ment of mechanical engineering and materials science at Duke University, was cited for his "contributions to active adaptive noise control."

ASA awarded an honorary fellowship, given occasionally to individuals who have attained eminence in acoustics or have rendered outstanding service to acoustics, to **Carleen M. Hutchins** in recognition of "her unique role in combining the art of violin making with the science of acoustics." Hutchins is a violin maker and acoustics researcher who cofounded the Catgut Acoustical Society, based in Montclair, New Jersey.

David E. Weston received the Helmholtz–Rayleigh Interdisciplinary Silver Medal, given for contributions to acoustical oceanography and underwater acoustics, for his "seminal work on the physics of explosive sources, scattering and the horizontal refraction of sound." Weston formerly worked for the UK's Admiralty Research Laboratory in Teddington and is now a consultant with BAeSEMA in London.

Engineering Excellence Awards Given by OSA

At its annual meeting in Baltimore last October, the Optical Society of America presented its 1998 Engineering Excellence Awards to Lee Shiozawa and Kenneth Walker for their achievements in optical engineering.

Shiozawa, chairman and chief scientist for Cleveland Crystals Inc in Cleveland, Ohio, was recognized for his "45 years of research improving electro-optics and nonlinear optical crystals for applications from the ultraviolet to the far infrared."

Head of the optical fiber research department at Lucent Technologies, Walker was recognized for his contributions to optical fiber manufacturing. His work has resulted in "an improved understanding of optical fiber fabrication, improved production processes and new fiber designs."

In Brief

On January 19, **J. Murray Gibson** will become the director of the materials science division of Argonne National Laboratory. He is replacing **Bobby Dunlap**, who will remain at Argonne for several months to ease the transition. Gibson was formerly a professor in the departments of physics and of materials science and engineering at the University of Illinois at Urbana-Champaign and associate director of the university's Frederick Seitz Materials Research Laboratory.

Riccardo Giacconi has been appointed president of Associated Universities, Inc, the nonprofit corporation that operates the National Radio Astronomy Observatory. Currently the director general of the European Southern Observatory, Giacconi will assume his new position in July 1999, replacing interim president **Martha P. Haynes**.

At the 20th International Free-Electron Laser Conference, held at Jefferson National Laboratory last August, **John Walsh**, a professor of physics at Dartmouth College, received the annual International Free-Electron Laser Prize in recognition of "his outstanding leadership in research and teaching in the field of free-electron lasers." The award consisted of an engraved clock, a certificate and $20 000.

Last September, **Carl Strawbridge** became the project manager for the Spallation Neutron Source at the Oak Ridge National Laboratory. He was previously the vice president for quality and information systems at VP Buildings Inc in Memphis.

At the 47th Annual Denver X-Ray Conference in Colorado Springs, Colorado, in August, the International Centre for Diffraction Data presented the J. D. Hanawalt Award to **Herbert E. Göbel**, a physicist working at Siemens AG in Munich, Germany. The award, consisting of a citation and $1000, is given every three years for important recent contributions to the field of x-ray powder diffraction.

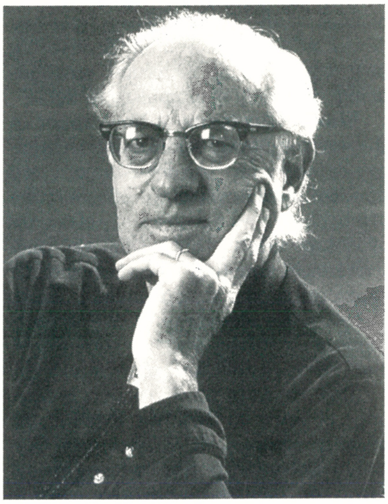
Obituaries

Frederick Reines

Frederick Reines, a pioneer in the field of neutrino physics and an ardent investigator of fundamental conservation laws, died on 26 August 1998 in Orange, California, after a long illness. By showing that it was possible to detect and study neutrinos experimentally, Reines opened the door to a new, fertile and exciting area of elementary particle physics. In 1995, Reines was a cowinner of the Nobel Prize in Physics for the first detection of the neutrino, accomplished in 1956 with his Los Alamos Scientific Laboratory colleague the late Clyde L. Cowan Jr.

Reines was born on 16 March 1918 in Paterson, New Jersey, of parents who had emigrated to the US from a small town in Russia. After receiving an undergraduate degree in engineering and an MSc in mathematical physics from Stevens Institute of Technology, in 1939 and 1941, respectively, Reines undertook graduate study in physics at New York University. There, he worked on experimental cosmic-ray physics under Serge A. Korff and eventually wrote a theory-based PhD thesis entitled "The Liquid Drop Model for Nuclear Fission" under Robert D. Present. The topic was timely, and, even before completing the thesis in 1944, he was recruited to work on the Manhattan Project in the theoretical division of the Los Alamos Scientific Laboratory under Richard Feynman.

