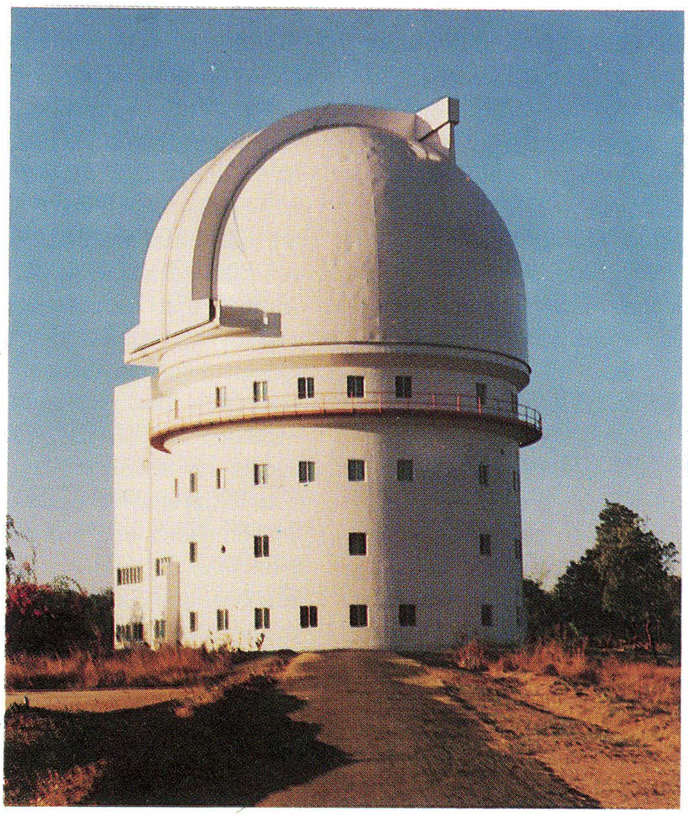
VBT news

Number 1 October 1989

Message from the Director

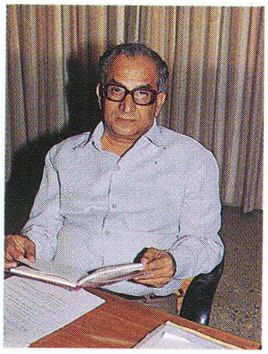
We are launching this new newsletter to bring to the notice of all the astronomers in the country about this unique facility. The Vainu Bappu Telescope, largest optical telescope in Asia was formally inaugurated by the Prime Minister of India, on 6th January 1986. Prime focus photography was started immediately afterwards and many deep sky photographs were taken. Shortly afterwards, a photometer for prime focus use was designed and constructed, to take advantage of the large collecting area and some photometric programmes were pursued. The detector of today, the charge coupled device, was next to come into use at this focus, by means of which detection of faint objects well beyond the dark sky limit was achieved by April this year.

The installation of the cassegrain secondary mirror has now been taken up, and the second focal plane will be operational before the start of the coming winter season. Conventional spectroscopy at this focus will open up new ways for observational programmes.



