

## VLA-PHOENIX OBSERVATIONS OF A NARROW-BAND DECIMETRIC BURST

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**ABSTRACT** We discuss observations of a highly-circularly polarized multiply-impulsive microwave burst detected by the Very Large Array and the Phoenix Digital Radio Spectrometer. The VLA was used to resolve the burst in two dimensions, while PHOENIX provided high time resolution information about its spectral properties. During part of the burst, positive frequency drifts were detected, suggesting inwardly propagating beams of electrons emitting Type III-like radiation.

### 1. INTRODUCTION

It is generally believed that gyrosynchrotron radiation from nonthermal electrons can explain the properties of most solar microwave bursts, including their brightness temperature, polarization and bandwidth. Recent observation using wide-band dynamic spectrographs have, however, discovered multiply-impulsive ( $\tau < 100$  msec) bursts including spikes, pulsations and decimetric type III bursts whose narrow bandwidths and frequency drifts require a different explanation such as plasma radiation or electron-cyclotron maser emission (eg. Stähli and Benz 1987). Practically nothing is known about the spatial properties of these events since they have only been detected with single dish instruments with poor angular resolution. Here we discuss some spatially resolved observations of a narrow band decimetric burst using the VLA and the Phoenix Digital Radiospectrometer.

### 2. COORDINATED OBSERVATIONS OF MICROWAVE BURSTS

The Very Large Array was used to observe the Sun between 1300-2300 UT on June 25 and 27, 1989 as part of the Max 91 Campaign. Observations were made simultaneously at 1446 MHz (20.7 cm) and 327 MHz (91.6 cm) with a time resolution of 1.67 s. They were coordinated with observations at the Nancy Radioheliograph (164 and 327 MHz) and with the PHOENIX Digital Radio Spectrometer (ten frequencies each between 301 and 356 MHz and 1365 and 1525 MHz- 20 msec time resolution) in order to study the spatial, temporal and spectral properties of decimetric bursts.

Figure 1a shows an example of a burst detected by the VLA and PHOENIX at 1446 MHz. It consists of several impulsive spikes, each of 20-30 seconds in duration, covering a period of a few minutes. There was no

evidence for burst emission at 327 MHz, nor was there a soft or hard X-ray burst detected by the SMM or GOES satellites. Snapshot maps (Fig. 1b) show that the bursts are compact ( $\theta = 25\text{--}30''$ ) and highly circularly polarized ( $\rho_c = 90\text{--}100\%$ ). Co-registration of these maps with a SOON H $\alpha$  image taken at 1617 UT showed that the burst was located above a faint optical flare lying between two active regions ( $\sim N25, E21$ )

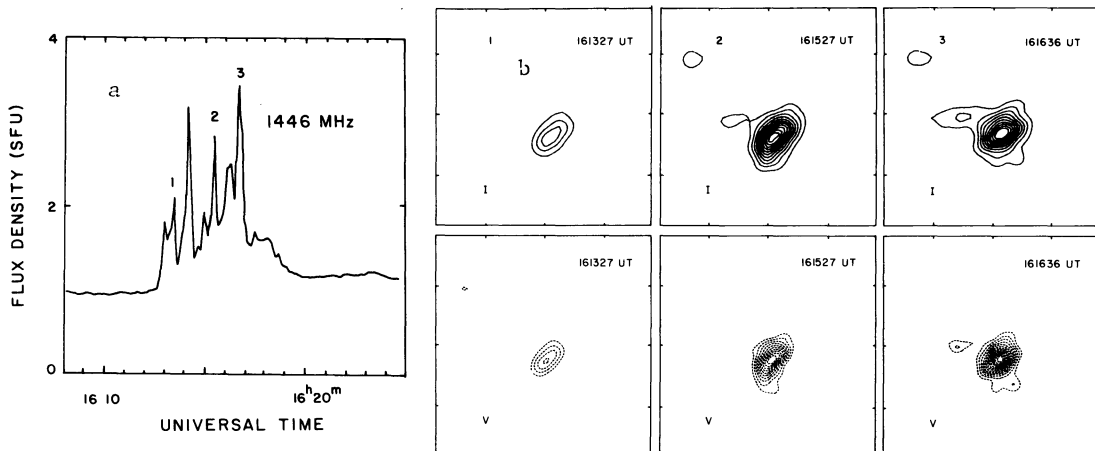


Figure 1. a) Time profile of the burst detected with one of the short VLA baselines on 1989 June 25. b) VLA 3.3 s snapshot maps at times 1, 2 and 3 shown in Fig. 1a. The brightness temperature contours for the I and V maps are drawn at intervals of  $T_b = 8 \times 10^5$  and  $4 \times 10^5$  K, respectively. Fiducial marks on the axes are drawn every  $60''$ .

The PHOENIX spectral data showed that the emission drifted from high to low frequencies near the time of the most intense peak (3) ( $\sim +750$  MHz/sec) suggesting an inwardly-propagating beam of electrons. Broad-band emission was detected at most other times. Although the positions of the bursts shifted from peak to peak ( $\Delta\theta \sim 10''$ ), these changes were not systematic, as would be expected for a source moving through the corona. Nevertheless, this event may be related to the decimetric type III events (Stähli and Benz 1987) whose narrow bandwidths and frequency drifts suggest a coherent emission mechanism, such as plasma radiation or electron-cyclotron maser emission.

### 3. ACKNOWLEDGEMENTS

Radio astronomical studies of the Sun at Tufts University are supported under grant AFOSR-89-0147 with the Air Force Office of Scientific Research, and by NASA grant NAG-5-501.

### 4. REFERENCE

- Stähli, M., and Benz, A.O. (1987) 'Microwave Emission of Solar Electron Beams', *Astronomy and Astrophysics* 175, 271-276.