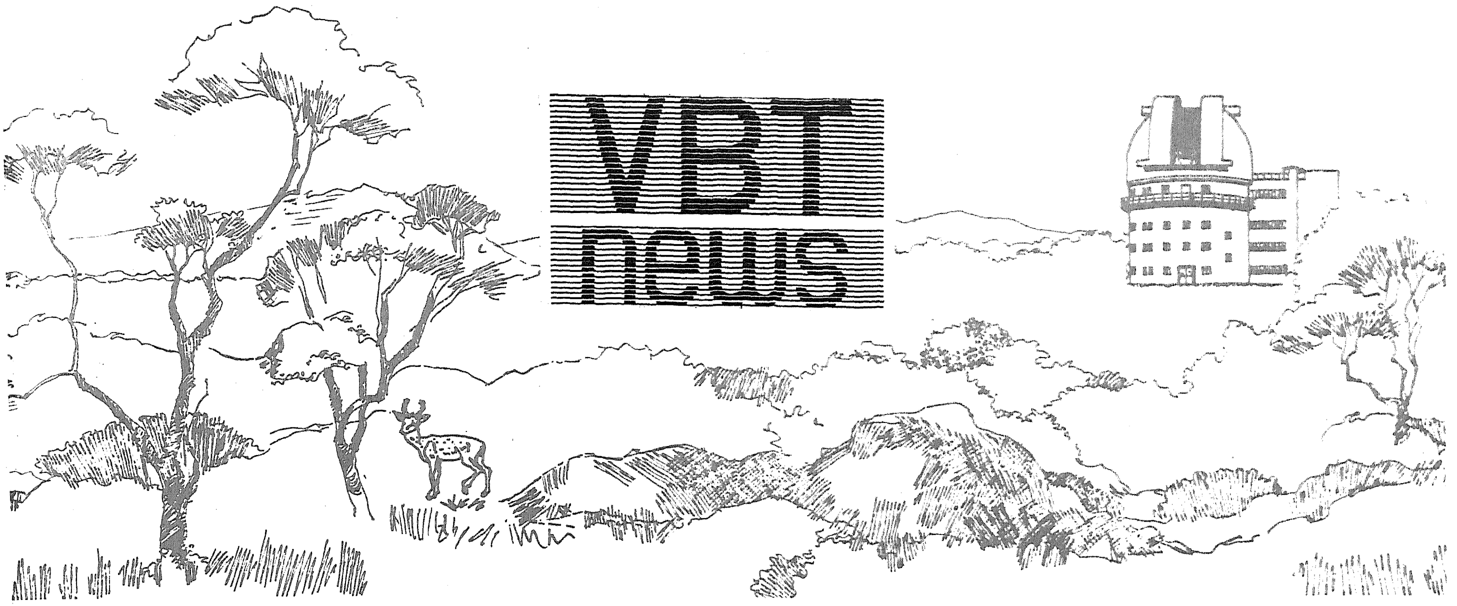
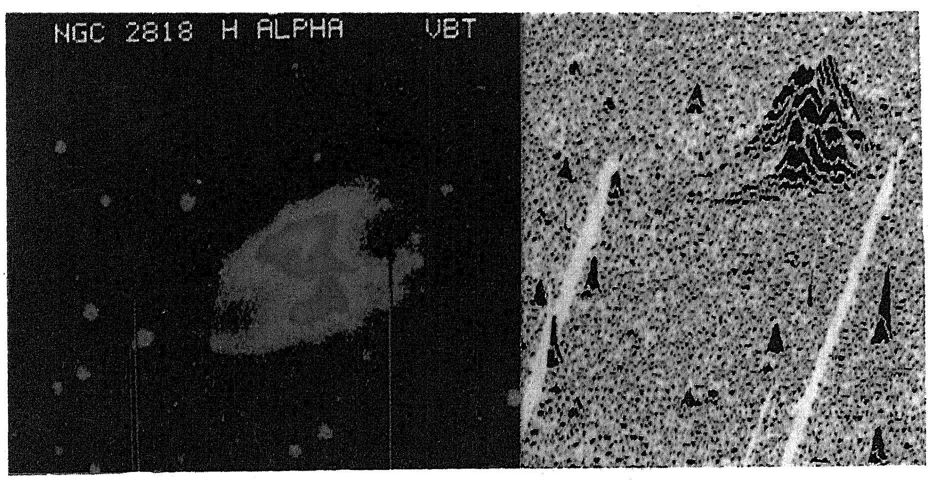


