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Photo-electric observations of shadow bands during 1995 total solar eclipse from Neem ka thana (India)

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During total solar eclipse of October 24, 1995 an experiment was conducted to record the light fluctuations associated with shadow bands on magnetic tape using twin photo detectors separated on a fixed arm. The output of each detector was converted into frequency having frequency deviation of 600 Hz/lux, by frequency modulation technique and recorded on two separate I & II channels respectively of a Hi-Fi tape recorder on a low noise chromium tape.

For obtaining the desired output record, the frequency modulated tape output of each channel was demodulated by frequency to voltage converter and plotted against time on a X-Y recorder as shown in Fig. 1a, b. It is observed that the light intensity variations associated with shadow bands (Y axis) occur for less than a minute duration before and after the totality. Fig. 1(a) shows that intensity fluctuates below the mean level with certain periodicity for about 45 seconds before the totality. Interestingly after such initial fluctuations of light intensity there is a significant increase in the intensity above the mean level attributing to a major peak A followed by a dip A'. Similar phenomenon is also recorded after the totality and also in channel II. It is further observed that the ratio of peak amplitude of A above the mean level to the total (i.e. A to A') amplitude variation is less than 37%. Therefore peak A appears to be a part of a diffraction pattern associated with a point source formed by the edge of the Sun's disk and occulting Moon immediately before and after the totality.

The power spectrum is obtained for light intensity variation of channel I. The observations of power spectrum (Fig.2) shows a significant power appearing at frequencies of 0.0388, 0.1553 and 0.3107 Hz thus giving the periodicities for intensity variation in shadow bands of about 25, 6.4 and 3.21 sec. respectively. The remaining peaks are neglected due to their low power. Interesting frequency of 0.3107 Hz appears to be the second harmonic of 0.1553 Hz.

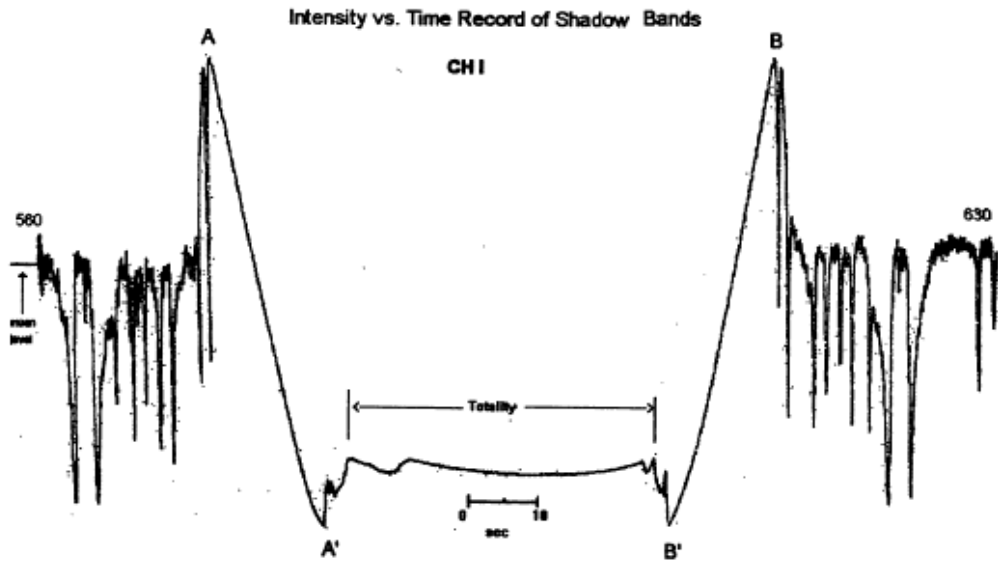


Figure 1(a)

