

Summary report of the Astronomical Institute observations during the July 11, 1991 eclipse

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Abstract. A brief description of the scientific goals and preliminary results related to the 11 July 1991 eclipse at La Paz is given.

Key words: Sun-corona-eclipses

1. Introduction

Several instruments were used to observe spicules, the white-light and emission corona over the 11 July 1991 eclipse at La Paz, Mexico (similar observations were made at the Lomnický Peak coronal station in Czecho-slovakia). The scientific goal of the Astronomical Institute, Slovak Academy of Sciences Expedition (AISASE) from Tatranská Lomnica, was to make both photographic and video records, and to use these observations to obtain a better understanding of the conditions in the solar corona. Spicules and their surrounding should have been observed with a big resolution, too. The results of the observations were to help in solving the following problems in the solar corona: (1) The heating of the solar corona (2) Connection of coronal structures with the underlying layers, their temporal changes or development (in the totality path if any), etc. (3) Physical conditions (temperature, density, velocities, polarization) at different coronal structures or around them, their variability over the solar cycle (4) To obtain information about the structure and magnitude of magnetic fields in the solar corona (5) To find a connection between coronal structures, their physical properties, and the solar wind or interplanetary space properties.

2. Eclipse Experiments

(1) A 20-cm lens with a 3-m focal-length and a special radial filter for observing the white-light corona (K+F), fed by a 30-cm Jensch mirror was used. Three color and four black-and-white pictures (18 x 24 cm, KODAK Ektachrome 64) were obtained, showing the corona out to $5 R_{\odot}$. The exposure time: 20 sec.

(2) The same equipment as in item 1, with a plane reflecting mirror added to deflect the coronal light out of the main telescope axis and divergent lens to prolong the focal length to 30 m was used. Just after the second contact three pictures (6 x 6 cm, KODAK) were obtained in the blue and red regions of the spectrum. The last one was taken in white-light. The exposure time: 1 sec.

The results are slightly distorted because of an error in the main mirror movement. Nevertheless, the results may be used for processing.

(3) A 195-cm focal-length telescope with a 13-cm aperture was used for studying the polarization in the white-light corona (Figure 1) and 530.3 nm emission corona (Figure 2). Three series of 1/125, 1/15, and 1 s exposure times were used to record the white-light corona polarization through a polaroid filter in four positions, differing by 45° (see Plate 1).

(4) The same equipment as in item 3, supplemented with a narrow passband Andover filter (0.2 nm) was used to obtain the polarization of the 530.3 nm emission corona. One series of four pictures with an exposure time of 30 sec was obtained through a polaroid filter in four positions, differing by 45° .

The records of both the white-light and 530.3 nm corona polarization are excellent quality.

(5) A Panasonic camcorder was used to record the white-light corona over the full phase of totality. The recording is excellent.

3. The green (530.3 nm) and red (637.4 nm) corona, and prominences (non-eclipse observations)

Standard limb observations (of about $50''$ above the solar limb with a leg of 5° from the north solar pole towards the east) of the green and red corona on the eclipse day and on days preceding and following it, were made at Lomnický Peak coronal station. The results are shown in Figs. 3 and 4. Comparison between the green line intensities and the NIXT corona (4-6 nm) on the eclipse day is shown in Fig. 5 (see Plate 2).

H-alpha limb prominences are shown in Figure 6.

