

President Presents National Medals of Science, Medals of Technology

Decaring that they “have given exceptional service in their fields, and bring great credit to themselves and credit to our country,” President Bush honored the laureates of the 2002 National Medal of Science and the 2002 National Medal of Technology at a White House ceremony this past November. The medals are the nation’s highest awards for scientific achievement and for technological innovation.

The National Medal of Science, which is administered by NSF, recognizes researchers who have made major contributions in science, engineering, or mathematics throughout their careers. Including the winners for 2002, the National Medal of Science has gone to 409 individuals since it was first awarded in 1962. Of the eight recipients in 2002, six either are physicists or work in physics-related fields.

Leo Beranek received a medal for his “leadership, dedication, and contributions to the art and science of acoustics.” He was also cited for cofounding BBN Technologies in Cambridge, Massachusetts, “one of the world’s foremost acoustical research and consulting firms,” and for “sustained contributions to scientific societies and civic organizations.” Beranek, who retired in 1979 as director of BBN Technologies, is a consultant in acoustics.

John I. Brauman was cited for his “seminal contributions in chemistry, giving new insight into the properties of ions and the dynamics and mechanisms of reactions.” He was also acknowledged for his “landmark achievement in clarifying the key role of solvent in determining acid–base chemistry.” Brauman is the J. G. Jackson and C. J. Wood Professor of Chemistry at Stanford University.

Richard L. Garwin, Philip D. Reed Senior Fellow for Science and Technology at the Council on Foreign Relations in New York City, received a medal in recognition of his “research and discoveries in physics and related fields, and of his long-

standing service to the nation by providing valuable scientific advice on important questions of national security over a half a century.” He is also a fellow emeritus at IBM Corp’s T. J. Watson Research Center in Yorktown Heights, New York.

James Glimm was cited for his “original approaches and creative contributions to an array of disciplines in mathematical analysis and mathematical physics, which are fundamental to the theory of operator algebras, shockwave theory, advanced quantum field theory, quantum statistical mechanics, applied mathematics, and scientific computation.” He is chair of the

department of applied mathematics at SUNY Stony Brook and director of the Center of Data Intensive Computing at Brookhaven National Laboratory.

W. Jason Morgan was honored for his “development of the theories of plate tectonics and of deep mantle plumes, which revolutionized our understanding of the geological forces that control the Earth’s crust and deep interior and consequently influence the evolution of the Earth’s life and climate.” He is a professor of geophysics at Princeton University in Princeton, New Jersey.

NSF bestowed a medal on **Edward Witten**, Charles Simonyi Professor of Physics at the Institute for Advanced Study in Princeton, New Jersey. He was cited for his “leadership in a broad range of topics in mathematics and theoretical physics, including attempts to understand the fundamental forces of nature through string theory, and his inspired use of insights from physics to unify apparently disparate areas of mathematics.”

Technology Medal winners

President Bush bestowed the National Medal of Technology, which is administered by the US Department of Commerce, on three individuals, a team of three researchers, a team consisting of two individuals, and a company. Among the laureates are the following who are involved in physics-related work.

Calvin H. Carter Jr was recognized with a medal for his “exceptional contributions to the development of silicon carbide wafers, leading to new industries in wide bandgap semiconductors and enabling other new industries in efficient blue, green, and white light, full color displays, high-power solid-state microwave amplifiers, more efficient/compact power supplies, higher efficiency power distribution/transmission systems, and gemstones.” Carter is one of the founders and currently the director of materials technology for



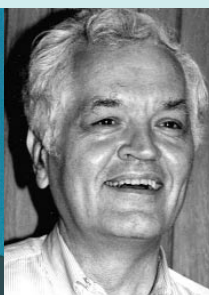
Beranek



Brauman



Garwin



Glimm



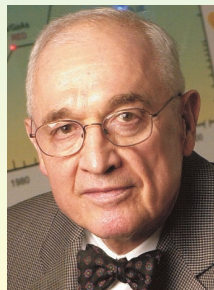
Morgan



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**Carter****Mead****Craford****Dupuis****Holonyak**

Cree Inc in Durham, North Carolina.

Carver Mead received a medal for his "pioneering contributions to the microelectronics field that include spearheading the development of tools and techniques for modern integrated-circuit design, laying the foundation for fabless semiconductor companies, catalyzing the electronic-design automation field, training generations of engineers that have made the United States the world leader in microelectronics technology, and founding more than 20 companies." He is the Gordon and Betty Moore Professor of Engineering and Applied Science Emeritus at Caltech.

