

New Jersey. He joined its research staff in 1945 after three years of research and development during World War II with the Radiation Laboratory at MIT. He remained at Fort Monmouth as one of the enthusiastic and communicative individuals until his formal retirement in 1970. Moreover, beyond retirement, he continued close association with former colleagues and played an active role in scientific colloquia, both national and state-wide in New Jersey.

He completed his undergraduate work in physics at Stanford University in 1932, obtained a master's degree at the University of California at Berkeley in 1938, and a PhD at Stanford in 1942. In the interim he held several positions as a physicist, first with the Western Sugar Refinery, then at the Litton Engineering Laboratory, and finally as a senior research investigator with Lever Brothers Corporation, before joining the Radiation Laboratory. Although he worked in many areas, he was best known for his investigations on special physical properties of solid materials, with much emphasis on ferroelectric dielectrics and x-ray spectroscopy. He published numerous papers in these fields.

FREDERICK SEITZ
The Rockefeller University

Stanley L. Shapiro

Stanley L. Shapiro, physicist at the National Bureau of Standards, died 22 August 1982 at the age of 41. A pioneer in the application of picosecond light-pulse techniques to physics, chemistry and biophysics, Shapiro was a leading contributor to studies of ultrahigh-speed electronic phenomena in condensed matter and biological systems. Many of his techniques, having been proved important for understanding rapid processes, are now used extensively.

Shapiro studied physics at the University of California at Berkeley and Santa Barbara. His PhD research, on light scattering by liquids, was carried out with Herbert Broida at Santa Barbara. This work, in 1966, was the first to use the laser for precise measurements of frequency broadening in the determination of orientation fluctuations of molecules in liquids.

Before joining the National Bureau of Standards in Gaithersburg, Maryland, in 1980, Shapiro served as a member of technical staffs at Bell Laboratories, GTE Laboratories and Los Alamos Scientific Laboratory. In 1967 Shapiro made the experimental discovery of two-photon fluorescence autocorrelation displays of picosecond light pulses, which subsequently found wide application.

A key contribution Shapiro made in nonlinear optics was the first generation of intense broad-spectrum picosecond pulses in glass and other media arising from self-phase-modulation and four-photon processes. Shapiro and others used these "white light continuum" pulses widely as probes in picosecond absorption spectroscopy. They are one of the most important tools currently available to the picosecond spectroscopist. Shapiro also made early measurements of optical phonon and molecular vibrational lifetimes in solids and liquids, and explained numerous features of intense picosecond light pulses and light sources.

Shapiro and his associates pioneered in picosecond optical studies of energy transfer in photosynthesis using novel streak camera and optical Kerr gate techniques. His measurements of fluorescence lifetimes in systems related to chlorophyll, for example, revealed fast relaxation, unexpected from earlier quantum efficiency measurements.

An energetic and prolific scientist, Shapiro organized and chaired the first International Conference on Picosecond Phenomena, edited a volume of conference proceedings and a text on *Ultrashort Light Pulses, Picosecond Techniques, and Applications* and served as an associate editor of *Optics Letters*.

ROBERT R. ALFANO
City College, New York
JOSEPH A. GIORDMAINE
Bell Laboratories

SHAPIRO



W. Arden Fate

W. Arden Fate, research scientist at Ford Motor Company, died on 14 April 1982 at the age of 43. Born and raised in Los Angeles, he attended Bucknell College and the University of Southern California, receiving from the latter his BS in physics in 1960. In 1967 he received his PhD in physics from Rens-

selaer Polytechnic Institute. Fate joined the Ford Motor Company shortly thereafter and was a member of the physics department, engineering and research staff, until the time of his death. At Ford he carried out research using ultrasonic techniques to study problems in basic solid-state physics as well as the properties of a variety of high-temperature ceramic materials, including silicon nitride and silicon carbide. During the last four years he was primarily concerned with the development of new sensor concepts for the measurement of oxygen concentration in gas mixtures, absolute pressure and air flow.

THOMAS K. HUNT
IRVING SALMEEN
JOHN R. REITZ
Ford Motor Company

Otfried Heybey

Otfried Heybey died in an airplane crash on 2 June 1982.

He attended George Washington University as an undergraduate and performed his graduate work at Cornell University. For his master's thesis (1962), he developed a tunnel diode oscillator with great frequency stability for use below 1 K. Subsequently, such oscillators have had important applications in studies of liquid He³-He⁴ mixtures and thermal-expansion coefficients of solids and in sensitive pressure measurements at low temperatures. For his doctoral thesis he investigated optical birefringence of single crystals in the hexagonal close-packed phase of solid He⁴ grown from the superfluid. In an experiment to determine the velocity of transverse and longitudinal sound in hcp solid He⁴ he determined the crystal orientation with his birefringence technique.

Following the completion of his PhD in 1969, Heybey went to Rice University as a postdoctoral research associate. He collaborated there with G. K. Walters on spectroscopic studies of metastable helium atoms and molecules in liquid helium bombarded by fast electron beams.

After leaving Rice, Heybey worked with F. H. Muller at the Polymer Institute of the University of Marburg in Germany. Upon his return to the US, he worked for several years as a research associate on the viscoelastic properties of polymers with Frank Karasz of the Polymer Institute at the University of Massachusetts in Amherst. He left there in late 1973 to work at the American Can Company, Whirlpool Company and AMP, Incorporated, on injection molding and other plastics technologies.

DAVID M. LEE
Cornell University □