

Early pioneers of telescopic astronomy in India: G. V. Juggarow and his observatory

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G. V. Juggarow was one of the early pioneers of observational astronomy in India who built his own observatory in 1840 at Vizagapatam (Vizagapatnam). His legacy was continued by his son-in-law A. V. Nursing Row till 1892, his daughter till 1894, the Madras Government till 1898, and his grandson till it became inactive in the early 1900s. Observations of comets, planetary transits, stellar occultations, etc. have been continued along with meteorological observations. Celestial photography was also started at the observatory. After 1898, the activities of the observatory were re-oriented towards meteorology. The establishment of the observatory, the people involved and the final closing of the institution are described here.

The G. V. Juggarow Observatory (Figure 1), established in 1840, was the earliest private, modern Indian astronomical observatory that functioned till the turn of the 20th century. Jesuit priest–astronomers were the real initiators of telescopic astronomy in India, particularly J. Richaud, who carried out systematic observations of binary stars, comets, zodiacal light, dark clouds, etc. at Pondicherry from 1689 (ref. 1). Although it was claimed that the telescope had been used on an earlier occasion by a visiting Englishman, Shakerley, in an unsuccessful attempt to observe the transit of Mercury at Surat around 1651 (ref. 2), the credit should go to Jesuits for making a real beginning of telescopic observations. A historical accident led the French Jesuit

mathematicians and astronomers to land in India. In 1687, King Louis XIV had sent a team of mathematicians that included a few astronomers like Richaud, to Siam on an invitation by King Nair of Siam. A palace coup occurred in Siam that forced the Jesuits to leave the country in a hurry. Three of them, Richaud, Father Jean-Vevant Bouchet and Charles Francois Dolu, reached the French colony of Pondicherry³. Richaud brought the 12 ft focus telescope he was using in Siam with him to Pondicherry and pursued astronomical observations until his death¹. Although introduction of optical telescopes into India occurred in the later half of the 17th century, establishment of observatories or institutions to pursue observational astronomy did not start

until the East India Company established its own observatories at Madras and Calcutta more than hundred years later in 1786 and 1825 respectively. Two other observatories were established, through Indian effort, 50 years later, one at Lucknow in 1832 by King Nasiruddin Hayder of Oudh, and the other at Thiruvananthapuram in 1836 by the Raja of Travancore, Rama Vurmah. Both these observatories were ostensibly meant for ‘...advancement of the noble science’s new discoveries as for the defusion of its principles among the inhabitants of India ...’ (Nasiruddin Hyder’s letter to William Bentinck the then Governor General of India)⁴ and ‘... that this country should partake with European nations in scientific investigations ...’ (Raja Rama Vurmah)⁴. However, the establishment of these institutions was at the behest of British surveyors (and astronomers) and were headed by British astronomers, Major Wilcox at Lucknow and John Caldecott at Thiruvananthapuram. Although several astronomical programmes were initiated by Wilcox at Lucknow, the results could not be published by him and his death in 1848, in a way, resulted in the closing of the observatory⁴. Caldecott also carried out several observational programmes at Thiruvananthapuram, including observations and orbital computations of comets of 1843 and 1845, observations of Bailey’s beads during the solar eclipse of 21 December 1843, etc. However, bulk of his observations remained unpublished and his death in 1849 resulted in changing the orientation of the observatory from astronomy to meteorology, and astronomy ceased to be practiced there⁴. The two Indian initiatives to pursue observational astronomy did not succeed. G. V. Juggarow

