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Book Review

C.V. Raman's Student L.A. Ramdas - From Agricultural Meteorology to Discovery of Ramdas Layer

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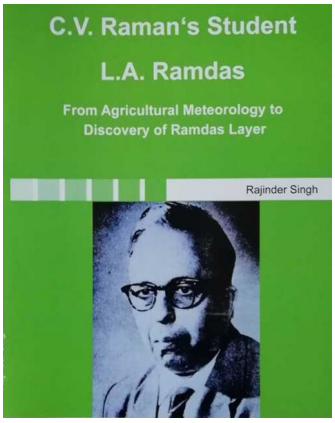

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Dr Rajinder Singh

Rajinder Singh's journey in history of science starts in 1995 at University of Oldenburg in Germany. He was awarded D.Sc. degree by University of Hamburg on his thesis "*Nobel Laureate CV Raman's Work and Light Scattering – Historical Contributions to a Scientific Biography*". In my opinion, he is not only an authority on CV Raman but also the best biographer of Raman's students at Calcutta School of Physics.

Indian Physicist Dr C.V. Raman, the founder of the Raman Spectroscopy, is the only Indian who received Nobel Prize in Science. Raman trained almost 100 scientists in his laboratory who influenced the development of science and technology in India. Dr L A Ramdas was one of them who began his research career under Raman in the beginning of 1920s. Not only, he coined the term 'Raman Effect', but also studied the scattering of light in gases and vapours. The present book written by Dr Rajinder Singh, presents Ramdas's work on light scattering in association with Raman, his venture in establishing a new field namely, Agricultural Meteorology, and subsequently the discovery of Ramdas Layer, named after him. The book under review describes the achievements of LA Ramdas (LAR) as a student of CV Raman. As a matter of fact, Ramdas deserves to be called 'Father of Agricultural Meteorology' in India.

In his Foreword, Prof. N. Sathyamurthy pays glowing tributes to LAR: "He was a pioneer in agricultural meteorology in India and was instrumental in connecting various aspects of soil, climate and other factors that influence the agricultural production – the lifeline of India". Arun K. Grover in his Prologue traces the history of India Meteorological Department (IMD) and its role in providing employment opportunities to Indian Scientists like Ruchi Ram Sahni, KR Ramanathan and LAR. He writes: "The teaching positions in the Universities and Post Graduate colleges were scarce for PhD holders in India in 1920s. Many Ph.Ds. in Physics had to

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be content with taking up jobs in the Department of Meteorology. LAR steered the Agriculture Meteorology agenda of IMD with great distinction".

In Introduction, the author deplores that many eminent scientists, who made fundamental contribution to development of science in India, have been ignored. Rajinder took up cudgels to write about their life and work. These lesser-known physicists include Sisir K. Mitra, Debendra M. Bose, Bidhu B. Ray, Kedareswar Banerjee, Sukumar C. Sirkar, Snehamoy Datta, Satish Ranjan Khastgir, Bibha Chowdhury, and LA Ramdas.

Chapter 1 describes some aspects of LAR's life. He was born on June 3, 1900, in Palghat, Kerala. His father, L.K. Ananthakrishna Iyer, was an anthropologist and a professor at the University of Calcutta, where C.V. Raman was the Palit Professor of Physics. LAR did B.A. from Presidency College Madras in 1923 and joined the University of Calcutta for his M.A. He was a Palit Research Scholar in Raman's group. He was awarded Ph.D. in 1927 for work on the scattering of light and observing the 'Raman effect' in ether vapour. In 1926, Ramdas joined the IMD, and became Assistant Meteorologist in Karachi. In 1930, he joined Poona Meteorological Office, where he was promoted to Agricultural Meteorologist. He retired as Deputy Director-General of Climatology and Geophysics Observatories of IMD in 1956.

Chapter 2 & 3 describe LAR's cordial relation with CV Raman and his discovery of the Raman effect in vapours. He coined the term Raman effect in an article submitted to *Nature*, which was published on July 14, 1928. Raman also gave credit to LAR for (i) establishing relation between surface-tension and surface-opalescence, and (ii) tracing "the transition from surface-opalescence to volume-opalescence which occurs at the critical temperature". Raman changed the title of *Proceedings of the Indian Association for the Cultivation of Science* to Indian Journal of Physics on the suggestion of LAR. In 1923, LAR attempted to verify Rayleigh's theory of scattering by spectrophotometry method. He prepared potassium chlorate crystals and investigated the refractive index for different wavelengths.