Number 3 April 1990



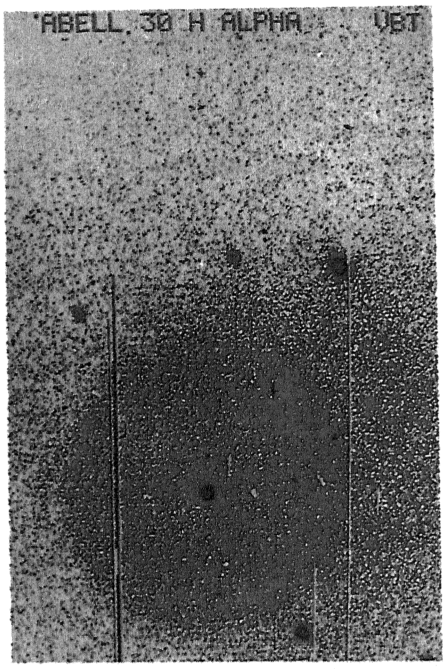
PRIME FOCUS IMAGING OF PLANETARY NEBULAE

NGC 2818:

This is one of the few planetary nebulae that belongs to a galactic cluster. CCD photometry of this cluster was reported in the first issue of the VBT News. The H_α image obtained on 8 February 1990 clearly shows the bipolar nature of the object and the nebular knots and condensations. To search for the location of the central star, one easy way is to distinguish between nebular condensations, knots and stars from the object profile. Mr.Narayankutty of VBO has developed a programme which takes the intensities across the image and displays it as a 3D picture of the field. The figure above illustrates such a picture on PN NGC 2818.

ABELL 30:

A30 is one of the first planetary nebulae in which the hydrogen deficient nebular knots and material were dis-



covered close to the central star. This is surrounded by a fairly faint nebula with normal composition which extends to a diameter of 120 arc seconds. A30 was imaged in a 50Å wide H_α filter with VBT on 7 February 1990 at the prime focus which shows the extent of the faint fairly circular outer nebula (the background has not been completely removed).

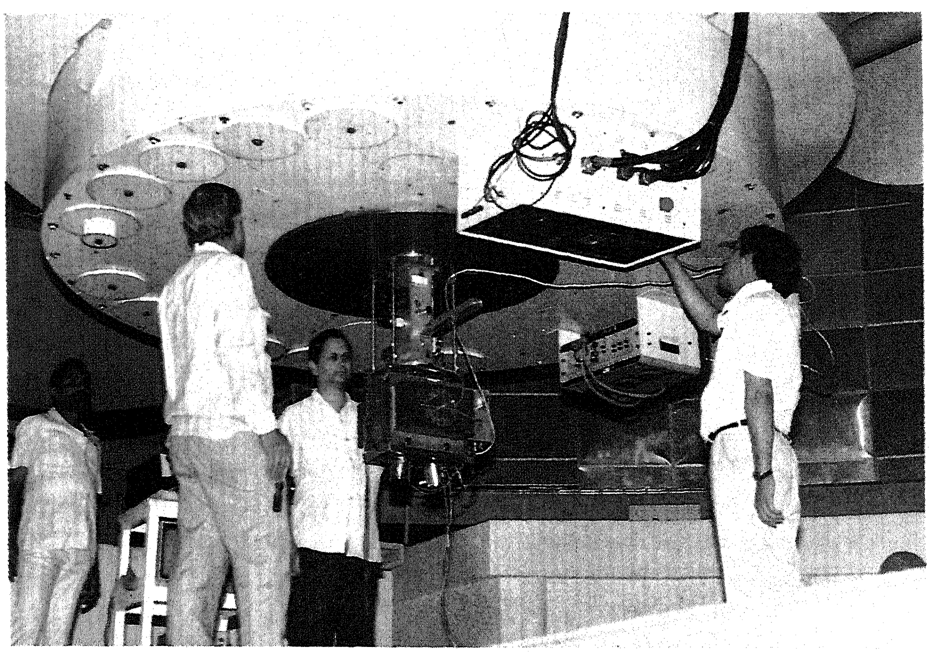
N.K. Rao and M.J.Rosario

FIRST PHOTOPOLARIMETRIC OBSERVATIONS WITH VBT: DETECTION OF THE SHORT TIME VARIABILITY IN Mrk 421

U.C. Joshi, M.R. Deshpande, and N.M. Vadher
Physical Research Laboratory, Ahmedabad
and
N.K. Rao, A.V. Raveendran and G.Selvakumar
Indian Institute of Astrophysics, Bangalore.