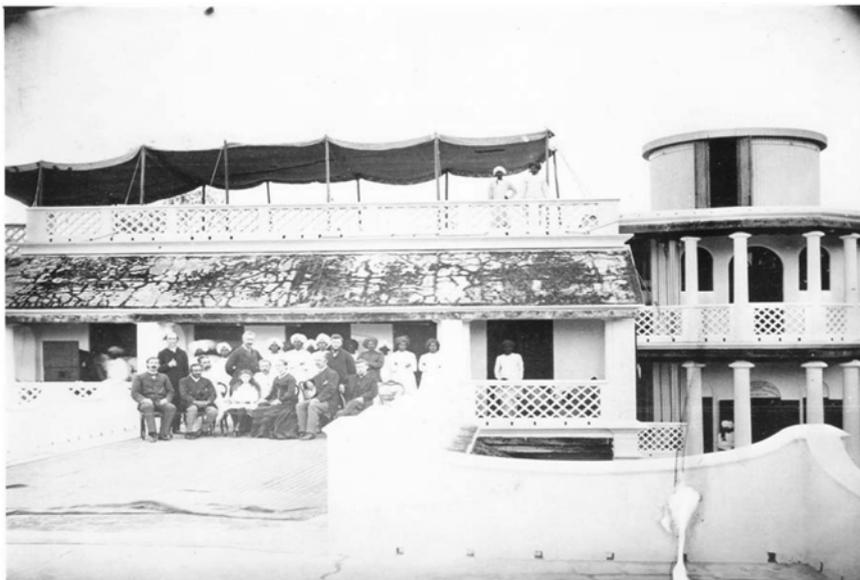


Figure 1. The G. V. Juggarow Observatory as seen in 1874 on the occasion of transit of Venus. The assembled gathering to witness the event can also be seen. A. V. Nursing Row was also present. (Courtesy: Royal Astronomical Society.)

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Observatory on the other hand, had a totally different beginning. Juggarow who 'imbibed the keenest interest in astronomy (again a rare accomplishment in men of his position)'⁵ during his student days at Madras Observatory under the tutelage of T. G. Taylor, then the Government Astronomer, started the observatory at his own expense and own initiative.

Juggarow and the beginnings of the observatory

Gode Venkata Juggarow (variously written as Jugga Row, Jagga Row, Jagga Rao, etc.) came from a family of rich and well-educated landlords (zamindars). Apparently the family paid more 'pesh cash' to the Government than any one in the district, except the Raja of Vizianagaram. His grandfather, also named Juggarow, was a 'dubash' (agent and interpreter) to John Andrews, Chief at Masulipatam, and he moved to Vizagapatam with Andrews in 1769. His uncle (father's elder brother), Surya Prakasa Rao was a naturalist and botanist of repute, who could speak and write English language 'uncommonly well'⁵. His father Surya Narayana Rao (along with his brother Surya Prakasa Rao) 'are well known to all residents in that neighbourhood, for their great intelligence and public spirit, and for the munificence with which they supported the character of native gentlemen'⁶.

Juggarow was born in 1817 and was educated at home. Apparently he had a good aptitude for mathematics. During 1833, he seems to have got inspired by astronomy as he says, 'I selected the divine science of Astronomy as the study and pursuit most congenial to my disposition and best calculated fully to occupy my attention'. He left for Madras at the age of 17 years 'from an innate desire of knowledge, he was induced to place himself under the tuition of Mr Taylor, of the Madras Observatory'⁶. By the time he was 19 years old, 'we have Mr Taylor's authority for saying, he is qualified to pass a first class examination in Mathematics in any College in Europe. His knowledge of the English language, also is highly creditable'⁶. Training under Taylor at the Madras Observatory must have provided Juggarow an opportunity not only to develop mathematical skills, but also to handle astronomical instru-

ments and to conduct astronomical observations. T. G. Taylor was a well-known Government Astronomer at the Madras Observatory from 1830 to 1848.

T. G. Taylor

T. G. Taylor grew up among telescopes. His father Thomas Taylor was first assistant at the Royal Observatory, Greenwich, under Astronomer Royal, Nevil Maskelyne. His father inducted Taylor into astronomy at the suggestion of John Pond, then the Astronomer Royal, when he was 15 years old. Taylor joined the Royal Observatory as a supernumerary in 1820 and became a regular staff after two years. Even before his arrival at Madras, Taylor had acquired the reputation as a good observer. He was selected by Edward Sabine to help him with his pendulum experiments. He assisted Stephen Groombridge and George Airy in reducing the data for circumpolar star catalogues. George Everest was particularly impressed with Taylor's skills and required his help in field operations for the Great Trigonometrical Survey. On the recommendation of Pond, the East India Company appointed Taylor as Director of Madras Observatory (Figure 2). At Madras, he got new instruments installed (a 5 ft transit, a 4 ft mural circle, and a 5 ft Dolland equatorial) and initiated regular meridional observations. However, Taylor's major achievement was bringing out the famous 'Madras General Catalogue' of 11,015 stars in 1844, which was acclaimed as 'the greatest catalogue of modern times' by Airy.

