Newsletter

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The 20-cm Reflector Telescope at Pachmarhi

Pachmarhi (latitude: 22°28′ N; longitude: 78°26′ E; 1100 metres above mean sea level) is a hill station on the Satpura hills in Madhya Pradesh and is 210 km by road from Bhopal. The meteorological parameters for Pachmarhi since 1870 are available in the climatological tables of the observatories in India, 1953, published by the India Meteorological Department (IMD). Monthly mean values of important parameters of the daily readings at 8.30 am (IST) from the climatological tables for the 60 years period are presented in Table 1. In the last column of Table 1, we present the absolute humidity calculated from the mean temperature, mean relative humidity and mean vapour pressure for each month. It is seen from Table 1 that wind speed is low during the months of October to March. The astronomical seeing at a place depends on the wind speed, as surges in wind speed deteriorates seeing. Rainfall is high only during the months of June to September. Another aspect is the low absolute humidity during most of the months which makes the place suitable for infrared observations.

MAPCOST and IIA joint programme to set up a telescope at Pachmaṛhi: Madhya Pradesh Council of Science and Technology (MAPCOST) encourages any developmental activity within the state offering funds and ground space. In 1987 Prof. T.S. Murthy (Director General, MAPCOST), Dr V. K. Shrivastava (Project Director, MAPCOST), Prof. J.C. Bhattacharyya (Director, IIA) and myself initiated action for the procurement of a small telescope. This project continued with vigour under their successors: Dr D. N. Misra (Director General) and Prof. R. Dasgupta (Project Director). Prof. K. R. Sivaraman, provided all help needed to set up the telescope at Pachmarhi. The two scientists recruited by MAPCOST (Messrs N. V. K. Prabhakar and B. K. Saxena) were given six weeks training at Kavalur in the operation of the telescope and in techniques for astronomical photography and photometry.

MAPCOST bought a 20-cm Schmidt reflector from M/s Tejraj and Co., Bombay. This telescope has imported optics and a locally fabricated equatorial mounting. The details are given below:

clear aperture	: 20 cm
focal length	: 200 cm
focus	: 25 cm to infinity
image scale	: 100 arcsec mm^{-1}
tube	: 22.5 cm dia. × 40 cm long
mirror	: pyrex glass
mount type	: German equatorial mount
RA drive	: synchronous motor 240 V AC, 50 Hz

Several modifications were made and accessories were provided to the telescope and mounting at the IIA mechanical and optical shops, Bangalore, to make it suitable for astronomical observations. One 7.5 cm refractor of 100 cm focal length was added as a guide telescope. The Cassegrain focus end was modified to take a 35 mm film transport system. The declination axis was shortened and a heavier weight was provided for balancing the telescope. We replaced the right ascension motor with another one of higher power to ensure good tracking. The telescope

Table 1. Monthly mean values of the surface meteorological parameters for Pachmarhi from the Climatological Tables (1959) published by (IMD).

Month	Temp. (°C) max	Temp. (°C) min	Rain cm	Wind kmph	Rel.hum. %	Abs.hum. g m $^{-3}$
Jan	22.2	8.7	1.63	3.8	65	4.8
Feb	24.0	10.4	1.70	5.0	55	3.9
Mar	28.9	15.2	1.42	5.6	40	2.8
Apr	33.3	20.4	0.94	6.7	32	2.4
May	35.4	23.9	1.57	8.5	38	3.7
Jun	31.0	22.2	22.96	9.9	71	10.7
Jul	24.7	19.9	66.62	11.5	91	15.3
Aug	23.8	19.4	60.50	10.2	93	15.2
Sep	25.3	18.9	36.04	7.0	86	13.6
Oct	26.3	14.9	5.84	3.7	63	10.3
Nov	23.6	10.4	1.88	3.0	60	5.2
Dec	21.8	7.7	1.09	2.9	65	4.9

