

POLARIZATION OF THE CORONA DURING THE SOLAR ECLIPSE OF JUNE 30, 1973

J. SÝKORA

*Astronomical Institute of the Slovak Academy of Sciences,
Skalnáté Pleso Observatory, Czechoslovakia*

The Astronomical Institute of the Slovak Academy of Sciences, Skalnáté Pleso, organized the expedition to observe the total solar eclipse, visible on June 30, 1973 in Africa. The expedition, consisting of eight people, chose its observing place near the village of El Meki ($I = 08^{\circ} 17'$; $\varphi = 17^{\circ} 44'$) in the Republic of Niger. The expedition travelled there in two cars (one lorry and one landrover) through Austria, Switzerland, France, Algiers and finally through the Sahara desert. The whole expedition, including the journey took two months. We spent three weeks at the observing place.

In this note the polarization measurements carried out at the time of the Africa eclipse and some pictures of the corona of June 30, 1973 will be presented. Owing to the short time elapsed after our return and as a result of the time-consuming preparations for this consultation, there was no time to obtain preliminary results and an interpretation of the polarization measurements from the original photographs.

However, let us describe the experiments:

1. The first experiment was "Polarization of the corona in the white light". A 100/1000 telescope was constructed in the workshop of our Institute and was completed by a rotating polaroid from Meopta, Bratislava.

The purpose of the experiment was to obtain a set of pictures in three positions of the polaroid, differing in the direction of the plane of polarization by one hundred and twenty degrees. From such a set of pictures, taken with different exposures, it is possible to study the intensity, the degree and direction of polarization of the corona in different coronal structures and, probably, near the prominences.

We obtained 27 pictures on ORWO NP-27 cine-film. The exposure times were as follows:

1/250; 1/125; 1/60; 1/30; 1/15; 1/4; 1; 4; and 16 seconds. Three pictures were taken with each exposure time, one by one in each position of the polaroid. The day after the eclipse six exposures of the calibration scale were made, which were to be used for calibration in absolute units.

Let me now show you six copies of the original films. The first three are taken with an exposure of 1—250 sec and the last three are taken with an exposure of 1/4 sec. Please, note the different shape of the corona when the position of the polaroid is changed. (Only one of these pictures is presented in Figure 1.)

2. The second experiment was the "Polarization of the corona in emission line 5303 Å". This experiment was more complicated than the first one. Professor Mogilevskii of IZMIRAN suggested it should be carried out. A 100/1000 telescope was made in the Ondřejov Observatory workshop. A narrow-band filter with a 3 Å passband, equipped with a rotating $\lambda/2$ plate, was fixed to the eyepiece end of the telescope. There was a thermostat which kept the filter at a temperature of about 43 °C and in this way it was centred on the 5303 Å line. The filter was constructed and in an extremely short time assembled by Dr. Valníček.

The purpose of the experiment was to verify the values of the polarization, measured by Prof. Mogilevskii during previous eclipses (1957, 1970). If the values obtained by Prof. Mogilevskii showing a rather large degree of polarization in emission coronal lines are true, they could then not be explained by an excitation of coronal lines by thermal electrons, but it would be necessary to find some other mechanisms of radiation in the solar corona.

During the Africa eclipse five pictures were taken on ORWO NP-27 film with exposures of 30, 90, 90, 90, and 30 seconds. Between the three

longest exposures the position of $\lambda/2$ plate was changed successively by 120° like in the first experiment.

On the slides you can see three of the best pictures—30 sec ($\lambda/2$ plate in position 1), 90 sec

(position 2) and 90 sec (position 3). You note that the different shape of corona may be caused partially or fully by the movement of the Moon across the Sun (Fig. 2).