A team medal went to **M. George Craford**, **Russell D. Dupuis**, and **Nick Holonyak Jr** for their "contributions to the development and commercialization of light-emitting diode (LED) technology, with applications to digital displays, consumer electronics, automotive lighting, traffic signals, and general illumination." Craford is the chief technology officer of Lumileds Lighting in San Jose, Califor-

nia, and Dupuis is the Steve W. Chadwick Endowed Chair in Electro-Optics and a Georgia Research Alliance Eminent Scholar at the Georgia Institute of Technology. Both are former graduate students of Holonyak, who also received a National Medal of Science in 1990. Holonyak is a John Bardeen Chair Professor of Electrical and Computer Engineering and Physics at the University of Illinois at Urbana-Champaign.

DuPont in Wilmington, Delaware, won a company medal for its "policy and technology leadership in the phase out and replacement of chlorofluorocarbons in the environment during the past three decades." The chair and CEO, **Charles O. Holliday Jr.**, accepted the medal on behalf of the company.

Anthony Tweed

SoR Honors Marrucci and Others

The Society of Rheology presented two awards at the 75th meeting of the society, held this past November in Pittsburgh, Pennsylvania.

Giuseppe Marrucci, professor of chemical engineering at the University of Naples in Italy, received the Bingham Medal, the society's highest honor. He was recognized for the "extraordinary breadth and depth of [his] contributions to the science of rheology." According to the citation, the scope of his contributions include his work on entangled polymers, liquid crystals and liquid crystalline polymers, constitutive equations and non-Newtonian fluid mechanics, dilute polymer solutions, and his service to the rheological community.

The 2003 *Journal of Rheology* Publication Award was shared by **Kasiraman Krishnan**, **Bryan Chapman**, **Frank S. Bates**, **Timothy P. Lodge**, **Kristoffer Almdal**, and **Wesley R. Burghardt** for their article "Effects of Shear Flow on a Polymeric Bicontinuous Microemulsion: Equilibrium and Steady State Behavior," which appeared on page 529 in volume 46 of the journal. Krishnan is a chemical engineer at GE Global Research in Niskayuna, New York. Chapman works as a senior research engineer for ExxonMobil Chemical in Baytown, Texas. Bates is professor and head of

**Marrucci**

chemical engineering and materials science at the University of Minnesota, Twin Cities. Lodge is a professor of chemistry and a professor of chemical engineering and materials science at the University of Minnesota, Twin Cities. Almdal is head of the department at the Danish Polymer Center at the Risø National Laboratory in Denmark. Burghardt is a professor of chemical and biological engineering at Northwestern University.

ASA Awards Presented in Austin

The Acoustical Society of America held its 146th meeting in Austin, Texas, in November last year. At the meeting, the society honored three individuals for their contributions to the field.

Sabih I. Hayek received the society's Trent-Crede Medal for his "contributions to the understanding of sound interaction with submerged structures." Hayek is a distinguished professor emeritus of engineering mechanics at Pennsylvania State University.

The Silver Medal in Physical Acoustics was presented to **Philip L. Marston**, professor of physics at Washington State University in Pullman. He was recognized for his "contributions to generalized ray theories for acoustical scattering, and the acoustical manipulation of fluids to study fundamental phenomena in fluid mechanics and optics."

Emily Thompson was given ASA's Science Writing Award for Journalists for her book *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (MIT Press, 2002). Thompson is a visiting scholar in MIT's Program in Science, Technology, and Society.

IOP Bestows Awards

On 22 January, Britain's Institute of Physics is presenting its prizes for 2004 at an awards dinner in London.

The Charles Vernon Boys Medal and Prize are going to **Mark Lancaster**, lecturer in the department of physics and astronomy at University College London. He is being recognized for his "important contributions to experimental high-energy physics, in particular to the ZEUS experiment (DESY, Hamburg) to investigate the structure of the proton and to the experiment at the Collider Detector at Fermilab (US) to measure the mass of the W-boson."

Elizabeth Swinbank, Fellow in Science Education at the University of York, is the recipient of the Bragg Medal and Prize. She is being honored for her “innovative contributions to the development of the school physics curriculum, in particular as director of the [university’s] Salters Horners Advanced Physics project.”

The IOP is awarding its Charles Chree Medal and Prize to **Joanna Haigh** for her “outstanding contributions to atmospheric physics, in particular for her work on solar variability and its effect on climate.” She is a professor of atmospheric physics at Imperial College London.

Michael B. Green, John Humphrey Plummer Professor of Theoretical Physics at the University of Cambridge, is this year’s recipient of the Paul Dirac Medal and Prize. He is being cited for his “crucial role in the development of superstring theory as a credible new framework for physics.”

The Duddell Medal and Prize are going to **James Hough** for his “seminal contributions to the design and development of gravitational wave detectors worldwide.” He is the director of the Institute for Gravitational Research, Physics and Astronomy at the University of Glasgow.

Ian Ward, recipient of the Glazebrook Medal and Prize, is being acknowledged for his “outstanding contributions to the structural understanding of polymeric materials and the development of innovative processing methods for their manufacture.” He is an emeritus professor in the physics and astronomy department at the University of Leeds.

