



His Highness' Sri Swathi Thirunal,
MAHARAJA OF TRAVANCORE - 1829-47.



HISTORY OF H. H. THE MAHARAJA'S OBSERVATORY, TRIVANDRUM,

From 1837 to 1937 A. D.

It is now exactly one century since the Observatory at Trivandrum was founded and it will be useful to trace its history since its start. The Observatory owes its origin to the initiative taken by the illustrious sovereign of Travancore, His Highness Sri Swathi Thirunal Maharaja whose reign covered a period of 18 years from 1829-1847 A. D. This period was one of the most eventful periods in the history of Travancore; during that period noteworthy improvements were made in many departments and new institutions of useful character were established. His Highness was a patron of both arts and letters and His Highness's fame extended throughout the length and breadth of India for his love and encouragement of science and arts. His Highness had marvellous poetical gifts; he was both a composer and singer of both Hindustani and Carnatic Music, and had mastery over several languages.

His Highness was himself a keen student of Astronomy. This Observatory started in 1837 under the patronage of such a distinguished sovereign, is not only one of the oldest of its kind in India but also one that has been hitherto doing very useful work under the patronage of the successive sovereigns since then. The suggestion for the establishment of an Observatory at Trivandrum was no doubt made by Mr. John Caldecott, the then Commercial Agent of the Travancore Government at Alleppey. General Stuart Fraser, the then British Resident at Trivandrum also supported his views. His Highness, desirous that his country should also partake of the scientific investigations in which other western countries were interested, bestowed his special care on the subject and sanctioned the construction of an Observatory at his capital, equipped with many instruments that were then available in Europe. The construction of the building was accordingly commenced in the year 1836, as planned under the supervision of Col. Horsely of the Madras Engineering service, and finished in the middle of the following year. The site chosen was the highest available in Trivandrum

and was at 200 feet above sea level, being the top of a hill commanding a good view on all sides. The top of the hill gave excellent view of the horizon particularly on the western side.

During that time the attention of the authorities was directed towards the appeals of Humboldt and others for a continued system of observations relating to terrestrial physics, especially to terrestrial magnetism. Travancore offered special advantage in this direction as the magnetic equator passes across the country, and hence Mr. Caldecott was asked to construct additional buildings for magnetic and meteorological observations. Mr. Caldecott, however, started a regular system of meteorological observations from July 1837. The publication of the first astronomical Ephemeris adapted to the meridian of the Trivandrum Observatory was started during his time (1838). He went to England in 1838 to select the various instruments required for the Observatory, and he returned in the year 1841; and the instruments brought by him were installed in their places during that year itself. An assistant trained under Mr. Taylor at the Madras Observatory and a few more were also appointed to take the routine observations. Three assistants were allotted to the Transit Instrument for observing transit of stars to standardise local time, and three to each of the Mural Circles. This was the astronomical work then.

A series of observations both meteorological and magnetic were also collected by other assistants and these were forwarded to the Royal Society of London and to the Court of Directors of the East India Company. Mr. Caldecott again went to England to seek the help of some of the scientific societies to publish his observations but he failed in his endeavour. He returned to Trivandrum in 1847 and continued to be in charge of the Observatory till 1849. He died at Trivandrum on 17-12-1849.

For some time after the death of Mr. Caldecott there was no Director for the institution.

Mr. John Allan Broun, F. R. S., was appointed three years later as Government Astronomer to succeed Mr. Caldecott.



John Allan Broun Esq, F. R. S.
Government Astronomer 1852-1869

He was an eminent astronomer and he had previous experience in the subject as he had been working at the Makerstoun Observatory in Scotland for some years. He took charge of the Trivandrum Observatory in 1852. He started with a reorganisation of the department. He wanted to examine the laws of terrestrial magnetism and the variation of meteorological elements as influenced by height in the atmosphere. This, he thought, was possible only by simultaneous observations at two stations differing in height. With this view he approached Government through Lieut-General Cullen, the then British Resident at Trivandrum and he obtained sanction in 1852 for the construction of an Observatory at a suitable site on the Western Ghats. This work had to be kept in abeyance for some time, as his time was taken up by certain improvements made in the astronomical and magnetical departments of the Trivandrum Observatory by making some alterations in the buildings and in the installation of the instruments. As it was quite necessary that the astronomer should always be by the side of his instruments, he was provided with quarters at the Observatory-Hill. As the Observatory occupied the summit of a small hill and as the visible horizon was many miles away all round, he desired to give as much architectural beauty to the Observatory buildings and his new quarters, as possible. These buildings were completed towards the close of 1855. The Observatory had three domes on its terrace and this formed a nice mark of identification of the Observatory even from a great distance from the site. These domes could be observed by the mariners when they passed across Trivandrum on the Arabian Sea.

