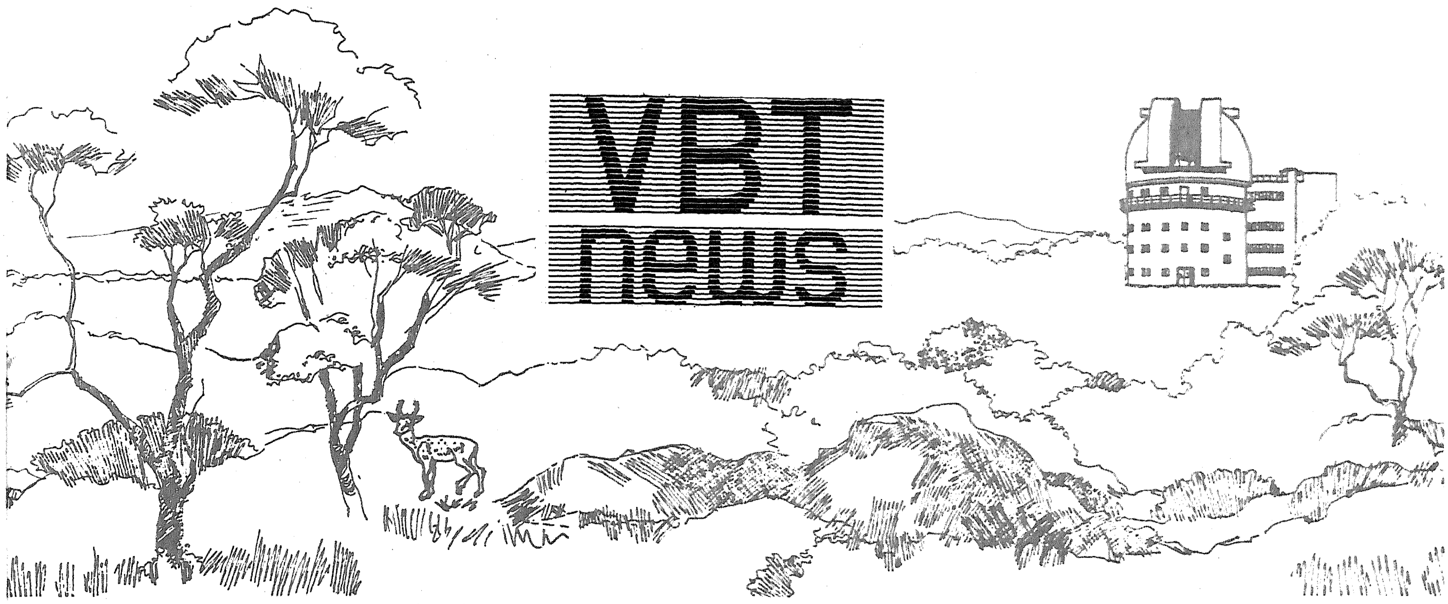
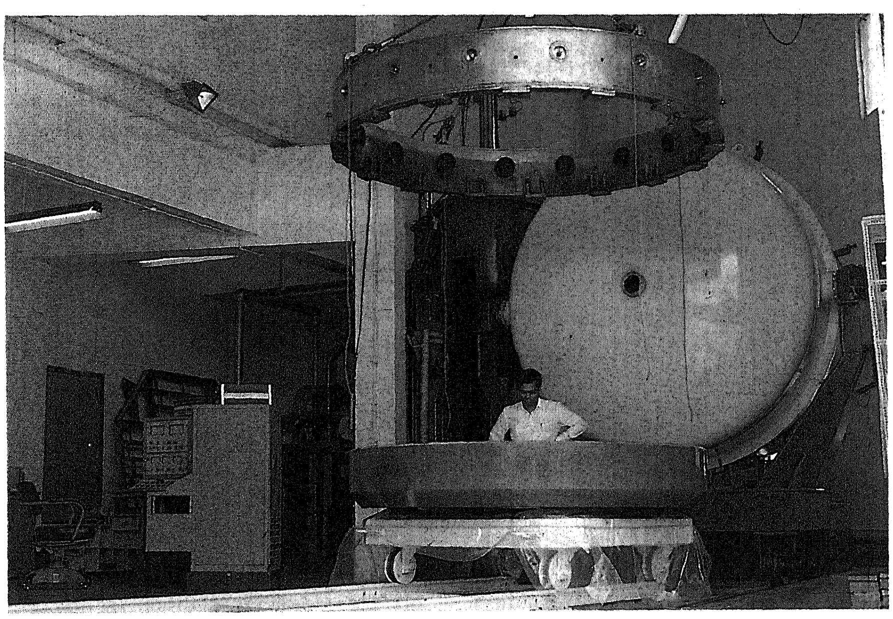


