KALPATHY RAMAKRISHNA RAMANATHAN

(1893-1984)

Foundation Fellow

BIRTH, PARENTAGE AND CHILDHOOD

KALPATHY RAMAKRISHNA RAMANATHAN was born in a brahmin family in the Kalpathy Village, Palghat, Kerala State on February 28, 1893. Ramanathan's ancestors came from Singanallur in Coimbatore district of Tamil Nadu. It appears that Ramanathan's grandfather's mother trekked all the way from Singanallur across the Western Ghats to Kalpathy, where her brother was a priest, to settle there once for all. At that time there were several tamilian brahmin families settled in many villages, in and around Palghat, where they were treated as respected citizens because of their scholarship and piety.

Ramanathan's father, Ramakrishna Sastrigal was an erudite scholar well-versed in Sanskrit, Tamil, and Malayalam. He was also a good astrologer, so that he was often referred to as Josier Ramakrishna lyer. He used to hold learned discourses in the Puranas, Upanishads and the Vedangas. They were attended by the local elite. Ramakrishna Sastrigal held such discourses in Tamil Nadu, the then States of Travancore and Cochin, and at several places in Karnataka, Maharashtra, and even in Gujarat. He had an innovative mind. He arranged for the publication of several of the Sanskrit books with annotations in Tamil by collecting prepublication subscriptions. He started a press of his own while his colleagues and students worked as type-setters and proof-readers in the afternoons. Ramanathan took part in all such activities and, thus imbibed an innovative mind. Ramakrishna Sastrigal had a large number of students who learnt Sanskrit, Jyotisha and other Vedangas from him, of course, without any remuneration. In those days accepting remuneration for imparting knowledge was considered improper. As a mark of gratitude the students of his father taught the fundamentals of sanskrit and classical religious literature to the young boy, Ramanathan. The family environment of scholarship, affection and friendship produced a great impact on him, of which the most important aspect was his abiding thirst for knowledge.

SCHOOL AND COLLEGE EDUCATION

Ramanathan's father realised that times had changed and that a modern English type of education was economically more beneficial than a classical sanskrit education





KRRamanathan



for his only son. Apparently the son also realised this quite quickly. The family was not at all affluent. At the final Lower Secondary Examination, Ramanathan stood first and won a Government scholarship. He also won a prize for the beautiful handwriting, which was an asset till the end of his life.

For his Secondary Education, Ramanathan joined the Municipal High School, about a kilometer away from his house at Kalpathy. He was to appear for his Matriculation Examination in 1908 but according to the Government regulations he was underage. Ramanathan therefore could appear for it only in 1909. Thereafter, he joined the Government Victoria College, located adjacent to the High School where he had studied.

The college had just then started the Intermediate courses in Science and Arts, in accordance with a reorganization of courses adopted by the University of Madras that year. Some of High School teachers became his lecturers for this course. In a sense the teachers and the taught learnt together. (Some of the Text Books in Physics had been those written by Richard Glazebrook and Napier Shaw. It may be recalled that later Sir Richard Glazebrook became the Director of National Physical Laboratory, Teddington, and Sir Napier Shaw, the Director-General of the UK Meterological Services, London. Professor Ramanathan in his later life, had to deal with them officially).

He studied at Victorial College, Palghat from 1909 to 1911. The College had a good library. Ramanathan was a regular reader of *Nature* and the *Philosophical Magazine*. CV Raman was one of the very few Indian contributors to these scientific periodicals. It impressed Ramanathan, and a desire to be a scientist of a similar type arose in him, although the college environment was not at all conducive to any kind of research or creative thinking.

Ramanathan moved to Madras in 1911 to join the prestigious Presidency College for the BA (Hons) course with Physics as the main subject. It was a recently introduced course as a result of the reorganization of the courses by the University. The students admitted to this course would cover in one year the topics covered in two years by the students admitted to the normal BA course; in the next two years they would cover the syllabus for the MA degree in Physics. Thus in three years, they would have covered all the topics which a student would normally cover during a period of four years. The students who failed to make the grade at the end of the three years, would be recommended for a BA (Pass) degree, which they could have got at the end of two years. Each year there were hardly five or six students selected for such a course in Physics from the undivided Madras Presidency. Ramanathan, aided with a government scholarship for the three years (1911-1914), was amongst those selected in 1911. At Madras he stayed with his maternal uncle, who was a



medical doctor. Ramanathan was aware that he was a student studying in the same environment in which CV Raman had studied a few years ago.

In 1914 he was awarded the BA (Hons) degree of the Madras University; and after another two years the University awarded him the titular MA Degree to which all BA (Hons) degree holders were entitled to.

At the BA (Hons) degree examination, one of the examiners was Professor Stephenson, Principal and Professor of Physics of the then Maharajah's College (now called University College), Trivandrum. He was so impressed by the performance of Ramanathan, that he offered the post of a Demonstrator (a Gazetted post those days) in his Department which Shri KR Ramanathan gladly accepted.