Vainu Bappu Telescope: A brief history

The idea of installing a large sized optical telescope in India was voiced in the report of the Saha Committee (1945) set up by the Government of India for drawing up post-war development plans for Astronomy. Dr.A.K. Das, Director, Kodaikanal Observatory, first suggested that this telescope may be of "a hundred inch class". Such telescopes were not available off the shelf, and had to be built according to customer's specifications. The estimated cost of such a telescope was very high and could not be accommodated in the first two Five Year Plans of the India Meteorological Department, to which the Kodaikanal Observatory was attached. Saha Committee had also recommended establishing a central observatory in India. A search for a suitable site was begun by Dr Das; a site survey team was located at Ujjain in Madhya Pradesh.The preliminary results were disappointing, and the survey was called off a couple of years later. Dr.M.K.Vainu Bappu took over the charge of the project in 1960. He argued that to take advantage of the geographical location of India the observatory should be established as far South as possible. Such a location would provide an access to the southern sky, where many new types of celestial objects were being discovered. Accordingly he led a new survey team over the southern part of Indian peninsula, and came across a suitable site amidst the sandalwood forests over Javadi Hills of Tamil Nadu. The site was named as Kavalur after a nearby village, and preliminary observations started in 1968, with a locally fabricated 15" telescope. In the third five year plan some funds were allotted with which an order for a one-meter telescope was placed with M/s Carl Zeiss of East Germany in 1965. This telescope was installed in 1972 at Kavalur. Efforts to acquire a hundred inch class telescope was continued. It was apparent that in those days of foreign exchange scarcity, only chances of realisation will be if the instrument is fabricated within the country. In 1971 M/s Tata Consulting Engineers, assisted by a Canadian firm, Dilworth, Secord, Meagher and Associates offered to undertake the task of designing a large optical telescope. A proposal to build such a telescope was approved by the Governing Council. An order was placed for a 93" blank with M/s Schott of West Germany in 1973 and it was received in May 1974 and it was stored in a specially built shed at Kavalur. M/s Tata Consulting Engineers were entrusted with the design contract in early 1975 and a conceptual design report was submitted by them in Nov 1976. In the meanwhile a survey team went around making spot observations covering the area of South of the Vindhyas and determining the observing conditions at selected places. After screening out sites at relatively higher latitudes, three places viz. Sakanagere in the Baba Budan hills of Karnataka, Horsley hills near Madanapally and Kavalur were subjected to critical examinations. After some intensive seeing observations at all the three places, Kavalur was ultimately chosen as the most suitable site. The consulting engineers' design was for a two pier, open yoke mount with a large horse- shoe at its northern bearing. The design team had not only visited some large telescopes abroad, but also gone round the mechanical fabrication capabilities available in the country, before arriving at the design. The project was started with a young engineer S.C.Tapde as its Manager. The work on civil constructions started immediately afterwards; it was taken up by a firm of construction engineers viz. M/s Subramaniam & Co of Madras. The fabrication of the 250 ton rotating dome was taken up by a Bombay construction firm, M/s Vikhroli Metal Fabricators. Many major components of the dome and building were fabricated by various engineering enterprises in Hyderabad, Bangalore and other cities in India. The work on grinding and figuring the optical components was entrusted to a team of scientists in the Institute's own laboratories in Bangalore. A grinding machine had to be designed, constructed and housed in a specially built laboratory building. Besides conventional testing of the surfaces, a new interferometric method was developed by the scientists in the laboratory. However,a major challenge of the project was the construction of the mechanical mount; the contract was awarded to M/s Walchandnagar Industries Ltd near Pune in Maharashtra. This involved fabrication of large mechanical parts beyond the then existing levels of precision attainable in India. Although the fabrication could not be completed within the contract period, the firm ultimately managed to finish their job with the stipulated precision. This delayed the installation of the telescope by about three years, and frustrated Dr Vainu Bappu's dream of seeing the big telescope operational before his untimely death in August 1982. In May 1984 the mount was completed in the works of M/s Walchandnagar Industries Ltd and the task of transporting the dismantled components part by part to the observatory site at Kavalur began. Elaborate arrangements for handling these and final installation at the remote site had to be set up. In August 1985 the mount was finally installed. In the meanwhile the laborious task of grinding, polishing and figuring the primary mirror was over; a giant vacuum deposition equipment for coating the mirror surface with chemically pure Aluminium was constructed by M/s Indo Burma Petroleum Co. as per design and supervision of the Technical Physics Division of the Bhabha Atomic Research Centre, Bombay. This equipment was installed at the ground floor of the telescope tower for easy availability during future periodic aluminization. The blank was transported by road from Bangalore; the last twelve kilometer of the winding road from Alangayam to Kavalur having been already reconstructed with the help of Tamil Nadu Government, no difficulty was faced in this delicate operation. Technical help in an another vital area was obtained from BARC. The precision control of movements was needed for the operation of the telescope. The Reactor Control Divison of BARC undertook this responsibility and a team of engineers and scientists from BARC and IIA jointly worked together to achieve this requirement. For higher order control and telescopic data acquisition and processing a VAX 11/780 computer system was acquired and installed in the dome building. Proper control circuitry was designed and fabricated at IIA, and these were set up in an imposing console desk made at the BARC workshops. There were many other small requirements which were essential before commissioning the telescope. The solid-state control system and the computer needed strict environmental control which was achieved by an elaborate air conditioning arrangement. For access to the Cassegrain focus and locating focal plane instruments there, a set of hydraulic platforms were required. For transferring power and control signals to the rotating dome an intricate bus-bar system was essential. A standby power arrangement and a precision mechanical shop were vital for smooth operation of the telescope. These and many other small requirements were met by a dedicated team of engineers and workmen working round the clock. Then in October 1985, the telescope was opened to the sky, the first person to have a peep was Mr A.P.Jayarajan on the night of October 30 who had spent last six years to bring the optics to a perfection. The first photograph was obtained two nights later; the honor for this was kept reserved for the Director and Chairman of the Telescope Project Management Board. In the initial phase, only the prime focus was operational. Minor problems of guiding and pointing showed up, which were solved, one by one by the team of engineers and scientists. A series of deep sky photographs of galactic and extra-galactic objects were obtained with a Wynne corrector system to enable wide field photography. The work for fabricating new focal plane instruments was taken up. On January 6, 1986 the telescope was formally inaugurated by the Prime Minister of India. The telescope and the entire Kavalur Observatory was named after Dr Vainu Bappu, who had devoted his entire life in making the dream of establishing modern astronomy in India a reality.



J.C.Bhattacharyya

Reminiscences

The first look at the VBT at Kavalur gives an impression of its being much larger than its actual aperture (as told to me by several visitors). The majestic size and configuration of and mechanical mount is also the contribution of its creator Vainu Bappu. Many different concepts for the mount were considered during the feasibility studies, but I think the Palomar 200 inch (5 meter) telescope had such a lasting impression on Bappu's mind that he decided to build a miniature in the "Ninety Inch" as he fondly called his pet. Back to the aperture, - it is larger than 90 inches. When I asked Bappu about how he decided the size of the mirror, he told 234 was an easy-to-remember number and fixed the aperture as 234 centimeters. The overall diameter of the blank as ordered and received was 236 cms, and which he again justified as easy (2x3=6)! At some other time, he told me - Russians were building 236inches (6 meter) telescope, ours was almost the same number but in centimeters!

Bappu dreamt of the "Ninety inch" for many years but the first concrete (Ney glass ceremic) shape it took was when the blank was received in 1974. When it reached Kavalur, it was unloaded opposite "Menaka" (the building which still houses the mess) by a specially constructed gantry crane. A shelter (hutment) of asbestos sheets-over-steel members was built over the blank and under the gantry crane, which continued to stand as a sentinel over the blank until 1977.

With a great funfare the blank was transported to Bangalore for grinding and polishing on a machine specially designed and constructed for the purpose. The "Operation Transport" started in the morning with pooja and photography. The hutment was dismantled and the blank loaded on the lorry. The convoy to Bangalore consisted of a few pilot vehicles and two cars at the tail of the large consignment in order to avoid any mishaps on the way. In fact, all implements were carried in one of the vehicles in case of any emergency on the way. A steady pace of 25 km/hr saw us in Bangalore by the evening with a lunch halt in Krishnagiri. The unloading in the optical laboratory where the grinding machine was awaiting to accept the burden, was accomplished the next morning.

