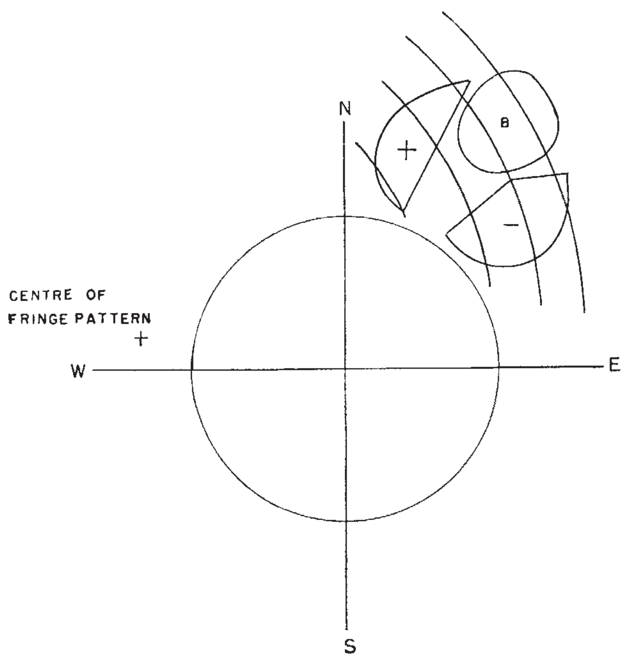

Fig. 1. Position of principal wavelength shifts and broadening of the 5303 Å line, and position of the fringe pattern. The region indicated by + has the line shifted toward longer wavelength and the region indicated by − the opposite. Region B corresponds to a decrease of intensity and a broadening of the line.

0·8 and 1·1 Å and that the intensity distribution was definitely unequal, with large intensities in the southern hemisphere and in an active area which extended up to 1·8 solar radii toward the north-east. This active area corresponds to the prominence and the strong arches and fan rays observed in this region[2], and seems of particular interest because of the large variations of width and the wavelength shifts associated with it. These variations seem to be restricted to definite localities corresponding to the arches in the white corona (Fig. 1).

The connexion between the prominences, the coronal streamers and the emission corona has long been believed to determine the structure of the corona[3]. Our preliminary results, as shown in Fig. 1, would reinforce this suggestion because they indicate a cooler fan system slowly rotating around a hotter and less dense plasma. We are studying the possibility of relating the wavelength shifts to the broadening of the line. Such a relationship could show a correlation between motion in the corona and the temperature and perhaps give a clue to the heating mechanism.

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[2] Photograph by Baumgardner, J., *Sky and Telescope*, **39**, 308 (May 1970).
[3] Van de Hulst, H. C., *The Sun* (edit. by Kuiper, G. P.), (Univ. Chicago Press, 1953).

The Outer Corona at the Eclipse of March 7, 1970

Light from the vicinity of the corona at total solar eclipses may come from five possible sources: (1) the E-corona of emission lines; (2) the K-corona, a partially polarized continuum scattered by free coronal electrons; (3) the F-corona, whose Fraunhofer spectrum is usually regarded as the central part of the zodiacal light-radiation scattered by interplanetary dust; (4) superposed light from the sky, ordinarily caused by multiple scattering from distant regions in partial eclipse; (5) scattered light within the instrument superposed on the final image.

Models of the solar corona depend markedly on the evaluation of the relative contributions from sources (3), (4) and (5). The most widely accepted model of the corona is that proposed by Van de Hulst[1] and updated by Blackwell and Petford[2], for which the intensity of the F-corona exceeds that of the K-corona beyond radii, measured from the centre of the Sun, exceeding about 2·2 for sunspot maximum. Preliminary results from our expedition to Miahuatlan, Oaxaca, Mexico, indicate that the K-corona may be dominant at much greater distances from the Sun than had been thought previously.

To separate the F- and K-coronas we carried out four kinds of experiments, from which data are now being reduced. First, a new spectrograph designed by J. G. Baker registered the coronal spectrum from 3500 to 6000 Å. Second, four television cameras recording on videotape scanned the corona over a field of 5 × 7 solar diameters, with rotating polaroids and different neutral and coloured filters, an experiment designed by W. W. Salisbury and D. L. Fernald. Third, we photographed the coronal polarization. Fourth, we photographed the corona with a variety of different lenses, as in Fig. 1.

During the eclipse the sky was exceptionally clear and Rayleigh blue to the edge of the solar disk. This condition was particularly favourable for observing the corona. To the naked eye, the corona appeared stellated, with long streamers plainly visible to four or five solar diameters. These structures would ordinarily have been obscured if any haze had been present. They also showed clearly on long-exposure calibrated photographs. Two of them, located at position angles 12° and 94°, extended

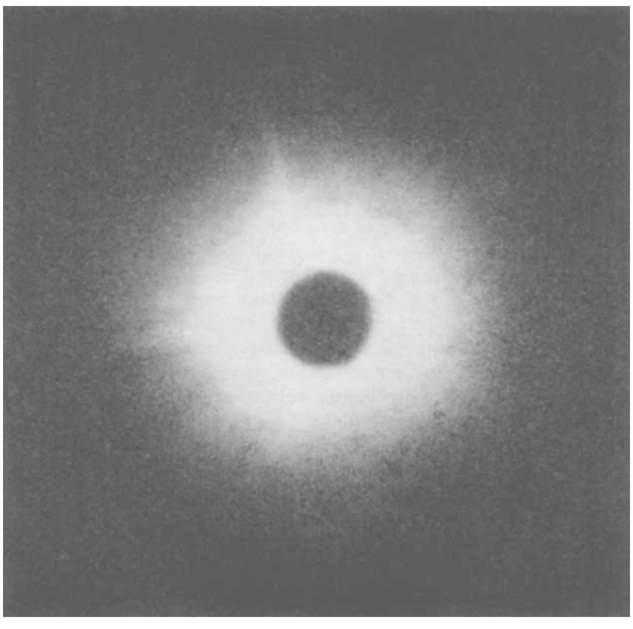

Fig. 1. Our calibrated photographs of the outer corona show streamers extending beyond 10 solar radii. This print, which shows more structure in the medium corona, is one of a series with stepped exposures.

out to at least 10 solar radii from the limb. They were long and straight, apparently unaffected by the curvature that solar rotation might induce. They also exhibited strong polarization.

