

## Astronomical Archives in India

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### ABSTRACT

A brief overview is given of the activities of nine observatories (located at Madras, Lucknow, Trivandrum, Poona, Calcutta, Dehra Dun, Kodaikanal, and Hyderabad) which were established in India in the 19th century. A bibliography of publications of these observatories, sorted according to type of astronomical data, and some notes on observational material, is also presented.

### 1. Introduction

India with its long tradition of star catalogues, spectroscopy, spectrography, and astrophotography has a very rich archival material on astronomy. We may recall that the first modern observatory was built at Madras already in 1792 where initially a series of observation of stars, the moon and eclipses of Jupiter's satellites were commenced. We list the following Indian observatories, which were established and started working in the 19th century<sup>1</sup> (Ansari 1985). The years of establishment and abolition are given in parentheses.

1. Madras Observatory (1792–1900)

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<sup>1</sup>S.M.R. Ansari, *Introduction of Modern Astronomy in India during the 18<sup>th</sup>–19<sup>th</sup> Centuries*, New Delhi, 1985. It is the corrected version of the article published originally in *Indian J. of History of Science*, Vol. 20 (1985) 363–402. In the sequel we refer to this publication just by Ansari (1985). For an earlier version, see S.M.R. Ansari, *On the Early Development of Western Astronomy in India and the Role of the Royal Greenwich Observatory*, Archives Internationales d'Histoire des Sciences, Vol. 27, No. 101 (1977), pp. 237–262 (Ansari 1977). This is the first detailed work based on archival sources on the modern astronomical observatories in India.

2. The Royal Observatory at Lucknow (1835–1849)
3. Raja of Travancore Observatory at Trivandrum (1842–1865)
4. Capt. W.S. Jacob’s Observatory at Poona (1842–1862)
5. St. Xavier College Observatory at Calcutta (1875– ca. 1918)
6. Maharaja Takhtasinghji Observatory at Poona (1882–1912)
7. Hennessy Observatory at Dehra Dun (1884–1898)
8. Solar Observatory at Kodaikanal (1901–to date)
9. Nizamiah Observatory at Hyderabad (1901–1954)

Modern observatories, established after the independence of India in 1947, are not the subject of the present review; we refer to recent publications by Kochhar & Narlikar (1993) and Bhattacharyya & Vagiswari (1985).

We give in the following a brief account of the above-mentioned observatories where important astronomical results were achieved, and whose astronomical work became internationally known.

## **2. The Madras Observatory (1792–1900)**

Established in 1792 through the efforts of Michael Topping (1747–1796), it was the first modern observatory. Active astronomical work was started when the Dane John Goldingham (d. 1849) was appointed as Government astronomer (1796–1830). He was followed by quite well-known astronomers: Thomas G. Taylor (1830–1848), William S. Jacob (1814–1858), and finally Norman R. Pogson (1861–1891). These astronomers started a series of observation of stars, the Moon, and eclipses of Jupiter’s satellites. Later Madras Observatory became internationally known for its general star catalogues published in two volumes by Goldingham; of 11000 stars by Taylor, supplemented by 1440 stars observed by Jacob, and of 51101 stars carried out during 1862–1887 by Pogson (see Ansari 1985, p. 21–27, and the bibliography below). Pogson was also an expert in the observations of asteroids and variable stars. He discovered six minor planets during his tenure at Madras, and continued working on his *Variable Star Atlas*. We presume that the records of all his observations, in particular the astrophotographic plates should be available in Kodaikanal Observatory.

All these Government astronomers had a very active correspondence with the Astronomer Royal: N. Maskelyne, G.B. Airy, and W.H.M. Christie. This correspondence is very significant for the study of the development of modern astronomy in India (Ansari 1985, p. 43–47; Ansari 1977, p. 257–261).

The contribution of Maj. James F. Tennant, who was the director of Madras Observatory during 1859–1860<sup>2</sup> is also noteworthy (Ansari 1985, p. 25). His major contributions were the observation of the total solar eclipses of Aug. 17–18, 1868 at Gunttoor and of Sept. 11–12, 1871 at Dodabetta (Nilgiri Hills) in India, as well as the transit of Venus in 1874 at Roorkey. He had specialized in the then new technique of photography. By that means, he found an ‘unknown’ yellow line in the solar spectrum, which was later identified by Sir Norman Lockyer as being due to the new element helium.