When I appeared on the scene in November '76 the concept report for the "Ninety Inch" had just been completed by Tata Consulting Engineers. Bappu gave me an advance copy when I had come to Bangalore in October for pre-survey of the place I was to serve for next decade. It took me quite some time to consolidate the expectations of astronomers about the new telescope (I hope they have realised). The concept report was approved by end November, before I had enough time to settle down. Then came a meeting in the same month held in the old library room of Project hutment with BARC to assign them the responsibilities of developing the aluminizing chamber. Within a few weeks of that a telegraphic order was released to TCE for developing the mirror grinding machine. Shortly afterwards Bappu took me to the Chief Engineer of Dept.of Space to persuade him to execute the construction of "Ninety Inch"building and dome (drawing for which were only in concept forum till then). By March 77 money was deposited with Dept. of Space for the purpose. I remember Bappu expressing a great satisfaction over the single large expenditure, commenting that he had committed the Institute to build the telescope. Things were happening quite fast and I had no time to settle down. A diesel generating set, was asked for procurement within 3 months. For a phone call to TCE to send specifications, I recall the shouting must have disturbed all occupants of the hutment. (A disturbance they had to suffer for quite some months). The DG set arrived after much crises management but had to be mothballed for want of a building. Such disappointments were very few in the project, but they had a fair share against the successes. Choosing a place for the "Ninety Inch" building in Kavalur was one of the few activities I could not participate in. Bappu described the details to me later but I missed being with him on those three days. A 'storm' was created (on paper) for felling a number of trees to clear 200ft. area. I also missed the 'Bhoomi Pooja' when the earth was broken for construction of the building. No amount of keeping records of progress of excavation and pouring concrete for foundations and superstructre on films could compensate for the things I missed. These films used to go to Kodaikanal for development and printing and staff members there knew more details of the progress of work than those at Bangalore.

Matching the speed of the contractor (we were fortunate to get one of that kind) with the supply of drawing from TCE was very thrilling. We had embarked upon constructing a building to house a facility, the details of which could not have been decided even by a super designer in the time available. The A.C. Plant, the elevator, the aluminizing chamber, the cassegrain platform and above all the dome and the telescope - for all of these systems the building had to have adequate room and interfaces. We had to make the best guesses and proceed, to quench the contractors ever increasing thirst of more and more drawings. I was caught on the wrong foot in changing the location of the toilet area. Although, I was correct theoretically, I had not realised the mess I landed in for obtaining the revised drawings for it from TCE and issuing them to the contractor in time so as not to face his claim of idle time.

Two floors were constructed and one day Bappu was reviewing the drawings with me. He exclaimed that a floor was missing! The concept drawings, as he had seen had five floors (ground + 3 + observing floor) as in the "forty inch" but the final drawings of the "Ninety Inch" had only four. Even after extensive digging of records, we could not trace the missing floor!

S.C.Tapde

Photography at Prime Focus - Initial Stages

Immediately after the installation of the 234 cm Telescope at Kavalur towards the end of 1985, I was given the task of testing the telescope for its performance and of designing and fabricating prime focus camera for photographic work. The telescope with its equatorially mounted horse-shoe-yoke structure, has control system designed for pointing accuracy of better than a few arc seconds and tracking accuracy of less than an arc second. The control system had to be brought to this level of performance and also many of the electrical and mechanical problems connected with the telescope, dome, shutters, etc. had to be solved before any photography at prime focus could be attempted.

A brief summary of some of the problems encountered during the testing is given below along with details of the prime focus cage and camera.

Oscillations

Control system for the telescope was designed and fabricated by BARC engineers. One big problem they faced immediately after the installation of the telescope was the large amplitude (about one degree) oscillation around the RA axis with period of about 1 second. Our steady search for the cause finally showed the culprit to be a defective tacho generator which gives one of the two reference voltages to the servo-system controlling RA drive amplifiers. It was found that while Tacho 1 shows a steady voltage of 450 mv, Tacho 2 shows periodic sudden drops in voltage to zero. When the tacho voltage drops to zero, the servo-system takes it as an indication of no movement in the telescope and hence tries to accelerate the telescope. The acceleration is clearly seen in the output of tacho 1 as a sudden increase in its output voltage. This sudden surge in the power amplifier out-put was producing the oscillations in the telescope. Unfortunately we did not have any spare tacho generators. As it was felt, a defective tacho generator will not create much problem in the DEC axis because of its larger mechanical damping, the defective tacho generator in RA axis was exchanged with a good one from the DEC axis. Even after this change, the telescope occasionally oscillated when moved to low altitudes in the South-West part of the sky. We decided to carry on with the programme of photography as the telescope was behaving satifactorily when pointed to all other directions.

Prime Focus Cage

The diameter of the prime focus cage is 850mm. This is 100mm bigger than the cassegrain hole and the resultant light loss is about 15.5%. The top ring of the telescope tube supports two systems of spiders, one for observers cage and the other for the Wynnu Corrector and the instrument to be mounted on top of the corrector. Observer moves in a circle between the Wynne Corrector tube and the prime focus cabin wall. The Swivel seat for the observer, allows the observer to take a fairly comfortable position in all orientations of the telescope tube. On top of the Wynne Corrector is mounted the focusing ring and a rotating sector. Plate holder assembly built in the Institute workshop is mounted on top of the rotating sector for prime focus photography. Details of the prime focus plate holder as-