# VBT news


Number 5 | October 1990

The 2.8 m aluminizing plant at Vainu Bappu Observatory, Kavalur

## REALUMINIZING OF THE 2.34-m PRIMARY MIRROR


A.K.Saxena, Indian Institute of Astrophysics, Bangalore.


The realuminizing of the 2.34-m primary mirror of the Vainu Bappu Telescope was done during the month of June 1990 and this is the third time the mirror is being aluminized since 1986. The operation includes preparation of the 2.8-m coating plant for taking up the work, removal of the primary mirror from the telescope, removal of the old coating, chemical washing and aluminizing.

Even though the plant was maintained and kept ready for taking up the aluminizing at short notice, a trial coating run of the plant was taken up to ensure a trouble-free performance during the realuminizing of the mirror. The operations of taking out the mirror from the telescope, and its removal from the cell and lowering it into the aluminizing chamber area was done as per the standard procedures laid down earlier. The chemical cleaning was performed meticulously following the pre-set procedures[1] of degreasing, removal of old coating and subsequent washing. For obtaining a satisfactory clean surface without any contaminations, about 15 cycles of acid and alkali wash were given with intermittent distilled water wash. The aluminizing run required about 12 hours of running of the coating plant spread over two days. The whole operation of aluminizing went on quite smoothly and satisfactorily. The mirror with good quality coating was ready by June 30 and was stored in the chamber under vacuum until reloading in the telescope.

From the past three occasions of aluminizing of the 2.34-m primary mirror it has been found that the present location of the plant is very hard to maintain and the loading of the mirror requires a much longer time due to constraint of space between the crane and the dolly location. The control of the dust level is another problem faced in this area due to large hatch openings. In view of these difficulties we plan to shift the 2.8-m coating plant to a separate place, close to the telescope building.

Attempts are on to develop a method of dry cleaning of the mirror using freon gas or dry $CO_2$ gas in the telescope itself to avoid very frequent aluminizing in the future. Details of the procedure will be communicated separately.

References:

1. A.K.Saxena, et.al. "1.5-m Aluminizing plant of the Indian Institute of Astrophysics" - Kodaikanal Obs. Bulletin Ser.A. (1980) 72-74.

## SPECTROSCOPY WITH THE VBT

N.K.Rao, Indian Institute of Astrophysics, Bangalore.

The Boller and Chivens spectrograph (abridged as B & C) has been in use since December 1989 at the Cassegrain focus of VBT (See VBT News 2 p.7). One of the problems faced intially was the coupling of the CCD dewar to the B & C spectrograph camera. No provision exists in the original B & C camera to bring the focus out onto the CCD chip which is about 30mm away from the shutter window. To overcome this difficulty we replaced the B & C camera by a Zeiss 6-inch Schmidt camera which has a provision for focus adjustment by 12mm. The aperture of this camera is wide enough to ensure no loss of light. The shutter to the CCD dewar (20mm thick) was relocated below the spectrograph slit. However, the problem of matching the focal ratios of the telescope to the spectrograph collimator is yet to be solved satisfactorily. Meanwhile several programmes have been started with the above set up and good spectra have been obtained. Experimentation is in progress to transfer the star image from the prime focus to the spectrograph slit by using an optical fibre (100 $\mu$ core) and a converter lens to change the output beam to f/18 to match the collimator of the spectrograph. This arrangement should be a satisfactory solution for point sources.

