APS NEWS

MARCH 1996 THE AMERICAN PHYSICAL SOCIETY VOLUME 5, NO 3

APS Elementary Education Institute was a Blizzard of Activity

From January 7 through January 11 in Washington, DC, 29 scientists from selected sites around the country participated in the second Elementary Science Education Reform Institute. The meeting, a component of the APS Teacher-Scientist Alliance Institute, was designed to provide a thorough overview of issues in school district reform of elementary science education

Originally almost 40 participants were expected to attend, along with nationally recognized experts in education who would be the presenters. However, an uninvited guest, the Blizzard of '96, reduced the final count of participants and made it impossible for many of the presenters to come. Despite these difficulties, there were enough resources at hand to reprogram the meeting and carry out a very successful institute.

Participants had the opportunity to identify goals for elementary science education, and identify the kinds of experiences that children need in order to realize those goals by participating in hands-on activities. They also examined nationally produced exemplary curriculum materials that should be at the heart of a reform effort. Yet having good materials is not enough. Participants learned about the other structural elements school districts must create in order to support and sustain good hands-on science education. They also examined the process of change in school systems and the role they might play to assist and facilitate reform. It was a very busy week.

These participants returned to their communities better informed and ready to assist ongoing reform efforts. The excitement was palpable as many felt that they really had a handle on how to make a real difference for children. For improving the ability of children to succeed in a scientific and technological world is the real mission of effective science education.

For information about becoming a participant in the APS Teacher-Scientist Alliance contact: Ramon Lopez, http://aps.org/educ/tsai.html.

Workshop participants Jennifer Ross and Robert Johanson calibrate a spring scale.

INSIDE THE BELTWAY

Political Chaos And Uncertainty Prod Scientists Into Action

by Michael S. Lubell, APS Director of Public Affairs

Like an "Indy 500" race car that has blown a gasket, the 104th Congress, which had peeled away from the starting line scarcely a year earlier, barely limped into its Christmas recess, many laps away from the checkered flag. The session that had begun amidst great euphoria in the House of Representatives, where the new Republican majority had rapidly passed all but one item in the Contract with America, ended officially on a distinctly sour note this past January 3, with much of the federal government still shut down for lack of money and many science agencies facing an uncertain future. Within weeks, rumblings of an impending research crisis began to emanate from Washington, and scientists across the country began to mobilize.

Months earlier, the Senate and, subsequently, an uncharacteristically stubborn President Clinton had set up road blocks that eventually proved insurmountable for the finely honed House machine. By the time the spending bills needed to keep the government running began to appear on the President's desk, well into the start of the new fiscal year, polls were showing that a majority of Americans had become wary of the pace of change promoted by the new Congress. Emboldened, President Clinton uncapped his veto pen and exercised his constitutional prerogative.

Without the authority to spend money, the agencies covered by the vetoed bills would have to cease operation. But this was not a unique moment in American history. The federal government had faced a similar situation many times before, and in virtually every instance, Congress and the President had agreed to a Continuing Resolution to maintain activities temporarily, usually at the previous year's level. But the Republican budget for FY 1996 was different in one critical respect: it eliminated or substantially reduced many existing programs.

The government was also running up against the debt ceiling. Unless Congress approved an increase, the country would be unable to meet its obligations. Again, this was not a unique occurrence. But, in the past, during the four decades that the Democrats had controlled the House, Republicans had grown accustomed to voting against such measures almost reflexively. Their nay votes were popular back home, and they were loathe to abandon the tradition.

As they had throughout the year, the House Republican freshmen became the catalysts for action. And while Senate Majority Leader Bob Dole (R-KS) and House Speaker Newt Gingrich (R-GA) reportedly expressed misgivings privately, the Republican leadership eventually bowed to the freshmen's high-risk response to President Clinton's intransigence. Although default on the federal debt was fraught with long-term perils, and temporarily shutting down government agencies would cause short-term inconvenience, the President, to keep operations normal, would have to sign the Reconciliation Bill that contained the seven-year Republican blueprint.

But during the summer and early fall, the Democrats had studiously laid the ground work for a counterattack. They had taken every opportunity to label the Republican plans for Medicare and Medicaid as radical cuts in programs that benefit the middle class and the poor. Regardless of its merit, the public accepted the claim, and President Clinton gained the upper hand.

He vetoed the Reconciliation Bill, and to deal with default, he had Treasury Secretary Robert Rubin adopt creative financing measures that could keep the country afloat for three or four months. Their debt ceiling strategy thus stymied, the Republicans, who fundamentally did not trust the President to negotiate faithfully, made good on their threat to shut the government down. By the time Christmas week arrived, national parks and passport offices were closed, as were agencies such as NSF, NASA and NIH.

Amidst the chaos, Congress left town. But before they did, the Republican House freshmen vowed that they would return to complete their unfinished business, so sure were they that their strategy would work. Many in the Republican leadership, including House Speaker Gingrich, were far less certain.

The three-week hiatus proved sobering, at least for the leadership: the public had come down clearly on the side of the President. The GOP strategy had failed. Yet White House jubilation was muted. Strategists there believed that the President would also begin to suffer serious rebuke, if the impasse lasted much longer.

The stage was thus set for a compromise. But first, the Speaker had to convince the freshmen. Otherwise he would have had to rely on a bipartisan coalition involving moderates from both

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IN THIS ISSUE

APS Council Elects 180 New Fellows

The APS Council elected 180 members as Fellows of the Society at its November 1995 meeting. For the names and citations of new APS fellows, see pages 8-11.

Nominations for fellowship are received by the APS headquarters throughout the year, and are forwarded for review to the appropriate division, topical group and forum fellowship committees. These in turn forward their recommendations to the APS Fellowship Committee. The APS Fellowship Committee was chaired in 1995 by APS President-Elect D. Allan Bromley (Yale University) and is currently chaired by APS Vice President Andrew Sessler (LBL).

Fellowship nomination forms may be obtained from the January 1996 issue of *APS NEWS*, the APS Home Page or by writing to the APS Fellowship Office, One Physics Ellipse, College Park, MD 20740-3844.

Physicists To Be Honored at 1996 March Meeting

Ten APS prizes and awards will be presented during a special ceremonial session at the 1996 APS March Meeting in St. Louis, Missouri, to be held later this month. Citations and biographical information for each recipient follow.

PRIZES

1996 OLIVER E. BUCKLEY PRIZE

Established in 1952 by an endowment from AT&T Bell Laboratories, the Oliver E. Buckley Prize is intended to recognize and encourage outstanding theoretical or experimental contributions to condensed matter physics.

Charles Pence Slichter
University of Illinois

Citation: "For his original and creative applications of the magnetic resonance techniques to elucidate the microscopic properties of condensed matter systems including, especially, superconductors."

Slichter is a pioneer in the development of magnetic resonance and its applications to problems in condensed matter physics, chemistry, and surface science and technology. He obtained his Ph.D. in 1949 from Harvard University, beginning research in magnetic resonance as a student with E. Purcell just two years after the discovery of NMR. He has taught at the University of Illinois since 1949, and is currently a professor both of Physics and Chemistry. He is a past recipient of the APS Irving Langmuir Prize.

With Hebel, Slichter provided the first experimental proof of the pairing correlation in superconductors. He has made important discoveries about both the normal and superconducting states of high temperature superconductors. Among his other contributions are the first measurements of the Pauli spin susceptibility, introduction of phase sensitive detection to pulsed NMR and its use to detect weak signals, studies of charge density waves and of the Kondo effect, first demonstration of dynamic nuclear polarization, co-discovery of J-coupling in molecules, and studies of NMR of metal surfaces.

1996 FRANK ISAKSON PRIZE

Established in 1980 and now sponsored by Pergamon Press, Ltd., the Isakson Prize is awarded biennially in recognition and encouragement of outstanding contributions to the field of optical effects in solids.

David E. Aspnes
North Carolina State University

Citation: "For his creative applications of experimental and theoretical methods to the study of optical properties of thin films, surfaces, and interfaces; in particular, for electric- field modulation, spectroscopic ellipsometry, and dynamic control of epitaxial growth."

Aspnes received his Ph.D. in physics from the University of Illinois in 1965. After a year there as a postdoctoral research associate, and another at Brown University, he joined the technical staff of Bell Laboratories. In 1983 he joined Bellcore to organize and head the Interface Physics Department. He became a faculty member at North Carolina State University in 1992.

Principal research interests have been in the areas of optical spectroscopy and semiconductor and surface physics. Contributions include the discovery, elucidation, and development of low-field electroreflectance for high- resolution spectroscopy of semiconductors and the determination of their band structures, the development and application of spectroscopic ellipsometry to surfaces, interfaces, thin films, and bulk materials, and the development and application of reflectance-difference spectroscopy to real-time analysis of epitaxial growth.

1996 GEORGE PAKE PRIZE

The George E. Pake Prize was established in 1983 by the Xerox Corporation to recognize outstanding physicists who combine original research accomplishments with leadership in the management of research or development in industry.

Charles Vernon Shank
Lawrence Berkeley Laboratory

Citation: "For his pioneering research accomplishments in the area of laser development and ultrafast phenomena for his outstanding research management leadership as director of the Electronics Research Laboratory at AT&T Bell Laboratories in the development of quantum electronics, and as director of Lawrence Berkeley National Laboratory for fostering industrial interactions."

Shank has been Director of the Lawrence Berkeley Laboratory in Berkeley, California, since 1989. In addition, Shank has a unique triple appointment as a professor at the University of California, Berkeley in the departments of physics, chemistry and electrical engineering and computer sciences. He graduated summa cum laude from UC Berkeley in 1965 and went on to receive his M.S. and Ph.D. degrees in 1969.

Shank then joined the staff at AT&T Bell Laboratories. During his 20-year career there, he held numerous leadership positions including director of the Electronics Research Laboratory. He made pioneering contributions to the study of ultrafast (nanosecond) events using short laser pulses. He contributed to fiber optic communications with the invention of the distributed feedback laser, a component in high data rate transmission systems.

1996 EARLE K. PLYLER PRIZE

The Earle K. Plyler Prize was established in 1976 by the George E. Crouch Foundation to recognize and encourage notable contributions to molecular spectroscopy.

Charles S. Parmenter
University of Indiana

Citation: "For his many important contributions to molecular spectroscopy, energy transfer, and reaction dynamics following his inventions and developments of fluorescence labelling and chemical timing spectroscopies."

Parmenter completed his B.A. in chemistry at the University of Pennsylvania in 1955. Following two years in the US Air Force with DuPont, he completed his chemistry Ph.D. in 1962 at the University of Rochester. After postdoctoral research with G.B. Kistiakowsky at Harvard, he began his academic career at Indiana University in 1964. He is a Fellow of the American Physical Society and is a member of the National Academy of Sciences.

Parmenter's development of single vibronic level fluorescence spectroscopy in the 1960's provided a general method for reliable vibrational assignment of polyatomic electronic absorption spectra. The technique also led to discovery of the high sensitivity of nonradiative excited electronic state decay rates to vibrational excitation and provided a general approach to single-collision state-to-state vibrational energy transfer in large molecules. His chemical timing fluorescence spectroscopy provided one of the first time-resolved spectroscopic views of intramolecular vibrational redistribution (IVR).

1996 HIGH POLYMER PHYSICS PRIZE

The High Polymer Physics Prize was established the Ford Motor Company to recognize outstanding accomplishment and excellence in contributions to high polymer physics research.

Alan N. Gent
University of Akron

Citation: "For fundamental contributions to the physics of adhesion and fracture of elastomers."

Gent is currently professor emeritus of polymer physics and polymer engineering at the University of Akron, where he has been a faculty member since 1961, as well as scientific advisor to the Goodyear Tire and Rubber Company. From 1949 to 1961 he was a research physicist at the British (now Malaysian) Rubber Producers' Research Association. He received a Ph.D. in 1955 from the University of London. His main research interests are in the mechanics of deformation and fracture of rubber and plastics. He is a past chair of the APS Division of High Polymer Physics, and past President of the Society of Rheology.

1996 BIOLOGICAL PHYSICS PRIZE

Established in 1981, the prize is intended to recognize and encourage outstanding achievement in biological physics research.

Sponsors include Abbott Laboratories, Bio-Rad Microscience Division, Candela Laser Corporation, Coherent Laser Products, Eastman Kodak, Furumoto Research Foundation, Newport Corporation, and Siemens AG.

Seiji Ogawa
AT&T Bell Laboratories

Citation: "For his many seminal contributions to the understanding of biological systems ranging from proteins to intact organs by nuclear magnetic resonance culminating in the development and application of functional magnetic resonance imaging by blood oxygenation level dependent (BOLD) contrast."

Ogawa received his B.S. degree from the University in Tokyo in Applied Physics in 1957 and his Ph.D. degree from Stanford University in Chemistry in 1967. He was a research associate at the Mellon Institute in the early 1960s, studying radiation chemistry. Since 1968, Ogawa has worked at AT&T Bell Laboratories, first in the Bell Laboratories Biophysics Department and then in the Biological Computation Research Department where he is currently employed. He is the 1995 Gold Medal Award recipient from the Society of Magnetic Resonance for scientific achievement.

