

Spectroscopy, Multicolour Photometry and Structure of the Solar corona during the Total Solar Eclipse on October 24, 1995

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Abstract

A brief description of the scientific goals and preliminary results related to the 24 October 1995 solar eclipse at Nim Ka Thana is given. The white-light corona was of a minimum type with several large helmet streamers seen up to 5 - 6 R_{\odot} , and located around the solar equator above the E- and W-limbs. Coronal holes and plumes are located around the solar poles. No CME or comet was observed.

Key Words : Total solar eclipse, Coronal streamers, Coronal holes and plumes, Spectroscopy.

Introduction

The solar eclipse of October 24, 1995 has been successfully observed at Nim Ka Thana (Rajasthan, India) by Astronomical Institute Expedition (Tatranska Lomnica, Slovakia). The eclipse occurred shortly before the sunspot minimum between cycles 22 - 23 (the minimum is expected to occur by mid - 1996). The aim of our experiments will be to study the following problems in the solar corona research :

- (1) The large-scale structure of the white-light corona (WLC),
- (2) Multicolour photometry (in blue, green and red spectral regions) of the WLC up to 7 R_{\odot} .
- (3) Fast changes (of about 1 s) in the WLC.
- (4) Spectroscopy of the WLC (an attempt to find a neutral matter in the solar corona).

Indirectly, we are able to study physical properties (temperature, density, and velocities) at different coronal structures, both the global and local magnetic fields of the Sun, a heating of the solar corona, etc.. The colour photos are used to derive colour index in the outer corona in order to study the nature of the scattered light.

Equipments

- 1) Horizontal Camera, $f = 3$ m, $D = 20$ cm.

The lens was fed by a siderostat mirror (Zeiss 35 cm).

Exposures 8 and 2 s were taken during totality on KODACHROME 100 Plus (plane film 18 x 24 cm).

- 2) Equatorially Mounted Camera, $f = 0.5$ m, $D = 6.3$ cm.

9 WLC pictures (from 4 s to 1/60 s) had been taken over the eclipse on KODACHROME 100 film.

- 3) Static Camera, $f = 1.2$ m, $D = 8$ cm.

A fast movie camera KRASNOGORSK-3 was able to take 36 pictures/s on the film ORWO NP-7. This system was working of about 35s during the total eclipse.

- 4) Coronal Spectroscopy

A low dispersion spectrograph (0.5 nm/pix) was fed by the light from the 4.0/300 telelens. There was a CCD ST-7 camera in the focal length and the signal was going into the computer Texas Instrument TravelMate 3000. One exposure of 2.5 s was taken. The spectral range is from 480 to 910nm. A slit was tangentially oriented toward the Sun above its eastern limb.

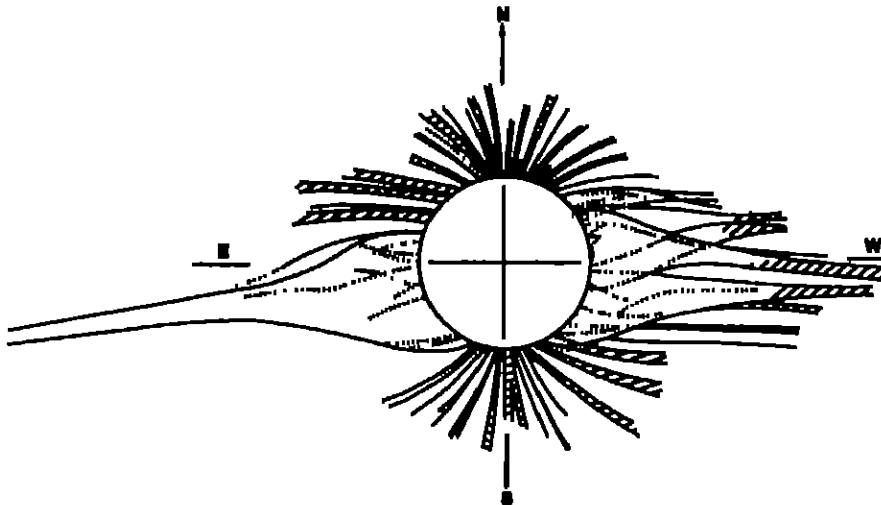


Figure 1. Large-scale structure of the white-light corona. Remarkable helmet streamers up to 5-6 R_{\odot} are seen in the equatorial regions, polar plumes and coronal holes at the poles. Prominences are denoted by a black area.

Preliminary results

All instruments performed well during the eclipse and weather conditions were excellent. Quantitative results are mostly not available at present. The WLC has an asymmetry shape not only between the equatorial and polar regions but between the E- and W-limbs as well.

The base of the E-limb streamer is located at P.A. $70^\circ - 157^\circ$. Bases of the W-limb streamers are located in P.A. $205^\circ - 324^\circ$ (see Figure 1). The streamers are seen nearly up to $5R_\odot$. A lot of polar rays are seen in coronal holes above both solar poles. An ellipticity (preliminary result) turns out to be 0.27, and it means the corona was nearly of minimum type. There are many small prominences (dark areas in Figure 1). It seems that the highest prominence at P.A. 304° was of a dynamic type.

Isodensities of the WLC (arbitrary units) are shown in Figure 2. No comet or CME was seen during the eclipse in our pictures.

Location : Nim Ka Thana (= $27^\circ 11' 14.8''$ N, $\lambda = -75^\circ 47' 45.4''$ E, H = 400 m, Rajasthan.

Participants : V.Rusin (leader), L.Klocok, M.Mlnarovjeh, P.Zimmermann and D.Ocnas.

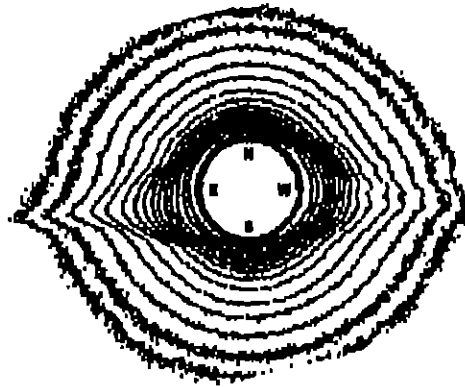


Figure 2. Isophotes of the WLC (arbitrary units).

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