The longitude and latitude of the site of the Observatory were re-determined during his time and the values arrived at were $76^{\circ} 59' 45''$ East longitude and $8^{\circ} 30' 32''$ North latitude.

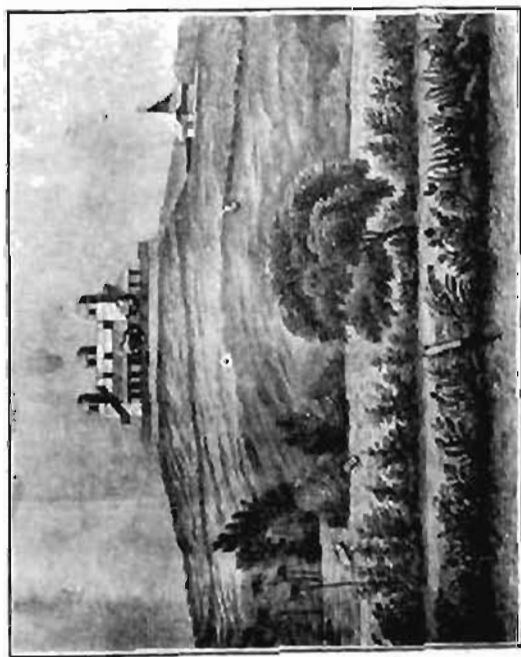
The question of the construction of a magnetic Observatory on the Ghats was soon taken up. Among the rugged peaks of the Western Ghats seen from Trivandrum, one is specially conspicuous for its unique height. It is also tapering like a cone. This peak was considered by the ancient people of Travancore as the place made holy by the stay of the great sage, Agastier.

It is one of the highest peaks of the Western Ghats and is nearly 22 miles from Trivandrum in bee-line. After encountering considerable difficulties, the construction of the Observatory at this site was begun in 1854 and it was completed by the end of 1855. The structure of the building was all in wood. The position of the Observatory at the Agustiar hill was approximately at $8^{\circ} 38'$ North latitude and $5^{\text{h}} 9^{\text{m}} 15^{\text{s}}$ East longitude. Its height was 6200 feet above sea level. The temperature at night would be about 45°F , and during a great part of the year the hill would be covered by clouds, and stormy conditions would prevail. At first, a set of instruments were taken for installation at the Agustiar Observatory, and before the final observations were collected, the Observatory at the peak had to be repaired in 1863 and a few more instruments were also added then.

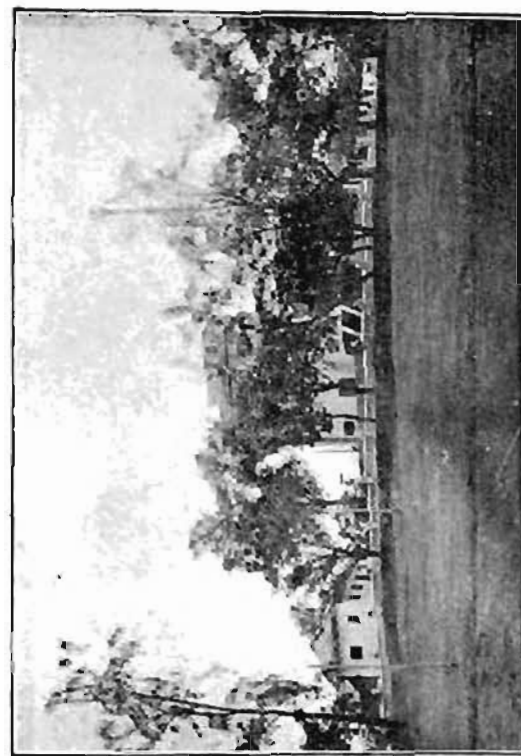
Besides the magnetic observations obtained at the two Observatories, others on magnetic declination and meteorology were made simultaneously at fixed periods at different stations situated nearly on the magnetic equator. There were thus observing stations at different elevations ranging from 200 feet to 6200 feet. For a month, hourly observations were taken in all these stations by about 15 observers.