In the early 1970's, Ogawa worked on studies of the structure-function relation in proteins by magnetic resonance spectroscopy, especially on cooperative oxygen binding in hemoglobin. From the mid 70's to mid 80's he pioneered *in vivo* studies of cellular metabolism and energetics and also enzyme kinetics. Currently, Ogawa is conducting research on functional MRI of the brain: BOLD contrast to brain function, functional mapping, spatio-temporal image patterns in functioning or non-functioning of the brain.

AWARDS

1996 EDWARD A. BOUCHET AWARD

Established in 1994, the Bouchet Award (formerly the Visiting Minority Lectureship Award) is sponsored by the Research Corporation. It is intended to promote the participation of under-represented minorities in physics by publicizing the lecturer's work and career development to the physics community, especially to minority physics students.

Anthony M. Johnson
New Jersey Institute of Technology

Citation: "For his pioneering contributions to nonlinear optics, lasers, and optoelectronics, his leadership in the national scientific community, and his many efforts to attract minorities to careers in science and engineering."

Johnson received his Ph.D. in physics from the City College of the City University of New York in 1981 and joined the technical staff of AT&T Bell Laboratories' Quantum Physics and Electronics Research Department that same year. He is presently a chair of the Federated Physics Departments at the New Jersey Institute of Technology and

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APS News

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Subscription orders, renewals and address changes should be addressed as follows: **For APS Members**—Membership Department, The American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org. **For Nonmembers**—Circulation and Fulfillment Division, American Institute of Physics, 500 Sunnyside Blvd., Woodbury, NY 11797. Allow at least 6 weeks advance notice. For address changes, please send both the old and new addresses, and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing issues will be honored without charge only if received within 6 months of the issue's actual date of publication.

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Inside the Beltway

(continued from page 1)

sides, a true gamble, because both parties were badly fractured. It was far from clear that the requisite 217 votes could be assembled, even if he and the President both twisted arms. And, if the strategy failed, both of them would lose big time.

On a morning in early January, Newt Gingrich met with the Republican caucus and in a stormy session laid down the law. Although there were 18 defections, the Speaker carried the day. The President, for his part, agreed to a seven-year balanced budget plan.

The government reopened, and some targeted programs received full-year appropriations, NIH among them. But NSF, NASA and NIST did not. The agency's plight, NSF Director Neal Lane warned, was headed toward criticality.

On Saturday, January 20, the APS swung into action, issuing an electronic alert to 26,000 members. Within five days, more than 2,000 letters and phone calls reached the Hill. The APS initiative spawned similar activities by other science societies, and today estimates of calls and letters run as high as 10,000. The result: a bipartisan initiative spearheaded by Rep. Vern J. Ehlers (R-MI and APS Fellow) to give full-year funding to NSF, an agency that had received support in every quarter at every turn, but had fallen innocent victim to the chaos that has marked the 104th Congress.

Physicists To Be Honored

(continued from botton page 2)

Rutgers. His research interests include nonlinear optics, ultrashort pulse propagation in optical fibers, and the optical and optoelectronic properties of II-VI semiconductor multiple quantum wells. He has served on the Executive Committee of the Laser Science Topical Group and a number of APS committees, including the APS Committee on Minorities, which he chaired.

1996 MARIA GOEPPERT-MAYER AWARD

Established in 1985 by the General Electric Foundation to recognize outstanding achievement by a woman physicist in the early years of her career, the Maria Goeppert-Mayer Award includes a travel allowance for the recipient to present her achievements to others through public lectures at four institutions of her choice within the U.S.

Marjorie Ann Olmstead
University of Washington

Citation: For her innovative application of electron spectroscopies to surfaces and interfaces that has elucidated the importance of interfacial reactions on the structure, properties and morphology of both the interface and growing film in systems involving dissimilar materials, especially when heteroepitaxy is involved."

Olmstead is an associate professor of physics at the University of Washington, Seattle. She received her Ph.D. in 1985 from the University of California, Berkeley. After a year and a half at the Xerox Palo Alto Research Center, she returned to Berkeley as an assistant professor of physics in 1986. She joined the faculty at the University of Washington in 1991.

Olmstead's primary research effort probes the chemical, structural, and kinetic constraints controlling the heteroepitaxy of strongly disparate materials. She also studies the role of local geometry and electronic structure on photoelectron energies and satellite excitations in insulators.

MEDALS & LECTURESHIPS

1996 DAVID ADLER LECTURESHIP AWARD

The David Adler Lectureship Award was established in 1988 by contributions from friends of David Adler. Its purpose is to recognize an outstanding contributor to the field of materials physics, who is noted for his or her research, review articles, and lecturing.

M. Brian Maple
University of California, San Diego

Citation: "For sustained impact in diverse areas including superconductivity, magnetism, high-pressure physics, and surface science. Not only has he developed many novel materials, he is also highly respected as a teacher."

Maple is the Bernd T. Matthias Professor of Physics at the University of California, San Diego (UCSD). He received his Ph.D. in physics in 1969 from UCSD. Maple chaired the APS Division of Condensed Matter Physics in 1987, and presided over the celebrated high T_c superconductivity ("Woodstock") session at the 1987 APS March meeting. He has chaired numerous international conferences and has advised national laboratories and IUPAP Commissions.

1996 JOHN H. DILLON MEDAL

The John H. Dillon Medal was established in 1983 by the Division of High Polymer Physics to recognize outstanding research accomplishments by a young polymer physicist.

Julia Ann Kornfield
California Institute of Technology

Citation: "For incisive experiments to relate microstructural dynamics to macroscopic behavior of polymer blends, block copolymers and liquid crystals."

Kornfield is an associate professor of chemical engineering at CalTech. She received her Ph.D. from Stanford University in 1988. Following a NATO post-doctoral fellowship at the Max-Planck-Institute for Polymer Research, she joined the faculty of Caltech in 1990. Professional activity has included serving on the APS Committee on Education, as well as involvement with the Division of High Polymer Physics.

Kornfield's experimental program has provided direct, quantitative observations of polymer dynamics from the local segmental motions that control their glass transition behavior to the overall relaxations of chain conformation and mesophase structures.

BOOK REVIEW

by Ben P. Stein

The Physics of Star Trek, *by Lawrence M. Krauss* [New York, Basic Books, 1995]

Arguably the most successful science-fiction "enterprise" of the 20th century, "Star Trek" has captured the imaginations of millions since it premiered as a television series in 1966. As we watch the crew of the Starship Enterprise encounter life on other planets and try to get along with alien species, we begin to see why Gene Roddenberry's "*Wagon Train to the Stars*" has spawned three additional TV series, seven movies, and a devoted, hard-core fan base. Star Trek gets us to think about a future for the human race that is filled with hope and potential. It also taps into the peculiarly American brand of optimism. From episode to episode, Captains Kirk and Picard navigate the Enterprise and its crew out of seemingly intractable situations using their ingenuity and resourcefulness.

But how many things in the Star Trek universe are actually possible, based on our current understanding of the world? This is ostensibly the premise of physicist Lawrence Krauss's latest book, *The Physics of Star Trek*. However, the mission of the book goes deeper than this. A professor of physics at Case Western Reserve University, Krauss uses the book as an opportunity to introduce the readers to many of the exciting ideas in modern physics and cosmology. I was very impressed with the breadth of topics that Krauss covers in this book. He discusses not only the subjects directly relevant to Star Trek, such as wormholes and time travel, but brings in less-obvious topics such as holograms, solitons, and physicists' attempts to create the exotic state of matter known as the quark-gluon plasma.

Krauss is very talented at performing entertaining back-of-the-envelope calculations to argue why certain Star Trek inventions might be implausible. For instance, he discusses how much fuel the Enterprise would need in its nuclear-fusion-powered impulse engines to accelerate to sub-light speeds: Krauss calculates that it would need to burn 81 times its entire mass in hydrogen fuel to get up to that speed.

Indeed, much of Star Trek physics barely gets off the ground even with Isaac Newton's 17th-century science. Krauss points out that even if the Enterprise were able to travel at faster-than-light-speeds, its acceleration from 0 to Warp 10 in several seconds of air time would pulverize the entire ship because of the tremendous forces involved.

Still, the Star Trek writers are very creative in imagining possibilities that go beyond apparent limitations in science. Krauss explores the Enterprise's warp drive, which allows the Enterprise to travel between galaxies in minutes without either violating restrictions on faster-than-light speed travel or by expending enormous amounts of fuel. According to the series, the Enterprise traverses large distances by warping spacetime: expanding the space behind it and contracting the space in front of it. This allows Krauss to talk about Einstein's general theory of relativity, in which the presence of mass curves spacetime and can hypothetically allow this to happen.

In addition, the bending of spacetime could conceivably be used to deflect enemy fire from other ships. But Krauss points out that the energy requirements for significantly warping spacetime are phenomenally high: an object as massive as the Sun, he points out, produces a gravitational field that bends light by only 1/1000 of a degree. Transporters are out, Krauss argues, because even if one were able to read and write the enormous amounts of information that constitute a human being, one would have to contend with the fundamental limits in knowledge prescribed by the uncertainty principle in quantum mechanics.

A discussion of matter-antimatter fuel allows Krauss to launch into an interesting history of antimatter research— and the lingering mystery of why we are made of matter instead of antimatter. A description of the Holodeck—the room on the Enterprise that creates a living, breathing virtual reality environment—leads to an explanation of holograms. Krauss's section on time travel gives him ample opportunity to describe Einstein's special theory of relativity, and ideas for making time machines with such theoretical exotica as wormholes. An exploration of the possibility of life on other planets brings Krauss to discuss how different types of stars evolve from birth to death, and how volcanic activity in the early days of the Earth created our atmosphere.

While Krauss very generously sprinkles many of the latest and deepest ideas in physics throughout the text, many of his explanations are confusing even after a second or third read. For example, he introduces the notion of "negative energy" which would be needed to keep wormholes open or to warp spacetime. He mentions that "negative energy" has something to do with the way in which black holes can lose energy, but the general concept could definitely have been spelled out a bit more clearly.

Another quibble is that Krauss is clearly first a physicist, and second a Star Trek fan. From all indications, Krauss had taken a crash course in Star Trek prior to writing this book. While the text is liberally sprinkled with examples of Star Trek episodes and movie scenes, it is done without any great passion for the series. Perhaps it would have been better if Krauss had a Trekkie co-author, someone who could have added more enthusiasm for the show, or perhaps even debated some of Krauss's conclusions. However, in fairness, Krauss is not dismissive of any ideas in Star Trek until after carefully analyzing them.

Krauss acknowledges that he does not exhaust all of the physics topics that can be discussed in connection with Star Trek. He even suggests that a sequel, which he wants to call *Star Trek II: The Wrath of Krauss*. However, I would suggest that before he sets out to do this, a second edition of the book be prepared to clarify some of the confusing sections. Even in its present form, however, *The Physics of Star Trek* successfully shows that the ideas in physics can be just as exciting and bizarre as those in science fiction.

Ben Stein is a science writer in AIP's Public Information Division.

ANNOUNCEMENTS

NOMINATIONS FOR PRIZES AND AWARDS

The following prizes and awards will be bestowed at meetings of the Society in the coming year. Members are invited to nominate candidates to the respective committees charged with the privilege of recommending the winners. A brief description of each prize and award is given below, along with the addresses of the selection committee chairs to whom nominations should be sent. Please refer to the APS Membership Directory, pages xxiii- xxxix, or the APS Home Page [http://aps.org] under the Prize, Award and Fellowship button, for complete information regarding rules and eligibility requirements for individual prizes and awards.

PRIZES

1997 IRVING LANGMUIR PRIZE

Sponsored by the General Electric Foundation.

Purpose: To recognize and encourage outstanding interdisciplinary research in chemistry and physics in the spirit of Irving Langmuir.

Nature: The prize consists of $10,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: George C. Schatz, Dept of Chemistry, Northwestern Univ, 2145 Sheridan Rd, Evanston, IL 60208, Ph: (708) 491-5657, Fax: (708) 491-7713, email: schatz@cooper.chem.nwu.edu. Nominations must be received no later than 14 June 1996.

1997 JULIUS EDGAR LILIENFELD PRIZE

Sponsored by the Lilienfeld Trust.

Purpose: To recognize a most outstanding contribution to physics.

Nature: The prize consists of $10,000, a certificate citing the contributions made by the recipient, and expenses for three lectures by the recipient given at an APS general meeting, a research university, and a predominantly undergraduate institution.

Send the name of candidates, biographical information and supporting letters to: Arthur Bienenstock, MS 69 SLAC, Stanford Univ, PO Box 4349, Stanford, CA 94309, Ph: (415) 926-3153, Fax: (415) 926-4100. Nominations must be received no later than 14 June 1996.

1997 LARS ONSAGER PRIZE

Endowed by Russell and Marion Donnelly.

Purpose: To recognize outstanding research in theoretical statistical physics, including the quantum fluids.

Nature: The prize consists of $10,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Joel L Lebowitz, Dept of Math Rutgers Univ, Hill Ctr-Busch Campus, New Brunswick, NJ 08903, Ph: (908) 932-3117. Nominations must be received no later than 14 June 1996.

1997 ARTHUR L. SCHAWLOW PRIZE IN LASER SCIENCE

Sponsored by the NEC Corporation.

Purpose: To recognize outstanding contributions to basic research that uses lasers to advance our knowledge of the fundamental physical properties of materials and their interaction with light.

Nature: The prize consists of $10,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: H. Jeffrey Kimble, Division of Physics, MC 12-33, Caltech, Pasadena, CA 91125, Ph: (818) 395-8340, Fax: (818) 793-9506, email: hjkimble@juliet.caltech.edu. Nominations must be received no later than 14 June 1996.