### 3. The Royal Observatory at Lucknow (1835–1849)

This observatory was founded by the Indian ruler of North providences (*Oudh*, modern *Awadh*), Nawab Nasiruddin Haydar (reign 1827–37), and Major Richard Wilcox was the director of the observatory during 1835–1848 (Ansari 1985, p. 29–33, where the whole story of its foundation and abolition after the death of Wilcox is given). We are concerned here with the astronomical work of Wilcox. He worked under the guidance of George Airy, the Astronomer Royal. His observations comprised major planets, the minor planets Ceres, Vesta, Pallas and Juno, eclipses of Jupiter’s satellites, lunar occultations of stars, meridian observations of stars of the Nautical Almanac, etc. He also reduced his observations for the years 1841–43. However, we have not been able to find at present a record of those observations, apart from the volume of Lucknow Magnetic Observatory<sup>3</sup> (Ansari 1985, p. 33–34).

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<sup>2</sup>He was elected in 1869 as Fellow of the Royal Society, and President of the Royal Astronomical Society (UK) for 1890–91.

<sup>3</sup>We conjecture that they might be available in Dr. Alloy Sprenger’s Collection. Dr. Sprenger was an Austrian Orientalist, who worked as the Principal of Delhi College, Delhi.

#### 4. Raja of Travancore Observatory (1842–1865)

The observatory was founded by the Raja Rama Vurmah (modern Verma) at Trivandrum in 1837. The director of the observatory, John Caldecott, started astronomical observations in the same year. He collected a good deal of stellar data with the assistance of an Indian, trained by T.G. Taylor. These data were transferred to the Royal Society. We may mention here his observations of the solar eclipse of Dec. 21, 1843, carried out at the source of Mahe river, including observations of Bailey's beads. He also observed and computed the elements of the comets of 1843 and 1845. The former was the 'daytime' comet observed in March 1843<sup>4</sup>. The latter was 'Colla's comet' observed in June 1845 (Ansari 1985, p. 34–35; Broun 1857). Caldecott's observations of this comet were used by J.R. Hind<sup>5</sup> to calculate its orbit.

#### 5. Capt. Jacob's Observatory (1842–1862)

A private observatory was founded by Capt. W.S. Jacob at Poona (modern Pune). It was in operation from 1842 to Jacob's death in 1862. The main work done by the founder was the observation of 244 double stars, of which he published a catalogue. He is also famous for his calculation of the orbits of a few binaries, e.g.,  $\alpha$  Centauri, and in particular for the triplicity of  $\nu$  Scorpii in 1847 (Ansari 1985, p. 35–36).

#### 6. St. Xavier College Observatory at Calcutta (1875–1918)

It was the *first* observatory with spectroscopic facilities under the directorship of Father Eugene Lafont (1837–1908), who joined the College in 1865. He started working in astronomy in 1874, when he took part in the expedition of the Italian astronomer P. Tacchini to observe the transit of Venus of Dec. 9, 1874 in Madhupur (Bihar). Father Lafont then set up the first spectroscopic laboratory in India, to record

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<sup>4</sup>The comet is important, since A.C.D. Crommelin in his *Comet Catalogue* (Memoirs of the British Astronomical Association, Vol. XXVI, Pt. 2, Perth, 1925) lists (Serial No. 198) its period as 512.39 years.

<sup>5</sup>Famous for his book: *The Comets: A descriptive treatise upon those bodies, with a condensed account of the numerous modern discoveries respecting them; and a Table of all the calculated comets from the earliest ages to the present time*. London, 1852.

solar and stellar spectra. To that end, he collaborated with Father A. Secchi (1818–1878), director of the Collegio Romano and founder of the *Società degli spettroscopisti Italiani* in 1867. In about 1877, a daily mapping of the solar prominences was carried out at the College Observatory.

Father Lafont, along with his assistant Father Alphonse de Penarande (d. 1896), carried out many observations: the motion of Mars (1879) and of a comet; recording the solar chromosphere during the solar eclipse of May 24, 1882 and of June 6, 1890 at Bhagalpur; the transit of Mercury on May 10, 1891 etc. Another Jesuit, Father V. de Campigneulles of the same College led an expedition to Dumraon (Bihar) to observe the total solar eclipse of Jan. 22, 1898 (Biswas 1994). He reported that the totality lasted 99 seconds, recorded solar prominences, inner and outer corona, the last one reflecting spectral lines of H, He, Ca, Fe, etc. De Campigneulles published two monographs on that important solar eclipse. According to our information, some records of these observations still exist at the College (Ansari 1985, p. 41).

