INTERFEROMETRIC OBSERVATIONS OF RADIO BURSTS AT 35 GHz

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Abstract

Observational results of radio bursts at 35 GHz by the sixteen-element fanbeam interferometer in Nagoya are briefly discussed.

Observations of solar activities at 35 GHz are being carried out by using a sixteen-element east-west interferometer since May 1976 and fifty nonthermal bursts and sixty GRF have been observed until April 1979. The longest baseline of the interferometer is 5849.1 wavelengths (50.1 m). The east-west HPBW and the beam separation are 29" and 8'49", respectively in the meridian.

A series of GRF sometimes occurs successively in the same active region, and we can obtain a map of GRF, if we assume that the relative brightness does not change with the time. The map of GRF in Figure 1 is obtained by ART (algebraic reconstruction technique, e.g. Gordon 1974) after deconvolution of fanbeam scan of the active region by Bracewell's chord construction method(1955) and correction for the solar rotation.

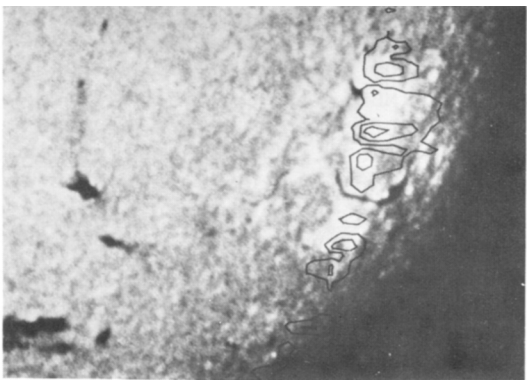

Figure 1. ART map of GRF on 25-26 June 1977. The excess brightness is 10000 K. The top is S and the left is W. The Hα phtograph is taken at Big Bear Solar Observatory and is supplied by Prof. H. Zirin.

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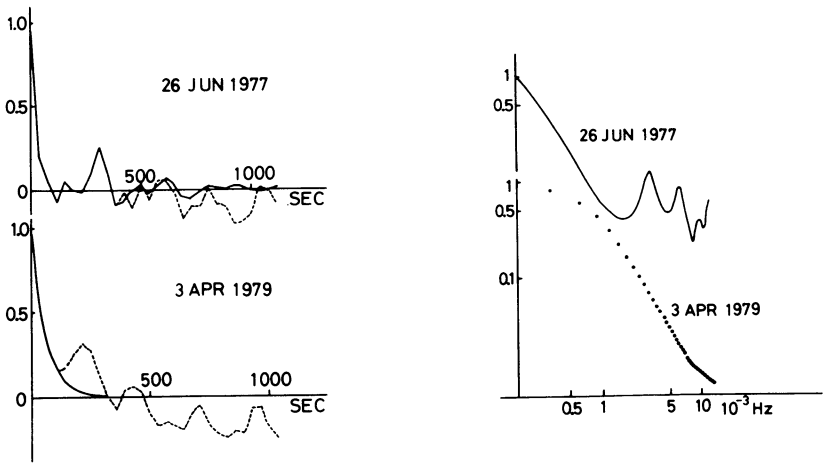

Figure 2. Examples of MEM analysis of the fanbeam brightness of GRF. GRF on 26 June 1977 is an exceptional case for which a periodicity of 300 sec is obtained by MEM analysis. At the left, dotted and solid lines indicate conventional and MEM autocorrelation respectively. At the right, MEM power spectrum of the fanbeam brightness.

ART is convenient to get a map of an active region from fanbeam observations, because the consistency of the assumption of constant relative brightness can be easily checked. The ART map indicates a general good agreement of radio brightness with Hα brightness. It should be mentioned that the radio brightness darkens at an Hα filament. A gap of radio brightness near the center of the active region, north of the filament, coincides with a gap of magnetic field strength.

Time profiles of postburst increases and GRF often indicate a fluctuation of radio emissions of about 5% with a time scale of several minutes. The fluctuation is much larger than the changes of the brightness in quiet regions and then is not instrumental nor atmospheric but is of solar origin. A study by a conventional autocorrelation analysis of the fluctuation often shows a periodicity of 200-400 sec as is illustrated in Figure 2. We applied a maximum entropy method (MEM) for autoregressive process of order n determined by Akaike final prediction error criterion (e.g. Ulrich et al. 1975) to the fluctuation of GRF. The MEM analysis indicates that the periodicity appeared in conventional autocorrelation is spurious for four cases out of five. Examples of MEM autocorrelation is also illustrated in Figure 2. The MEM power spectrum of the fluctuation is the power low. The spectral index is 1.5-2.0 (Figure 2).

An example of observations of big bursts occurred near the limb is illustrated in Figure 3. The flare on 7 May 1978 occurred at N28,W68. The central distance of the flare is 0.956. The radio source is stationary during the early phase of the burst and starts to rise in the declining

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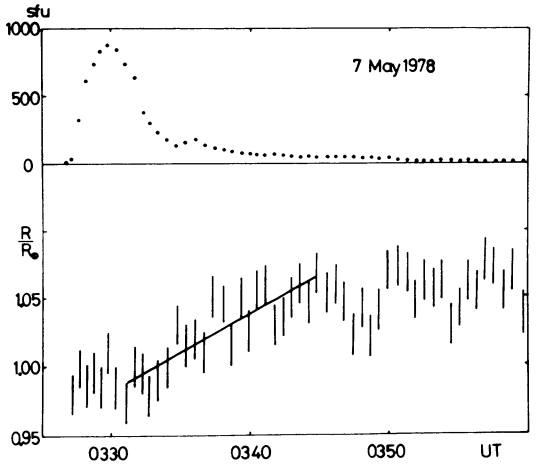

Figure 3. Time profile of flux densities and distances of the radio source from the disk center for 7 May 1978 big burst.

phase of the burst. The velocity of the rising motion is 66.2 ± 1.7 Km/sec. In the late phase of the postburst increase, the radio source appears to be stationary. The similar phenomenon has been also observed on a behind-the-limb flare on 7 September 1977. In the latter case, the rising motion appears twice with velocity of 26.3 ± 3.5 and 35.0 ± 4.7 Km/sec respectively. The height and the velocity of radio sources are in agreement with those of X-ray loop system indicating a physical connection of big bursts and postburst increases with X-ray loops(e.g. Kawabata 1966, Pallanicini et al 1975, Rust and Webb 1977).

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DISCUSSION

Alissandrakis: Is there any association of the event shown in the last slide with ejection of matter observed in Hα?

Kawabata: Fanbeam scanning curves are definitely variable to some extent. But we have not yet analyzed the details of time variation of the fan beam brightness distributions.

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