

president of the American Association of Physics Teachers (1966–67). In 1981, AAPT gave her its inaugural Melba Newell Phillips Award.

Phillips received other honors. In 2003, the American Physical Society bestowed on her its Joseph A. Burton Forum Award. She received Vanderbilt University's Guy and Rebecca Forman Award for Outstanding Teaching in Undergraduate Physics in 1988; the American Institute of Physics's Karl Taylor Compton Medal for Leadership in Physics in 1981; and AAPT's Oersted Medal in 1974.

We have lost a good and kind friend, an outstanding scientist, a courageous woman, and a great educator in physics.

Joel Lebowitz

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Raja Ramanna

On 24 September 2004, with the death of Raja Ramanna following cardiac arrest in Mumbai, India, one more star disappeared from India's scientific sky. To most of the country's citizens, Ramanna was the father of India's test nuclear explosion in the Rajasthan desert on 18 May 1974. But he was much more than that. Raja, as he was known to his close friends, was a multifaceted personality—an eminent scientist, an able administrator, a gifted musician, a scholar of Sanskrit literature and philosophy, and above all a complete human being.

Born on 28 January 1925 in Tumkur, a town in southern India, Ramanna received his early education in Mysore and Bangalore. After obtaining his BSc in physics with honors from Madras Christian College in Chennai, India, he proceeded to King's College London for graduate studies in nuclear physics. In 1948 he obtained his PhD, under F. C. Champion, for work on the design and fabrication of a modified ionization chamber for studying angular distribution of ionizing particles.

The following year, Ramanna returned to India to join the Tata Institute of Fundamental Research in Bombay. As a young member of the team under Homi Jehangir Bhabha, the architect of India's nuclear program, he was a leader in organizing the physics program at the Atomic Energy Establishment, Trombay (now the Bhabha Atomic Research Centre, or BARC).

His early investigations involved neutron thermalization in several moderating assemblies as a part of the studies relating to the design and construction of India's first research reactor, Apsara. Once commissioned, Apsara made intense thermal neutron beams available for basic research, thus prompting Ramanna to initiate a program of experimental investigations of thermal neutron-induced fission of uranium-235. As a result, the Trombay fission group was created and became internationally recognized for its high-quality investigations, despite meager resources, and use of indigenously designed and fabricated equipment.

Ramanna's most important contribution to fission theory, however, is his stochastic theory of fragment mass and charge distributions in fission. The theory, which is based on the model of a random exchange of nucleons between two nascent fission fragments before scission, explains most of the observed features of fragment mass and charge distributions in low-energy fission and the features' dependence on the excitation energy of the fissioning nucleus. Direct experimental evidence for nucleon exchanges between nuclei in close proximity would come much later, though, with the advent of heavy-ion accelerators and studies of nuclear collisions at near-barrier energies.

Under Ramanna's leadership, the Trombay fission group discovered not only that shell effects vanish with excitation energy, but also what consequences that disappearance has on the production of super-heavy nuclei through heavy-ion fusion reactions. The necessity of producing cool compound nuclei as a precursor to super-heavy element production is still recognized even today. Another novel



Raja Ramanna

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contribution of Ramanna's was a geometrical interpretation of atomic and nuclear binding energies.

India's first nuclear test, in 1974, is undoubtedly a moment of great achievement for Ramanna and his associates at BARC. While the credit for the success of the test goes to many spread over several institutions, it was at BARC where all the design and development work had been done under the direct leadership of Ramanna.

Ramanna's influence on India's nuclear program carried over into the area of human resource development. He singularly contributed to the creation in 1958 of the Atomic Energy Training School of what was then the Atomic Energy Establishment, Trombay. Under the leadership of Ramanna, the school trained staff in multiple disciplines for the country's nuclear establishment. Apart from the nuclear program, he was involved in the development of several higher institutions of learning and research in India.

Ramanna occupied many prestigious positions in the Indian government and shaped its programs. He was scientific adviser to India's defense minister (1978–82) and chairman of the country's Atomic Energy Commission (1983–87). As the chief of defense research and secretary for defense research, Ramanna made important contributions to India's efforts to design and manufacture its own defense equipment. He also had a brief stint in 1990 as minister of state for defense in the government's Union Cabinet.

Ramanna's death is indeed a loss to India, particularly to the Indian scientific community.

