Newsletter

Quarterly Newsletter of the Indian Institute of Astrophysics

Volume 7 | Numbers 3 & 4 | October 1992

The Institute gets a new Director

Ramanath Cowsik was born in Nagpur on August 29, 1940 to Ramakrishna and Saraswathi Cowsik. He obtained the B.Sc. degree from Mysore University in 1958 and the M.Sc. from Karnataka University in 1960. He joined the Atomic Energy School in 1960 and the Tata Institute of Fundamental Research in 1961. He was awarded the Ph.D. degree in 1968 by the Bombay university for his work on cosmic-ray interactions.

His scientific researches have been mainly in the fields of cosmic rays, high energy astrophysics, in the area interfacing particle physics and cosmology, and latterly in experiments pertaining to gravitation and nonaccelerator particle physics. Among his important contributions is the suggestion that weakly interacting particles from the Big Bang would survive to the present era and have a very high density in the universe. If these particles should have even a tiny rest mass of a few electron volts, they would constitute gravitationally the dominant component of this universe and would have triggered the formation of galaxies. This in turn would lead naturally to dark matter halos that surround galactic systems. This suggestion has led to many other developments: e.g., stringent limits on the mass of the neutrino, suggestions of several new theories of formation of large scale structures in the Universe. On the experimental side, he has contributed to the study of gravitation, Einstein's Principle of Equivalence and the Fifth Force with a set up in Gauribidanur, Karnataka. Most recently he has measured the double beta decay life time of the Tellurium isotopes of mass 130 and 128 in collaboration with scientists of the Washington University in St. Louis, Missouri. The measured lifetime of ^{128}Te is 7.7×10^{24} years, the longest radioactive lifetime ever measured. This measurement places important constraints on the Majorana mass of neutrinos.

His current interests are in the areas of high-energy astrophysics, origin of the Universe and particle physics including the emerging area of non-accelerator particle physics. He is a Senior Professor in the Faculty of the Tata Institute of Fundamental Research and has been on the Faculty of the University of California, Berkeley, Max Planck Institute, Washington University. He is a receipient of the Shanti Swarup Bhatnagar Award and the Vikram Sarabhai Award. He is a Fellow of the Indian Academy of Sciences, Indian National Science Academy and National Academy of Sciences.

CCD Photometry of NGC 2453

Introduction

NGC2453 ($\ell = 243^\circ.33$, $b = -0^\circ.94$) is an open cluster in Puppis located $8'.5$ to the north-east of the planetary nebula (PN) NGC 2452. The radial velocity of the nebula as determined by Campbell & Moore (1918, *Lick Obs. Publ.*,Vol.XIII) is +68 km s^{-1} and the radial velocity of one of the cluster members has been estimated to be 67 ± 14 km s^{-1} (Moffat & Fitzgerald 1974, A&AS, 18, 19, hereinafter MF). Gathier included the cluster in his program of photometry of stars in the region of NGC 2452 to determine the reddening-distance relation (see Gathier 1984, Ph.D. thesis, Univ. Groningen). The cluster was previously studied by MF. While the $E(B-V)$ colour excesses of the cluster stars determined by the two groups agreed with each other, the estimated distance moduli to the cluster differed by nearly a factor of two. While MF obtained a distance of 2.9 ± 0.3 kpc by fitting the main sequence to the cluster CMD at the very bright end ($V \leq 15.5$), Gathier obtained an average $(m-M)_0 = 13^m.48 \pm 0^m.26$ for the five bright stars for which he had obtained accurate photometry which yielded a distance of 5.0 ± 0.6 kpc. The reddening-distance relation of the region gave a distance of 3.57 ± 0.47 kpc to the nebula NGC2452. In view of the large discrepancy in the two determinations of the distance to the cluster and to focus on the intriguing question of the association of the PN with it, we decided to do a detailed photometric study of NGC2453.