Observations of some BL Lacertae objects and a few late type stars were carried out at the Cassegrain focus of the VBT between January 18-23,1990 with PRL Photopolarimeter. The details of the photopolarimeter are given elsewhere (Deshpande et al 1985). The instrument works on the principle of rapid modulation to measure the degree of polarization and the flux is measured by counting the total number of photons. Several objects were observed during the observing run between January 18-23, 1990. Polarimetric standards and zero polarization standards were also observed to check the performance of the polarimeter and to get the off-set in the polarization angle and to measure the instrumental polarization. In fact the performance of the polarimeter was checked by inserting a Glan prism in the beam which produces 100% polarization. The efficiency of the polarimeter was found to be 98% which is considered to be excellent. The detailed analysis of the observation on various objects is in progress.

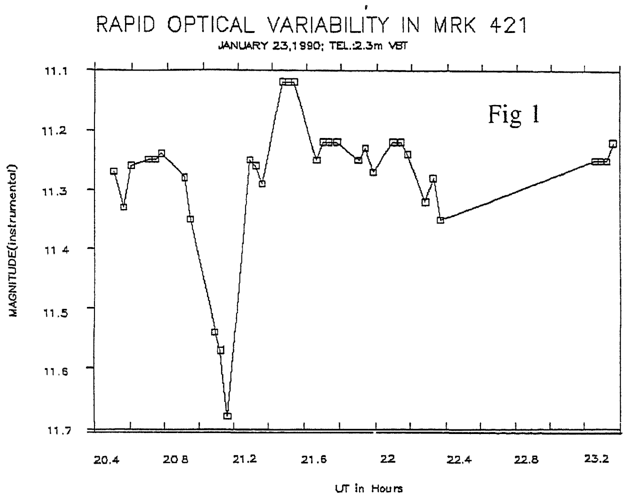
One of the exciting observations is the detection of the rapid variability in flux as well as in degree of polarization in BL Lacertae Mrk 421.

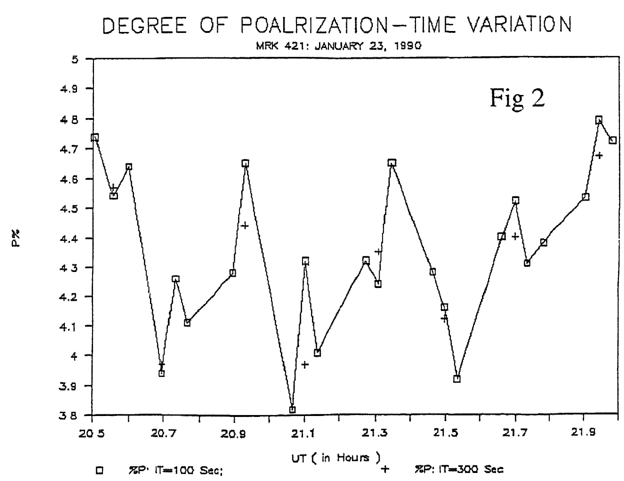


PRL Photopolarimeter

Mrk 421

Mrk 421 is a highly variable BL Lacertae object and has been studied extensively by various observers. Simultaneous multifrequency observations of Mrk 421 in radio, optical, UV and X-ray bands were carried out in the recent past to understand the nature of the enigmatic nucleus (Brodie et al. 1987; Macino et al. 1987). Rapid optical variations are expected in some of the BL Lac objects. It is vital to investigate the high speed optical variability of these objects to understand the nature of their central energy sources. In particular, the presence of periodicity in the ràdiation would support the gravimagnetic rotator model (Lipunova, 1987) while in case of the accreting black hole model we do not expect periodic variation.