Mean barometric pressure: 893.1 mbs

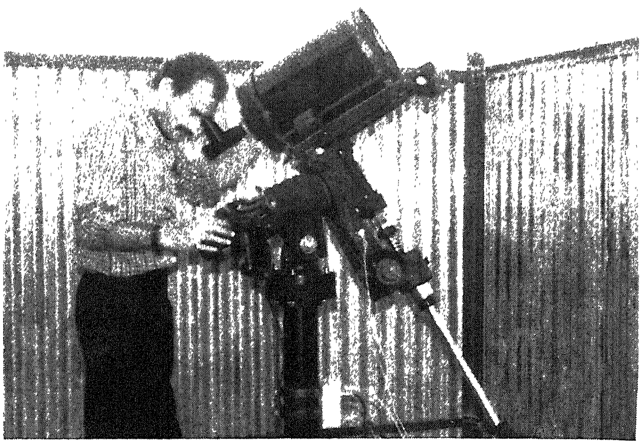

Fig. 1. Mr B.K. Saxena of MAPCOST examining a star image through the 20 cm Schmidt telescope after installation.

has both manual and electrical slow motion controls for both the axes. We also provided a dew cap with a heating arrangement which operates at 12V DC. The heater may be put on if any condensation is noticed on the corrector plate of the Schmidt system.

One light-weight photometer (model SSP-3 from Optec Inc., USA) was procured and fitted at the Cassegrain focus. This photometer operating at 9V DC gives a digital output and has a dynamical range of 7.5 magnitudes. The telescope is perfectly balanced for the weight of the photometer. Thus the Pachmarhi reflector though small in size, has all the requirements of a modern telescope for direct photography and photoelectric photometry.

Telescope installation: Several possible locations for the installation of a telescope have been mentioned by Dr M.K.V. Bappu in his survey reports: like Mahadeo, Doop Garh, Rajendra Giri etc. near Pachmarhi. But it was decided to set up this telescope inside the high-energy gamma-ray observatory campus, where TIFR has a workshop and other facilities. Prof. P.V. Ramana Murthy, station-in-charge, was kind enough to permit to set up this telescope inside their campus. The administrative officer of the gamma-ray observatory and all the other TIFR scientists posted at Pachmarhi offered help to set up the telescope.

The telescope was installed on 18 November 1990 on a $6\frac{1}{2}$ft x $6\frac{1}{2}$ft platform on the ground level by Dr K.K. Scaria, Mr A. Mani and Mr B.K. Saxena. A wall $5\frac{1}{2}$ feet high was constructed of angle iron and corrugated galvanized iron sheets around this platform to protect the telescope from wind and external light while observing. Arrangements to provide a rolling roof for the telescope are being made. The polar axis of the telescope is well aligned and the star images stay within the diaphragm for more than twenty minutes. The telescope is at present regularly used for photoelectric photometry by B.K. Saxena. In addition to these, valuable data on the seeing conditions at Pachmarhi will also become available from these observations.

K.K. Scaria

Mutual Phenomena of Jovian Satellites

Twice during a Jovian year, the equatorial plane of the planet sweeps across the sun and the inner solar system. During a few months around this time, the Galilean satellites frequently eclipse (occult) each other when any two of them are aligned with the sun (Earth).

The mutual events during 1973, 1979 and 1985 were observed extensively all around the world. The present mutual eclipse season which commenced around end of 1990 will continue till middle of 1991. An observational programme to record these events is being carried out at VBO using the 75 cm, 102 cm and 234 cm telescopes. Most of the events predicted were attempted.

The recording system consists of a single channel photometer, a pre-amplifier and discriminator (PAD) unit and a PC-based pulse-counting unit running in occultation mode developed by R. Srinivasan. The 32 kilobyte RAM buffer stores 16k data points. Availability of a large buffer this size was useful in getting a good time resolution. Integration times of 0.15–0.8 seconds were selected, depending on the duration of the events. Output from the PAD was tapped and integrated for DC recording to facilitate real-time monitoring.