Taylor made several nonmeridional observations, like observations of comets in 1831, Wilmot's comet in 1845, Halley's comet in 1836, determination of the longitude of Madras, and meteorological and magnetic observations. He also trained many native assistants. Taylor used to provide training for people from other institutions like the Thiruvananthapuram Observatory. Taylor was elected as a Fellow of the Royal Society on 10 February 1842. He was also a Fellow of the Royal Asiatic Society. Apart from publishing his researches in other journals, Taylor was a regular contributor to the *Madras Journal of Literature and Science (MJLS)*.

Juggarow at Madras Observatory

Working with such an accomplished astronomer such as Taylor, it is not surprising that Juggarow got inspired and started his own observatory. Taylor and Morris, who was the editor of *MJLS* and a FRS, encouraged Juggarow to contribute his researches to the journal. Taylor, in his paper on Halley's comet published in *MJLS*⁷ based on observations obtained at the Madras Observatory acknowledges Juggarow's help, 'I take this opportunity of acknowledging my obligations to *Goday Venkata Juggarow*, who rendered me very great assistance in the computations'. Juggarow⁸ contributed a note in the same journal titled 'Tables for computing the position of HALLEY's comet', in which he describes his computations of the ephemeris of the comet, from the orbital elements

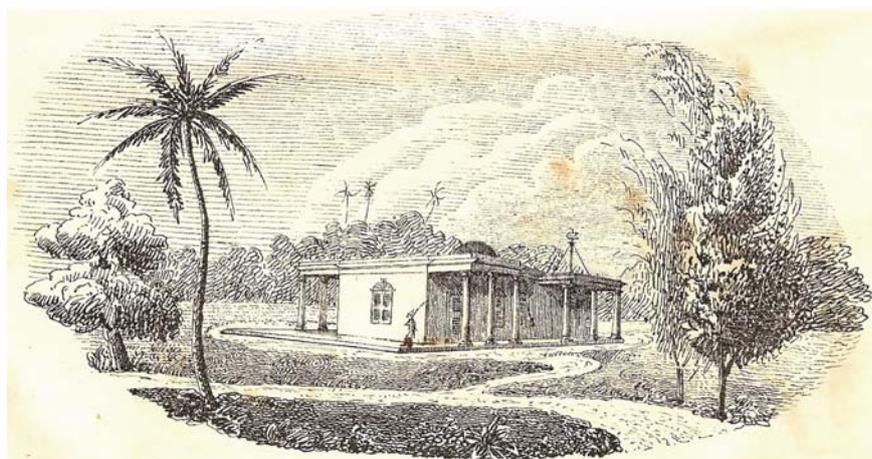


Figure 2. The Madras Observatory during the period of T. G. Taylor, 1830–1848 (Indian Institute of Astrophysics Archives)³⁰.

ounce collected by the gauge the tenth of an inch of rain had fallen. The measure could of course be graduated to any degree of nicety and it may easily be reproduced, if required. The cost of the equipment was also cheap.

Juggarow prepared a place near the transit circle for a standard barometer, wet and dry bulb, thermometers, anemometer and an anemoscope constructed by him on the principles of Hutton's investigations¹⁵.

Juggarow died in 1856 at young age of 39 years; leaving his property and the observatory to his daughter Ankitham Atchayamma Garu (who became zamindarini of Shermahomedepuram and Yembaram Estates) and son-in-law A. V. Nursing Row. Nursing Row devoted considerable efforts in promoting astronomy at Daba Gardens.

A. V. Nursing Row and the Observatory

Ankitham Nursing Row (variously spelt as Nursinga Row, Narasing Row) was born in 1827. His father, Ankitham Sriramulu, was a Dewan to Nawab of Masulipatam, and died soon after his son's birth. Nursing Row grew up in Vizagapatam at his maternal grandfather's house and got educated there by private tutors. His teachers were Porter initially and J. Hay, later, who apparently also provided him some early training in astronomy. Nursing Row joined the East India Company quite young and rose to the level of a Deputy Collector in the Government. He resigned his position to manage both his (wife's) estates and G. V. Juggarow Observatory. He added a workshop and other amenities to the observatory. The early astronomical observations at the observatory seem to be confined to the generation of corrections to the sidereal clock by observing stars with Troughton's transit circle as well as providing accurate mean time signals to the flagstaff and guns on Dolphin's Nose, for civilian needs.

