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The Kodaikanal Observatory – A Historical Account

The East India Company having resolved to establish an observatory at Madras for promoting the knowledge of Astronomy, Geography and Navigation in India, Sir Charles Oakeley, then President of the Council had the building for the observatory completed by 1792. The Madras series of observations had commenced in 1787 through the efforts of a member of the Madras Government - William Petrie – who had in his possession two three-inch achromatic telescopes, two astronomical clocks with compound pendulums and an excellent transit instrument. This equipment formed the nucleus of instrumentation of the new observatory which soon embarked on a series of observations of the stars, the moon, and eclipses of Jupiter's satellites, with the accurate determination of longitude, as its first concern. The pier that carried the original small transit instrument on a massive granite pillar has on it an inscription in Latin, Tamil, Telugu and Hindustani, so that "Posterity may be informed a thousand years hence of the period when the mathematical sciences were first planted by British liberality in Asia". In any case this quotation from the first annual report of the observatory is at least a record of the fact that astronomical activity at the Madras Observatory was indeed the first among British efforts at scientific studies in India.

The longitude of the Madras Observatory has a most important role as a fundamental meridian from which observations for longitude in the Indian survey are reckoned. The accuracy with which a map of India fits into a map of the world depends solely on the accuracy of the longitude determination of the transit instrument pier at the Madras Observatory. The work of the Great Trigonometrical Survey of India commenced at Madras on April 10, 1802 when a baseline measurement, related to the Madras longitude, was made.

For over a century, the Madras Observatory continued to be the only astronomical observatory in India engaged in systematic measurement of star position and brightness. Goldingham, Taylor, Jacob and Pogson were the Government astronomers who dominated the activity at Madras. With a new five feet transit, Taylor completed in 1884 his catalogue of positions of over 11,000 stars. Double star catalogues, measures of their separation and the determination of their orbits were Jacob's principal interest. The observatory received a new meridian circle during his tenure and with it, besides observations for the determination of star position and evaluation of proper motions, a series of observations of the satellites of Jupiter and Saturn were commenced. From 1861 until his death in 1891, N. R. Pogson as Government astronomer, in keeping with progress in the science, entered into newer areas of observations. While the transit instrument and the meridian circle were both usefully utilized for a star catalogue of 3000 stars that included standard stars, large proper motion stars, variable stars and the like, it is with the new 8-inch Cooke equatorial that he made discoveries of asteroids and variable stars. The asteroids Asia, Sappho, Sylvia Camilla, Vera and the variable star Y Virginis, U Scorpii, T Sagittari, Z Virginis, X Capricorni and R Reticuli were all first discovered visually at Madras either with the transit instrument or by the equatorial instruments. The discovery in 1867 of the light variation of R. Reticuli by C. Raghunathachary is perhaps the first

astronomical discovery by an Indian in recent history. Pogson also undertook the preparation of a catalogue and atlas of variable stars, complete with magnitude estimates made by him both of the comparison and the variable. These were edited by Turner after Pogson's death.

During this period the Madras Observatory participated in observations of the important total solar eclipses that were visible from India during the nineteenth century. These were the eclipses that established the foundations of astrophysics and especially of solar physics, and in these observations the Madras Observatory's contributions were most significant. The first one of August 18, 1868 created the subject of solar physics, for at this eclipse the spectroscope was used for the first time to discover the gaseous nature of the prominences. The hydrogen emission lines seen in the prominence were so strong that the French astronomer Jansen reasoned they could be seen without the eclipse. The next day at the eclipse site the speculation was proved to be correct, making it possible for daily surveys of prominences thereafter, without the need of a total eclipse.

There were several eclipse teams scattered over the path of totality for this vital eclipse. The Madras Observatory had two teams, one at Wanarpati and the other at Masulipatam. Clouds at Wanarpati interfered with the success of the expedition. At Masulipatam, Pogson detected the hydrogen lines in emission, as had all the teams that had a programme of observation with the spectroscope. They also saw a bright yellow line near the position of the D lines of sodium. The line originated from a hitherto unknown element later termed helium, after the source of its earliest detection.

On June 6, 1872 an annular eclipse was visible at Madras. Pogson examining the region close to the moon's limb found the bright chromospheric spectrum flash out for a short duration on the formation and again at the breaking up of the annulus. This is the first observation on record of viewing the flash spectrum at an annular eclipse.

An Indian Observatories Committee in England advised the Secretary of State on matters pertaining to the administration of the Madras Observatory. In many respects, with no adequate staff to help him, Pogson had taken on more programmes of work than he could bring to a successful termination. There were questions raised in London in 1867 whether the Madras Observatory need be continued at all, since the British had started some other observatories in their possessions in the Southern Hemisphere. It was even recommended that the Madras Observatory should concentrate more on publication of the observations already made; than make new ones. The work of Pogson was commended on, and questions on the closure of the Madras Observatory relegated to the time when Pogson would retire.