By his efforts, Mr. Broun was able to show the scientific world the importance of carrying on such observational work at Trivandrum. His personal guidance and supervision of the work had to be discontinued after 1865, when he left for England. Broun returned in 1866 and continued in service till 1869. This record of pioneer work of Mr. A. Broun from 1852 to 1865 led to results of the greatest importance in magnetism and Broun's speciality in the field will be evident from the fact that his work and results are quoted even to this day in papers on magnetism. Broun died in Lynton (Devonshire) on 22-11-1879.

The Government of Travancore, later on, decided to close the institution, on grounds of finance; but provision was made for carrying on a limited series of observations for six more years. These were sent to Mr. Broun in England for incorporation into his book.



Trivandrum Observatory during the time of
Mr. J. A. Broun.



Trivandrum Observatory during the time of
Dr. A. C. Mitchell.

Trivandrum Observatory
Mr. J. A. Broun

The next period of nearly two decades was one of no active work in the Observatory due mainly to the absence of any Director and the reduction of the establishment. It is to be noted here that the annual charge for the establishment during the time of Mr. Broun was nearly Rs. 20,000, which was reduced to Rs. 1116 per year after his retirement. The routine work of meteorological observations was, however, carried on by the assistants attached to the institution.

In the year 1892, Dr. A. C. Mitchell, D. Sc. F., R. S. E. Professor of Mathematics, offered his services to the Government as Honorary Director of the institution, and Government gave him charge of the Observatory in addition to his work at the College as Professor. During his time, the astronomical building was extended on its western side and a tower of about 50 feet height was erected with a revolving dome to house a small equatorially mounted telescope of 4 inches aperture. His main work, however, was to extend the meteorological observations, for which additional instruments were purchased, and he began hourly recording of meteorological data. Cloud studies were also begun at his time. He also organised a scheme of rainfall measurements in the State with a specially designed raingauge. The observations thus collected were telegraphed to the Meteorological Department of the Government of India and were published weekly in the Government Gazette.

About this time, as a result of Mrs. Broun approaching the Government of India through the Royal Societies of London and Edinburgh and other Scientific bodies, the former undertook to publish the observations of Mr. Broun, whose records were then with the Royal Society of Edinburgh. Mr. J. Eliot, Meteorological Reporter to the Government of India and the person who was entrusted with the work of editing these observations, visited Trivandrum in 1892 and saw some of the instruments used by the late Mr. Broun and inspected the various places where Mr. Broun had made observations. The results were published and fully analysed and constitute a permanent record of the Meteorological work of Broun in this country (see Vols. 7, 8 and 10 of the Indian Meteorological Memoirs).

For a long time, it was the practice to fire time-guns at Trivandrum, the time being given by the Observatory. Dr. Mitchell introduced the system of firing time-guns by an electrical switch operated from the clock-room of the Observatory. Though this formed an improvement upon the till then existing system of daily correcting the clock kept at the Brigade indicating gun-fire times, its successful work could not be relied upon always as in one year it failed to operate 134 times.

He was also responsible for compiling a few tables of meteorological information collected from the daily observations available. Dr. Mitchell held the office of the Honorary Director till 1910, when he was succeeded by Mr. J. Stephenson, B. Sc., A. R. C. Sc., Professor of Physics. He continued the routine work started by Dr. Mitchell till 1916, when he went to England on furlough. During his time, Government appointed in 1915 Mr. M. Rama Varma Raja as Assistant Director. He was an enthusiastic amateur in astronomy and was in charge of the Observatory when Mr. Stephenson was on leave. He published in 1916 an astronomical ephemeris giving some of the important celestial information usually given in the Nautical Almanac published in England. It has to be mentioned that during the time of Mr. Caldecott, the first Astronomer of Trivandrum, there were three such publications. Mr. Raja's Ephemeris was published for 3 more years. He also put in working condition the 5-inch Equatorial telescope kept unused for many years before his time. As there was not sufficient funds available to house it properly, it had to be erected in open space, with a small movable roofing to prevent direct Sun light and rain falling on it. In the year 1919, on the recommendation of the Honorary Director, the Assistant Director's place was abolished.