1997 DANNIE HEINEMAN PRIZE FOR MATHEMATICAL PHYSICS

Endowed by the Heineman Foundation for Research, Educational, Charitable, and Scientific Purposes, Incorporated through the American Institute of Physics.

Purpose: To recognize outstanding publications in the field of mathematical physics.

Nature: The prize consists of $7,500 and a certificate citing contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Charles W Misner, Dept of Phys, Univ of Maryland, College Park, MD 20742-4111, Ph: (301) 405-5958, Fax: (301) 314-9525, email: misner@umail.umd.edu. Nominations must be received no later than 14 June 1996.

1997 I.I. RABI PRIZE

Endowed by family, friends and colleagues of I.I. Rabi.

Purpose: To recognize and encourage outstanding research in atomic, molecular and optical physics by a physicist within ten years of receiving the Ph.D. degree.

Nature: The prize consists of $7,500 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Sheldon Datz, Phys Div-MS 6377, Oak Ridge Natl Lab, PO Box 2008 Bldg 5500, Oak Ridge, TN 37831-6377, Ph: (423) 574-4984, Fax: (423) 574-1118. Nominations must be received no later than 14 June 1996.

1997 TOM W. BONNER PRIZE IN NUCLEAR PHYSICS

Sponsored by Friends of Tom W. Bonner.

Purpose: To recognize and encourage outstanding experimental research in nuclear physics, including the development of a method, technique, or device that significantly contributes in a general way to nuclear physics research.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Michael J Musolf, MS-12H2 , CEBAF, 12000 Jefferson Ave, Newport News, VA 23606. Nominations must be received no later than 14 June 1996.

1997 HERBERT P. BROIDA PRIZE

Supported by friends and colleagues of Herbert P. Broida.

Purpose: To recognize and enhance outstanding experimental advancements in the fields of atomic and molecular spectroscopy or chemical physics.

Nature: The prize consists of a $5,000 stipend and a certificate citing the contributions made by the recipient. The first prize was awarded in 1980 and beginning in 1981, every odd numbered year thereafter. An allowance will be provided for travel expenses of the recipient to the meeting of the society at which the prize is bestowed.

Send the name of candidates, biographical information and supporting letters to: Alexander Pines, Chem Dept, UCB, Berkeley, CA 94720, Ph: (510) 642-1220, Fax: (510) 486- 5744, email: pines@cchem.berkeley.edu or the APS Home Page [http://aps.org] under the Prize, Award and Fellowship button. Nominations must be received no later than 14 June 1996.

1997 OLIVER W. BUCKLEY CONDENSED MATTER PHYSICS PRIZE

Endowed by AT&T Bell Laboratories.

Purpose: To recognize and encourage outstanding theoretical or experimental contributions to condensed matter physics.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Robert J Birgeneau, 6-123, MIT, 77 Massachusetts Ave, Cambridge, MA 02139, Ph: (617) 253-8900, Fax: (617) 253-8901, email: robertjb@mit.edu. Nominations must be received no later than 14 June 1996.

1997 DAVISSON-GERMER PRIZE

Sponsored by AT&T Bell Laboratories.

Purpose: To recognize and encourage outstanding work in atomic physics or surface physics.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient. This annual prize will normally be awarded alternatively for outstanding work in atomic physics one year and for outstanding work in surface physics the following year. The 1997 prize will be awarded for outstanding work in atomic physics.

Send the name of candidates, biographical information and supporting letters to: Mark J. Cardillo, 1D-358, AT&T Bell Labs, 600 Mountain Ave, Murray Hill, NJ 07974, Ph: (908) 582-2418, Fax: (908) 582-3619, email: mjc@allwise.att.com. Nominations must be received no later than 14 June 1996.

1997 HIGH POLYMER PHYSICS PRIZE

Sponsored by the Ford Motor Company.

Purpose: To recognize outstanding accomplishments and excellence of contributions in high polymer physics research.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Jeffrey T. Koberstein, Inst of Material Sci U136, Univ of Connecticut, Storrs, CT 06269-3136, Ph: (203) 486-4716, Fax: (203) 486-4745. Nominations must be received no later than 14 June 1996.

1997 GEORGE E. PAKE PRIZE

Sponsored by the Xerox Corporation.

Purpose: To recognize and encourage outstanding work by physicists combining original research accomplishments with leadership in the management of research or development in industry.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Charles B. Duke, 114-38D, Xerox Webster Research Center, 800 Phillips Road, Webster, NY 14580, Ph: (716) 422-2106, Fax: (716) 265-5080, email: duke.wbst128@xerox.com. Nominations must be received no later than 14 June 1996.

1997 W.K.H. PANOFSKY PRIZE

Sponsored by the friends of W.K.H. Panofsky and the Division of Particles and Fields.

Purpose: To recognize and encourage outstanding achievements in experimental particle physics.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Gary J Feldman, Lyman Phys Lab, Harvard Univ, Cambridge, MA 02138, Ph: (617) 496-1044, Fax: (617) 495-0416, email: FELDMAN@HUHEPL. Nominations must be received no later than 14 June 1996.

1997 EARLE K. PLYLER PRIZE

Sponsored by the George E. Crouch Foundation.

Purpose: To recognize and encourage notable contributions to molecular spectroscopy.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Kevin Keith Lehmann, Dept of Chem, Princeton Univ, Princeton, NJ 08544, Ph: (609) 258-5026, Fax: (609) 258-6746, email: Lehmann@Chemvax.princeton.edu. Nominations must be received no later than 14 June 1996.

(continued on top of next page)

1997 PRIZE TO A FACULTY MEMBER FOR RESEARCH IN AN UNDERGRADUATE INSTITUTION

Sponsored by the Research Corporation.

Purpose: To honor a physicist whose research in an undergraduate setting has achieved wide recognition and contributed significantly to physics and who has contributed substantially to the professional development of undergraduate physics students.

Nature: The prize consists of a $5,000 stipend to the recipient, a certificate citing the contribution of the recipient, and a separate $4,000 unrestricted grant for the research of the recipient to the awardee's institution.

Send the name of candidates, biographical information and supporting letters to: Howard A Mizes, 114-22D, Xerox Webster Res Ctr, 800 Phillips Rd, Webster, NY 14580, Ph: (716) 422-5079, Fax: (716) 422-2126, email: MIZES@WRC.XEROX.COM. Nominations must be received no later than 14 June 1996.

1997 ANEESUR RAHMAN PRIZE

Sponsored by the IBM Corporation.

Purpose: To recognize and encourage outstanding achievement in computational physics research.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Warren E Pickett, Code 6604, NRL, 4555 Overlook Ave SW, Washington, DC 20375-5345, Ph: (202) 404-8631, Fax: (202) 404-7546, email: pickett@dave.nrl.navy.mil. Nominations must be received no later than 14 June 1996.

1997 J.J. SAKURAI PRIZE FOR THEORETICAL PHYSICS

Endowed by the family and friends of J.J. Sakurai.

Purpose: To recognize and encourage outstanding achievement in particle theory by a young physicist.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Lawrence J Hall, Phys Dept UCB, Berkeley, CA 94720, Ph: (510) 642-6536. Nominations must be received no later than 14 June 1996.

1997 ROBERT R. WILSON PRIZE

Sponsored by friends of Robert R. Wilson.

Purpose: To recognize and encourage outstanding achievement in the physics of particle accelerators.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Christopher Leemann, MS 12A2, CEBAF, 1200 Jefferson Ave, Newport News, VA 23606, Ph: (804) 249-7554, Fax: (804) 249-7398, email: soltys@cebaf.gov. Nominations must be received no later than 14 June 1996.

AWARDS

1996 LEROY APKER AWARD

Endowed by Jean Dickey Apker, in memory of LeRoy Apker.

Purpose: To recognize outstanding achievement in physics by undergraduate students, thereby providing encouragement to young physicists who have demonstrated great potential for future scientific accomplishment.

Nature: Two awards may be made, one to a nominee from an institution that offers a Ph.D. program in physics, the other to a nominee from an institution that does not. The award to each recipiant consists of $3,000, an allowance for travel to the meeting of the Society at which the award is being presented, and a certificate citing the work and school of the recipient. Each of the finalists in the annual competition will receive an honorarium of $1,000 and a certificate as an Apker Award Finalist. Certificates and grants equal to 50 percent of the recipiant and finalist awards will be presented to the home institutions.

Send the name of candidates, biographical information and supporting letters to: Harry Lustig, Administrator, Apker Award Selection Committee, The American Physical Society, One Physics Ellipse, College Park, MD 20740-3844. Nominations must be received no later than 14 June 1996.

1997 MARIA GOEPPERT-MAYER AWARD

Sponsored by the General Electric Foundation.

Purpose: To recognize and enhance outstanding achievement by a woman physicist in the early years of her career, and to provide opportunities for her to present these achievements to others through public lectures.

Nature: The award consists of $2,500, plus a $4,000 travel allowance to provide opportunities for the recipient to give lectures in her field of physics at four institutions of her choice and at the meeting of the Society at which the award is bestowed. Nominee must be a female physicist having U.S. citizenship or a permanent U.S. resident and received her Ph.D. after Sept. 1, 1986.

Send the name of candidates, biographical information and supporting letters to: Bunny C Clark, Phys Dept, Ohio State Univ, 174 W 18th Ave, Columbus, OH 43210, Ph: (614) 292-1843, Fax: (614) 292-7557, email: bcc@mps.ohio-state.edu. Nominations must be received no later than 14 June 1996.

1997 SHOCK COMPRESSION SCIENCE AWARD

Sponsored by the friends of the Topical Group on Shock Compression of Condensed Matter Physics.

Purpose: To recognize outstanding contributions to understanding condensed matter and nonlinear physics through shock compression.

Nature: This award consists of a certificate citing the accomplishments of the recipient and a cash award of $2,000.

Send the name of candidates, biographical information and supporting letters to: James Russell Asay, Div 5602, Sandia Natl Lab, PO Box 5800, Albuquerque, NM 87185-5800, Ph: Not Available, Fax: (505) 844-4543, email: jrasay@sandia.gov. Nominations must be received no later than 14 June 1996.

1997 JOHN WHEATLEY AWARD

Endowed by Biomagnetic Technologies and IBM, and friends in memory of John Wheatley.

Purpose: To honor and recognize the dedication of physicists who have made contributions to the development of physics in developing countries.

Nature: The award consists of $2,000 and a certificate citing the contributions made by the recipient.

Send the name of candidates, biographical information and supporting letters to: Jorge G. Morfin, Fermilab, MS220, PO Box 500, Batavia, IL 60510, Ph: (708) 840-4561, Fax: (708) 840-2950, email: JORGE@FNALV.FNAL.GOV. Nominations must be received no later than 14 June 1996.

1997 FORUM AWARD FOR PROMOTING PUBLIC UNDERSTANDING OF THE RELATIONSHIP OF PHYSICS & SOCIETY

Purpose: To recognize outstanding accomplishment in the endeavor to promote public understanding of issues involving the interface between physics and society.

Nature: The award consists of a certificate citing the contributions of the recipient and a sculpture to be held one year and passed on to the next recipiant.

Send the name of candidates, biographical information and supporting letters to: Nina Byers, Dept of Phys, UCLA, 405 Hilgard Ave, Los Angeles, CA 90024, Ph: (310) 825-3588, email: byers@physics.ucla.edu. Nominations must be received no later than 14 June 1996.

1997 LEO SZILARD AWARD FOR PHYSICS IN THE PUBLIC INTEREST

Purpose: To recognize outstanding accomplishments by a physicist in promoting the use of physics for the benefit of society in such areas as the environment, arms control, and science policy.

Nature: The award consists of a certificate citing the contributions of the recipient and a sculpture to be held one year and passed on to the next recipiant.

Send the name of candidates, biographical information and supporting letters to: Nina Byers, Dept of Phys, UCLA, 405 Hilgard Ave, Los Angeles, CA 90024, Ph: (310) 825-3588, email: byers@physics.ucla.edu. Nominations must be received no later than 14 June 1996.

DISSERTATION AWARDS

1997 AWARD FOR OUTSTANDING DOCTORAL THESIS RESEARCH IN BEAM PHYSICS

Supported by the Universities Research Association.

Purpose: To recognize doctoral thesis research of outstanding quality and achievement in beam physics and engineering.

Nature: The award consists of $1,500 and a certificate to be presented at an awards ceremony at the Division of Physics of Beams Annual Meeting.

Send the name of candidates, biographical information and supporting letters to: Co-Chairs: Thomas Marshall, 213 Mudd Bldg, Columbia Univ, New York, NY 10027, Ph: (212) 854-3116, Fax: (212) 854-8257, email: TCM2@COLUMBIA.EDU and John Nation, 325 Engr & Theor Ctr, Cornell Univ, Ithaca, NY 14853, Ph: (607) 255-8703, Fax:(607)255-3004, email: jnation@ionvax.tn.cornell.edu. Nominations must be received no later than 14 June 1996.

MEDALS AND LECTURSHIP

1997 DAVID ADLER LECTURESHIP AWARD

Sponsored by the friends of David Adler.

Purpose: To recognize an outstanding contributor to the field of materials physics who is noted for the quality of his/her research, review articles, and lecturing.

