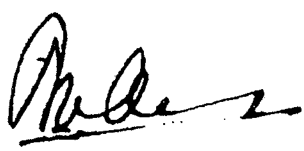

ANIL KUMAR DAS

(1902 - 1961)

Elected Fellow 1943

BIRTH AND FAMILY

ANIL KUMAR DAS was born in February 1902 in a village in undivided Bengal. As birth registration was not common in those days, proof of birth-date used to be the matriculation certificate, which sometimes became the only document proving the holder's age. In Bengal, this was issued by the Calcutta University, which counted only completed months. As a result of this practice, many persons used to have their official birth date as the first of a month. In all probabilities, Anil Kumar Das birth date was thus fixed as the first of February 1902.

Anil Kumar's ancestral home was in a village called Harop, under the Police Station at Bagnan. The village was under Hooghly district at that time, but later, after reorganization brought under Howrah district. The Das family was among the original inhabitants of this village. The profession followed in the family in ancient times was that of village-barber; but Anil Kumar's grandfather made successful efforts to break-away from the old ways. He had his sons properly educated, and they all prospered in their new profession. The eldest, Priyo Nath, had become a toll-collector, the second son Pyari Mohan chose the profession of a contractor and the youngest, Debendra Nath qualified himself as a Civil Engineer. Debendra Nath took up the job of an engineer in the provincial service of Bengal and had to spend his life away from his native village.

Debendra Nath was married to Sarojini, a daughter of the progressive Pal family of Chinsura. Sarojini's education was informal, but she was well versed in English, and could read and write in that language. Their only child, Anil Kumar was born in Chinsura, in his mother's paternal home.

Anil Kumar Das spent his early childhood in Chuadanga in the Kusthia District of undivided Bengal (now in Bangladesh), where his father was posted. He was a student of Chuadanga High School, where along with his curricular activities, he took keen interest in sports. He was particularly skilled in swimming and in football. His active interest in football continued till his college days; he was the captain of the Presidency College football team during 1923-24.

Das passed his matriculation examination from Chuadanga in 1918 and joined the Berhampore College in Murshidabad of Bengal. In the meanwhile his father had his house constructed at Chinsura. In 1920, he passed his ISc Examination and joined the Presidency College, Calcutta, where he stayed in the college hostel. He lost his father a few months before his BSc Examination. In 1922, he passed his BSc with honours in Physics. He continued his post graduate education in the same college. Among his teachers here, Prasanta Chandra Mahalanobis, Charuchandra Bhattacharyya and Snehamoy Dutta were all well known for their roles in developing scientific temper among the students. In 1924, Das obtained his MSc degree in Physics and secured a first class in this examination, a feat which was quite difficult in those days. He topped the list of successful candidates and won the University Gold Medal.

Early twenties was the time when spectacular advances were being achieved in the field of spectroscopy and astrophysics, and Indian scientiests were playing pivotal roles. In Calcutta, MN Saha had just expounded his theory of stellar spectra connecting thermal ionization with the radio active processes occurring in their outer layers ; CV Raman's researches were opening up new frontiers in spectroscopy; Das decided to devote himself completely in scientific research in these areas. But the facilities available for post graduate studies to those fields in India were limited; he had no choice other than going abroad and studying in a foreign university. Scholarships or study grants were few and far-between, and Das could not secure any help. He sold his house in Chinsura, and with that money sailed to France in 1925.

He enrolled himself as a student of the University of Paris. He joined Prof Ch Fabry's group in Laboratorie de Physique and started working in spectroscopy. In 1926 he completed his dissertation on the *Studies in the Absorption Spectra of Halogens* and was awarded the degree of Doctor of Sciences by the University. For the next two years, Dr Das worked with Prof Max Born at the Institute fur Theoretische Physik and with Prof Augenheister at the Geophysicalishes Institut, Gottingen, and then spent a brief period at the Solar Physics Observatory at Cambridge, England. During his stay in Europe, he came in contact with many physicists and astronomers, and maintained a life-long association with many of them. His interest in astrophysics, particularly about the new enigmatic radiation, the cosmic rays was kindled during this period.

