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Multibaseline Observations of the Occultation of Crab Nebula by the Solar Corona at Decameter Wavelengths

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Extended abstract

Information about the outer solar corona can be obtained by observing the occultation of radio sources by the solar corona. As the radio waves pass through the corona they get scattered due to the fact that the electron density and consequently the refractive index varies from point to point. The effect of scattering is manifested by an apparent increase in the angular size of the radio source which can be measured by suitable interferometers. We present here multibaseline observations on the occultation of Crab Nebula at 34.5 MHz with baselines extending upto 4.9 km during June 1986 and 1987.

Observations presented here were made with a compound grating interferometer with an East-West fan beam of 3 min of arc at 34.5 MHz. It consists of four grating units placed at intervals of 1.4 km on an East-West baseline starting from the western end of the East-West array of the Gauribidanur radio telescope (Sastry 1995). Each grating unit consists of 8 Yagi antennas combined in a branched feeder system. The ouput of each one of the grating units was correlated with the East-West array. Observations of the radio source Crab Nebula were made at the time of transit during June 1986 and 1987. The fringe amplitude V(S) for a baseline S was calibrated using the corresponding baseline fringe amplitude of radio source 3C123 or 3C134 and normalised to the preoccultation value V(O). Normalised fringe amplitudes V(S)/ V(O) for baselines 0.7 km, 2.1 km, 3.5 km and 4.9 km were obtained for days when there was a fortuitous lull in the solar activity. The spatial coherence is described by a mutual coherence function given by τ (S) = V(S)/V(O). The structure function D(S) is related to mutual coherence function by τ (S) = exp(–D(S)/2) (Prokhorov *et al.* 1975). If the scattering medium is characterized by an electron density fluctuation spectrum of power-law, then the wave structure function also has a power-law form given by D(S) $\propto S^{\beta-2}$ for $2 \leq \beta \leq 4$. A plot of log (D(S)) versus log(S) for the 4 baselines is used to obtain the value of β. The least square fitted spectral component β has a value in the range of 1.8 to 4.25 in the elongation range of 5 to 43 solar radii as shown in Fig. 1.

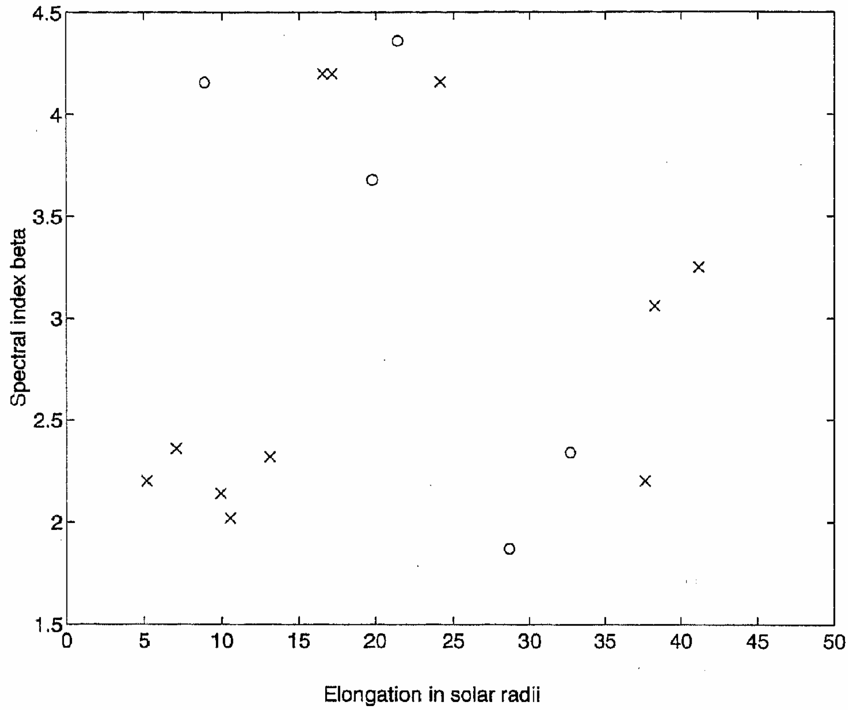

Figure 1. Variation of spectral index β with elongation during June 1986 and 1987 denoted respectively by crosses and open circles.

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