Nature: The award consists of an award an honorarium for the lecturer, and a certificate citing the contribution made by the recipient.

Send the name of candidates, biographical information and supporting letters to: J. Murray Gibson, Dept of Phys, UIUC, 1110 W Green St, Urbana, IL 61801, Ph: (217) 333-2997, Fax: (217) 244-2278, email: j_gibson@uiuc.edu. Nominations must be received no later than 14 June 1996.

1997 EDWARD A. BOUCHET AWARD

Sponsored by the Research Corporation.

Purpose: The Bouchet award is intended to promote the participation of under-represented minorities in physics by publicizing the recipiants work and career development to the physics community, especially to young minority physics students.

Nature: The lectureship consists of a stipend of $3,000 plus support for travel to an APS general meeting where the recipient will receive the award and give his/her first address. In addition, the recipient will be invited to lecture at least three academic institutions where the impact of the visit on minority students would be significant.

Send the name of candidates, biographical information and supporting letters to: Jin-Joo Song, Ctr for Laser Res, Oklahoma State Univ, 413 Nobel Res Ctr, Stillwater, OK 74078, Ph: (405) 744-6403, Fax: (405) 744-6406, email: jjsong@okway.okstate.edu. Nominations must be received no later than 14 June 1996.

1997 JOHN H. DILLON MEDAL

Purpose: To recognize outstanding accomplishments by young polymer physicists.

Nature: The prize consists of a bronze medallion and a certificate.

Send the name of candidates, biographical information and supporting letters to: Jeffrey T. Koberstein, Inst of Material Sci U136, Univ of Connecticut, Storrs, CT 06269-3136, Ph: (203) 486-4716, Fax: (203) 486-4745. Nominations must be received no later than 14 June 1996.

OPINION

APS VIEWS

Preparations Are Well Underway for Centenary Celebration in 1999

by Brian Schwartz, Chair, APS Centenary Planning Committee

The APS is having a party and everyone is invited.

In 1999, the Society will celebrate its Centenary Year, having been founded in New York City on 20 May 1899 at Columbia University. Preparations are well underway for the formal celebration, which will take place in Atlanta, Georgia, in conjunction with a combined March and April Meeting, 20-26 March 1999. All APS members and units are invited to contribute and participate in the celebration. Those APS units that hold their own (or secondary) meetings separately may continue to do so, and have agreed to make a special effort to plan a significant program and encourage their members to attend the general meeting and celebration.

A task force was appointed in 1993, chaired by Mildred Dresselhaus (MIT), with the assistance of APS Treasurer Harry Lustig, to prepare a report on how the APS should celebrate the Society's centenary. The report was presented to the APS Executive Board, Council and units for comments and improvements. After considerable discussion, it was agreed that the major celebration would combine the 1999 March and April meetings in Atlanta, and that the pomp and circumstance of the Centenary Celebration would begin on the weekend prior to the usual five- weekday general and scientific meeting. In addition, the program and celebration would be international in character, involving the leadership of physics and the science policy community around the world, and the Society will develop and implement strategies to widely disseminate the history and accomplishments of physics and the APS over the past 100 years. A Centenary Planning Committee was appointed last year to handle the details, with myself as chair.

The celebration in Atlanta, although not yet finalized, will include one weekend day devoted to a symposium on the international nature and economic importance of physics. This will be followed by a banquet including the leadership and members of physical societies throughout the world. A second weekend date will feature attending Nobel laureates discussing personal moments of discovery which affected their careers. This will be followed by a gala event at the local science museum. In addition, there will be a plenary two-hour session celebrating the accomplishments of physics in the 20th century on Monday and Tuesday of the general meeting. Individual APS units will celebrate the accomplishments within their own fields with symposia and other events.

For those unable to attend the week-long celebration in Atlanta, two major outreach programs are being planned for the Centenary Year. In collaboration with APS units, the Society will prepare a Centenary Speakers Bureau booklet for distribution to educational, governmental and industrial institutions encouraging the recipients to schedule one or more colloquia or seminars. The topics would include the historical, societal, scientific and technological accomplishments of physics in the 20th century. A second planned major project is the development of an attractive illustrated and annotated "time line" wall chart depicting the impact of physics, physicists and technology on the culture and development of the 20th century.

To have a successful Centenary celebration, the APS will need the input, participation and talents of all its members and subunits. The Society has developed an interactive Centenary page on its World Wide Web site. To keep up with the planning and to make suggestions or volunteer, please access the APS Centenary Web page at http://aps.org.

THE HIGHEST AIM OF THE PHYSICIST

BY HENRY A. ROWLAND.

[PRESIDENTIAL ADDRESS DELIVERED AT THE SECOND MEETING OF THE SOCIETY, ON OCTOBER 28, 1899.]

Gentlemen and Fellow Physicists of America :

We meet to-day on an occasion which marks an epoch in the history of physics in America ; may the future show that it also marks an epoch in the history of the science which this society is organized to cultivate ! For we meet here in the interest of a science above all sciences, which deals with the foundation of the Universe, with the constitution of matter from which evervthing in the Universe is made, and with the ether of space by which alone the various portions of matter forming the Universe affect each other even at such distances as we may never expect to traverse whatever the progress of our science in the future.

[Reprint from *BAPS*, Vol. I, No. 1, Pg. 2 (1899)]

LETTERS

Don't Blame Foreigners for Job Problem

I have read with great interest the review of David North's book, *Soothing the Establishment: The Impact of Foreign-Born Scientists and Engineers on America*, by Brian Schwartz (*APS NEWS*, December 1995). Speaking as one of those FBSEs, I hope you will allow a rebuttal to the theme and the contents of the book.

The central theme of the book as reviewed in *APS NEWS* is the cheap labor smell of foreign scientists. Although the credentials of foreign born scientists are impeccable, by agreeing to work for lower wages they are taking away jobs which legitimately belong to U.S. scientists. Several suggestions are put forward, including further study by the National Academy of Sciences and the National Science Foundation. If this study were to be carried out using public funds, allow me to suggest the inclusion of foreign born scientists such as Fermi, Szilard, Einstein, Bethe, Chandrashekhar, Weisskopf, Yang, Lee, Patel, Bloembergen, Wannier, Dyson, etc. If the thesis of the book is viable these scientists must have lowered the wages of U.S. scientists.

As for anecdotal information that has been quoted, let me pass along what I know: that the standards of Ph.D. qualifying exams are occasionally lowered to allow U.S. students to pass in order to preserve balance.

Let me move on to economic incentives for U.S. citizens to study science. People don't study science primarily because they will get rich. Those who want to get rich go into business. It is a terrible mistake to compare physicists with lawyers, accountants and physicians. The latter are professions. As long as we are taught to maximize the ratio of income/work, we are not going to attract the best students to physics. In spite of billions spent annually on schools only 2 percent of high school graduates are proficient in algebra, 5 percent are able to write a job application without making grammatical errors. Instead of blaming foreigners perhaps one should look elsewhere for the cause of the dismal level of education of our citizens.

There are serious problems but money is not the solution. Those who want to study physics should be prepared to work hard for long hours, low pay and to accept job insecurity. This is a description of an immigrant's work.

If according to the reviewer the book is not xenophobic, then I don't know what xenophobia is.

Munawar Karim
St. John Fisher College
Rochester, New York

I had to re-read the book review of *Soothing the Establishment* by David North to believe my eyes.

As recently as April 1995, a small graph of the annual citizenship breakdown of annual physics Ph.D. graduates since 1971 drew an irate letter in the June 1995 issue of *APS NEWS*. Yet reviewer Brian Schwartz seems to have broken a taboo by calmly recognizing (1) that an oversupply of Ph.D.'s leads to unemployment and depressed wages; (2) that foreign-born scientists and engineers (FBSEs) have something to do with the oversupply; and (3) that adjusting the immigration of FBSEs and cutting industry's use of foreign non-immigrant labor may be necessary. Startling news, but it comes a little late.

The large increase in annual admissions of scientists and engineers — allowed by the 1990 Immigration Act in response to the National Science Foundation's forecasted "shortfall" of these professionals — is unlikely to be lowered. The report of the recent Jordan Commission on Immigration Reform leaves "skill- based" immigration around the 100,000 level. Some immigration "reform" bills now in Congress would actually increase that number. Even the National Academy of Sciences, which also studied the FBSE situation, decided to take no action, viewing it as a non-problem.

There seems to be no highly organized group lobbying for recommendations like those in Mr. North's book. (Most of the immigration reform groups, such as FAIR or SOS in California, target the low-skilled labor market segments.) Conversely, there is an odd coalition of immigrants rights groups and high-technology manufacturers (the latter naturally favoring cheap labor) fighting any limitations. Contrast this situation with the medical profession, which is about to cut back on doctor training and reduce the number of positions for graduates of foreign medical schools to counter the oversupply of M.D.s and the declining median physician income.

The bottom line: be prepared for more whining about the dismal employment prospects in physics. It has taken too long for the APS even to acknowledge implicitly through the publication of Schwartz's book review that U.S. immigration policy has an adverse economic impact on a large segment of its membership. Unfortunately, in the words of John Locke, "Hell is truth seen too late."

William E. Murray, Jr.
Portola Valley, California

APS Should Eschew Political Partisanship

I am responding to the letter of Samuel Park in the December 1995 issue, which was in response to my letter in the October 1995 issue responding to a back page article by Dana Rohrabacher (*APS NEWS*, July 1995). Park's letter expressed a plea for humility among physicists, provoked by my sentiment decrying political partisanship in an APS forum.

I attempted to express two ideas. First, that discourse and debate in any Society forum should be judged by the

OPINION

We Must Protect U.S. Investment in Scientific Knowledge

by Mark B. Boslough

In northern Arizona, signs along I-40 read: "Meteor Crater... the planet's most penetrating natural attraction." South of the interstate a low ridge rises from the flat desert. An earlier generation called the ridge "Coon Butte", not realizing that it was the rim of a deep crater. The cavity is so expansive that it changes the wind patterns and attracts raptors that soar in the updrafts. This big hole is truly one of the natural wonders of the world.

Meteor Crater was also once the subject of a great scientific controversy, and was a focal point for defining the scientific method and promoting scientific research. A century after that debate, Meteor Crater is a reminder of the importance of science to our way of life.

G.K. Gilbert, one of the top scientific thinkers of his time, gave an address on this subject in Washington on December 11, 1895. At the center of the scientific method, he said, is the hypothesis, or "the scientific guess." Gilbert used the crater to illustrate how science works.

Four scientific guesses to explain the crater's origin had been made at the time. The first came from a shepherd named Mathias Armijo, who found pieces of iron near the crater and reasoned that an explosion had hurled the metal out of the ground and formed the big hole (one does not have to be a scientist to think scientifically). Geologists offered two more scientific guesses involving volcanic processes. A fourth hypothesis was the radical idea that a meteorite had hit the Earth.

Gilbert traveled to Arizona and made measurements to test the various ideas. Little was known about the physics of meteorite impacts, and he predicted that such a cosmic collision would have left a very large piece of buried iron. His tests failed to find it, so Gilbert rejected the impact idea. The iron objects on the surface turned out to be meteorite fragments (ruling out Armijo's hypothesis that they came out of the ground) but Gilbert concluded that they were not related to the hole.

Of the two volcanic ideas, one predicted that volcanic rocks would be found in the crater. But the crater had none, so there was only one hypothesis left that had not been eliminated: some type of volcanic steam explosion. Gilbert accepted that explanation, even though he had arrived at the crater thinking it was formed by an impact (a good scientist does not allow personal feelings to get in the way of evidence). However, he recognized that new facts might be discovered about meteorites and impacts that would overturn his conclusion.

And that is exactly what happened. Gilbert had overestimated the amount of speeding iron that would be needed to blast out such a big hole: hypervelocity impacts are much more powerful than he realized. Furthermore, most of the meteorite was vaporized by the impact, leaving few traces. It had been a mistake to think that the impact would leave a lot of buried iron. Many years later, scientists would discover rare new minerals in the rocks at the crater—minerals that had been predicted to form from an impact—finally settling the controversy.

Science is sometimes slow, but it always involves making educated guesses that eventually lead to testable predictions. If the predictions turn out to be incorrect, the test is still successful if scientists learn enough to modify the theory, find a better one, or discover mistaken assumptions.

Unfortunately, even after the successes of 20th-century science, there are a lot of people who still don't like (or don't understand) the scientific method. Science is now under attack from many directions.

On the left are those who twist legitimate multiculturalism by going way beyond it. They dogmatically assert that all ways of seeking knowledge are equally valid, but still insist that science is flawed because they view it as a "Eurocentric" white male endeavor. Such thinking has encouraged belief in pseudoscientific and unscientific ideas ranging from crystal healing in Taos to flying saucers in Roswell. Even worse, it has turned some women and minorities away from careers in science, to their detriment and to that of society.

Science is also under attack from the religious right, whose literal interpretation of the Bible supersedes scientific evidence, logical reasoning, and common sense. To fundamentalists, any fact that is at odds with their beliefs must be ignored. This faction is not satisfied merely to reject science for itself, but it now has an active campaign to remove scientifically validated subjects — such as evolution — from the classroom and have them replaced by their own unscientific opinions, such as creationism.

And science is now under attack by a budget-cutting Congress to whom dollars have measurable value but scientific knowledge does not. They think that spending on science is like throwing money into a big hole in the ground. They do not realize that a dollar saved is a dollar saved, but it may be two dollars (or more) worth of knowledge lost.