Observations

Observations were carried out on several nights during 1989–92 in *BVRI* photometric bands using a Thomson-CSF TH 7882 CCD chip with the format 384×576 pixels, at the f/13 Cassegrain focus of the 102-cm telescope at VBO. The pixel size of 23 microns square corresponds to 0.357 arcseconds square on the sky, the entire chip thus covering a field of $2'.3 \times 3'.4$ of the sky. Bias frames were taken at regular intervals. Flat field exposures were made on the twilight sky with exposure times varying from 1 to 10 seconds in the various filters.

Since our main objective is to obtain an accurate distance to the cluster, in the present work we report on the V and I band measurements of the cluster core region as it is in these two bands we were able to observe down to the very faint levels and hope to identify the unevolved main sequence without ambiguity.

The core of the cluster which covers the inner circle of radius $2'.4$ as displayed in the Figure 1 of MF was covered in two image frames. In this way we maximized the number of measurable cluster members and minimized the proportion of field stars for inclusion in the cluster colour-magnitude diagram. Landolt (1983, AJ, 88, 439) standards were observed for calibration purposes. They cover a range of $9^m.2$ to $13^m.4$ in V and $0^m.01$ to $1^m.4$ in $V-I$.

Data Reduction

The data were reduced at VBO using the Vax 11/780 computer and the COMTAL Vision One image display station. Initial processing of the data frames was done using the STARLINK package in the same way as described in Sagar & Pati (1989, Bull. Astr. Soc. India, 17, 6). Uniformity of the flat fields is better than a few percent in both V and I filters.

Although the cluster fields are not exceptionally crowded, the magnitude estimation of a star on each of the frames has been done using the DAOPHOT profile fitting software (Stetson 1987, PASP, 99, 191), so that reliable values are obtained to faint levels. The stellar point spread function (PSF) used by DAOPHOT was evaluated from the sum of several uncontaminated stars present on each frame. In order to average the magnitudes of a star measured on more than one frame, we have used a differential photometry technique by calculating the mean frame-to-frame magnitude difference from stars spread over 5 to 6 magnitudes in brightness. In this way, we have been able to minimize the errors introduced due to uncertainty in the evaluation of atmospheric extinction coefficients.

By performing synthetic aperture photometry on photoelectric standards, the following colour equations were derived for the present CCD system :

$$\Delta V = \Delta v_{\rm ccd} + 0.06(V-I)$$
$$\Delta I = \Delta i_{\rm ccd} + 0.02(V-I)$$

where V and I are the standard magnitudes taken from Landolt (op.cit.) and v and i subscripted 'ccd' are the aperture magnitudes.

The zero points for the V and I cluster frames were determined with respect to the photometric observations of Landolt by taking into account the differences in the exposure times, atmospheric extinction coefficients and the difference between the aperture and PSF magnitudes. The zero points determined this way have an uncertainty of about $0^m.02$ in V and I.

Results

Figure 1 shows a V, $V-I$ plot of the core region of the cluster. A total of 275 stars have been plotted in the diagram. It is immediately obvious that the vast majority of the stars in the diagram define a well populated main sequence down to $V \geq 20^m.0$. As expected some field star contamination is present specially at the fainter end but the cluster sequence can be discerned without difficulty down to the faintest levels present in the data. This is the first time that the unevolved main sequence of the cluster has been observed. The main sequence is spread over 4 magnitudes in V. We are also able to see clearly the evolved main sequence and locate the turn-off point of the cluster. The cluster CMD has to be corrected for interstellar reddening and extinction and superposed on an appropriate ZAMS before a distance modulus to the cluster is obtained. As we were not able to estimate the reddening and extinction corrections from our data we depended on the results of the earlier photometric