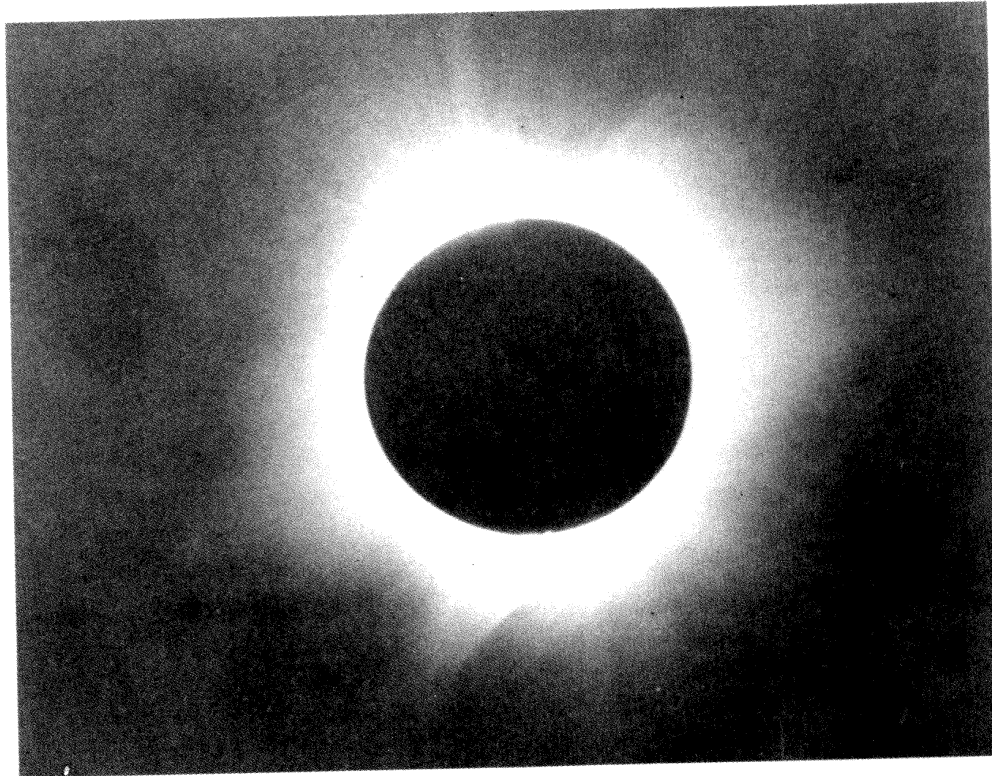


Fig. 1. The white-light corona taken through polarization filter with an 1 s exposure time.

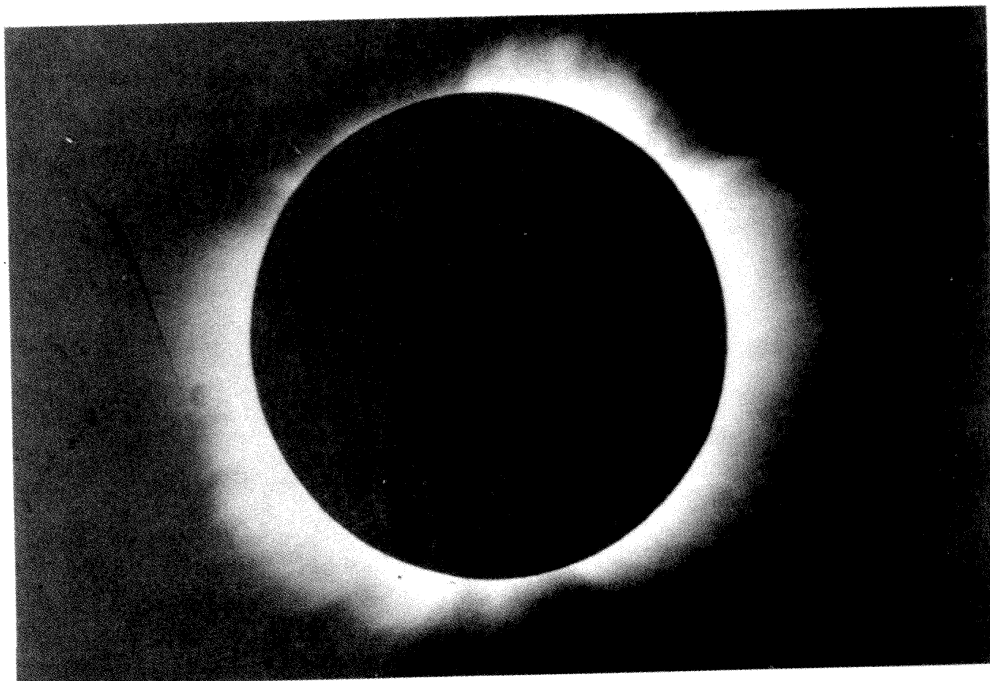


Fig. 2. The green corona (530.3 nm) taken through a polaroid with an exposure time of 30 s.