G.K. Gilbert closed his address 100 years ago by explaining that "fertility of invention implies a wide and varied knowledge of the causes of things," that deep understanding of nature through scientific research is essential, and that our "material, social, and intellectual condition" directly depends on our scientific knowledge. He compared science to an investment: "Knowledge of Nature is an account at [the] bank, where each dividend is added to the principal and the interest is ever compounded..."

Our scientific bank account has led to inventions that Gilbert's audience could not have imagined. It has swollen with the advances we associate with modern living, with medical discoveries that have given us longer, healthier, happier lives, and with unsurpassed national security.

We should again ask those in Washington to pass along the American tradition of a strong investment in scientific knowledge, and trust in the scientific method, to future generations. And we should remind them that research spending is money in the bank, not money in a hole.

Mark B. Boslough is an Albuquerque scientist who specializes in impact physics.

LETTERS *(continued from page 6)*

cogency of the logic, integrity and applicability of the facts or data. Political partisanship, being a hybrid of advocacy and marketing, has its place, but that place is in Congress, political conventions, and pep rallies. And no, physicists do not have "comprehensive knowledge of all issues." However, that does not mean that we cannot speak passionately about intellectual integrity and principled debate. Further, it does not forbid us from crying foul when advocacy is masqueraded as rationality and popular opinion is proffered as fact.

My second point was that the value and worthiness of funded projects must not be judged solely on the accrual of short-term benefits or its ultimate profitability. This does not mean that fiscal irresponsibility is acceptable; rather, it means that there are other values in addition to economic ones. For example, if our educational system is failing two-thirds of the participants, we do not forsake our children because the economic return on investment is sub-par. The return on the investment in education is worth far more to citizens and to this society than mere dollars.

I am not quite clear why these ideas are so threatening and why they are perceived as somehow being arrogant or lacking in humility. I believe that the APS membership can bring intellectual honesty and disciplined thinking to funding arguments. I believe that the politically partisan arguments currently in vogue do not comprehend these tenets and therefore should be eschewed in the halls of this Society. If these sentiments lack humility, then humility is no virtue.

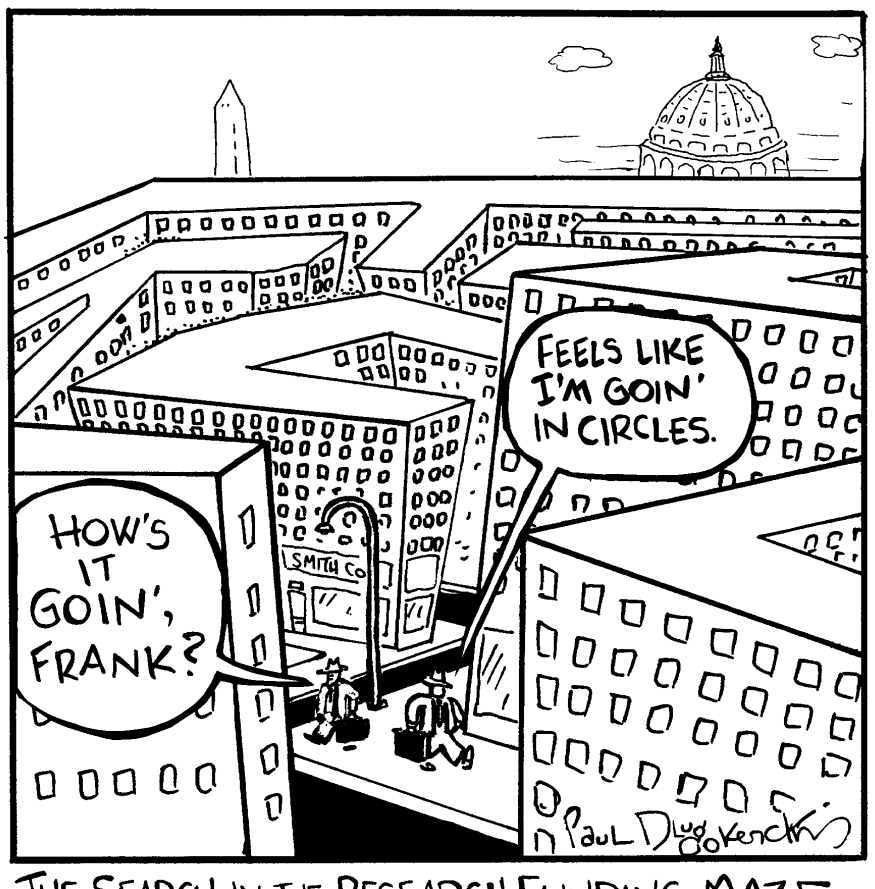
Douglas Verret
Texas Instruments

Ph.D. Benefits Go Beyond Research Skills

I very much enjoyed Geoff Heuter's story in the "Career Corner" of the December 1995 *APS NEWS*. As a physics Ph.D. whose career has strayed far from traditional science, I really appreciated the part where he talked about the benefits of his Ph.D. training: not the specialized skills, such as gamma-ray astronomy, but the other skills, such as basic physics and math, writing proposals, and planning experiments (i.e., measurement and analysis of just about anything). I have often felt the same way, but Geoff put it into words very well. I also agree with his four tips. I think that he presents these tips in the correct sequence, corresponding to their priority: getting familiar with, and appreciating, the mind-set of the business world is the most important.

The next step: how can we get university faculty to recognize and encourage these values in their students, so that the students will be better prepared to succeed in the current environment?

Peter Heimann
AT&T Bell Laboratories



THE SEARCH IN THE RESEARCH FUNDING MAZE.

ANNOUNCEMENTS

Members Elected to APS Fellowship in 1995

General

Henry Don Isaac Abarbanel
University of California, San Diego
For contributions to the understanding of complex, chaotic signals and their analysis for discovering new properties of a broad range of physical systems.

Vernon J. Ehlers
Congressman from Michigan
For contributions to atomic physics research, physics education, and dynamic leadership in the pursuit of bettering the health and welfare of science in the United States.

Jay N. Marx
Lawrence Berkeley Laboratory
For his leadership of the successful construction of the Advanced Light Source (ALS), the first of the third generation synchrotron light sources in the U.S.

Joseph Rotblat
PUGWASH
For forty years of dedicated effort to alert the world to the dangers of nuclear weapons and to bring together scientists and citizens of many nations in this endeavor.

Astrophysics

Gerald J. Fishman
Marshall Flight Center
For pioneering advances in gamma-ray astronomy, particularly his important observations of gamma-ray bursts that suggest a possible cosmological origin.

Margaret J. Geller
Harvard-Smithsonian Center for Astrophysics
For her pioneering contributions to mapping the nearby universe and elucidating the large-scale structure in the distribution of galaxies.

James Conway Higdon
The Claremont Colleges
For his important work on interplanetary and interstellar turbulence and his innovative studies of gamma ray bursts, cosmic rays, pulsars, novae, supernovae, and galactic nucleosynthesis.

Richard Alfred Matzner
University of Texas at Austin
For his analyses in general relativity of a wide range of astrophysical phenomena, especially his numerical simulations of strong-field gravitational systems and the gravitational radiation they produce.

Samuel Harvey Moseley, Jr.
NASA/Goddard Space Flight Center
For his contributions to instrumentation in astrophysics, especially his conception and development of the X-ray microcalorimeter and his studies of the SN1987A fine structure lines of iron with long-wavelength infrared detectors.

Richard Eiseman Rothschild
University of California, San Diego
For his seminal work in determining the spectra and time variations of cosmic X-ray sources, and for his innovative development of instrumentation for these studies.

Joseph I. Silk
University of California, Berkeley
For his pioneering role in understanding the cosmic microwave background radiation and the formation of large-scale structure in the universe, and in recognition of the bridges he helped establish between particle and nuclear physics and cosmology.

(continued on of page 9)

EDITOR-IN-CHIEF

The American Physical Society is seeking a successor to the current Editor-in-Chief who is retiring. The Editor-in-Chief is one of the three operating officers of the Society and has responsibility for the research journals published by the Society. Since the Editor-in-Chief is responsible for the large editorial and journal support staff located in Ridge, NY, near Brookhaven National Laboratory, nominees should be prepared to spend a substantial amount of time there. Among the responsibilities of the Editor-in-Chief are preserving and enhancing the quality of APS journals, leading APS efforts in electronic publishing, working with senior editors to set journal policies, and handling appeals and ethics cases involving authors.

Applicants or nominees should be physicists with significant reputations and demonstrated organizational and managerial skills. Editorial experience is desirable. The initial appointment is for five years with renewal possible after review. Salary is negotiable. The desired starting day is January 1, 1997. The APS is an equal employment opportunity employer and specially encourages applications from or nominations of women and minorities. Inquiries, nomination, and applications should be sent by March 30, 1996 to:

Professor Burton Richter
Chair, Search Committee
The American Physical Society
One Physics Ellipse
College Park, MD 2074.

AIP Issues Study on Ph.D. Physicists in National Laboratories

A study released in December by the American Institute of Physics (AIP) found that 4,500 Ph.D. physicists are employed in 29 major federally funded research and development centers (FFRDCs). Of these, about 3,450 have permenant positions and the remainder are postdoctoral, visiting, or temporaty. A total of 20,000 Ph.D. physicists were employed to do physics in 1995 in the FFRDCs and three other sectors: 10,000 in academe, 3,200 in industry, and 2,300 in government and other areas.

The study was produced by Jean M. Curtin and Christine Cassagnau of AIP's Education and Employment Statistics Division. The four-page report is the first released by the division on employment at the national laboratories, with another survey to be conducted in about two years. The FFRDCs surveyed included Los Alamos National Laboratory, Sandia, Fermi National Accelerator Laboratory, MITRE Corporation, and the Space Telescope Science Institute.

When asked what the short-term future might look like for their laboratories or units, many respondents were uncertain. However, the majority of contacts indicated that the most they could hope for was to maintain the "status quo." In assessing the future, respondents predicted a fairly stable economic outlook with continued inhibitions to growth. But one person responded: "Dismal…foresee a continual slow attrition unless policy change occurs."

Early retirement programs resulted in a retirement rate of 4.3 percent in 1993 and 1994. The report estimates the retirement rate will drop to 3.7 percent in 1995 and 1996. The estimated gross turnover rate of permanent, Ph.D.-level physicists in the national laboratories increased from 4.3 percent in 1994 to 4.6 percent in 1995. This translated to a projected 160 openings in 1995. The report estimated that in 1995 the labs had about 270 postdoctoral positions to fill. The postdoc turnover rate is approximately 45 percent per year.

The outlook for 1996 shows little, if any, growth in the estimated number of employees with physics Ph.D.s. Postdoctoral appointments may increase from 600 to 620. Visiting scientists and other temporary positions may go from 430 to 440. Utilization of Ph.D. physicists varies among employment sectors. More than 70 percent of Ph.D. physicists at the national laboratories work in physics. This compares to less than one-third of Ph.D. physicists similarly employed by industry.

The survey also found that 87 percent of the surveyed laboratories participate in one or more Cooperative Research and Development Agreements (CRADAs). A free copy of the report may be obtained by contacting jcurtin@aip.acp.org or by calling (301) 209-3071.

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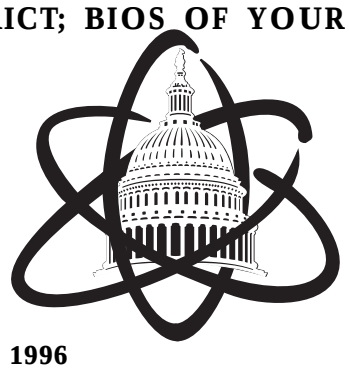

TO PARTICIPATE, CONTACT:
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1050 National Press Building
Washington, DC 20045
(202) 662-8700
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DEADLINE: APRIL 5, 1996

Change...

HARRY WU TO BE HONORED AT CIFS RECEPTION

As reported in the February edition of *APS News*, the Committee on the International Freedom of Scientists will hold a reception to start off its signature drive for a petition on behalf of colleagues in the People's Republic of China whose rights are being violated. The reception will feature and honor human rights activist Harry Wu and be held on Tuesday, March 19, 1996 at 5:30 p.m., not Sunday, March 17th as it was originally scheduled. Please check the event directory at the Adams Mark hotel or the *Bulletin of The American Physical Society* to learn the exact location of the reception. You are invited and encouraged to attend, and to sign the petition!

Thomas A. Weaver
Lawrence Livermore National Laboratory
For his crucial contributions to our understanding of massive stars and their evolution, supernovae, and the origin of the chemical elements.

Biological Physics

Carlos J. Bustamante
University of Oregon
For pioneering the application of optical methods and scanning probes in measurements of the properties of single DNA molecules.

Rodney Elbert Harrington
University of Nevada
For elucidating DNA structure in chromatin, and the sequence basis of DNA bending.

Larry S. Liebovitch
Florida Atlantic University
For advancing the physics of fractals and chaos and using these methods to analyze and understand biological systems

Jose Nelson Onuchic
University of California, San Diego
For advancing our understanding of electron transfer in complex molecules.

George W. Rayfield
University of Oregon
For definitive experimental proof for quantized vortex rings in superfluid helium; for high precision studies on phase transitions in monolayers; for extensive studies on the optical and electrical properties of bacteriorhodopsin, and ensuing device applications.