The first published account of the observatory's scientific activities was described in a pamphlet brought out by Nursing Row on the occasion of the famous solar eclipse of 16 August 1868, which was partial at Vizagapatam. He got a telescope of 4.8 inch aperture, whose optics was earlier procured by G. V. Juggarow, made ready in his own

workshop for the occasion. The optics was fitted into the tubes and mounted on 'large and original kind of altazimuth stand' supplied with vernier-circles, levels and slow-motion screw movements. Nursing Row also describes that the quality of images is good without chromatic and other aberrations (coma, etc.). 'The present telescope will discharge its duties faithfully.' He goes on to describe his attempts of observing the eclipse. They hoped to see prominences at the limb during the eclipse; however, they could not see any because of clouds and also because it was only a partial eclipse. He also describes the Indian method (panchang) of calculations of the circumstances of the eclipse at Vizagapatam and mythological stories about the eclipses (Figure 5 shows a portrait of Nursing Row).

After this beginning, Nursing Row kept publishing his observations regularly in *Monthly Notices of the Royal Astronomical Society (MNRAS)*. He kept in regular touch with other British astronomers, most notably C. Piazz Smyth of the Royal Observatory, Edinburgh and W. Huggins, who communicated several of his observations to *MNRAS*. On one occasion, Piazz Smyth¹⁷ wrote admiringly about Nursing Row 'a Hindoo gentleman of Vizagapatam, whose family has been much given to science, through two generations. He possesses an extensive observatory both astronomical and



Figure 5. A. V. Nursing Row who essentially equipped, maintained and conducted observations at the observatory until his death in 1892 (www.avncollege.ac.in/aboutus/history.html, 2010).

meteorological'. On another occasion Piazz Smyth¹⁸ mentions with admiration 'well-known and liberal-minded, amateur-astronomer, computer, and meteorologist'.

Even in 1868 Nursing Row had plans of adding to the observatory a '6-inch equatorial, with driving clock, micrometer and a spectroscope'¹⁷. It is significant that he realized the potential of using the spectroscope with a telescope. Unfortunately, he never seems to have used a spectroscope.

Soon after the solar eclipse of 18 August 1868, another significant astronomical event, the transit of Mercury over the Sun's disc, occurred on 5 November 1868, which was observed by Nursing Row with his 4.8 inch telescope at Daba Gardens. His account of this event was published in *MNRAS* (communicated by Piazz Smyth)¹⁹, 'The planet was seen as an intensely dark spot on the Sun's disk'. He shows a diagram illustrating the path of the transit across the disc and gives the timings of the chord. He seems to have observed a curious phenomenon 'when the planet approached half-way of the transit, some of my European friends and myself observed a wavy tint of light darting from the upper edge, disturbed at times, but continued until the planet had passed some distance from the highest point of the line of transit'. It is not clear what caused that wavy phenomenon. He could not see similar behaviour during the transit of Mercury on 10 May 1891.

The importance of observations of the transits of inner planets across the Sun's disc is that, by combining observations of the chords of transit trajectories from different geographical locations, one can derive the earth's distance to the Sun (the astronomical unit) as proposed first by Edmond Halley in 1716. Realizing the importance of these, Nursing Row tried to observe them whenever he could. Apart from 5 November 1868, he made observations of transit of Mercury on two other occasions, 7–8 November 1881 and 10 May 1891, and noted the timings of internal and external contacts (with solar limb) at egress. During such observations in 1881, it is reported 'But at this stage of the proceedings there came pouring into his observatory such a stream of his English lady and gentlemen friends that Mr. Nursing Row confesses he lost his presence of mind as an observer'¹⁸. He also observed the transit of Venus on 9 December 1874 (last contact), which has

been discussed in detail by Rathnasree and Kumar²⁰. Incidentally, Samanta Chandrasekhar, a traditional Indian astronomer from Orissa, also calculated by independent methods the timings of the transit of Venus in 1874. Both the methods and timings of Chandrasekhar have been assessed by Balachandra Rao²¹ and were found to be correct.