The scattered light due to Jupiter was carefully estimated by taking sky measurements in four directions at equal distances from the satellites. For occultation events, the contribution of individual satellites were measured before and/or after the events. The objects were monitored for about 3 hours around the predicted mid-time for esti-

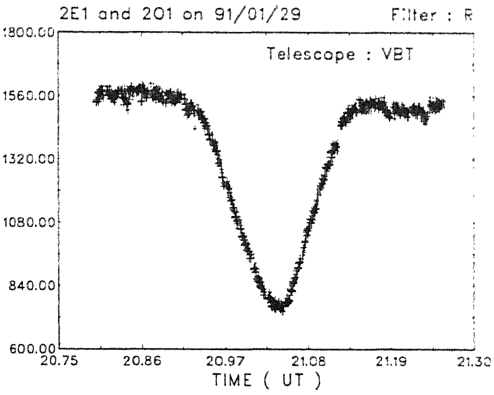

Fig. 1. Composite light curve of occultation of Io by Europa (2O1) and eclipse of Io by Europa (2E1) on 1991 January 29 recorded using the 234 cm VBT.

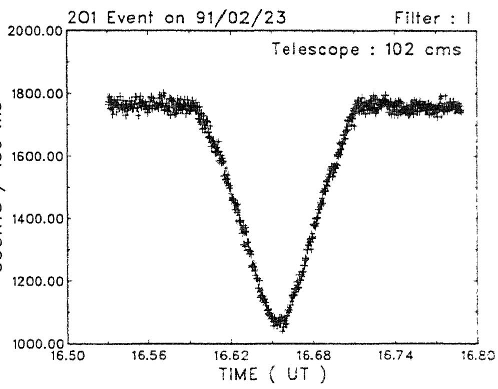

Fig. 2. Occultation of Io by Europa (2O1) on 1991 February 23 recorded using the 102 cm telescope.

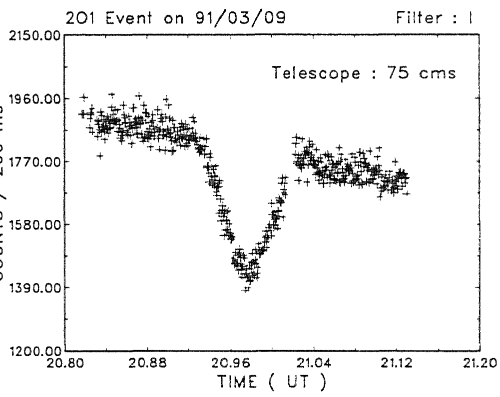

Fig. 3. Occultation of Io by Europa (2O1) on 1991 March 9 recorded by N. Dinakaran and G. Ganeshan using the 75 cm telescope. The large scatter and slope outside the occultation is due to the large zenith distance of about 70° at mid-event.

mating the extinction coefficients. Standards were also observed on most of the days.

Figures 1, 2 and 3 show the light curves obtained at the 234 cm, 102 cm and 75 cm telescopes respectively. The data has not been corrected for extinction. The gaps in the data correspond to instants when sky measurements or centring at the diaphragm were being carried out. Fig.1 is actually a blend of a occultation (2O1) and eclipse of Io by Europa (2E1) on 1991 January 29. This is because the event took place just a day after the opposition of Jupiter; therefore the terrestrial (occultation) and heliocentric (eclipse) geometry almost coincided.

The mid-times of the events would be determined from the light curves for comparison with theoretical predictions. The data will be fitted with theoretical light curves to derive the impact parameter and to study the scattering laws which determine the light distribution across the surface of the eclipsed or occulted satellite.

Simultaneous and time-critical observations of this kind from two telescopes require joint effort by several observers. The following staff members at VBO have been actively participating in recording these events: K. Jayakumar, K. Kuppuswamy, A. Muniyandi, M. Appakutty, C. Velu, G. Selvakumar, J.S. Nathan, N. Dinakaran, A.K. Venkataramanan and G. Ganeshan.

R. Vasundhara

Rocket-Borne EUV Spectroheliometer for High-Resolution Studies of the Sun

As a joint project with Stanford university, USA, ESTEC, The Netherlands and Padova university, Italy, a programme has been initiated to develop a rocket-borne extreme ultraviolet (EUV) spectrometer/spectroheliometer for high resolution studies of the sun. The basic objectives of this programme are two-fold: to test the technology of EUV instrumentation, and to seek a unified understanding of the interplay between the time-dependent geometry of the magnetic field structure and the associated flows of mass and energy.

There are three main parts of the payload : telescope, spectrometers and the detectors. Important features of the payload are given in Table 1.