Chemical Physics

Max L. Berkowitz
University of North Carolina
For penetrating theoretical contributions to our understanding of aqueous systems in bulk and at interfaces, and to our understanding of aqueous clusters.

Kit Hansell Bowen (Jr.)
The John Hopkins University
For his pioneering fundamental contributions to our knowledge of negative ion solvation, the electronic structure of metal clusters, the stability and structure of negative ions and the science of nanostructured materials.

Wilson Ho
Cornell University
For his pioneering contributions to the field of photophysics and photochemistry on solid surfaces, especially in the elucidation of the fundamental mechanisms and photochemical dynamics.

William Morgan Jackson
University of California, Davis
For his fundamental contributions to experimental chemical dynamics and his original use of lasers in pioneering work in astrochemistry.

Kevin K. Lehmann
Princeton University
For fundamental contributions to our knowledge of molecular dynamics. In particular, by means of eigenstate-resolved spectroscopy and rigorous theory, he has dramatically advanced our understanding of intra-molecular vibrational energy redistribution.

Paras N. Prasad
State University of NY at Buffalo
For pioneering work on phonon-phonon and electron-phonon interactions and phase transitions in molecular solids and especially on the study, modeling and design of nonlinear optics of molecular and polymeric materials.

Harvey Scher
The Weizmann Institute
For inaugurating the field of time scale invariant transport in disordered systems which has since impacted other areas such as reaction, energy transfer and glassy relaxation.

Michael C. Zerner
University of Florida
For development of semi-empirical theory of electronic structure of large molecules, and its application to determination of molecular structure and spectra.

Computational Physics

Larry Lee Boyer
Naval Research Laboratory
For the formulation, development, and implementation of novel methods of modelling the mechanical and thermodynamic properties of ionic materials.

Shiyi Chen
IBM T.J. Watson Research Center
For outstanding research in lattice gas methods involving creative analysis and massive computations at the frontiers of high performance computing; and for contributing fundamental advances in the theory of turbulence.

Ching-Yao Fong
University of California, Davis
For pioneering work in developing theoretical models and applying them to computational studies of the fundamental electronic and vibrational properties of semiconductor systems.

Harvey Allen Gould
Clark University
For his work in statistical and computational physics, specifically his studies of clusters and the dynamics of first-order phase transitions, and for his work on introducing computer simulations and computational methods into the undergraduate curriculum and to a wider scientific audience.

Dale D. Koelling
U.S. Dept. of Energy
For seminal contributions to the computational theory of the electronic properties of crystalline materials, especially rare earths and actinides, and for providing direction and leadership to the DoE computational science community.

Henry Krakauer
College of William & Mary
For outstanding accomplishments in formulating and implementing the all-electron description of the electronic structure and related physical properties of complex crystalline solids and their surfaces.

Peter Sejersen Lomdahl
Los Alamos National Laboratory
For his outstanding work on the development and application of large-scale Langevin and Molecular Dynamics simulation techniques to problems in nonlinear condensed matter physics and materials science.

Peter James Reynolds
Office of Naval Research
For his pioneering work on combining the renormalization group method with Monte Carlo simulations in the study of statistical problems, for his contributions to quantum Monte Carlo simulations, and for his service to the physics community through his activities as a Program Officer at the Office of Naval Research.

DAMOP (Atomic, Molecular, Optical)

Miron Ya Amusia
For the discovery of the collective nature of atomic photoionization and prediction of the collectivization of few electron shells under the action of many-electron neighboring shells.

James Samuel Cohen
Los Alamos National Laboratory
For pioneering contributions to the application of techniques of theoretical atomic and molecular physics to formation of muonic atoms and molecules, their interactions with normal species, and muon-catalyzed fusion.

Lee A. Collins
Los Alamos Laboratory
For distinguished theoretical research in atomic and molecular physics, notably on novel approaches to electron-molecule scattering, electron-atom scattering in intense fields, and the simulation of dense plasmas.

George Csanak
Los Alamos National Laboratory
For development of many-body Green's function techniques of bound-state and scattering properties of atomic and molecular systems; significant contributions to the theoretical foundation and physical interpretation of electron-photon coincidence experiments, and for contributions to the understanding of electron scattering by laser excited targets.

Reiner Martin Dreizler
Johann-Wolfgang-Goethe University
For important contributions to the development and applications of density functional theory and to the theory of atomic collision processes.

Ilya I. Fabrikant
University of Nebraska
For his studies of electron collisions and Rydberg atom collisions involving the formation of temporary negative ions, and for photodetachment of negative ions in the presence of external static fields.

Donald Christian Griffin
Rollins College
For theoretical developments in the fields of relativistic atomic structure and electron collisions with atomic ions, as well as contributions to undergraduate science education.

Randall G. Hulet
Rice University
For his contributions to a broad range of important problems in atomic and optical physics including cavity quantum electrodynamics, quantum jumps, ion storage, and laser cooling of atoms.

Eric H. Pinnington
University of Alberta
For his extensive studies of highly ionized and excited atoms and the development of new techniques for the precise determination of lifetimes and oscillator strengths of cosmological significance.

Stephen Turnham Pratt
Argonne National Laboratory
For fundamental contributions to molecular physics through imaginative and innovative studies that probe electron-nuclear coupling, and, in particular, for his elegant experiments on molecular photoionization, predissociation, autoionization, and excited-state reactions.

Mordechay Schlesinger
University of Windsor
For the development of the unitary group approach to the theory of complex spectra and pioneering studies of impurity ion spectra in crystals.

Dieter Herbert Schneider
Lawrence Livermore National Laboratory
For his contributions to the understanding of ion-atom collisions through electron spectroscopy and for his experiments elucidating the collision dynamics of very highly charged ions.

John Bailey West
Daresbury Laboratory
For seminal contributions to understanding of electron correlation effects and resonant phenomena in photoionization of atoms and molecules, through pioneering work in the application of photo-ion and angle resolved photo-electron spectroscopy.

DCMP (Condensed Matter)

Punit Boolchand
University of Cincinnati
For Mossbauer studies of chalcogenide glasses that elucidate coordination, cluster formation, and incipient phase separation.

Ludwig W. Bruch
University of Wisconsin
For contributions to the theory of physical adsorption and interactions of physically adsorbed atoms on surfaces.

Barbara Hope Cooper
Cornell University
For her innovative studies of fundamental ion-surface interactions in the hyperthermal energy range, including experiments and simulations to develop accurate interaction potentials and comprehensive studies of ion-surface charge transfer dynamics.

Michael C. Cross
California Institute of Technology
For contributions to the theory of superfluid 3He, magnetic order in solid 3He, pattern formation near non-equilibrium instability and quantitative understanding of spatiotemporal chaos.

Harry William Deckman
Exxon Research & Engineering Co.
For developing an innovative, new approach to microlithography using self-organized mask structure, and for using this approach in developing the hardware for x-ray micromography and in other novel applications.

Howard Dennis Drew
University of Maryland
For his contribution to the study of the electrodynamic response of superconductors in magnetic fields, and collective effects in semiconductor heterostructures.

Donald M. Eigler
IBM Almaden Research Center
For his achievements in the field of atomic manipulation using a scanning tunneling microscope.

Theodore Lee Einstein
University of Maryland
For his contributions to the theory of interactions between chemisorbed atoms, their consequences for two-dimensional phase transitions and to the theory of measurable properties of vicinal surfaces.

Nigel David Goldenfeld
University of Illinois
For his contribution to theory of non equilibrium systems, and pairing states in high temperature superconductivity.

David Lawrence Griscom
Naval Research Laboratory
For contributions to the analysis and interpretation of electron spin resonance spectra of transition-group ions, radiation-induced point defects, and ferromagnetic precipitates in glass.

Robert Cort Haddon
AT&T Bell Laboratories
For work on organic electronic materials, including the prediction and discovery of superconductivity in alkali-doped carbon-60.

William P. Halperin
Northwestern University
For contributions to our understanding of liquid and solid 3He, particularly the discovery of magnetic order in solid 3He, and fundamental investigations of collective excitations in the superfluid phases.

Russell Julian Hemley
Carnegie Institution of Washington
For advancing ultra high-pressure of condensed matters and for discovering new materials, transitions, and properties at high pressures.

Kai Ming Ho
Iowa State University
In recognition of his contributions to electronic structure calculation for the study of surface geometry's and lattice dynamics, and for his work on photonic band gap materials.

Evelyn Lynn Hu
University of California, Santa Barbara
For contributions to the fabrications and study of low dimensional structures.

Thomas Albert Kennedy
Naval Research Laboratory
For advances in the identification and properties of defects in semiconductors.

Stephen D. Kevan
University of Oregon
For his pioneering work in the use of high-resolution photoemission spectroscopy (synchrotron radiation) to elucidate the interplay between electronic properties and structure at surfaces.

Barry M. Klein
University of California, Davis
For his contributions to the theory of electronic and vibrational properties of solids, and for building and leading dynamic research groups.

Mel Philip Levy
Tulane University
For contributions to the understanding and advancement of the mathematical foundations of density functional theory, and for revealing key properties of the exact density functional.

Tsuneyoshi Nakayama
Hokkaido University
For contributions to our understanding of the dynamics of fractal structures by large-scale computer simulations and of the Kapitza resistance at millikelvin temperatures.

Risto Matti Nieminen
Helsinki University of Technology
For developing and applying theoretical and computational techniques in several areas of condensed matter and materials physics.

Michael Ray Norman
Argonne National Laboratory
For studies of correlated electrons and their magnetic and superconducting properties by modeling of real materials using ab-initio calculations.

Robert N. Shelton
University of California, Davis
For his contributions to low temperature, high pressure studies of superconducting and magnetic materials.

Michael S. Shur
University of Virginia
For his contributions to physics of ballistic transport in semiconductors.

Haskell Joseph Taub
University of Missouri, Columbia
For his studies of the structure and dynamics of adsorbed monolayer and multilayer films, with particular focus on the influence of dimensionality and molecular shape on melting and crystal growth.

Dale J. Van Harlingen
University of Illinois, Urbana-Champaign
For his investigation of the phase coherence and quantum phenomena in superconductors and the experimental determination of the symmetry of the pairing state, in high-Tc superconductors.

(continued on page 10)

David Vanderbilt
Rutgers University
For contributions in condensed matter theory, including pseudo potential, polarization theory, surfaces stress, and structural phase transitions.

Zeev Valentine Vardeny
University of Utah
For his pioneering work on the application of photomodulation techniques and picosecond spectroscopy to the study of conducting polymers, fullerenes, amorphous semiconductors and high temperature superconductivity.

Alice Elizabeth White
AT&T Bell Laboratories
For contributions to the study of transport phenomena in metallic thin films and for her work on buried silicide films formed by ion implantation.

Few Body Systems

Bradley D. Keister
Carnegie Mellon University
For important contributions to the development of relativistic descriptions of few body systems.

Richard Guy Woolley
The Nottingham Trent University
For fundamental advances in the proper quantum description of molecules and their interaction with radiation.

Fluid Dynamics

Philip A. Blythe
Lehigh University
For consistent work of outstanding originality in fluid mechanics and chemically reacting flows. Specifically for seminal contributions to non-equilibrium nozzle flows, shock and detonation processes and buoyancy driven motions.

Nagi Nicholas Mansour
NASA - Ames Research Center
For his leading role in the use of numerical simulations to investigate fundamental problems of fluid mechanics including turbulence and drop and bubble flows.

Moshe Matalon
Northwestern University
For fundamental contributions to the mathematical theory of flame propagation including the dynamics and stability of flame fronts, and to the mathematical modeling of diverse combustion problems.

Philip John Morris
Penn State University
For contributions to the aeroacoustics and stability of supersonic jets, the hydrodynamic stability of compliant wall boundary layers and the modeling of large scale structures in turbulent free shear flows.

Robert Louis Powell
University of California, Davis
For contributions to the fluid mechanics of suspensions and the development of experimental techniques.

Forum on Education

David Orlin Hestenes
Arizona State University
For elucidating the relevance of cognitive science to physics education, establishing the deficiency of standard lecture methods, developing superior pedagogy, and constructing a new mathematical language for research and education.

Forum on International Physics

Ved Prakash Bhatnagar
JET Joint Undertaking
For significant contributions to the understanding of both theory and experiment of tokamak reactor-relevant fast-wave antenna design, heating and current drive in the ion-cyclotron range of frequencies.

Helmut Rainer Brand
University of Bayreuth
For his elucidation of novel phenomena in driven complex condensed matter systems, and for his extraordinary success in motivating quantitative experiments relevant to his theoretical work.

Robert Woodhouse Crompton
Australian National University
For his extended and penetrating analysis and use of the swarm method for studying the behavior of slow electrons in gases, and his tireless work for improving physics in Australia.

Francisco de la Cruz
Centro Atomico Bariloche
For his contributions to our understanding of the vortex state in the High Tc superconductors and no less importantly for his impact on our community as an exceptional teacher of young scientists.

Malcolm Golby Haines
Imperial College
For his leadership of a research group at Imperial College Group and his major contributions to Z-pinches, theta pinches, cusp confinement, inertial confinement and magnetic fields, and stability theory.

Pertti J. Hakonen
Helsinki University of Technology
For his experimental investigations on vortex structures in superfluid 3He and studies of nuclear ordering in metals at positive and negative subnanokelvin temperatures.

