Bull. Astr. Soc. India (1996) **24,** 653–657

Total solar eclipse observations of 24 October 1995 Meja Khas, Allahabad

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Abstract. Monochromatic coronal images during the total solar eclipse of 24 October 1995 were successfully obtained in 6374 Å [Fe X] line. The experiment carried out at Meja Khas, Allahabad during the eclipse and the preliminary results are briefly reported.

Key words : total solar eclipse - coronal line filtergrams - CCD observations

1. Introduction

A number of observations of the corona is possible, viz, regarding its form and its change with the solar cycle, the heating mechanism, hydrodynamics and finally the study of the coronal lines and their variation in intensity with the solar cycle.

Observations of the solar corona in the most prominent lines i.e., in the red (λ 6374 Å Fe X) and the green (λ 5303 Å, Fe XIV) lines, are regularly made in every eclipse as the monochromatic corona shows structures like loops, rays, spikes etc (Dollfus 1971; Dunn 1971; Guetman *et al.* 1994; Takeda *et al.* 1994 and Pasachoff 1994). These structures appear differently in different lines. Local intensity ratios, green line : red line, are used to derive excitation temperatures.

Keeping all this in mind we have carried out the observations, with narrow band filters, during the total solar eclipse of 24 October, 1995.

After inspecting many sites, falling on the central line of the belt of totality in the state of Uttar Pradesh we selected Jawahar Navodaya Vidyalaya (Longitude : 82° 07' 32.5" E, Latitude : 25° 07' 36.4" N and altitude of about 134 meters from MSL) Meja Khas, Allahabad as the eclipse observation site. The weather on the eclipse day was cloudless and good for observations. At the Vidyalaya, which was almost on the central line, the duration of totality was observed to be 57.8 seconds.

The observational program consisted of the following experiments :

(1) Observations of solar cornoa in red line of Fe X (6374 Å)

(2) Observations of corona in green line of Fe XIV (5303 Å)

(3) Observations of corona in integrated white light.

2. Instrumentation

The observations have been carried out with a 15-cm, f/15 Coudé refractor. This telescope forms about 21 mm image of the sun's disk at the focal plane and has about 5.8 cm diameter (1.5 degrees) field, free from optical aberrations.

A manually rotating filter disk, equipped with the red and the green narrow band Daystar coronal filters and also with a clear aperture hole, is placed before the focal plane.

The specifications of the filters are as follows :

	red filter	green filter
aperture	7.0 cm	7.0 cm
central wavelength	6374 Å	5303 Å
pass band	2.0 Å	3.0 Å
transmission	37.39%	25.66%
operating temperature	45°C	45°C

At the back of the filter disk a 6-cm diameter electro-mechanical shutter was placed. This shutter through an interface card fabricated at the Observatory, operated at the desired time on the command signal generated by the Sun computer i.e., the computer controlled the exposure time at the desired time intervals.

On the focal plane of the telescope, a Photometrics PXL High Speed Modular CCD Camera system was mounted. This CCD system includes the following components :

(i) Thermoelectrically cooled FTS Cold Probe camera head (ambient temperature-42°C) with TK 1024 CCD class I chip (pixel size 24 x 24 microns); fibre optics bonding (2.45 : 1) to the CCD in the Camera head (aperture 6.2 x 6.2 cm^2). System acts as 58.8 micron sized pixels with a spatial resolution of about 5 arc seconds.

(ii) 12 bit digitizer (reading rate 0.5 to 4 Megapixels per second)

(iii) Camera controller, Sun computer interface card and software.

SUN SPARC Station-20, with 7.3 GB hard disk and with the help of the software at command, acquired CCD images, stored them on the hard disk and readied the camera for the next exposure. The readout rate of the camera controller during eclipse observations was set to 990 K pixels sec^{-1}. At this read out rate the system's dark current was minimum. A GPS clock was used to adjust and to correct universal time of the computer clock.

