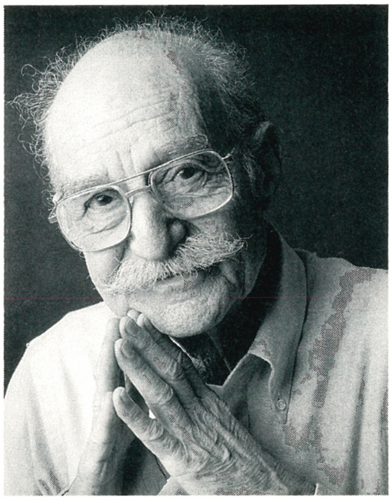
the *American Journal of Physics*. Ed seemed particularly happy to have won the 1967 Oersted Medal of the American Association of Physics Teachers.

Ed's death takes from us a man of great wisdom and integrity, and of generosity in sharing his enthusiasm for and the pleasure of understanding the wonders of physics.

ROBERT V. POUND
Harvard University
Cambridge, Massachusetts

Robert Herman



ROBERT HERMAN

Robert Herman, the L. P. Gilvin Centennial Professor Emeritus in the civil engineering department at the University of Texas at Austin, and associate director of the university's Center for Statistical Mechanics, died in Austin on 13 February 1997. During his career, Herman contributed to theoretical studies of the use of high-energy electron scattering in determining nuclear structure and to the Big Bang model of cosmology, as well as to pioneering applications of statistical mechanics and operations analysis to vehicular traffic flow.

Born in New York City on 29 August 1914, Herman earned his BS in physics from City College of New York in 1935 and his PhD in physics from Princeton University in 1940. His dissertation was on molecular structure and infrared spectroscopy. As both an undergraduate and graduate student, Herman published 18 papers on disparate topics. Throughout his career, he switched freely between theoretical and applied physics and remained very productive.

After earning his PhD, Herman spent a year at the Moore School of Electrical Engineering at the University of Pennsylvania, where he worked on early digital computers. When the US entered World War II, he joined Section T of the Office of Scientific Research and Development, which was then getting under way at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. In 1942, Section T became the Applied Physics Laboratory of Johns Hopkins University. At APL, Herman worked primarily on operations analysis of the efficacy of variable time fuzes (proximity fuzes) for rotating projectiles. After the war, he became head of a molecular spectroscopy group at APL that was largely concerned with combustion reactants, and he served for several years as assistant to the director of APL. He also did research on classical quantum mechanical problems and on problems involving color centers in alkali halide crystals.

Beginning in 1947, Herman collaborated with George Gamow and me in the development of the physics of the Big Bang model of the universe. The essence of this research was the realization that the cosmic abundances of the lighter chemical elements were formed by thermonuclear reactions in the early stages of a relativistic radiation-dominated expanding universe and that there should now exist a cosmic microwave blackbody background radiation reflecting conditions in the expansion after matter and radiation decoupled—precisely the 3 K background radiation found in 1965. In addition, Herman, James Follin Jr and I established a methodology still used today for dealing with physical conditions in the early universe.

In 1955, Herman served as a visiting professor of physics at the University of Maryland. In 1956, he moved to the Research Laboratory of General Motors Corp in Warren, Michigan, where he headed both the theoretical physics and traffic science departments.

His career at General Motors was notable for two principal contributions. First, along with others, he collaborated with Stanford University's Robert Hofstadter (a fellow graduate student from his Princeton days) on studies of nuclear structure using high-energy electron scattering. These studies led to Hofstadter's winning the Nobel Prize for Physics in 1961. Second, Herman led the development of vehicular transportation science as an operations research discipline. He established a transportation science section of the Operations Research Society of America and, in 1967, founded the section's journal, *Transportation Science*, serving as its first editor. For this pioneering work, he was elected to the National Academy of Engineering in 1978. It was always startling for me to receive a preprint from Herman, with such coauthors as the late Elliott Montroll and Ilya Prigogine, in which the solution to some problem in traffic science started with the Boltzmann equation.