Telescope: This is an 18 inch Gregorian system. Unlike the conventional EUV payloads, the optics in the present payload will be used in the normal mode of incidence. The secondary mirror of the telescope will be connected to an active focussing mechanism. Development of the telescope, complete with the optics and the mechanical structure, is the resposibility of IIA, Bangalore.

Spectrometers: The payload will carry the following three main spectrometers : (i) EUV spectrometer built around a toroidal grating, (ii) Wadsworth spectrometer for observations in the IR line He I 10830 Å, and (iii) Low resolution EUV irradiance spectrometer. The last spectrometer has been included in the payload because no reliable measurements of solar irradiance in the EUV region are currently available. These measurements will be useful in calibrating some of the instruments on the SOHO mission.

Table 1. Instrumentation details.

Telescope	
Type	: Gregorian
Size of the primary	: 18 inch (457 mm)
f-ratio of the primary	: *f*/2
Overall *f*-ratio	: *f*/15
Plate scale in focal plane	: 33 μm arcsec $^{-1}$
Mirror coating	: Ir
EUV Spectrometer	
Type	: Rowland mounting with toroidal grating
Entrance slit	: 14 μm$\times$6.2 mm
Instantaneous field-of-view	: 0.4 arcsec $\times$ 3.0 arcmin
Grating ruling frequency	: 3600 lines mm $^{-1}$
Grating RC	: 1000 mm (mean)
Angle of incidence	: 11.95°
Aspect ratio of the toroid	: 0.9782
Stigmatic wavelength range	: $\sim$ 120 Å from 510 Å to 630 Å in the first order
Spectral resolution (2 detector pixels)	: 78 mÅ
Imaging IR Spectrometer	
Type	: Wadsworth mounting with spherical grating
Entrance slit	: 14 μm $\times$ 6.2 mm
Instantaneous field-of-view	: 0.1 arcsec $\times$ 3.0 arcmin
Grating ruling frequency	: 300 lines mm $^{-1}$
Grating RC	: 2000 mm
Wavelength range	: 10824 Å to 10834 Å
Detector format	: 64 pixels $\times$ 400 pixels
EUV Irradiance Spectrometer	
Type	: Rowland mounting with concave grating
Entrance slit	: 10 μm $\times$ 3.0 mm
Grating ruling frequency	: 1028 lines mm^{-1}
Dispersion (first order)	: 38.7 Å mm^{-1}
Spectral resolution	: 2 Å(two detector pixels)
Spectral recording	: 280 Å to 1270 Å recorded with a (1$\times$1064) pixel MAMA detector of pixel size 25 μm$\times$ 6.5 mm
Temporal resolution	: 1.6 s
EUV MAMA Detector	
Type	: Open structure
Format	: 728 $\times$ 2808 pixels
Pixel size	: 14 μm $\times$ 14 μm
Position sensitivity	: $<$ 1μm (signal-to-noise ratio limited)
Photocathode material	: MgF_2 or KBr
Temporal resolution for spectral recording	: 0.1 s

Designing of the Wadsworth spectrometer has been done jointly by IIA and the Stanford group. The EUV spectrometer is being developed jointly by the ESTEC and the Italian groups.

Detectors: Multi-anode microchannel (MAMA) detectors will be used for recording the EUV spectra/spectroheliograms as well as the EUV irradiance. For recording the He I 10830 Å spectra, it is planned to use an infrared CCD. The MAMA detectors have been developed by the Stanford group.

The instrument can be used either in the spectral mode or in the spectroheliometric mode. Final decision about the mode of operation will be taken later. During the observations, the rocket will be controlled by solar pointing astronomical rocket control system (SPARCS) which also carries two sun sensors — MASS (Miniature Acquisition Sun Sensor) and LISS (Lockheed Intermediate Sun Sensor).

The payload is tentatively scheduled for the first flight abroad a NASA sounding rocket in the last quarter of 1992 or early 1993. During the instrumentation phase, the IIA team consists of S.K. Jain, J.C. Bhattacharyya and A.K. Saxena.

We have been receiving very able help from Mr P.K. Mahesh in the design of the mechanical structure of the telescope. The SHAR centre of the Department of Space, Govt. of India, has helped in the computer analysis of the structure.

