

E.C.G. Sudarshan : passing of an era



Outspoken, opinionated, candid and combative Ennackal Chandy George Sudarshan (1931 – 2018) — ECG to friends — was one of the most brilliant scientific minds ever to emerge from South Asia. When the last echo of the controversies surrounding him has died away, the world will still remember him for his deep insights and outstanding contributions to fundamental science.

Born in Kerala, Sudarshan graduated from the Madras Christian College in 1951 and got his Master's degree from the University of Madras a year later. He then spent three years (1952 – 55) working in Homi Bhabha's cosmic ray group at TIFR, before moving to the University of Rochester in the USA, where he did his Ph.D. with Robert E. Marshak — who had visited TIFR and been impressed by the bright young student he met there. Sudarshan's Ph.D. work was simply brilliant — he proved that the weak interaction acts through currents of the $V - A$ form, where V is a vector and A is a pseudovector. This work was a milestone in the development of weak interaction theory and was later built into the structure of the unified model of electroweak interactions by Glashow, Salam and Weinberg. Normally, such a vital contribution should have led straight to a Nobel Prize for its authors, but this discovery got bogged down in controversy. Marshak and Sudarshan's paper was presented in a conference proceedings in 1957, but six months later, the much-more-famous Caltech duo of Richard Feynman and Murray Gell-Mann published a paper with the same result, derived in a different way. The controversy over priority has lasted to the present day. As a result, the Nobel Committee played safe by deciding not to award this discovery at all, despite multiple nominations for Marshak and Sudarshan over the years.

This unfortunate incident embittered Sudarshan for life, but it did not inhibit his scientific creativity. In 1962, with Bilaniuk and Deshpande, he proposed the existence of *tachyons* — particle that travel faster than the speed of light. Then, in 1963, he proved the equivalence of semiclassical and quantum descriptions of light beams using what is now known as the *Sudarshan-Glauber representation*, which is a foundational work in the science of quantum optics. Glauber, however, did not initially accept this representation, and it was only later, after correspondence with Sudarshan, that he reinvented it under the name P representation. To his amazement and horror, the then-septuagenarian Sudarshan found that the 2005 Nobel Prize had been awarded to Roy J. Glauber for his work in quantum optics, and that his own seminal work had been passed over — again.

In 1969, Sudarshan moved from Rochester to the University of Texas at Austin, where he remained till the end. Here, in 1977, he and Baidyanath Mishra quantified the *quantum Zeno effect*. Earlier, in 1961, Homi Bhabha had tried to lure him back to TIFR, but somehow that did not work out, though he remained an Honorary Fellow of TIFR till his last day. In fact, Sudarshan — who always retained his Indian passport — did keep coming to India for extended periods. He founded the Centre for Theoretical Studies (CTS) inside the Indian Institute of Science (IISc) at Bengaluru in 1972. He accepted the Directorship of the Institute of Mathematical Sciences (IMSc) at Chennai in 1986, where he would spend half the year, the other half being at Austin. During his Directorship, the IMSc expanded greatly in budget and personnel, but his idiosyncratic style of management led to a succession of controversies which lasted during the whole of his tenure.

In his lifetime, Sudarshan was showered with many awards, including the Dirac medal of the ICTP, the TWAS prize and the Majorana prize. In India, he was awarded the C.V. Raman prize in addition to the Padma Bhushan and the Padma Vibhushan. He lived into a feisty old age, despite the frustration of having twice been passed over for the Nobel prize and of seeing others awarded for work that was his. But that transient pain of the frail human psyche is now over, and it is only the outstanding scientific legacy of E.C.G. Sudarshan which will last for future generations to study and admire.