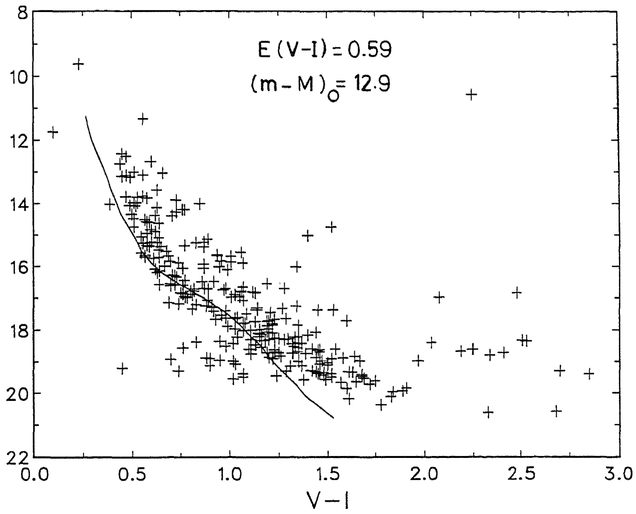


Fig. 1. HR diagram of the core region of NGC 2453.

work on the object (MF and Gathier 1984) and adopted a $E(B-V)$ of $0^m.47$ and an $A_v = 3.06*E(B-V)$. The fiducial zero-age main-sequence chosen to fit the cluster CMD was taken from Walker (1985, MNRAS, 213, 889). To this sequence we applied the extinction correction in V and a colour correction $E(V-I) = 1.25 \times E(B-V)$, originally due to Dean, Warren & Cousins (1978, MNRAS, 183, 569). The solid line in Figure 1 is the superposed ZAMS. This corresponds to a true distance modulus of $12^m.9$. Due to uncertainties in extinction, main sequence fitting and photometric errors, we estimate an error of $\pm 0^m.25$ in the distance modulus. In Table 1 we summarise our results and compare them with the previous ones.

Table 1.

Reference	Faintest V obs	$E(B-V)$	d kpc	Method
MF	15.5	0.47 $\pm$0.04	2.9 $\pm$0.3	main sequence fitting
Gathier	14.4	0.49 $\pm$0.01	5.0 $\pm$0.6	photometric method
This work	20.5	0.47	3.80 $\pm$0.47	**ZAMS fitting over a wide range in V**

As we see from Table 1 the new distance modulus falls almost in the middle of the two previous determinations. Our value is closer to the value obtained by MF than to Gathier's. The accuracy of our result is much greater as we have been able to unambiguously identify the unevolved main sequence of the cluster unlike in MF where only an evolved sequence was observed.

We notice in the cluster CMD a paucity of stars between $V = 13^m.1$ and $V = 13^m.5$. Such a gap is expected from stellar evolution theory when stars at turn-off lie above $m \geq 1.2 m_\odot$ where they suffer a rapid overall contraction following the cessation of hydrogen burning in the core before the establishment of a full-fledged hydrogen shell source. The turn-off is located at $M_v = -0.34$ and $(V-I)_0 = -0.11$. The corresponding $(B-V)_{to} = -0.09$. Using the tables of isochrones due to Maeder & Meynet (1991, A&AS, 89, 451) we obtain an age of approximately 2×10^8yr and a mass at turn-off of about $4 m_\odot$ for this cluster. These last two numbers are rather preliminary. We have also observed outer regions of the cluster and a comprehensive analysis of the entire data will appear in a future publication.

Since our distance estimate to the cluster puts it at nearly the same distance as the nebula NGC 2452, we may ask the question — is the nebula associated with the cluster and if so, what are the implications?

D. C. V. Mallik, Ram Sagar & A. K. Pati

Solar seeing experiments at Kavalur and Kodaikanal

The quantitative measurement of solar 'seeing' and other related parameters are essential for various observational needs such as (i) site survey and selection, (ii) determination of the desirable height and design of a telescope at a given site, (iii) study of seeing variations caused by the telescope and its environment, (iv)continuous monitoring for optimal utilization of the intermittent good moments of seeing common to the day skies, and (v) to correct, as far as possible, the wavefront distortions and image motion introduced by the atmosphere or by the telescope.