The IOP is handing out its Guthrie Medal and Prize to **Henry Hall**, emeritus professor of physics at the University of Manchester. The society is citing him for his “outstanding experimental and theoretical contributions to quantum fluids and in particular for the development of the ^3He – ^4He dilution refrigerator.”

Sharing the Kelvin Medal and Prize are **Mike Gluyas**, who formerly was a lecturer in the University of Salford’s department of pure and applied physics, and **Wendy Gluyas**, who taught English as a foreign language to undergraduates, linguists, and educators. The husband–wife team, now retired, are being recognized for their “outstanding lecture-demonstrations on the physics of sound and music, delivered to over 200 000 schoolchildren, university students, and the public throughout the UK, Eire, and internationally.” The pair currently travels worldwide

to deliver an illustrated demonstration lecture entitled “Musical Squares—Adventures in Sound,” which explores the many aspects of sound and hearing.

Martin Bodo Plenio of Imperial College London is being honored with the Maxwell Medal and Prize for his “influential contributions to quantum information theory, in particular the characterization and manipulation of quantum entanglement and its application to the processing of information.” He is a professor of quantum physics.

The Mott Medal and Prize are being bestowed on **Ted Forgan** for his “outstanding contributions to condensed matter physics, in particular for his influential work on the study of vortices in superconductors using small-angle neutron scattering and muon spin rotation.” He is a professor of condensed matter physics at the University of Birmingham.

Ian Gilmore, principal research scientist at the UK’s National Physical Laboratory, is the recipient of the Paterson Medal and Prize. He is being cited for his “major contributions to the analysis of molecules at surfaces, particularly for the development of a new technique (G-SIMS), which allows direct interpretation of spectra. This technique is now available commercially, providing solutions for polymer liquid-crystal display and hard disk developments in industry.”

The IOP is awarding its Rutherford Medal and Prize to **David Wark** for his “personal contributions to particle astrophysics, in particular to the field of solar neutrinos.” He is a professor of physics at the University of Sussex and the Rutherford Appleton Laboratory near Didcot in Oxfordshire.

Aspnes Set to Be Next President of AVS

David Aspnes is the AVS Science and Technology Society’s president-elect for 2004. Aspnes, who will become president of the society in January 2005, succeeded **Robert Childs**, who is president effective this month (see PHYSICS TODAY, January 2003, page 61).

Aspnes received his BS in 1960 and his MS in 1961, both in electrical engineering, from the University of Wisconsin–Madison. He earned his PhD in physics in 1965 from the University of Illinois at Urbana-Champaign and spent the next two years doing postdoctoral research at Illinois and at Brown University.

In 1967, he became a member of the technical staff at AT&T Bell Laboratories (now Lucent Technologies’ Bell Labs) in Murray Hill, New Jersey, where he spent the next 17 years. Aspnes then moved to Bellcore, an R&D and telecommunications company in Piscataway, New Jersey, in 1983. There, he managed the interface physics department and later headed the optical physics department, before joining North Carolina



NORTH CAROLINA STATE U.

Aspnes

State University (NCSCU) faculty in 1992. Also a member of the American Physical Society and the Optical Society of America, he is currently a Distinguished University Professor of Physics and head of the real-time diag-

nostics and control Group at NCSCU. His research spans a broad spectrum of subjects, including semiconductor and surface physics and optical spectroscopy.

When asked about his vision for AVS, Aspnes said, “AVS and its members have a more than 50-year history of identifying relevant technologies and expediting their implementation through a unique mix of science and technology. I will work toward promoting these interactions by encouraging volunteer participation, particularly by younger members, and by strengthening relationships with the international community and with sister organizations such as the APS.”

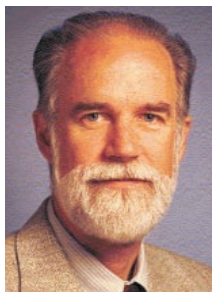
In other AVS election results, **Joseph Greene** (University of Illinois at Urbana-Champaign) retains his position as secretary and **John Coburn** (University of California, Berkeley) remains the society’s treasurer. Also taking office this month are two new AVS directors: **Neal Shinn** (Sandia National Laboratories in Albuquerque, New Mexico) and **Anne Testoni** (Varian Semiconductor Equipment Associates Inc in Gloucester, Massachusetts). **Fred Dylla** (Thomas Jefferson National Accelerator Facility in Newport News, Virginia) and **Paula Grunthaner** (NASA’s Jet Propulsion Laboratory at Caltech) are AVS’s new trustees.