Professional Career and Scientific Contributions

At Maharajah's College, Trivandrum

From 1914 to 1921 Ramanathan served in the Physics Department of the Maharajah's College, Trivandrum. His duties also involved lecturing to the University classes. His colleagues were kind to him and he had the freedom to do whatever he wanted outside his duty hours. He took full advantage of it and became an expert in glass-blowing and other laboratory arts. Noticing that the relative humidity values of the atmosphere at Trivandrum calculated by his students were different from those published by the local Meteorological Observatory, he walked into that Observatory one day. It was found that the observers were using the wrong tables to determine the relative humidity. When the error was brought to the notice of Professor Stephenson, who was the Director of the Meteorological Observatory, he promptly asked Ramanathan to become the Director of the Observatory in addition to his teaching duties at the college. We should admire the nobility of Professor Stephenson.

At Meteorological Observatory, Trivandrum

The association of Ramanathan with meteorology began during the second half of 1910's. He toured extensively in the Travancore State, visited all the plantations which had rain-gauges of their own. He collected all the data from these stations and the State rain-gauge stations and prepared the first complete rainfall map of Travancore State. He also produced his first Research Paper On Thunderstorms over Trivandrum.

During this period he read widely and became quite familiar with the work of Professor CV Raman at the Indian Association for Cultivation of Science, Calcutta. He also had a significant amount of correspondence on scientific matters with Professor Raman.



Towards the end of 1921, Ramanathan joined Professor CV Raman at Calcutta. He was on leave from the Government of Travancore and the Madras University provided him with a Research Scholarship. KS Krishnan, S Venkateswaran and LA Ramdas were already there as students. Professor Raman treated Ramanathan more as a mature colleague than as a student. Ramanathan collaborated with Professor Raman in the studies of the molecular scattering of light. By June 1922, he contributed to the Proceedings of the Royal Society an important paper entitled: The Molecular Scattering of light in vapours and in liquids and its relation to the opalescence observed in the critical state. He published ten papers on molecular scattering of light and X-ray diffraction in liquids, gases and mixtures, within a period of less than one year. For this work he was awarded the DSc degree of the Madras University. He was the first recipient of such a degree from the University of Madras.

Towards the end of 1922, he was offered an appointment as an Assistant Professor at the University of Rangoon. Economic considerations and domestic responsibilities demanded that he take up the job. However, he continued to visit Calcutta during the vacations, and participate in the work going on there under the guidance of Professor Raman. It was during one of the vacations from Rangoon that he worked intensively on the molecular diffraction of light by water. He detected a weak fluorescence in the scattered beam which he attributed to impurities in the liquid. The fluorescence—and the attributed impurities persisted in spite of repeated purifications by repeated distillations. Serveral of his colleagues repeated the experiment with different liquids and gases, all subjected to repeated purifications, only to find that the fluorescence persisted. Not satisfied with the explanation of this phenomenon as fluorescence, Professor Raman finally deduced it as a characteristic of the substance, associated with a change in frequency equal to the molecular vibrational frequency of the substance. That was the Raman Effect announced in 1928 observed by Professor Ramanathan in 1923 but wrongly attributed as fluorescence due to impurity.

At India Meteorological Department

In 1925, Dr KR Ramanathan joined the India Meteorological Department on invitation, after resigning from the University of Rangoon. Professor Ramanathan used to say that his scientific work in the India Meteorological Department was a continuation of his interest in physics and geophysics. Solar and atmospheric radiation, the spectrum of the night sky, meteorological optics and acoustics, atmospheric ozone, terrestrial magnetism, seismology, studies of the general circulation of the atmosphere in its global and regional aspects, the Indian monsoon circulation, monsoon depressions and cyclonic storms of the Indian Seas were all of great interest to him. He made substantial contributions to all of them, mostly of an observational nature. His contributions in the thermal structure and movements of upper air, as well as in the field of atmospheric ozone are outstanding. He was the first to publish



the now famous diagram showing the distribution of upper air temperatures over the world upto 25 km in summer and winter. That diagram had the indication of the sub-tropical jet stream if one applied the thermal wind equation to that diagram. It also showed that the tropopause is low over the polar regions and high above the tropical zone.

At that time the Meteorological Department was also responsible for activities in other disciplines, notably geo-magnetism and solar physics. Dr Ramanathan was for a few years in-charge of the Colaba and Alibag Magnetic Observatories and for a short time Director of the Kodaikanal Solar Physics Observatory. He was to a certain extent instrumental in having these institutions later made into the autonomous bodies, Indian Institute of Geomagnetism and Indian Institute of Astrophysics.