The Kavalur Tower

J. C. Bhattacharyya and K. R. Sivaraman prompted the seeing studies to be taken up at Kavalur, in anticipation of a large solar facility coming up in the country and, equally importantly, for the use of these techniques in the existing solar facilities of the Institute.

A tower is usually preferred for direct seeing observations as it is inappropriate to judge a site using an image acquired close to the ground. At VBO, a double tower was erected with the help of the mechanical lab there, in the year 1988. The tower structure fabricated for the February 1980 eclipse was utilized for the purpose. The available 12m height was accepted since the thermal fluctuations due to ground heating are known to be markedly less at heights of 10 to 15m and above (Coulman 1969: Sol. Phys., 7, 152).

A 23 cm coelostat and a second mirror of similar size, both with their pedestals and drive system fabricated for the 1980 eclipse, were mounted on the inner tower platform, with additional provisions made for image adjustments from the laboratory on ground. A 20 cm Grubb Parsons objective lens was also mounted on the platform, beneath the second mirror. A 30 cm third mirror was installed at the bottom of the tower. This optical system formed a 17 cm $f/90$ image of the sun in the lab, to the south of the tower. Installation of the coelostat and objective, and their alignments were done in early 1989. The image quality was often good to excellent but marred by the vibrations of the tower caused by wind. Cladding was hence provided to the upper 2/3rd portion of the outer tower in 1989. This reduced the wind vibrations significantly but was still in the range of several arcseconds similar to the reported wind shake observed in such tower structures elsewhere (Bohlin & Weart 1970: PASP, 82, 1145; Goldberg & Brown 1972: PASP, 85, 534).

The proposed plans with the tower were to (a) clad the outer tower further down, (b) provide optimal holes in the cladding to avoid the cushion effect, (c) provide a slide off roof on the outer tower, (d) adapt the reportedly efficient wind shield technique of Hammerschlag & Zwaan (1973: PASP, 85, 468), and to replace the coelostat and its drive system with more accurate ones. However these tasks could not be taken up as the uncertainties in the funding of solar community's long-awaited national facility pushed this project to one of a low priority.

The Limb Monitor:

During 1989, a solar limb monitor with radial slits and phototransistors behind them as the sensors, was fabricated by adopting the techniques of Bray et al. (1959: Observatory, 79, 63) Colgate & Moore (1975: Sol. Phys., 41, 487), and Brandt et al.(1987: A&A, 188, 163). The signals from opposite ends of the limb along RA were fed to a monitor which gave the individual, sum and difference of the signals amplified to an analog recorder. The monitor was designed by Dr. R. Srinivasan and fabricated by Mr. K. S. Ramamoorthy. However, the wind vibration of the tower did not permit the measurement of either image motion or seeing.

The limb monitor observations were obtained only during moments of quiet in the winds. Simutaneous broad band filtergrams were obtained using a mechanical shutter made by Mr. F. Gabriel and a 35 mm magazine on Kodak 2415 film. The advantage of the height of the tower was obvious in the image quality but the exposures were not short enough to freeze the shake. We could use the set-up only to assist in the regular sky definition observations. By 1992 May, three years of continuous qualitative data on cloud coverage and sky definition at Kavalur have been obtained. These data are being analysed.

Experiments at Kodaikanal

In January 1992, the limb monitor was shifted to the Solar Tower Telescope at Kodaikanal. The image at

