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I. PHYSICS

Astrophysics (Solar Corona)

MULTICOLOUR PHOTOMETRY AND POLARIMETRY OF THE SOLAR CORONA

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EQUIPMENT AND PURPOSE

1. *Horizontal Camera, $f = 1.9$ m, $D = 12.5$ cm*

Main purpose of this camera is the measurement of coronal intensity distribution in a field of 4° diameter (upto 7.5 solar radii), with high spatial resolution (1″–2″) and in blue, green, red spectral regions. Using colour fimls (resolution 0.02 mm) a focal length of atleast 2 m is necessary and for a 4° field the film size becomes 18 × 24 cm. Because the dynamic range of the film (for high precision photometry) is only about 1 decade, a radial-gradient filter is used. The optics, a three lens apochromatic refractor objective, is sufficiently free from chromatic errors but as with all "thin" refractor objectives, astigmatism and field curvature restrict the field. In order to extend the field of high resolution by a factor 2, we use a field-flattening lens (plano-concave). The field-flattening lens was cemented to the radial-gradient filter and mounted movably in order to press the large film sheets into the focal plane during exposure. To our knowledge, this is the first time such a lens-filter combination has been used for coronal photography.

For calibration we used a small grating spectrograph fixed in front of the objective (the objective serving for camera lens of the spectrograph). So, during partial phase a solar spectrum was produced and photographed through a photometric wedge.

The camera was fed by a heliostat mirror (Zerodur ceramic glass) whose motion was controlled by a crystal oscillator.

Keywords : Multicolour Photometry; Polarimetry

2. *Horizontal Camera $f = 0.9$ m, $D = 11$ cm*

This camera, also fed by a heliostat mirror, was designed for conventional photometry without radial-gradient filter, 50 pictures, frame size 56 × 72 mm, were made on 70 mm film during partial and total phase (Kodak Plus-X Pan with yellow filter). The purpose of these pictures is absolute and relative calibration of coronal intensities, calculation of the coronal aureole from the measured scattering function and determination of sky brightness.

3. *Equatorially Mounted Camera, $f = 0.4$ m, $D = 4$ cm*

This camera is equipped with a polarizing filter in front of the objective lens. The transmission direction can be adjusted at 4 positions 45° apart. 70 mm Kodak Plus-X Pan film is used. 50 photographs (56 × 72 cm) were made through orange

filter during partial and total phase. From these photographs polarisation and intensity of the corona and the different scattered light components can be deduced.

4. *Photoelectric Photometer*

The instrument is designed to measure the total coronal intensity in a field upto 3 solar radii, with precision better than 1 per cent. The detector is a silicon photoelement sensitive from 400 nm–700 nm (IR is blocked by a filter). The instrument is used to measure the variation of coronal brightness during the solar cycle. The data can also be used for absolute calibration of coronal intensities.

Preliminary Results

All instruments performed well during the eclipse and weather conditions were excellent. With camera No. 1, photographs were made on colour reversal film (Agfachrome 50 S) and on black and white film (Ilford FP 4) through different filters. Spatial resolution is about 2″ and the scattered light level is low, so the features on the moon's disk can be seen through a hole in the radial-gradient filter. A lot of large and fine streamers are visible, the whole corona is striated. A detailed analysis of some of the most conspicuous structures is intended using also polarimetric data. Of special interest are the differences occurring in west equator region between our pictures and those made 2 hours earlier in Africa.

The colour photos are used to derive colour indices in the outer corona in order to investigate the nature of diffuse enhancements (Koutchmy, 1972; and Ajmanov & Nikolsky, 1980). Some of our pictures are already reproduced (Dürst & Zelenka, 1980; and Dürst, 1980) but quantitative results are not available at present.

Location

Yellapur (Karnataka).

Participants

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Credit

Swiss National Science Foundation.

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