Das returned to India and joined the Indian Meteorological Service as an Assistant Meteorologist in March 1930. He was posted at Poona for a short period, then transferred to the meteorological office at Alipore, Calcutta, where he remained posted for the next four years. His main official work was meteorological forecasting, which he carried out creditably. But this was not enough to satisfy his scientific zeal; he published several papers giving some new ideas in meteorological measurements. These were the preradiosonde days before wireless communication became an easy method for remote sensing. He devised instruments with pellets of sulphuric acid inside glass helical tubes, which could be hung from hydrogen filled balloons. On reaching pre-set heights, explosive mixtures would be ignited by the sulphuric acid and the flash could be observed from ground. Such instruments were fabricated and flown, and Das used the collected data in understanding several features of weather phenomena. But his interest spread much wider; unexplained topics in nature intrigued him. During this period he wrote a long article dealing with seismology and volcanic activity, which was published in the *Calcutta Review,* in its April 1934 issue.

In September 1934, Das obtained a year's leave and proceeded to England. He spent this period at the Solar Physics Observatory, Cambridge working with Prof FJM Stratton on spectrophotometric investigations of the temperature of the solar surface. Later he continued this line of work at Kodaikanal.

On return from leave, Das was posted to the Upper Air Observatory in Agra. This was the centre of the Meteorological Department for investigations in upper air currents and temperatures which needed among many other facilities, the use of hydrogen filled balloons. The facilities here, were sought by top scientists of the time including Millikan and Compton for cosmic ray studies; the observatory had among their staff, some members who had participated in their exciting experiments in India. Das did not have elaborate resources for conducting all experiments, but with his characteristic energy and enthusiasm, started regular observations on cosmic ray intensities. Later he continued his systematic investigations at Kodaikanal. In 1940, he published a paper entitled *Measurements of Cosmic Rays at Agra and Kodaikanal;* this was the first account of regular measurements at two places situated in different latitudes as well as in altitude. He attempted to correlate variations in cosmic ray intensities with solar activity in this paper.

In 1938, Dr Royds retired as Director, Kodaikanal Observatory, and Dr AL Narayana succeeded him. His vacant place was filled up by Das on transfer from Agra. From September 1937 to June 1942, he was posted as Assistant Director of this Observatory. During this period, he published a series of papers on solar prominences and motion of gases in the solar atmosphere. In a statistical analysis of 14 years' data, he showed that the area of calcium prominences was maximum in January and minimum in July. It is well known that the earth in its orbital passage comes closest to the sun in January; Das argued that the increased gravitational attraction on the sun is responsible for the increase in the area of the prominences. This increase was found to vary in accordance with an approximate inverse cube law, in relation to the sun-earth distance. In a series of papers on *The Motion of Gases in the Sun's Atmosphere* published in the *Indian Journal of Physics* during the years 1940 to 1942, Das attempted to work out a unified theory based on simple particle dynamics to explain many of the enigmatic behaviours of solar phenomena. All these happened a few years before Hannes Alfven developed the theory of magnetohydrodynamics which was able to account for most of the observed solar phenomena on the basis of a new concept. The same theory based on particle dynamics was later extended to explain the behaviour of sunspots.

In 1941, Edlen's famous work proved that the most prominent coronal emission lines are due to highly stripped heavy atoms. No explanation of generation of those highly ionized heavy atoms existed at that time; Das readily forwarded a hypothesis based on ejection of particles from the core. Years later, alternate hypotheses appeared to explain the phenomena better.

When World War II broke out in India, Das was posted outside Kodaikanal, where he did meteorological work for the war operations. After the end of the war, he was posted back to Kodaikanal in early 1946. In July 1946, he was appointed as the Director of Kodaikanal Observatory. In the meanwhile a very important event in the history of astronomy took place in India. A committee for the planning of post war development of astronomy and astrophysics in India was appointed in 1945 by the Imperial Government; the committee consisted of several scientists and was chaired by Prof MN Saha. The committee remarked "On account of the restricted nature of activities Kodaikanal Observatory has not grown and kept pace with development of new knowledge and fundamental discoveries in astrophysics, and our considered view is that in consideration of its excellent location for astrophysical work and the very good work done by the institution in the past, immediate steps should be taken for its development".