Van Stryland Is OSA Vice President for 2004

On 2 January, **Eric Van Stryland**, director of the School of

Optics/Center for Research and Education in Optics and Lasers (CREOL) and a professor at the University of Central Florida (UCF) in Orlando, begins his term as the Optical Society of America's vice president. Van Stryland, who succeeds **Susan Houde-Walter** (see PHYSICS TODAY, December 2002, page 75), will become president-elect in 2005 and will serve as president in 2006. **Peter Knight** begins his term as the OSA president for 2004 (see PHYSICS TODAY, January 2002, page 69).

Van Stryland graduated in 1970 with a BS in physics from Humboldt State University in Arcata, California. While working at the Optical Sciences Center at the University of Arizona in Tucson, he completed his MS (1975) and PhD (1976), both in physics. He then spent two years in the Center for Laser Studies at the University of Southern California, and subsequently joined the University of North Texas in 1978 as an assistant professor of physics. He was a founding member of the Center for Applied Quantum Electronics at North Texas and served as the center's chairman from 1983 to 1985. In 1987, he joined UCF as a professor of



Van Stryland

physics and electrical and computer engineering and in 1998 helped establish the School of Optics, where he is now director. His current research interests involve the characterization of the nonlinear optical properties of materials and their temporal response and the applications of those properties for sensor protection, switching, and beam control.

In his candidate's statement, Van Stryland said he would "focus on furthering the society's commitment to education and international outreach." He also plans to "work with the OSA board to determine new ways to encourage and expand the society's volunteer base, as well as embrace the developing fields of optics and photonics, including biophotonics and nanotechnology."

Also taking office this month for three-year terms are OSA's new directors at large: **Martin Fejer** (Stanford University), **Julie Fouquet** (Agilent Laboratories in Palo Alto, California), and **Katherine Hall** (PhotonEx in Maynard, Massachusetts).

In Brief

Martin Rees, Astronomer Royal and a Royal Society Research Professor at the University of Cambridge, takes office this month as the master of Trinity College, Cambridge University.

US Navy Rear Admiral Thomas Q. Donaldson V becomes the director of NASA's John C. Stennis Space Center in South Mississippi on 5 January. Donaldson previously was the commander of the Naval Meteorology and Oceanography Command at Stennis. He replaces interim director **Michael Rudolph**, who moved in December to NASA's Marshall Space Flight Center in Huntsville, Alabama, where he manages the Space Shuttle Propulsion Office.

Garry W. Rogerson took the reins last month as the new CEO of Varian Inc in Palo Alto, California. Rogerson, who has a PhD in biochemistry, had been the company's president and chief operating officer and will retain the title of president. He succeeds **Allen J. Lauer**, who will remain the chairman of Varian's board of directors.

In November, the American Society of Mechanical Engineers presented its 2003 Per Bruel Gold Medal for Noise Control and Acoustics to **David Feit**. A senior research scientist for structural acoustics with the Naval Surface Warfare Center's Carderock Division in West Bethesda, Maryland, Feit was recognized for "advancing the understanding of structural-acoustic phenomena and subsequent noise and vibration control treatments related to submerged vehicles, high-frequency noise radiation from fluid-loaded structures, and the vibration of fuzzy structures."

Three individuals recently joined the physics faculty at the University of Texas at Austin. This month, **Gennady Shvets** began working as an assistant professor. He previously was an associate professor in the department of biological, chemical, and physical sciences at the Illinois Institute of Technology in Chicago. **Ernst-Ludwig Florin** and **Maxim Tsoi** both began their positions as assistant professors this past October. Florin previously was a scientist with the cell biology and biophysics program at the European Molecular Bi-

ology Laboratory in Heidelberg, Germany. Tsoi had been working with the research division at the IBM Almaden Research Center in San Jose, California.

At a ceremony in Munich in October, the Eduard Rhein Foundation, based in Hamburg, conferred its awards for 2003 to three winners, two of whom do physics-related work. The Cultural Award, with a cash prize of €20 000 (about \$23 500), went to **Ernst Peter Fischer**, a physicist who has been a writer since 1987 and who also routinely teaches the history of science at the University of Konstanz in Germany. He was recognized for his "recent book, *Die andere Bildung: Was man von den Naturwissenschaften wissen sollte* [*The Other Culture: What You Should Know From the Natural Sciences* (Ullstein, 2001)]. With this volume, [Fischer] has strongly and positively influenced the ongoing debate in Germany about the appropriate strategies in higher education." The foundation gave the Technology Award to **Paul C. Lauterbur**, Center for Advanced Study Professor of Chemistry at the University of Illinois at Urbana-Champaign, for "the invention of magnetic resonance imaging as a noninvasive method for cross-sectional imaging at high spatial resolution and with endogenous tissue contrast." Lauterbur received a cash prize of €50 000 (about \$59 000).

This past October, **Jack Rowe** became the deputy director of the newly formed Institute for Advanced Materials, Nanoscience and Technology at the University of North Carolina at Chapel Hill. Rowe, also an adjunct professor in the university's department of physics and astronomy, had been a senior research scientist responsible for special studies in the physical sciences directorate at the Army Research Office in Research Triangle Park, North Carolina, since 1996.

