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Dr. K. S. Krishnan, F. R. S.

India and International Science have suffered a great loss by the death of Dr. K. S. Krishnan, F.R.S., National Professor and Director, National Physical Laboratory of India. He passed away on the night of 13/14 June 1961 following a sharp heart-attack. Professor Krishnan worked in his Laboratory till the evening of the 13th. On that day, Krishnan was looking forward to a study-cum-lecture tour in U.S.A. in the autumn of 1961 prior to his retirement from the N.P.L. and settling down to an academic life.

Kariamannikkam Srinivasa Krishnan was born on 3 December 1898 in the village of Watrap near Srivilliputtam in the district of Madurai. His father, Sree Srinivasa Iyengar was a scholar of the old school deeply versed in Tamil and Sanskrit literature and spent a good part of the year at the famous shrine of Tirupathi. Krishnan had his early education in his home-town Watrap and later in Madurai and in Madras. After graduating in Physics from the Madras Christian College, he worked as a Demonstrator in that Institution for a couple of years. He then migrated to Calcutta to study for his M.Sc. in the University College of Science, Calcutta, under Professor Sir C. V. Raman. In 1923, Professor Raman took him as a Research Scholar in the Indian Association for the Cultivation of Science and for the next six years, from 1923 to 1928, Krishnan made a deep study of the problems of Optics and in particular of the molecular scattering of light and questions connected with the anisotropy of molecules. Krishnan's first paper was on an experimental study of the intensity and polarisation of light scattered by a large number of pure liquids. The paper appeared in the *Philosophical Magazine* in 1925, and brought out his outstanding qualities as a careful and critical investigator. Krishnan worked with Professor Raman in examining various problems relating to molecular anisotropy and collaborated with him in making a detailed examination of the change in the nature of light which was found to be associated with molecular scattering. As is well known, these studies led up to the discovery of the Raman Effect in 1928.

In 1928, Prof. Sommerfeld spent a short period as a Visiting Professor in the Indian Association in Calcutta and gave a course of lectures on "Wave Mechanics". Krishnan was an earnest member of the audience and edited the lectures for publication. Sommerfeld has noted that Krishnan worked out five of these lectures "in a very independent way".

In 1929, Krishnan accepted the post of Reader in Physics in the University of Dacca where Professor S. N. Bose was Professor. Krishnan liked teaching and loved research. At Dacca, he developed elegant experimental methods for measuring accurately feeble magnetic susceptibilities and anisotropies of small crystals, and with his students, made measurements on a large number of crystals both diamagnetic and paramagnetic. The work of Krishnan and his students at Dacca demonstrated the fruitfulness of the magnetic method as a valuable supplement to the method of X-ray analysis for determining the structure of certain types of crystals.

Krishnan was appointed Mahendralal Sircar Professor of Physics in the Indian Association for the Cultivation of Science at Calcutta in 1933 where he continued his work on the magnetic and optical properties of crystals. His studies with A. Bose and A. Mookherjee on the magnetic properties of the salts of the rare earth and iron groups and with N. Ganguli on graphite are outstanding contributions.

In 1937 Krishnan made his first visit to Europe. He lectured at the Cavendish Laboratory, Cambridge, and in the Royal Institution, London, and was awarded the University Medal at Liege. In 1939 he was invited to participate in the International Symposium on Magnetism at Strassbourg. Krishnan was elected to the Fellowship of the Royal Society in 1940.

From 1942-47, Krishnan was Professor and Head of the Department of Physics at Allahabad. He took his teaching duties seriously, but was able to make with A. B. Bhatia original and critical studies on classical light scattering, and the scattering of low velocity electrons by liquid metals and alloys.

