

TITLE: DMSP SATELLITE DETECTIONS OF GAMMA-RAY BURSTS

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# DMSP Satellite Detections of Gamma-Ray Bursts

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Gamma-ray burst detectors are aboard six U. S. Air Force Defense Meteorological Satellite Program (DMSP) spacecraft, two of which are currently in use. Their 800-km altitude orbits give a field of view to  $117^\circ$  from the zenith. A great many bursts have been detected, usually in coincidence with detections by GRO or other satellites such as PVO or ULYSSES. The directions of the sources can be determined with considerable accuracy from such correlated observations, even when GRO/BATSE with its directional capabilities is not involved. Thus these DMSP data, especially in conjunction with other observations, should be helpful in trying to understand the true nature of gamma-ray bursts.

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## INTRODUCTION

Six of the DMSP spacecraft launched by the U. S. Air Force have carried gamma-ray burst detectors into orbit at 800 km. Two of these (DMSP 12 and 13) are currently in operation, in near-polar orbits, attaining latitudes of  $81^\circ$  with an initial launch direction of  $99^\circ$ . Each carries two gamma-ray detectors with  $\sim 100 \text{ cm}^2$  of NaI, sensitive to gamma-rays of 50 keV or more coming from sources within  $\sim 117^\circ$  of the spacecraft zenith. A fuller description may be found elsewhere<sup>1-3</sup>.

## RESULTS

Many gamma-ray bursts have been detected by two or more of the DMSP spacecraft. When other spacecraft have also detected these bursts, relative times of detection and fields of view can give considerable information on source location, even when no detection was made by the Compton Observatory (GRO).

Such a burst was detected by DMSP 11, 12, and 13 on 7 April 1995, and also by ULYSSES and WIND. Figure 1 shows the data from DMSP 11 for this

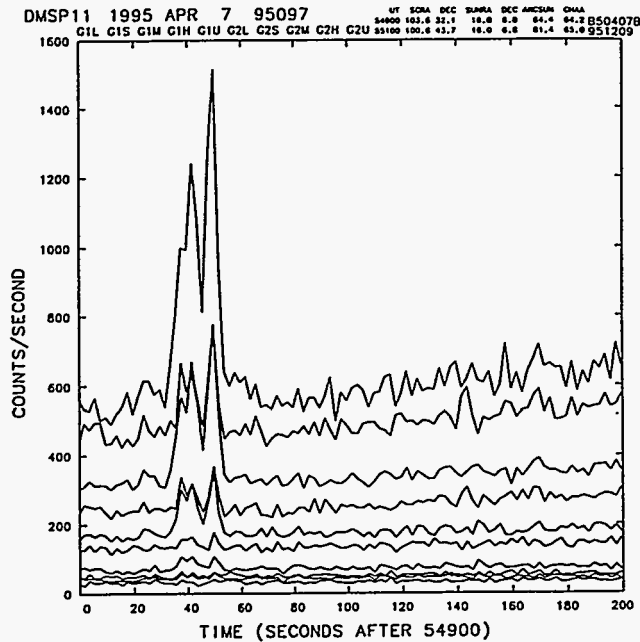


FIG. 1. DMSP 11 data for a hard gamma-ray burst on 7 April 1995.

hard burst, with gamma rays exceeding 430 keV in both detectors (for DMSP 11 the channel thresholds are at 50, 100, 200, 430, and 550 keV, with cutoff at 1000 keV). The first counting-rate peak in the DMSP data occurred in the 2-second time channel centered on 54932 sec UT. Direction analysis, undertaken in cooperation with other investigators, has not yet been completed for this and other events reported here.

Another hard burst, much more intense, was detected on 22 August 1995. The DMSP 12 data are shown in Figure 2. This was probably the most intense burst ever detected by DMSP satellites, with a counting rate increasing to almost 4000 counts/sec at the peak time of 13767 sec UT. It was also detected by BATSE (GRB No. 3767), KONUS, and ULYSSES.

DMSP 13 detected a softer but interesting burst on 25 August 1995, shown in Figure 3. The first peak count at 15786 sec UT was followed by a brief higher peak at 15864 sec, and then by a long high-energy peak extending from  $\sim 15900$  to 16950 sec UT. The NaI detectors on DMSP 13 have thresholds at 60, 150, 375 keV. The high-energy peak (lowest counting rates in Figure 2) corresponds to photons of energy  $>6$  MeV.