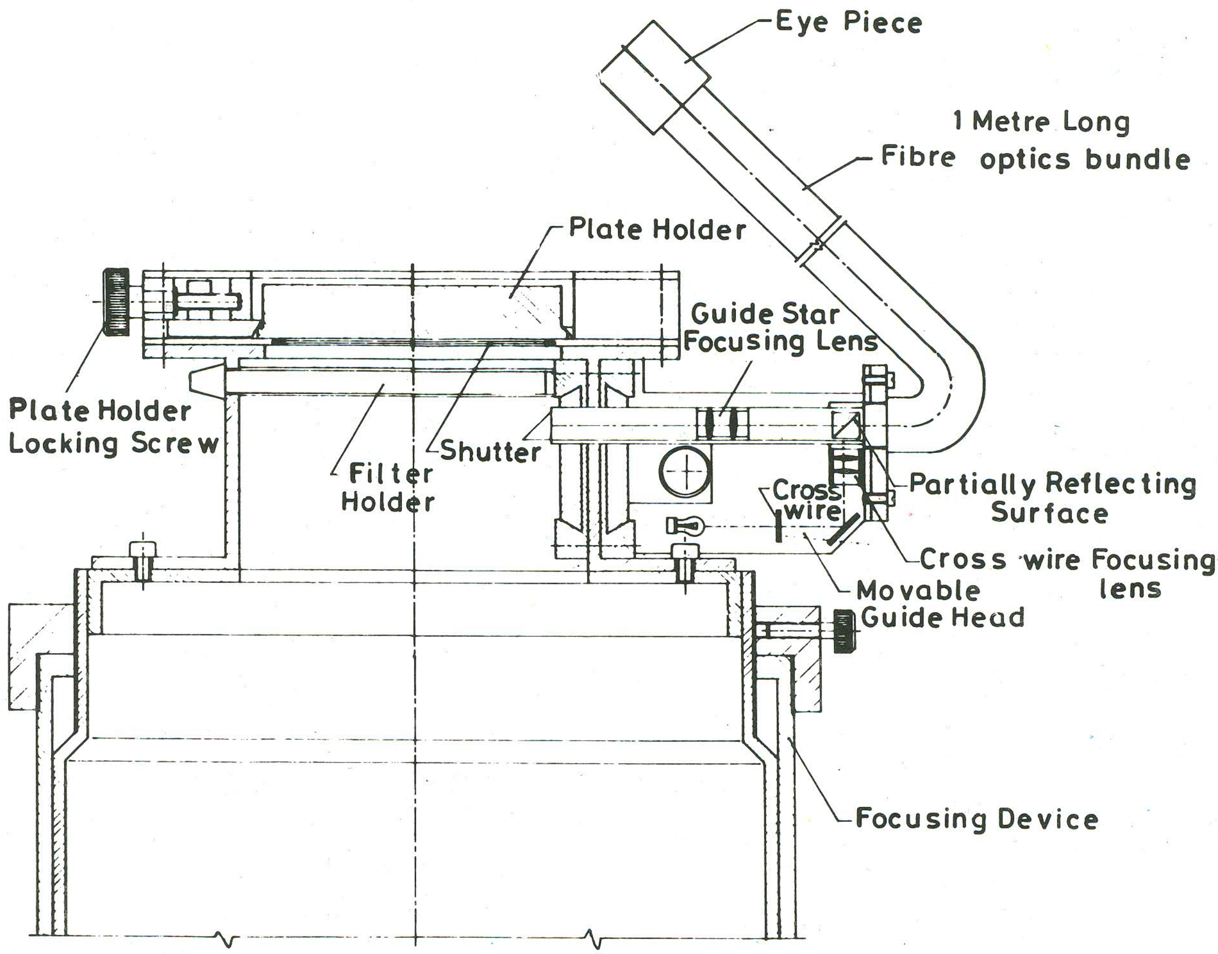


Fig: 1 Prime focus camera assembly

sembly is shown in Figure 1. The 3 element Wynne Corrector made of UBK7 glass is designed to correct a field of 40 arc minutes. The plate holder takes a 8cm x 8cm square plate to cover the full field of 40 arc minutes. Focusing ring has a movement of 25mm and the pitch of the screw is fine enough for accurate focusing. Observer uses a one meter long fibre optics bundle to see the guide star. A guide star is picked from the prime focus field by a right angled reflecting prism and focused on the fibre optics surface. An illuminated cross wire is seen superimposed on the star field for easy guiding. The guiding head is sturdy enough to avoid any differential movement with respect to the photographic plate. The plate holder assembly may be rotated to any desired angle and this rotation and the linear movement of the reflecting prism are used to centre the guide star yn the guiding eye piece of the fibre optics. There is also provision to put 8 cm x 8 cm square filters just below the plate holder for UBVRI or narrow band filter photography.

Cabin Control Panel

A control panel was fixed in the east side of the prime focus cabin. The eight inch circular panel has the following controls.

1. _ 15V supply
2. _ 5V supply
3. 2000 V HT supply for PMT
4. Power supply for CCD
5. Output of PMT and CCD
6. Emergency switch to switch off the power to the telescope.
7. Hand set connections for set, guide and fine guide speeds.
8. Cabin illumination.
9. Intercom for communication with the main control room in the observating floor.

Landing platforms

Though the dome is rotated by six 5 HP - DC motors, the rotation of the dome is rather slow. It takes more than 15 minutes for one rotation. Prime focus observer goes into the cabin using a small landing platform fixed to the dome near the dome control panels. Everytime the observer goes in and comes out of the cabin, this platform has to be brought near the centre of the horseshoe. To speed up the process two more landing platforms were provided inside the dome.

Polar axis alignment

120 stars distributed in all parts of the sky were observed to determine the pointing accuracy of the telescope. A preliminary analysis showed that the polar axis needs further alignment both in altitude and

azimuth. Polar axis was raised by one and a half arc minutes. The azimuth correction made was also of the same order towards west.

Small amplitude oscillations

While doing photography at the prime focus, it was noticed that the telescope had a small amplitude oscillation with period of one second. The amplitude of this oscillation was a few tenths of an arc second to a few arc seconds depending on the balance of the telescope and the tuning of the servo-system. By proper tuning it was possible to reduce the amplitude to 0.3 arc second which was about twice the expected value of 0.18 arc second. Oscillations are seen both in RA and DEC axes.

Dark Room facility

The dome has provision for two dark rooms, one in the observing floor and the other in the first floor. Dark room in the observing floor is small and is useful for plate loading only. The main dark room in the first floor is around the north pier. A double-door entrance to the dark room and 5 micron dust free filter in the air conditioning duct help to maintain the dark room dust free. Facilities for hyper-sensitisation of the plates will be provided in this dark room. The polished granite tops of the platforms provided inside this dark room are ideal for good photographic work and also for the testing of various optical instruments.

Prime Focus Photography

Many prime focus photographs with exposures ranging from a few minutes to one hundred minutes, obtained with the VBT have already been published in IIA Newsletter. Seeing as judged from these photographs is two to three arc seconds. Probably by removing the panels covering the telescope tube, seeing could be improved. Also the many heat sources within the dome like scores of power supplies, amplifiers, generator supplying power to computer etc. must be isolated from the observing floor to reduce the convection currents setting in when the dome is opened.

