sota); **George K. Wong** (Northwestern University); **Frank A. Wilczek** (Princeton University); **Bernard A. Weinstein** (Purdue University); **F. Barry Dunning** (Rice University); **Haruo Kojima** (Rutgers University); **Robert E. Tribble** (Texas A&M University); **Paul E. Boynton** (University of Washington); **Talbert S. Stein** (Wayne State University); **Carl E. Carlson** (College of William and Mary) and **Itzhak Bars** (Yale University).

At Bell Laboratories, **Alan G. Chynoweth** has been named executive director of the electronic device, process and materials division; he was formerly director of the materials research laboratory.

John A. Wheeler, who has taught physics at Princeton University since 1945, will take up a position as professor of physics at the University of Texas, Austin on 1 September. At that time, Wheeler will become professor emeritus of Princeton.

George E. Boyd, formerly assistant director of the Oak Ridge National Laboratory and now professor of physical chemistry at the University of Georgia, has been named recipient of the 1976 Charles H. Stone Award of the American Chemical Society in recognition of outstanding service to the chemical profession. Boyd has done extensive work in nuclear energy and is an authority on the chemical aspects of nuclear power.

Gerald T. Garvey, formerly professor of physics at Princeton University, has become director of Argonne National Laboratory's physics division.

Recently appointed coordinator of the Sherman Fairchild Laboratory at Lehigh University is **Sidney R. Butler,** professor of metallurgy and materials science.

The new head of the ISABELLE design study and associate director of Brookhaven National Laboratory is **James R. Sanford,** formerly associate director for program planning at Fermi National Accelerator Laboratory. At Brookhaven, Sanford will be responsible for the design and eventual construction of its 200 GeV storage-ring facility.

Denys Wilkinson, head of the department of nuclear physics at the University of Oxford, will assume his new position as vice-chancellor of Sussex University in September; Wilkinson will also become professor of physics at Sussex.

The 1976 Space Award of the American Institute of Aeronautics and Astronautics has been presented to **Riccardo Giacconi,** associate director for high-energy astrophysics at Harvard University's Center for Astrophysics. The award, which consists of a certificate and honorarium, cited Giacconi for his contributions to x-ray astronomy.

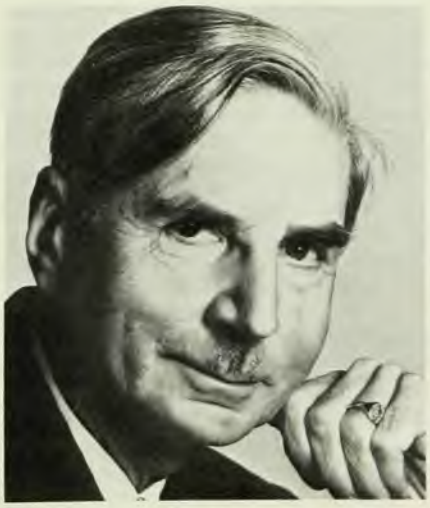
The following changes at Los Alamos Scientific Laboratory have been announced: **Robert N. Thorn** has been appointed associate director for weapons and **Raymond Pollock, Jr** has become theoretical-design division leader, in the position previously held by Thorn. **George I. Bell** has been appointed alternate theoretical division leader.

obituaries

Walter Schottky

Walter Schottky, who was known for the numerous effects and devices that bear his name, died 4 March in Pretzfeld, Germany at the age of almost 90. He was born 23 July 1886 in Zürich, Switzerland and was the son of the mathematician Friedrich Schottky. His youth was spent in Berlin where he entered the University and studied under Max Planck for his doctorate, which he obtained in 1912 with a paper on special relativity. However, this subject was not the point of departure for his subsequent work in solid-state physics and electronics—it was rather the fields of thermodynamics and statistics, to which his master and teacher had contributed so much.

Among Schottky's own contributions to these areas was his book *Thermodynamics* (1929). The following passage from the preface shows the sure eye he kept to the future: "The time when man could dispose freely over the resources of energy and materials given to us by nature will one day appear to belong to an era



SCHOTTKY

obituaries

past, probably in the lifetime of our children."