Herman retired from General Motors in 1979 and joined the faculty of the University of Texas. At the time of his death, he had several papers in progress—on traffic problems and on the serviceability of pavements—as well as a book on cosmology, which he was writing with me. This polymath also did research on the theory of the English flute, the measurement of pupillary diameters and the infrastructure problem in American cities. He had a one-man show of his wood sculptures at the headquarters of the National Academy of Sciences in Washington, DC. Moreover, he was a published cartoonist in PHYSICS TODAY.

Robert Herman will be sorely missed by a host of scientists in many disciplines, and by me, as I struggle to finish our book.

RALPH A. ALPHER
Union College and Dudley Observatory
Schenectady, New York

Henry Margenau

Henry Margenau, a long-time member of the Yale University physics and philosophy faculties who contributed significantly to our early understanding of atomic, molecular and nuclear physics, and especially to the philosophical foundations of physics, died on 8 February 1997 in New Haven, Connecticut, at the age of 96.

Margenau was born in Bielefeld, Germany. After graduating from a "normal" school, which qualified him to teach elementary school, the 21-year-old Margenau escaped the hard times of the post-World War I German inflation by emigrating to Fremont, Nebraska. There, he worked first as a farmhand and then as a grocery store clerk. A customer at the store, the president of Midland College, finding that the young clerk had taught himself Latin and had read most of the Roman historians, arranged for Margenau to enroll at the college. The president then awarded him a bachelor's degree almost immediately (in 1924), after accepting his thesis on the philosophy of Seneca.

Margenau next enrolled as a graduate student at the University of Nebraska, where he worked as an assistant to the spectroscopist, Burton Evans Moore, even though he had never taken a course in physics or advanced mathematics. After Moore's death, Margenau completed some experimental work in Moore's laboratory, which he then published. This, the first of about 130 physics papers to be published over the next 40 years, was entitled "The Zeeman Effect in the Cerium Spectrum between 3000 and 5000 Å" and was published in the *Physical Review* in 1927. With a master's degree and a publication in hand, he was accepted as a graduate student in physics at Yale, where he was appointed instructor in 1928 and awarded his PhD in 1929. He remained at Yale throughout his career and retired in 1969 as Eugene Higgins Professor of Physics, after 41 years on the faculty.

After his first papers describing experimental work, Margenau worked primarily in theory. He was especially concerned with the phenomenology of atomic and molecular forces, nuclear forces, line broadening and plasma physics, though he did make a fairly significant fundamental calculation of the relativistic correction to the electron magnetic moment in 1939.

Physicist and philosopher, Henry Margenau was always very much a teacher; over the years, he taught most of Yale's elementary courses and many of its graduate courses in physics. This didactic bent led to a textbook on elementary physics (with William Watson and C. G. Montgomery) and one on quantum mechanics. With George Murphy, he wrote a compendium of theoretical techniques for the advanced student, *The Mathematics of Physics and Chemistry* (Van Nostrand, 1943), which was known to generations of younger physicists simply as "Margenau 'n' Murphy." And his book *The Nature of Physical Reality* (McGraw-Hill, 1950) was the touchstone of those students who wanted to understand the bases of the knowledge they sought.

By the late 1920s, after relativity and quantum mechanics had swept away much of the classical epistemology of physics, the deep questions of the character of reality raised by the new physics interested Margenau deeply. His second scholarly publication, entitled "The Problem of Physical Explanation" and published in the *Monist* in 1929, was but the first of his more than 70 articles concerned with the philosophy of science. Eventually, he found the explanation of reality more interesting than the specific calculations of pieces of that reality that he did so well. After 1965, until his health failed as he entered the tenth decade of his life, he worked wholly in philosophy.