### Comet Austin

Post-perihelian spectra of Comet Austin were obtained during 15 to 18 May 1990 through cloudy skies. The long slit of the spectrograph was used with a dekker with ten apertures of ~13 arcsecs each and with the adjacent apertures separated by 20 arcsec. The slit was oriented east-west and one of the slit apertures was placed on the bright part of the nucleus as seen visually. The grating (600 $grmm^{-1}$) and camera combination gave a resolution of ~1.3Å. Figure 1 illustrates the spectrum of the comet obtained in the early morning of 18 May. The comet was at a distance of ~1.0 a.u. from the Sun and 0.288 a.u. from the earth. Note the dramatic change in the strength of the [OI] line between the nucleus and the region 20" east of it. Also the $NH_2$ bands appear a little weaker away from the nucleus. The spectrum is dominated by $NH_2$ and the $C_2$ bands.

### Hydrogen deficient stars.

A programme to monitor the oscillation in Hydrogen deficient stars has been initiated. Figure 2 illustrates the spectrum of the hot hydrogen deficient star BD - 9° 4395 ( $\upsilon$r 10.5). This star shows emission in some of the HeI lines and displays pcygni type or sometimes inverse pcygni type profiles in CII lines (e.g. $\lambda$4267). The H$\alpha$ flanked by redward emission in addition to several strong CII lines in absorption can also be seen. These have been interpreted in terms of mass loss due to non-radial oscillations of the star by C.S.Jeffrey (IAU Coll.87.p.81, 1986). Thus monitoring these variations is of great interest. Figure 2 also illustrates the spectrum of RCrB obtained in a similar programme to monitor the variations in chromospheric lines ($\lambda$5876) and $C_2$ band strengths.

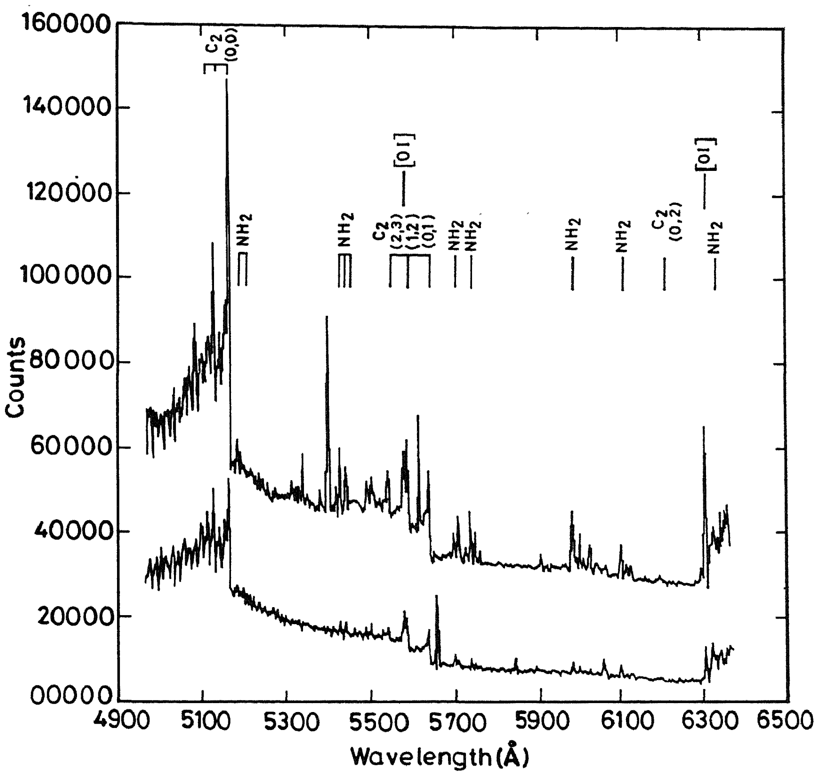



Fig.1 Spectrum of Comet Austin: Upper : Nucleus. Lower : Region 20" East of the nucleus.