Das stepped in at this stage; he strove hard steadfastly to organize and develop an astrophysical observatory at Kodaikanal equipped with the most uptodate instruments for work on the frontiers of astronomy. He established a small modern workshop and trained young persons in the construction of instruments for astrophysical research. To quote the words of Das, "These efforts were so successful that within a very few years it became possible to build locally at an insignificnt cost quite a number of perfectly satisfactory instruments of solar research, such as high dispersion spectrographs, coelostats, siderostats, photoelectric photometers and variety of other physical apparatus which made the daily routine work, as well as the investigational work of the observatory far quicker and more convenient than before". While concentrating on this instrumentation development, he kept up his scientific contributions and guided a number of research workers in the field of astrophysics, geomagnetism, ionosphere, cosmic rays and other allied subjects.

The observatory hill at Kodaikanal is situated at the geographical latitude of 10° 14'N and a geomagnetic latitude of 0.6° has several advantages for astrophysical and geophysical work. Almost a total coverage of southern skies is possible from this latitude, and almost horizontal geomagnetic lines of force impart some peculiarities in the behaviour of the ionosphere overhead. Das foresaw enormous advantage of simultaneous investigations of geomagnetism, ionosphere and solar activity and discovered the links between them.

A geomagnetic observatory was established in 1948. In 1951 a C-3, CRPL automatic vertical ionospheric recorder was installed. Many new characteristics of equatorial ionsophere were unfolded by these instruments. The C-3 ionosonde is still in operation, almost forty years after its installation and has collected invaluable data, a unique collection in the world. The magnetometers here have recorded violent fluctuations during many a magnetic storm, from which some insights into the nature of particle precipitation from the magnetosphere has been obtained. Both the ionosonde and magnetic records have established subtle links between the activity on the sun and reactions on the earth's outer atmosphere. In fact, in a series of papers from Kodaikanal Observatory, a few years after the death of Das, solar X-ray fluxes were estimated from ionospheric data. But in the early fifties, such possibilities could be visualised only by a few persons with extra-ordinary foresight.

Das organized a division of 'Radio Astronomy' at the Kodaikanal Observatory. In fact, he was the leader of the team which started first radio observations of the sun in India. Two 'radio telescopes' in 100 and 200 MHz, consisting of a pair of Yagi antennas each and separated by a baseline of a few wavelengths formed two interferometers. Transit of the sun across their beams resulted in fluctuating intensity records on chart recorders. The same instrument could detect radio signals from strong sources like Cygnus and Cassiopeia.

The Stellar Physics divisions was already in existence with an 8 inch refractor under regular operation. An old 20 inch telescope from Poona Observatory was also available with them. Das extensively modified these instruments and adapted them to suit new experiments he planned. He joined the International Mars Observation Program 1954-55 and used the telescopes to photograph the martian disc during its close approach.

There were recommendations in the Saha committee report for creation of a central observatory with large aperture telescopes. Das made plans to create such an observatory with a 100 inch telescope and 46/34 inch Schmidt Cassegrain telescope. The instruments were very expensive and Das could not get funds for acquiring these. Much later, Vainu Bappu could obtain funds for indigenously fabricating a 93 inch telescope.

Das however managed to equip the Solar Physics group at Kodaikanal with most modern equipment. This division was already equipped with a fair number of optical telescopes and spectrographs, including both H-alpha spectrohelioscope and K and H-alpha spectroheliographs. But new and more powerful equipment were lacking; he took upon himself the construction of a large solar telescope combined with a powerful spectrograph of exceptionally high dispersive and resolving powers. It consists of a coelostat with three fused silica mirrors of 60 cm aperture and two telescope objectives of 37.5 and 20cm apertures. The primary and secondary mirrors of the coelostat are mounted on a double walled stone masonry tower of 11 meter height above ground and are so arranged that a broad beam of sunlight can always be reflected vertically downwards; the third mirror of this coelostat system (mounted on the floor of the tunnel) reflects the light horizontally into an underground tunnel of about 70 meter length. This long tunnel houses the telescope objectives and mirrors mounted on long horizontal steel rails and an exceptionally powerful 20 meter long spectrograph having both a reflection grating and a system of prisms as its alternate dispersive elements. The instrument incorporates every desirable feature useful for solar research. The design, construction and installation of the equipment required very thoughful planning, foresight, energy and determination, and Das poured his body and soul for creation of this telescope. The equipment was fully ready for operation just a few months before he retired from service at the Kodaikanal Observatory.

