

The Robotic Palomar 60-Inch Optical Afterglow Catalog: 2007

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Abstract. We present here the photometric results of the Robotic Palomar 60-inch Telescope (P60) observations for GRB optical afterglows. The quick response time and the size of the telescope allows us to observe the optical transients through V, R, I, g', i', z' filters, sometimes as early as 0.01 day after the trigger. Comparing the data obtained with the various filters we were able to compute color indices for the 1 day after the trigger epoch. The observations lasts until the OT fades below the detection threshold.

Keywords: GRB, optical afterglow, photometry

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INTRODUCTION

In the present work we summarize the GRB OT observations of the 2005-2007 period respecting the color behaviours of the optical transients.

In this paper we focus on the colors of the observed OT-s. During the majority of the P60 observations the data were obtained through g', r', i', z' filters. Although the datasets are limited i.e. there are no long photometric series we could derive the decay rate of the OT in the specific color bands and therefore we were able to compute the extrapolated brightnesses for the "1 day after the trigger" epoch. From the computed colors for this epoch we derived color indices in order to compare the color behaviour of the various events. In the cases when redshift measurements were available for the GRB sources we constructed the color-redshift diagrams as well.

THE DATA

All the data presented here were obtained with the aid of the Robotic 60-inch Telescope at Palomar Observatory (P60) [1]. For the photometric data reduction the aperture photometry (ATV software package (IDL)) method was used. The standard stars were selected from the USNO or from the SDSS catalogue. From the USNO magnitudes the g', r', i', z' magnitudes were computed according to Jordi et al. 2006 [2] with the modifications made by Derek Fox.

In the cases when both USNO and SDSS comparison stars were available for the photometry of the GRB OT-s we compared the USNO based g', r', i', z' magnitudes to the SDSS values respectively. The overall accuracy of our GRB OT photometry is in order of tenths of magnitude due to the low S/N ratio near to the detection limit of the CCD camera.

THE RESULTS

For the well observed GRB OT-s we determined the coefficients of the powerlaw decay in the various color bands. Table 1. presents the list of the computed powerlaw decay index (α) and the extrapolated magnitudes in the individual color bands for the 1 day after trigger epoch. Table 2. shows the "1 day after the trigger" epoch g'-r', r'-i', i'-z' color indices and the available redshift values. Based on the previous P60 observations data we have to mention that in our

sample according to the optical to X-ray spectral index β (OX) significant fraction of the events belongs to the "dark bursts" Cenko et al. 2008 [3] category (β (OX) < 0.5).

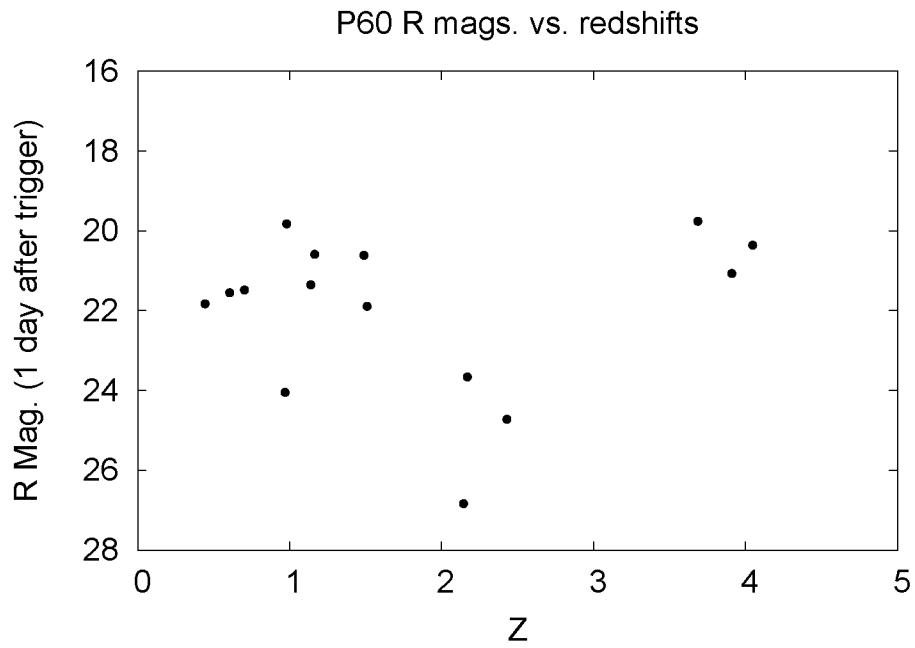


FIGURE 1. R mag. - Z plot. There is a clearly visible difference between the R brightness distribution of the lower redshift (left group) and higher redshift GRB-s (right group).