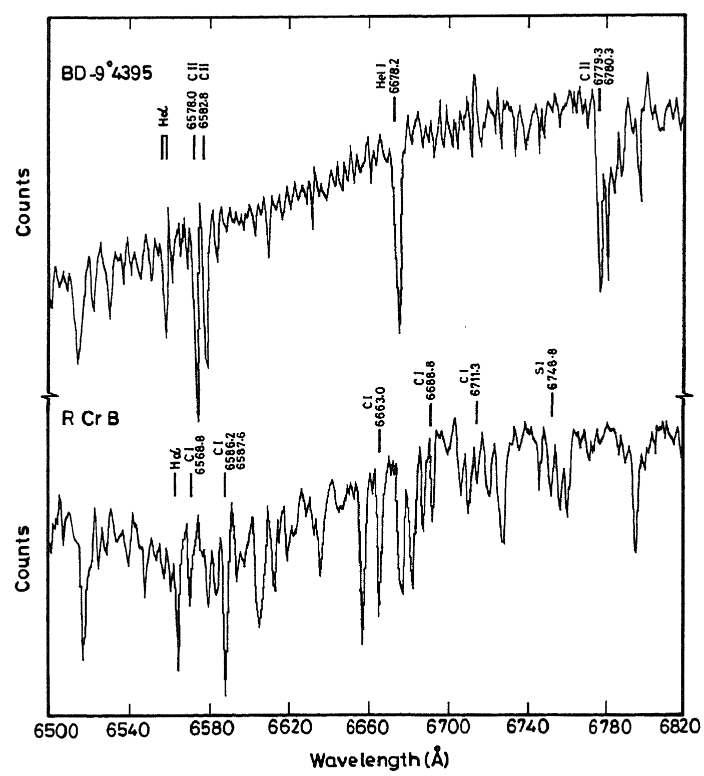



Fig.2. Upper : Spectrum of BD-9°4395. Lower : Spectrum of RCrB.

## INSTALLATION OF X-RAY SPECTRAL FITTING SOFTWARE

K.K.Ghosh, Vainu Bappu Observatory, Kavalur.

Over the past decade, particularly since the launch of the EXOSAT and GINGA satellites, instruments with greater sensitivity have collected very important observations that will help us to extend our knowledge of cosmic X-ray spectra. For example, the X-ray spectra of Active Galactic Nuclei (AGN) have begun to give us many important insights into the nature of the active nucleus. The exciting prospects which the astronomical x-ray spectroscopy offers in providing a glimpse of the x-ray universe is the main motivation that led us to take up the analysis of x-ray spectra.

The software required to analyse the spectra called XSPEC is, a command -driven, interactive, x-ray spectral fitting programme designed to be completely detector-independent so that it can be used for any X-ray spectral instrument. The first version of XSPEC was prepared in 1983 at the Institute of Astronomy, Cambridge under VAX/VMS by R.A. Shafer and later improved by him at the EXOSAT Observatory in collaboration with F.Haberl. Now, in the present form one can run XSPEC under the Sun/UNIX systems. XSPEC reads spectra from PHA files using the data command. Several files may be specified in the command line. Background subtraction and response corrections can be done interactively. XSPEC allows users to fit data to models constructed with many components which may either be additive or mutliplicative: e.g. blackbody, thermal bremsstrahlung, comptonization power law with high energy exponential cutoff, photoelectric absorption including compton scattering, accretion disk where the opacities are dominated by free-free absorption, relativistic accretion disk, disk model with gas pressure viscosity, gaussian, high energy cutoff, simple photon power law, photoelectric absorption from warm absorber, etc. The basic fit command is called FIT which performs a minimization using Marquardt algorithm. XSPEC plotting is performed through the PLT interface. Flux and equivalent width of a model in the given energy range may be obtained using FLUX and EQWIDTH command. XSPEC has an interactive help facility also.

