form of double dispersion relations. Later he made an effort to quantize string theories as ordinary quantum mechanical systems. He extended the work of Peter Goddard, Goldstone, Claudio Rebbi and Charles Thorn on the quantized free string to interacting strings. Mandelstam was among the first to make use of functional integration techniques in string theory.

Mandelstam obtained his PhD in mathematical physics from the University of Birmingham, in England, in 1956. After a year as a research assistant in mathematical physics at the university, he held a postdoctoral position in physics at Columbia University in 1957–1958 and then was an assistant research physicist at the University of California, Berkeley, until 1960. He then became a professor of mathematical physics at Birmingham, a post he held until 1963, when he moved to his present position at the University of California.

Previous Dirac Medalists included Ludwig D. Faddeev of the Steklov Mathematical Institute in Leningrad and Sidney R. Coleman of Harvard University in 1990, and Michael B. Green of Queen Mary College of the University of London, in England, and John H. Schwarz of Caltech in 1989.

IN BRIEF

The National Academy of Sciences will present several awards at a ceremony in Washington, DC, on 26 April. **Jerome B. Wiesner,** former president of MIT (now an emeritus physics professor there), will receive the NAS Public Welfare Medal for "his devoted and successful efforts in science policy, education, and nuclear disarmament and world peace."

John A. Simpson will receive the Arctowski Medal for "his pioneering studies of the properties of the charged particle environment of the Sun, the Earth and the other planets." Simpson is Arthur H. Compton Distinguished Service Professor of Physics at the University of Chicago.

The Comstock Prize will go to **Erwin L. Hahn,** emeritus professor of physics at the University of California, Berkeley, and **Charles P. Slichter,** a professor of physics and chemistry at the University of Illinois, Urbana–Champaign. Hahn was cited for "his revolutionary discoveries in magnetic resonance and coherent optics, in particular for the Hahn spin echo, the Hartmann–Hahn cross-polarization and self-induced transparency." Slichter was cited for "his seminal contributions to the development and application of magnetic resonance in condensed matter, including the first experimental proof of pairing correlations in superconductors and fundamental studies in surface science and catalysis."

Hiroo Kanamori, the John E. and Hazel S. Smits Professor of Geophysics at Caltech, will receive the Arthur L. Day Prize for "his outstanding contributions to the fundamental physics of the earthquake source process and to its application to earthquake prediction and mitigation of seismic risks."

The Henry Draper Medal will be shared by **Ralph A. Alpher,** Distinguished Research Professor of Physics at Union College, and **Robert Herman,** the L. P. Gilvin Centennial Professor in the department of civil engineering at the University of Texas, Austin. They were cited for "their insight and skill in developing a physical model of the evolution of the universe and in predicting the existence of a microwave background radiation years before this radiation was serendipitously discovered; through this work they were participants in one of the major intellectual achievements of the 20th century."

Harold S. Johnston will receive the NAS Award for Chemistry in Service to Society for "his pioneering efforts to point out that man-made emissions could affect the chemistry of of the stratosphere, in particular, the danger of the depletion by nitrogen oxide of the Earth's critical and fragile ozone layer." He is a chemistry professor at the University of California, Berkeley.

F. Sherwood Rowland, the Donald Bren Professor of Chemistry at the University of California, Irvine, was selected to give the Robertson Memorial Lecture for "his research which shows that mankind's activities, through the release of chlorofluorocarbons, lead to the destruction of the protective ozone layer in the upper atmosphere."

The NAS Award for the Industrial Application of Science will go to **Nick Holonyak Jr,** a professor in the department of electrical and computer engineering at the University of Illinois, Urbana–Champaign. He was cited for "his profound impact on industry and on the daily lives of the people around the world, through his prolific inventions in the area of semiconductor materials and devices including practical light-emitting diodes."

R. Eric Betzig will receive the NAS Award for Initiatives in Research for "the implementation of a near-field scanning optical microscope which extends the resolution of optical microscopy far beyond the diffraction limit to dimensions as small as one-fortieth of an optical wavelength."

The German Physical Society has given **Klaus Winter** the 1993 Stern–Gerlach Medal in recognition of his "fundamental research related to the structure of the weak neutral currents, in particular his precision experiments on the scattering of high-energy neutrinos on electrons and quarks." Winter is a senior physicist at CERN.

In January **Walter H. Munk,** a professor of geophysics at the Institute of Geophysics and Planetary Physics at the Scripps Institution of Oceanography, received the Vetlesen Prize from the G. Unger Vetlesen Foundation and Columbia University. He was cited for "his work in using sound waves to measure changes in ocean temperature."

The Alexander von Humboldt Foundation and the Max Planck Society have awarded the 1992 Max Planck Research Award to **Tomaso A. Poggio,** the Uncas and Helen Whitaker Professor of Vision Sciences and Biophysics at MIT, and **Manfred Fahle,** a professor at the Universitäts-Augenklinik Tübingen in Tübingen, Germany. They were chosen for their research in vision, brain science and learning.

On 28 April **Frank Press,** the president of the National Academy of Sciences, will receive the 1993 Japan Prize in the category of safety engineering and disaster mitigation. He will receive the prize from the Japanese government at a ceremony in Tokyo. The award citation recognizes him for his work in advancing scientific understanding of earthquakes and for encouraging international cooperation in reducing damage caused by natural disasters.

OBITUARIES

Nikolai N. Bogolubov

Nikolai Nikolaevich Bogolubov, a distinguished mathematician and theoretical physicist and the director of the Joint Institute for Nuclear Research in Dubna for almost a quarter of a century, died on 13 February 1992.

Bogolubov was born in Nizhny Novgorod, Russia, on 21 August 1909. He