A year later, he became a group leader in the division and embarked on a career at the scientific lab (the forerunner of Los Alamos National Laboratory) that spanned 15 years and included directing the Atomic Energy



Frederick Reines

Commission's Operation Greenhouse experiments on Eniwetok and studying bomb tests on Bikini and in Nevada. During that period, he wrote a study on the Mach effect and the height of bomb bursts with John von Neumann. Reines later served as a delegate to the 1958 Atoms for Peace Conference in Geneva.

Until its detection, the neutrino enjoyed an anomalous status. It was postulated by Wolfgang Pauli in 1930 to solve the problem of the apparent violation of conservation laws in nuclear beta decay, and was named by Enrico Fermi, who incorporated it into his 1934 theoretical formulation of the weak process. However, most physicists thought the neutrino interacted far too weakly to be detectable. To Reines, this situation was philosophically intolerable, for it endowed the neutrino with the properties of a poltergeist. The neutrino would have to be detected to achieve the status of a particle.

Reines had begun to think about detecting the neutrino as early as 1947, but it was not until 1951, when he took a sabbatical-in-residence at Los Alamos, that ideas for the search began to crystallize. It was known, from a 1934 estimate by Hans Bethe and Rudolf Peierls, which was consistent with Fermi's theory, that the cross section for the most likely detection process—namely, inverse beta decay ($\bar{\nu} + \mathrm{p} \rightarrow \mathrm{n} + e^{+}$)—was less than about 10^{-44} cm^2. Hence, to make any detection possible, an extremely abundant source of neutrinos was required. (Indeed, in their paper, Bethe and Peierls had concluded: "It is therefore absolutely impossible to observe processes of this kind with the neutrinos created in nuclear transformations.") Reines's first idea was to use a nuclear explosion as a source and a detector with a sensitive mass of about a ton. He tried out the idea on Fermi, who was a summer visitor at Los Alamos. According to Reines, Fermi at first hesitated, then agreed, and then they both agreed that they had no idea how to construct such a detector.

Soon, however, Reines and Cowan conceived the key idea of using a delayed coincidence between the positron and neutron capture gamma rays to strongly suppress the background. This technique was realized with the newly discovered organic liquid scintillators and the innovative use of a large array of photomultiplier tubes for detection. By suppressing the background in that way, it became possible to use a steady fission reactor source instead of a nuclear bomb. An experiment was initiated at the reactor at Hanford, Washington, which produced the first hints of a result. Reines and Cowan subsequently learned from John Wheeler about a new, more powerful reactor being built at the Savannah River facility in South Carolina, and it was there that the first clear observation of the electron antineutrino occurred.

Reines next extended his research activities to include gamma-ray astronomy and the conservation laws. His good friend Cowan had left Los Alamos and their very fruitful and harmonious collaboration had come to a natural end. In 1959, Reines became a physics professor and the head of the physics department at the Case Institute of Technology in Cleveland. The productive research group he developed there embarked on several series of experiments directed at studying reactor neutrinos, searching for solar neutrinos and pursuing the underground detection of neutrinos produced by cosmic-ray interactions in the atmosphere.

A collaboration between Reines and Jacques P .F. Sellschop of the University of Witwatersrand, in Johannesburg, using a large-area liquid scintillation detector in a deep gold mine in South Africa, led to the first detection of atmospheric neutrinos in 1965. The investigation of atmospheric neutrinos was prescient, for it anticipated recent experiments such as Super Kamiokande, which has produced striking evidence suggesting the existence of neutrino oscillation.

Studies that Reines undertook with Thomas L. Jenkins and F. E. Kinard at the Savannah River facility in 1969 detected, for the first time, the charged current interaction of electron antineutrinos with the deuteron. About ten years later, Reines worked with Elaine Pasierb, Henry S. Gurr, John Lathrop and Henry Sobel, and the corresponding weak neutral current interaction was observed. Another series of studies at Savannah River that involved Reines ultimately yielded the first detection (with Gurr and Sobel in 1976) of the electron antineutrino elastic scattering on electrons, providing important and timely information on the parameters of the electroweak theory of Sheldon Glashow, Abdus Salam and Steven Weinberg. In all of these experiments, many proceeding in parallel, Reines worked closely with students, postdocs and faculty colleagues. His coworkers remember his uncanny and almost intuitive ability to diagnose problems in an experiment.