S.K. Jain

Missile Technology in India

The fifth in the series of Indian Institute of Astrophysics Bicentennial Commemorative Public Lectures was delivered on 6 February 1991 by Dr A. P. J. Abdul Kalam, Director, Defence Research and Development Laboratory (DRDL) Hyderabad. Dr Kalam, who is also the Chairman of the Integrated Guided Missile Development Programme (IGMDP), spoke on Rocket technology and its streams.

Dr Kalam opened his lecture recalling the starting pulse provided to Indian rocket technology by the desire to study the Indian skies. From the cradle of Indian rocketry at Thumba Equatorial Launching Station, Trivandrum (which started off with sounding rockets for weather monitoring and electrojet studies) to the Indian dream of a hyperplane, Dr Kalam drew the complete picture of how Indian rocket technology matured through the years. Dr Kalam who was the project director for SLV 3 launch vehicle programme, spoke in the former part of his lecture, about the underlying technology and future of India's launch vehicle programmes.

IGMDP, with Dr Kalam as the Chairman, can be pronounced as the most successful technology demonstration programme of the country and so far the most envied one by any non-Indian. *Prithvi,* surface to surface missile, which uses liquid propellant for its propulsion has a range of 250 km and has been successfully test-fired; along with *Trishul* (surface to air and solid propulsion) it will soon go into production. *Nag,* India's third generation anti-tank missile with a range of 4 km can be fired from a helicopter or from a platform. *Akash,* surface to air missile (similar to Patriot missiles used in the Gulf War) is a multi-target missile. *Agni,* India's intermediate range ballistic missile (IRBM) with a range of 1000 to 2500 km has demonstrated our technological capability of atmospheric re-entry and close-loop guidance system. Indian missile programme is also demonstrating our capabilities in the use of carbon-carbon composites, and high quality inertial navigation and guidance systems.

Dr Kalam, while talking on the circular error probability (CEP) * of Indian missiles, maintained that our missiles do stand at par with any other world class missiles in this most important aspect, and use very efficient real-time software. He explained that lighter payloads and correspondingly ensuing smaller CEPs will be more strike effective. This aspect marks the difference in approaches for payload weights in launch vehicles and in missiles. While the former aim in carrying more and more the latter aim for lesser but more effective payloads.

Dr Kalam went on to talk about hyperplane, India's reusable spacecraft which is in the conceptual stage and has astonished even the technologists of advanced countries with its light weight and other superior design concepts. This spacecraft leaves the ground as an aeroplane, at higher cruising speeds uses propulsive devices like Fan-Ramjet and Scramjet, and in the last stage behaves as a rocket. The idea to use the atmospheric air as an oxidizer has served in reducing the weight to a considerable extent. Dr Kalam saw this as a confident step towards establishing a space platform in the future. However he acknowledged the difficulty involved in the crucial task of in-flight liquefaction of air and the breakthrough yet to be achieved in the design and material technology development for this task.

Dr Kalam stressed on the "multi-institutional" collaboration which has brought about these significant feats. The credit for India's missile technology does not entirely belong to DRDL but also to scores of Indian universities and other research organizations which have actively collaborated. This shows an emerging culture of pooling together of Indian scientific and technological resources for a common national goal, and this has also made the mission very cost-effective. Answering a question regarding the percentage of foreign components in the missile programmes, Dr Kalam remarked that even if the foreign countries decide to strangle us, we will still survive, thus highlighting the very small percentage of foreign components in our programmes. He cheerfully answered all questions and explained even the rudimentaries of aerodynamics to suit the diverse nature of the audience.

The speaker was formally introduced to the audience by the Director, Prof. K.R. Sivaraman. Prof. R.K. Kochhar, while delivering the welcome address remarked that throughout history the desire for wealth and for security has been the driving force for the development of science and also pointed out that both defence science and astronomy have many salient features in common.

J. Ramachandran
Control Systems Division, ISAC, Bangalore

* CEP may be considered as a direct measure of the missile's accuracy and effectiveness. CEP is the diameter of the circle with the target as the centre within which 50% of the missiles fired at the target may be expected to fall.