Recently XSPEC has been installed on the VAX - 11/780 computer system of the Vainu Bappu Observatory. In Figure 3 the spectrum (+symbol) of an AGN, MKN 352, in the energy range 1 - 10 KeV reduced at VAX II/780 using this package is shown along with the fitted model (stepped curve in solid line) which is composed of photon power law and photoelectric absorption components.

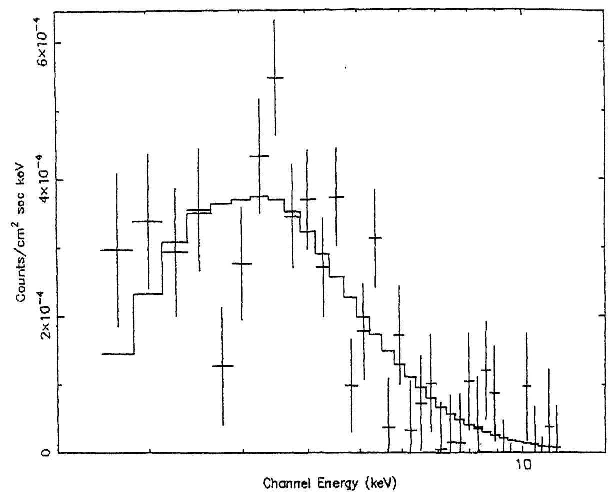


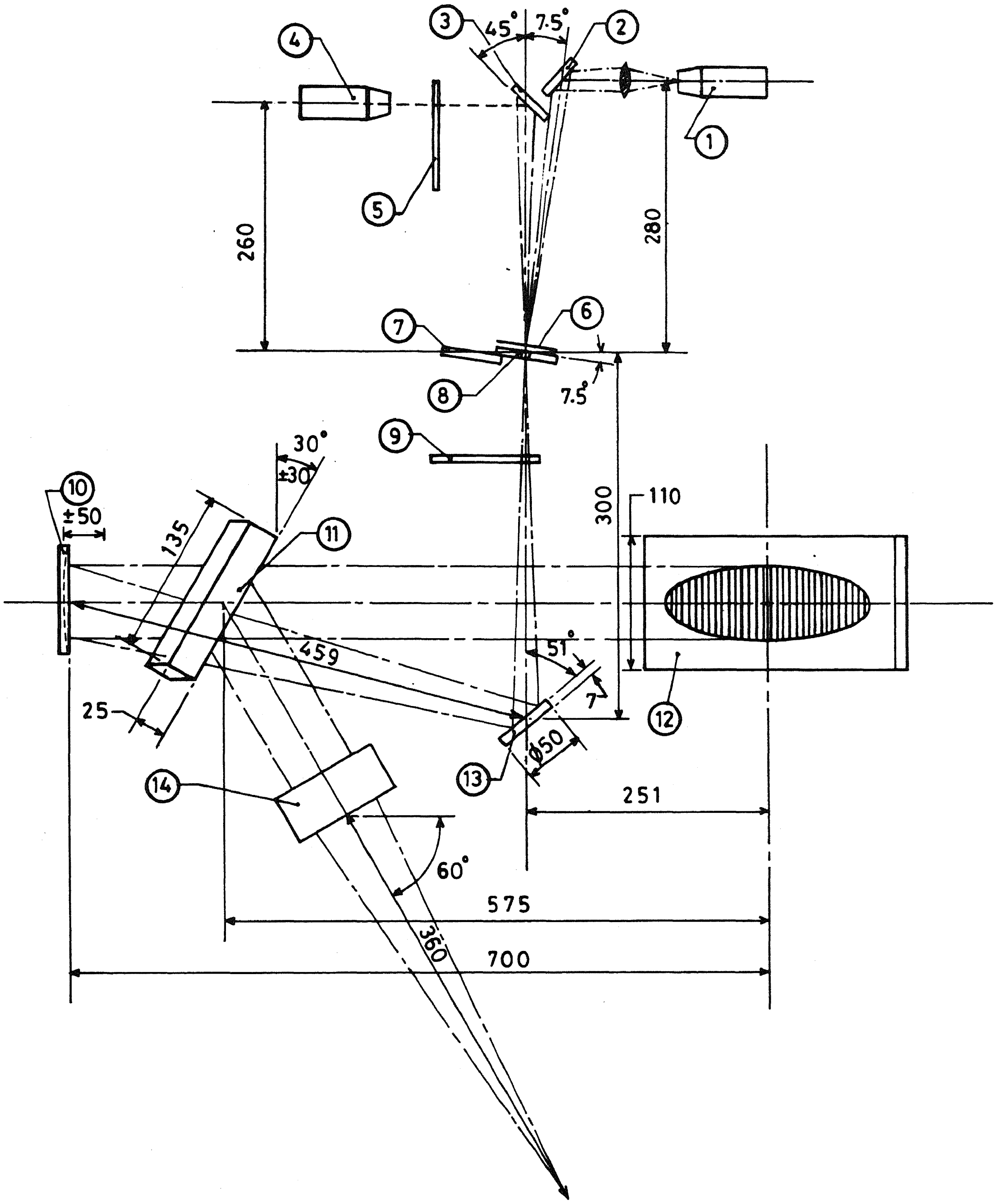

Figure 3: Spectrum of the AGN, MKN 352 (+symbol). Photon power law and photoelectric absorption model have been fitted (solid line) with the observed spectrum.

## A CASSEGRAIN ECHELLE SPECTROGRAPH FOR THE VBT

R.Rajamohan, B.R.Madhava Rao, & R.Srinivasan, Indian Institute of Astrophysics, Bangalore.

The optical layout of the Cassegrain Echelle Spectrograph for the f/13 cassegrain focus of the VBT is shown in Figure 4. The mechanical design has been provided by M/s TEKCONS, Hyderabad. The design features of this spectrograph was mostly dictated by the immediate requirements of the observers for a high resolution spectrograph until the proposed full fledged fibre fed coude echelle spectrograph becomes available.

The 79 lines per millimeter, echelle grating together with two cameras of focal lengths 150mm and 360mm will provide linear dispersions of about 4 Åmm$^{-1}$ and 10 Åmm$^{-1}$. The liquid nitrogen cooled GEC CCD chip will be used as the detector. The guiding arrangement will use an intensified CCD camera (VBT News No.3 p.6). The spectrograph is expected to be fabricated by April 1991.




1. Guiding System
2. Retractable Flat Mirror
3. Flat Mirror
4. Comparison Light Source
5. Filter Wheel
