

Session 3: Diagnostics of High Gravity Objects with X- and Gamma Rays

3-4. Gamma-Ray Bursts

POSSIBLE X-RAY COUNTERPARTS TO GAMMA-RAY BURSTS, GRB930131 AND GRB940217

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1. Abstract

We made a search of quiescent X-ray counterparts of two Gamma-Ray Bursts (GRBs), GRB930131 and GRB940217. These GRBs were detected with BATSE, EGRET, COMPTEL on board *CGRO* together with the GRB detector on *Ulysses* spacecraft, then they were localized in small error regions. These observations showed that the bursts were remarkably bright accompanying delayed high energy gamma-rays. *ASCA* observations have found a single X-ray source for each GRB on the possible location determined with the above instruments.

2. Introduction

GRB930131 was the brightest GRB recorded by BATSE in the 3rd catalog [1]. It was a rare GRB in which very high energy (GeV) photons were detected [2] and was also detected by several other gamma-ray detectors, including EGRET, COMPTEL on board *CGRO*, as well as the GRB detector on board *Ulysses*. GRB940217 was also detected with the above instruments [3][4][5] and was the most peculiar burst observed so far. It was one of the GRBs which showed the strongest fluence, and had the longest

duration among the GRBs detected with *CGRO*. COMPTEL observed six separate emission peaks during this burst.

3. Observations and Results

3.1. GRB930131

The searched sky area was determined to cover the 2.5σ EGRET error region with *ASCA*-GIS along the IPN annulus of $43''$ wide (90% confidence). There is only one source found in the combined IPN/EGRET error region taking account of the *ASCA* location uncertainty of $1'$. The detection significance of the source is $4.5 \sigma_D(\text{SIS})/4.8 \sigma_D(\text{GIS})$, and the source is localized to be at R.A. = $12^h 15^m 11^s$, Dec. = $-10^\circ 18' 21''$ (J2000) with a 90% confidence error radius of $1'$. This location coincides with an X-ray source detected with the *ROSAT* All-Sky Survey, which is claimed to be associated with HR4657, an F-type star of $V=6.1$ mag at $D=34$ pc [6]. If the extremely intense GRB930131 came from the normal star HR4657, how was the burst energy produced? Even if the burst energy is produced by flares, the luminosity of this X-ray source cannot reach this burst luminosity. This result is likely that the X-rays from the counterpart were too weak to detect with *ASCA*. More detailed discussions have been published in [7].

3.2. GRB940217

ASCA observations were made to cover the combined IPN/EGRET- 3σ error region. The analysis has revealed one X-ray source on the combined IPN/EGRET (95%) error region with the detection significance of $6 \sigma_D$ at R.A. = $2^h 00^m 6^s.48$, Dec. = $4^\circ 12' 46''.8$ (J2000). Archived optical plates were studied with the APM system at Royal Greenwich Observatory, and we found two objects within radius of $1'$ around the *ASCA* source. One of them was located inside the 3σ IPN annulus. This optical source being $37''$ apart from the *ASCA* location shows blue color, $B-R = 0.27$, and is likely an AGN. More detailed discussions have been published in [8].

References

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