Sun Kwok became director of the Taiwan-based Institute of Astronomy and Astrophysics in September. He had been a professor of astronomy at the University of Calgary in Canada and Killam Fellow of the Canada Council for the Arts.

Clifford V. Johnson joined the physics and astronomy faculty at the University of Southern California in Los Angeles last August as a professor

of theoretical physics. He remains a visiting professor at the University of Durham in England, where he had been a professor of applied mathematics.

Obituaries

Alexander Rawson Stokes

Alexander Rawson Stokes was closely associated with one of the most important scientific discoveries of the 20th century, namely the discovery of the double helix structure of DNA by James Watson and Francis Crick. Alec died of cancer on 6 February 2003 in Welwyn Garden City, England. It is sad that he missed the many celebrations of the 50th anniversary of the double helix to which he had been invited.

Alec was born on 27 June 1919 in Macclesfield, England. He was educated at the Warehousemen and Clerks School (now the Cheadle Hume School) in Cheadle Hume and at Trinity College, University of Cambridge, where he was graduated in 1940 with a BA in natural sciences. He then became a demonstrator in electricity at the University of Cambridge and worked in the Cavendish Laboratory as a research student in x-ray crystallography. He received his PhD from Cambridge in 1944; his doctoral thesis, "Imperfect Crystals," was done under the supervision of Lawrence Bragg.

The 1940s was a very productive period for Alec, who made important contributions to a number of x-ray diffraction studies. Of particular importance was his contribution to the analysis of x-ray diffraction line broadening due to stress and particle size and, with Bragg, his work in developing the "Fly's Eye" as one of the earliest techniques using optical diffraction to assist in the solution of x-ray diffraction structure analysis.

Alec was appointed lecturer in physics at the Royal Holloway College, London, in 1945. Two years later, John Randall recruited him to King's College, University of London. Randall had set up a biophysics unit within the King's Wheatstone Physics Laboratory, where biologists and biochemists worked with physicists.

When I went for an interview to be a postdoc at King's in 1952, Randall introduced me to Maurice Wilkins (who shared the 1962 Nobel Prize in Physiology or Medicine with Crick and Watson). Wilkins subsequently introduced



Alexander Rawson Stokes

me to Alec and Rosalind Franklin. I knew of Alec's work on line broadening, which was relevant to my PhD studies on the effect of stress on metals, and I was apprehensive that he would ask me awkward questions! However, my worries on that account were unfounded. I met with a gentle and courteous person, and as I found later, if he had one characteristic above all others, it was extreme modesty.

In 1950, Wilkins obtained a preparation of calf thymus DNA from Rudolf Signer of Bern, Switzerland. From gels of that material, he was able to draw thin, uniform fibers that showed sharp extinction between crossed polarizers. With Raymond Gosling, Wilkins obtained from those fibers x-ray diffraction patterns that showed a high degree of crystallinity. When Alec was shown photographs of the patterns, he suggested that they could be due to a helical structure. Alec was thus the first person to suggest, on the basis of experimental data, that DNA had a helical structure.

Wilkins asked Alec if he could work out what sort of x-ray pattern would be given by a helical structure. Alec mulled over the problem on the train home and realized that the Fourier



analysis that was needed to solve the problem involved Bessel functions; he came in the next day with a diagram of Bessel functions that became known as Waves at Bessel-on-Sea. Alec later said, "I was fortunate in that I had met Bessel functions before, in different contexts, so I knew what sort of creatures they were and I was not at all scared of them!" One such context, pointed out by Archibald Howie, was in A. J. C. Wilson's analysis of "Diffraction by a Screw Dislocation," published in 1949 in *Research*, in which Wilson acknowledged Alec for criticism and suggestions. Wilson had been Alec's collaborator in some of the x-ray diffraction line-broadening analyses. Alec did not publish his helical diffraction theory; rather, the theory was published in *Acta Crystallographica* in 1952 in an independent derivation by William Cochran, Crick, and Vladimir Vand.

When Wilkins and Alec compared the helical theory with the DNA diffraction patterns, they agreed that there was something very helixlike about the patterns. But the question was, What kind of helix? Watson and Crick answered that question when they proposed their double helix model of DNA.

When Watson and Crick announced their discovery, there were two accompanying papers from King's College that gave experimental support for the model. One was by Wilkins, Stokes, and myself, and the other was by Franklin and Gosling. All three articles appeared in *Nature* on 25 April 1953.

Alec contributed to further DNA studies and used optical diffraction to analyze x-ray fiber diffraction patterns of DNA and other polymer structures. He brought his exceptional mathematical skills and understanding of diffraction phenomena to analyze a number of other problems of biophysical interest, including image formation in optical microscopy, light scattering from randomly oriented prismatic structures, and x-ray scattering by long chain molecules. Among Alec's publications are two books: *Theory of the Optical Properties of Inhomogeneous Materials* (E. & F. N. Spon, 1963) and, with C. J. Smith, *The Principles of Atomic and Nuclear Physics* (Edward Arnold, 1972).

