

## Rajendran Raja (1948–2014)

Dr. Rajendran Raja (matr. 1967, elected Fellow 1973) passed away peacefully on 15 Feb 2014 at his home in Naperville, Illinois, USA, surrounded by his loved ones. The cause of death was brain cancer. ‘Raja’ as he was commonly known, was an Indian-American experimental particle physicist at the Fermi National Accelerator Laboratory (commonly known as Fermilab), where he worked after obtaining his Ph.D. in physics from the Cavendish in 1975. He was for more than twenty years an important liaison between India and the USA for cooperation on scientific matters, chiefly concerning high-energy particle physics.

Rajendran Raja was born in 1948 in Guruvayur, Kerala, India. His parents were Professor P. K. S. Raja and Chandramathi Nair. He was descended from a distinguished lineage: his father was a prince from the Zamorin family, one of whose ancestors was the Maharaja (Zamorin) of Calicut whom Vasco da Gama met when da Gama sailed to Calicut in 1498. Rajendran was nine when his mother died. His father, a geophysicist, remarried and moved his family to Kenya, where he became a professor at the University of Nairobi. Rajendran was aged ten at the time. He attended the Duke of Gloucester school and went on to Strathmore College (today Strathmore University) where he completed his A-levels. He received four straight A’s in science, which had not been previously accomplished by anyone in Kenya. In 1967, he was accepted to Trinity College, Cambridge, where he obtained a B.A. (Hons.) in June 1970. One fateful night in 1971, he met Selitha Freundorfer, a German student, at the Turk’s Head Coffee House, and she became his future wife. In 1973, Rajendran was inducted as a Fellow of Trinity. In 1975, Rajendran received his Ph.D. in physics from the Cavendish Laboratory, with a thesis titled ‘Single Pion Production.’ He immigrated to the United States, where he joined Fermilab as a research associate. He spent his entire professional career (approximately forty years) at Fermilab.

At Fermilab, numerous colleagues remarked that Raja was a remarkable person, a respected friend and colleague. He made frequent contact with scientists senior and not so senior, and showed a lively and deep intellect with an extraordinary breadth of interests and an openness to new ideas. Raja’s early experiments included particle production from antiproton collisions in bubble chambers, novel properties of the production of particles containing the newly discovered charmed quark and an experiment studying the weak interactions in sigma particle beta decays. He also developed some early ideas to exploit computer technology for lattice gauge theory. (This latter topic is a major ongoing research effort by many theoretical physicists.) In the early 1980s Raja worked in the Accelerator Department to help in the design of the new superconducting accelerator at Fer-

milab (later named the Tevatron). As one colleague said, “Raja was among the HEP (high-energy physics) experimentalists who joined in the construction of the Tevatron... Raja was energetic, determined, inquisitive, and engaging during his valuable efforts in systems creation.” Another colleague during those years remembered Raja as ‘intense and very enthusiastically involved’ and “He was very interested to see just how well his algorithm worked. I am sure that only a few others today remember this atypical but important departure of Raja from his usual interests.” After this sojourn to the accelerator department, Raja returned to the experimental physics department. He led several research projects at Fermilab. In particular he played a leading role in the design of the hermetic D0 detector (one of two large particle physics detectors at the Tevatron) and is credited for the multivariate algorithm that led to the discovery of the top quark in 1995. “Discovery of the top quark at Fermilab is the biggest achievement of Dr. Raja’s. Unlike many who came and joined the marathon of top quark research at the last minute to be part of the team, Dr. Raja worked on it from start to finish and led the group to this very important discovery in high-energy physics,” said former colleague and fellow physicist Shekhar Mishra, a colleague at Fermilab and professor of physics at the University of Delhi, India. “As he got closer to discovering the top quark, he was on the computer around the clock,” said his wife of thirty-seven years, Selitha. “He was constantly doing calculations in his head and would grab a napkin or whatever was handy to write on.” In the 1990s, Raja initiated collaborations between several Indian institutions and Fermilab on the D0 experiment, and helped recruit and graduate more than ten Indian Ph.D. students. Around the same time, Raja also initiated collaborations between Indian institutions and the ill-fated Superconducting Supercollider (SSC) project in Texas. (The SSC project was terminated by the U.S. Congress in 1993.) When India carried out its nuclear test in 1998, Rajendran defied the US ban for scientists to attend conferences in India and showed his solidarity with Indian scientists. After the top quark discovery, Raja became interested in conducting his own experiment. He believed in fundamental measurements and in 1999 Rajendran became spokesperson for the Main Injector Particle Production Experiment (MIPP) to acquire data important for gaining insights into neutrino interactions. Early in his Fermilab career, he devised what he called a General Theorem for particle production, and one of his dreams for MIPP was to accumulate a body of data that would enable him to perfect such ideas, even as he was acutely aware of the ‘engineering value’ of the MIPP measurements. Raja was an early and fervent adherent of the muon collider and neutrino factory, both of which stirred his imagination. He took particular pride in his 1998 proposal, with Alvin Tollestrup, to calibrate the energy of a muon-collider Higgs-boson factory using spin precession. (The Higgs boson

was discovered in 2012 at the Large Hadron Collider at CERN in Geneva, Switzerland. The muon collider project is still in its design stages.)

Raja was also interested in solving the energy crisis and was a proponent of accelerator-induced thorium reactors. Rajendran was also very involved in giving back to the Indo-American community and served on the Board of Directors of the Indo-American Center. In his private life, Rajendran liked to play bridge and Trivial Pursuit. He was also an avid golfer and enthusiastic about fishing. Since the early 2000s, he and his family spent several weeks in the summer in Davos, Switzerland, where he very much enjoyed mountain hiking and found the quiet time to write his papers. His incisive and quick-witted humor was appreciated by friends and family alike, and he was always the one to fill a room with laughter. Later in life, he became more involved in spiritual matters and became a follower of Mata Amritanandamayi or Amma. Through her organization he helped organize a concert to raise funds for victims of the 2004 Indian Ocean tsunami.

I first met Raja when I worked at Fermilab in the period 1987-89. He was by then a senior scientist at Fermilab, and very much involved with Indo-American cooperation in matters of particle physics, as mentioned above. We were pleasantly surprised to discover that we were both Trinity men. We became fast friends, which continued up to his untimely death. It is a matter of pride and pleasure that, on the occasion of the Cambridge University 800<sup>th</sup> Anniversary Gala Dinner, held in New York in December 2009, Rajendran and Selitha flew from Chicago and stayed with my family, and the four of us (Rajendran, Selitha, my wife and I) attended the gala dinner and dance in New York.

Rajendran is survived by his beloved wife Selitha (née Freundorfer) Raja, and their daughter Anjali Raja Beharelle, Ph.D. (married to Aaron Beharelle) and his sister Dr. Paru Sharma.

– Sateesh Mane, Ph.D. (matr. 1978)