Because the F-corona should be symmetrical around the limb, structureless and unpolarized, the character of these streamers and many other shorter rays indicates that they comprise the K-corona. Their polarization also supports this conclusion.

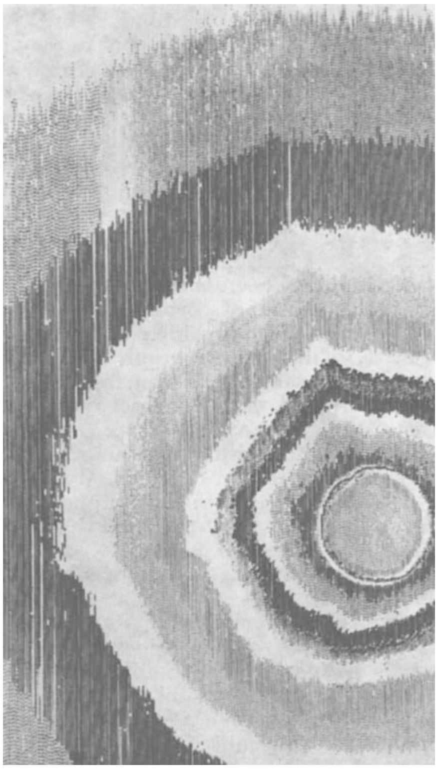

Fig. 2. Preliminary isophotes for the eclipse of March 7, 1970. Each change in the output of the isodensitracer—dashes to dots, dots to blank, and so on—corresponds to a change of 0·2 in photographic density.

Preliminary photometry of the records indicates that the streamers, however prominent they may seem to the eye, represent only slight increases of photographic density. Although the isophotes are not at all circular on Fig. 2 out to at least four radii, the streamers show up only as slight projections. This result indicates that they decrease in intensity away from the Sun at approximately the same rate as the overall coronal radiation. According to theory, the F-corona should decrease more slowly than the K-corona, so we conclude that inner zodiacal light does not contribute appreciably to the corona out to distances of at least 10 solar radii. As for ground-based observations of the Fraunhofer spectrum of the outer corona reported for previous eclipses, we suggest that it may well derive from cause (4): superposed skylight. To test this point, the slit of our spectrograph was long enough to cross the entire solar disk, so that any sky spectrum from the Moon's silhouette could be used for calibration.

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Variations in Line Profiles from Photosphere to Chromosphere

WE observed from Miahuatlan (Oaxaca), Mexico, near the centre line of totality. A high-resolution Littrow-type grating spectrograph, fed by a coelostat and an objective lens (25 cm, 340 cm), was provided at second contact with a slit 12 μm wide, slanting through the last crescent of the solar photosphere and the chromosphere. The slit was removed before third contact.

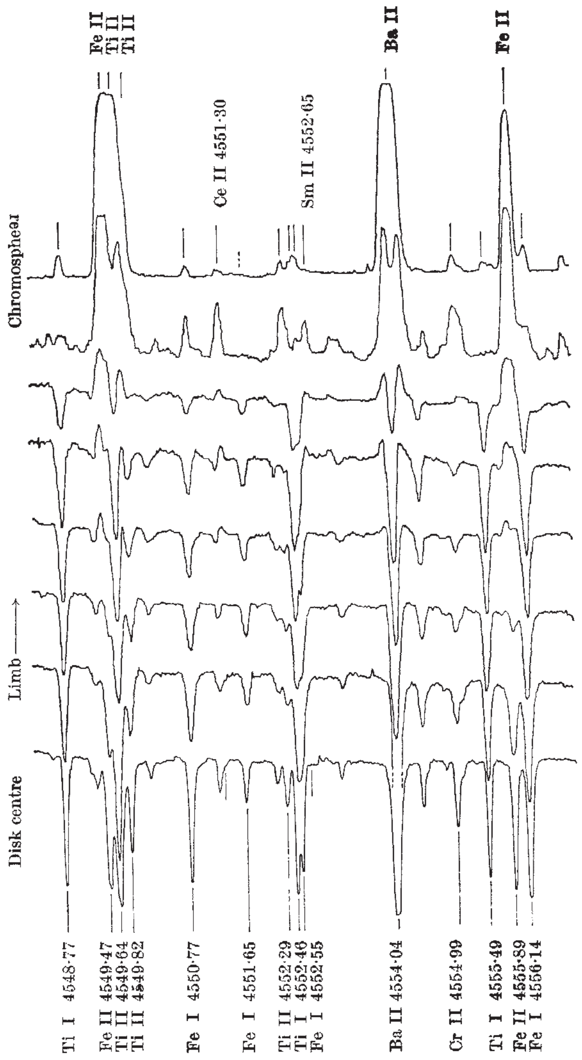

Fig. 1. Variation of spectral lines around 4550 Å from photospheric absorption lines to chromospheric emission lines.