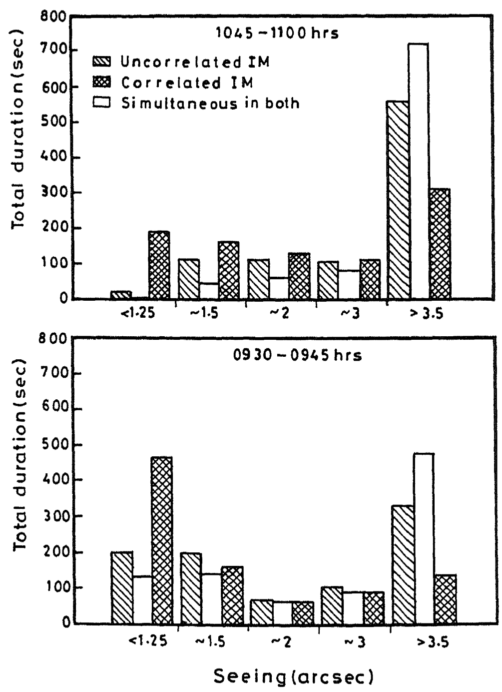


Fig. 1. Illustration of the limb monitor observations of image motion (IM) obtained on 1992 February 21, showing a good spell and a poor one that followed later. Single durations of three seconds or less are not included in the first four bins.

this telescope can be held steady by using the new solid state coelostat drive system (R. Srinivasan et al. 1989: IIA Technical Report No.3). In fact, it was found that the fine variations could be easily noted using the limb monitor and adjustments made on the drive. On the few days of observations available for the monitor trials, the image could be held steady to within ±1 arcsec for 1 to 1.5 minutes without guiding. Further increase in the accuracy and duration can be attempted by adjusting the frequency settings of the coelostat drive, subject to the limit imposed by the component of the varying diurnal Dec motion which is not compensated for. Autoguiding of the image is to be provided shortly using the limb monitor and the fine motion of the second mirror in RA and Dec.

The instrumental parameters such as matching of the pairs and linearity of response of the phototransistors, the slit widths, the filter passband etc were optimized and observations obtained. While the difference in signals from the two sensors give the image motion, the departure from a dc level of their sum gives a measure of the 'seeing' in terms of the uncorrelated image motion (image distortion). The image motion was calibrated using a disc template close inside the limb and by moving the sensor mount in steps. This calibration was checked and corrected using the actual solar limb during periods of maximum steadiness. The observations obtained on a few days have been analysed. The intermittency of good conditions was evident from the recorded observations. The details of the instrument, the technique and results will be published shortly. In Fig. 1 a portion of the observed conditions recorded on 1992 February 21 is illustrated. The average periods for which the seeing remained continuously within the specified bins of < 1.25, ~ 1.5, ~ 2 and ~ 3 arcsec were approximately 6, 7, 7 and 9 seconds respectively. Single durations of three seconds or less were not included in these bins as they are not likely to be useful in observations involving automated exposures.

Further plans

Beside obtaining the limb monitor observations on a regular basis, it is proposed to carryout the following programs:

1. Switch over from the present analog mode to online digitized data acquisition, storage and analysis.
2. Assemble a device for online measurement of image blurring using the solar limb profile.
3. Provide an arrangement for automated electronic shutter and camera operation to obtain filtergrams under specified conditions of seeing and image motion.
4. Online measurements of the granulation contrast using a CCD camera, frame grabber, and an algorithm for computation.
5. Development of the instrumentation and measurement of microthermal fluctuations at selected points within the telescope and its vicinity. A captive balloon will be required to reach heights of up to 200 m above ground.