6. Dekker
7. Sliding Shutter
8. Slit
9. Filter wheel
10. Collimator
11. Cross Dispersor
12. Echelle Grating
13. Flat Mirror
14. Camera

Fig 4. Schematic layout of the Cassegrain echelle spectrograph.

(All dimensions in the figure are in mm)

## MODIFICATIONS OF MECHANICAL COMPONENTS

B.R.Madhava Rao, Indian Institute of Astrophysics, Bangalore and F.Gabriel, Vainu Bappu Observatory, Kavalur.

1. Mechanical stoppers with rubber cushioning for the secondary focus assembly unit were designed and fabricated. These were assembled in the annular area between the fixed outer shell and the moving hollow drum (see description of focus assembly unit in VBT News 2 p.5). This is intended to protect the telescope and its sensitive instruments in case of failure of the electromagnetic brake or the coupling.

2. The limit switch is also fitted in the annular area between the stationary shell and the moving hollow drum. This will limit the travel of the drum which supports the secondary mirror on one face and the Wyne corrector assembly on the opposite face.

3. The scale and scanning unit of the Linear Transducer (HEIDENHAIN make LS 303 having system accuracy $\pm$ 10 micron) has been mounted inside the annular space between the outer shell and moving drum using properly machined mounting fixtures. The scale and scanning unit is connected by flexible cables to the Digital counter located inside the control panel at the Cassegrain end. Digital counter displays the correct position of the drum with an accuracy of $\pm$10 microns. The traverse is limited to $\pm$ 40mm about the mean position. Arrangement has also been made to have the above display inside the console room.