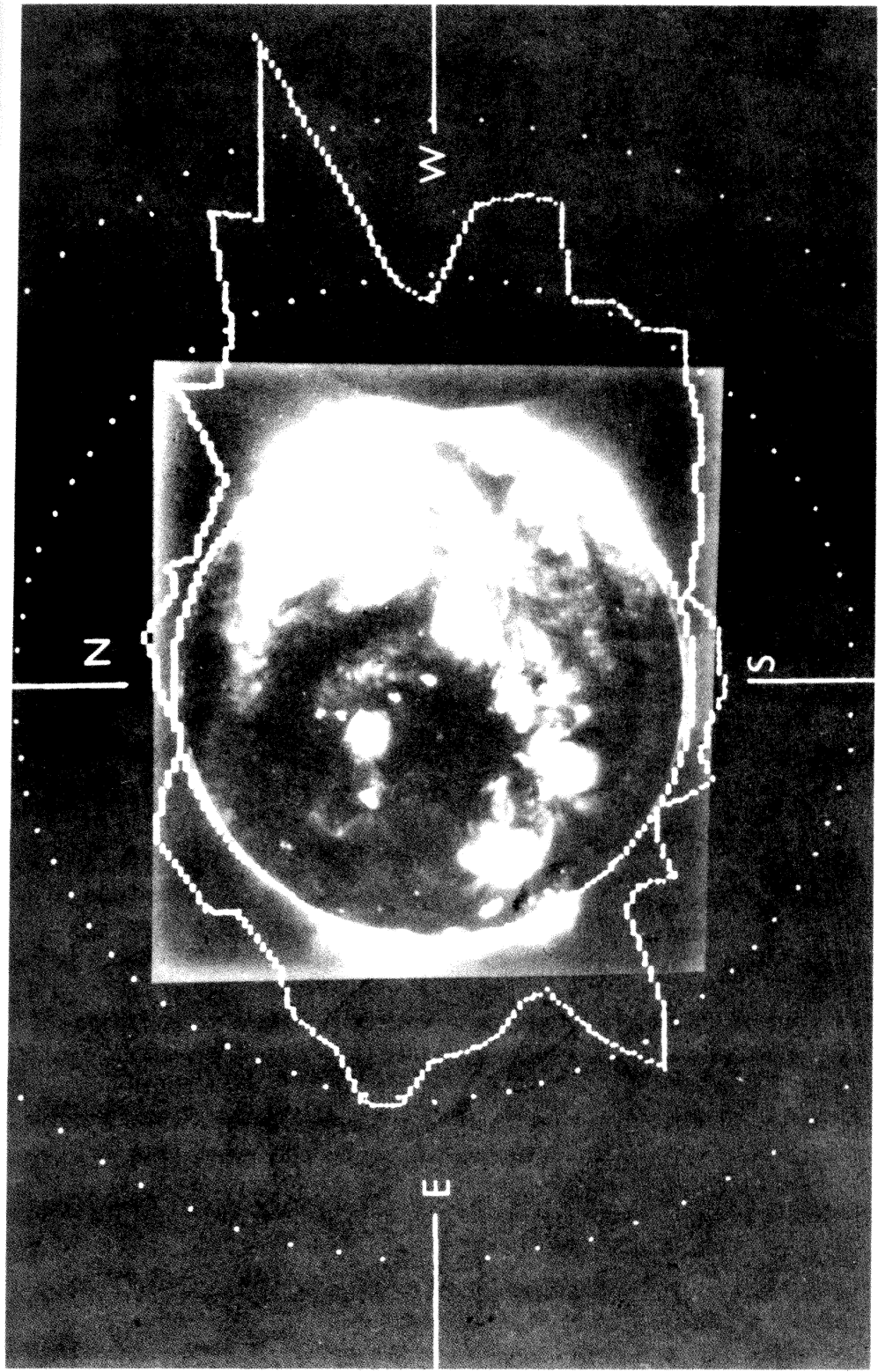


Fig. 5. Comparison of the green corona intensities (non-eclipse measurements) with the NOXT (4-6) corona (Courtesy by L. Golub) on July 11, 1991. The inner circle: $100 \times 10^{-6} B_{\odot}$, the outer one: $200 \times 10^{-6} B_{\odot}$.