In 1920 Mr. K. R. Ramanathan, M. A., (now Dr. Ramanathan, Director, Colaba Observatory) Lecturer in the Physics Department was appointed Honorary Director when Mr. Stephenson went on leave and he held the post till the end of 1921, when he went on leave and Mr. V. Sivaramakrishna Iyer, M. A., was appointed acting Director of the Observatory. Dr. Ramanathan took the trouble of arranging for the normals of a large



J. Stephenson Esq., B. Sc., A. R. C. Sc.,
Honorary Director (1911-1920)



Dr. A. C. Mitchell, D. Sc., F. R. S. E.,
Honorary Director (1892-1910.)

number of meteorological elements being computed up to date. He also wrote a paper on thunderstorm activity in Trivandrum and addressed the Meteorological Department of the Government of India in regard to the need for recognising the meteorological work done in this institution. Dr. Ramanathan left Travancore service in 1922 and Mr. V. Sivaramakrishna Iyer was confirmed as Honorary Director. Self-recording instruments for the automatic registration of pressure, temperature, humidity and wind velocity were fitted up in 1922, and the institution was recognised as a first class Meteorological Observatory by the India Meteorological Department from 1922 onwards. The results of the daily observations were published in the Monthly Weather Review and in the Annual Review of the India Meteorological Department.

In 1927, certain changes were introduced by Government in the working of the Observatory Department. Government considered it necessary to revive the astronomical activity of the institution and with a view to bring this about, they placed the Honorary Director, Mr. Sivaramakrishna Iyer, in charge of Meteorological work with the designation 'Government Meteorologist' and appointed Dr. H. Subramani Iyer as 'Government Astronomer' to carry on astronomical work. From that time, two independent sections have been working in the Observatory.

Meteorological Work.

Consequent on the growth of aviation and the need of daily upper air data for pilots, the India Meteorological Department requested the Government of Travancore to open a Pilot Balloon Station as an annexe to the Meteorological Observatory. This was sanctioned and balloon observations commenced in December 1928, under the technical supervision of the Upper air section of the India Meteorological Department who have supplied all the observing instruments and look after their upkeep.

Eye observations of all important meteorological elements are now taken thrice daily at 8 A. M., 12 Noon and 4-30 P. M. All these observations are printed in the daily weather reports

monthly and annual weather reviews of the India Meteorological Department. The Pilot Balloon observations are also published separately by the Upper Air Observatory at Agra and incorporated in the daily weather report of the India Meteorological Department. The results of the Balloon observations from this station are communicated daily to the Pilot, Tata Air Mail Service on days when the aeroplane is in Trivandrum and also to other forecasting centres like Quetta and Karachi whenever demanded.

There are 77 rain-gauge stations in the State maintained by this Department. There are besides a very large number of non-departmental stations also maintained by the Agricultural and Public Works Departments. The daily rainfall observations from all these stations are received here at the end of each English month. They are published in the Government Gazette and the normals for each station are calculated for statistical purposes. Rain-gauges of standard design, measuring glasses and other accessories are all supplied from this Department to other stations.

Government recently sanctioned the opening of a Weather station at the Alleppey pier under the technical supervision of the Government Meteorologist. This station started work from Edavom 1112. The opening of another station at Cape Comorin also is under the consideration of Government. It is possible to have an efficient system of weather forecasting and storm-warning for the whole state when the stations at Alleppey and Cape Comorin function fully and supply data to Trivandrum.

Astronomical Work.

With the creation of the Astronomical Department, weekly publication of astronomical notes giving the position of the Sun, Moon and the planets for Trivandrum mean-noon was started. Information regarding other important celestial phenomena was also included in this publication. This has now been changed to an advance annual publication forming the first part of the Government Almanac and Directory from 1938 onwards. Such a publication requires greater attention and harder work on the



**Dr. K. R. Ramanathan, M.A., D.Sc.,
Honorary Director—1920-1921.**



**V. Sivaramakrishna Iyer Esq., M.A.,
Honorary Director (1921-1927) and
Government Meteorologist
from 1927.**

existing small staff of the Department. But this has been willingly undertaken, as a handy volume containing such data on modern lines would be more useful to the public who are interested not only to know the exact positions of important celestial bodies and other astronomical facts, but also to apply these data for casting horoscopes etc., with great accuracy.

