

A study of Inner Solar Corona during Total Solar Eclipse of October 24, 1995

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Abstract

To study the inner corona during the total solar eclipse of October 24, 1995, an experiment was setup at Kalpi, the second location of the two IIA camps. Continuous broad band record at regular interval at 40ms (TV rate) using EEV P46580 CCD camera have been obtained from the beginning to the end of the eclipse with special emphasis on the totality period. The angular resolution corresponding to each pixel is 23 sec. of aro. The images were recorded with 8 bit resolution in terms of intensity. High quality data have been obtained upto 1.25R without any saturation in the inner region. The data are being analysed for two dimensional intensity maps in the regions of the inner corona and their variations with time. The study will also confirm the existence of oscillations in these regions and may be able to elaborate on their behaviour. The preliminary results of our analysis are presented.

Key Words : Total solar eclipse, Intensity oscillations, High frequency photometry

Introduction

An experiment to study the intensity variations in the inner corona was setup at Kalpi, a village near Kanpur in Uttar Pradesh, during the total solar eclipse of October 24, 1995. The details of the experiment and the preliminary results are presented in this paper.

Instrumentation

A siderostat of 12 inch aperture was used to collect the light from the Sun and reflected horizontally. The beam was splitted into two directions using an aluminized 6 inch prism. An aperture stop was used to allow a beam of 3 inch diameter. A 200mm focus zoom lens was used to image the Sun onto the CCD chip. We have used an uncooled Photon EEV CCD camera P46580. The photon asynchronous camera was operated in the standard video mode giving a 40ms exposure time. The pixel size is $15 \times 22.5 \mu\text{m}$ with an imaging area of 8.7×6.5

mm. Each pixel corresponds to 15×23 secs of arc of the solar image. The entire event was recorded on a good quality VHS video tape.

Analysis

The recorded VHS images were digitized using DT 2851 frame grabber card at a period of 1 second from SONY EVO-9800 P Hi8 VCR. Altogether 46 frames were digitized and the data correspond to 46 seconds of totality. The analysis was carried out as follows.

1. The solar images were fitted to a circle by choosing 8 points on the solar image. By doing this, the centre of the solar disc was defined precisely. It is found that the drift in the centre from all the images is about ± 1 pixel. This ensures that all frames have same centre for the purpose of analysis. Figure 1 shows the contour plots of the intensity at the inner corona.

