damage, in part because it has a disordered atomic structure.

Sensitive detection requires that the x-rays passing through an imaged object must be stopped in the thin film sensor. Detectors must be made from high atomic number materials. Even then, a thickness of 200-500 micron is required for the energies that are best absorbed by x-rays. The x-ray image is formed by the charge that the detector generates, hence it is called the charge-coupled device (CCD). Since the charge is stored on the Si:H sensor, it cannot be erased, thus the name, charge-coupled.

Bob Street is senior research fellow and manager of the Large Area Systems group at the Palo Alto Research Center.

The Physics of Football Goes Global
A series of local sports segments on the physics of football is finally going global. The series is the brainchild of University of Nebraska, Lincoln (UNL) professor Tim Gay, who completed 21 three-to-five-minute segments for the National Football League (NFL) this summer. The segments are slated to be used by the NFL in a two-year on an international sports program called "Blast!". Gay was chosen for his unique recognition as an authority on football physics three years ago, when he won the first ever series of 45-second spots for UNL's HuskerVision during football season last fall. "I have a passion for physics and I enjoy teaching all kinds of aspects of it," Gay says: "It's the one thing besides football that I really love." For him, the two subjects are closely related: "Football is a manifestation of real-world physics, and it's something important in the everyday lives of people.

The new NFL spots touch on the same topics as the original series. "I really enjoyed the idea of taking concrete examples in physics to be applied to various aspects of football," Gay said. "It's a wobbly pass presence greater air resistance than an acceleration, which is not as easily recognized by the player given the impatience to think about physics." Also, while "Blast!" is shown on the Nebraska program, the US isn't one of them, so American fans will have to wait two years for domestic broadcast.

"It was essentially a propaganda tool of the NFL to try to get over the heads of the teeming masses across the ocean and convince them of the merits of American football," Gay jokes. He also hopes of one day showing his sequences on NFL films for the Discovery Channel, and might even get around to writing a book on the physics of football in the distant future. But for now, he's focusing on combining his love for football and teaching responsibilities. "Writing a book is a major commitment, so it's not something I want to do immediately."
Physicists Honored at November Unit Meetings

Nine physicists will be honored with APS prizes and awards at APS unit meetings being held this month. The 2002 Maxwell Prize, Award for Excellence in Plasma Physics Research, will join the P-24 Plasma Physics Colloquium: Laboratory Experiment on the Magnetic Reconnection Experiment (MRX) at the University of Wisconsin, Madison, to be held November 24-26 in Dallas, Texas.

2002 James Clerk Maxwell Prize

Edward A. Schamiloglu
Science Application International Corporation

University of California, San Diego

Citation: For contributions to the theory of magnetically confined plasmas, including experimental work on the formulation of the MHD Energy Principle and on the foundations of linear and nonlinear gyrokinetic theory essential to the analysis of microinstabilities and transport.

Dennis Freeman

Freeman is a plasma physicist with research interests that extend into other physical science fields. He was a professor at Princeton University for more than 25 years, after which he was employed by the federal government and in the private sector. Freeman earned his doctoral degree in physics in 1952 from Polytechnic Institute of Brooklyn, New York. Currently senior vice president, science and technology at SAIC, Freeman is also director emeritus of the Scripps Institution of Oceanography.

2002 Award for Excellence in Plasma Physics Research

Troy Carter
University of California, Los Angeles

California Institute of Technology

Hannajj Jin
Princeton Plasma Physics Laboratory

Manabu Yamada
Princeton Plasma Physics Laboratory

Citation: For the experimental investigation of driven magnetic reconnection in a laboratory plasma. In this work, careful diagnostic studies of the current sheet structure, dynamics and associated wave activity provide a comprehensive picture of the reconnection process.

Hui Hou

Hou received her BS degree in electrical engineering from the University of California at Los Angeles in 1993. She received her PhD in plasma physics from Princeton University in January, 2000, having investigated ion heating and acceleration during magnetic reconnection on the Magnetic Reconnection Experiment (MRX). Subsequently, he went to Caltech to work on the MRX, where he pursued experiments designed to study magnetic field topology in the MRX experiment. In December, 2002, Hou will join the PPPL Plasma Physics Group at Los Alamos National Laboratory and continue pursuing research in basic experimental plasma physics.

