Kodaikanal Obs. Bull. (1997) 13, 147-149

Radio spectrograph observations of the recent solar eclipse on October 24, 1995

A. Shanmugaraju, S. Umapathy
School of Physics, Madurai Kamaraj University, Madurai 625 021, India

Abstract

A solar radio spectrograph has been developed to observe the transient solar radio emissions in the band of 30 MHz - 80 MHz at our School of Physics. A non trackable log periodic antenna having beam width of 60° in E-W and 90° in N-S is being used. Solar radio flux measurements are being made in the frequency range of 30-80 MHz. The recent solar eclipse of October 24, 1995 was observed with maximum obstruction of sun's disc by moon to the tune of 40% using the above radio spectrograph. The initial results have been reported in this paper.

Key Words : Solar eclipse, Radio spectrograph.

1. Introduction

A low cost solar radio spectrograph (Shanmugaraju and Umapathy, 1996)operating in the frequency range of 30 - 80 MHz has been constructed at the School of Physics, Madurai Kamaraj University. It consists of a wide band log periodic antenna (LPA) to observe the transient radio emissions, a double stage super heterodyne receiver to process the RF signals, a controlling system to control the sweeping frequency synthesizer and a high speed data acquisition system to acquire the data from the receiver. Our spectrograph is one of the few instruments to study the radio emissions from the Sun in India. It is located at Madurai Kamaraj University, Madurai (Lat : 9° 55' N, Long : 78° 07' E).

On October 24, 1995 the spectrograph was used for observing the radio emission from the Sun in the frequency range of 30 - 80 MHz. Radio observations at metre and decametre wavelengths during the eclipse enable us to measure the size of the corona and to locate bright features of radio emission in the corona using radio telescopes of low spatial resolution (Castelli and Aarons, 1965). The eclipse was observed at Madurai with a maximum magnitude of 0.574 and an obscuration of nearly 40% using a non trackable log periodic antenna (LPA),

specially designed for the Gouribindanur Radio Heliograph. The wide beamwidth of a single LPA allows us to observe the sun for a minimum of four hours without tracking.

2. Observations

In Madurai, the partial eclipse started in the morning at 02:07:07:49 UT and ended at 04:25:04 UT with a maximum phase at 03:12:02 UT. The single log periodic antenna was titled towards east to get maximum response during the maximum phase. The observations were started before the first contact at 01:07 UT and continued upto 06:45 UT. The observations were made by sweeping the local oscillator from 125 - 175 MHz (i.e. RF = 30 - 80 MHz) in steps of 1 MHz with a sampling time of one sec. The radio emission of the Sun was recorded in total power mode in the frequency range of 30 - 80 MHz throughout the observation. The solar radio emission was also observed on the days preceding and following the eclipse day for comparison. Noise in the data was reduced by averaging the data for 3 minutes.

3. Results and Discussions

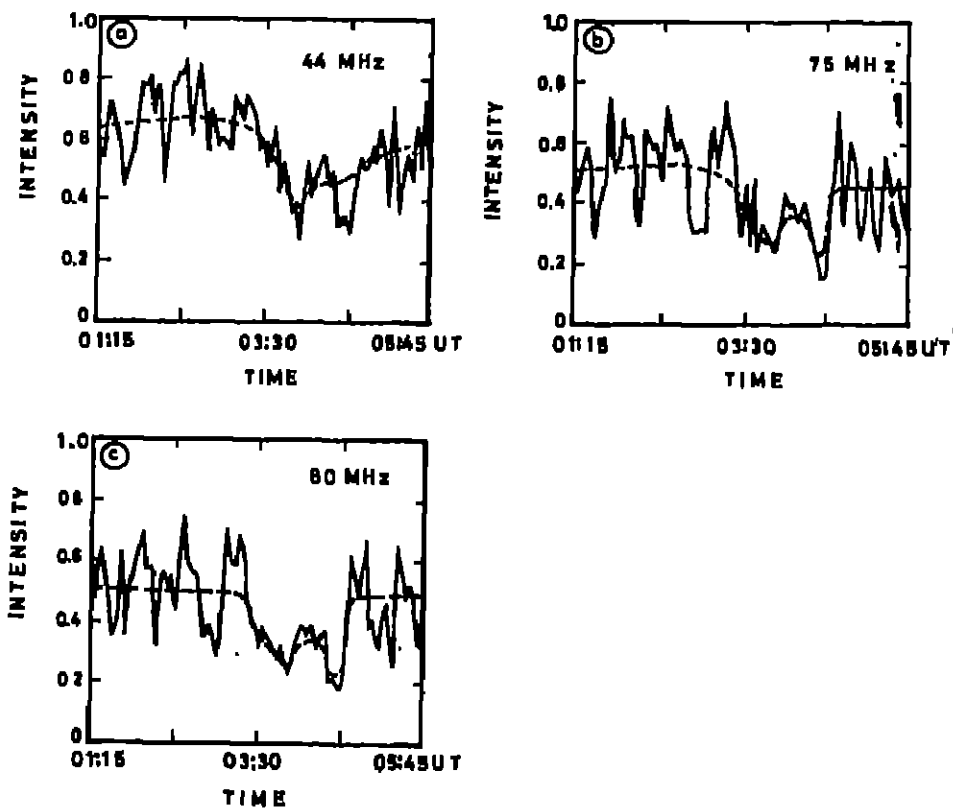

Figure 1 : Eclipse curve on October 24, 1995 observed using the solar radio spectrograph at (a) 44 MHz, (b) 75 MHz and (c) 80 MHz from 01:15 to 05:45 UT.

Fig. 1 shows the eclipse curves at 44, 75 and 80 MHz. The diameter of the radio Sun at the above frequencies can be determined from the eclipse curves and using the rate of movement of the moon in the sky. From the figure, it can be seen that the intensity is reduced from 03:15 UT to 04:50 UT. It is found that the duration of the eclipse increases with decreasing frequency. The eclipse curves give the diameter of the radio sun as 48 arc min at 44 MHz, 40 arc min at 75 MHz and 80 MHz. The dashed line in the figure shows the pronounced variation in the intensity during the eclipse period. The eclipse observation enables low resolving power radio telescopes to locate small angular size sources in the solar disc as reported by some authors (Bhonsle *et al.*, 1982, Bagchi *et al.*, 1996, Ramesh *et al.*, 1996). The double hump in the eclipse curve indicates the possibility of existence of two discrete sources.

4. Acknowledgment

The financial assistance from DST, New Delhi is gratefully acknowledged. One of the authors (A S) thanks CSIR, Government of India for Senior Research Fellowship.

References

Bagchi J., Subramanian K.R.,, Ebenezar E., Gowda N. and Abdul Hameed A.T., 1996, Abstracts of National Meeting on Total Solar Eclipse of 24, Oct. 1995, Bangalore.

Bhonsle R.V., *et al.*, 1982, Proc. Indian Nat. Sci. Acad. **48A**, 75.

Castelli J.P. and Aarons J., 1965, Solar radio Astronomy (ed. Aarons J.), Plenum Press, New York, p.49.

Ramesh R., Subramanian K.R., Sundarrajan M.S. and Sastry. Ch. v. 1996, Abstracts of National Meeting on Total solar eclipse of 24 Oct. 1995, Bangalore.

Shanmugaraju A. and Umapathy S. 1996, Indian Journal of Radio and Space Physics, **25**, 53.