One more ambitious project was started by Das, which could only be partly completed. Das wanted a coronograph to be installed at Kodaikanal. Corona and coronal streamers have fascinated the common men and astronomers equally, ever since they were seen at the time of solar eclipses. But there existed no methods of investigation of these except during total solar eclipses and even on those rare occasions the chance of success lay on the mercy of the weather. By moving all over the world, undertaking most hazardous journeys, the maximum total time one could get was about one hour in 25 years. Prof Bernard Lyot wanted a way out of this impass; he designed and built a telescope with very little scattering, where the brilliant disc of the sun could be occulted and one can study solar corona outside eclipses. Das lost on time in arranging for a coronograph at Kodaikanal. Through his persistent efforts and personal contacts he had the coronograph of 20cm aperture built by the associated and co-workers of Prof Lyot. He also obtained another of Lyot's inventions : the monochromatic heliograph. The main component of the instrument is a very narrow band interference polarising filter, incorporating a marvel of primitive electronic instrumentation. This instrument was installed and proved extremely useful. The coronograph, however, could not be put to optimum use, owing to unforeseen difficulties.

While engaged in large scale operations for developing and improving the observatory, Das kept up his scientific contributions and wrote a large number of papers. One of his outstanding contributions to solar physics was made in 1953 when he measured the temperature difference between the pole and equator of the sun. This provided an observational confirmation of the theory advanced by Bjerknes in 1926, that the sun is a baroclinic cosmic vortex in which angular velocity decreases with distance from the equatorial plane, which should result in a temperature increase at the poles. His observation also lent support to the thermodynamical theory of the origin of sunspots. Shortly before leaving Kodaikanal, he published another interesting paper in the Kodaikanal Observatory Bulletin, where he attempted to explain the origin and behaviour of sunspots and prominence from purely dynamical considerations. A large number of solar phenomena, including Evershed effect were satisfactorily explained in his simple theory.

Das organized an expedition to Iraq for making scientific observations during the total solar eclipse of February 25, 1952. The expedition, however, was not successful owing to vagaries of weather. He organized and sent a team of young scientists to Phalodi in Rajasthan to cover another eclipse on June 30, 1954, and then himself led a larger team to Ceylon next year. Although the circumstances of this eclipse were very favourable, he was again frustrated by overcast skies, and only managed to obtain some radio and geomagnetic observations during the eclipse.

As the Director of Kodaikanal Observatory and a leading astronomer of the country, Das went abroad a number of times. He attended the meeting of the General Assembly of the International Astronomical Union held in Rome in September 1952, and took the opportunity to visit the astronomical observatories in the continent at Arcetri (Florence), Zurich and Arosa (Switzerland), Potsdam, Paris and Meudon. He also visited the leading instrument factories at Cambridge, Oxford and London and the new Greenwich Observatory at Herstmonceux Castle. In 1955 he undertook another extensive tour. He attended the special symposium on Radio Astronomy organized by the IAU at Manchester, and then attended the Ninth General Assembly meeting at Dublin. On his way back, he went to the Crimean Observatory in USSR and attended a conference there on Physics of the Sun, Stars and Nebulae. He also visited other important astronomical observatories in Europe, UK and USSR before returning to India.

After retiring from Kodaikanal, Das went to the Ondrejov Observatory in Czechoslovakia in September 1960 and returned after about two months. This was his last visit abroad. Das always attempted to keep himself abreast of the development and discoveries in astrophysics; all of his foreign visits were aimed at this objective. He lost no time in translating these experiences into practice at Kodaikanal.