In the beginning of 1940's he made arrangements for making ozone observations from Kodaikanal, Pune and Delhi, using Dobson Ozone Spectrographs. By mid 1940's he had devised ways of correcting the Ozone observations for atmospheric scattering by aerosols. Professor Ramanathan's interest in Atmospheric ozone continued even after he became Director of the Physical Research Laboratory, Ahmedabad in 1948. With Dave, he evolved and extended the use of the Gotz Umkehr method of finding the vertical distribution of ozone in the atmosphere. His major contribution in the study of atmospheric ozone are (i) the discovery of the quasi biennial oscillations of total ozone in the tropics, (ii) the dependence of ozone distribution on meteorological phenomena such as jet streams and their location, tropopause discontinuities and inter-latitudinal air exchange, and (iii) on the whole its relationship with the general circulation of the atmosphere. These studies led to a large number of theoretical investigations by several authors on the behaviour and transport of ozone in the upper atmosphere. In International circles, Professor Ramanathan used to be called Mr Ozone.

At Physical Research Laboratory, Ahmedabad

Professor Ramanathan retired from India Meteorological Department on superannuation at the age of 55. He then joined the Physical Research Laboratory (PRL) in 1948, as Professor of Atmospheric Physics and its first Director. Under Professor Ramanathan's stewardship, the Physical Research Laboratory grew from very modest beginnings to become one of the finest research laboratories in India, where a great number of highly competent people carry out research work under conditions of complete intellectual freedom, usually not found in Government organizations. His involvement in the International Geophysical Year (IGY) helped the growth of PRL. After superannuation, Professor Ramanathan had a full second scientific career lasting another thirty five years.



His research work at the Physical Research Laboratory beside ozone was mainly connected with studies of night air glow, ionospheric and space physics and solar and galactic influences on the ionosphere. His interest in night airglow and twilight goes back to 1930. The first airglow spectrum at low latitudes was taken by him at Pune in 1930. This work, continued by him and his students at Pune, and later at Ahmedabad, Mount Abu, Gulmarg and Srinagar, established the nocturnal and seasonal variations of the green and red lines of oxygen, and the effect of solar flares on the green emissions. Another significant contribution, again with Dave, was the estimation of the role of secondary and higher order scattering in twilight.

The contributions to ionospheric physics by Professor Ramanathan and his students at PRL, Ahmedabad over a period of nearly thirty years, have been outstanding. They are the effect of electron-ion collission in the F-region of the ionosphere on the absorption of cosmic radio noise, the effect of X-rays from discrete galactic sources on the lower ionosphere, and the existence of atmospheric general circulation systems in the ionospheric regions also.

Physical Research Laboratory, during Ramanathan's Directorship, was also the cradle of Space Research in India. As such he played important roles in the establishment and development of the Thumba Rocket Launching Station, and the studies of the upper atmosphere, the ionosphere and magnetosphere through instrumented rocket launching from Thumba, Trivandrum.

Professor Ramanathan relinquished the Directorship of the Physical Research Laboratory in 1966, but continued to be Professor Emeritus till the end of his life. More than thirty research scholars working under his guidance have secured Doctorate degrees in Science. He played constructive roles in the development of geophysics and oceanography in India. Most of the scientific organizations in India sought his advice and guidance. In 1983, on the occasion of Professor KR Ramanathan's ninetieth birthday, the Indian Academy of Sciences published his Selected Papers in 2 volumes (pp 937).

MEMBERSHIP OF LEARNED SOCIETIES AND HONOURS

Professor Ramanathan was the Foundation Fellow, Indian Academy of Sciences (1934); Foundation Fellow, Indian National Science Academy (1935); President, Indian Science Congress (Mathematics and Physics Section) at Lahore (1939); President, International Association for Meteorology (1951-54); President, International Union of Geodesy and Geophysics (1954-57); President, International Ozone Commission (1960-67); Honorary Fellow of the Royal Meteorological Society, London (1960-84); Chairman, Indian National Committee for International Hydrological Decade (IHD) (1966-76), and the Chairman, Board of Nuclear Sciences, Department of Atomic Energy (1961-68). He was the recipient of International Meteorological



Organization Prize (1961), Padma Bhushan (1965); Padma Vibhushan (1976) and Aryabhatta Medal (1977).

MARRIAGE, FAMILY AND PERSONAL QUALITIES

Following the custom prevailing in those days, Ramanathan got married to Parvati Ammal while he was a student at Madras. His father-in-law was a railway official. During the vacations, he stayed at the quarters at the different railway stations in South India. Thereby he acquired first hand knowledge about life in those places also. Apparently this served to generate in him a sense of universal brotherhood. He lost his wife Parvati Ammal in 1952. Professor Ramanathan passed away peacefully during sleep on the night of 30-31 December 1984. He had attended the PRL even on the 21st December 1984. He is survived by four daughters and his second son Dr K Ramanathan is the Director of the Ambalal Sarabhai Enterprises, Ahmedabad.

Professor KR Ramanathan by his energy and enthusiasm for research inspired two generations of students and exerted an enduring influence on the development of several scientific fields over a period of more than sixty years, in India and abroad. The impression that he has left on his colleagues Indian and foreign is that of a "quiet, modest, wise, tolerant, understanding, happy and serene gentleman." In all his interactions with others, Professor KR Ramanathan followed the Yajur-Vedic Hymn:

मित्रस्य चक्षुषा समीक्षामहे

May we look on one another with the eye of a friend.

PR PISHAROTY

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