Partial eclipses of the Sun have been monitored at Daba Gardens starting 16 August 1868, 12 December 1871 of magnitude 0.629, 6 June 1872 of magnitude 0.972 and 17 May 1882. They were particularly interested in the drop in atmospheric change in temperature, pressure, humidity and solar radiation. All these were reported in *MNRAS* through letters to Huggins. Nursing Row followed his father-in-law's interest in Jupiter by monitoring the morphology of the red spot through his 6 inch equatorial.

Most interesting are observations of comets by Nursing Row. The spectacular sun-grazing Great Comet of 1882 II, made history as one of the comets that launched the project of 'carte du ciel' (photographic mapping of the sky)²². A lot has been written about the comet, which is now thought to belong to Kreutz Sungrazers and also called Kamikaze comets (named after the Japanese suicide pilots of World War II). These are the comets that are thought to be plunging into the Sun. The evolution of these comets has been studied by Sekanina and Chodas^{23,24}. The Madras Observatory observations particularly pre-perihelion are described by Rao *et al.*²⁵. Nursing Row²⁶ has presented a colourful description of post-perihelion passage of the comet: 'The length of the bright part of tail is between 7° and 8°, above the narrow rays or streaks of light extending more than 12' – concave towards the south and shaped like the *tusk of an elephant*, the thick part being at the greatest altitude'. Interestingly, he says, 'Our Hindoo astronomers predicted the appearance of a comet in the Southern hemisphere . . . it would possess a bright copper colour like the rising moon, and a long tail. The name given by them to the predicted comet is *Silpacam*'. Another comet which was observed at Daba Gardens is Comet Pons-Brooks on 31 January 1884.

Nursing Row's efforts at improving the facilities at the G. V. Juggarow Observatory by getting a new Cook equatorial telescope of 6 inch aperture and

7.5 feet focal length that is driven by clock work, and a new 36 inch transit instrument with two setting circles by 'Negratti and Zambra' and a Dent pendulum clock and more importantly, communicating his astronomical observations to other astronomers and to *MNRAS* drew admiration. He was elected as a Fellow of the Royal Astronomical Society on 4 November 1870. His name was proposed by Astronomer Royal G. B. Airy and W. Huggins, C. Piazzi Smyth and C. Pritchard (RAS Archives)²⁷. He was the first Indian to be elected Fellow and not Ragoonatha Chary as earlier mentioned by Rao *et al.*²⁸. He was also a Fellow of the Royal Geographical Society in 1872. By 1874 before the event of transit of Venus, he got a moveable dome of 12 feet diameter and 9 feet high installed. It is quite common for Vizagapatam to be hit by cyclones. The observatory used to record rainfall, wind velocity, etc. One of the worst cyclones occurred on 7 October 1876 evening, lasting the whole night. The winds were so strong that the new dome of the observatory – a corrugated iron structure which had been placed in position but not riveted down was blown away to a distance of 33 feet.

Nursing Row was also service oriented. When the time-gun firing from Dolphin's Nose was stopped in 1871 by the Government, he took the initiative of maintaining it by paying the expenses from his private funds. He also got a new and expensive flagstaff at Dolphin's Nose in 1886 (Figure 4). The notification in the District Gazette dated 1 May 1886 says, 'It is hereby notified for the information of the public that Mr A. V. Nursing Row has erected an expensive and durable Flagstaff on the Dolphin's Nose and the time signals are now hoisted on it under his orders every morning between 8 and 9 O'clock to indicate time. . . .' He also regularly furnished to the *Meteorological Reporters* with daily reports of meteorological conditions. Because of such activities he was honoured by the Government with the title of 'Rai Bahadur'. He was also appointed as Honorary Meteorological Reporter to the Government of India for Vizagapatam. He donated a sum of 115,000 rupees as an endowment to the then Hindu college, when it was in financial difficulties. The college was later named as Mrs A.V.N. College.

