

City College of the City University of New York.

**Constantine M. Dafermos**, professor of applied mathematics at Brown University.

**Morton M. Denn**, Albert Einstein Professor of Science and Engineering and director of the Benjamin Levich Institute for Physico-Chemical Hydrodynamics at the City College of the City University of New York.

**David DeRosier**, professor of biology and a member of the Rosenstiel Basic Medical Sciences Research Center at Brandeis University.

**Russell J. Donnelly**, professor of physics at the University of Oregon, Eugene.

**Victor J. Emery**, senior physicist at Brookhaven National Laboratory.

**Shafira Goldwasser**, RSA Professor of Electrical Engineering and Computer Science at MIT.

**Wayne Lester Hubell**, Jules Stein Professor of Ophthalmology and a professor of chemistry and biochemistry at UCLA.

**Richard Lewis Haganir**, professor of neuroscience at Johns Hopkins University and an investigator with the Howard Hughes Medical Institute.

**Robert C. Kennicutt**, professor of astronomy at the University of Arizona and editor-in-chief of the *Astrophysical Journal*.

**Steven Allan Kivelson**, professor of physics at UCLA.

**Eve Marder**, professor of biology and a member of the Volen National Center for Complex Systems at Brandeis University.

**Tony Maxworthy**, Smith International Professor of Mechanical Engineering and a professor of aerospace engineering at the University of Southern California.

**William Esco Moerner**, professor of chemistry at Stanford University.

**Cherry A. Murray**, vice president of physical sciences research at Bell Labs, Lucent Technologies in Murray Hill, New Jersey.

**Simon Ostrach**, Wilbert J. Austin Distinguished Professor of Engineering at Case Western Reserve University and director of the National Center for Microgravity Research on Fluids and Combustion in Cleveland, Ohio.

**Mark A. Ratner**, Morrison Professor of Chemistry at Northwestern University.

**Paul H. Roberts**, professor of mathematics and geophysical sciences at UCLA.

**Barbara A. Romanowicz**, professor of geophysics and director of the Berkeley Seismological Laboratory at the University of California, Berkeley.

**Robert Rosner**, William E. Wrather Distinguished Service Professor of Astronomy and Astrophysics and a professor in the department of physics and in the Enrico Fermi Institute at the University of Chicago.

**Gerald Schubert**, professor of geophysics and planetary physics at UCLA.

**Nathan Seiberg**, professor of physics at the Institute for Advanced Study in Princeton, New Jersey.

**Ben G. Streetman**, dean of engineering at the University of Texas at Austin.

**Andrew Strominger**, professor of physics at Harvard University.

**Ignacio Tinoco**, professor of chemistry at the University of California, Berkeley.

**Stan E. Woosley**, professor of astronomy and astrophysics at the University of California, Santa Cruz.

**Fred Wudl**, Courtauld Professor of Chemistry at UCLA.

**Hong-Tzer Yau**, professor of mathematics at New York University.

Among the foreign honorary members are

**Olga Alexandrovna Ladyzhenskaya**, principal scientific researcher at the laboratory of mathematical physics at the Steklov Institute in St. Petersburg, Russia.

**Ryoji Noyori**, professor of chemistry and director of the Research Center for Materials Science at Nagoya University in Nagoya, Japan.

## IN BRIEF

At the Special Libraries Association's annual conference in San Antonio, Texas, in June, **Günther Eichhorn** received the PAM Award for 2001 from the Washington, DC-based Physics-Astronomy-Mathematics Division of the SLA. A project scientist with the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, Eichhorn was recognized, in part, for his role "in the genesis and growth of the Astrophysics Data System, the development of which represents an unparalleled shift in the propagation of the literature of astronomy."

The Canadian Astronomical Society recently handed out three awards. **Peter G. Brown**, assistant professor of physics and astronomy at the University of Western Ontario, London, Ontario, received the J. S. Plaskett Medal, awarded jointly with the Royal

Astronomical Society of Canada, for the most outstanding thesis in astronomy or astrophysics in Canada. His thesis was entitled "Evolution of Two Periodic Meteoroid Streams: The Perseids and the Leonids." **James E. Gunn**, a professor of astrophysical sciences at Princeton University, was awarded the R. M. Petrie Prize Lecture by CASCA. He gave a lecture entitled "The SLOAN Digital Sky Survey: A Year In" at CASCA's annual meeting in May. CASCA and the RASC jointly awarded the Helen Sawyer Hogg Public Lecture to **Jill Tarter**, director for SETI (Search for Extraterrestrial Intelligence) research and Bernard M. Oliver Chair for SETI at the SETI Institute in Mountain View, California. Her talk was entitled "SETI: Pulling Signals Out of Noise" at the May meeting.

The National Academy of Engineering (NAE) earlier this year awarded **Vinton G. Cerf**, **Robert E. Kahn**, **Leonard Kleinrock**, and **Lawrence G. Roberts** the Charles Stark Draper Prize for "principal contributions to the development of technologies that are the foundation of the Internet, a stunning engineering achievement that profoundly influences people, commerce, communications, productivity, and interpersonal relationships throughout the world," according to the citation. Cerf is senior vice president of Internet architecture and technology with WorldCom in Ashburn, Virginia. Kahn is chairman, CEO, and president of the Corporation for National Research Initiatives in Reston, Virginia. Kleinrock is a computer sciences professor at UCLA, and founder and chair of Nomadix in Los Angeles. Roberts is the founder, chair, and chief technology officer of Caspian Networks in San Jose, California.