As part of a program for seeking the evidence of rapid optical variability in BL Lac objects and AGN's we have carried out observations of Mrk 421. Although there is keen observational interest in short time scale variability, such data are lacking. In spite of the extensive study of Mrk 421 only scattered information is available on the optical variability (Guangzong et al.1988; Brodie et al. 1987; Macino et al. 1987).

Observations, without any filter, carried out on January 23 ,1990 show rapid variability in flux on a time scale of about 45 minutes; Figure 1 is a plot of instrumental magnitude with time. As seen here the flux decreased by $\Delta m \sim 0.4$ mag. We have not tried to convert the instrumental magnitude to the photometric standard since it does not affect the conclusion. Measurements were made through clear aperture to increase the S/N ratio for polarimetric data. Figure 2 shows the variation of the observed degree of the polarization with time; the X-axis is the time in UT expressed in hours and Y-axis is the degree of polarization in per cent. Polarimetric data show fluctuations on a time scale ~ 20 minutes. The signal to noise ratio for the polarimetric data is always better than 20. The variations thus appear to be very significant. Detailed analysis is in progress to find out if there is any correlation between variation in flux and the degree of polarization. Present polarimetric observations indicate that short time periodic variation may exist. This finding, if confirmed, will have great implication in the understanding of the nuclear energy source. Further observations are planned.

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HIGH ANGULAR RESOLUTION IN OPTICAL ASTRONOMY

S. K. Saha, Indian Institute of Astrophysics, Bangalore

Turbulence in the atmosphere restricts the resolution of optical telescopes to about 1 arc second, irrespective of their sizes (>10 cm). The method of speckle interferometry has opened up a new way of utilising the large telescopes to obtain diffraction limited information[1]. The deployment of spacebound telescopes may improve the resolving power to its diffraction limit but the size and the cost of such a venture is its shortcoming. The progress in achieving high angular resolution in optical astronomy has been modest since the pioneering measurement of the diameter of α Orionis by Michelson and Pease. Over the years optical interferometry has slowly gained in importance and today it has become a powerful tool. Success in synthesizing images obtained at two independent telescopes on a North-South baseline configuration impelled astronomers to venture towards ground-based very large arrays. Plans are also on to put an interferometer of a similar kind on the surface of the moon by 2000 - 2005 A.D.

Fig 1

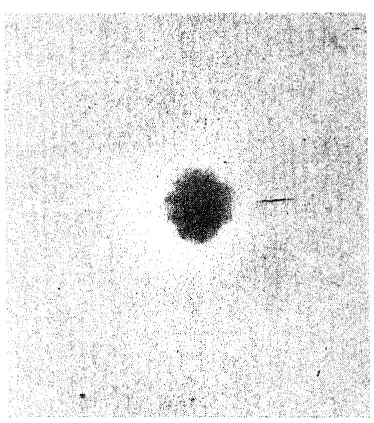

Fig 2

A host of basic problems need high angular resolution for their solution. Single aperture speckle interferometry has already been successfully used to study separation of close binaries, to measure diameters of giant stars, to resolve the heavenly dance of the Pluto-Charon system, to determine shapes of asteroids, to estimate sizes of expanding shells or envelopes around planetary nebulae and supernovae, to reveal structures of active galactic nuclei and of compact clusters of a few stars like the R 136a complex. Long base-line interferometry is capable of making angular measurements to a few milliarc seconds. The extended envelope of the emission-line star, γ Cassiopeae was angularly resolved by a prototype interferometer[2]. Subsequent measurement with a large interferometer (G12T) clearly showed the rotation of the envelope[3]. Eclipsing binaries (like Algol type) which show evidence of detached gas rings around the primary are also good candidates for long base-line interferometry. We have made a beginning with interferometric experiments in the laboratory and with the telescopes at Kavalur to study atmospheric blurring. These have been analysed further with the help of extensive computer simulations in our computer centre. The salient features of the laboratory experiments conducted while designing the speckle camera system for use at the prime focus of the 2.34 meter Vainu Bappu Telescope (VBT) will be discussed.