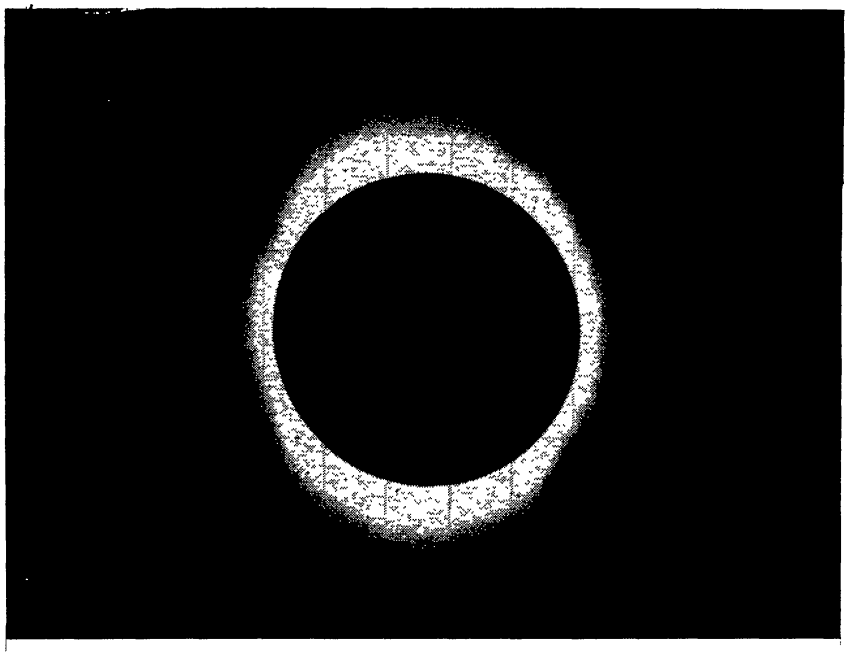

Figure 1. Image of the corona taken in red coronalline (03:10:20 UT).

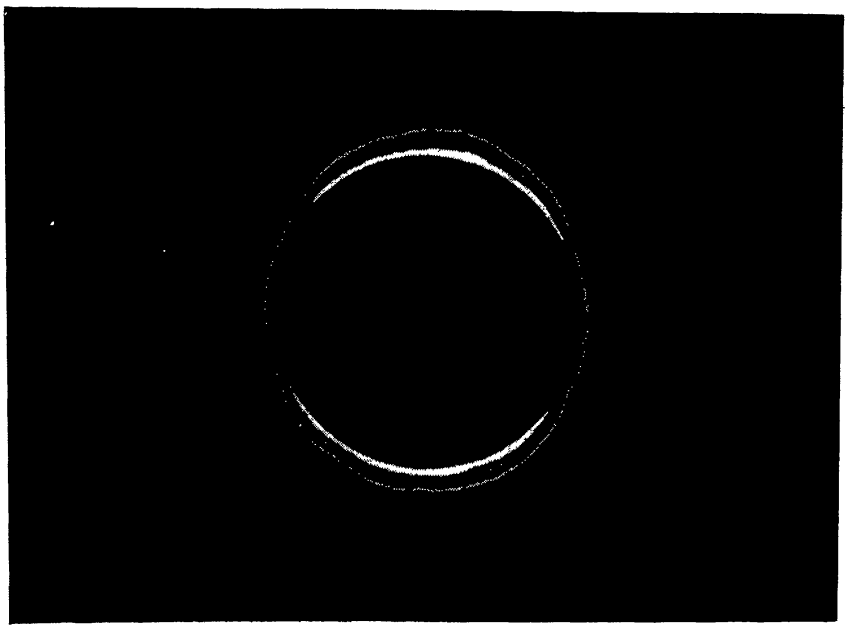

Figure 2. Relative intensity contours of the corona (03:10:20 UT).