In 1966, Reines left Case, and took the core of his neutrino group, to the newly built University of California campus at Irvine, where he became the founding dean of the school of physical sciences and where he remained for the rest of his professional career. He became distinguished professor in 1987 and professor emeritus in 1988.

While at UCI, in addition to his relentless pursuit of neutrinos, he indulged in one of his other great and long-standing interests—namely, the study of baryon conservation and the search for proton decay. His interest in this topic dated at least as far back as 1954, the year in which Reines, Cowan and Maurice Goldhaber had written a paper that reported an experimental lower limit on the lifetime of free protons of about 10^{22} y. Several subsequent experiments involving Reines and various colleagues (Herald W. Kruse, Charles C. Giamati, William R. Kropp, Gurr, Basil Meyer, and Marshall Crouch) at Los Alamos and Case set increasingly more stringent limits for various decay modes.

A Toast

Here's to Wolfgang Pauli
who made a funny joke

Here's to the Great Enrico
who then of weakness spoke

Here's to all those gathered
To celebrate the fruits
Of all the patient workers
Who followed those astutes

Here's to the proposition
That we shall meet again

and Here's to the fond hope
The sun will shine till then.

FREDERICK REINES

In the 1970s, as the advent of grand unified theories led to growing interest in baryon number violation, Reines's group at Irvine began a very large scale collaborative effort to search for proton decay. The result was the IMB (Irvine-Michigan-Brookhaven) experiment, which was conducted with an 8000-metric-ton water Čerenkov detector at a depth of 600 m in a salt mine near Cleveland, and was led jointly by Reines and Jack van der Velde of the University of Michigan. By the completion of the experiment in 1991, this effort had set the then-best lower limits on the proton lifetime (about 10^{33} y), had obtained evidence for the atmospheric neutrino anomaly and had made the serendipitous detection of a burst of neutrinos from Supernova 1987A. The supernova observation, together with the coincident detection by the Kamiokande experiment in Japan, yielded the first experimental information concerning the role of neutrinos in stellar collapse, and is seen by many as the birth of neutrino astronomy. For Reines, it was a fitting and gratifying result, since he had always been mindful of the possibility of seeing neutrinos from stellar collapse. Indeed, his previous large detectors had been adorned with signs identifying them as "Supernova Early Warning Systems."

Although Reines will always be identified with the neutrino, he was also passionately interested in testing the fundamental conservation laws. His research included studies of charge conservation and the stability of the electron, and lepton conservation as probed in double beta decay, as well as basic physics laws, such as the Pauli exclusion principle. He also had a strong interest in, and contributed significantly throughout his career to, the development of new detectors—liquid scintillation and large water Čerenkov detectors, for example. An early pioneering contribution (1953) of his was the use of liquid scintillation detectors to measure total body radioactivity.

In his contacts with colleagues, students and coworkers, Reines was a constant source of new ideas, stimulation and motivation. He was very generous in extending resources to colleagues to pursue their own ideas. This trait of his led to some outstanding research and advances achieved by colleagues, including Michael Moe in double beta decay, and Herbert Chen in accelerator and underground neutrino physics.

In his early years, Reines developed a strong interest in literature, music and theatre. While in college, he sang in choirs and performed major solo roles in oratorios, such as Handel's "Messiah." Indeed, his vocal abilities were so promising that he was encouraged to consider a singing career. Although he focused his attention and considerable energies on science, he retained a lifelong interest in singing and drama, performing in later years with the chorus of the Cleveland Symphony Orchestra. On a more informal basis, he frequently entertained his friends and colleagues with his deep-voiced renditions of folk songs and excerpts from Gilbert and Sullivan operettas.

Reines's physical stature, booming voice and natural, imposing stage presence invariably commanded attention. However, his interactions with people, especially the undergraduates he taught, were usually warmed by his penchant for the lighthearted use of quips, puns, riddles and the poems he was so fond of fashioning and reciting.

WILLIAM R. KROPP
JONAS SCHULTZ
HENRY W. SOBEL
University of California, Irvine

Edward Leonard Ginzton

Edward Leonard Ginzton, the first director of SLAC and chairman of the board, president and CEO of Varian Associates for many years, died on 13 August 1998 in Palo Alto, California, after a long illness associated with Parkinson's disease.

Ginzton was born in the Ukrainian city of Ekaterinoslav (renamed Dnipropetrovs'k in 1926) on 27 December 1915. When revolution swept through the Russian empire a short while later, the Ginzton family—like many others—sought refuge in the distant city of Harbin, Manchuria, where young Edward attended elementary school. In 1929, the family moved to San Francisco, where he attended high school after quickly mastering English.