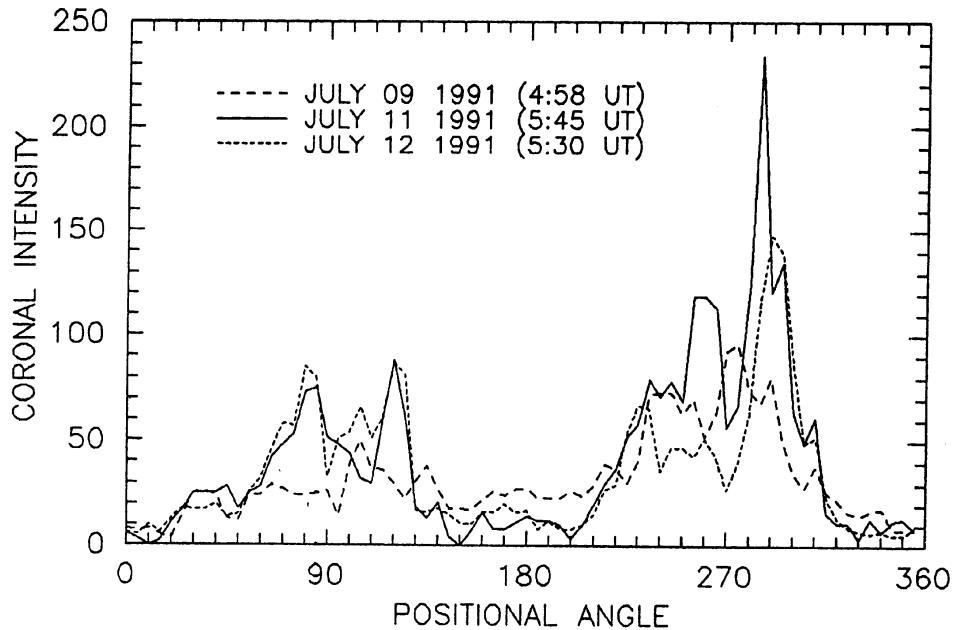


Figure 3. The green line (530.3 nm) spectral limb intensities measured at Lomnický Peak coronal station. The day of observation is shown directly in Figure. Coronal intensities are expressed in absolute coronal units ($\times 10^{-6}$)

4. Preliminary results

The white-light corona pictures show the corona nearly at maximum cycle, or shortly after it. Large, well developed helmet streamers very close to the polar regions are observed in the SW and NE quadrants and extend nearly up to $9-10 R_{\odot}$. Very thin, fan streamers extend mainly above the large, dynamical prominences, located at the solar surface at positional angles of $70^{\circ} - 130^{\circ}$ (centered at $+10^{\circ}$ E and -20° E), and 285° ($+15^{\circ}$ W). Some of them are not radially oriented with the height above the Sun, and they lost in the F-corona at the height of $4-5 R_{\odot}$. Observations outside the solar eclipse showed that both active region prominences were highly dynamic. Similarly, the green corona intensities showed rapid changes in its intensity at the same places. Thin and faint polar rays mainly above the north solar polar region were observed. They extend nearly out to $4 R_{\odot}$. Nine stars were identified in the white-light corona frame. A remarkable feature (plasmoid ?) is seen above the north solar pole which resembles the prominence. Nevertheless, it is not prominence.

The inner corona displays a very faint, but more complicated structure (thin loops, dark cavities, voids etc.). No remarkable coronal mass ejection was observed least over the three-hours interval, in the totality path from the Hawaii