4. The 3mm thick sheets which were screwed on to the outer surface of upper and lower serrurier truss were removed to improve "seeing". This has not only reduced the total weight of the telescope tube but also provides good ventillation across the tube.

5. During the trial runs it was observed that the D.C. motor was saturating and was unable to lift the secondary mirror and its aligning attachment which together weighs about 748 kg. It was also observed that since the braking torque characteristic of the ball nut and screw assembly is very low, the entire secondary mirror assembly had the tendency to slide down. This, adversely affected the proper control while focusing. After the introduction of the 70:1 reduction gear box, the torque required by the motor is much less and the breaking torque of the entire system has increased manifold. The Hydax coupling which was used to connect the D.C. motor and ball nut and screw rod assembly was a source of backlash. This was eliminated by replacing the Hydax by Boston coupling.

6. A prime focus camera with plate holder and guiding system was being used until the end of April 1990. This camera has now been modified. In the modified version it has a filter wheel which can accommodate four numbers of 2-inch square or 2-inch circular filters. The filters can be selected at will by operating M061 stepper motor by remote control. The operating filter number is also displayed at the console room. The scanning by the intensified CCD used for guiding is executed by another M061 stepper motor. Remote controlled motorising for varying the focus position of the intensified CCD is also incorporated in this compact system. In addition, the manual method of changing the instrument focus (which was the practice hitherto) at the prime focus cage has also been motorised with remote control. This eliminates the need of an observer at the prime focus cage during observations. Provision has been made to fill liquid nitrogen into the dewar without having to remove it from the prime focus camera. All these facilities are intended to reduce the pressure on skilled manpower and also to increase the effective observing time on any given night. No doubt the pleasure of sitting in the prime focus cage during observations will pass into the nostalgic memory.

7. The baffle tube supported at the primary mirror cell which was not operational until recently because of a mechanical problem was set right and made operational. A baffle tube for the VBT secondary mirror was fabricated as per specifications.

8. As per the original design the primary mirror supports were covered all round by 25mm thick plates in three equal segments. The inner radius is 575mm outer radius is 1450mm. There was a need to reduce the weight on the telescope tube to compensate for the heavy new position angle device recently installed. The first target was the 25mm thick cover plate. Now this has been replaced by 8 mm thick m.s. plate of the same shape.

9. From the point of view of better workmanship, asthetics, easy approach for maintenance of motor and ease of mounting and dismounting, the declination axis motor covers (two in number) were redesigned and fabricated.

10. The petals of the primary mirror flaps fixed to the lower ring of the tube were not functioning smoothly. This was rectified.

11. A new position angle device having a bore of 662mm near the Cassegrain focus has been provided at the rear end of primary mirror cell. This would facilitate precise rotation of the Cassegrain instruments. It is designed for an instrument weight of 500kg acting at 700mm measured from the rear end of the mirror cell. The rotation is accomplished through a stepper motor and worm gears combination. A 14 bit absolute encoder enables the display of the position.

| VAINU BAPPU OBSERVATORY<br>Sky Condition at Kavalur, July - September 1990 | | |
|---|---|---|
| Month | Spectroscopic hours | Photometric hours |
| July | 28 | 4 |
| August | 45 | 4 |
| September | 15 | 2 |

The deadline for receiving proposals for the allotment of observing time on the 2.34 m Vainu Bappu Telescope are :

| | |
|---|---|
| 15 February | for April - June |
| 15 May | for July - September |
| 15 August | for October - December |
| and 15 November | for January - March |

*Photograph by K.K.Scaria*

Water Lily (Nymphaea) is the largest and most important of aquatic plants. It is also suitable for small ponds. The above photograph shows lilies in the pond just in front of the dining hall at Kavalur. It is one variety bearing showy pale yellow flowers which open in the day and close in the evening. The leaves are big, round and impressive.

*A.Vagiswari*

Editor: R.Rajamohan, Editorial Assistant: S.Rajasekaran

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