Meanwhile in May 1882, Pogson had proposed the need for a twenty-inch telescope, which could be located at a hill station in South India, engaged in photography and spectrography of the sun and the stars. The proposal received active support both in India and Britain and necessary authority given for the search of a suitable location in the southern highlands of India. Michie Smith undertook the survey of Palni and Nilgiri hills in 1883 and 1885, his observations covering both the requirements of transparency and steadiness of image during both day and night. But in 1884, the Astronomer Royal recommended that Pogson having accumulated large arrears in observations, saddling him with additional work connected with the new large equatorial would not be desirable — "On Pogson's retirement, the question of establishing a branch observatory or removing the Madras Observatory to

a more favourable station might be considered. I am disposed to prefer the latter alternative. . . . . ."

The idea of making solar observations under tropical skies soon gained ground and the search for a suitable site extended over the entire Indian sub-continent. In the north, Leh, Mussoorie and Dehra Dun were examined for their suitability. In the southern part, the study was confined to Kodaikanal, Kotagiri and Madras. In his recommendation to the Government of India, the Meteorological Reporter, on the basis of his two year survey pointed out that the skies were seldom free of dust as to permit observations that called for high transparency. And so the new Observatory had to be located in the southern hills, with Kodaikanal becoming the obvious choice, on the basis of performance. At the Indian Observatories Committee meeting of July 20, 1893 with Lord Kelvin in the Chair, the decision was taken to establish a Solar Physics Observatory at Kodaikanal with Michie Smith as its Superintendent, the decision on the permanent site of the Astronomical Observatory being deferred to a later date. The observatory was to be under the control of the Government of India instead of under the Government of Madras, as it had been for a century earlier.

The last five years of the nineteenth century witnessed a rapid transformation of work from the Madras Observatory to Kodaikanal. The first observations were commenced at Kodaikanal in 1901, and these conformed to patterns in the "new astronomy" that were planned for the observatory. While the two observatories functioned together under the control of a Director at Kodaikanal, the astronomical observations at Madras were confined only to the measurement of time. The new observatory had a wide array of spectroscopic equipment specially acquired for solar studies. There were instruments to visually examine the prominences around the solar limb and the spectra of sunspots. Photographic studies included daily white light photography of the solar disc and monochromatic chromospheric pictures with the spectroheliograms in the light of ionized calcium and of hydrogen. This uninterrupted series photographs, continue unto the present day, and form one of the most unique collections of a record of solar activity available anywhere in the world. Only two other institutions, the observatory at Meudon in Paris and the Mount Wilson Observatory have a collection that spans an equivalent time interval.

Perhaps the most important result of these early years was the discovery by Evershed at Kodaikanal in 1909, of radial motion in sunspots. In the next few years numerous studies of this phenomenon now known as the **Evershed effect,** were made both at Kodaikanal and at a temporary field station in Kashmir. These early studies have been so comprehensive that little has been added to our information on it in the subsequent half century. In 1922, Evershed also discovered under conditions of good seeing, innumerable small displacements of lines equivalent to velocities of the order of a few tenths of a kilometre per second. Nearly fifty years later, with better spectrographic and image resolution, extension of this early discovery have added much information on wave phenomena in the solar photosphere and chromosphere.

For the thirty eight years between 1922 and 1960, the directors were Royds, Narayan and Das. The activity in solar physics was maintained at the pace it has been and work progressed in the traditions of the early years. Highlight of this era are the discovery of the oxygen lines in emission in the chromosphere without the aid of an eclipse, the centre-limb variations of the hydrogen lines and their use to study the solar atmosphere and the detailed study of the properties of the dark markings seen in H-alpha.

For studies of the physical properties of stars the observatory had limited instrumental resources. Nevertheless, some interesting results on comets and stellar spectra were obtained that substantiate the concept that at any such institution the men who use the instruments are more important than the instruments. Soon after his arrival in 1907, Evershed discovered the ultraviolet tail bands in Comet Daniel that are now ascribed to CO^+ Evershed made numerous studies of the planet Venus and of Nova Aquilae 1918. And his high dispersion spectra of Sirius have had the highest dispersion values employed in stellar spectroscopy until recently. . . . .

The IAU Colloquium on the 'Cyclical Evolution of Solar Magnetic Fields' was held in Kodaikanal to mark the Centenary of the founding of the observatory there. The above account of the origin of this observatory, and its activities during the first few decades, is from an unpublished note by the late M. K. V. Bappu, a former Director of the Kodaikanal Observatory and the founding Editor of the Journal of Astrophysics and Astronomy.

The adjacent page carries a photo of Michie Smith, the first Director of the Kodaikanal Observatory, and the front cover shows one of the main buildings dating back to the early years. The discovery by John Evershed of radial motions in sunspots was undoubtedly the most seminal contribution from this distinguished observatory. The back cover carries a photograph of Evershed. We have also reproduced the first two pages of his discovery paper from the Bulletin of the Kodaikanal Observatory.

The Editor
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