Mirror Supports

Primary mirror was realuminized in September 1987. When the mirror was removed for aluminizing the old support system which was moving around bush bearings was replaced by a new set of highly sensitive ball bearings. Tests made on individual supports properly balanced in the horizontal position showed a 10 micron vertical movement for an additional weight of only 30 gms.

Guide telescopes

Two eight inch refractor guide telescopes are provided for the 234cm reflector, one attached to the north side and the other to the south side of the tube. The lenses are of Zeiss make and have focal lengths of 2990 mm. Focusing units for these telescopes were designed in the Institute.

Summary

Prime focus image is well concentrated as seen from the smallness and crispness of the star images in the direct photographs. Very often the track speed of 15 arc/sec set for the RA drive jumps over to the DEC side whenever there was some electrical disturbance and the DEC axis also started tracking at 15 arc sec/sec. I lost many photographs because of this problem. These problems have since been set right. Facility for tracking both in RA and DEC was very useful in photographing comets. Comet Wilson was photographed beautifully using this tracking facility.

On several occasions, the telescope started moving at slewing speed eventhough nobody had been operating the slewing control. Later it was found that one of the tacho output was not coming through. Now a safety device has been added to the control system so that whenever either the tacho output or the encoder output is absent, the telescope power cuts off. This device also stops the power to the telescope just in case the large amplitude oscillation sets in. For the full safety of the telescope, it is better, we provide mechanical stops at both ends of the horse- shoe.

I was ably assisted in my task by the Project Manager S.C.Tapde, Sr.Electronics Engineer V.Chinnappan, Head of Electronics and Computer Centres R.Srinivasan and by a whole team of observational and technical assistants. Special mention must be made of F.Gabriel who was available night and day to solve any telescope problem.

K.K.Scaria

(Most of the problems related to the drive system has since been solved and we will carry a comprehensive report about the optical, electronics and mechanical system in subsequent issues. -Ed.)

Computational Facilities at VBT

The computational facility at Kavalur includes a VAX-11/780 system with 8 Mb of physical memory,online disk storage of about 1.2 Gbytes, 2 magnetic tape drives, 12 terminals, a COMTAL vision-1 image display system,a TEXTRONIX graphics terminal with a hard copy unit.It has also CAMAC and DR-11k (parallel I/O) interfaces for various instrumentation and control applications. Till recently the system was operating under 3.5 version of VAX/VMS.

The CAMAC driver obtained from AAT has been installed and initial tests indicate satisfactory performance of the driver. However some more tests are needed before declaring the driver fully operational. Presently CAMAC system has very few user modules. In order to utilise the capabilities of CAMAC some more user modules need to be procured, depending upon the nature of the experiments.

The DR-11k driver has also been modified so as to enable some of the data acquistion programs to be implemented through DR-11k. Regarding special packages for astronomical data reductions, recent versions of STARLINK and STARMAN have been installed. However some of the programs for spectroscopic data reduction need to be procured and installed.Hopefully by the end of this year some of these packages would be availble.

Finally we wish to thank Lewis Waller of the Anglo Australian Telescope Board for providing us the CAMAC driver.

A.V.Ananth

A PC/AT Based Image Data Acquisition/Processing System for CCD Cameras.

A PC/AT based image data acquisition has been developed for VBT,Kavalur to acquire images from cooled CCD cameras, operating in the slow scan mode. The hardware configuration is as follows:

1) A CCD camera system, comprising of a GEC P8603 CCD chip enclosed in a DEWAR and cooled by liquid nitrogen and a remotely programmable controller for CCD chip operation, bought from M/s Astromed Ltd, U.K.

2) A parallel/serial and seriql/parallel convertor for trqnslating commands/data into serial form.This enables communication between the remote program computer and the camera controller through a single serial link.The serial link operates at 10 mbauds. This simplifies cabling and ensures portability and reliabality.

3) A PC/AT system with 40 MB Winchester and 1.2 MB floppy drive and other standard interfaces.

4) Two 16 bit parallel I/O slots. One for CCD command generation and another for transferring data to a magnetic tape system.

5) A frame grabber with 2 frame buffers of 256 K bytes each and a RGB output for image display purposes.

6) A pixel processor for performing simple image processing functions.

7) A 60 mb cartridge tape drive for image backup.

8) A half inch computer grade magnetic tape drive system for transporting image data to mainframe/minisystems for further image analysis.

The software is a user friendly menu driven package to perform the following broad categories of functions::-

1) A series of tests for ensuring proper operation of the controller, the datalink between the CCD controller and the computer, temperature sensors and the shutter operation.

2) Image data acquisition including dark, bias, flatfields etc.

3) Image processing functions like frame addition, subtraction multiplication, logical operations, filtering etc.

4) Image analysis functions like contrast stretch,maximum and minimum values, pixel intensity,row/column cut etc.

5) Windowing operations like zoom/pan etc.

6) File operations for image save,restore etc.

The program comprises of routines developed in Assembly, Pascal and Modula-2. The user friendly menu and various menu screens have been developed using a package called Clipper. The system has been operational since January 1989 and a number of images have been obtained. The system is being modified to accommodate various other useful features. In order to port the data from the PC/AT to VAX, a tape reading program is also available on VAX- 11/780.