## 7. Maharaja Takhtasinghji Observatory (1882–1912)

The observatory was sponsored and financed by the Maharaja Takhtasinghji of Bhavanagar at the instance of the Parsi physicist Kavasji Dadabhai Naegamwala (1857–1938), who had got his training of spectroscopic work at the solar physics laboratory of Sir Norman Lockyer (Ansari 1985, p. 36–40). Naegamwala was in fact the *first* Indian astrophysicist. His work at the observatory consisted of spectroscopy of the Orion Nebula, Nebula NGC 4594, 43 Virginis, NGC 6595, Nova Persei, besides his observation of the transit of Mercury on May 9, 1891 (Ansari 1985, p. 41). However, his most remarkable work was the meticulously planned expedition to record the solar chromosphere and corona at the time of the total solar eclipse on Jan. 22, 1898, at Jeur (Western India)<sup>6</sup>. The importance of that total solar eclipse, particularly for coronal photography, can be gauged from the fact that a Joint Eclipse Committee of the Royal Society and the Royal Astronomical

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<sup>6</sup>See the bibliography for reference.

Society was set up, headed by the then Astronomer Royal Sir W.H.M. Christie, to undertake an expedition to India<sup>7</sup>.

Naegamwala corresponded actively with Sir Christie and Sir Norman Lockyer. This historically important correspondence is still extant in the collection of MGAB (Ansari 1977, p. 256–257; Ansari 1985, p. 38–39), AAHE, and should also be at the archives of Lockyer Observatory at the University of Exeter, UK (Wilkins 2004).

## **8. Hennessy Observatory at Dehra Dun (1884–1898?)**

This observatory is named after J.B.N. Hennessy, Deputy Surveyor General of the Trigonometric Branch of the Survey of India. It was built in 1884 with a facility for photoheliographic work. Sir Norman Lockyer visited it in 1898, when he came to India to observe the total solar eclipse of 1898. He noted the importance of the Observatory for its type of work. It is said that solar photographs were taken routinely from 1878 down to 1925 (Kochhar and Narlikar 1993, p. 27). We conjecture that the plates from these times might still be available in the record office of the Survey of India at Dehra Dun (Ansari 1985, p. 41).

## **9. Solar Observatory at Kodaikanal (1900 to date)**

This observatory (hereafter Kodaikanal Observatory) was planned during the tenure of Michie Smith as the director of the Madras Observatory (1891–1899). It started functioning in 1901 as a solar observatory with Michie Smith as its first director. The observation programme comprised the examination of solar prominences around the solar limb and the spectra of sunspots. When John Evershed, famous for his effect, became its director (1911–1923), a programme of systematic observation of sunspot spectra was initiated<sup>8</sup>. Kodaikanal Observatory has to-date the most unique solar activity record, available on photographic plates, which is now a hundred years old. Recent daily observational data is being stored in computer, and the process of digitisation of older material has now started (Vagiswari 2000).

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<sup>7</sup>See the bibliography. Christie came to India with the expedition. Even Sir Norman Lockyer and Sir Alexander Pedler led a team to observe the eclipse at Vizianagur; see Ansari (1985), p. 72.

<sup>8</sup>For a summary of Evershed's work, see Bhattacharyya & Vagiswari (1985).

## 10. Nizamiah Observatory at Hyderabad (1901–1954)

The observatory founded by an Indian noble, Nawab Zafar Jung in 1901, was acquired by the 6<sup>th</sup> ruler (*Nizâm*) of Hyderabad State (Decan), in 1908. It was attached to the Osmana University in 1991. The successive directors were A.B. Chatwood (1908–1914), R.J. Pocock (1914–1918), T.P. Bhaskaran (1918–1944), and Akbar Ali (1944–1960). This observatory participated in the international astrophotographic *Carte du Ciel* project, which continued up to 1964 (Chinnici 1999). Out of the 21 observatories that participated in the programme, Nizamiah Observatory was the *only Asian* observatory, which participated successfully in this international endeavour. In fact, the observatory replaced first Santiago Observatory (Chile) in 1909, and later was asked to cover also another sky zone originally assigned to Potsdam Observatory (Ansari 2000). In short, this astrographic data covers the sky zones  $-17^\circ$  to  $-23^\circ$  and  $+36^\circ$  to  $+39^\circ$  (Bhattacharyya & Vagiswari 1985, Kochhar & Narlikar 1993). This work comprised also measurements of 763,542 stars on the plates, which were published in 12 volumes. Besides that, a programme of observations of variable stars and of measurements of double stars was also initiated at Nizamiah Observatory (Ballabh 1983).