In order to obtain the light beam from a point source similar to the star in the sky, we have produced an artificial star image. The collimating beam from this star enters a simulated telescope whose focal ratio was similar to the prime focus of the 2.34 meter VBT at Kavalur. The image was slowed down considerably to discern the finer features. Atmospheric seeing was simulated by introducing various static dielectric cells (SDC) of regular sizes. The speckle patterns were recorded by photographic emulsion.

Recently, we have obtained a few snapshots of speckles of various stars using an intensified CCD and a Barlow lens at the Cassegrain focus of the VBT. Figure 1 shows the speckles of η Gem using a filter in the H_α region ($\Delta\lambda$~50 Å). Simultaneous studies have also been made to obtain the fringe pattern with various apertures in the laboratory.[6,7] The fringe pattern obtained through nine apertures is depicted in Figure 2.

The artifacts may lead to wrong information about the object. To avoid this, one has to be careful about the focal point instruments. A simulation bench consisting of an artificial star, a telescope with various focal ratios viz f/3, 25. f/13 etc. a reducing optical system is needed in the laboratory to carry out operations before undertaking any on-site observations. The technique can be improved upon by replacing lenses and SDC with reflectors and rotatable discs respectively. Series of frames containing speckles and fringes should be recorded with the intensified detector to reconstruct the image of the artificial star using image processing systems.

To summarise, a few groups are actively involved in developing the aperture synthesis in optical domain. In the field of radio astronomy, the introduction of Very Large Array and the rapid growth of image reconstruction techniques have brought images to milliarc second resolution. With the help of the expertise in astronomical optics and electronics, the development of aperture synthesis in optical astronomy may be foreseen to achieve angular resolution to a few nano-radians in the near future.

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THE CASSEGRAIN PANEL

The Cassegrain panel has been installed and is operational with the VBT since November 1989. During the initial phase of the VBT wiring in 1985, the cables related to the Cassegrain system were laid and terminated at the junction box located at the centre piece. These cables provide communication, handset, AC and DC power utilities. In the second phase, wiring has been extended from the centre piece elmex connectors to the circular connectors at the Cassegrain panel. It provides all the facilities like switching off of the telescope under emergency, display off etc. Two pairs of UHF connectors are available for the Cassegrain instruments. The panel houses a cage which can accommodate up to six euro cards. The focus position display unit is also mounted on this panel. All the movements of the telescope, dome, hydraulic platform and focus drum assembly can be controlled using sleek handsets which can be plugged on to the Cassegrain panel. Baffle up/down and position angle movements are controlled by the front panel switches of the Cassegrain console.

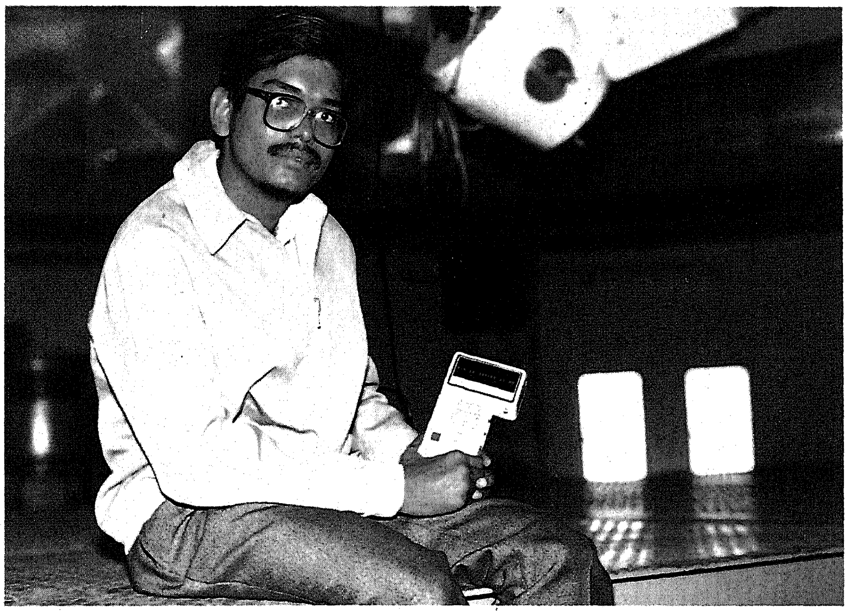
In some orientations of the telescope, access to the Cassegrain panel display unit may become inconvenient. To overcome such a difficulty a hand-held display unit is provided for easy reading of the information like RA, DEC, HA, ST, UT. This hand-held terminal is controlled by an Intel microprocessor 8085A. The display information available at the console is read through three 8 bit ports. These data in BCD form are converted to ASCII codes and are transmitted serially to the cassegrain console using RS-232C.

