Astro. Lett. and Communications, Vol. 39, pp. 273–276
Reprints available directly from the publisher
Photocopying permitted by license only

A search for Optical Transients in GRB error boxes provided by WATCH and BATSE

S. S. Guziy[1,2], A. V. Salykin[1,2], A. A. Shlyapnikov[1].

1) Space Research Group, Nikolaev Astronomical Observatory, Observatornaja 1, Nikolaev 327030, Ukraine

2) Astronomical Observatory Of Nikolaev State University, Nikolskaya 24, Nikolaev 327030, Ukraine

ABSTRACT We present preliminary result for deep optical searches in 29 small (radius $\sim$ 30 arcmin) GRB error boxes, which were provided by both the GRANAT/WATCH and CGRO/BATSE instruments. We have examinated archival plates at the Crimean Astrophysical Observatory and Nikolaev Astronomical Observatory in order to look for Optical Transients within the GRB error boxes. We present here the preliminary results of this search.

KEYWORDS: gamma-ray-bursts.

1. INTRODUCTION

The physical nature of the gamma ray bursts (GRB) of cosmic origin remains unclear in spite of the optical observations that have been carried out for some GRBs that have been precisely localized by -mostly- the BeppoSax satellite. A great variety of different GRB models have been suggested and emission at longer wavelengths was expected -and indeed found in 1997 and 1998- following the brief gamma-ray event. Therefore, in some cases we expect to find short-lived optical counterparts (optical transients) soon after the bursts (van Paradijs et al. 1997). If optical transients can be found in archival plates, this remains and open question, and no positive result has been yet achieved (Gorosabel & Castro-Tirado 1998a,b).

Here we present the results of our optical study in 29 GRBs error boxes: 19 of them provided by the BATSE experiment on CGRO (Meegan et al. 1996) and 10 provided by WATCH on GRANAT (Sazonov et al. 1998).

2. RESULTS

The selected GRB sample was obtained from both the GRANAT/WATCH Catalogue (Castro-Tirado 1994b, Sazonov et al. 1998) and the Third CGRO/ BATSE Catalogue (Megan et al. 1996). We selected GRB error boxes which declination in the range 0 to +90 degrees and radius smaller than 30 arcmin. We are using individual positional error box radius for each GRB from catalogues. Table 1 displays the GRB sample.

2.1 The GRB sample

Table 1 shows the GRB sample we have used in this work.

TABLE 1: The GRB sample

GRB	*R.A.* 2000.0	*DEC* 2000.	*Errorboxradius* (degrees)
910601	20 40 32	32 20 24	0.17
910807	10 15 25	06 29 24	0.28
920622	10 48 25	47 10 12	0.31
920720	13 32 07	36 52 12	0.31
921230	01 18 05	17 12 36	0.33
930916	18 42 53	65 23 24	0.22
931031	21 40 27	62 43 48	0.32
931103	05 51 32	65 03 00	0.31
931204	16 39 43	37 15 36	0.19
941017	20 06 15	09 48 36	0.19
950208	22 27 54	54 11 24	0.33
950401	05 44 15	43 45 00	0.29
960124	03 24 10	54 03 00	0.30
960201	23 52 16	14 27 36	0.31
960321	00 30 14	67 03 00	0.25
960807	10 30 09	32 07 48	0.21
961001	02 51 10	59 01 48	0.22
970111	15 25 02	18 43 48	0.15
970315	00 08 36	60 43 12	0.15
900708	12 23 40	30 37 12	0.22
900708b	16 51 12	16 12 00	0.43
901116	02 39 43	24 58 12	0.48
901121	02 01 33	72 24 00	0.55
910310	12 16 26	06 22 48	0.24
920723b	19 08 22	27 19 48	0.19
920903b	20 06 13	22 35 24	0.22
920925c	22 03 15	25 28 48	0.34
921013b	07 50 51	33 24 36	0.25
940703	08 52 49	28 06 36	0.12

2.2 Archival Plate Searches

Archival plate searches were performed on astronomical plates taken at both Crimean Astrophysical Observatory (CrAO) and Nikolaev Astronomical Observatory (NAO).

All CrAO plates were taken with the Double Astrograph (D=400 mm and F=1600 mm). All NAO plates were taken by means of The Zone Astrograph (D=140 mm and F=3000 mm). These two instruments are mainly used for planets, comets and minor planet research. Not plates are taken in during the bursts. All plates were taken only for researching the positions a planets and minor planets. Table 2 displays the characteristics of the archival plates we have examined.

TABLE 2: Types of archival plate

FOV (degrees)	Limiting magnitude	Observing Interval	Number of plates
CrAO 10x10	17	1982-1996	1192
NAO 5x5	11	1966-1996	4204

The double astrograph at CrAO allows to obtain images of a given region simultaneously on two plates. Such search allows to exclude plate faults. Moreover, as happens in minor planet research, the shift of stars on the plate , allows to exclude satellite glints, aircraft flashes or minor planets.

In the case of imagery at NAO, the observing technique makes use of three exposures. While one plate is being exposed, the other two are slightly shifted, in order to discard any of the above- mentioned objects as real objects.

Table 3 list the GRBs for which plates were found.

We searched for optical transients on CrAO plates by means of the stereocomparator at CrAO. For the NAO plates, we visually inspected all the plates.

We studied a one degree radius region centred at the GRB error box position. The use of the stereocomparator allowed to find either low-amplitude variables or new objects on the CrAO plates. Most of the examined plates were exposed for about 1 hour, and reached 17th magnitude.

TABLE 3: Plates for which GRBs were found

GRB	CrAO selected plates	CrAO used plates	NAO selected plates	NAO used plates
910601	3	-	-	-
910807	7	6	12	7
921230	23	12	12	10
931204	2	-	-	-
941017	1	-	1	1
960124	5	-	-	-
960201	5	4	-	-
961001	1	-	-	-
970111	2	2	1	-
970315	1	-	-	-
900708	6	5	-	-
901116	3	2	4	-
910310	7	4	17	15
920903b	1	-	1	1
921013b	-	-	1	-
940703	4	3	3	-

3. CONCLUSIONS

None of our searches has produced a positive result. No new object displaying a variation of more than 0.5 mag has been found. Only the minor planet 270 was found within the GRB 910807 field of view. Future work needs to make use of a larger number of plates.

ACKNOWLEDGEMENTS We thank L.I. Chernyh, N.S. Chernyh, L.A. Gudkova for their help with localizing the plates and useful coments. Also to A. Castro-Tirado and R. Hudec for fruitful conversations.

REFERENCES

Castro-Tirado, A. J. et al. IAUC 6744 (1997b).
Gorosabel, J. & Castro-Tirado, A. J. 1998a, A&A 333, 417
Gorosabel, J. & Castro-Tirado, A. J. 1998b, A&A 337, 691
Sazonov, S., Terekhov, O., Sunyaev, R., Lund, N., Brandt, S. & Castro-Tirado, A.J. 1998, A&AS 129, 1
Meegan, C.A. et al. 1996, ApJS 106, 65
van Paradijs, J. et al. 1997, Nat 386, 686