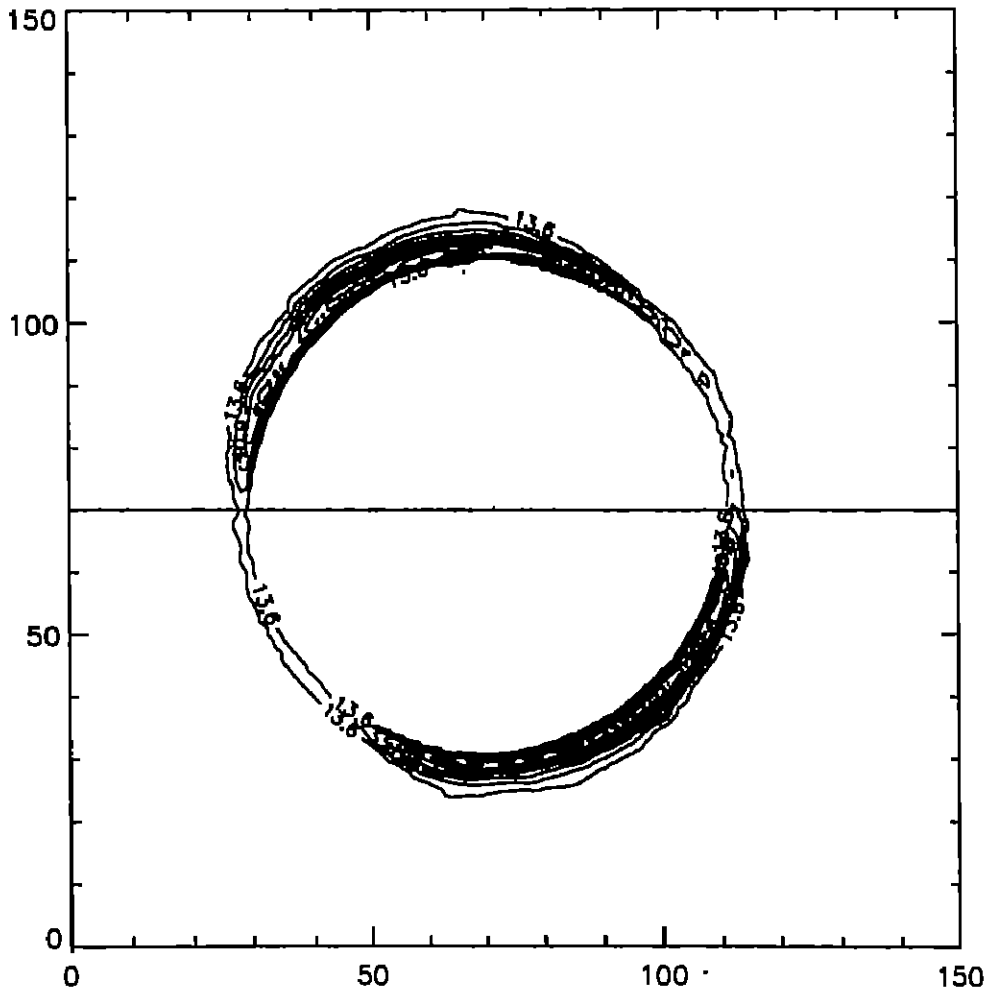


Figure 1 : Intensity contour plot.

2. Using IDL software, the intensity profiles at different r and θ were plotted. The intensity profiles (Fig. 2) at different angular positions of the solar disc have been drawn at 1.1R.