LAR studied light scattering from metal and liquid surfaces and concluded that the surface scattering in transparent liquids was due to molecular bombardment of the surface. In 1931, he studied the spectrum of glow-worm light and reported in Nature that the obtained spectrum consisted of a single band in the range from 5290 to 5860 Å. He observed that when oil layer/film was spread over water surface, there was less evaporation. If oil layer is spread over a large surface area of sea water, it will lead to drastic decrease in evaporation. Consequently, there would be a decrease in the rainfall over the globe. *His idea was called by the editor of Nature, a "novel suggestion".*

Chapter 4 establishes LAR as 'Founder of the Agricultural Meteorology in India'. Agricultural Meteorology is an interdisciplinary science, which covers fields like soil science, atmospheric science, micro-climatology, biology, etc. It is based on fundamental principles of radiation and surface aerodynamics and thermodynamics. He presented a paper: "The influence of climate on agriculture" at *Punjab Educational Conference and Exhibition*, which was highly appreciated. A special unit of 'Agricultural Meteorology' was established within the IMD on August 22, 1932, under LAR with the aim: (i) To link meteorology and agriculture, and (ii) To provide research facilities for post-graduate students to investigate border line problems like soil science, plant physiology, and agricultural meteorology.

Chapter 5 & 6 sum up scientific work of LAR at the Agricultural Meteorology Division of IMD. He started working on some of the important aspects of the micro-climatology such as: "Role of solar radiation", "Surface conditions", "Soil conductivity", "Convection process and radiation from the earth's surface and adjacent air layers", "Wind movements", "Limits of surface climate", "Evaporation", "The water vapour content in the atmosphere", and "Dew fall". LAR fabricated instruments to undertake study of different type of soils (black soil for cotton belt of then Bombay Presidency, alluvial soil of Trivandrum, and alkaline soil of Panjab), effect of moisture, percolation, evaporation, and capillary action in soils. Wheat and sugarcane crop patterns were studied for introduction of better agricultural practices in India.

LAR and his associates studied Monsoon and weather abnormalities, such as floods, droughts, cyclonic storms, thunderstorms, hailstorms, dust-storms, cold waves, and frost hazards. They calculated the damage done by frost for the winter of 1933-34. LAR concluded from his experiments: (i) Punjab was most liable to frost hazard, and the hazard decreased rapidly as one moved southwards or eastwards. (ii) Frosts were caused by cold waves reaching India during winter in the wake of the winter depressions.

LAR was also a pioneer in the field of Solar and Wind energy in India. He proposed in 1941, in a conference of the Indian Science Congress, on the utilization of solar energy. He summarized the data on the intensity and duration of sunshine in India. LAR and K.P. Ramakrishnan gave a talk on, 'Wind energy in India' in the UNESCO - Symposium on 'Solar Energy and Wind Power' in the Arid Zones, New Delhi, 22-26th Oct. 1954. They gave a short survey of the potentialities of wind energy in India.

The most prominent contribution of LAR is his discovery of Ramdas Layer/Effect. His experiments on conduction, convection, and advection using hot surfaces/plates led to the conclusion with implication for this new discovery. It was reported in Nature (1938): Experiments done at Poona in winter established that the air temperature has a minimum some distance above the ground. Until 1990, this phenomenon was known as "Lifted Temperature Minimum". In 1991, Rodham Narasimha applied the term "Ramdas Effect". He tried to explain the effect by considering the surface emissivity and thermal conductivity of the soil. Narasimha and his co-workers gave a numerical model to explain the lifted temperature minimum. During 2016-17, evidence was found for the Ramdas layer using modern technology such as satellites and from high resolution temperature observations.

Chapter 7 describes research work of LAR at National Physical Laboratory, New Delhi, where he was employed (1956-61) as Assistant Director and Head of the Heat and Power Division, after his retirement. During his stay in NPL, he wrote a book: "*Crops and*

weather in India”, which was published in 1960. This monograph was written for the students of agriculture, to show the importance of weather science, and weather forecast in agriculture.

LAR compiled a chart showing the frequency of floods and droughts in the period from 1875 to 1950. To investigate the main abnormalities of monsoon in India, he considered the seasonal rainfall from the year 1875 onwards. Apart from the monsoon, he also gave a brief review of the phenomena which affected the rain, eastern- and western depressions, cyclonic storms, thunder- and hailstorms, artificial rain, and reduction of evaporation losses with chemicals’ films on the water surface. In 1973, Ramdas discussed the significance of monsoon at the global level. For India, he analysed the monsoon data for about 200 years.

The author concludes his biography of LAR with ten-point agenda. He calls LA Ramdas as an innovative scientist. To justify this statement, we may quote K.R. Ramanathan, who called him as one of Raman’s students who *discovered* (emphasis added) the light scattering at the surface of pure liquids. His article in Nature on “Oil contamination as a climatic factor” is a sterling contribution to science. In it, he proved that the minor organic layer of oil could hinder evaporation, and consequently, decrease the rain fall at global level.

LA Ramdas was a prolific writer and contributor to the research journals. He published 148 research papers, mostly in Agricultural Meteorology. Rajinder Singh deserves our appreciation for bringing into limelight another brilliant student of CV Raman. I congratulate him for his effort in establishing the legacy of LA Ramdas as ‘*Father of Agricultural Meteorology*’ in India.