

ILLUMINATING THE LIFE AND SCIENCE OF CHANDRASEKHARA V. RAMAN

Journey Into Light: Life And Science of C. V. Raman

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The centenary of Chandrasekhara Venkata Raman's birth offers an opportunity for a fresh look at the life of this remarkable man of science. A child prodigy, he developed a strong interest in scientific research and spent his early adulthood living a double life—a highly esteemed civil servant by day, and an obsessed scientist during all his spare time after "discovering" the Indian Association for the Cultivation of Science in Calcutta. Soon he himself was discovered by the vice chancellor of Calcutta University, Asutosh Mookerjee, and appointed as Palit Research Professor at that institution. There, his acoustical and optical research expanded into an intensive, comprehensive program on light scattering that culminated in the discovery of the Raman effect, for which he received the 1930 Nobel Prize. By 1930, Raman had become a public figure on the Indian scene who spoke for science to the Indian public and for the cause of science to the government. He established a scientific tradition where none existed before, founded a school of physics known internationally for world-class contributions and created journals and academies providing a forum for Indian science. Raman's

contribution continued after he moved to Bangalore in 1933 as director of the Indian Institute of Science and ceased only at his death in 1970. But above all, Raman's extraordinarily productive life will be remembered for his uniformly first-rate science punctuated with numerous innovative and creative discoveries.

G. Venkataraman, a condensed matter physicist from India well known for his work on inelastic neutron scattering and lattice dynamics, has written an authoritative biography of Raman. Raman dazzled the Indian public for over half a century and inspired her scientific community during the struggle for independence. Thus, his life especially challenges the biographer, who must avoid blind admiration; critically examine all the facts; establish the importance and significance of the contributions by international standards; critically evaluate positive and negative personality traits; and understand, digest and judge the social and institutional events into which a public figure like Raman is inevitably drawn. Venkataraman has accomplished all this.

Venkataraman carefully reviews the social and educational life in India just after her complete political conquest by the British in the early 1800s, providing a valuable background for India's younger post-independence generation as well as for readers from the West. Calcutta as the intellectual center at the beginning of this century, Raman's activities in the Indian Association for the Cultivation of Science and Calcutta University are delightfully described.

Venkataraman lucidly explains the highlights of Raman's scientific achievements, writing at what the author describes as the level of *Scientific American*. One can actually learn the physics associated with musical instruments, whispering galleries, vibrating strings, evanescent waves, the Foucault test, and numerous interference phenomena. We are

told how Raman's curiosity about the blue color of the sea evolved into a full-scale scientific program on light scattering from matter in all states of aggregation.

Venkataraman carefully documents the discovery of the Raman effect beginning with its conceptual origins in Raman's 1922 monograph "Molecular Diffraction of Light." Almost from the outset Raman and his students observed anomalies such as wavelength-dependent depolarization and "persistent feeble fluorescence." Raman wrestled with the quantum concepts underlying the Compton effect, refocused on the "persistent feeble fluorescence" in late 1927 and finally recognized it as a new effect arising from the inelastic scattering of light, to be named the Raman effect. Venkataraman also critically examines contemporary light-scattering research of the 1920s in France (Cabannes and Rocard), Russia (Landsberg and Mandelstam), Austria (Smekal) and Germany and Denmark (Kramers and Heisenberg). He describes in detail the renaissance in Raman spectroscopy, triggered by the discovery of the laser in 1960, and the associated nonlinear spectroscopy (the stimulated Raman effect, the hyper Raman effect, coherent anti-Stokes Raman scattering). Raman spectroscopy has now become a powerful analytical tool that has had a tremendous impact on physics, chemistry, biology, geophysics and materials science.

Venkataraman describes the intellectual activities and social dynamics that characterize every professional community. He meets head on the strong personality traits and intellectual energy that produced fierce loyalty from Raman's students and associates but aroused hostility in and sometimes the envy of some of his contemporaries in both Calcutta and Bangalore. As director of the Indian Institute of Science Raman tried to transform an institution that had yet

Anant Krishna Ramdas, professor of physics at Purdue University, was a pupil of C. V. Raman from 1950 to 1956. His current research interests are in the area of optics and spectroscopy of condensed matter, in particular, collective and localized excitations of semiconductors and insulators.