# John Beverley Oke

Judith Cohen

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Astrophysics in Munich, Germany (1961), and the British Atomic Energy Establishment in Harwell (1961). He received the Turkish Presidential Science Prize in 1972 and the Kemal Ataturk Society Prize from that society in 2000. He was particularly pleased by this honor because of his lifelong adoration of Ataturk.

Behram possessed a sharp wit and an open demeanor, qualities important not only for attracting leading scientists to the center, but also for enlisting the participation of local philanthropists to host conference banquets in their homes and on their yachts.

Behram's life was characterized by two powerful visions. First, there was his own research on unified field theory, which persisted when gravitation became a central issue in astrophysics and particle physics. In his later work, he emphasized a running fundamental length parameter related to the cosmological constant and stressed the capacity of his theory to encompass both short- and long-range attractive and repulsive interactions. That work had profound implications for the expansion of the universe. His second vision, which resulted from a deep humanist belief in the interactions of humans, was to convene, in an atmosphere of calm deliberation, some of the greatest minds of our time to investigate the scientific, political, and economic problems facing our civilization. His success in fulfilling both of those visions is noteworthy.

**Arnold Perlmutter**
*University of Miami*
*Coral Gables, Florida*
**Sydney Meshkov**
*California Institute of Technology*
*Pasadena*

## Edward Bryant Nelson

Edward Bryant Nelson's long professional career as a physics teacher and research physicist is identified principally with Columbia University and the University of Iowa. He died of age-related complications on 30 April 2004 in Gainesville, Florida, where he and his wife Judith moved after his retirement from the Iowa faculty in 1983.

Born on 26 July 1916 in McHenry, Kentucky, Nelson earned a BS (1937) from Western Kentucky State Teachers College in Bowling Green, an MS (1938) from Vanderbilt University, and a PhD (1949) from Columbia University, all in physics. During the period 1938–49, he taught physics at Western Kentucky and at Columbia and was a research physicist in the Columbia component of the Manhattan Project.

Edward Bryant Nelson

Nelson and John E. Nafe, fellow graduate students in I. I. Rabi's laboratory at Columbia, used the atomic beam magnetic resonance method to make the first experimental measurements of the hyperfine structure of atomic hydrogen and deuterium. The findings of Nafe, Nelson, and Rabi were published in the *Physical Review* in 1947. Behind the closed door of their laboratory, the two hard-working students referred to their mentor as "I. I.," as in "Aye, aye, sir," after responding to his frequent inquiry, "Any results yet?"

In an extended follow-up paper (*Physical Review*, 1948), Nafe and Nelson reported values of the hyperfine transition frequencies with improved precision, namely 1420.410 (±0.006) MHz for hydrogen and 327.384 (±0.003) MHz for deuterium. The relatively small (0.25%) but glaring discrepancy between their experimental values and the prevailing theoretical expectations for the electron spin-flip transition in the ground state of these atoms led theorists to identify the "anomalous" magnetic moment of the electron in the context of relativistic quantum electrodynamics.

In a quite different context, the Nafe–Nelson value for the hyperfine transition frequency in hydrogen facilitated the search for the corresponding emission from atomic hydrogen in remote astrophysical systems. Such emission, discovered by Harold I. Ewen and Edward M. Purcell in 1951, soon became a major component of radio astronomy. Nelson and Nafe also collaborated on two closely related *Physical Review* papers (1949), "The Hyperfine Structure of Tritium" and "A Comparison of the *g* Value of the Electron in Hydrogen with That in Deuterium," based on their respective PhD dissertations.

In 1949, Nelson joined the physics faculty at Iowa and turned his talents to teaching and to research in experimental nuclear physics using proton beams from Iowa's nuclear accelerators. In collaboration with James A. Jacobs, Richard R. Carlson, and a sequence of graduate students, he specialized in nuclear gamma rays, nuclear energy levels, and the spectra and angular correlations of the products resulting from the bombardment of a wide variety of elements. After Iowa acquired a large Van de Graaff accelerator, he conducted experiments with helium-3 beams up to 6.2 MeV and with lithium beams up to 13.8 MeV.

Throughout his long tenure at Iowa, Nelson was a devoted and enthusiastic teacher. He was a leader in the development and supervision of the undergraduate laboratories and in the training of graduate teaching assistants. His *Physics Laboratory Manual*—the first edition was published in 1961 (William C. Brown)—was used for many years at Iowa and elsewhere. The career total of enrollments in his courses exceeded 10 000 student-semesters. He was active in the programs of the Iowa Academy of Science and the American Association of Physics Teachers, and he wrote and edited examinations for the American College Testing Service.

During the 1960s, Nelson helped design the new buildings for housing the physics and astronomy department and gave special attention to lecture rooms and teaching laboratories. From 1963 until his retirement in 1983, he served as associate head of the department and as principal adviser of undergraduate majors.

Nelson is remembered with affection and admiration by his colleagues at Iowa and elsewhere and by many friends in Iowa City and Gainesville.

