

Narrow Band Photometry in Emission Lines during the Total Solar Eclipse of October 24, 1995

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Abstract

To investigate the spatial variation of temperature and density within coronal structures, narrow band photometry in three coronal emission lines was done during this eclipse. The emission lines 6374 (FeX), 7892 (Fe XI) and 5303Å (Fe XIV) represented temperatures in the Å range of 1-2 million degrees. Peltier cooled CCD camera was used to record the coronal images through 5Å passband interference filters with pixel resolution of 11 arcsec.

Key Words : Narrow band photometry, Emission lines, Electron density, Coronal structure.

Introduction

Estimates of electron densities and temperature are essential for understanding the energy balance of the coronal plasma. High spatial resolution pictures of solar corona obtained during eclipses yield fine details of coronal structures and coronal pictures in different lines may show different fine structure. (Ichimoto *et al.*, 1995). Radiations in different lines from different regions in the solar corona along the line of sight may result in such coronal pictures. But low spatial resolution pictures may show similar gross structures in the solar corona. Therefore, in the low resolution pictures intensity ratios of emission lines at various locations are likely to give information about temperature and electron density (Waldmeier, 1954, Trellis, 1957). The comparison of these quantities in the 'open' and 'closed' field structures will help in making realistic modelling of coronal structures. With this view narrow band photometry of solar corona was performed in three emission lines during this eclipse.

Observations

A two mirror coelostat was used to direct the Sun/coronal light to an objective of 75 mm aperture and 40 cm focal length. A rotating wheel capable of holding six filters was mounted

in front of the objective. It could be driven by a stepper motor or manually. A spring loaded ball made sure the location of filter at the centre of the objective. Three narrow band filters of pass band centred at 6375, 7892 and 5304Å and each of ~5Å band width and a broad band filter of 50Å pass band and centred at 7000Å were mounted on the rotating filter wheel. Provision was made to introduce neutral density filter in the light beam to obtain the calibration pictures through different filters. The solar and coronal pictures were recorded using peltier cooled CCD camera from Astromed. 22-micron pixel size provided a spatial resolution of 22 arcsec². 8.4 x 12.6 mm² size CCD chip permitted recording of the solar corona upto 2 in one and 3 solar radii in the perpendicular direction. The observations made before, during and after the eclipse. The coronal pictures in FeX and FeXI obtained during the eclipse are shown in Figures 1 and 2.

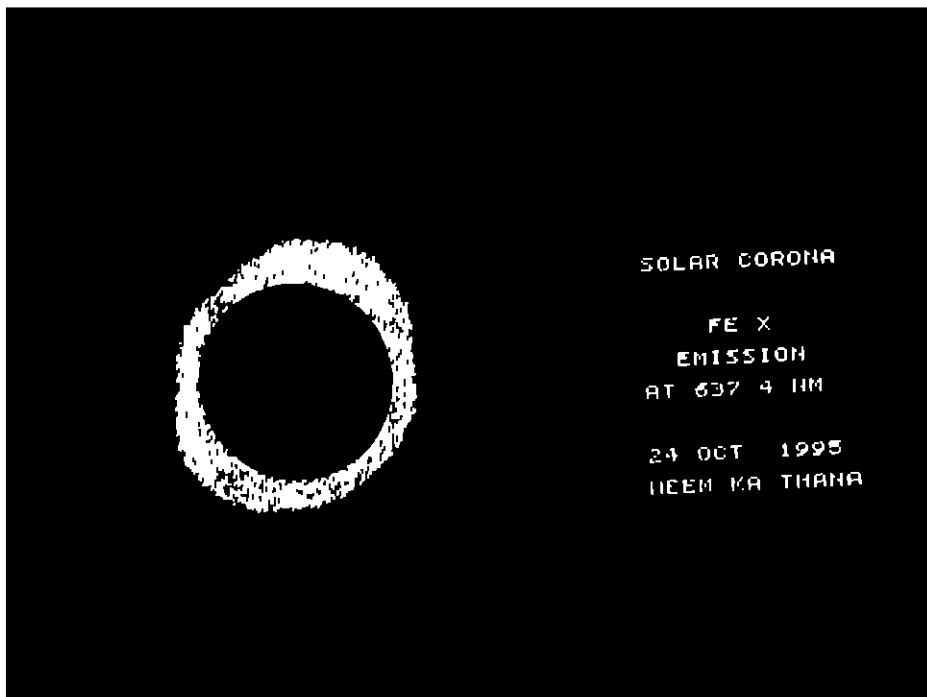


Figure 1 : Picture of solar coronas in FeX (6374Å) emission line obtained during the total solar eclipses of October 24, 1995 at Nim Ka Thana.



Figure 2 : Picture of solar corona in FeXI (7892Å) emission line obtained during the total solar eclipse of October 24, 1995.

The coronal emission lines which had been selected for narrow band photometry are 6374Å (FeX), 7892Å (FeXI) and 5303Å (FeXIV). The coronal ions corresponding to these lines are dominant emitters at temperature of 1.0×10^6 , 1.2×10^6 and 1.2×10^6 k respectively. Since these emission lines cover a considerable temperature range, the various line intensity ratios would enable us to determine temperatures, electron densities and relative abundances of ions within the coronal structures.

The data are being analysed to obtain the line intensities by subtracting the contribution due to continuum.

References

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