THERMAL AND DENSITY STRUCTURE OF THE INNER CORONA OBSERVED AT THE 1991 TOTAL SOLAR ECLIPSE

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Abstract

We observed the total solar eclipse on 11 July,1991 with the multi-channel telescope at Lapaz,Mexico, and successfully obtained high-resolution pictures of the innermost corona at the wavelength shown in Table 1. This is a brief summary of preliminary results obtained from the photometric mesurement of the photographic pictures and their image processing.

1. Introduction

Kwasan and Hida Observatory team (three of the authers but A.T.) successfully observed the total solar eclipse of 11 July,1991 with multi-channel telescope at Lapaz,Baja California Sur,Mexico. Our primary purpose was to get high-resolution images of inner corona at the wavelengths of coronal emission lines and continuum shown in Table 1. Details of the obsevation and the data reduction are fully described in the priveous papers (Kurokawa *et al.* 1992, Takeda 1993).

Table 1. Lines and continuum in which photographic images were ontained.

wavelength (nm)	ion or atom	temperature (K)	passband (nm)	notes
637.4	FeX	1.0×10^6	0.30	red line
530.3	FeXIV	2.0×10^6	0.30	green line
569.4	CaXV	3.5×10^6	0.34	yellow line
656.3	HI	1.0×10^4	0.25	Hα line
610.0	—	—	6.1	continuum

There have been published several observational works on the temperature structure of the coronal loops. Some authors proposed that hot coronal loops have cool cores (Foukal 1975, Hanaoka *et al.* 1988), but others denied such coaxial models (Cheng *et al.* 1980, Dere 1982). Our high-resolution images obtained at the eclipse enables us to compare the positions of the loops seen in different emission lines of different ionization tempratures more precisely than any other previous observations.

We made detailed photometric measurements of the high-resolution images, and estimated the electron densities of fine coronal loops observed in the green and the red lines.

2. Results

The global structures of the continuum corona are similar to those seen in green line as reported by the previous observation (Hanaoka *et al.* 1988). There are few counterparts found in the continuum corona, however, corresponding to many fine loops seen in the green line and the red line. (see Fig. 1 and Fig. 2)

Various types of fine loops and streamers are seen in the red line above the both limbs. They are slender than any other coronal loops of 10^6K published before. The loops seen in the green line are generally broader or diffuser than the red line loops. This result is also consistent with that obtained from our 1980 eclipse obsevation (Hanaoka *et al.* 1988).

The shapes of some red line loops and the green line loops are similar to each other, but their positions are different, or they are not coaxial in most cases. We show such spatial relations between the red line and the green line loops by carefully overlaying them in Fig. 1 and Fig. 2.

The general appearance of the yellow line corona is quite similar to the continuum images. This means that the brightness of yellow line pictures is, in most parts, attributed to the continuum intensitiy which is transmitted through the 0.34nm pass band of yellow line filter. Carefully substracting the continuum intensity from the yellow line images, we detected no substantial emission of yellow line except in one region on the east-south limb. This means that there existed no abnormaly hot region except one region on the both limbs during the eclipse time.

We picked up a few regions which contain the green and the red line loops of similar shape, and estimated their electron densities. We measured the surface brightness and diameter of the loops, and used Mason's(1975) table for the line emissivity, in which the temperature of 1×10^6K and 2×10^6K were assumed for the red and the green line loops, respectively. The caluclated values of the densities range from 3×10^8 to $9 \times 10^9 cm^{-3}$ for the green line loops and from 1×10^9 to $6 \times 10^9 cm^{-3}$ for the red line loops. Futher studies of more loops are in progress, and the full description on this work will be given elsewhere.