Bretislav Victor Heinrich
Simon Fraser University
For the elucidation of loss in ferromagnetic resonance; for the contribution to the invention of ferromagnetic antiresonance; for adapting molecular beam epitaxy to studies of exchange interactions and anisotropies in the highest quality ultrathin magnetic films.

George Francis Imbusch
University College - Galway
For his contributions to our understanding of the static and dynamical processes which affect the optically excited states of luminescent materials.

Peter I.P. Kalmus
Queen Mary & Westfield College
For his many contributions to experimental particle physics, to teaching, to international cooperation in science and to the public understanding of physics.

Yoshiaki Kato
Osaka University
For development of beam smoothing techniques and high power lasers and demonstration of their effectiveness for irradiation uniformity improvement and plasma instability suppression; and for his contributions to x-ray lasers.

Syamal Kumar Lahiri
Nanyang Technological University
For his pioneering contributions in elucidating stress relaxation properties of thin films and in the development of thin film materials for the study and application of high quality Josephson tunnel junctions.

Bernard Sapoval
Condensed Matter Physics Laboratory
For his outstanding work, on semiconductors, on disordered systems and fractals - diffusion fronts, interfaces in electrochemistry and catalysis, vibration modes of fractal drums; and for his leadership in fostering scientific collaborations worldwide.

Douwe Alle Wiersma
For his outstanding contributions to chemical physics, non-linear spectroscopy and ultrafast dynamics of complex molecular systems.

Forum on Physics & Society

Pierce S. Corden
US Arms Control & Disarmament Agency
For steering the American course towards the goal of a Comprehensive Test Ban Treaty from the earliest negotiations to the threshold of completion of the accord.

Nancy M. Dowdy
For her role on treaty verification at the close of the Cold War, for research accomplishments and leadership in the development of synthetic fuels instrumentation, and for leadership and service in behalf of women in physics.

Gerald E. Marsh
Argonne National Laboratory
For more than fifteen years of technical-policy contributions to nuclear arms control issues, including the comprehensive test ban, strategic defense, nuclear-naval strategy, and information-security reform, all in addition to contributions in various areas of theoretical and applied physics.

Michael M. May
Lawrence Livermore National Laboratory
For high scientific quality and demonstrated personal integrity devoted to the cause of decreasing the threat of nuclear war and developing an international regime of arms control.

Natalia Kalfe Meshkov
Argonne National Laboratory
For her use of scientific approaches to environmental problems and for her pioneering work in establishing programs for women in science.

Joel A. Snow
Iowa State University
For leadership in formulation and analysis of science policy, effective communication of science to the public, accomplishments in science management and administration, and support of women and minorities in physics.

Fundamental Constants

Timothy Edward Chupp
University of Michigan
For his ingenious use of optical pumping techniques to produce high-density samples of polarized noble gas nuclei, and his exploitation of these samples for precision measurements in atomic, nuclear, and particle physics.

Gabriel Luther
Los Alamos National Laboratory
For his ingenious and precise measurements of the Newtonian gravitational constant and for contributions to the determination of the velocity of light.

Terence John Quinn
Bureau Intntl des Poids et Mesures
For his high accuracy measurements of the values of important fundamental constants of physics and for his seminal contributions to thermometry, absolute radiometry, and mass metrology.

High Polymer Physics

Guy C. Berry
Carnegie Mellon University
For his fundamental studies using rheo-optical methods on dilute and concentrated solutions of flexible branched and rigid-rod liquid crystalline polymers.

Robert M. Briber
University of Maryland
In recognition of fundamental work on the elucidation of the effect of crosslinking on the thermodynamics and phase separation behavior of polymer blends.

Robert Allen Bubeck
Dow Chemical Co.
For his pioneering synchrotron X-ray scattering studies of technologically important polymer deformation and processing problems.

Patricia Metzger Cotts
IBM Almaden Research Center
For her contributions to the understanding of the role of chemical architecture on polymer flexibility using static and dynamic light scattering.

Lewis John Fetters
Exxon Research & Engineering Co.
For developing controlled syntheses of numerous model polymers, and for providing exquisitely tailored materials essential for the critical evaluation of polymer theory.

Peter Fitzroy Green
Sandia National Laboratories
For significant contributions to the understanding of the dynamics of block copolymer, homopolymer melts and polymer blends and to the behavior of block copolymers near surfaces.

Instrument & Measurements

Jack W. Ekin
NIST
For his discovery of the superconductor strain scaling law, and his development of low specific resistivity interfaces for oxide superconductors and a superconducting dc transformer.

Donald G. McDonald
NIST
For contributions to submillimeter wave and infrared applications of superconductivity.

Roger L. Stockbauer
Louisiana State University
For outstanding contributions to atomic, molecular, optical, and condensed matter physics through the design and implementation of sophisticated instrumentation that has served as the genesis for new fields of research.

Laser Science

Ennio Arimondo
Universitá degli Studi di Pisa
For the interpretation of “dark resonances” in terms of coherent population trapping, and for contributions to nonlinear dynamics and chaos in lasers.

Richard Alan Haight
IBM, T.J. Watson Research Center
For the development of laser photoemission spectroscopy and for innovative applications of the method to investigate electron dynamics at surfaces and interfaces.

Dennis Gene Hall
University of Rochester
For his contributions to the understanding of optical phenomena in thin metal films, in semiconductors, and in optical waveguides.

Anthony M. Johnson
New Jersey Institute of Technology
For his contributions to ultrafast optoelectronics and nonlinear optics, including high speed semiconductor sampling gates, optical pulse compression and tunable ultrafast laser sources.

Howard Michael Milchberg
University of Maryland
For his research on high-temperature, ultradense plasmas and studies of X-ray emission and optical guiding by laser generated plasma structures.

Thomas W. Mossberg
University of Oregon
For his work on optical resonance and cavity quantum electrodynamics, including the imaginative use of dressed-atom effects to control atomic dynamics and create new mechanisms for optical gain.

Jin-Joo Song
Oklahoma State
For her pioneering nonlinear optical mixing experiments in condensed phases and for contributions to semiconductor quantum well characterization through innovative laser spectroscopy.

Materials Physics

James Whitman Davenport
Brookhaven National Laboratory
For the development of new techniques for computing the electronic structure of molecules and solids and for applying them to adsorbed molecules, metallic alloys, and liquid metals.

Marcos Hugo Grimsditch
Argonne National Laboratory
For significant insights into elastic properties, magnetic excitations and phase transitions of solids and their heterostructures obtained through a skillful application of inelastic light scattering techniques.

Warren Bruce Jackson
Xerox PARC
For pioneering research in the fundamental properties of amorphous semiconductors, including seminal studies of the intrinsic electronic density of states and metastable mechanisms and processes, and for the application of photothermal deflection spectroscopy to address a wide range of problems in hydrogenated amorphous silicon.

Jeffrey S. Lannin
Penn State University
For pioneering contributions toward the understanding of the structure and dynamics of liquids, amorphous solids and fullerenes as deduced from Raman and neutron scattering methods.

Charles M. Lieber
Harvard University
For innovative contributions to the synthesis and characterization of transitional metal chalcogenides, carbon nitrides, and high temperature superconductors.

Carmen Ortiz
IBM Research Division
For her sustained contributions to the understanding of the materials science underlying the thin films essential to optical and magnetic applications.

Ian Keith Robinson
University of Illinois
For contributions to the science of surfaces and interfaces studied with X-ray scattering techniques and in particular for increasing our understanding of important Si surfaces and interfaces.

Jan Frederick Schetzina
North Carolina State University
For his extensive contributions to the development and understanding of II - VI materials and devices.

(continued on page 11)

Jeffrey Y. Tsao
Sandia National Laboratories
For fundamental contributions to the thin film and surface science underlying semiconductor epitaxy and processing.

Nuclear Physics

Cyrus Baktash
Oak Ridge National Laboratory
For discoveries of identical bands at normal deformation of band termination in heavy nuclei, superdeformation in the A = 80 region and for seminal studies of shape evolution with spin and temperature.

Martin D. Cooper
Los Alamos National Laboratory
For contributions to the study of lepton number conservation in the decay of the muon and studies of nuclear structure in pion scattering.

Thomas M. Cormier
Wayne State University
For pioneering research that provided the first direct experimental evidence for 12C-12C nuclear molecular resonances and for the development of the first practical recoil mass spectrometer for use in nuclear studies.

Cary N. Davids
Argonne National Laboratory
For contributions to nuclear astrophysics and in particular for the experimental determinations of important reaction rates associated with nuclear processes that power the stars.

John Jacob Domingo
CEBAF
For sustained scientific and technical contributions to intermediate energy nuclear physics at the Swiss Institute for Nuclear Research (SIN), and for leading the design and construction of the three experimental facilities at the newly completed Continuous Electron Beam Accelerator Facility (CEBAF).

Geoffrey L. Greene
NIST
For contributions to precision measurements on the free neutron, in particular, the determination of the neutron lifetime.

Blayne Heckel
University of Washington
For performing precise tests of fundamental symmetries, especially parity and time reversal, using neutrons, nuclei, and atoms, and for carrying out sensitive searches for new forces of macroscopic range.

Kirby Wayne Kemper
Florida State University
For sustained contributions, using Lithium-induced nuclear reactions and scattering, to the understanding of exotic highly excited states in light nuclei, including vector and tensor spin-dependent effects.

James Paul Miller
Boston University
For the development of a high resolution NaI detector and the performance of pioneering experiments on nuclear Compton scattering and radiative kaon capture utilizing this device which paved the way for the design and construction of other high resolution calorimeters.

Paul Anthony Quin
University of Wisconsin
For numerous contributions to symmetry tests in nuclear beta-decay and critical assessment of the field.

Wolf-Udo Schröder
University of Rochester
For contributions to an understanding of the dynamics of energetic nuclear collisions in terms of microscopic transport processes, and in particular the demonstration of the relevance of multi-nucleon exchange in heavy-ion reactions.

Paul Stoler
Rensselaer Polytechnic Institute
For many important experimental contributions, using electromagnetic and hadronic probes, to our understanding of the properties of pions, nucleons and excited baryons and their interactions in nuclei.

Stephen A. Wender
Los Alamos National Lab.
For development of innovative techniques and unique facilities for studying scattering and capture reactions with polarized and unpolarized fast neutron beams.

Particles & Fields

James Stutsman Ball
University of Utah
For contributions to the theoretical understanding of the strong interactions. His development of theoretically based phenomenology and its comparison with experiment have allowed rapid testing of theoretical ideas.

Guenter G. Baum
University of Bielefeld
For his important contributions to electron and muon deep inelastic scattering, particularly with polarized beams and targets to study QCD sum rules and determine the nucleon's internal spin structure.

Sally Dawson
Brookhaven National Laboratory
For outstanding work in particle phenomenology, including the effective W approximation and Higgs physics.

Lance Jenkins Dixon
Stanford University
For his elucidation of the general principles which connect the theory of superstrings to concrete models of elementary particle physics.

Steven Michael Errede
University of Illinois
For contributions to the understanding of the nature of the weak gauge bosons.

Kenneth Jefferson Heller
University of Minnesota
For his contributions to the discovery and exploration of inclusive hyperon polarization and the use of this phenomenon to make precise measurements of the hyperon magnetic moments.

Rudolph C. Hwa
University of Oregon
For contributions to the study of soft hadronic processes in high energy collisions, signatures of quark gluon plasma, fractal structure in multiparticle production and phase transition.

John Alan Jaros
Stanford University
For his pioneering contributions to the development, construction, and use of precision secondary vertex detector for the study of the properties of short-lived elementary particles.

Paul Blanchard Mackenzie
Fermilab
For his substantial contributions to the application of lattice field theory to the solution of particle physics problems.

William Anthony Mann
Tufts University
For two decades of outstanding contributions to the study of neutrino interactions at accelerators and the properties of cosmic-ray neutrinos using large underground detectors.

William R. Molzon
University of California
For contributions to the study of K-meson interactions, including a leading role in initiating and executing the most sensitive search for muon and electron number violation in kaon decays.

Tetsuji Nishikawa
Science Univesity of Tokyo
For technical contributions and leadership in Japan's high energy physics and other scientific programs.

Robert Steell Orr
University of Toronto
For co-discovery of B° - B° mixing, contributions to the understanding of charged and neutral current neutrino scattering and for leadership in the development of the ZEUS and SDC experiments.

Probir Roy
Data Inst. of Fundamental Research
For his many original contributions to Particle Physics and specifically for the exclusion of a light graviton on the basis of sound theoretical arguments.

Serge Rudaz
University of Minnesota
For original and influential contributions to the phenomenology of heavy quarks, supersymmetry and grand unification, and particle astrophysics.

Julia A. Thompson
University of Pittsburgh
For her contributions to our understanding of a broad range of particle physics phenomena through experimentation and instrumentation development, and for her continued efforts to encourage participation in physics by high school students and under represented groups.

York-Peng Yao
Edward University of Michigan
For his important contributions to the quantization of gauge theories with spontaneous symmetry breaking and many interesting calculations in the standard model.

Physics of Beams

William A. Barletta
Lawrence Berkeley Laboratory
For his contributions to the combination of plasma devices and electron beams, free electron lasers, and conventional accelerators, as well as to the wise direction of beam physics programs during the last decade.

Swapan Chattopadhyay
Lawrence Berkeley Laboratory
For his pioneering studies of fluctuations, coherence and phase-space cooling and his contributions to the accelerator physics foundation of PEP II, an asymmetric B-factory collider for CP-violation studies.