During his directorship at Kodaikanal Das refused, more than once, promotion as Deputy Director General of Observatories. There was no post of DDG at Kodaikanal and acceptance of promotion would have meant his leaving Kodaikanal. However, eventually, the Government of India created a post of DDG for him at Kodaikanal from March 1954. He was also granted an extension of service for 3 years from 1.2.57, beyond his normal age for superannuation.

After retirement from Kodaikanal Observatory, Das accepted the post of Director, Nizamiah Observatory and Professor of Astronomy, Osmania University in Hyderabad. A few months that he had here was mostly spent in planning the constructions at the new observatory near Japal-Rangapur village. The end came too suddenly. In February 1961, he was taken ill at Hyderabad and was removed to hospital, where a few days later, on 18th he breathed his last. Except for his new colleagues at the university, some of them being his old students at Kodaikanal, no other friends and relatives were present at the bedside. His faithful servant-boy, Velan, who was brought up by Das at Kodaikanal, looked after him in his last days; it was he who performed Das's last rites.

PERSONAL LIFE

Das married Millicent in England in 1934, much against the wishes of his mother; they were known to each other from the days at laboratoire de Physique in Paris. She proved herself to be a very apt companion of Das, spending her entire life at Kodaikanal, encouraging him always in his creative work. Both Dr & Mrs Das were keen lovers of dogs; they used to keep a large number of dogs at home and were keen dog-breeders. She, herself, was a well known social worker at Kodaikanal, being a member of the Skippo Van Committee for providing medical relief to the villagers around Kodaikanal. She organized a midday meal scheme in the primary school near the observatory. She was connected with the activities of the Sacred Heart College at Shenbaganur at the outskirts of Kodaikanal. Some of her personal collection of curios may be seen on display at the museum there. In 1959, towards the end of Das' service, she fell ill; diagnosis revealed it as cancer. She spent her last days at the Christian Medical College Hospital, Vellore. They had no children.

In his private life; Das was extremely helpful to anybody who sought his help and guidance. Anybody requesting for any data collected by the observatory was never disappointed. He was of a very helpful disposition, and privately he had many a time extended all kinds of assistance, including financial help, to many needy persons - whether it was for their children's education or for their maintenance. After his wife's death he drew up his will, bequeathing all his property to the Kodaikanal Observatory, for creation of a few scholarships in the memory of Mrs Das. To those who had come in close contact with Dr and Mrs Das, their demise has been the loss of a pair of kind and lovable hearts, who were always sought for help and consolation whenever needed.

Das had many qualities of head and heart. He was a hard task master and at the same time kind and considerate. He used to demand the best out of his colleagues and students; I have known the darkroom assistants at Kodaikanal Observatory taking meticulous care in preparation of chemicals; for they knew that the tiniest fluff on the developed plate will catch his eye. At the same time, he was always ready to roll up his sleeves and dirty his hands in difficult experiments. The amount of work which he himself had put in for the improvement of Kodaikanal is very large indeed. Das and his staff formed a compact team almost dedicated to the one great aim in view, namely to make Kodaikanal one of the foremost places of research.

Membership and Awards

Das was elected a Fellow of the Royal Astronomical Society in 1935. He was a Fellow of the National Institute of Sciences (now the Indian National Science Academy) being elected in 1943. In recognition of his distinguished services to the nation he was awarded Padmashri by the President of India on the Republic day of 1960. But the greatest recognition of his contribution to science was given by the International Astronomical Union in its 14th General Assembly at Brighton, England, when a newly discovered crater on the far side of the moon was named after him.

Das had a genuine and abiding affection for Kodaikanal. With a singular devoting to scientific research, he worked with untiring energy to build up a first class modern institution. The task that Das undertook upon himself was completed to a major extent; his followers at Kodaikanal could bring out some new discoveries through instruments built by him. But he, himself, did not have the opportunity of working with the instruments set up through years of toil and strife, most of which were completed just before he left Kodaikanal. Das had one ambition in life which he had expressed on many occasions. He wanted to work at Kodaikanal during the last years of his life. In fact the assignment he took at Hyderabad was only for three years; thereafter, he wanted to proceed to Kodaikanal and had already written to the authorities for permission to this effect. But providence ordained otherwise, and he passed away within a year of his leaving Kodaikanal!

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