References

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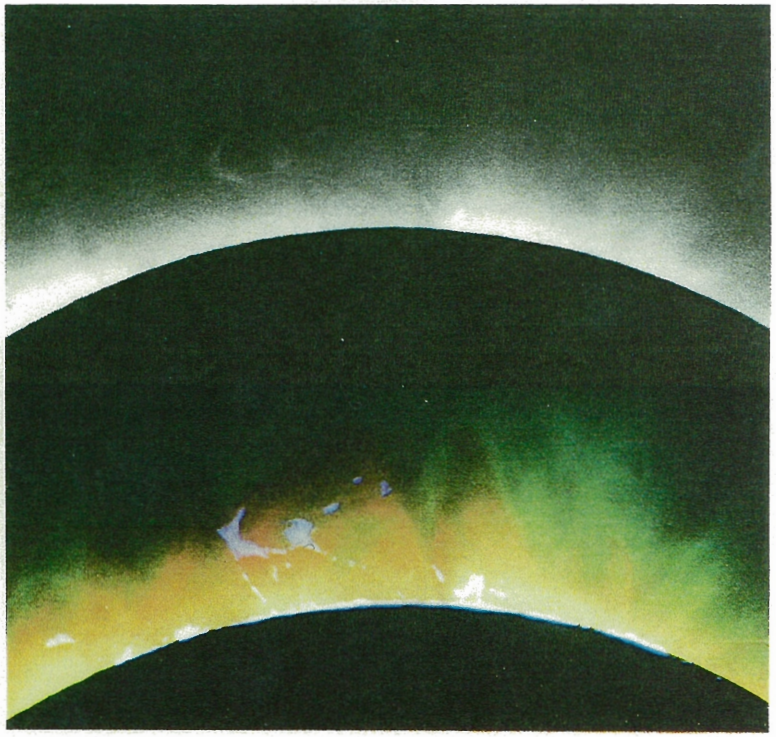
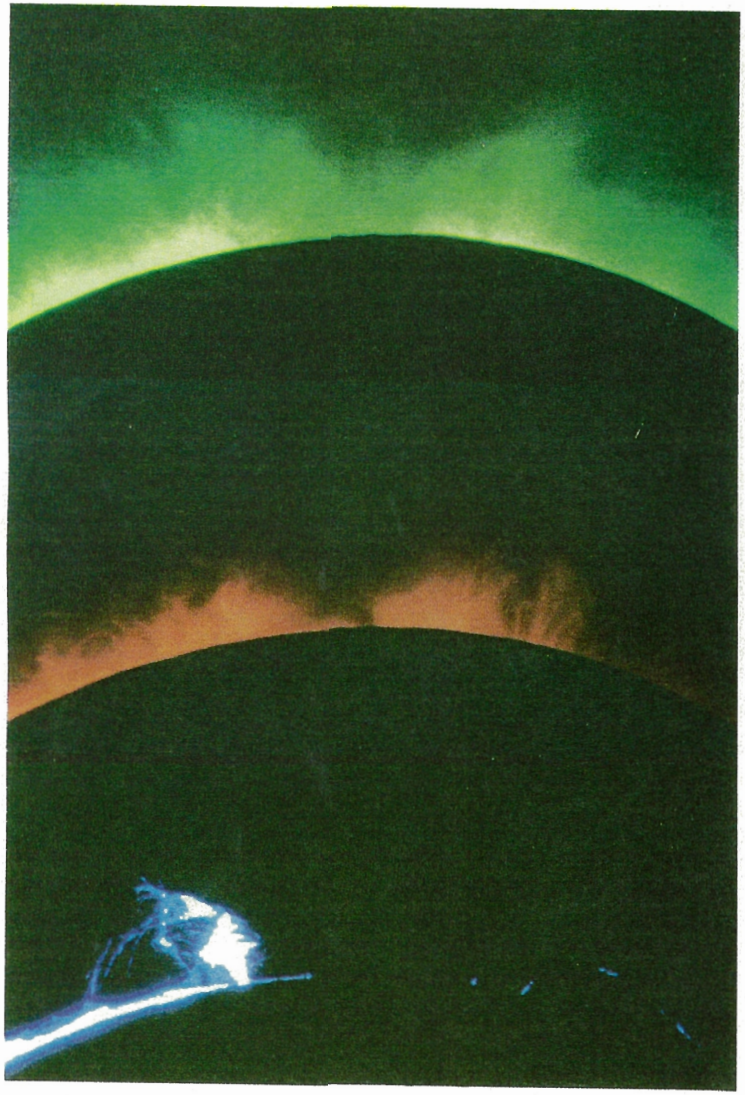


Fig. 1. Fine structures of the inner corona seen on the **east** limb(Jul.11,1991).

Left column :		/	Right column :	
top	: the green line image	/	top	: a continuum image
middle	: the red line image	/	bottom	: an overlay image of the green
bottom	: the Hα line image	/		line(green), the red line(red),
		/		and Hα line(blue) images



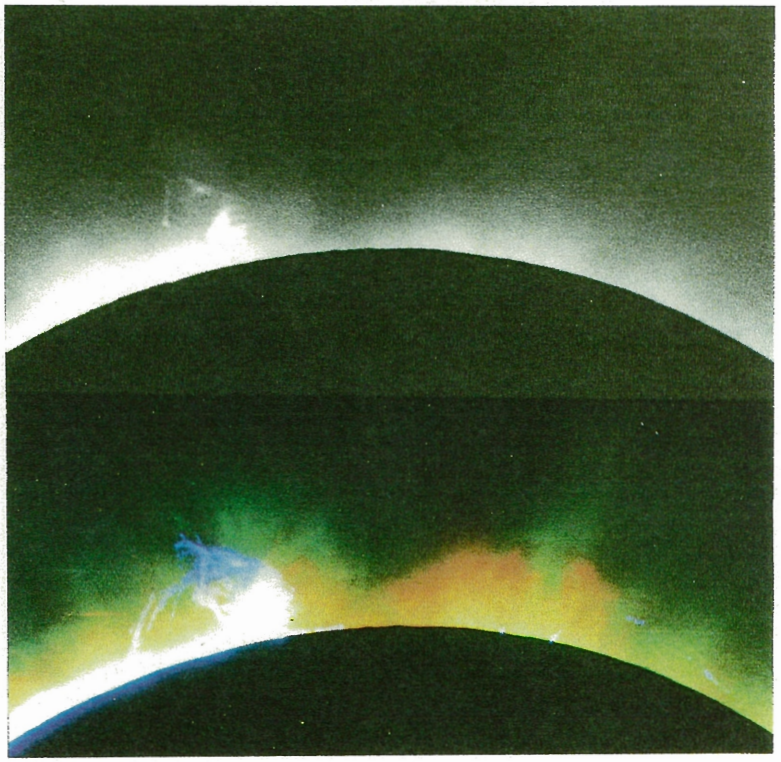


Fig. 2. Fine structures of the inner corona seen on the west limb(Jul.11,1991).

Left column :		/	Right column :	
top	: the green line image	/	top	: a continuum image
middle	: the red line image	/	bottom	: an overlay image of the green
bottom	: the Hα line image	/		line(green), the the red (red),
		/		and Hα line(blue) images