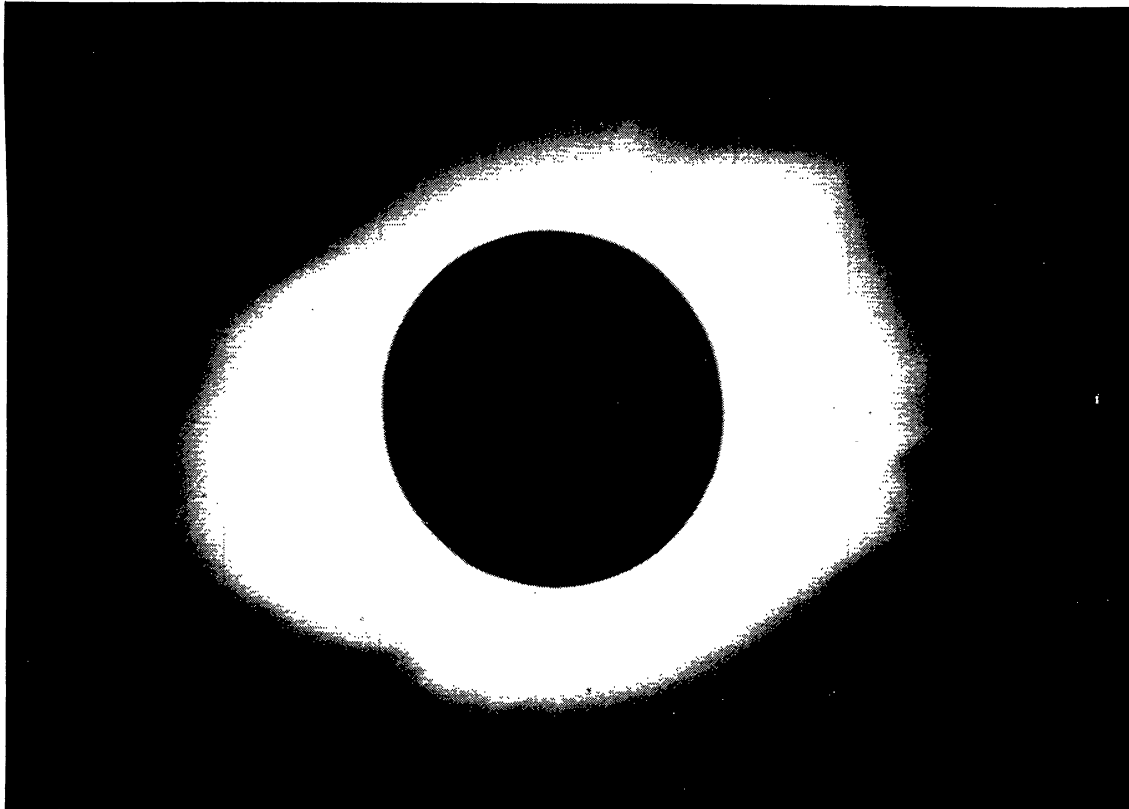


Fig. 1. White-light corona through the polarizing filter. 1 second exposure taken on Orwo NP-27 film at $11^{\text{h}} 45^{\text{m}} 56^{\text{s}}$ UT. North is above.

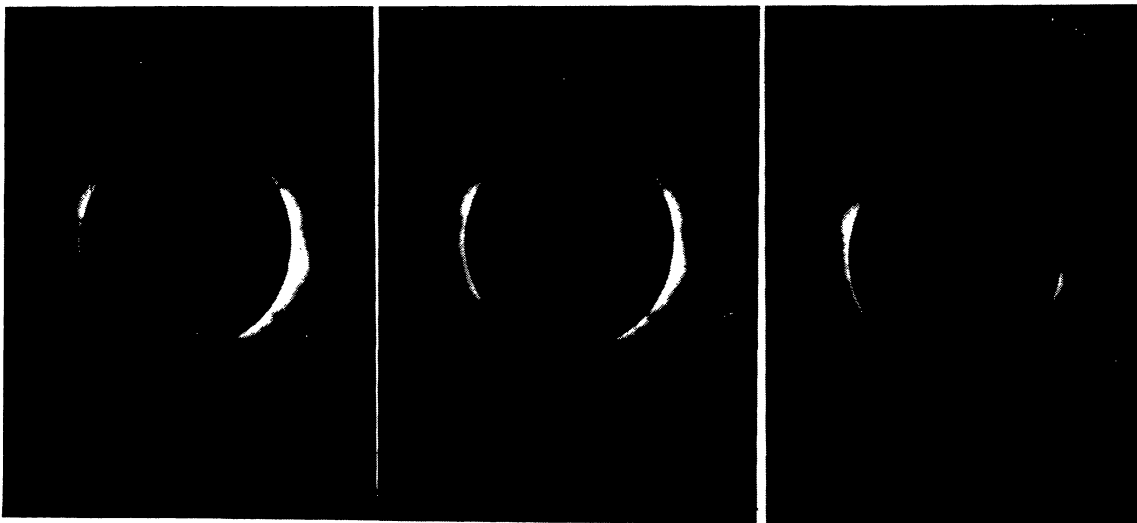


Fig. 2. Three pictures of the monochromatic corona (5303 Å) taken (from the right to the left) with exposures 30, 90 and 90 seconds on Orwo NP-27 film. $\lambda/2$ plate was changed successively by 120° . North is above.