Born in Beijing, China, Hou received a B.S. degree in physics from Ehime University (Japan) in 1989, and a PhD in physics from University of Tokyo (Japan) in 1990. After work at the Lawrence Livermore National Laboratory, she returned to Japan and since 1995 he has been conducting research on the Magnetic Reconnection Experiment (MRE) at Princeton Plasma Physics Laboratory. Currently, his research interests include physics of magnetic reconnection, magnetorotational instability and MHD surface waves in liquid gallium, dynamo effects and conservation of magnetohelicity in self-organizing plasmas, turbulence and associated transport processes.

Yamada is a Distinguished Researcher at the Princeton Plasma Physics Laboratory, and heads the MRX research program.

Sanjay Kumar

Kumar received his PhD from the University of Wisconsin, Madison, in plasma physics in 1973. In that same year he joined PPPL as a postdoctoral fellow. He became the head of the Q-1 research group in 1977 and carried out many basic plasma physics experiments. During 1998-1999, he headed the research effort on the spheromak, then a new concept for fusion, utilizing the S-1 device. Yamada pioneered the use of gain in plasma fusion, turbulent fluctuations and self-organizing plasmas, turbulence and associated transport processes.

Yamada and his research group are among the leaders in the study of self-organized plasma turbulence, and turbulence in a number of different systems. They are currently using spheromaks for studies on the physical processes that may be responsible for the formation of the solar magnetic field.

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The Bush presidential style does not sit well with members of Congress in either party, who as the elected representatives of the people are duty bound to act daily. When the President treats them with disdain—that happened during Clinton's first term—they get their hackles up and run with their own agenda.

Approaching the end of their terms, they have no great desire to spend energy and political capital defending the Administration's agenda. As the House and Senate jointly moved ahead with an authorization bill that would set the NSF on a course to double its budget over a five-year period, the Foundation's director expressed the hope that the Administration would conclude this in a way that was sent to Senator Ron Wyden (D-OR) on September 16.

While the Foundation appreciates the Committee's firm commitment to support fundamental research in physics, technology, engineering, and mathematics (STEM) education, we oppose S. 2817 in its current form. Although other bills do not conform to the Administration's FY 2003 Budget request, what was that request for research, you asked? You guessed it, zero increase, after transfers of activities from other agencies are taken into account.

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Andrea Prosperetti

Prosperetti received his PhD in engineering science at Caltech in 1974. He was a member of the physics faculty from 1974 to 1985 at the University of Milan. Since 1989 Prosperetti has been a professor of Applied Physics (part-time) at University of Twente (The Netherlands) and since 1999 the Charles A. Townes Chair at the University of California, Berkeley. His research interests include fluid-solid dispersive multiphase flows, bubbly liquids, aspects of bubble dynamics and cavitation, free surface flows, computational fluid mechanics and acoustics.

2002 Andreevich Awards

Wade Schoppa

Citation: For his studies on the generation of coherent structure in near-wall turbulence.

2002 Nobel Prize

Raymond W. Noyes

Noyes was an astrophysicist who is known for his work on the stability of stars and the theory of multiphase flows, the dynamics of bubble oscillations, underwater sound, and free-surface flows and for providing elegant explanations of paradoxical phenomena in these fields.

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What Produces a Thriving Undergraduate Program?

By Ken Krane

During the 1990s, the number of bachelor's degrees awarded annually in the US dropped by about 25%, from about 5000 to 3800 a year in 1990 to 1998. Simultaneously, the number of bachelor's degrees awarded was increasing, so the percentage of bachelor's degrees awarded to 18-24 year-olds fell from 0.9% to 0.3%. Although there is evidence of a small increase in physics baccalaureate degrees in the past two years, it is not clear that this increase represents a trend and even less clear that it can be sustained to reverse the declines of the past decade. The decrease in undergraduate physics degrees occurred at all types of institutions, although it was especially severe at M.S. and Ph.D.-granting institutions (down 33%) compared with 4-year colleges (down 17%).

What leads to, or limits, this decline? There appears to be no definitive answer, but it is clear that the physics programs in the US, and the changes in which they have been affected, are mostly characteristic of the entire US and not necessarily produce results that are characteristic of the entire US. For comparison purposes, NTFUP also conducted a survey of 11-member panel created in 1999 by APS, AAPT, and AIP. has carried out a study of such departments to determine what factors are responsible for their success. Information about the Task Force's membership and projects can be found under “Programs” through the AAPT web site (www.aapt.org).