The secondary drum assembly is controlled by a focus handset for movements in either direction for two different speeds. The position information of the secondary is read through a precision linear encoder (20 micron accuracy) and is presented on the display unit mounted in Cassegrain panel. A remote reading facility at the console room is also provided to facilitate focus adjustment from the console room.

S. Murali Shankar, R. Srinivasan, & A.V. Ananth

DEVELOPMENT OF A CONTROLLER FOR GEC P8603 CCD CAMERAS

The present CCD Imaging system with the VBT makes use of a CCD dewar and controller imported from M/s



S. Murali Shankar

ASTROMED LTD, UK. In order to provide a standby system for the existing controller at VBT and to meet the future requirements on other telescopes at VBO, a CCD controller is being developed in our electronics laboratory.

As a first step, a high speed serial link electronics board has been developed in the laboratory. This improved board sits on one of the PC/AT expansion slots. It combines in a single card the functions of the parallel I/O port (DIGIANA card) and the parallel/serial converter electronics unit of the existing ASTROMED system. It runs with the same PC power supply and also minimises the I/O cabling. A general purpose 16 bit parallel I/O port has also been included to interface magnetic tape system. The clocks module and the Double Correlated Sampling module of the controller have also been tested in the laboratory. The Printed Circuit Boards for these modules are under fabrication

R. Srinivasan & G. Srinivasulu

REMOTE GUIDING UNIT FOR VBT

We have installed an intensified CCD camera for remote guiding of the telescope. It uses second generation microchannel plate for image amplification. A gain of up to 10000 can be reached with the camera. The gain of the intensifier can be adjusted with a potentiometer. A GEC P8603A CCD has been used in the system. It provides a 50 frames per sec output in CCIR format. The guide star is picked up by the camera from the surrounding and the field is displayed on a TV monitor in the console room for easy guiding.

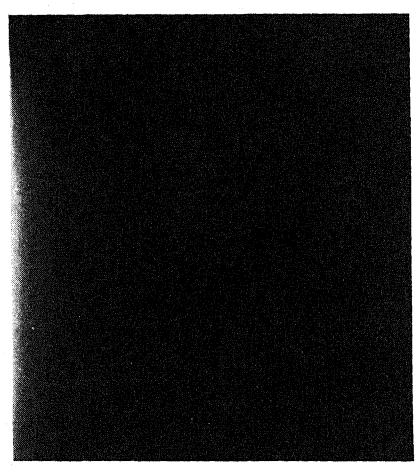
The faintest star visible depends on the CCD integration time and the sky background. The integration time is set to 20 millisecond. The output of the intensified CCD camera is in CCIR 520 lines video signals. To digitize the image, Data Translation's 2851 video frame grabber is used. It contains two 512 x 512 x 8 buffers. A PC based image processing station is provided to enhance the image and to subtract sky background. The sky background is subtracted from the image field and the resultant frames are co-added to increase the faintness limit. The processed image is written back in the frame grabber for display at video rates.

The camera position can be controlled from the console room. It is found that stars of 13.5 magnitude are easily visible on dark nights at the Cassegrain focus of VBT. By doing image processing and enhancements, we hope to gain another two magnitudes. Messrs. K.Ravi, S. Ramachandran and F.Gabriel of VBO assembled and wired the remote movement of the camera from the console room. Ms. Faseehana is writing the software for image processing. Mr. M.R. Somasekhar made the art work for the 16 bit analogue I/O Card.

V.Chinnappan and N.K. Rao

INSTALLATION OF NEW UV COATED CCD CHIP

I was deputed to Astromed Ltd, U.K., from January 5-18, 1990 for changing the defective CCD chip and to perform the acceptance test for the new chip. A new CCD was loaded in our dewar and during tests it revealed some hot pixels and bad columns. Another chip was loaded and tested during January 17-18, 1990. The new chip has no defects and the evenness of response conforms to within the specified 3% variation for pixel to pixel. The noise also lies within 7 electrons (rms).