Experiments on Closure-Phase Imaging

Fig. 1. Shapes of the fringe pattern taken using a 3-hole aperture mask, with a narrowband filter centred on λ 5577 Å and FWHM 100 Å. The aperture was arranged in a triangular pattern.

The advantage of closure phase technique in high resolution imaging (R.C. Jennison 1958, *M.N.R.A.S.* **118**, 276) is that its visibility remains uncorrupted in the presence of atmospheric turbulence. Its potential lies in exploiting fully the resolution attainable with large telescopes. Recent experiments (J.E. Baldwin *et al.* 1986, *Nature*, **320**, 595) with a three-hole aperture mask using a large telescope clearly establish its value. Its implementation on three ground-based telescopes in the optical domain would enable one to achieve very high resolution. This induced us to perform a series of experiments in the laboratory to study the shapes of fringes using aperture masks of different sizes arranged redundantly as well as non-redundantly. The light beam from an artificial star enters a simulated telescope. The image was magnified considerably to discern finer details. The fringes were obtained through the aperture mask placed in front of the telescope. These have been compared with computer simulations. Fig. 1 depicts the fringe pattern produced by 3-apertures arranged redundantly.

The image shown in the figure was digitized by the PDS 1010 M micro-densitometer and processed using COM-

TAL image processing system at the VAX 11/780 installation of VBO. The clipping method was used to enhance the contrast in grey levels. The clipped image is superposed on the histogram-equalized original image.

S.K.Saha

Cosmic Clustering by Inverse Cascade

Recent observations of very large structures in the universe like the Great wall indicate the existence of a hierarchy of well-ordered coherent formations up to the very large scales of a few hundred Mpc. (M. Geller & J. Huchra 1989, *Science,* **246,** 897). There are enormous superclusters of galaxies as well as giant cellular voids. This has seriously called into question the conventional ideas of formation of such structures, *i.e.,* scenarios in which the density fluctuations grew in amplitude with the expansion of the universe. The necessity of newer ideas to explain clustering of galaxies at all scales has been strongly felt. Completely different views regarding redshift–distance relationship and cosmic microwave background have been proposed. In another scenario, a large population of hitherto unseen dwarf structures (galaxies) is required for the formation of the large-scale structures in a rather contrived picture in which the dwarf galaxies are miraculously consumed by a cosmic vacuum cleaner (R.S. Ellis & C.S. Frenck 1990, *Nature*, **346**, 790). It turns out that the smaller structures should have been more abundant in the past which then disappeared by merging processes involving perhaps half the total mass.

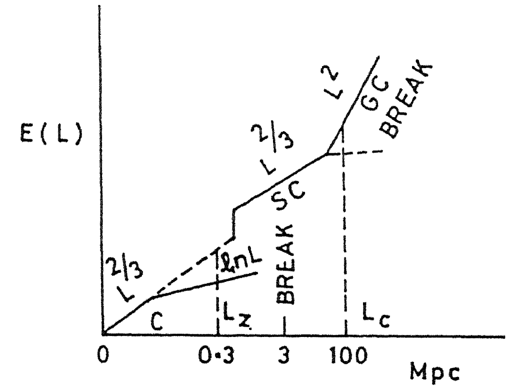

Fig. 1. Turbulent energy spectrum. L_z = scale of the first break due to buoyancy, L_c = scale of the second break due to the Coriolis force, C = cluster, SC = supercluster and GC = giant cluster.

Recently, the importance of inverse cascade in cosmic turbulence was pointed out in which it was proposed that the nonlinear interactions between small eddies in the pre-recombination era could result in the formation of very large strucures in the universe (V. Krishan 1991, *M.N.R.A.S.,* in press; *IAU Symp.* **138**, 329); V. Krishan & C. Sivaram 1991, *M.N.R.A.S.* in press). In this picture, the helicity fluctuations naturally present in a turbulent medium play an important role. In a three-dimensional system, the tendency of alignment of velocity and vorticity inhibits the flow of energy to small scales. This leads to the build up of a large-scale correlation of helicity fluctuations until in the vertical direction it is constrained by gravity.