On India's achieving independence in 1947 and the decision to create National Laboratories, Krishnan was offered and accepted the first Directorship of the National Physical Laboratory. Till he left Allahabad, Krishnan's life was essentially academic. At Delhi, he had to build up a new national laboratory with a large staff and many sections, and definitely biased towards Applied Physics. His success in that undertaking is evidenced by the present high position of the N.P.L. in the nation's life. Krishnan always recognised that no clear line of demarcation can be drawn between Pure and Applied Physics. Krishnan's administrative duties in the Laboratory and Committee work of various kinds (inextricably linked with his stature, freedom from bias and critical mind) did not make him forget his personal scientific work. He worked with S. K. Roy on the frequencies and anharmonicities of alkali halide

crystals, and with S.C. Jain on fundamental problems of Thermionics, and developed an elegant method for determining the thermionic constants of elements based on the effusion of electrons through a hole from a heated cavity. He published with Jain a series of papers on the distribution of temperature along a thin rod electrically heated in vacuo, a problem of great importance in electrical technology. In the last few years of his life, Krishnan devoted much thought to problems of Crystal Physics and the Physics of the Solid State.

Dr. Krishnan was a Fellow of many scientific organisations both in India and abroad and the recipient of many honours. He was Vice-President of the Indian Academy of Sciences (1939-47), President of the National Academy of Sciences, Allahabad (1945-46), General President of the Indian Science Congress (1948-49), President of the National Institute of Sciences of India (1953-54) and First President, Indian Society of Theoretical and Applied Mechanics (1955-57). He was a member of the Governing Body of the Council of Scientific and Industrial Research, India; Chairman of the Radio Research Committee (1950-61); Chairman of the National Committee for the International Geophysical Year (1955-61); Member, Atomic Energy Commission (1948-61); Chairman, Board of Nuclear Science (1955-61) and Member, University Grants Commission (1957-61).

Krishnan was always interested in problems of Geophysics and particularly in Geomagnetism and the Upper Atmosphere, Solar-Terrestrial relationships, and Oceanography. He was for many years an active and very helpful member of the Central Board of Geophysics. When the question of starting a new Research Unit for the study of Cloud and Rain Physics came up, Krishnan with the approval of Sir S. S. Bhatnagar offered the facilities of the National Physical Laboratory for its establishment. The Research Unit under Shri A. K. Roy has worked with the fullest co-operation with the India Meteorological Department. As Chairman of the National Committee for the International Geophysical Year, Krishnan brought together all active Indian workers, both old and young, in different branches of Geophysics and encouraged them to review and expand their work. Regarding the IGY, Krishnan said in an address to the International Telecommunications Union, "Apart from the purely scientific results emanating from this (the IGY effort), the mere fact of such an intense co-operation for a common scientific cause in which so many different countries participate, has a value of its own, quite as significant and permanent as the scientific outcome".

Krishnan was knighted in 1946 and was awarded the title of PADMA BHUSHAN by the President of India in 1954. He received honorary doctorates from many Universities and was invited to deliver the Sardar Vallabhbhai Patel lectures in 1957. The Patel lectures were entitled "New Era of Science" and show up very well Krishnan's qualities as a scholar, thinker and speaker. Krishnan was awarded the Sir Shanti Swarup Bhatnagar Memorial Prize in 1961 and in acknowledging it, reviewed his scientific work at the N.P.L.

Krishnan was an ideal ambassador of India in International scientific and cultural bodies. He had firm faith in International co-operation. His integrated human personality was deeply rooted in science and culture. He quickly grasped the essentials of a problem and spoke with brevity and lucidity. His engaging social qualities won him friends in all countries.

Krishnan was Vice-President of IUPAP (1951-57); Vice-President of ICSU (1955-58) and Member, International Committee on Weights and Measures (1958—). He was the Guest of Honour of the National Academy of Sciences in U.S.A. in 1955 and was elected Foreign Associate of the Academy in 1956. In 1960, the Society of Visiting Scientists in London elected him a Member of the Council of Honour. Dr. Krishnan's last important international assignment was as a Member of an Editing Committee of four eminent scientists appointed by UNESCO for scrutinising a report on a "Survey of main trends in Scientific Research in the fields of natural, pure and applied Science", which met in March 1961.

Krishnan was a keen student of Indian classical literature both in Tamil and in Sanskrit. He was a writer and speaker of distinction on scientific and philosophical subjects in Tamil, combining delicate humour with erudition and insight. People in all walks of life came to Krishnan for advice, sympathy and help and rarely did they go away disappointed. He had a warm heart.

Krishnan leaves behind him his wife, two sons and four daughters. Our sympathies go out to them and to the workers of all ranks in the N.P.L. who held him in great affection and high regard.

K. R. RAMANATHAN