**Valangiman Subramanian
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Dale Edward Sayers

Dale Edward Sayers, a professor of physics at North Carolina State University who made pioneering contributions in x-ray spectroscopy, died on 25 November 2004 in Raleigh. He had suffered a heart attack while jogging several weeks earlier.

Born on 29 November 1943 in Seattle, Washington, Dale earned his bachelor's degree in 1966 in physics at the University of California, Berkeley, and his master's and doctoral degrees, both in physics, in 1972 at the University of Washington, Seattle. His PhD research, completed in 1971 under the direction of one of us (Stern), centered on developing a new local-structure determination tech-

nique named extended x-ray absorption fine structure.

The first EXAFS paper, which Dale wrote with Stern and Farrell Lytle in 1971, opened this new field. EXAFS became an important experimental technique for local-structure studies at synchrotron radiation sources worldwide. The researchers' effort also led to the establishment of the International XAFS Conferences, the 12th of which convened in 2003 in Sweden. Dale was also instrumental in establishing the International XAFS Society (IXS), now a subunit of the International Union of Crystallography. The IXS organizes the International XAFS Conferences, sets standards in the field, and conducts other activities.

Soon after he started his PhD research, Dale began experiments at the Boeing Scientific Research Laboratory in Seattle in collaboration with Lytle. On completing his PhD, he became a research engineer at Boeing Aerospace Co in Seattle before returning to the University of Washington as a postdoctoral research associate. In 1976 he joined the physics faculty at NC State and flourished there for the remainder of his career. Dale went on sabbatical in France as a visiting professor at the Université de Paris–Sud in Orsay from 1982 to 1983 and at the Université Joseph Fourier in Grenoble in 1996. He also was a visiting scientist at the European Synchrotron Radiation Facility in Grenoble in 2000 and the Advanced Light Source in Berkeley, California, in 2000.

A master in the art of collaboration, Dale had wide-ranging scientific interests, from his primary focus on the applications of synchrotron-radiation-based techniques to the study of complex materials. He applied the EXAFS technique to studying many systems,

including amorphous alloys, the semiconductor–metal interface, catalysts, electrochemical systems, environmentally contaminated systems, and metalloproteins. Other techniques that he developed and used were anomalous scattering and x-ray diffraction, fluorescence microprobe, and microscopy. In 1995 he was part of a team that discovered a new x-ray imaging modality called diffraction enhanced imaging, or DEI. Shortly before his death, Dale had been investigating the potential of DEI in medical research as a clinical tool for mammography, osteoarthritis, and bone density studies.

In recognition of his many accomplishments, Dale received international and local research awards. In 1979 he shared the American Crystallographic Association's Bertram E. Warren Diffraction Physics Award with Lytle and Stern, and he won the IXS's Outstanding Achievement Award in 2003.

Dale's genius lay in his ability to apply the right techniques to the problem at hand. That skill manifested itself in his administrative roles in the department, college, university, and international research community. His colleagues often viewed him as a sort of "WD-40" that one could spray on problems or situations that were stuck and needed help to gain momentum. A member of innumerable committees, Dale was a highly valued source of reason who recognized what should be done and directed forces toward the reality of what could be done.

Dale quickly developed and thoughtfully nurtured relationships with a host of colleagues and was known as a clever raconteur. He loved to travel and dine, and reveled in the fact that his research took him to synchrotrons far and wide, where at the end of a day of research, he could socialize while enjoying escargots in Orsay, bratwurst in Berlin, or borscht in Dubna. Dale thrived in academe: He delighted in being a mentor to students, a supporter of junior faculty, and a team player who could use his many skills to advance causes and projects in which he believed.

The breadth of his contributions and the warmth of his character magnify the loss of our dear friend and colleague.

Michael Paesler

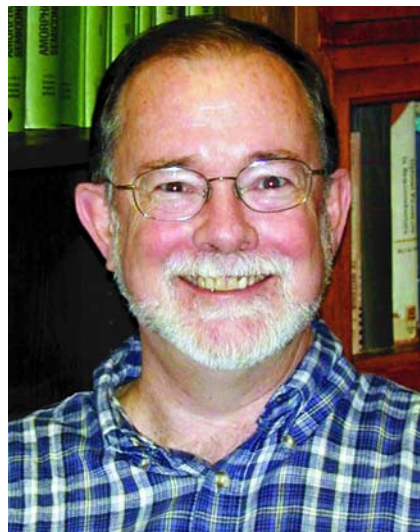
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Dale Edward Sayers