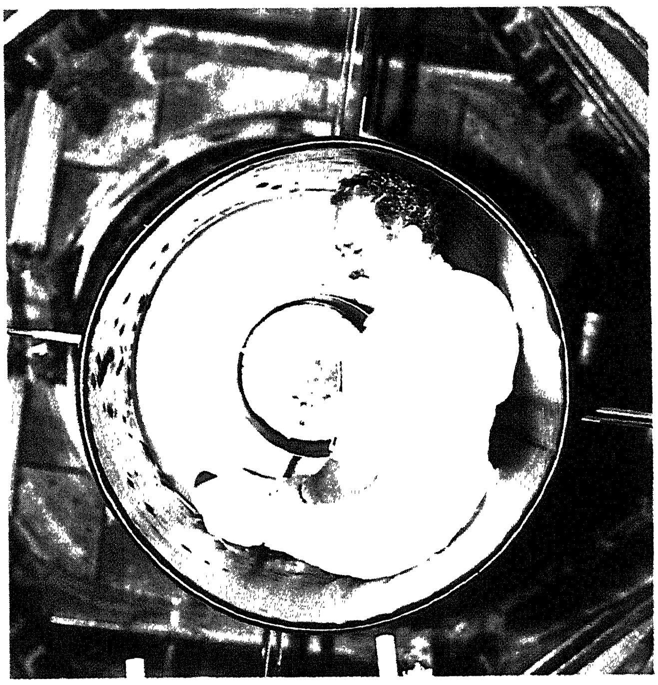
These instruments will be of immediate use in the optimal utilization of the good periods of seeing available at the telescope. Further, it is important to pursue the following programs, if and when one wishes to take up a major solar site survey and selection work:

6 .Measurement and study of the related meteorological parameters such as wind speed, cloud coverage, atmospheric dust, humidity, precipitable amount of water vapour etc.

7. Stabilization of the existing tower at Kavalur on the lines described earlier and further experimentation on the novel technique of removable but stable prototype towers (Hammerschlag 1981: in Solar instrumentation: What's next?, Ed. R.B. Dunn, Nat. Solar Obs.,Sunspot, p.583).
8. Finalization of a package plan with designs for the minimum instrumentation required and the representative parameters to be studied, for a proper evaluation of any given site.

S. P. Bagare

K. K. Scaria (1938–1992)



Kanjirathinkal Kurien Scaria, Principal Scientific officer, passed away on the morning of 29 August 1992 after a protracted illness. He was born on 13 January 1938 at Tripunithura in Kerala state. After obtaining his B.Sc. degree from the Kerala University, he joined the Kodaikanal observatory on 8 February 1961. He continued his academic career while in service and obtained his M.Sc. degree in 1968 from the same university. Later, he took up investigations on globular clusters under the supervision of M.K.V. Bappu and obtained his Ph.D. degree from Madurai Kamaraj University in 1981. Bart J. Bok, during one of his visits to Indian Institute of Astrophysics, Bangalore in the early eighties, complimented highly the excellent thesis work of Scaria and commented that copies of the thesis should be kept in all observatory libraries for guidance of those engaged in observational astronomy.

Scaria was engaged in many types of observational programmes, but he excelled most in photographic techniques especially those requiring great skill and meticulous attention. His thesis displays many of his photographic skills, where he had analysed globular cluster fields by employing methods such as sabattiering, density subtractions etc. His efforts in bringing out fine details of the solar corona by the diffuse masking technique has now found a permanent place in the Institute's picture gallery. He was the main architect in building the first prime focus camera for the Vainu Bappu Telescope and then for photographing deep sky objects with it; these excellent pictures, besides finding a permanent place in our collection, have often been copied and presented to important visitors to the Institute.

Scaria's contribution to the building up of the Institute is virtually immeasurable. The setting up of the photographic laboratory at the Bangalore campus was his personal concern. He was a member of the original survey team which selected the new observatory site at Kavalur. Later when the observing equipment and the infra-structure were being built he could be seen all over the place with his boundless energy. He was fully involved in solving the teething difficulties in the initial stages of VBT with the help of the engineering staff of the Institute. Whenever there was a need for latitude and longitude determination, he was considered the final authority. When the Madhya Pradesh Government wanted to establish a new observatory at Pachmarhi, he shouldered the responsibility of acquiring the telescope and accessories, installing them and finally training the observers for the observational programmes.

As destiny would have it Scaria left us early; he had several more years of service left in the normal course. Many of the tasks he had undertaken remain incomplete. To his colleagues at the Institute the memories of his jovial self will live for a long time. He leaves behind his wife, a daughter and a son.