His enthusiasm for astronomy was such that he was always trying to improve the

facilities at the observatory. Recognizing the benefits of photography to astronomical observations he 'commenced making arrangements to place the observatory on a permanent basis as well as to erect a Celestial Photographic Observatory, but he died before completing this work'¹⁴. Nursing Row died on 18 June 1892.

Transition period and A. V. Juggarow

In 1894, Nursing Row's wife proposed to endow the institution with a fund of three lakh rupees and hand it over to trustees under the control of the Madras Government. However, the Government was unable to accept the position at that time. After the death of Nursing Row, his wife took charge of the observatory and conducted it with great 'liberality'. She brought out the *Results of Meteorological Observations 1894* under the auspicious of the G. V. Juggarow Observatory 'maintained by Mrs A. A. Nursing Row, zamindari of Shermahamudpuram and Yembaram Estates'. She continued to supply meteorological results to the Government of India, Meteorological Reporters at Bengal and Madras, and, in addition, erected a Celestial Photographic Observatory with a photographic telescope. In accordance with the wishes of her father as well as her husband, she handed over the observatory and the Dolphin's Nose flagstaff on 8 November 1894 to the Government of India with an endowment of three lakh rupees for the permanent maintenance of the institution. The management of the institution was to be done by a committee comprising the Collector for the time being, the Meteorological Reporters of the Governments of Bengal and Madras, the Government Astronomer and others. Soon after, it appears that the committee appointed Bion as the Government Astronomer for a period of three years to run the observatory. Till 1898, the committee consisted of W. O. Horne as the Chair and J. Elliot as Secretary.

The committee (Government) also started a new observatory at Waltair to conduct meteorological observations. The routine observations which consisted of measurement of double stars, celestial photography and daily time service continued. By now a telegraphic line was established for the time-gun firing from the

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observatory to Dolphin's Nose. The error of the sidereal clock was determined by transits of clock stars and the flash of the time-gun and its error being observed every night from the observatory.

The binary stars being observed (we assume the angular separations and position angles for orbital measurements) in 1897 were 41 Aqr, μ Cygni, γ Ari, γ Cet and 326 Σ Ari.

Photography of night-sky objects

The G. V. Juggarow Observatory must have been the first one in India to systematically obtain photographic observations of the night sky. Photographs of various clusters and nebulae were taken with the small photographic telescope, the best being perhaps that of the region near η Argus (now η Carina; Figure 6). 'As the lens of the camera is small one, photographs of nebulae are not as successful as those of clusters' (the focal length of the telescope might have been large too!). H. H. Turner was helping and advising in the selection of various kinds of plates which were being tested at the observatory. Apparently, a sidereal time watch was ordered for the photographic observatory. The camera and chronometer were kindly ordered for the observatory by Michie-Smith, Government Astronomer at Madras, but they did not arrive by the end of the year. Contact with the Madras Observatory was restarted after his son A. V. Juggarow took over.

A. V. Jugga Row and the fading of the observatory

Subsequently A. V. Jugga Row regained control of the observatory and its endowments (Figure 7).

A. V. Jugga Row Bahadur Garu was born on 4 February 1866 at Vizagapatam¹². His early education was at London Mission High School in Vizagapatam and at home by his father. He had special training in astronomy and meteorology. The partial solar eclipse observations of 10 May 1882 were done by Jugga Row and Verabadroodoo²⁹. Jugga Row took over the management of the estate in October 1898. Soon after, he took over the observatory and started maintaining it. He was more interested in meteorological observations. He opened a magnetical observatory, one of the three in the country. 'He has also opened a Seismological Observatory, which is very rare institution in any country for measuring the current of earthquakes.'

Jugga Row was elected a Fellow of the Royal Astronomical Society on 8 May 1900; his name was proposed by E. V. Struobel, W. Huggins and H. H. Turner²⁷. Jugga Row became a member of the Royal Meteorological Society, Royal Colonial Institute and Society of Arts in 1900, when he visited England and Queen Victoria. During this tour, he apparently visited various observatories and studied their workings. Jugga Row was also elected as one of the Vice-

Presidents of the Astronomical Society of India from 1911 to 1912.

The astronomical activity slowly (or abruptly?) faded away at Daba Gardens during Jugga Row's time. It is not clear (no records) what led the Government to relinquish the management of the observatory.