Celestial photographic work was also undertaken whenever important celestial phenomena worthy of a permanent record occurred. Transit of Mercury in 1927 was photographed; a number of Solar and Lunar photographs were taken with the Solar Camera during eclipses and some of these published in Journals like the "Current Science".

A small workshop equipment was added to the Observatory and an Attender-Mechanic appointed to look after the upkeep of the various instruments. Among the new instruments purchased for the astronomical section may be mentioned the addition of an astro-camera. As the clock-drive of the equatorial mounting here was not accurate enough to allow long photographic exposures, this camera was tested in the private observatory of Dr. Parameswaran and it is noteworthy that it was responsible for the discovery of a nova during these testing operations early in February 1937.

From 1928 daily Time-Signals are being received by the use of a wireless set. Till then, the mean time clock was standardised only by the star observations with the 4-inch Transit circle, whose errors had not been well determined and allowed for so as to give time correct to a fraction of a second. With the introduction of Time Signal observations and their checking by transit observations of stars, time determination became more accurate and less dependent on transit observations, which could not be made for nearly half the year due to bad weather conditions.

Another change made in connection with giving accurate time to the public was the system of firing the time-gun by the use of an electric signal controlled from the clock-room of the Observatory. This was different from the type started by

Dr. Mitchell and discontinued later. A light signal at the gun-shed given by the operation of a switch in front of the mean time clock, gave the exact instant for firing the gun. This arrangement started in 1935, is working most satisfactorily till now and has not failed even once during all these days and the time given could be relied on correct to a second.

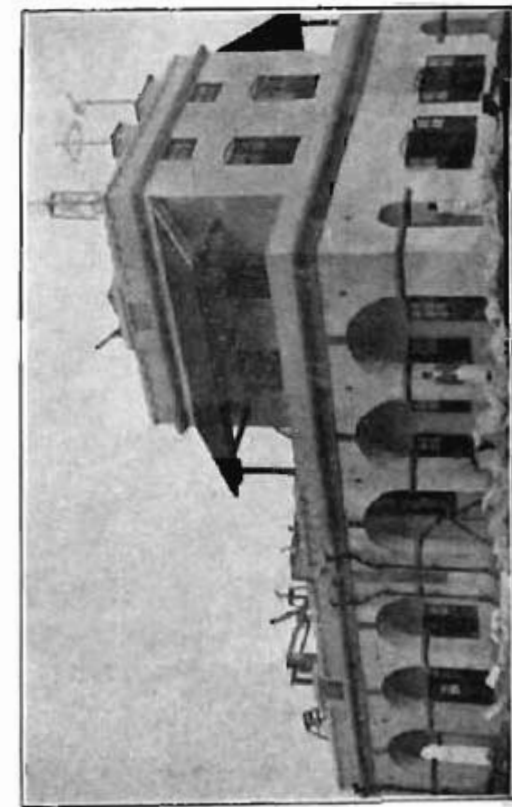
Training in Practical Astronomy.

Apart from giving all facilities to the students of the Science College in both studying the sky and the use of the chief astronomical instruments, training of students in practical and observational astronomy has been undertaken and it is gratifying to note that this is perhaps the only astronomical institution in India where such instructions are given to students who come seeking it. So far no fee has been charged for such instruction though this involved additional work for the staff. Some students who offered astronomy as one of their subjects of study for the I. C. S. Examination had undergone training in this Observatory since 1932. This activity of the institution is particularly note-worthy, especially when a separate university for the State is established by Government at present.

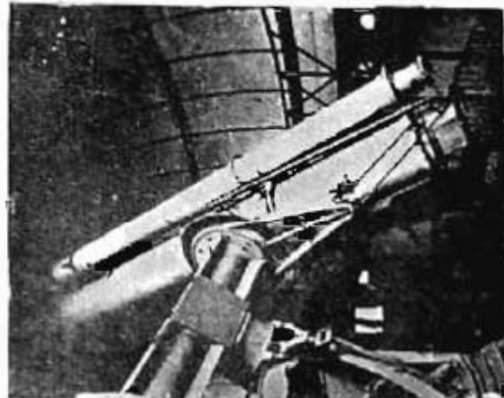
The Observatory Annexe.