At this stage the system becomes more and more anisotropic, eventually attaining the characteristics of a quasi-two-dimensional turbulent medium. The inverse cascade of energy in a 2-D system is well known. Thus the disappearance of elementary vortices may actually occur due to the transfer of energy to large scales, thus forming the large-scale structures at later epochs. It is found that the complete spectrum consists of three distinct branches of two well-defined breaks. We identify the first branch having the energy spectrum $E(K) \propto K^{-5/3}$ with the clusters of galaxies which then inverse cascade to superclusters with the same energy spectrum. The intermediate region characterizes by a flat spectrum $E(K) \propto K^{-1}$ may correspond to the observational absence of structures of sizes lying between clusters and superclusters. The superclusters inverse cascade to form giant clusters in the nearly 2-D turbulent medium now under the influence of coriolis force. The energy spectrum becomes steep and is given by $E(K) \propto K^{-3}$. This implies a gap between superclusters and giant clusters. We propose that the largest structures like the wall are formed in this region. Since the larger structures are formed from the smaller structures, the energy content of larger structures should not exceed that of the smaller ones. We find that a turbulent velocity of 300 km s^{-1} of the clusters of galaxies (of size $\sim$ 0.3 Mpc) is sufficient to form superclusters of size 3 Mpc in a time period of 3 billion years ; a turbulent velocity of 10^4 km s^{-1} of the superclusters is sufficient to form giant clusters of size 100 Mpc in a Hubble age (so the rarity of such structures). In conclusion, the processes of inverse cascade may account for the formation of large-scale structures.

V. Krishan & C. Sivaram

Nova Herculis 1991

A bright nova was discovered on 1991 March 24.78 UT by M. Sugano in Japan, and independently on March 25.19 UT by G. Alcock, in the constellation of Herculis at a magnitude of about 5. The nova turned out to be a fast one similar to V 1500 Cygni 1975, and faded to $V = 10.76$ by April 2.78.

The information on the nova was received at IIA on April 1 through the International Astronomical Union Circulars. The 1-m reflector at VBO was pressed into service and spectra were recorded on April 2 and 3 using the Universal Astronomical Grating Spectrograph equipped with the Photometrics CCD system. Employing a 600 g mm^{-1} grating a dispersion of about 1 Å per pixel was achieved. A spectral range extending from 4250 Å to 6800 Å was covered in three segments.

On April 4, the Director made available a part of the engineering time on the 2.3 m VBT. Spectra were recorded around $H\alpha$ and $H\beta$ regions at similar dispersions.

The spectra show broad emission lines at $H\alpha$, $H\beta$, $H\gamma$, He I 4471, 5876, 6678 Å, Na I D, N II 5667, 5680 Å, Si II 6347,6371 Å, N II 4640 Å with likely contribution from He II 4686 Å, and lines of multiplet 42 of Fe II. The full width of the $H\alpha$ line is about 6000 km s^{-1} at the base of the line, and 4500 km s^{-1} at half-intensity point. P Cygni absorption dips are seen for brighter lines that are not having strong blends on the blue side. The implied expansion velocities are 3280 km $s^{-1}$from $H\alpha$, 3130 km $s^{-1}$from $H\beta$ and $H\gamma$, and 3090 km $s^{-1}$from Si II and He I 5876 Å lines. The $H\alpha$ line showed an additional absorption feature at -4100 km s^{-1}.

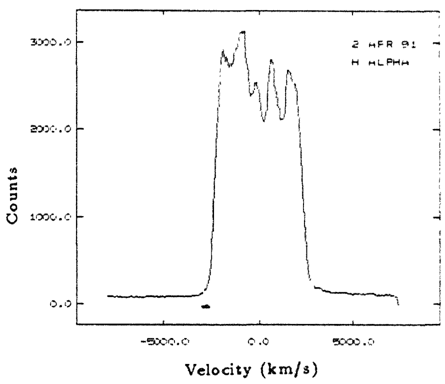

Fig. 1. **The profile of the $H\alpha$ line from Nova Herculis 1991 plotted in the velocity domain. The ordinates are counts not yet reduced to fluxes.**

All line profiles are similar and show structure. Prominent peaks in $H\alpha$ are at -1910, -940, -210, $+730$ and $+1560$ km s^{-1}. Additional peaks are present at -1740, -1510, -1220, -780 and $+1880$ km s^{-1}. These are shown in Fig. 1 where the absorption dips are not clearly evident due to the low scale of the ordinates. The blue peaks were brighter than the red peaks, and brightened further by April 4. In the $H\beta$ line, however, the blue peaks were of similar intensity as the red ones. The nova is indeed mimicking V 1500 Cygni 1975 (*cf.*, T.P. Prabhu 1977, *Kodaikanal Obs. Bull. Ser. A,* **2**, 75).