Presently, Dolphin Hotel, a three-star hotel, exists at Daba Gardens where once G. V. Juggarow Observatory stood.

Concluding remarks

The G. V. Juggarow Observatory is a unique institution that was created by an inspired individual, Juggarow, who was fascinated by the allure of the night sky and acquired the taste of making observations of celestial sources by working with an accomplished professional astronomer. He, in turn, seems to have conveyed this excitement of rediscovery of the nature and splendor of celestial sources, when the rest of world had gone to slumber, to his son-in-law, Nursing Row, who continued to carry on this fascination of working with telescopes till his death. It was really Nursing Row who provided and developed not only the facilities at the observatory, but also conveyed his enthusiasm of whatever he has done to other astronomers and to journals, irrespective of whether it was a simple phenomenon of partial solar eclipse or looking at the red spot on Jupiter or helping measure the astronomical

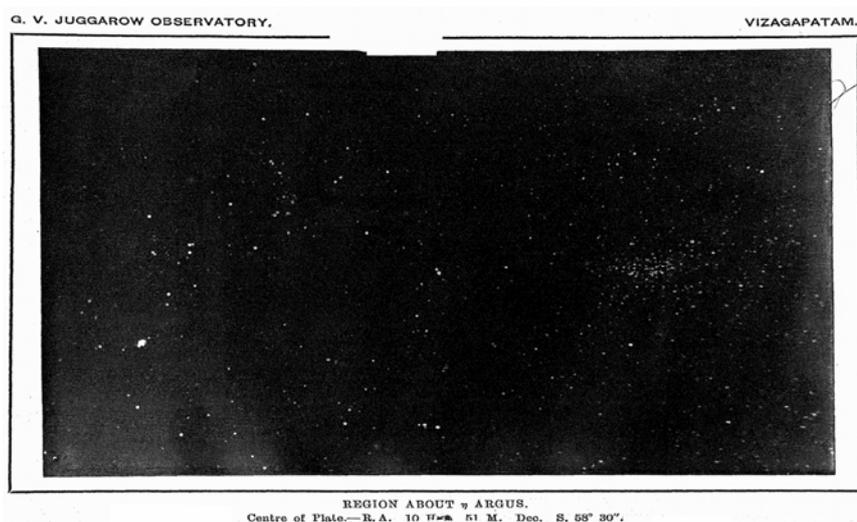


Figure 6. Photograph obtained at the G. V. Juggarow Observatory of η Carina region³¹.



Figure 7. A. V. Jugga Row Bahadur, grandson of the founder. He was Vice-President of the Astronomical Society of India during 1911–1912 (www.avncollege.ac.in/aboutus/history.html, 2010).

unit by tracking the transit of planets over the Sun's disk. Nursing Row was also aware and sensitive to the contemporary developments in astronomy. He planned to acquire a spectroscope realizing its importance in physical astronomy. He made efforts to start photographic observations of the sky, which could be materialized only after his death. The Juggarow Observatory was the only observatory in India which started systematic photographic observations of the night sky (star clusters and nebulae). Unfortunately, it did not continue.

Contrary to the general belief among science historians that 19th century observational astronomy simply failed to take-off under Indian auspices, it did flourish in some quarters. It is often forgotten that observational astronomy needs a lot of resources, not only human initiatives and ideas, but a great deal of technical support to put them into practice. To pursue photographic observations, one needed continuous supply of sensitive photographic plates, chemicals, apart from telescopes with cameras and plate holders, dark room, etc. which had to be imported and properly preserved (so that emulsions do not get damaged). It was a tough job. It is remarkable that the G. V. Juggarow Observatory functioned with enthusiasm for about 60 years, when two other contemporary Indian-sponsored observatories at Lucknow and Thiruvananthapuram barely managed to survive for ten years and that too without being able to publish any results.

It is not clear, presently, how the management of the observatory changed from the Madras Government to A. V. Jugga Row Garu and more importantly, how and why the observational programmes enumerated in the 1898 annual report got discontinued. It was a pioneering effort by G. V. Juggarow and A. V. Nursing Row to demonstrate Indian effort at modern observational astronomy.

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