One of the strongest bursts ever detected by BATSE and COMPTEL<sup>4,5</sup> was GRB No. 2831 ("Olympic"), which triggered BATSE at 82962 sec UT on 17 February 1994. This was also detected by DMSP 10, DMSP 11, and ULYSSES. The data from DMSP 10, shown in Figure 4, indicate a curious pattern of repeated outbursts over  $\sim 180$  seconds. A Fourier analysis of this

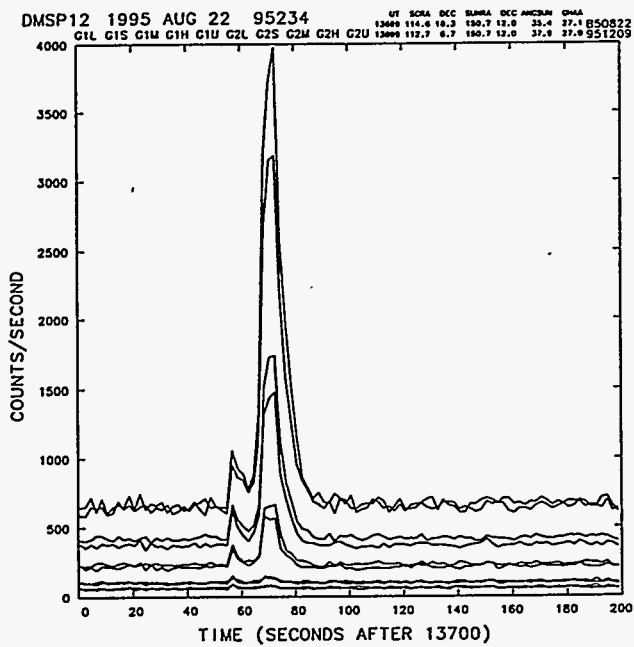


FIG. 2. DMSP 12 data for a hard and very intense gamma-ray burst on 22 August 1995.

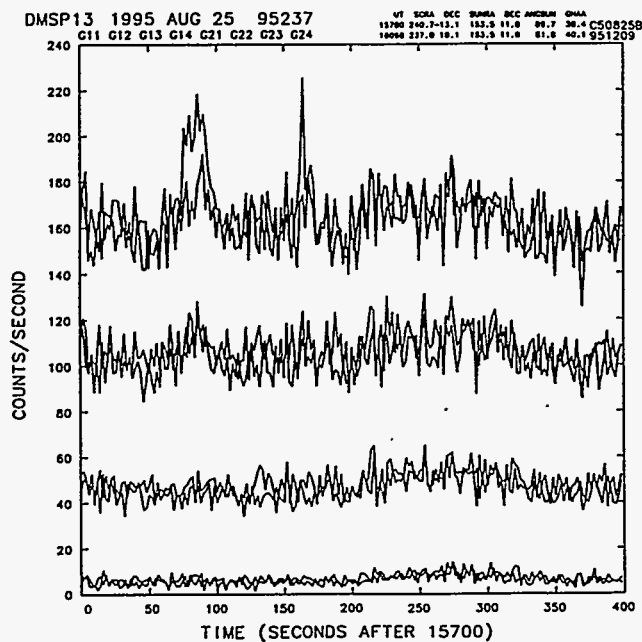


FIG. 3. DMSP 13 data for a soft gamma-ray burst followed by a very long hard afterpulse, on 22 August 1995.



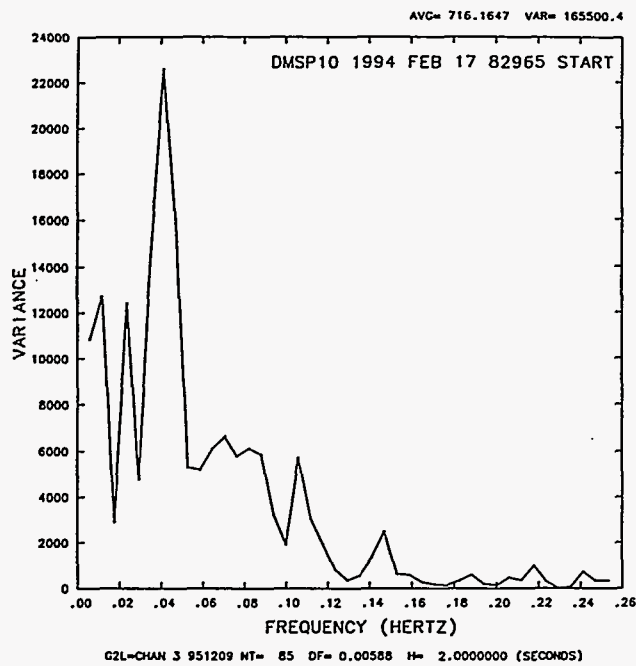


FIG. 5. Fourier power spectrum of the gamma-ray burst data in Figure 4 (DMSP 10, 17 February 1994).

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