An inspiring and sympathetic teacher, Alec was also a longtime member of the King's College Board of Studies in Physics and was its chairman for a number of years. However, he was not enthusiastic about administrative duties. He retired as senior lecturer in 1982.

In September 1993, a plaque was unveiled at King's College that commemorated the x-ray diffraction studies of DNA carried out in 1953 at the university. The names on the plaque are Franklin, Gosling, Stokes, Wilkins, and Wilson.

Alec enjoyed many activities outside science. He had a keen interest in music, played the piano, and participated in choral singing. He was also an elder in his local Free Church (Presbyterian Church) in Welwyn Garden City.

Herbert R. Wilson

*University of Stirling
Stirling, Scotland*

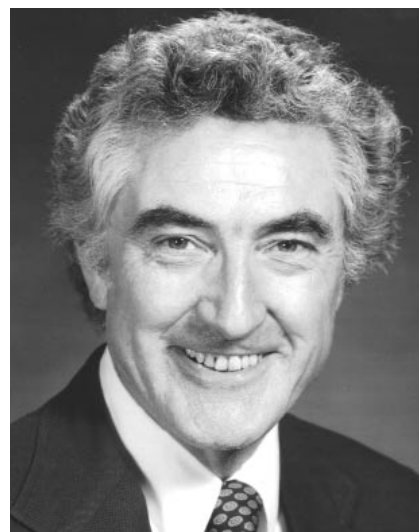
Albert Roach Hibbs

For many years, Albert Roach Hibbs was "The Voice of JPL"—one of the principal spokesmen for the Jet Propulsion Laboratory in Pasadena, California. He died in Pasadena on 24 February 2003 of complications following heart surgery.

Hibbs was born in Akron, Ohio, on 19 October 1924. At a very early age, he displayed an interest in science, probably encouraged by his father, an engineer, and his mother, a chemist. In 1942, he entered Caltech and received his BS in physics three years later. He then attended the University of Chicago and earned his MS in mathematics in 1947. He returned to Caltech for his PhD in physics under his adviser, Richard Feynman, with whom he had a great deal in common and became close friends. He received his PhD for a thesis on the interaction of wind and water to form surface waves. Together, he and Feynman would later write an undergraduate text, *Quantum Mechanics and Path Integrals* (McGraw-Hill, 1965).

Hibbs's earliest exploit that gained national attention was a project to make money from roulette tables in Nevada. He and his student roommate, Roy Walford, decided that no roulette wheel was perfect and if one knew the imperfection, one could gamble on the wheel and make money. At Las Vegas, they recorded every play on a wheel for two weeks. They then gambled and won \$15 000. With their winnings, they bought a boat and set sail out of Miami, Florida. On reaching Puerto Rico, they decided they didn't want to be sailors, and returned to Pasadena.

Hibbs joined JPL as a mathematician in February 1950. At that time, JPL was under contract to the US Army Ordnance to develop ballistic



Albert Roach Hibbs

missiles. Hibbs's assignment was to calculate missile performance. When JPL became involved in the satellite program, he was principal mathematician on performance calculations. At the 1958 launch of Explorer-I, the first US Earth satellite, Hibbs was at Cape Canaveral, Florida, and made the initial orbit estimate using very sketchy real-time data. He did well: His orbit calculation was only eight minutes short and his estimated lifetime of 15 years in orbit was three years too long. After NASA started operations in October 1958, it took over JPL in December, and the laboratory was assigned deep space scientific missions. An important Hibbs document is *JPL Report 30-1*, published in 1959. It outlined a proposed series of planetary missions for JPL and NASA. Although his schedule was too optimistic, Hibbs established the general framework for planetary missions for the next decade.

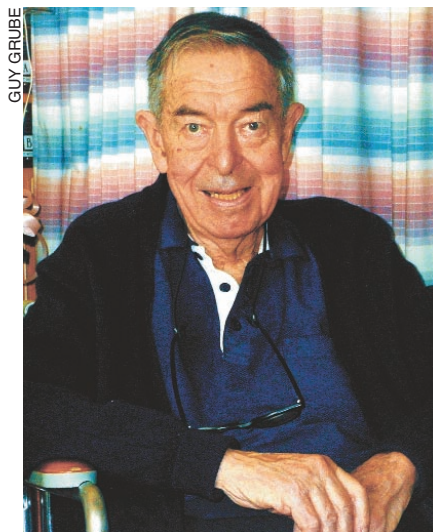
By 1960, Hibbs had been asked to form and take charge of the space science division at JPL. The division endured a slow start in the early 1960s, beginning with a series of six failures of Ranger, a project involving robotic probes that would make close-up TV pictures of the Moon. After that, though, JPL had a long series of successful lunar and planetary missions that naturally attracted broad media interest. JPL established Hibbs in a data room, where he could interpret flight data for the media and the general public. His scientific background and his facility with the English language made him the authoritative source of information on JPL missions.