## 11. Concluding Remarks

Summing up, we may reiterate that an enormous amount of astronomical data of the 20<sup>th</sup> century, which was generated in a number of Indian observatories, is still available in India and abroad. At Kodaikanal Archives some documents are nearly 200 years old. More than 5000 pages have been digitised and are available at CDS (Vagiswari 2000). The Centre of Advanced Computing (Pune) is also cooperating in this effort (Sagar 2000). An astronomical data centre in collaboration with Strassbourg Data Centre had been established at the Inter University Centre for Astronomy and Astrophysics (IUCAA) in Pune (Vagiswari 2000). We may mention in passing that the problem of data archives was recently discussed at a two-day workshop on “Front-end Controls and Data Archival for Indian Telescopes”, which was held in Pune on Jan. 29–30, 2004. Plans are also afoot for the so-called “Virtual Observatory–India Project”, which is being promoted at IUCAA (Kemhavi 2004). It is hoped that the Indian Observatories will be able to transfer electronically their data to this VO-project.

For easy reference, a bibliography of publications concerning Indian Astronomical Data, arranged according to the nature of the data, is attached to this article.

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- Vagiswari, A. 2000, private communication, dated 9 June.
- Wilkins, G.A. 2004, JAD 10, 7 (These Proceedings p. 153).

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<sup>9</sup>see <http://vo.iucaa.ernet.in/~voi/>



Abbreviations for Archives in India and abroad:

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AAHE	Astronomical Archives at Herstmonceaux Castle (England)
IIAB	Indian Institute of Astrophysics (Bangalore) [est. 1971]
KO	Kodaikanal Observatory (Kodaikanal)
MGAB	Maharashtra Govt. Archives (Bombay)
NAND	The National Archives (New Delhi)
RASL	Library of the Royal Astronomical Society (London)
RSL	Library of the Royal Society (London)

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### Star Catalogues

- Goldingham, J., *Astronomical Observations made in the Honourable East India Company Observatory at Madras*, Vol. II (1812), Vol. III (1824), Madras. Vol. I (1793) is in manuscript form, available in the archives of KO and IIAB.
- Jacob, W.S., MNRAS 8 (1848), 17 (1857) and 22 (1862). The data therein concern double stars.
- Taylor, T.G., *Results of Astronomical Observations made at H.E.I.C. Observatory at Madras*, 4 volumes, Madras 1831–1837.
- Pogson, N.R., *A Star Catalogue of 51101 Observations Carried out during 1862–1887*, including a number of southern stars between  $110^\circ$  and  $150^\circ$  of North Polar Distance.
- Pogson, N. R., *Observations of 31 Variable Stars*, Royal Astronomical Society, London 1908. [Presumably edited by Turner after Pogson's death, with contributions of the first Indian astronomer C. Ragoonathchary, who discovered two new variables: R Reticuli (in 1867) and V Cephei (in 1878)].
- Nizamiah Observatory, *An Astrographic Catalogue of Stars for the Sky Zones  $-17^\circ$  to  $-23^\circ$ , and  $+36^\circ$  to  $+39^\circ$* , Hyderabad (India), 12 Volumes, 1919–1951. [We conjecture that the photographic plates should be available in the Jappal-Rangapur Observatory of the Dept. of Astronomy, Osmania University, Hyderabad].

### Miscellaneous

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### Solar/Astrophysical Spectroscopy

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### Solar Eclipse Data

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Tennant, J.F., *Observation of Total Solar Eclipses of Aug. 17–18, 1868 (at Guntoor), and Sept. 11–12, 1871 (at Dodabetta)*. [Consult his *Obituary Notice* in MNRAS 76 (1916), 272–276, or *Proceed. Roy. Soc.* 92 (1916), x–xiv. His data might be available in archives of KO, RASL and RSL].

### Solar Activity Data

Sohini, V.V., *Reports of the Kodaikanal Observatory 1901–1951*, India Meteorological Dept., New Delhi. [These Reports by various directors, including Evershed and his predecessors contain a mine of information; see also *Kodaikanal Observatory Bulletins* of 1920s and 1930s, for the record of observations and data].