INTERFEROMETER OBSERVATIONS OF A RADIO BURST AT 8.6 mm ASSOCIATED WITH A POLARIZED HARD X-RAY EVENT

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Abstract. Observations of a radio burst at 8.6 mm wavelength on 1970 November 5, are described with the particular interest on the correspondence between radio and polarized X-ray events. The radio observations were carried out using an interferometer with a half power width of 2.9' at the Dept. of Physics, Nagoya University, and indicated that the location of the radio burst coincided with preceding sunspots and the size of the burst source must be very small, less than about 1'. Mechanisms of radio and X-ray emissions are discussed briefly.

1. Introduction

A two-ribbon flare of importance 3B (private communication from the Tokyo Astronomical Observatory) occurred on 1970 November 5 at 12/E37 in a plage region McMath No. 11019 (see Solar-Geophysical Data issued by U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service). Observations of the associated radio burst at 8.6 mm wavelength were carried out at the Dept. of Physics, Nagoya University, using a four element east-west interferometer (Figure 1). The instrument has a half-power beam width of about 2.9' and a beam separation of about 12.6' near the meridian plane. The time interval between observations due to drift scanning depends on the declination and on the observing time, and is about 50 s at the meridian transit. The performance of the instrument is described in more detail elsewhere (Kawabata and Sofue, 1972).

The solar event on 1970 November 5 is of particular interest in that we have radio data on the location and the size of the radio burst at 8.6 mm from the interferometer, linear polarization data on the hard X-ray event from Intercosmos-4 satellite (Tindo et al., 1972a), and a lot of other observational data. In the present article, we describe briefly the 8.6 mm observations with the particular interest on the detailed correspondence between radio and X-ray events, and we discuss the physical implications of the observations in order to throw some light on the solar mechanism involved.

2. Observations

The two-ribbon flare on 1970 November 5 started at 0308 UT and attained full development at 0323. The sunspots associated with the active region, in which the flare occurred, were not so large but had strong magnetic fields of up to 2500 G (Academy...
of Science, U.S.S.R., 1970). The associated hard X-ray event observed by Tindo et al. (1972a) started at 0316 UT and consisted of two successive bursts peaking at 0320 and 0329, respectively. The degree of polarization of the X-ray event attained a maximum value as high as 21% at the time of maximum intensity of the first X-ray burst. However, the observations did not show any indication of a peak in the degree of polarization at the time of maximum intensity of the second X-ray burst. The polarization degree of the second X-ray burst was less than 10%.

Figure 2 gives a comparison of our radio observations with the hard X-ray observations by Tindo et al. (1972a). The radio flux density at 8.6 mm started to increase gradually in coincidence with the starting time of the X-ray event, but the flux density at 8.6 mm remained small until about 0325. At about 0325 UT, the 8.6 mm flux density increased abruptly and attained a value of 260 f.u. (10^{-22} \text{ W m}^{-2} \text{ Hz}^{-1}) at 0326. The time of peak flux density at 8.6 mm approximately coincided with that of the second X-ray burst. The 8.6 mm observation did not show any indication of a peak at the time of maximum intensity of the first X-ray burst. The correspondence between 8.6 mm and hard X-ray bursts appears to indicate that an X-ray burst with a large degree of polarization is associated with only a small increase in the 8.6 mm emis-