**James A. Van Allen**
**Edwin Norbeck**
*University of Iowa*
*Iowa City*

## John Beverley Oke

John Beverley Oke, emeritus professor of astronomy at Caltech, died on 2 March 2004 of heart failure at his home in Victoria, British Columbia.

Born on 23 March 1928 in Sault Sainte Marie, Ontario, Oke earned his bachelor's degree in physics in 1949 and master's degree in astronomy a year later, both from the University of Toronto. He moved to Princeton University, where he earned his doctorate

John Beverley Oke

in astronomy in 1953 under Lyman Spitzer Jr. In his thesis, he constructed theoretical models of O stars. That same year, Oke joined the faculty of Toronto as a lecturer in astronomy and, in 1955, was appointed an assistant professor.

In 1958, Oke moved to Caltech to take an assistant professorship. He was the person most responsible for keeping the 5-meter Hale Telescope at the Caltech-operated Palomar Observatory a first-rate facility by building a sequence of progressively more complex, elegant instruments to improve the telescope's light-gathering power. He began with a single-channel scanner. Then, as photomultipliers became more widely available, he designed and built the multichannel scanner, which he completed in 1968. Its ability to measure the absolute energy distribution of extremely faint objects benefited many astronomers over the years.

In the late 1970s, Oke and James Gunn used the new technology of CCDs to design and build a double spectrograph—one of the first uses of those devices for astronomical spectroscopy. The instrument has been widely copied and, with upgraded detectors, is still in use at the Hale Telescope. That project was a prelude to Oke's masterpiece, the Low-Resolution Imaging Spectrometer (LRIS), which he built for the first light of the inaugural Keck 10-m telescope. LRIS made possible many of the early successes of the Keck telescopes.

Oke realized that the absolute calibration of astronomical measurements was not sufficiently precise and was introducing significant uncertainties into the detections his new instruments could achieve. To remedy those problems, he and his postdoctoral fellow Rudy Schild placed a crucible of molten platinum (that is, a blackbody cavity) on a high tower at Palomar and then, using a 4-inch telescope, observed the crucible and the very bright standard star Vega. At that time, the resulting improved absolute flux they determined for Vega as a function of frequency had an uncertainty whose major contribution came from Planck's constant.

All of the instruments Oke built were created under difficult financial constraints, yet in each case, he achieved essential functionality without excessive and expensive complexity. He was a skilled instrument designer, and it was my privilege and pleasure to work with him on several projects, including the LRIS.

In addition to instrument design and construction, Oke also carried out an active research program on understanding the spectra of galaxies and quasi-stellar objects, the evolution of clusters of galaxies, and the properties of x-ray binaries. He retired from Caltech in 1992 and returned to his native Canada, where he worked part time at the Dominion Astrophysical Observatory in Victoria.

With his small team and minimalist elegant approach, Oke was among the small number of serious and excellent astronomer–instrumentalists so crucial to the development of our science. Palomar and Keck users owe him an enormous debt of gratitude for the years of effort he put into his instrument work. Yet Oke did not win a prize, nor was he given an endowed chair at Caltech. He was not the director of an observatory, although he was the associate director of the Hale Observatories from 1970 to 1978. It is only now after his death that the Palomar and Keck communities fully sense the breadth of his contributions and the magnitude of our loss.

**Judith Cohen**
*California Institute of Technology*
*Pasadena*

## Hugh Campbell Paxton

Hugh Campbell Paxton, who made pioneering contributions in experimental criticality and the specialty of criticality safety, died on 25 December 2003 in Albuquerque, New Mexico.

Born in Los Angeles on 29 April 1909, Hugh attended UCLA, where he studied physics and earned an AB degree in 1930. During the early 1930s, he worked in the development division of the Bell Telephone Laboratories in California. He began graduate studies at the University of California, Berkeley, in 1932 and received his

Hugh Campbell Paxton

PhD in physics in 1937 under the direction of Ernest Lawrence.

That same year, he joined Frédéric Joliot at the Laboratory of Nuclear Chemistry of the Collège de France in Paris and began work to design and build a cyclotron. However, his planned two-year stay was cut short in 1938, when he and his wife were advised to return to the US because of the perceived threat of war. For the next four years, Hugh was an instructor in physics at Columbia University in New York City and continued his work in nuclear physics. He shifted to wartime activity in gaseous diffusion technology at Columbia's Substitute Alloy Materials Laboratory and at the Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee. Peacetime found him engaged in precision casting development at the Sharples Research Laboratories in Philadelphia.

In 1948, Hugh became leader of the criticality group at the Los Alamos Scientific Laboratory when the science of criticality was just beginning and the safety of operations with fissionable materials was not yet formalized. He and Dixon Callihan of Oak Ridge Laboratory organized and systematized the existing data in a series of Atomic Energy Commission, Los Alamos, and Oak Ridge documents. Those data provided a foundation for conducting experiments and calculational studies, whose results were the basis for safety in operations of fissionable materials.

Some especially important experiments carried out under Hugh's direction established the bare and reflected metallic critical masses of plutonium-239 and highly enriched uranium-235. Further experiments at