A man of remarkable insight, he perceived the "hole" in the valence-band structure of a semiconductor—what he called the "defect electron"—as far back as 1929, when he wrote ". . . in a certain sense the places available for conduction electrons are occupied by static electron space charges and the passage of conduction electrons thereby blocked." This anticipated the significance of the "hole" in certain semiconductors two years before Werner Heisenberg (1931) finally clarified the subject by quantum mechanics. Thus was set the first milestone in modern semiconductor engineering.

Schottky selected his objectives so skillfully that his work not only benefitted pure physics but also found practical application as well. He is recognized as the originator of fundamental physical studies on starting-current and space-charge laws in electronic tubes, electron emission in metal and oxide cathodes and shot and flicker effects. He invented the screen-grid tube in 1915 and in 1918, he discovered the super-heterodyne principle with if amplification—this same principle is employed in every radio and television set today. He also explained imperfections in semiconductors and, above all, created the barrier theory of crystal rectifiers (1938). Schottky emission in cathodes, Schottky defects in semiconductor crystals, Schottky diode and Schottky transistor–transistor logic testify to the further milestones he set in modern electronics.

Being a widely versed research scientist, he worked both as a professor of theoretical physics at the University of Rostok, 1923–27, and as industrial researcher at Siemens AG from 1927 until the end of his life.

Despite his fame, Schottky was modest and selfless. He always refused the limelight, but knew how to reach out beyond his immediate circle of colleagues to young people, whom he always encouraged. The work bearing his name will serve as his memorial.

HEINRICH WELKER
Siemens AG
Erlangen, West Germany

Harry Nyquist

Harry Nyquist, a retired Bell Laboratories scientist who was known for his inventions and theoretical studies in communications, died 4 April at the age of 87.

Nyquist was awarded 137 patents during his 37 years with the Bell System and was best known for his discovery of the conditions necessary to keep feedback circuits stable, called the Nyquist Criterion. It is used not only in the study of electronic devices, such as amplifiers, but also in the study of human-regulative processes.

Many of his inventions and theories are widely accepted as fundamental to voice, picture and data transmission. He was responsible for the development of a method of transmission presently used in television broadcasting and also devised a way to correct image distortion caused by delayed transmission. He was the first to establish a quantitative explanation of thermal noise and, through theoretical analysis, determined the minimum band frequencies required for communication signal transmission—these studies laid the foundation for modern information theory and data transmission.

Born in Sweden, 7 February 1889, Nyquist emigrated to the US and received his doctorate in physics from Yale University in 1917. He joined Bell Labs in 1934 and held the position of assistant director of systems studies at the time of his retirement in 1954. He received many awards in recognition of his scientific contributions, including the Rufus Oldenburger Medal of the Society of Mechanical Engineers (1975).

Charles Manneback

Charles Manneback, an internationally known physicist, died 15 December 1975 in Brussels. At the time of his death he was secretary emeritus of the Royal Academy of Belgium. He was a graduate of the University of Louvain and the Massachusetts Institute of Technology where he acquired a PhD in 1922 under Vannevar Bush.

A true humanist with perfect fluency in many languages and interests in philosophy and literature, Manneback was capable of discussing with equal competence Bergson's work, Dante's poetry or the most sophisticated subtleties of modern physics. Electromagnetism was his speciality—in his early years, he was one of the first to clarify a number of difficult problems related to electromagnetic radiation and the skin effect. He was also active in education as a professor of theoretical physics at the University of Louvain (1922–64).

Manneback's frequent travels brought him in contact with many outstanding figures, such as Peter J. W. Debye, whom he met in Zürich in 1926. This was the beginning of Manneback's numerous contributions to the theory of molecular spectra, which are well referenced in "*Der Smekal Raman Effect und Ergänzungsband*," by Karl W. F. Kohlrausch and in "Infrared and Raman spectra of polyatomic molecules," by Gerhard Herzberg. His work in this area cast new light on the effect of anharmonicity and coupling between atoms and the substitution of isotopes. His most recent work in spectroscopy, published in 1969 with Paul