In 1931 the Observatory buildings built by Mr. Broun and Dr. Mitchell had to be dismantled, as that spot had to be given over to the Engineering Department for the construction of a high level reservoir for distributing water in various parts of the town. There was no other site so high and fitted for the purpose, and various other sites were inspected for locating the new Observatory. None could be found so good as the Observatory Hill. Thereupon Government sanctioned the construction of a new building adjacent to the High Level Reservoir, for locating the Observatory, in addition to part of the quarters of the Astronomer built during the time of Mr. Broun. In both these buildings, are at present, located the Meteorological and Astronomical Departments.

The five-inch Equatorial has been shifted to the top of the newly built Reservoir and is thus able to secure a better view of



Observatory Annex built in 1931.



Telescope fitted with a camera and a guiding telescope.



the sky all round, than its old position allowed. A revolving dome and a separate and more decent house will be given to it in the near future. These constructions and installations of the Transit Instrument and the Equatorials and fixing of the clocks in the new rooms etc, took a long time, as the latter involved a series of observations extending over many weeks.

Malayalam Calendar Computing Section.

Towards the end of 1934 Government asked Dr. H. Subramani Iyer to be in charge of the Malayalam Almanac computing section, which was till then housed in the Huzur Secretariat buildings. It was thought convenient to remove the office of this section temporarily to the Observatory buildings and three issues of the Almanac were published under the supervision of the Astronomer. The main work of this section is the computation of the Malayalam Panchangom according to the Hindu traditional method. It will not be out of place here to mention that the first Government Malayalam Panchangom was published about the year 1837 A.D. so that this office also is almost entering its 100th year of working under the kind patronage of His Highness the Maharaja.

The facilities given for the almanac computing section to work with those employed in computations according to modern astronomical methods are bound to improve the accuracy of the Hindu mode of calculating the positions of celestial bodies, which has a past history [of several] centuries. The astronomical calculations devised by the ancient Hindus, though they do not yield the same accurate results as modern astronomical calculations, are in themselves tolerably interesting and have a value in as much as they form the basis of many religious and other festivals regulating the lives of many Hindus all over India. When it is also remembered that all their knowledge and calculations are based upon continuous and patient observations with the naked eye and other simple instruments, it is even now a matter for great wonder how even such an amount of accuracy has been possible. Therefore when this mode of calculation receives the improvement that is possible by the introduction of western astronomy wherever necessary, we can

expect a result for which there is so much of demand. It is also high time that our calendar computation compares favourably with the results of computation embodied in any western calendar, and at the same time it be allowed to preserve its special features wherever possible.

Conclusion.

It may be mentioned that year after year the value of the institution is rising in importance and many who come to Trivandrum, whether party of students or party of sight seers, take special interest in visiting the institution and looking at the celestial objects with the aid of the telescope, and seeing the balloons rise. There is no doubt that the work of this institution could be considerably raised in quality and quantity, if adequate facilities could be given for the whole staff to stay at the premises of the Observatory and if more trained assistants could be had with a view to carry on research work when finances would permit such an improvement. It is hoped that, with the rapid advancement the State is making in all directions, a still brighter and more useful period will open for the Observatory. An up to date magnetic and seismic Observatory at Cape will form a useful adjunct and will go a long way towards focussing the attention of the scientific world on this institution.

The Royal house which planted this little thing on a small mount a century ago has been watching its growth and helping it to grow and blossom into a big tree. The process of growth is not yet complete. His Gracious Highness Sri Chithira Thirunal Maharaja of Travancore, a patron of arts and science, no less great than his predecessor who founded this institution, is a keen lover of astronomy and meteorology and has, with his characteristic zeal, infused more life and energy into it. Considering its past traditions and its unique position near the extreme south of India, this institution, with additional facilities for observations and research, which His Highness's Government are always ready to give, will, in future years, grow up to its full stature and serve as one of the world's beacon lights to guide mankind in his survey of this mysterious universe around him.

H. SUBRAMONIA IYER,
Government Astronomer.



Dr. M. Rama Varma Raja
Assistant Director (1916—'19)



Dr. H. Subramonia Aiyar, M. A., Ph. D., (London)
Government Astronomer from 1927.

THE EARLY YEARS OF TRIVANDRUM OBSERVATORY AND THE SCIENTIFIC WORK OF JOHN ALLAN BROWN.