During the 1960s and 1970s, JPL was busy with the planetary program and Hibbs continued to be the pri-

mary contact with the media. Instead of missions lasting a few days, some of those missions lasted for many years. The longest mission was Voyager 2. Launched in 1977, it flew past Neptune in 1989 and, as of press date, was still communicating with Earth.

Hibbs retired from JPL in November 1986. During his retirement, he pursued underwater photography, a major interest that took him to scuba diving sites all over the world. He also worked in the joint JPL and Caltech project to use retired engineers and scientists to help the medical profession with space technology to improve health care.

William H. Pickering
La Canada Flintridge, California



Walter Lewis Hyde

Walter Lewis Hyde

Walter Lewis Hyde, former president of the Optical Society of America (OSA), an inventive optical instrument designer, and a creative educational administrator, died following a heart attack on 9 January 2003 in Cambridge, Massachusetts.

Lem was born in Minneapolis, Minnesota, on 30 May 1919. Having taken the entrance exam without his family's knowledge, he entered Harvard College (now Harvard University) in 1937. He was graduated in 1941 with an AB in physics. Lem then taught physics at Amherst College for a year before joining the research staff at Polaroid Corp in Cambridge to work on war-related research. In 1945, he returned to Harvard as a graduate student and received his PhD in physics in 1949. His dissertation on far-infrared spectroscopy was done under the supervision of E. Bright Wilson Jr.

In 1948, Lem became assistant director of research at Baird Associates, an instrument and consulting firm in Cambridge. There, he designed an instrument for daytime star-tracking; the principles of that instrument were later used in the tracking portion of the Sidewinder air-to-air missile. He left Baird in 1950 to become a scientific liaison officer at the London branch of the US Office of Naval Research. While in Europe, he helped revitalize the International Commission for Optics. Three years later, Lem joined the American Optical Company in Southbridge, Massachusetts, and later became director of development for its J. W. Fecker division, a manufacturer of large optical instruments in Pittsburgh, Pennsylvania.

Lem held patents on a range of optical instruments, including the air-puff tonometer, designed to test for

glaucoma by measuring the eye's intraocular pressure without mechanically touching the eye. The instrument enabled optometrists—then forbidden from using anaesthetizing drugs—to make the measurement. While at Fecker in the late 1950s, he also invented a periscope to help pilots to look forward and another periscope to help drivers to look backward. The key innovation was to use cylindrical optics at unit magnification. Although the backward-looking periscope invention was licensed to an automobile mirror company, it was never commercialized.

Having joined the University of Rochester's Institute of Optics in 1963, first as a professor, Lem subsequently became director of the institute and associate dean of the College of Engineering and Applied Science in 1965. He had an avocational interest in old optical instruments and, using a large number of instruments as examples, gave a very popular course on instrument design. He also organized the first International Lens Design Contest in 1966, a competition that continues today.

In 1968, Lem became provost of New York University's University Heights campus, which included the Engineering School as well as the uptown College of Arts and Science. It was a pleasant campus of 35 acres in the Bronx, with a sweeping view of the Hudson River and the Palisades beyond. The late 1960s were a particularly turbulent time to be a university administrator. However, Lem's administrative skills and, above all, his wonderful sense of humor, enabled him to manage on-campus racial tensions, student demonstrations, and opposition to the ROTC (Reserve

Officer Training Corps) sufficiently well to avoid the problems many other universities faced at that time. However, NYU's overall financial problems during that period, combined with the recruitment challenges of a campus in the Bronx, were too great. In 1972, NYU sold its uptown campus to New York City to be used as the site of Bronx Community College.

Lem then moved to Connecticut, where he served first as executive director of the Connecticut Conference of Independent Colleges from 1972 to 1979 and then as head of the central staff of the Connecticut State Technical College system from 1979 to 1985.

Following his retirement in 1985, Lem worked in the Soviet Union with scientists from the Vavilov State Optical Institute, a large military-controlled research facility in what is now St. Petersburg. He published articles on the optical institute's scientific advancements, arranged for a US distributor for the institute's microscopes, and helped some of the scientists there to relocate to the US.

Lem was an active participant in OSA. From 1963 until 1965, he was a member of the society's board of directors, and from 1968 until 1971, he was a member of the presidential sequence. He served as president from 1969 to 1970 and guided the society through a difficult change in management during that period. On retirement, he and his wife of more than 60 years, Betty, regularly went to OSA headquarters in Washington, DC, to help organize the OSA library. In addition to his service to OSA, Lem was elected as a vice president of the International Commission for Optics in 1962 and was secretary-treasurer from 1966 to 1969.