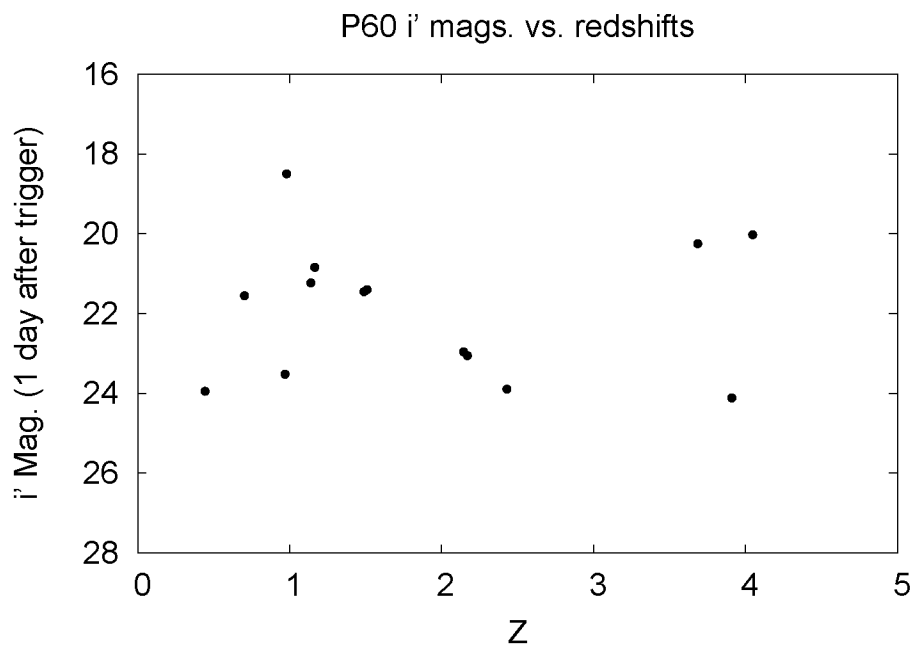


FIGURE 2. i' mag. - Z plot. The difference between the lower redshift (left group) and higher redshift GRB-s (right group) is remarkable.

TABLE 1. Table of the measured color indices and the redshift (Z) values for some GRB OT-s observed during the period of 2005-2007 (Table a.). Powerlaw decay index and magnitudes for the various filters (epoch = trigger + 1 day). (Table b.)

Table a.					Table b.					
GRB	g-r	r-i	i-z	Z	GRB/color band	α	mag.	- GRB/color band	α	mag.
050525	-0.31	-0.15	-	0.606	050525 g	-1.347	21.24	070419a g	-1.784	27.82
060206	1.37	0.34	2.58	4.048	050525 r	-1.710	21.55	070419a r	-0.891	24.05
060210	-	-3.05	-0.88	3.91	050525 i	-1.876	21.70	070419a i	-0.923	23.52
060418	0.09	-0.84	-	1.489	060206 g	-1.490	21.73	070419a z	-0.612	21.68
060512	1.74	0.15	-	0.443	060206 r	-1.110	20.36	070419b r	-0.560	20.98
060904b	-0.83	-0.07	2.13	0.703	060206 i	-1.230	20.02	070419b z	1.502	13.33
060906	-0.28	-0.49	0.93	3.686	060206 z	-0.382	17.44	070612a R	-2.152	18.24
060908	-1.45	0.83	-	2.43	060210 r	-0.384	21.07	070612a i	-1.692	18.55
070208	1.15	-0.25	0.49	1.165	060210 z	-1.448	25.00	070612b r	0.070	22.26
070419	3.77	0.53	1.84	0.98	060418 V	-0.738	20.70	070612b i	-0.009	21.89
070612b	-	-1.39	-1.47	-	060418 r	-0.860	20.61	070612b z	-0.543	23.37
070810	-2.49	0.60	-0.94	2.17	060418 i	-1.311	21.45	070810a g	-0.451	21.17
071010a	-	1.33	-2.65	0.98	060502 g	-0.755	22.64	070810a r	-1.473	23.66
071011	-	1.72	-1.20	-	060502 r	-0.854	21.89	070810a i	-1.452	23.05
071020	-	3.88	-0.97	2.145	060502 i	-0.579	21.40	070810a z	-1.854	23.99
071122	-	0.12	1.80	1.14	060512 r	-0.730	20.60	070810b r	-0.244	22.47
					060512 i	-2.200	20.45	070810b i	0.130	22.71
					060814 i	-0.272	22.39	071010a r	-0.620	19.82
					060904b g	-0.063	20.66	071010a i	-0.342	18.50
					060904b r	-1.029	21.48	071010a z	-0.876	21.14
					060904b i	-0.871	21.55	071010b r	-0.684	20.30
					060906 g	0.875	19.43	071010b i	-0.604	19.90
					060906 r	0.315	19.48	071011 r	-0.979	23.60
					060906 i	-0.153	19.76	071011 i	-0.754	21.87
					060906 z	-0.236	20.25	071011 z	-0.998	23.07
					060908 g	-0.114	19.31	071020 g	0.989	18.01
					060908 r	0.908	23.28	071020 r	-2.367	26.84
					060908 i	-1.005	24.72	071020 i	-1.055	22.96
					060908 z	-1.206	23.9	071020 z	-1.324	23.93
					070208 g	-0.630	21.74	071112 r	-0.330	22.57
					070208 r	-0.367	20.59	071112 i	-2.150	23.66
					070208 i	-0.419	20.84	071122 r	-0.463	21.35
					070208 z	-0.268	20.35	071122 i	-0.486	21.23
								071122 z	0.031	19.43

CONCLUSIONS

Based on the good results from our P60 photometry we plan to continue our GRB OT observations. According to our recent results the issue of the GRB colors and the investigation of the color - redshift relations needs much more efforts.

The results for the year 2008 are in preparation. We plan further investigation and refinement of the transformation coefficients between the USNO and SDSS catalogue and the P60 photometric system as well.

ACKNOWLEDGMENTS

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