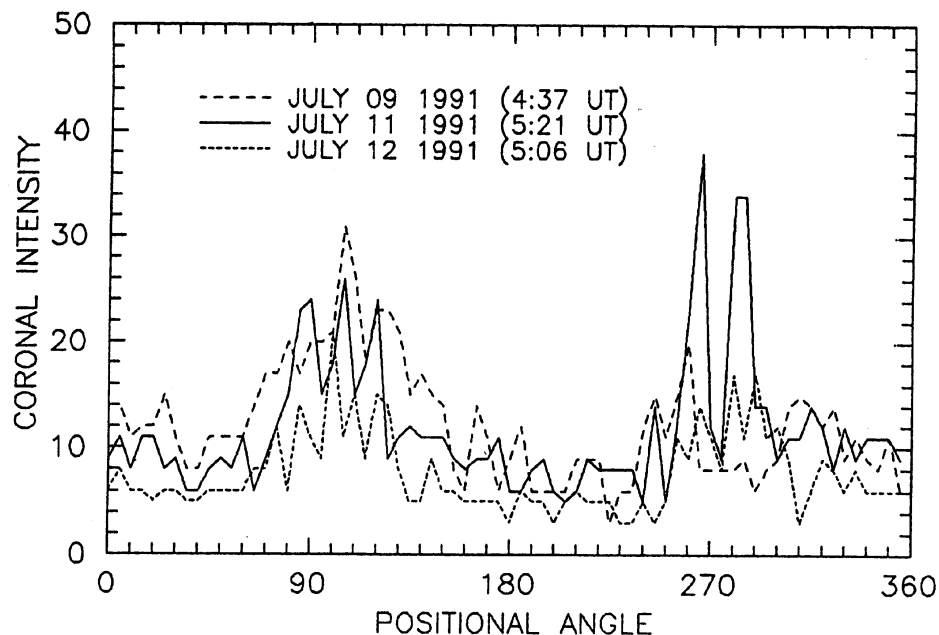


Figure 4. The red line (637.4 nm) spectral limb intensities measured at Lomnický Peak coronal station. The day of observation is shown directly in Figure. Coronal intensities are expressed in absolute coronal units ($\times 10^{-6}$)

to Brasil via Mexico, as follows from the International Multistation Coronal Experiment. A detailed analysis will be published elsewhere.

Location: La Paz, Baja California Sur, Mexico, Areal Universidad Autonoma de Baja California Sur (UABCS)

Longitude: 110°15'45

Latitude: 24°9'40

Time of observations: 18:47:33.5 - 18:54:00.2 UT

Participants: Lubomír Klocok, Vojtech Rušin (chief of the Expedition), Milan Rybanský, Ján Štohl, Julius Sýkora and Peter Zimmermann.

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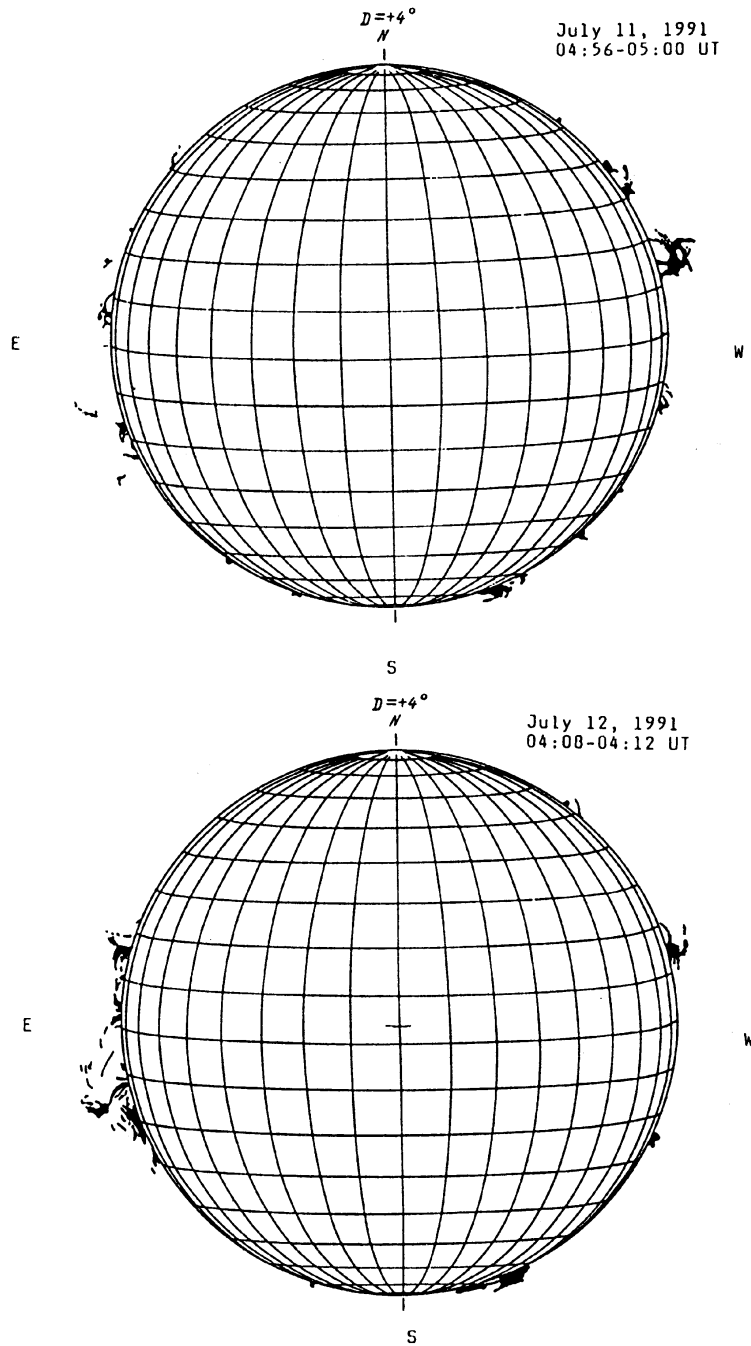