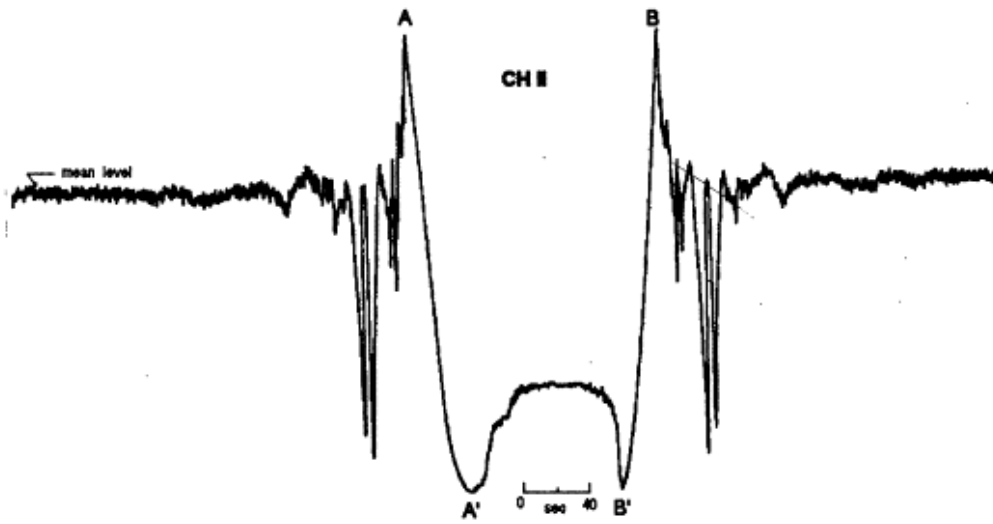


Figure 1(b)

Power Spectrum for 70 % Lag

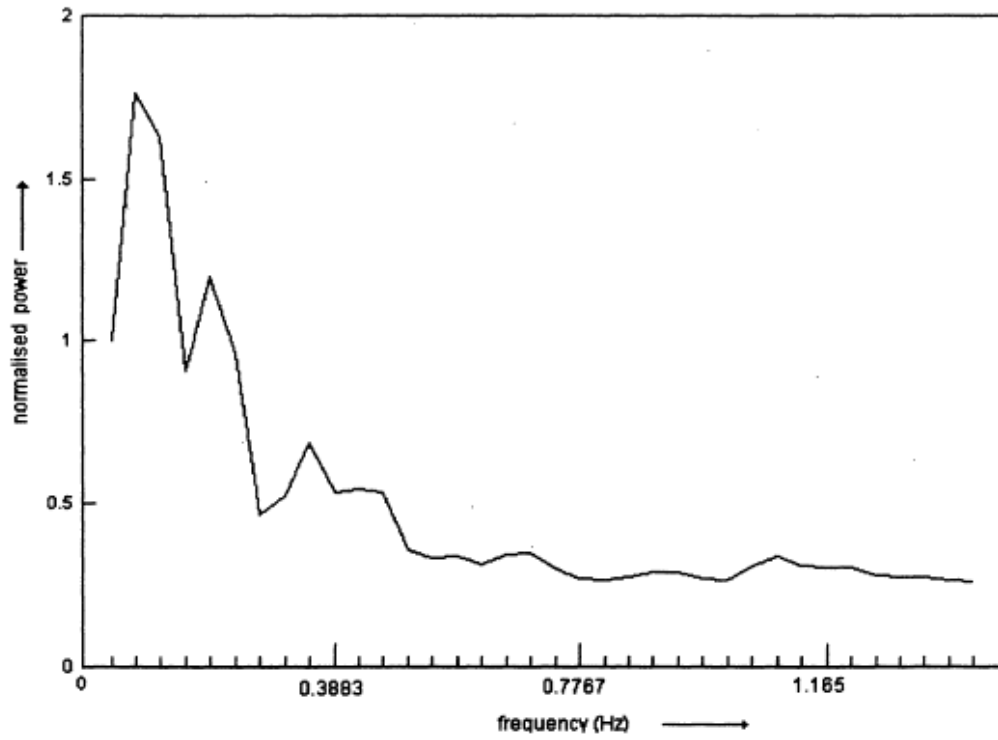


Figure 2.