Among his varied publications on the philosophy of science, Margenau's early technical work on the theory of measurement in quantum mechanics was especially notable. In his later years, Margenau, a deeply religious man and a member of the Commission of the World Council of Churches, moved away from the mainstream of philosophy and the philosophy of science toward explorations of his position that there are characteristics of the mind (and spirit) that are fundamentally apart from known physical mechanisms. He emphasized this position in the last of his nine books (with psychologist Lawrence LeShan), *Einstein's Space and Van Gogh's Sky* (MacMillan, 1982).

His friends remember Henry Margenau especially for his kindness and courtesy. As Paul Roman said of Margenau's friend and sometime collaborator, Eugene Wigner, Henry Margenau was a gentleman.

Robert Adair
Yale University
New Haven, Connecticut

Jean Weil Gallagher

Jean Weil Gallagher, an international leader in providing atomic, molecular and optical data, died in Baltimore on 5 October 1996 following a long fight with cancer. She was 59.

Born in Buffalo, New York, Jean received a BS in physics in 1958 from Purdue University, an MS in physics in 1960 from Columbia University and a PhD in physics from New York University in 1965.

In 1974, Jean joined the staff of the Atomic Collision Data Center at JILA in Boulder, Colorado, working there part-time while her children were young, then full-time and finally, in 1980, becoming its director. Jean's forte was identifying the most urgent requirements for data evaluation and persuading the most qualified people to do the job. Many distinguished scientists came to the center during her tenure and produced compilations that have served as benchmarks for many years.

In 1988, Jean moved to Gaithersburg, Maryland, to manage the National Institute of Standards and Technology's physics standard reference data programs. There, she critically evaluated data in atomic, molecular and optical physics (AMOP). In pulling together the vast AMOP literature, she developed remarkable insight into the many techniques used to generate these data and a masterful ability to assess their adequacy. Her compilations and evaluations represent some of the most authoritative sets of AMOP data and are *de facto* standards for the execution and reporting of such measurements.

At NIST, Jean was able to assemble and nurture perhaps the best group of AMO physicists ever put together to evaluate the data. Her emphasis on computerized databases has made the resulting evaluated data more widely used than ever.

In 1992, Jean became editor of the *Journal of Physical and Chemical Reference Data* and immediately expanded its coverage to meet the needs of the scientific community. She enjoyed interacting with the authors and reviewers of the journal and worked assiduously to maintain the high standard of their contributions.

Jean was an extraordinary woman who experienced both the demands and satisfactions of being a mother and a successful scientist. She was a person with wide outside interests, especially in art and nature. She was also a person of unassailable integrity, intelligence and dedication, who undertook a demanding career in the service of the larger community. Just as her outstanding compilations of evaluated data served as benchmarks, so her courage, humor and wisdom inspired all who knew her. Her friends across the world miss her.

Katharine B. Gebbie
John R. Rumble
National Institute of Standards and Technology
Gaithersburg, Maryland

Rolf Wideröe

Rolf Wideröe, who was born in Oslo, Norway, on 11 July 1902, died on 11 October 1996 in Nussbaumen-Baden, Switzerland. At the age of 20, while studying electrical engineering at the Technische Hochschule Karlsruhe in Germany, he conceived the idea of an "electron beam transformer" (later called a betatron). Like many others at that time, he was inspired by Ernest Rutherford's first observations of artificial nuclear transmutations three years earlier. When Wideröe tried to make the electron beam transformer the topic of his PhD thesis at Karlsruhe, he was turned down.

Moving to the Technische Hochschule Aachen, he found the necessary support for the construction of such a machine, but his accelerator did not work. During his studies, however, Wideröe realized for the first time that the magnetic field strength at the beam orbit had to have a certain relationship to the magnetic flux inside of the orbit (the famous Wideröe 1:2 condition).

To get his PhD he quickly had to invent another new accelerator idea: He turned to the acceleration of heavy ions on a straight path, making use of an idea that a Swede, Gustav Ising, had published in 1924. But in place of Ising's shock wave excitation of drift tubes by way of delay lines, Wideröe applied RF voltages on drift tubes of appropriate lengths. He showed theoretically as well as experimentally that,