Among the prominent features of the scientific progress of the first quarter of the 19th century was its awakened interest in geophysical science. This was largely the result of investigations made by Humboldt, Arago, Biot, Hansteen, and others. It led to the establishment in several parts of the world of observatories whose principal object was the study of meteorology, terrestrial magnetism, atmospheric electricity, and other cognate subjects. Among these, Trivandrum Observatory took an honoured place, and a brief account of its establishment and of the work of the distinguished man who did so much to bring it into prominence, may be of interest in connection with the centenary of its foundation.

The proposal to establish an observatory at Trivandrum was first formulated in 1836 by Mr. John Caldecott who, at that time, was Government Commercial Agent at Alleppey. Colonel Fraser, then British Resident in Travancore, brought the matter to the notice of His Highness Rama Varma Maharajah of Travancore. His Highness was well known as a scholar and a lover of learning, and, as might be expected, he gave the project his hearty approval and most effective support. He sanctioned the establishment of the Observatory, appointed Mr. Caldecott as its first Director, and empowered him to proceed with the erection of the building and the purchase of such instruments as would be most suitable for its intended work.

It is right that attention should be drawn here to this highly enlightened action of the Travancore Government. The State of Travancore is relatively small in area; its secluded position has kept it outside the main stream of contention and strife of which India has frequently been the scene; its people have been peacefully occupied with their own avocations, and have seldom thrust themselves on the attention of a busier and less happy world. But the country has been blessed by a long succession of Maharajahs who have been among the most enlightened of the Ruling Princes of India, and not the least of their aims has been

the encouragement of learning. It is to this that the State owes its present position as the best educated area of India. And although the action of His Highness Rama Varma was quite in accord with traditional policy, it was none the less praiseworthy, for, Trivandrum Observatory, in its early development, was the first institution in Asia to be devoted to the study of terrestrial physics.

According to Mr. Caldecott's proposals, the intention at first was the establishment of an astronomical observatory, and a certain amount of equipment for this purpose was ordered for the Observatory. The earliest work of the institution was however devoted to meteorology, and systematic observations in this department began in July 1837. It would appear that observations in terrestrial magnetism were also begun about the same time. Mr. Caldecott experienced some difficulty in arranging for the publication of his observations, and his absence in Europe in connection with this and related matters prevented the newly established institution making an immediately effective start. Mr. Caldecott remained in charge until his death in 1849. In January 1852, Mr. John Allan Broun assumed charge as Director and continued in this office until his retirement in April 1865.

Terrestrial Magnetism, with the investigation of which Broun was so closely identified, seems to have a peculiar attraction for Scottish students of science. Johann von Lamont, though he became a naturalised German, was a native of Braemar. Balfour Stewart, to whom we owe several most suggestive ideas in the science, was born in Edinburgh. Welsh, who was in charge of Kew Observatory, belonged to Haddington. Chree, one of the most active workers and writers on the subject, and Walker, who was in charge of Eskdalemuir Magnetic Observatory, were both Aberdonians. And coming down to recent or present times, the leader of the British Magnetic Expedition to Northern Canada, during the International Polar Year in 1933-34, was Mr. J. M. Stagg; and our most accomplished auroral observer of today is Mr. G. W. Reid, of Kirkwall; both graduates of Edinburgh University. To this list we have to add

the name of Broun. He and Lamont were two of the leading authorities in terrestrial magnetism during the nineteenth century.

Some particulars of the life and work of Broun will be of interest at this juncture. He was born at Dumfries on 21st September 1817, and entered Edinburgh University in 1837. Here he became acquainted, and formed a lasting friendship with John David Forbes, then Professor of Natural Philosophy at Edinburgh, and under whom Broun became deeply interested in physical science. In 1842, Sir Thomas Macdougall Brisbane had established a magnetic observatory (the first of its kind in Britain) at Makerstoun, in Southern Scotland, and Broun was appointed as its first Director. Here he remained for seven years and produced some most excellent work. The Royal Society of Edinburgh published the detailed observations at Makerstoun in volumes XVII, XVIII and XIX of their *Transactions*.