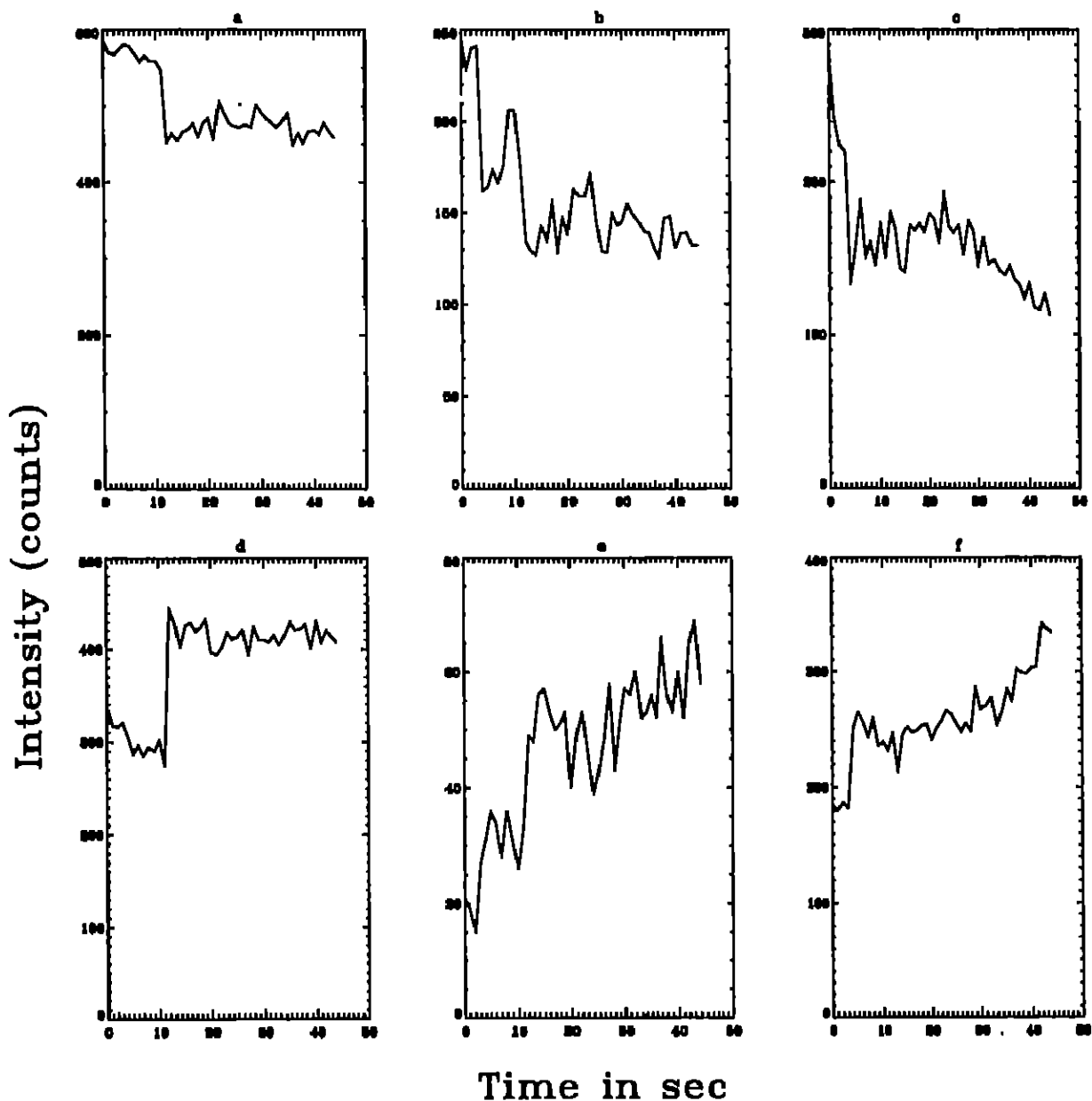


Figure 2 : Plot of the intensity variations during totality period. The curves for different angular positions. a, b, c correspond to positions at 83, 123 and 173 respectively with respect to the horizontal axis of the Figure 1 and d, e and f correspond to 180 opposite to a, b and c.

Conclusions

The intensity profiles at different angular positions were Fourier transformed to find out the period of oscillations at that particular radial distance. Though, indications of such oscillations are seen from the data, a rigorous analysis taken with shorter intervals may reveal an interesting phenomena. The plots in Fig. 2 show the intensity plots at different angular positions. The frequency spectra of these profiles are also given in Fig. 3a & 3b.

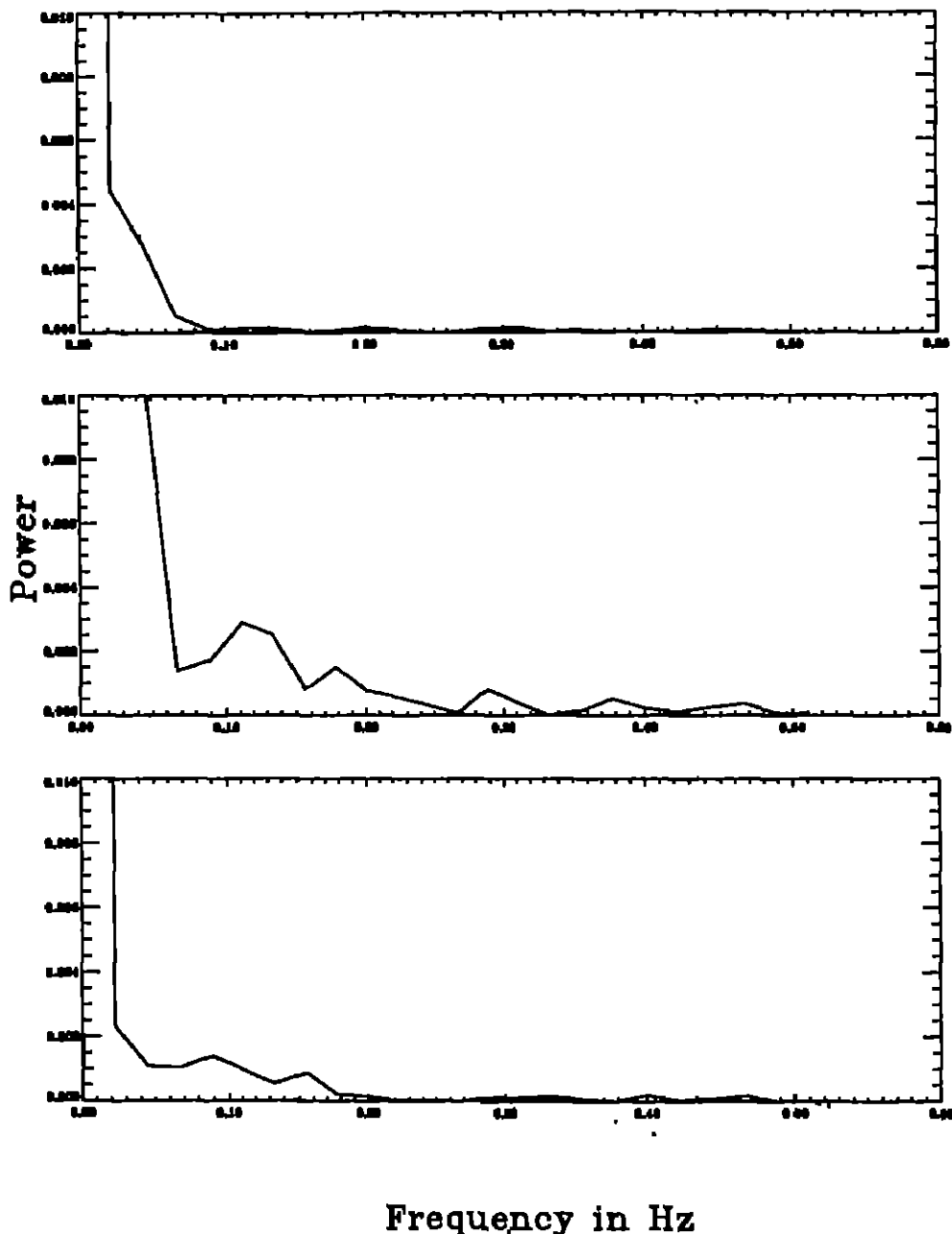


Figure 3a : Frequency plots for the intensity plots in Figure 2 using Fast Fourier Transform.

