physics in 1948 and a doctorate in mathematics in 1954 from the Swiss Federal Institute of Technology in Zurich. He pursued his initial professional career, from 1951 through 1961, in the US. He worked at General Electric and Bell Telephone Laboratories on vibrations, waves and information theory. With the dawn of modern plasma physics, he joined the Aerospace Corporation, where he carried out research on confinement, stability and field-plasma interactions from 1956 until 1961. Then he returned to Switzerland in 1961 to centralize the plasma research program there. A leading figure in the plasma program of Euratom, Weibel became a professor of physics at the Swiss Federal Institute of Technology in Lausanne. Out of his many achievements, three major ones include the analysis of intense electromagnetic effects (ponderomotive force) in plasmas; the principles and applications of dynamic stabilization; and the detailed study of microscopic instabilities in anisotropic plasmas, a central issue in plasma and fusion physics. His direct and illuminating approach to analysis and his instinct for accuracy and completeness were exemplary. One of the best-known instabilities of magnetized plasmas bears Weibel's name.

In December 1981, after 20 years in this position, Weibel resigned as director of the Center. It had acquired, under his stewardship, an international staff, reputation and established role in plasma research. In recent years he emphasized the overriding importance of fundamental research in plasmas, the need to examine openly the complexities of paths to fusion, and the responsibility of scientists and research leaders to the community they serve. In memory of his contributions and leadership, the APS Division of Plasma Physics dedicated a special session at its annual meeting in Los Angeles on 10 November 1983.

R. A. STERN
University of Colorado
Boulder

Isidor Walerstein

Isidor Walerstein, professor emeritus of physics at Purdue University, died on 11 June 1983 in Jerusalem, Israel, where he had made his home since his retirement in 1971. He was born in Lubartow, Poland, on 1 March 1905 and, as a child, emigrated with his parents to North America. He received his AB degree from the University of Toronto in 1926 and his PhD degree from the University of Chicago in 1929. He joined the Purdue physics department in that year as an instructor, advanced to assistant professor in 1931,

WALERSTEIN

associate professor in 1939, and full professor in 1942.

During his first year at Purdue, Walerstein and Karl Lark-Horovitz, who had just taken charge of the physics department, redesigned the demonstration experiments for the general physics lectures. Many of the demonstrations they prepared then are so effective that they are still in use.

His involvement in the new research program was also immediate. He played a major role in the design and construction of the first large piece of research equipment in the department, a research-quality electromagnet, and used it in a varied program of research in optics and spectroscopy, including studies of resonance spectra, the mercury spectrum, and Zeeman spectra.

At the beginning of war research in 1942 he participated in the early studies of the properties of germanium, which led to the foundation of the solid-state physics program at Purdue.

After Walerstein retired from Purdue in 1971, he spent two years at Tel Aviv University advising on the needs of the physics department and preparing a physics syllabus in Hebrew now used in a number of Israeli universities.

VIVIAN JOHNSON
HUBERT JAMES
Purdue University

Shang-keng Ma

Shang-keng Ma, professor of physics at the University of California, San Diego, died at his home in La Jolla on 24 November 1983. He was a leading theoretical physicist and educator in statistical mechanics.

Ma was born in Szechuan, China, in 1940. In 1959 he transferred from the National Taiwan University to the University of California, Berkeley, where he received his BS (1962) and PhD (1966) degrees. He wrote his thesis, "Correlations of Photons from a Thermal Source," under the supervision of Kenneth Watson.

Ma came to UCSD for postdoctoral work with Keith Brueckner in 1966; in less than a year his extreme promise was recognized with a faculty appointment. He exhibited great versatility in his work on problems in quantum mechanical many-body theory, which included charged Bose systems and non-uniform Fermi gases. In 1968 he was invited to the Institute for Advanced Study in Princeton, where he collaborated with Shau-Jin Chang on the infinite-energy limit of Feynman diagrams relevant to high-energy processes in quantum electrodynamics. With Roger Dashen he produced a series of papers on the S-matrix formulation of statistical mechanics.