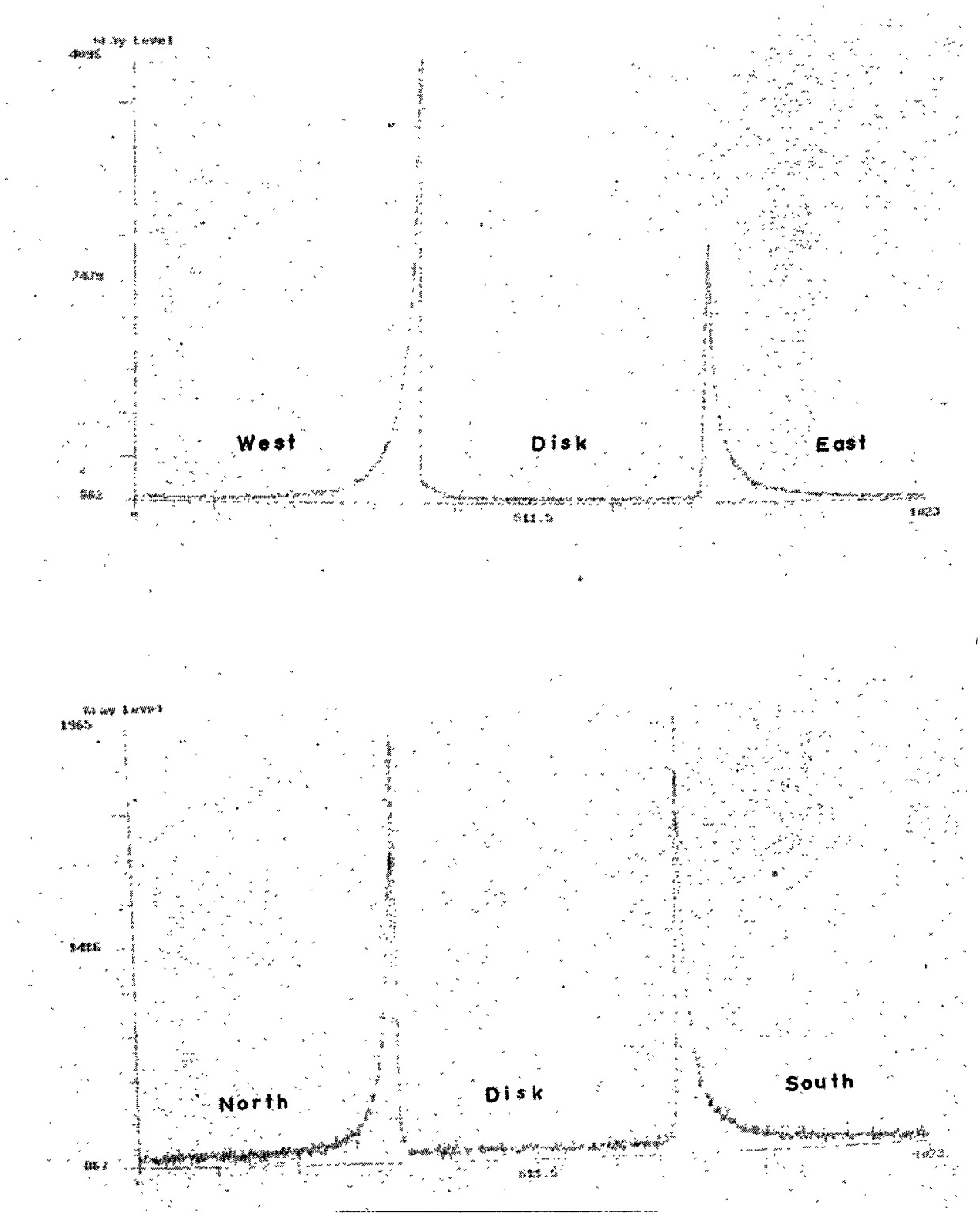

Figure 3. Intensity profile in East West (upper) and North South (lower) directions.

3. Observations and results

The backend instruments used for narrow band photometry could be tested on the telescope only on 20th of October 1995 because of various reasons. The progress of the eclipse i.e., CCD imaging of the partial eclipse phase was carried out on the red filter. During totality 9 filtergrams in red coronal line could be recorded successfully with exposure times as 2 seconds and 1 second. Figure 1 shows the corona in red filter. Polar plumes can be seen very clearly. In the equatorial direction the extension of the corona as compared to north-south direction is more. In Figure 2 the intensity with computer coded colour contours changes as a function of distance from limb are shown in equatorial and polar directions. The peak intensities of the corona in east and west directions are higher as compared to intensities in north and south directions. As is expected during solar activity minimum (cf., Figure 3) is also an east-west asymmetry in intensity profiles. The detailed analysis of these observations are in progress.

The corona could not to be observed in the green line because of a mechanical problem in the filter slide.

Acknowledgements

We are thankful to the Principal, Jawahar Navodaya Vidyalaya Meja Khas, Allahabad for permitting us to use the Vidyalaya Campus for the solar eclipse observations. We are also thankful to Drs M.C. Pande and H.S. Mahra for their constant support and encouragement during this eclipse expedition.

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