Figure 6. H-alpha limb prominences as observed at Lomnický Peak coronal station on July 11, 1991 (above) and July 12, 1991

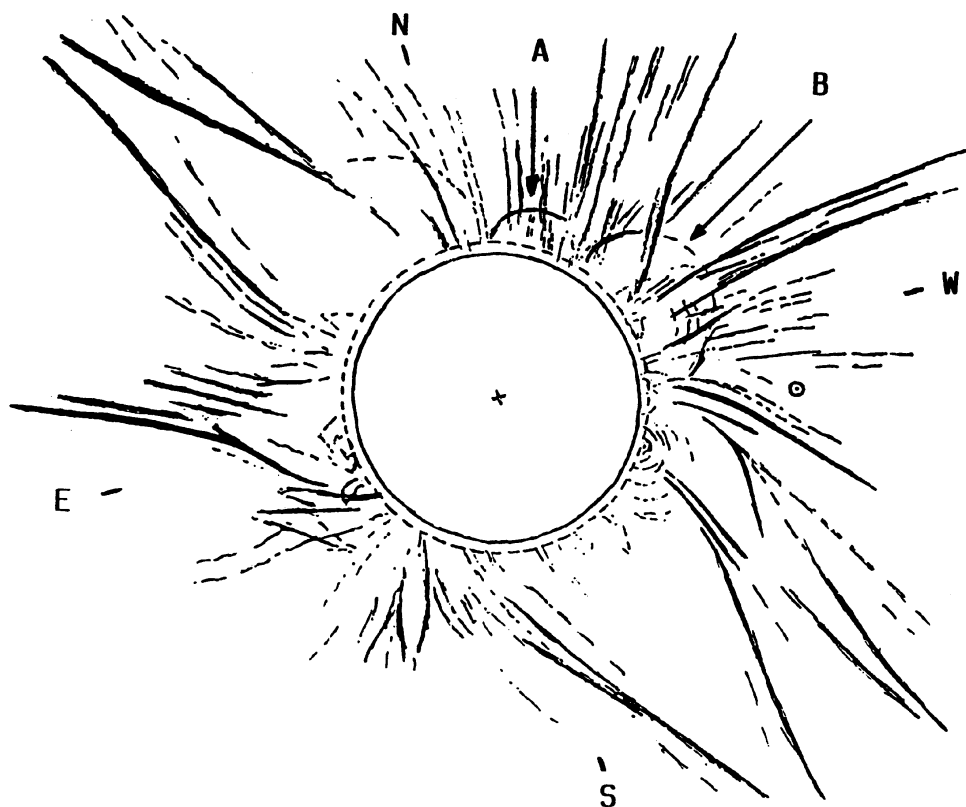


Figure 7. Large-scale structure of the white-light corona (Zirker et al., 1992). Remarkable features in the NW quadrant are denoted by letters A,B

La Paz and to all people from CUPOE headed by Ing. Manuel Osegua Chazaro. Dr. J.C. Bohigas provided us with the much information before the 11 July 1991 eclipse. Dr. J. Tauer helped us to improve the English language. Thank you all.

References

- Golub, L.: 1992, private comm.
 Zirker, J.B., Koutchmy, S., Nitschelm, C., Stellmacher, G., Zimmermann, J.P., Martinez, P., Kim, I., Dzjubenko, N., Kurochka, L., Makarov, V., Fatianov, M., Rušin V., Klocok, L. and Matsuura, O.T.: 1992, *Astron. Astrophys.*, in press.