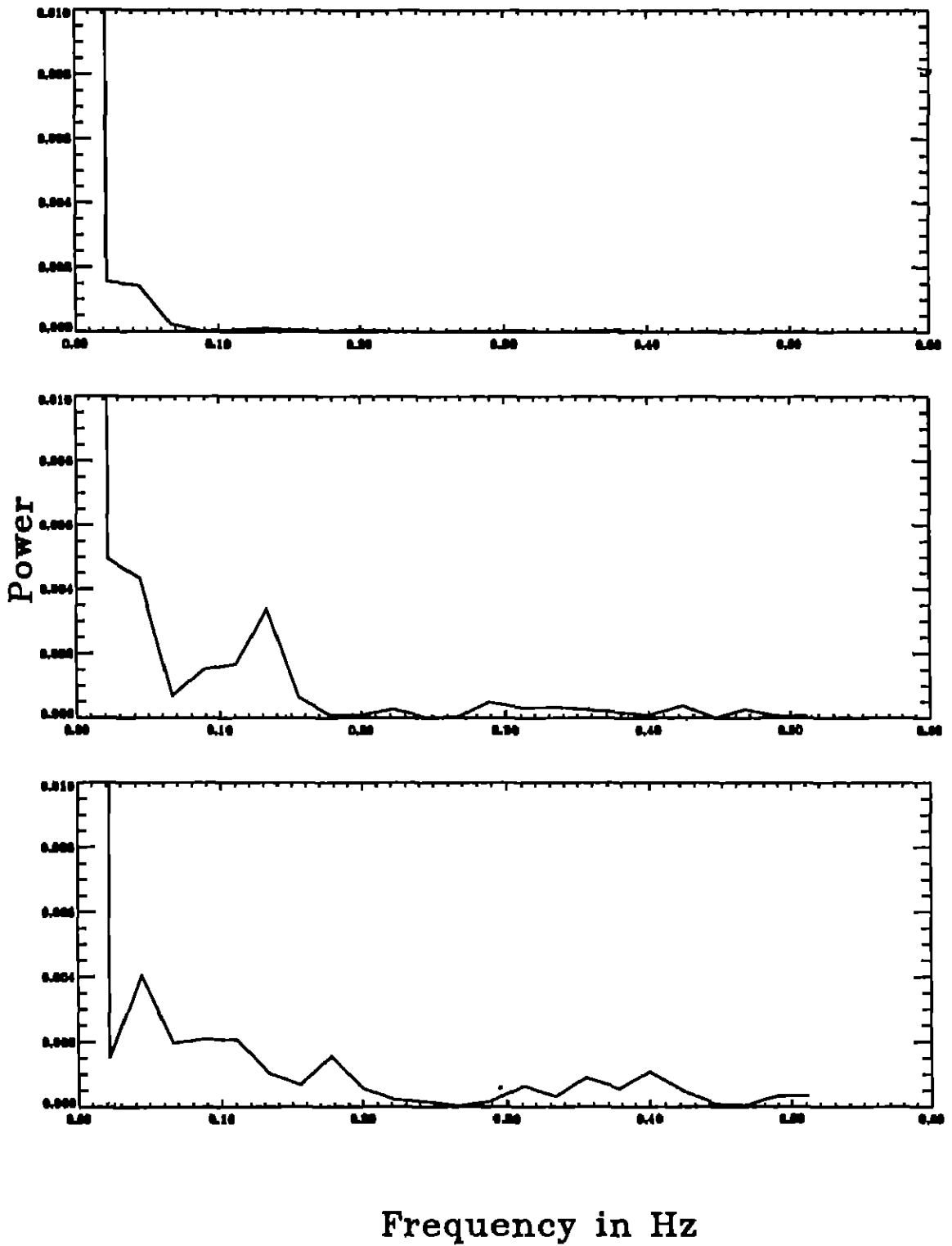


Figure 3b : Frequency plots for the intensity plots in Figure 2 using Fast Fourier Transform.

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