Strong, narrow, and low-velocity absorption lines were seen at Na I 5890 and 5896 Å superposed on the broad emission line of Na I D. These arise in the interstellar matter in the direction of the nova. The equivalent widths of these two lines are 150 and 90 Å, respectively.

The observations of the nova are continuing at both the 1 m and 2.3 m telescopes at VBO.

T.P. Prabhu, K.K. Ghosh, G.C. Anupama & G. Selvakumar

newsline

P.M.S. Namboodiri participated in the mini-workshop on N-body Simulations in Stellar Dynamics held at Department of Astronomy, Osmania University, Hyderabad during 16–21 January 1991 and gave a talk on "N-body simulations of interacting galaxies".

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S.K. Jain visited the Stanford University and Cockeysville, Maryland, in January 1991 to participate in the meetings of the collaborators and the Research Support Instruments Inc., to discuss the progress of the project on Rocket-borne EUV spectrometer, and to decide about the future course of action. From among the various possibilities of the telescope structural design, the choice finally narrowed down to two options. The designs of the spectrometers were, however, finalized during the meeting.

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S.S.Hassan visited Osmania University, Hyderabad during 21–24 January 1991 and gave two invited lectures on: (a) "Oscillation in sunspots", (b)"Dynamical effects and energy transport in intense flux tubes on the sun". He also presided over the National Science Day Celebration of the Lawrence School at Lovedale, Ooty on 28 February 1991 and delivered the keynote address on "The Challenge of Astronomy".

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T.P. Prabhu delivered a talk on "Recent developments in optical astronomy", at the Regional Seminar on Recent Trends in Physics, Bangalore University, 21 February 1991.

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Dr R. R. Rausaria, Regional Engineering College, Srinagar, has joined the Institute as a Visiting Scientist for a period of one year till December 1991.

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The tenure of Dr A. Satyanarayanan as a Visiting Fellow has been continued for a period of one more year till May 1992.

IIA Colloquia

The following lectures were given at IIA between 1991 January to April:

1. Angular momentum loss instabilities, and mixing in stars (I.W. Roxburgh, Queen Mary College, London).
2. A model of inertial inductions ; some astrophysical and cosmological consequences (A. Ghosh, I.I.T. Kanpur).
3. Millimetre interferometric observations of solar flares (M.R. Kundu, Astronomy Program, University of Maryland).
4. The electrodynamics of a neutron star in general relativity (A.G. Muslimov & A.I. Tsygan, Ioffe Institute, Leningrad, U.S.S.R.).
5. Waves in stratified atmospheres (Yu. D. Zhugzhda, IZMIRAN, Moscow).
6. Helioseismology investigations in IZMIRAN (Yu. D. Zhugzhda, IZMIRAN, Moscow).
7. Ensemble concepts in Physics and Geophysics (G.S. Murthy, BARC, Bombay).
8. Quasar spectra: simplicity and complexity (Ajit Kembhavi, IUCAA, Pune).
9. Space project CORONAS (Yu. D. Zhugzhda, IZMIRAN, Moscow).
10. Initial mass function in the LMC star cluster (Ram Sagar, IIA, Bangalore).
11. Intel 64 bit microprocessor i 860 (V. Chinnappan, IIA, Bangalore).

Student Seminars:

1. Planetary nebulae: emission lines as probes of phy conditions (D. Banerjee).
2. H-R diagram and stellar evolution (B. Eswar Red
3. Continuum absorption cross-section in stellar a spheres (S. Sengupta).
4. The solar corona (Uma Gorti).
5. CCD in astronomy (N. Annapurni).

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