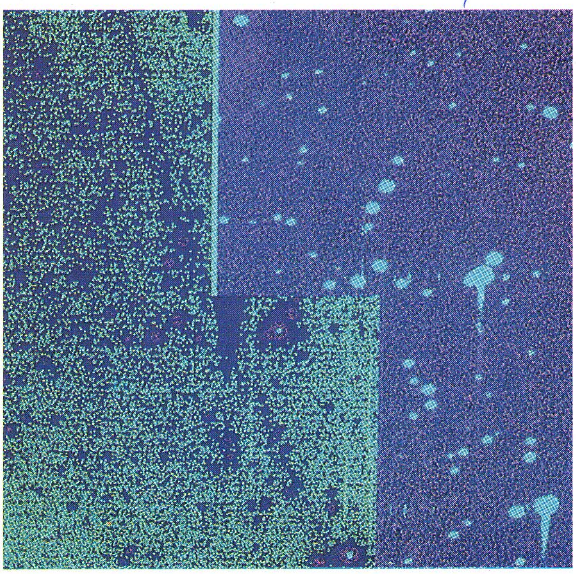
The specification of the system is given below:

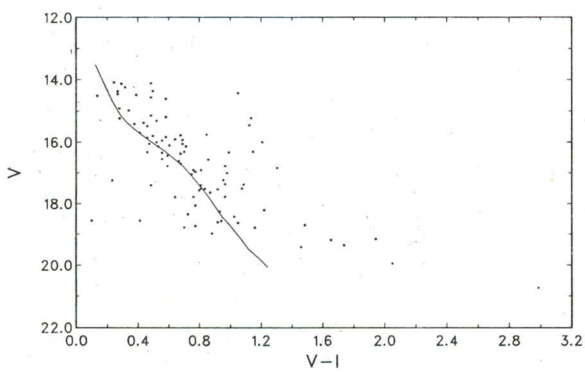
1) CCD chip	GEC P8603
2) Array size(pixels)	385*576
3) Frame size:(pixels)	400x600
4) Frame size:(mm)	8.2*12.6
5) Pixel Size(microns)	22*22
6) Digitizer	16 Bits
7) Peak quantum efficiency	50% around 700 nm
8) Time per frame, store and display	2 min
9) Pixel data format	16 Bit binary.

A.V.Ananth R.Srinivasan G.Srinivasulu
S.S.Chandramouli V.Chinnappan

Galactic Cluster NGC 2818

One of the main programmes taken up with VBT prime focus CCD system is the study of star clusters in VRI (B) filters. The galactic cluster NGC 2818 is unique in one respect, that it is the only galactic cluster which is associated with a planetary nebula (also known as NGC 2818) and this is of great importance for the study of stellar evolution and particularly for the mass estimates for the progenitor stars of planetary nebulae. However, there is some difference in the distance estimates made for the PN independently and the cluster. The estimates of the PN range from 1.6 kpc to about 2.65 kpc, whereas the distance estimated to the cluster by Tifft, Connolly and Webb (TCW 1972: MNRAS,158,47) is about 3.2 kpc and later revised by Dufour to 3.5 kpc. The distance modulus of the cluster determined from ZAMS fitting by TCW is uncertain because their photographic photometry goes only upto V 17 mag. and the main sequence turn off etc occur around V 15.5 mag. as a result the fitting is done with very few stars. With a view to improve the distance modulus of the cluster by observing the stars down to V 21 mag. which could give good sequence for ZAMS fitting, several CCD images in VRI filter have been obtained with VBT.



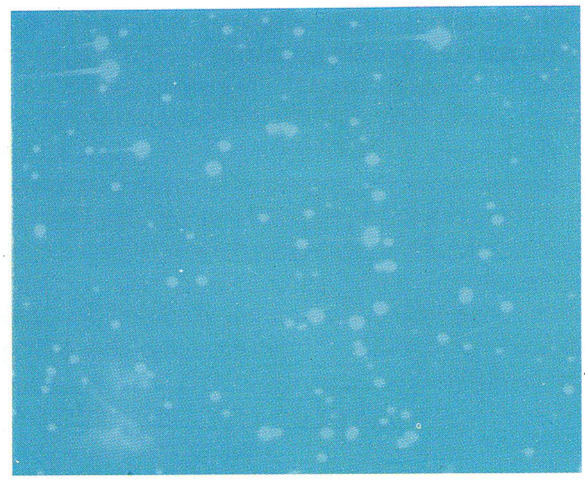


One of the images obtained in R filter of the Central region of the cluster is shown above. The analysis is in progress using the Vax 11/780 system, with Comtal image display unit at Kavalur. The starlink package consisting of Starman is being used for the phtotometric reductions. The figure above shows the colour magnitude diagram V vs (V-I) for the 3'x2' central region of the cluster fitted with ZAMS from Walker 1985 (MNRAS 213,889). After applying the reddening correction for the cluster of E (B-V) = 0.22, (E V-I = 0.35), the preliminary result is that the distance modulus is 12.9 and agrees with the value obtained by TCW for the cluster.

R.Surendiranath, N.K.Rao,
J.S.Nathan, Ram Sagar, K.K.Ghosh

SN 1006

One of the programmes which was initiated with the CCD system at prime focus VBT is the imaging of nebulae in various spectral lines using interference filters.



The supernovae remnant 1006 AD was imaged (by N.K.Rao, K.K.Ghosh, J.Rozario and R.Surendiranath) with the CCD system at F/3.25 prime focus of VBT on 8 April 1989 both in H-alpha line using a 50A wide interference filter (image on left) and through a wide band red filter (image on right). The remnant, the ribbon like structure running from top left to bottom right (i.e. NE to SW) is prominent only in the H-alpha image. This is a characteristic feature of some of the supernova remnants and thought to arise when a fast shock wave encounters nuetral material as a result of charge exchange reaction between the neutrals penetrating the shock and the fast ionized hydrogen behind the shock. The veil like character of the emission is also the character of the Balmer line dominated (eg.H-alpha) supernova filaments. The image displayed above is obtained after one hour integration.

N.K.Rao, K.K.Ghosh,
M.J.Rozario and R.Surendiranath.

