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career at the University, first on a boron hydride project under H. I. Schlesinger and then in the fission product group at the Metallurgical Laboratory (Atomic Bomb Project), where he did pioneering work on rare-earth nuclides. The latter studies formed the basis of his doctoral thesis. From 1947 to 1950, on the staff of the Physics Division at Argonne National Labora-



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tory, he carried out studies on neutron diffraction and small-angle neutron scattering. While in Israel, he organized a radiochemistry laboratory and initiated a survey of the radium and radon content of the springs and wells of Israel. He also investigated the production of ^{39}Cl in the lower atmosphere by cosmic rays and the application of ^{85}Kr to geochemical surveys.

His central and most persistent interest was in nuclear reactions induced by high-energy projectiles, pursued at the University of Chicago synchrocyclotron, the Berkeley Bevatron, the Argonne ZGS and, most recently, Fermilab. He did pioneering work on meson-induced reactions, fragmentation reaction and the analysis of fragment recoil measurements. During the last few years he made a major effort to correlate the extensive literature on high-energy nuclear reaction mechanisms, especially that involving fragment recoils, in terms of some simple, unifying principles.

In 1961, while still on the staff of the Chemistry Division at Argonne National Laboratory, Les was appointed professor of physics at the then two-year undergraduate branch of the University of Illinois in Chicago. Moving to the University full time in 1964, he was

head of the physics department from 1964 to 1967, during which time the two-year school started to become a comprehensive graduate campus. Under his leadership the graduate faculty was greatly expanded and an MS program was successfully initiated. His interest in communicating the excitement and broad perspectives of science found a successful outlet in his favorite course, Natural Science for Nonscience Majors, for which he prepared a draft manuscript of a book, "The Evolving Universe."

ARNOLD R. BODMER

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Emerson M. Pugh

Emerson Martindale Pugh, professor emeritus of physics at Carnegie-Mellon University, and his second wife Kathryn died in an automobile accident in Fremont, Ohio, on 1 July 1981.

Pugh was born in 1896 in Ogden, Wyoming (now a part of Utah). He saw active service as an engineering officer in the US Navy in 1918-19 and worked as a cashier at Unita County State Bank in Mountain View, Wyoming in 1919-20. His early adventures at sea and the hardships of life in a frontier town are recalled with humor in his autobiography *Wyoming Scientist: From Horses to Spaceships*.

He obtained a doctorate in physics under Robert A. Millikan's guidance at the California Institute of Technology in 1929. Having started teaching as an instructor in physics at the Carnegie Institute of Technology (now Carnegie-Mellon University) in 1920, Pugh became a full professor in 1948.

Most of his basic research in physics concerned the Hall effect of ferromagnets. He published a few experimental investigations between 1928 and 1940, despite his heavy teaching loads and sparse research funds. Following World War II, financial support from the Office of Naval Research and other agencies enabled him to equip a modern laboratory with instruments including a 125-kW magnet designed by Francis Bitter and manufactured by A. D. Little Co., which bore the serial number 2. Between 1950 and 1965, he carried out systematic measurements on ferromagnetic elements and alloys together with his many students and collaborators. To the present day, their work remains the most comprehensive and reliable source of Hall data for concentrated ferrous alloys.

They found the Hall voltage varied linearly with field above ferromagnetic saturation, with a (very small) slope R_0

called the ordinary Hall coefficient. As in nonmagnetic metals, R_0 gives important information on the nature and concentration of electrical carriers. In the case of Ni-Cu, Ni-Fe and Ni-Co alloys, Pugh and his students concluded that 4s electrons of majority spin carry most of the current. This constituted an experimental verification of ideas proposed by Nevill Mott in 1936. Transport experiments by other authors such as I. A. Campbell have confirmed Pugh's conclusions and generalized them under the name of the "two-current model."

Pugh's extensive data stimulated theoretical work on the explanation of the main, truly ferromagnetic, part of the Hall voltage, described by the "anomalous" Hall constant R_1 . Although already noticed by Edwin H. Hall in his second paper in 1880, the large magnitude and the peculiar temperature dependence of the anomalous Hall effect of iron remained unexplained for another 80 years. While the ordinary Hall effect is related to the Lorentz force and to free motion of electrons, Jacob Smit, Walter Kohn and Joaquin M. Luttinger finally showed theoretically in 1958-59 that the anomalous effect is associated with spin-orbit interaction and with electron collisions.

By measuring R_1 in ternary alloys such as Ni-Fe-Cu, Pugh and his students gathered the most complete and useful existing body of facts concerning the dependence of R_1 on alloy composition. Their information, more useful than anything obtained from binary series, has provided the crucial clues for the theoretical understanding of how the sign of R_1 is influenced by the "energy-split" nature of the 3d band of alloys.

During and after World War II, Pugh directed experiments on shaped charges as part of the Carnegie Insti-

tute of Technology Explosives Research Program at Bruceton. He also made an important and elegant contribution to the theory of penetration of steel armor by hypervelocity metal jets.

During his long teaching career, Pugh guided and encouraged countless students, many of whom went on to distinguished careers in physics and engineering. He devoted considerable attention to the development of new physics curricula and to the introduction of metric units in engineering education. With his son Emerson William, he was the author of the widely used textbook *Principles of Electricity and Magnetism*, and with George H. Winslow, he wrote *Analysis of Physical Measurements*.

L. BERGER

Carnegie-Mellon University

Krzysztof M. Serkowski

Krzysztof M. Serkowski, research professor in the Lunar and Planetary Laboratory of the University of Arizona and astronomer at its Steward Observatory, died after a long illness on 7 October 1981. He was 50 years old. Despite his being afflicted by amyotrophic lateral sclerosis for eight years, he maintained a cheerful outlook and strong involvement in his work.

Serkowski, born and raised in Warsaw, obtained his doctor's degree in astronomy from Warsaw University in 1958. He worked at the Lowell Observatory in Flagstaff and at the Mount Stromlo Observatory near Canberra, Australia, until he came to the University of Arizona in 1970.

Serkowski's major interests and accomplishments were in polarimetry of starlight and in the design of polarimeters and spectrometers. He executed a large survey of interstellar polar-

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