The task force has identified a number of features that should characterize a thriving undergraduate physics program: a sufficient number of majors, including significant representation of women and minorities, faculty and student morale; success in placing graduates in schools and industry; attracting a diverse student workforce; the respect of the administration and other departments on campus, involvement of a majority of the students in research and teaching; inclusion of students and staff on the departmental team; and excellent preparation for graduate study in K-12 education.

With the support of the ExxonMobil Foundation, NTFUP carried out site visits to 23 depart- ments which have maintained success in some aspects of the undergraduate program. These departments were selected primarily, but not exclusively, based on national baccalaureate enrollments in the physics major. The Ph.D.-granting institutions, in general, had more than twice the average number of bachelor's degrees (more than 20 and (some many more) bachelor's degrees per year (com- pared with the national average of about 10). The four-year colleges visited generally produced more than 10 graduates per year, far exceeding the national average of about 3. The sites were located across the US. About 1/3 were public and private Ph.D. — granting institutions, about 1/3 were private four-year colleges, and the remaining 1/3 were primarily public bachelor’s-and masters-granting institutions.

At the invitation of the depart- ment Chair, a three-person team visited each of these campuses for 1-1/2 days and met with students, faculty, administrators, and department personnel. Each visiting team was led by a member of the NTFUP and included two other members of the physics community. Altogether about 70 physics faculty members participated in the site visits. The department prepared in advance a response to a questionnaire de- signed to provide background information for the visit. Rather than being a comprehensive review of the department or even of its under- graduate programs, the site visit was designed to address the crucial aspects of the program and the local climate that created and sustained the program. Each site visit team provided a site visit report that was circulated only to the NTUP members and to the department. Concise summaries of many of these reports have been de- veloped into a series of publicly available “case studies” that highlight the notable activities and each department head, including the opportunity for the department to obtain feedback from students on any aspect of the undergraduate program; undergraduate research, and employment of undergraduates as teaching assistants. Examples of especially noteworthy programs include:

- Lawrence University conducts a number of mini-symposia in the spring/March weekend workshops for high school seniors. Between 60 and 80 students apply to attend, about 30 are invited, and about 10-15 choose to attend. The University pays all costs for the workshop ($15-180). U.S.
- Colorado School of Mines holds a summer workshop for high school students for 6 weeks at the end of the summer. Supervised by 4 or 5 professors and 1-2 graduate students, the program takes place on campus and includes research, past physics, chemistry and computer science.
- Rutgers University has developed a multistage degree program, which has helped it to grow to about 40 degrees per year. About 1/3 of its students choose in the traditional physics track, about 1/3 choose an applied or engineering track, and about 1/3 choose a general track that serves students in pre-law, pre-medicine, or pre-service teaching.
- The University of Wisconsin—Madison, the physics program granted an average of one degree every two years in 1990. Through curricular reforms, aggressive recruiting, and a 3/2 engineering program, they have grown to award an average of 15 degrees per year.
- At the University of Illinois, the department undertook a complete overhaul of the introductory courses, resulting in a physics education research, improving TA training, and introducing en- hancements to “companion” courses targeted at specific audiences (new majors, at-risk students, students seeking additional challenges). At Reed College, the required senior year thesis serve to build a coherent program starting in the first year that includes physics and its faculty and students in collaborat- ing to reach a specific set of goals. It is also worth commenting on a number of programs that seem to be important in promoting a thriving undergraduate physics program with many majors.
- While advising was important, both highly centralized advising and advising distributed among all faculty appeared to work equally well.
- The type of recruiting that was effective depended heavily on the institution. For example, for a few departments, pre-college recruitment was an important tool, while for many others it was of little benefit. While the recruiting programs and supportive campus atmos- phere of these departments clearly had an impact, it was difficult to tie down what factors were most important. In fact, of the factors that we could identify, had no apparent effect on the fraction of majors who were women or ethnic minorities. Those fractions in the site visit departments were consistent with the averages for all US physics departments.

“Ther are a number of undergraduate programs that have not only avoided the national decline in numbers of majors, but in some cases have even been able to grow and thrive in this new environment.”

Ken Krane

Ken Krane is Professor of Phys- ics at Oregon State University. This report was prepared with the assistance of the Task Force, with particular contributions from Robert Hilborn, Ruth Hughes, and Carl Wieman.