Deep CCD Photometry of the Globular Cluster NGC 6401

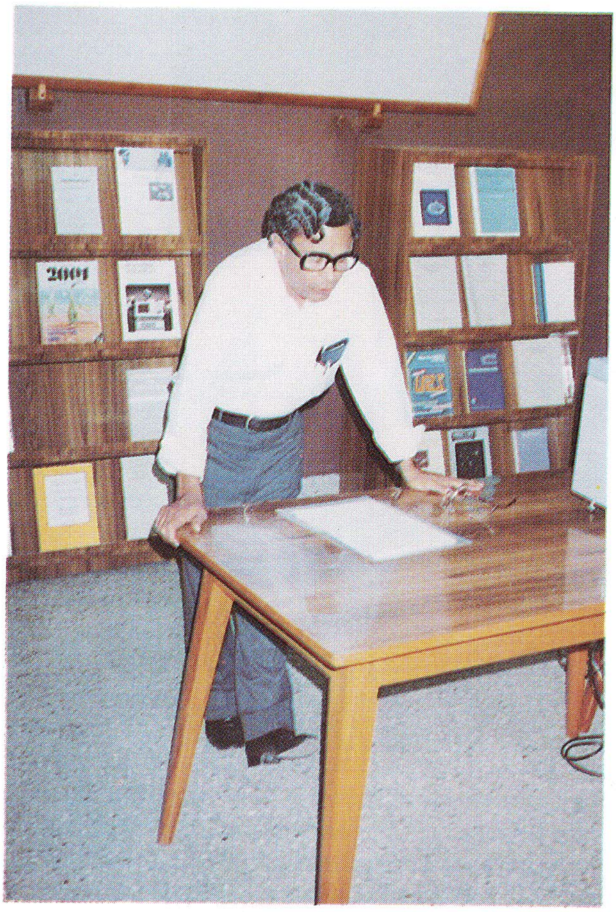
The faint globular cluster NGC 6401 is located almost in the direction of the galactic center (l = 3.45 and b = +3.97) and it lies in a region (R.A. = 17.6 and Dec = -23.9) where large amount of interstellar matter is present. The photographic photometry of this cluster done by the earlier authors gives E(B-V) = 0.8 mag.and A(v) = 2.5 mag with distance determination ranging from 8.5 kpc to the unreasonable distance of 22-

40kpc. In the present work, we have been able to resolve the individual stars in the central region of this cluster for the first time by using the CCD facilities available at the 102-cm and the 234-cm telescopes in the standard B,V,R and I bands. Preliminary processing of this CCD data done with the STARLINK package installed at the VAX computer shows a large number of stars fainter than 18 mag. in V band. The faintest ones are probably close to 20 mag. However, the best resolution is seen in R and I bands, partly due to the higher sensitivity of the CCD chip in that region and partly due to the reddening caused by the interstellar matter in that direction. The processing is still in progress.

G.S.D.Babu and Bharat Adur.

The First VBT Workshop

R.Rajamohan has been entrusted with the responsibility of bringing out VBT News regularly and arrange for regular VBT Workshop to highlight not only the science but also all other problems relating to 234cm Telescope. D.C.V.Mallik has kindly consented to help him in both these matters. They decided to have the general title for these workshops as "Low Light Level Astronomy". The first meeting was held in the Library hall in the first floor of the 234cm Telescope dome building. For this meeting the emphasis was on 'Existing Facilities' together with some scientific objectives. The meeting opened after garlanding of Dr.Bappu's photograph by the Director, J.C.Bhattacharyya. Rajamohan welcomed the participants and gave a short introduction regarding the theme of these meetings. He, of course, has taken the advantage of being the organizer of the Workshop and the Editor of this News Bulletin by publishing his own photograph below. The summary of the Workshop that follows was prepared by K.D.Abhyankar of the Osmania University.



The following presentations were made:

J.C.Bhattacharyya of IIA talked on 'Direct Imaging, CCD Scanning and Photometry'. One observes the intensity of radiation and its variation. The methods of observation include photography, two dimensional photometry, spectroscopy, polarimetry,interferometry and combinations of these. The observations consist of predetection processing which involves collection and filtering of light, detection process involving eye (1 to 2 percent efficiency); photographic plates (1 percent efficiency) photomultipliers (40 percent efficiency) and CCD (70 percent efficiency); and post-detection processing. A list of present and future large telescopes was given. N.Kameswara Rao of IIA described the spectroscopic instruments at the cassegrain and coude foci of the VBT. The existing ones include:

i) An f/15 Boller and Chivens spectrograph with Schmidt Cassegrain Camera attached at cassegrain focus. It is converted to an F/13 system and the Schmidt camera is replaced by 20-inch camera and CCD. It has gratings with 300, 600 and 1200 lines/mm giving dispersions of 20 to 80A/mm in the first order. The limiting magnitude is expected to be about 14-15 for S/N=50.

ii) A Carl Zeiss spectrograph at cassegrain focus. It has three cameras and three gratings giving dispersions of 29 to 450 A/mm. iii) An FTS has a traverse of 2cm and covers the region from 0.64 to 2.5 microns.

Future Plans Include:

iv) Multiple application spectrograph at the cassegrain focus on the lines of similar instrument working at ESO. It will provide for direct imaging upto 25.5 mag. with S/N 3, slit spectra of 18 mag. objects with 13A/mm dispersion in 30 minutes, Grism spectra upto 17mag. with dispersions of 10 to 23A/mm.

v) A cassegrain Echelle Spectrograph.

vi) A fibre linked coude Echelle spectrograph.

vii) Heterodyne spectroscopy.

K.D.Abhyankar of CASA discussed the 'Spectrosopic and photometric studies with VBT'. He concentrated on binaries and mentioned the following problems:

i) Simultaneous photometric and spectroscopic observations of Algol systems for getting the secondary eclipses in R and I and for observing the secondary spectrum during the primary eclipse to determine the mass ratio. High dispersion studies for determining the evolutionary effects on elemental abundances should also be made on the lines pursued by M.Parthasarathy.

ii) Observations of RS CVn stars to study their spot cycles and for modelling the spots. In this connection he emphasised that simultaneous spectroscopic observations at high dispersion with a resolution of 0.1A will be very useful, because the Doppler imaging can fix the latitude of spot while photometry can give its longitude.

iii) Recently Sreedhar Rao has found phase variations in the intensities of lines in the metallic line binary 41 Sex A. Similar studies of other Am stars with good coverage of optical phase can give important information about the abundance patches in these stars and the magnetic field configurations associated with them.

iv) On a scrutiny of the catalogue of spectroscopic binaries it is found that 75 percent of them lie in the northern hemisphere while only 25 percent belong to the southern hemisphere. This is so because the eclipsing binaries in the Southern hemisphere are not systematically surveyed for radial velocity variations. It would be a good project to undertake such a survey. What one needs to do is to obtqin the spectra of all southern eclipsing binaries at quadrature phases and see whether they show differences in radial velocity. Those which show such variation, can then be studied in detail.