Lem was an omnivorous reader and a prolific writer. He wrote newspaper articles and gave speeches on an enormous range of topics. In his lecture entitled "Where is Massachusetts?" he reviewed the still unresolved problems caused by late 18th-century surveyors who had strayed off their course to spend a night with a very friendly innkeeper's widow. He also wrote a monthly newsletter to his family and friends to inform them which of the several books he was reading that month were worth their while. In one of Lem's last newsletters, he wrote, "We drove out this afternoon to a mountain called Sugarloaf. Sure enough, except for the size, color, and shape, it is exactly like a loaf of sugar."

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Subramanian Raman

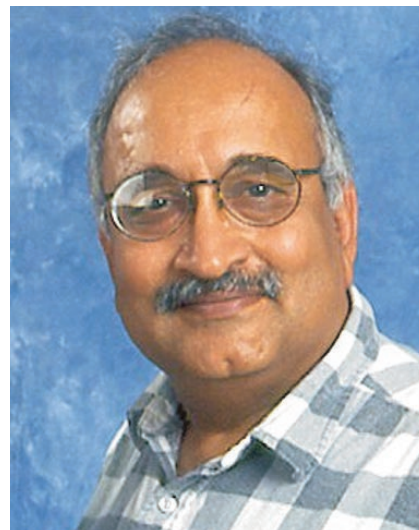
Subramanian Raman, a senior staff member in the physics division at Oak Ridge National Laboratory (ORNL), died 8 April 2003 at his home in Oak Ridge, Tennessee, of complications following heart surgery.

Born 2 April 1938 in Kollengode, a small town in southwestern India, Raman, often called "Ram" by his friends and colleagues, received his BE in 1959 from the University of Madras. After failing the eye examination required for employment by the India Railway Co, he decided to apply for a Bank of India study-abroad program. Raman came to the US in 1959 and enrolled in the graduate program at Rensselaer Polytechnic Institute, where he received his MS in electrical engineering in 1961. He did his doctoral work at Pennsylvania State University under the supervision of William Pratt. In 1966, he earned his PhD in physics for his thesis "Energy Levels of ^{82}Kr Populated by ^{82}Br Decay."

In June 1966, Raman joined ORNL to work on the nuclear data project directed by Kay Way. That work provided him insights—into both nuclear structure physics and the power of "horizontal" compilations of properties across a broad range of nuclei—that would guide his research interests throughout his 36-year career at ORNL.

Raman established definitive decay schemes for about 35 radionuclides, most of them for the first time, and discovered two new isotopes, potassium-48 and argon-45. In the early 1970s, he made a series of careful measurements to establish reliably the lowest $\log ft$ value for a β transition of a particular forbidden type. That work resulted in his landmark paper entitled "Rules for Spin Parity Assignments Based on $\log ft$ Values," published in *Physical Review* in 1973. His interest in β decay led to two additional compilations, one on superallowed $0^+ \rightarrow 0^+$ and isospin-forbidden Fermi transitions and another on mixed Fermi and Gamow-Teller β transitions and isoscalar magnetic moments. He pursued the experimental study of superallowed $0^+ \rightarrow 0^+$ transitions and studied in detail four of the dozen cases that are presently well established.

In the late 1970s, Raman initiated a program of neutron-capture gamma-ray spectroscopy that would significantly influence an entire subfield of nuclear physics. He carried out precise measurements (at both ORNL and Los Alamos) on a large number of nuclei and developed an advanced theory of



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direct capture for interpreting the observations. His work on the 1^+ states in lead-208 was particularly significant. He carried out much of the ORNL work at the Oak Ridge Electron Linear Accelerator, where he was scientific director at the time of his death.

During the 1970s, Raman also undertook the measurement of fission cross sections for the higher actinides. That work led to the establishment of the US-UK actinides program (1979-92) and the Japan-US actinides program (1988 to present); he served as a lead US participant in both programs.

In his last 15 years, Raman became particularly interested in the systematics of quadrupole distortions in nuclei. He initially compiled $B(E2)$ values for all even-even nuclei and then published a series of papers in which he developed the systematics and theory of collective behavior in those nuclei.

Raman's outgoing and friendly demeanor was apparent to hundreds of visitors to the ORNL physics division over the years. He organized the weekly technical seminars and served as de facto host for many of them. His ready camera also served to document the division's social activities.

His friends and colleagues will remember Raman for the breadth of his work in nuclear structure physics and his significant contributions to allied fields. We will remember his enthusiastic enjoyment of life in general and science in particular, his interest and concern for friends and colleagues, and his deep love and devotion to his family.

James Ball
Fred Bertrand
Oak Ridge National Laboratory
Oak Ridge, Tennessee ■