Blooming due to improper bias adjustment

We conducted the first imaging trails with the new CCD at VBT during the first week of February 1990. We noticed that a bright patch appeared on the left side of every image frame. On the advice of M/s Astromed, we reduced the substrate voltage (VSS) from 6.5 volt to 5.5 volt. With this substrate voltage adjustment, the blooming problem is solved. Now the new UV coated CCD (GEC 8603A) chip is operational with the telescope and is available to the users.

R. Srinivasan

REPORT FROM COMPUTER CENTER.

The VAX -11/780 system at Kavalur has a number of application packages presently available for astronomical data reduction,. They include the STARLINK, STARMAN, RESPECT (developed by T.P. Prabhu et.al.). Recently the AIPS package has also been installed with the help of TIFR scientists.

We have also acquired a recent release of MIDAS package (Nov '89) from ESO. The image display device with the VAX-11/780 is a COMTAL system. This is different from the normal GOULD/DEANZA system supported by MIDAS, It would take some time for the modification of IDI routines to suit the COMTAL display. We acknowledge the help received from Mr.P.Grosbol, Head, Image Processing Division at ESO.

A program has been developed for acquiring CCD images directly through DR-11K. This is intended to be a standby for the PC based image data acquisition system presently available. The Vax version of the program is slow and needs to be improved for speeding up the acquisition process.

A.V. Ananth

VAINU BAPPU OBSERVATORY

Sky Condition at Kavalur December 1989-February 1990.

	Spectroscopic hours	Photometric hours
December	159.5	37.5
January	216.5	91.0
February	173.0	56.5

-Photograph by K. Thiyagarajan

Tecoma Argentia or Tebuibia Argentia is a medium sized tree usually planted in big gardens along the fence. The foliage is pretty consisting of graceful pinnate leaves. The average height of the tree is about 4 meters. The flowers are golden yellow in colour and are funnel shaped. They bloom in huge clusters covering the whole tree making it a magnificent spectacle. The flowering season is from end of February to beginning of March . These trees are found both in Kavalur Campus (on the gourmet path) and in Bangalore garden along the western boundary.

A.Vagiswari

TELESCOPE TIME ALLOTMENT

Date	Observer/s	Project
'FEBRUARY 1990		
1-3	T.P. Prabhu and F. Sahibov	Multicolour photometry of young star formation complexes in outer galaxies.
4-6	K. K. Scaria	Prime focus photography.
7-16		Change over to Cassegrain & Testing
17-20	A. V. Raveendran and N. K Rao	Multiband polarimetry of carbon rich objects.
21-26		Alignment/maintenance
27 & 28	A. V. Raveendran and R. Surendiranath	Photoelectric photometry of NGC 2818
MARCH 1990		
1-3	T. M. K. Marar	Calibration of two star Photometer
4-11		Testing
12-15	M. V. Mekkaden	Polarization of weak-emission T Tauri Stars.
16-21	Y. Y. Balega, V. A. Vasyuk and S. K. Saha	Speckle Interferometry of red dwarf stars.
22-24	T. M. K. Marar	White dwarf pulsations.
25		Change over to Prime and testing
26-28	P.N. Bhat, T.P. Prabhu and A.K. Kembhavi	Calibration of TIFR CCD System
29-31	A. K. Pati and Gopal Krishna	Optical Imaging of ultra steep radio spectrum sources
APRIL 1990		
1-5	A. K. Kembhavi, P. N. Bhat and T. P. Prabhu	Surface photometry of field galaxies
6-8		Maintenance
9-10		Change over to Cassegrain & Testing
11-13	M. Parthasarathy and S. K. Jain	Polarization measurements of post AGB stars and Proto planetary nebulae
14-17	P. C. Agrawal, M.V.K. Apparao and Priyamvada Bhat	Study of periodic and quasi periodic pulsations in A M Her and DQ Her type objects.
18-20	J. C. Bhattacharyya and R. Rajamohan	Photography of outer rings of satrun.
21-22		Change over to Prime & testing
23-25		to be announced
26-28	R. Surendiranath	CCD Photometry of NGC 2818
29-30	T.N. Rengarajan, T.P. Prabhu and Y.D. Mayya	H_α and H_β observations of W 31 star forming region.

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