Gopalkrishna of GMRT discussed the stepwise search for distant i.e. high redshift galaxies. In the early days radio galaxies covered values from 0.5 to 1.0. We need to extend this range to answer the following questions:-

i) At what z galaxies were formed?
ii) How do stellar populqtions of galaxies evolve?
iii) How does the active nucleus of a galaxy affect the protogalactic material?

In order to reach higher values of z we can proceed as follows:

a) Push the optical identification to deeper surveys.

b) It is found that radio power increases with the steepness of the spectral index. Therefore use ultrasteep spectrum sources (- 1.1 at 1GHZ).

In this way z has been extended for galaxies to 2 and even upto 3.8 during the last two years. These values rival those of quasars and take us back to an age of 10 billion years after big bang. It is found that the radio lobes of these galaxies are surrounded by Lyman Alpha halo, but they have no core. Why is this so? It is also found that high z galaxies are elongated in the direction of lobes: again the mechanism is not known. Is it the effect of protogalactic medium. In order to answer these questions we should make identification upto 22 mag. objects which is possible with a telescope of 2 metre aperture like VBT.

A.Kembhavi of IUCAA talked on 'Galaxies and Active Galactic Nuclei'. He stressed on the prime focus imaging of galaxies. Ellipticals are not ofmuch interest but the spirals show structure - sometimes even secondary structure. They have a bulge with different eccentricities. In addition we have a nucleus. We have to separate the three components. The ratio L (nucleus)/L (galaxy) varies from zero for normal galaxies to infinity for quasars. CCD's can bridge this large dynamical range. One can observe one galaxy in 3 filters in one hour. So we can cover 50 galaxies in a season for:

i) Statistical studies ii) Detailed mapping and iii) Colour variation across the galaxy. Image processing packages are available, they involve cleaning, fitting ellipses, estimating seeing, deconvalution for seeing and modelling.

U.C.Joshi of PRL talked on 'Polarimetric studies of faint objects with VBT'. Precision of polarimetry (about 0.1 percent) is affected by scintillation, seeing, sky background,instrumental polarization, ratio of linear to cirular polarization and photon noise. One canr each 16 mag. with the VBT. Programmes will include:

i) Study of dark clouds and star formation regions; here polarization due to alignment of grains can indicate the magnetic field structure of the region.

ii) Study of active galactic nuclei will tell us whether the central source is thermal or nonthermal. BL Lac objects and High Polarization Quasars (HPR) show dramatic variations which have to be understood.

iii) Magnetic white dwarfs show large variation of circular polarization, polarimetric studies can give models for such variation.

The following short presentations were also made on the spot.

C.L.Bhat of BARC, Srinagar, pointed out how VBT can be used for nonconventional astronomies like observation of gamma rays which show a good correlation with circular polarization in the case of polars and intermediate polars. He also wanted pulsars to be observed photometrically for which one needs a good time standard and fast (millisecond) photometry. This will give improved ephemeries for these objects for use by gamma-ray astronomers.

R.Surendiranath of IIA presented the preliminary results of CCD photometry of NGC 2818 in VRI. This is important for obtaining the age of the planetary nebula which is a part of the cluster.

Rangarajan of TIFR drew attention to the availability of IR imaging Indium-Antimony arrays with pixel size of 60 microns. They can be used for the study of star forming regions, molecular clouds and galaxies. It is also possible to do polarimetric imaging.

K.D.Abhyankar

"Adi Krithigai" Festival at Kavalur village or light pollution at VBO

When Moon enters "Krithika" (Pleiades) in the Tamil month of Adi (July/August), a festival in praise of Lord Murga (or Karthikeya) is celebrated - photograph by A.Paranjpye

VBT : Change over to Cassegrain System

Presently (as of this writing) the installation of the cassegrain secondary system to VBT is·in progress. The installation and testing of the 660mm hyperbolic secondary and focusing unit is expected to be over by the end of October. This would provide f/13 beam with a plate scale of 6.5"/mm at cassegrain focus. After the installation VBT would be having a new look, the side panels which make the telescope a closed tube are being removed (for good). It is expected that this would improve the seeing. As soon as Cassegrain focus becomes accessible, spectroscopy with VBT would commence with a Boller and Chivens spectrograph and a CCD camera.

N.K.Rao

Editorial

VBT News will be published as a Quarterly and will appear in the months of January, April, July and October each year. This Newsletter will be concerned mainly about the 234cm Telescope and the activities, programmes, projects and developments associated with this National Facility.

Deadline for contributions for the next issue is December 15,1989. Please remember we can print only what is written and unless you write we cannot bring out VBT News regularly The first issue has been produced rather hurriedly. we are particularly thankful to R.M.Paulraj for the letterhead design. S.Muthukrishnan helped for the line drawings and A.Elangovan in producing the required black and white prints. We are also thankful to A.Vagiswari and L.Christina for the considerable help they rendered in the final composition of this Newsletter.

It has been decided to evaluate the proposals four times in a year for the allotment of observing time on the 234cm Vainu Bappu Telescope. The deadlines for receiving proposals for different quarters are:

15 February	for April-June
15 May	for July-September
15 August	for Oct-December
and	
15 November	for Jan-March

Elephant Menace

R.Sivashanmugham, the Officer-in-charge at Vainu Bappu Observatory, Kavalur, has a huge tusk these days. About dozen elephants visit the observatory at nights. The next issue will carry a very special article by R.Sivashanmugham on his attempts to keep these relatively harmless animals away from the observing community

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