Pisin Chen
SLAC
For his contributions in novel accelerator concepts including the Plasma Wakefield Accelerator and the self-focusing plasma lens, and for contributions to the understanding of the beam-beam interaction in linear colliders, including the discovery of beamstrahlung coherent pair creation.

Luis R. Elias
University of Central Florida
For the development of Free Electron Lasers, based on electrostatic accelerators, and for demonstrating that electrostatic accelerators can operate on a quasi-continuous basis using beam-charge and beam-energy recovery.

Shoroku Ohnuma
Houston University
For development of the theory and practice of magnet selection according to measured field errors resulting in suppression of nonlinear behavior and highly predictable operation of the Fermilab Tevatron.

John Theodore Seeman
SLAC
For his contributions to the physics of electron-positron colliding beam machines, both storage rings and linear accelerators.

Kenneth Wayne Shepard
Argonne National Laboratory
For seminal contributions to the development of superconducting niobium radio-frequency accelerating structures and associated cryogenics and controls leading to the successful construction of the first superconducting ion accelerator.

Plasma Physics

Steven Lynn Allen
Lawrence Livermore National Laboratory
For scientific leadership in the physics of tandem mirrors, generation of intense microwave pulses and their absorption in tokamak plasmas, and in the development of the radiative divertor.

Ian Gordon Brown
Lawrence Berkeley Laboratory
For significant contributions to applied plasma physics, particularly its use in materials sciences and surface modification as well as development and study of vacuum arc ion sources.

Christopher E. Clayton
UCLA
For outstanding contributions to the understanding of relativistic wave-particle interactions and demonstration of electron acceleration by beat-excited plasma waves.

Joel Fajans
University of California, Berkeley
For important basic experiments with free electron lasers and nonneutral plasmas.

Taik Soo Hahm
Princeton Plasma Physics Laboratory
For outstanding contributions to progress in understanding anomalous transport and enhanced confinement regimes in toroidal plasmas through nonlinear analysis of microinstabilities and the development of the toroidal gyrokinetic formalism.

Brian James MacGowan
Lawrence Livermore National Laboratory
For developing and demonstrating short wavelength x-ray lasers and for optimizing and characterizing the plasma x-ray amplifier.

Janardhan Manickam
Princeton University
For his extensive contributions to the understanding of magneto-hydrodynamic plasma processes, discovery of the "infernal mode," and stewardship of the PEST code - a universal tool for assessing tokamak stability properties.

Michael E. Mauel
Columbia University
For investigations of new, high poloidal beta tokamak operating regimes using modified current profiles and for the investigation of collisionless instabilities of magnetically-trapped, hot electron mirror plasmas.

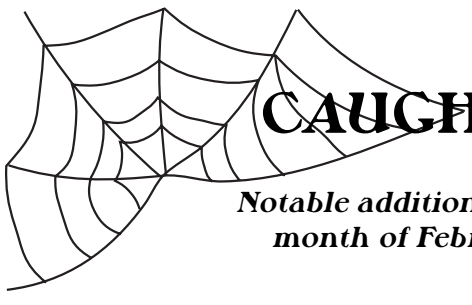
Bruce A. Remington
Lawrence Livermore National Laboratory
For exceptionally thorough experiments clearly demonstrating the ablative stabilization of the Rayleigh-Taylor instability in x-ray accelerated targets and for quantitative comparison with theory.

Charles Wayne Roberson
Office of Naval Research
In recognition of his seminal contributions to free electron laser beam quality, stellarator focusing of intense beams and outstanding beam plasma experiments.

Ned Robert Sauthoff
Princeton Plasma Physics Laboratory
For seminal contributions to the application of X-ray diagnostics to the study of sawteeth and disruptions in tokamaks, and for distinction in the leadership and management of important research projects.

Ker-Chung Shaing
Oak Ridge National Laboratory
For his seminal theoretical contributions to neoclassical transport in non axisymmetric toroidal plasmas, to the connections between neoclassical and turbulent transport and to the theory of L-H transitions in toroidal plasmas.

Edward J. Strait
General Atomics
For his contributions to the understanding and improvement of the stability of high beta tokamak plasmas.



CAUGHT IN THE WEB

Notable additions to the APS Web Server for the month of February. The APS Web Server can be found at http://aps.org

Access Information:
- Improved instructions for accessing the *APS News Online*
- Improved instructions for accessing the Membership Directory

New/Updated Links:
APS News Online (latest edition)

Units
- News of the Division of Biological Physics
- FIAP Call for Volunteers

Meetings
- 1996 March Meeting Program
- 1996 Joint APS/AAPT Meeting Ride Board
- 1996 International Sherwood Fusion Theory Conference
- 56th Annual Conference on Physical Electronics

Miscellaneous
- Link to AAPT added
- 1996 Committee On International Scientific Affairs (CISA) Members
- Chinese Physical Society Joint Scientific Workshop
- Call for support of NSF
- Physics Graduate Education For Diverse Career Options

THE BACK PAGE

RESOURCES AND POPULATION: A WAGER

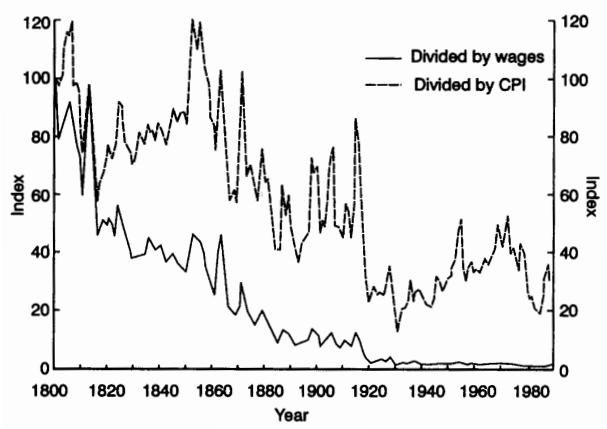
Julian L. Simon

Many natural scientists such as physicists Murray Gell-Mann, William Shockley, and Andrei Sakharov have worried about human population size and growth. Henry Kendall, speaking for the Union of Concerned Scientists (including 99 Nobelists), asks nations to "stabilize population growth." A 1993 Science Summit on World Population, organized by the U.S. National Academy of Sciences with 59 other scientific academies (including Albania, Cuba, and Mongolia) stated: "Humanity is approaching a crisis point with respect to the interlocking issues of population, environment, and development" because "The Earth is finite."

Yet, almost every measure of material and environmental human welfare in the United States and in the world shows improvement rather than deterioration. The long range trends are examined in 50 articles in *The State of Humanity* (Basil Blackwell, 1996). These are some of the findings:

- On average, people throughout the world live longer and eat better than ever before. After a millennia of almost no improvement, things began improving 200 years ago in rich countries, 50 years in poor countries.
- Fewer people die of famine than in earlier centuries.
- The real prices of food and other raw materials, showing increased natural-resource availability rather than scarcity, began dropping rapidly in the last 200 years.
- The major air and water pollution in the advanced countries has been lessening rather than worsening, particularly in the last 40 years.
- Maximum transport speeds have zoomed upwards in the last 200 years, and in the mid-19th century, maximum message speeds went from 30 miles an hour to the speed of an electrical impulse.
- Income and wealth rose above subsistence for more than a small minority for the first time in human history, beginning 200 years ago.

Figure 8.1
The Scarcity of Copper as Measured by Its Prices Relative to Wages and the Consumer Price Index



Many assert that these benign trends cannot continue indefinitely because of some physical limit. One supposed limit is the land area for agriculture. But this constraint may well be loosening rather than tightening, and less land may be needed even as population continues to grow, making more land available for recreation and wilderness. Best commercial practice now uses land millions of times more efficiently that did early humans. On a single acre (0.4 hectare) a hydroponic farm using artificial light raises a ton of food every day, enough to feed a thousand people. And if land were to become more expensive, one could choose to build the factory 100 stories high rather than a single story, and multiply the output per acre by 100. And so on, without practical limit.

Another candidate limit is the quantity of raw materials such as copper. Biologists deride as "alchemy" the notion that these quantities could be augmented by transmuting one element into another. But physicists know that there is no physical impossibility, only a cost factor. Besides, the declining real costs of all raw materials make transmutation unnecessary in the foreseeable future.

Another commonly-mentioned limit is energy, and the Second Law of Thermodynamics is cited. But the Second Law is only meaningful within some bounded space. And it is quite clear that the relevant bounded space includes our sun, whose lifetime is not relevant on an human time-scale.

To epitomize the matter, I have a standing offer to wager a week's or month's pay that any trend in material human welfare will improve rather than get worse. You pick the trend, the country, and the future year. Anything I win goes to fund research.

Some ecologists criticize economists' thinking about limits because it seems to violate common sense. "[To] a scientist [these ideas] are in the same class as the idea that Jack Frost is responsible for ice-crystal patterns on a cold window," writes Paul Ehrlich. He laments the "blunders... economists... commit when they attempt to deal with problems of population, resources, and environment."

Economists think that the whole world is just a market system, and that free goods are infinitely supplied. They are a discipline built on transparent mistakes, from the point of view of a physicist or a biologist.

In the economics of population growth, as in physics, common sense can lead one astray. Indeed, common sense is more dangerous here than in physics because one is less willing to acknowledge that one's daily experience does not apply than with respect to high speeds or small particles. With natural resources, for example" it makes perfect sense that there is a fixed stock of them; as some are used up there must be less left. Yet, the economic scarcity of a resource is defined by its price — and natural resources become less and less scarce economically with every passing decade and century.

The theory of impending scarcity is falsified by all the data from the past. And across-nations comparisons do not show a negative effect of population growth upon economic growth; population density is even correlated positively with economic growth. If physicists will inspect and respect the data, perhaps they will reject the discredited common-sense theory - first-edition Malthusianism based on fixed physical limits, a theory that Malthus himself abandoned in his second and subsequent editions. As the great 19th century economist F.Y. Edgeworth noted: "The treating as constant what is variable is the source of most of the fallacies in Political Economy."

"To epitomize the matter, I have a standing offer to wager a week's or month's pay that any trend in material human welfare will improve rather than get worse. You pick the trend, the country, and the future year. Anything I win goes to fund research."

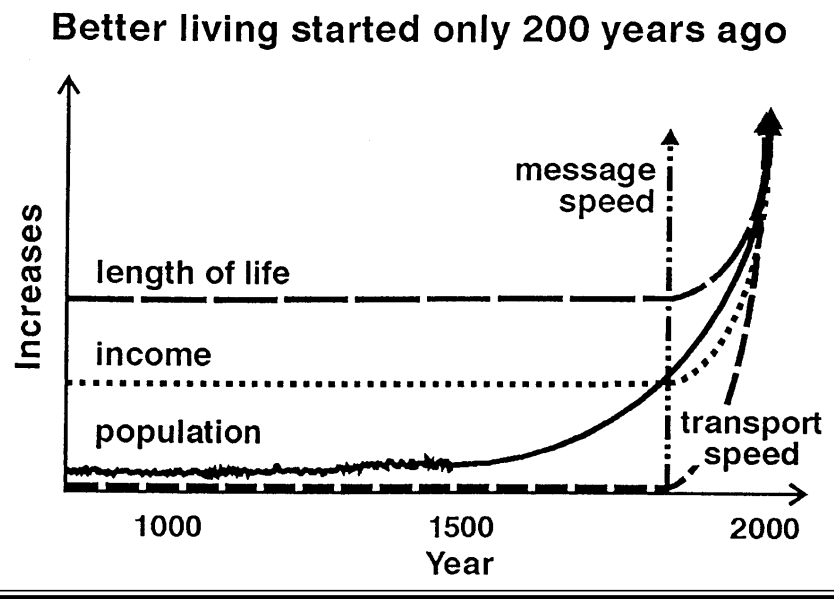
The following theory fits the data: Population growth and increase of income expand demand, forcing up prices of natural resources. The increased prices and the opportunities for productive research trigger the search for new supplies. Most seekers fail, but eventually some succeed, and new sources and substitutes are found. These discoveries leave humanity better off than if the shortages had not occurred. Hence human beings create more than they destroy, on balance.

Bob Park asked: "Doomsayers often preface their warnings with 'if we don't take steps to prevent it.' Is it possible that their warnings have helped produce a better environment?" I answer: Those who warn against real trouble help. Even if the warning is wrong, I do not criticize unless the warner is willfully ignorant or dishonest. But some forecasts are knowingly exaggerated or false. Atmospheric scientist Stephen Schneider says:

"Scientist should consider stretching the truth to get some broad base support, to capture the public's imagination. That, of course, entails getting loads of media coverage. So we have to offer up scary scenarios, make simplified, dramatic statements, and make little mention about any doubts we might have... Each of us has to decide what the right balance is between being effective and being honest."

I know of no evidence that false warnings of doom on balance are beneficial. And in the absence of such evidence, I continue to believe that professing the truth is humanity's best hope.

Julian L. Simon *is a Professor in the College of Business and Management at the University of Maryland, College Park. He is editor of* The State of Humanity *(Basil Blackwell, 1996).*



The Back Page is intended as a forum to foster discussion on topics of interest to the scientific community. Opinions expressed are not necessarily those of the APS, its elected officers, or staff. APS News welcomes and encourages letters and submissions from its members responding to these and other issues.