

Balu Venkataraman (1929–2010)

Balu Venkataraman, one of the most distinguished chemical physicists of India passed away on 28 October 2010. Venkataraman was born in Chennai to Dr N. S. Balu and Krishnammal on 17 December 1929. He graduated from the University of Madras in 1949 and received his MSc degree in chemistry from the Banaras Hindu University, Varanasi, both with distinction. Immediately thereafter, Venkataraman went to Columbia University, New York for his PhD, working under Prof G. K. Fraenkel, one of the pioneers of electron spin resonance (ESR), specially the creation and detection of organic free radicals and interpretation of their spectra. Thus Venkataraman took to electron paramagnetic resonance (EPR) spectroscopy within 6–7 years after its discovery in 1945 by Zavoisky. He is among the few scientists who worked under Fraenkel and took up the construction of an X-band ESR spectrometer along with a facility to produce radicals under anaerobic conditions for his classic work with the radicals of semiquinones, not only looking at the proton hyperfine interactions, but also proton–deuteron hyperfine structure in similar organic free radicals.

While at Columbia University he was both a teaching and research assistant during 1951–1955, followed by a Research Fellowship and Lectureship. After getting his PhD, the urge to do science in India brought Venkataraman initially to Department of Physics at Aligarh Muslim University; though he was basically a chemist, since EPR was virtually unknown to chemists at that time. The progressive recruitment policies of Homi Bhabha brought Venkataraman initially to the atomic energy establishment and then to the Tata Institute of Fundamental Research (TIFR), Mumbai, where he continued until his retirement. He also served as the Dean of the Physics faculty at TIFR. Venkataraman held visiting appointments at Columbia University, University of Notre Dame and University of Copenhagen.

Though he was under the affectionate leadership of Prof Dharmatti in the early days of the development of magnetic

resonance in India, Venkataraman formed an excellent team with C. R. Kanekar, both taking care of EPR and NMR respectively, at TIFR. His scientific contributions revolve around ESR and in later years time-resolved spectroscopy, inclusive of fluorescence. He had shifted



from his earlier ESR studies mainly contributing to the unravelling of hyperfine interactions of Pi electrons with ring protons as well as satellites attributed to the low abundance C^{13} hyperfine interaction. He was the main motivator in constructing a X-Band ESR instrument, including the magnet. He also developed instrumentation to measure T_1 (spin-lattice relaxation time of free radicals in solution), probably for the first time by saturation recovery technique. Venkataraman radically shifted his interest from measuring hyperfine interactions to unravelling the relaxation mechanisms in semiquinone-related radicals. Other important contributions include T_1 measurements of hydrogen deuterium in water, study of T_1 's of radicals with near degenerate energy, Heisenberg and chemical change effects on T_1 's, and development of electron–electron double resonance for understanding cross-relaxation effects. His other fabrication expertise includes time domain ESR spectrometer for flash photolysis. Later, he employed a picosecond time-resolved fluorescence spec-

trometer to study diffusion-controlled reactions and other dynamics-related molecular motions.

Venkataraman was passionate about the study of fast chemical reactions by non-ESR techniques. He initiated and encouraged research programmes using pulsed lasers in the 1970s in TIFR and elsewhere. The three-week workshop organized by him on the 'Study of Fast Chemical Processes in 1987 at Lonavala was well known for the depth and extent of coverage of the then frontline topics, and served as a forerunner for many laser spectroscopy programmes in the country. His active and enthusiastic involvement in ISRAPS and biennial TSRP conferences will be remembered by the community of photochemists.

Venkataraman's other contributions to science include being member of the editorial boards of many scientific journals, co-authoring the NCERT chemistry textbook, and preparing science video programmes. In the later part of his life, Venkataraman shifted to science education, particularly at school level, by giving several lecture demonstrations in many cities in India. He attracted brilliant students to carry out their doctoral degrees in the various areas mentioned above. His work brought him pride and recognition among Indian scientists; thereby he played a vital role in developing substantial manpower in the field of chemical physics and, in particular, EPR as an important theme. In appreciation of his scientific contributions, Venkataraman was elected Fellow of the Indian Academy of Sciences, Bangalore in 1975.

The demise of Balu Venkataraman, is a serious loss to the field of chemical physics and science education in India. He is survived by his wife, son, daughters and grandchildren, as well as a large family of his students and colleagues.

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