NAE's Fritz J. and Dolores H. Russ Prize went to **Earl Bakken** and **Wilson Greatbatch** for "saving, extending, and improving the quality of human lives through the engineering development and commercialization of implantable heart pacemakers." Bakken was senior chairman of the board of Medtronic Inc in Minneapolis, Minnesota, until his retirement in 1989; he remains active in the company as founder and director emeritus. Greatbatch is president of Greatbatch Gen-Aid Ltd in Akron, New York.

During a June ceremony in Washington, DC, the Boston-based Computerworld Honors Program

handed out its annual awards to organizations in 10 categories. The awards acknowledged the organizations' most innovative applications of technology that benefit society. The program also honored three individuals with leadership awards. Of the awards given, one was related to work in physics. The 21st-Century Achievement Award in the science category went to **CERN** for its Datawarehouse, "a dynamically reconfigurable computing system architecture [that] allows a world-renowned physics center to simultaneously upgrade and match its resources to the constantly changing needs of its experimenters."

**T**he Royal Swedish Academy of Sciences in Stockholm has selected

**Elliott H. Lieb**, Higgins Professor of Physics and a professor of mathematics at Princeton University, as the winner of the Rolf Schock Prize for 2001 in the mathematics category. Lieb is being honored for "his outstanding work in mathematical physics, particularly for his contribution to the mathematical understanding of the quantum-mechanical many-body theory and for his work on exact solutions of models in statistical mechanics and quantum mechanics." He will receive the award and a cash prize of 500 000 krona (about \$47 000) in October at a ceremony in Stockholm. The award will also be given in the categories of logic and philosophy, the visual arts, and the musical arts.

ment involving interference at the single photon level: Two beams derived from independent lasers were attenuated to a level such that the average interval between photon emissions was very long compared to the transit time through the apparatus. Interference fringes were nonetheless recorded. As in the Hanbury Brown–Twiss experiment, the detection scheme explored interference of the fourth order in the amplitudes of the fields, as opposed to the more familiar second-order interference (as in a Michelson interferometer, for example), but now with an ingenious extension. Over the next three decades, Mandel continued to refine fourth-order interferometry into a powerful tool for investigating the quantum nature of light. It is now a standard technique used worldwide.

Perhaps spurred by the debate about the quantum statistical properties of lasers and other light sources, Mandel and his students were among the first to carry out basic experiments from 1967 to 1968 to elucidate the coherence properties of the laser in the transition from incoherent to coherent emission around threshold. In the ensuing decades, those early studies grew into diverse investigations of more complex laser behavior, including mode correlation and competition in ring lasers, and optical bistability and first-order phase transitions in dye lasers.

Mandel played a leading role in the quest to investigate states of the electromagnetic field with manifestly quantum or nonclassical characteristics. In 1977, his group made a historic advance in this endeavor with the first observation of photon antibunching in the case of the fluorescent light from a single atom. Subsequently, Mandel and one of his students made the first measurements of another nonclassical effect, namely, sub-Poissonian photon statistics.

In the early 1980s, Mandel initiated what would become a landmark set of experiments involving pairs of photons produced by the fission of a pump photon in the process of parametric down conversion. Following earlier work by others on the correlation between photon pairs in atomic cascades, Mandel and his students first demonstrated a key nonclassical aspect of the down conversion process and were able to achieve a localized one-photon state.

Pursuing the theme of fourth-order interference with pairs of photons in the late 1980s, Mandel and his students demonstrated quantum spatial

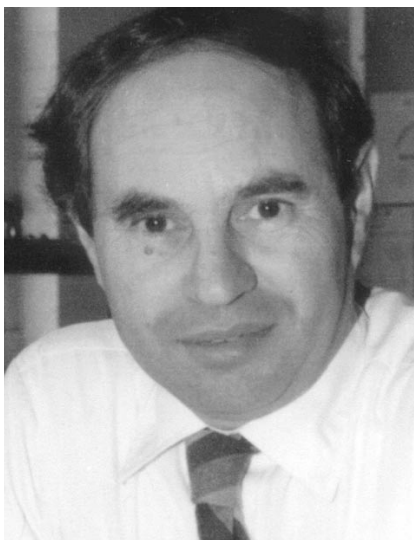
## OBITUARIES

### Leonard Mandel

**I**n the early hours of 9 February 2001, the physics community lost one of its most distinguished members, Leonard Mandel, after a long illness. Mandel was the Lee DuBridge Professor Emeritus of Physics and Optics at the University of Rochester, having become emeritus only a few months before he died, at the age of 73, at his home in Pittsford, New York.

Born on 9 May 1927 in Berlin, Germany, where his father had emigrated from Eastern Europe, Mandel received a BSc in mathematics and physics in 1947 and a PhD in nuclear physics in 1951 from Birkbeck College, University of London, in the UK. He became a technical officer at Imperial Chemical Industries Ltd in Welwyn, UK, in 1951. In 1955, he became a lecturer and, later, senior lecturer at Imperial College, University of London. He remained at Imperial College until 1964, when he joined the University of Rochester as a professor of physics.

Mandel is widely credited as being one of the founding fathers of the field of quantum optics. Although he made seminal contributions across most of quantum optics, the central theme of his research was the exploration of the nature of light through insightful theoretical analyses and a set of pioneering experiments that have become landmarks in the field. Not since the beginning of quantum mechanics has an individual so intimately investigated and so dramatically advanced our understanding of



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the quantum aspects of light.

Mandel's early interest in quantum optics was stimulated by the Hanbury Brown–Twiss experiments, in which correlations in the fluctuations of photocurrents from two photodetectors illuminated by light from a distant source reveal information about the spatial coherence properties of the light. Mandel's entrance into the debate about the appropriate theoretical description of this experiment was a basic paper published in 1958 in the *Proceedings of the Physical Society (London)* in which the so-called Mandel formula for photoelectric counting made its first appearance.

In 1968, Mandel's research group performed the now famous experi-