

Search for Hydrogen-alpha Emitting Cool Pockets in Corona During the Total Solar Eclipse of October 24, 1995

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Abstract

Narrow pass band hydrogen alpha filtergrams were obtained during totality at Kalpi, to look for cool pockets of H-alpha emission in corona first observed by Bappu and Bhattacharyya during the 1970 Mexican eclipse observations. A 1k Xik liquid cooled CCD camera was used to record the corona using 2 cm solar image. No evidence of any H-alpha emitting pockets was found in the observed part of the Corona.

Key Words : Solar corona, H-alpha emission, Cool pockets in corona

1. Introduction

Bappu *et al.* (1972) reported the observation of H-alpha emission line in the spectrum of corona obtained during the 1970 Mexican total solar eclipse and they ascribed it to possible existence of cool columns in outer corona. Since then there have been several attempts during total solar eclipses to search for such cool pockets. These efforts, mostly using photographic methods, have been inconclusive.

Recently Yokoyama and Shibata (1995), in their magnetohydrodynamic simulations of reconnection processes in solar corona, showed that X-ray jets and H-alpha surges can be ejected simultaneously from microflares. The cool H-alpha surges or pockets can be accelerated to outer corona without heating them in the process. They suggested therefore that it would be interesting for future observations to search for H-alpha emitting cool islands in the solar corona. This is important for understanding the magnetic reconnection processes in coronal activity.

During the total solar eclipse of 24 October 1995, we obtained high spatial resolution filtergrams in H-alpha to look for these cool emission pockets. The details of observation, the reduction process and the results obtained are discussed below.

2. Observation and results

A 20cm coelostat and a 15 cm objective providing an $f/15$ beam were used to obtain a 2cm image of the Sun. A 0.75 Å passband Daystar H-alpha filter was used close to the focal plane with a liquid cooled Photometrix 1024 x 1024 pixel CCD camera to record the images. The size of CCD chip was capable of recording the solar corona only upto $1.2 R_{\odot}$ if used on optical axis of the image. Therefore, an arrangement was made to move quickly the CCD camera to a predetermined position and locate the camera to record a part of corona upto $2 R_{\odot}$ from the centre of the solar disk. ND filters were used while recording the calibration images of the Sun.

In order to cover a maximum extent of the corona and to optimise on the exposure, two exposures covering solar position angle of about 110° each in N-W and N-E portions of corona were taken. Since the readout time was 7 sec and the expected duration of totality was 52 sec, 22 sec exposure each was planned. It however turned out that the actual duration of the totality was about 48 sec only (Bagare et al., 1997). One of our frames covering more of the equatorial region was thus much over exposed by the diamond ring.

The frame covering North-Eastern region was recorded with an extent of about 90° position angle unaffected by the excess light entering one extreme end of the frame. We obtained isophotes of this region using NOAO/IRAF image processing package and found that there were two tiny regions of emission just above the limb, each about 50,000 km in extent. As could be expected from their close proximity to the solar limb, these are locations where prominences can be seen in the broad band pictures obtained from Nim ka Thana, (Bagare et al. 1997).

We therefore conclude that in the North Eastern about 90° portion of the outer corona on 24 October 1995, evidence for any H-alpha emitting cool pockets is not there.

References

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