Broun remained at Makerstoun until 1849. He then resigned his appointment, and studied at Paris and other Continental centres for two years until his appointment to Trivandrum in 1851. His first task on arrival was that of taking careful stock of the general position of affairs in connection with the Observatory, and of reaching some decision on the difficult question as to the lines on which its future work should be planned. He came to the conclusion that the prosecution of astronomical research work at Trivandrum would be a matter of very serious difficulty, and that it would be better to concentrate upon the study of meteorology and terrestrial magnetism. The results of his thirteen years' work at Trivandrum abundantly justified this decision; for it has been given to few workers in the sciences named to reap so rich a harvest. His chief discovery is now one of the fundamental principles of terrestrial magnetism; that magnetic change or disturbance on the earth is not a local, but a world-wide phenomenon. Another very important discovery was his establishment of the connection between disturbances on the surface of the sun, and subsequent changes in the state of the earth's magnetism, and proving that these changes recurred after intervals of 26 or 27 days. He also

reached the remarkable conclusion that large magnetic disturbances proceed from particular solar meridians. It is interesting to note that these relationships are still the subject of much research work. A third result was reached in his work on the lunar influence on terrestrial magnetism. This was slightly later than, though quite independent of, the work of Kreil. He showed that there existed a lunar-diurnal effect; that it varied with the position of the sun, and that its amount was inversely proportional to the cube of the moon's distance. Lastly, he was the first to give a definite form to the solar-diurnal variation in terrestrial magnetic force in equatorial regions, a matter of very considerable importance in the theory of the diurnal variation. These are four of the really fundamental principles of the science of terrestrial magnetism as it stands today, and their establishment was the work of Broun. And it is pleasing to notice that in many textbooks and memoirs, his work at Trivandrum is quoted down to present times.

An interesting feature of Broun's activity at Trivandrum was his establishment of an observatory on the summit of Agastia Malley, 6200 feet above sea-level. It was one of the earliest efforts of the kind. This peak forms the most prominent feature on the eastern horizon as seen from Trivandrum. The difficulties encountered in carrying out this project were of a kind sufficient to discourage most men. But they were overcome by Broun, and he made a valuable series of observations on the effect of height on the diurnal variation of atmospheric pressure.

Mr. Broun retired from his post as Director in 1865. During the fourteen remaining years of his life, he was chiefly engaged in editing the publication of the Trivandrum magnetic records, of which, unfortunately, only one volume was issued. The chief results of his work are, however, contained in his numerous papers, of which he published more than fifty. They appeared chiefly in the *Transactions* of the Royal Societies of Edinburgh and London, and in other scientific journals. The meteorological observations made at Trivandrum under Mr. Broun's supervision were considered to be of such value that the Meteorological Department of the Government of India undertook their publication, along with an exhaustive discussion

by Sir John Eliot, and they are included in the tenth and succeeding volumes of the *Indian Meteorological Memoirs*.

Broun's work was recognised by scientific men as being of very high value, and as evidence of this it may be stated that he was awarded two prizes which are generally reserved as the reward of distinguished merit. The first was the Keith Prize and Medal of the Royal Society of Edinburgh, for the period 1859-1861. The second was the Royal Medal of the Royal Society of London, awarded in 1878.

The life of a man whose energies are thus given so wholly to scientific investigation is lived on an entirely different plane from that occupied by his fellow creatures. He is concerned with enquiry into matters which are far removed from the play of human passion and from the debasing effects of merely temporal or personal interest. His business is the ascertainment and establishment of truth in a region which far transcends the petty affairs of this world, and as a rule, he confines himself strictly to that business. It becomes the one thing which makes life worth living. It may mean – and often has meant – comparative poverty, the negative indifference of the unlearned mob, and the positive neglect of the time-serving politician. But the reward comes in time, with a peace of mind which the world can neither give nor take away.

The present occasion prompts one final reflection. A century ago, the Government of Travancore took a most important step forward in the prosecution of geo-physical research; a step, it must be said, that was far ahead of the time. Their action, and its consequent results, have been rewarded by the appreciation of all who deal with the study of those subjects whose investigation was thus so effectively supported. Since then, the advance in the physics of the globe has been truly remarkable, and it is to be remembered that no inconsiderable part of that progress was initiated in Trivandrum Observatory. But though the horizon widens, it still remains; there is much that is still obscure, unexplained, and even mysterious. Is it

too much to hope that ere long the Government of His Highness the Maharaja will again lead the way, and true to the traditional policy of a hundred years, initiate a scheme for the further prosecution of this most important branch of scientific research.

Edinburgh,
25th May 1937.

A. CRICHTON MITCHELL.