Ma is perhaps most recognized for his contributions to the theory of critical phenomena. As a visiting professor at Cornell University in 1972, he became involved with the early developments of the renormalization-group theory of critical phenomena. He was instrumental in the formulation of the $1/N$ expansion, together with its implementation in the calculation of the critical exponents for a variety of systems. In collaboration with Bert I. Halperin and Pierre C. Hohenberg he generalized the renormalization group theory to dynamical critical phenomena.

Ma is also well known for his lucid review articles of the renormalization group theory. His interpretation and refinement of the conceptual and the calculational ideas unraveled much of the initial confusion in this complex subject and contributed significantly to our current understanding.

While on sabbatical leave at Berkeley, between 1973 and 1974, Ma investigated the problem of dynamical symmetry breaking and further extended his work on dynamical critical phenomena. In 1974 Ma was invited to write a monograph on the rapidly developing field of critical phenomena. The result was his book, *Modern Theory of Critical Phenomena* (1976), which has provided the foundation for many scientists currently involved in condensed-matter physics and continues to be a standard resource in this field.

In 1976, visiting at Saclay, Ma developed the Monte Carlo renormalization group technique. His idea of a hybrid theory, constructed from the union of two disjoint techniques, has evolved into a powerful technology that is widely used today for the numerical study of critical phenomena.

Ma also made significant contributions to the theory of random systems. In 1975, with Yoseph Imry, he published the seminal paper on the effect of a random magnetic field on ferromagnetic order. Their model has come to be known as the random field Ising

MA

model. Their work, predicting the value of the lower critical dimension, continues to stimulate intense and controversial research (see PHYSICS TODAY, July, page 17).

In 1981, Ma formulated the "coincidence counting" method for the calculation of entropy from the phase space trajectory. He felt strongly that such a dynamical formulation of entropy was crucial for understanding random and other systems exhibiting metastability.

Ma had a deep interest in furthering scientific development and education in his native land. He believed very strongly that fundamental science should be taught in the native language in any country. He taught at Tsing Hua University, Taiwan, in 1977 and in 1981, and wrote an advanced text on statistical mechanics in Chinese. This book, published shortly before his death, is the culmination of his lifelong interest in statistical mechanics. Based in dynamics, it eschews the traditional approach built on the Gibbs ensemble. An English translation is in progress.

In addition to being a dedicated teacher and physics scholar, Ma had a broad range of cultural and social interests. He was a frequent contributor to Chinese newspapers of commentary on contemporary political issues. He was a gifted painter and in recent years had extended his interest in music by learning to play the classical Chinese *ch'in* (zither).

Despite his declining health, Ma insisted on continuing to teach a graduate course in statistical mechanics until a few days before his death. The required energy and determination came naturally from his quiet dignity, enthusiasm and passionate concern to communicate his unique insights to his students.

His colleagues and friends at UCSD have founded a scholarship and physics prize fund in his memory, and invite those who wish to join in this tribute to send their (tax-exempt) contributions to: Shang-keng Ma Memorial Fund, c/o Department of Physics, B-019, University of California, San Diego, La Jolla, California 92093.

JOSEPH C. Y. CHEN
JEFFREY PRENTIS
SHELDON SCHULTZ
University of California
San Diego

William R. Fredrickson

William R. Fredrickson died on 9 January 1983 at the age of 79. A member of the physics department of Syracuse University from 1928 to 1971, he served as its chairman longer than any other person, from 1939 to 1965.

Fredrickson graduated from the University of Chicago in 1924 and received his PhD in molecular spectroscopy there in 1928. When he came to Syracuse he was one of six faculty members in the physics department. By the time he retired as chairman, the faculty had grown to 22 and occupied a new building that he had planned. Even though his main activities were teaching and administration, he found enough time to supervise infrared research, to encourage young faculty in their own research and to serve on national committees planning the future of infrared research. Despite his many commitments, he was always available to any of his students who wanted to see him, even though his lectures in astronomy had enrollments over 300. He was named the William R. Kenan Professor of Physics in appreciation of his devotion to undergraduate studies.

In 1978, in recognition of his 50 years of service to the University, the William R. Fredrickson Scholarship Fund was set up by former students and the department faculty to provide a living tribute to the inspiration he had provided during his leadership.

HENRY LEVINSTEIN
JOHN W. TRISCHKA
Syracuse University □

FREDRICKSON