J. C. Bhattacharyya

newsline

The **Mauritius Radio Telescope** (MRT), a joint Indo-Mauritian venture, was inaugurated by the Rt. Hon. Sir A. Jugnauth, the Prime Minister of Mauritius on November 4. The occasion was graced by Hon. P. R. Kumaramangalam, Minister of State for Science & Technology, Ocean Development, Electronics and Parlimentary Affairs, Government of India, accompanied by Prof. Ramanath Cowsik, Director, IIA. The Indian institutions participating in the project are IIA and RRI, under the leadership of Prof. Ch.V. Sastry. The telescope is a T shaped array with a 2 km east-west arm and 1 km north-south arm, the total collecting area being 16000 m^2. 1024 fixed helical antennas are used in the E-W arm and 32 antennas on movable trolleys are used in the N-S arm. The observing frequency is 151 MHz, resolution 4 arcmin × 4 arcmin and the sensitivity 300 mJy.

* * *

Vinod Krishan was awarded the Hari Om Ashram Prerit Vikram Sarabhai Research Award for the year 1991 in the field of Space Sciences.

* * *

C. Sivaram's essay 'A Born-Infeld type of modification of general relativity with maximal curvature: Consequences for black hole physics and cosmology' received honourable mention in the 1992 essay competition of the Gravity Research Foundation, USA.

* * *

A winter School on Astronomy and Astrophysics is being organized at Kavalur, December 22-31, co-ordinated by K.K. Ghosh.

* * *

G.S.D. Babu has assumed charge as the Director of Jawaharlal Nehru Planetarium, Bangalore, on 1st October, on deputation from IIA for a period of 2 years. He attended the IAU Coll. 138 on Peculiar vs Normal Phenomena in A-type and related Stars, Trieste, July 6–10. He also participated on invitation as a faculty member in the 19th Intl. School for Young Astronomers, Beijing, July 19 – August 8. Prabhjot Singh also attended the School. M. Parthasarathy attended the Workshop on Luminous High Latitude Stars, Cambridge, USA, May 28 – 30, and later visited the Astronomical Observatory, Padova, Dept of Astronomy, Univ. Trieste, and Kapteyn Astronomical Institute, Groningen. V. Krishan attended the Intl. Conf. on Plasma Physics and Symp. on Double Layers and other Non-linear Potential Structures in Plasmas, Innsbruck, June 29 – July 8. C. Sivaram was a visiting professor at several universities including the Univ. Rio-di-Janeiro, during June – July. He also attended the Intl. Conf. on Gravity and Cosmology, Buenos Aires. D.C.V. Mallik, M. Parthasarathy and R. Surendiranath attended the IAU

Symp. 155, Innsbruck, July 13–17. J. H. Sastri attended the 1992 STEP Symposium and COSPAR GA, Maryland, August 24 – September 5. J. Singh participated in the IAU Coll. 141, Beijing, September 6–12. K. R. Sivaraman and S. S. Gupta visited the National Solar Observatory, Tucson, and Sacramento Peak Observatory, New Mexico, during September – November for observational work. R. Vasundhara is visiting Bureau des Longitudes, France, September – November, for collaboration with J. E. Arlot. Ch. V. Sastry and G. N. Rajasekhara were working at MRT, Mauritius, since September.

* * *

M. F. Ingalgi was declared qualified in 1992 for the Ph. D. degree of Karnataka University, Dharwad for his thesis on 'Dust in the outer layers of stars'. He is now back in his parent service as Deputy Director of Collegiate Education, Dharwad. P. Bhattacharjee joined the institute as Fellow on November 11. Charu Ratnam, JAP, IISc, has undertaken her Ph.D. work under the guidance of R. Cowsik. M. Ramani has been promoted to the post of Senior Administrative Officer.

colloquia

The following lectures were given at IIA between 1992 March 20 and 1992 November 20:

1. Some darker aspects of black hole physics (C.Sivaram, IIA)
2. Mean tidal fields in clusters of galaxies (Monica Valluri, JAP, IISc, Bangalore)
3. Vertical distribution of stars perpendicular to the galactic plane (S. Chatterjee, IIA)
4. The emission spectrum of $TiCe^+$ in the yellow-green region (K. S. Chandrasekhar, University of Victoria, British Columbia, Canada)
5. Role of the state in science and technology development (Krishna Kumar, Institute of social and economic change, Bangalore)
6. Recent trends in digital signal processors (S. Ganesan, Oakland University, Michigan, USA)
7. Faint galaxies and gravitational lensing by clusters (R. Guhathakurta, Institute for advanced study, Princeton, USA)
8. Design of a very accurate drive system using PWM amplifier and step motor (V. Chinnappan, IIA)
9. Myth and reality about psychology (Jitendra Mohan, Punjab University, Chandigarh)
10. A photoionization model for the low excitation PN M4–18 (R. Surendiranath, IIA)
11. Solar-terrestrial energy program (STEP) (Juan G. Roederer, Geophysical Institute, University of Alaska, USA)
12. Yohkoh Satellite — Studies of the sun (C. D. Pike, Rutherford Appleton Labs, UK)
13. Superfluidity and superconductivity in neutron stars (G. Srinivasan, RRI, Bangalore).
14. Evaluation of emission mechanisms at W_{pe} using ULYSSES observations of type III bursts (G. Thejappa, University of Maryland, USA)
15. The effect of density inhomogeneities on radio emission from the Sun (G. Thejappa, University of Maryland, USA)
16. Chemical composition of post-AGB stars (M. Parthasarathy, IIA)
17. Strong interactions of photons (R. M. Godbole, Dept of Physics, University of Bombay)
18. Outstanding problems in planetary science (T. Gehrels, University of Arizona, Tucson, Arizona, USA)
19. Symbiotic stars and Russian space project 'Spectr UV' (A. A. Boyarchuk, Astronomical Council, USSR Academy of Sciences, Moscow, Russia)
20. Future large telescopes (L. Woltjer, Observatoire de Haute Provence, France)
21. Coronal heating and turbulence: an observational association (P. Venkatakrishnan, IIA)
22. Hydrodynamic approach to galaxy formation (A. Satya Narayanan, IIA)
23. High resolution astronomical imaging using rotational shear interferometry (J. K. Rajagopal, RRI, Bangalore)
24. Energy transport to the solar corona by magnetic kink waves (D. Banerjee, IIA)
25. Deep infrared survey of the southern sky (Alain Omont, Institute de Astrophysique, Paris, France)

erratum

Improving the Hα Flare Patrol with the Spectroheliscope at Kodaikanal

Jagdev Singh, P. S. M. Aleem
& B. S. Nagabhushana
IIA Newsletter, **7**, Nos 1 & 2, p.2.

The list of authors was left incompete inadvertantly. The error is regretted.

Editors

M. G. K. Menon

The Governing Council of the Indian Institute of Astrophysics has conferred the first Honorary Fellowship of the Institute to Prof. M. G. K. Menon, FRS, in recognition of his pivotal role in shaping the Institute from its formation.

Deadline for VBT Proposals

Considerable efforts have been put in towards preventive maintenance of VBT since 1992 July. Some trial observations were made in September and more trials are planned during December. The telescope will be available for regular programmes from 1993 January 15. Though the last date for submission of proposals for the January – March trimester is normally the previous November 15, the proposals will be entertained till 1992 December 15 for the period 1993 January – April. Observers may take note of this and submit their proposals if not done so already.

Editors: T.P. Prabhu & A.K. Pati
Editorial Assistant: Sandra Rajiva
Published by the editors on behalf of the Director, Indian Institute of Astrophysics, Bangalore 560034.

Newsletter
Quarterly Newsletter of the Indian Institute of Astrophysics
Vol. 7, No. 3 & 4, October 1992

To:

___

___

___

Indian Institute of Astrophysics
Bangalore 560034