Bull. Spec. Astrophys. Obs., 1994, **37**, 132-135.

INVESTIGATION OF LOW-MASS X-RAY BINARIES WITH SUPERHIGH TIME RESOLUTION. DETECTION OF NONTHERMAL OPTICAL FLARES FROM A BURSTER MXB 1735-44

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A search for superhigh optical variability among some low-mass X-ray binaries has been made. Observations have been made with the soft- and hard-ware complex MANIA (Multichannel Analysis of Nanosecond Intensity Alterations) linked to the 2.15 m telescope of CASLEO Observatory (Argentina). Stochastic variability on time scales from 10^{-7} to 10 s of the objects 4U1659-487, 4U1822-630, 4U1636-536, 2S0921-630 and 4U1543-475 has not been detected. Upper limits of relative power of the variable emission component are from 45% to 1.5% for minimum and maximum time scales, respectively (confidence probability $\geqslant$99%) (Table 1). Two flares of about 0.25 s duration have been recorded from the MXB 1735-44 X-ray burster (Figs. 1,2), the brightness of the object has increased 15-30 times during these flares. Their forward fronts have steep regions with characteristic times of 0.05-0.06 s and fine time structure within 0.005-0.006 s, with a confidence probability of $\geqslant$95%. Brightness temperatures of the mentioned flare phases are higher than $5 \cdot 10^7$, 10^8, 10^{10} K, respectively (Table 2). The detected events with a high probability may be caused by nonthermal processes only. These results evidence probable departures from the standard model of gasodynamic accretion on compact objects in the MXB 1735-44 system.

Table 1. The results of search for optical variability.

Object	Date Time (UT)	V	Star/ backgr. counts/s	Flux 10^6 counts	Relative power upper limits of variable emission component (%)					
					10^{-7}- 10^{-7}s	10^{-6}- 10^{-5}s	10^{-5}- 10^{-4}s	10^{-3}- 10^{-2}s	10^{-2}- 10^{-1}s	1- 10s
4U1822-371 V691 Cr A	5.05.91 7:14:32- 8:00:30	15.6	800/2100	9.6	40	20	10	3.5	3	2
2S0921-630 V395 Car	6.05.91- 1:42:26- 2:25:50		750/350 *)	7.2	40	20	15	5	3	2
	7.05.91 2:45:54- 4:07:06	15.8	250/200	3.6	40	30	15	5	4	2.5
4U1659-487 V821 Ara GX339-4	6.05.91 3:28:08- 4:23:24	17.4	100/860	7.2	45	30	15	6	3	1.5
4U1636-536 V801 Ara	7.05.91 5:26:57- 5:43:02	17.2	130/700	3.6 **)	45	35	20	7	4	1.5
MXB1735-44 V926 Sco	9.05.91 5:02:51- 5:56:46	17.2	170/350	3.6	70	40	25	10	7	2.5

*) Observations are carried out in B filter.
**) Without samples containing flashes.

Table 2. Parameters of the optical flashes of MXB 1735-44.

Param\Flash	I			II		
	Phases			Phases		
	front edge	the steepest part of the front edge	fine structure	front edge	the steepest part of the front edge	fine structure
τ_v, ms	110	60	6	120	60	5
A	32	26	26	17	17	17
T_{bmin}, °K	$7.5 \cdot 10^7$	$2 \cdot 10^8$	$2 \cdot 10^{10}$	$3.5 \cdot 10^7$	$1.5 \cdot 10^8$	$2 \cdot 10^{10}$

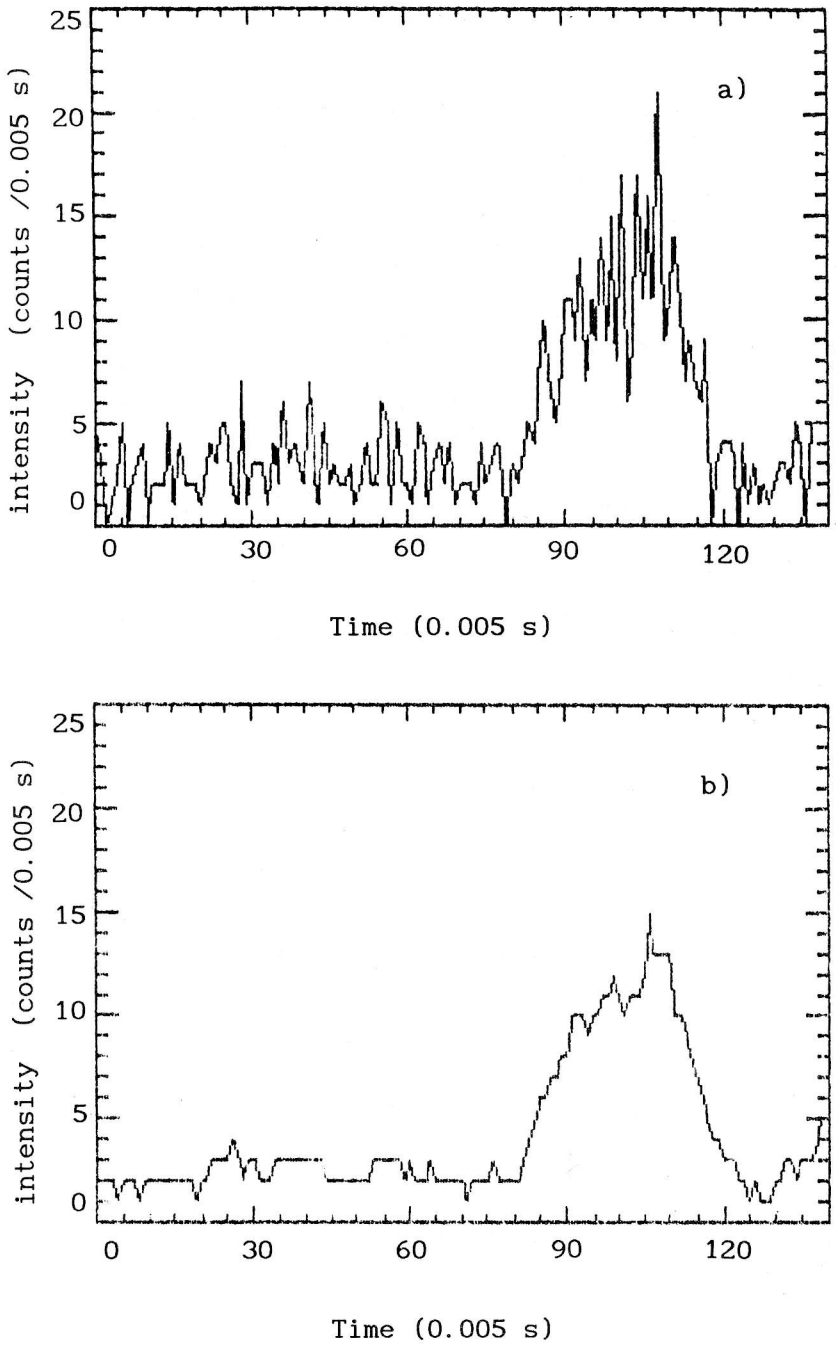

Fig. 1. a) Initial light curve;
b) Smoothed light curve.

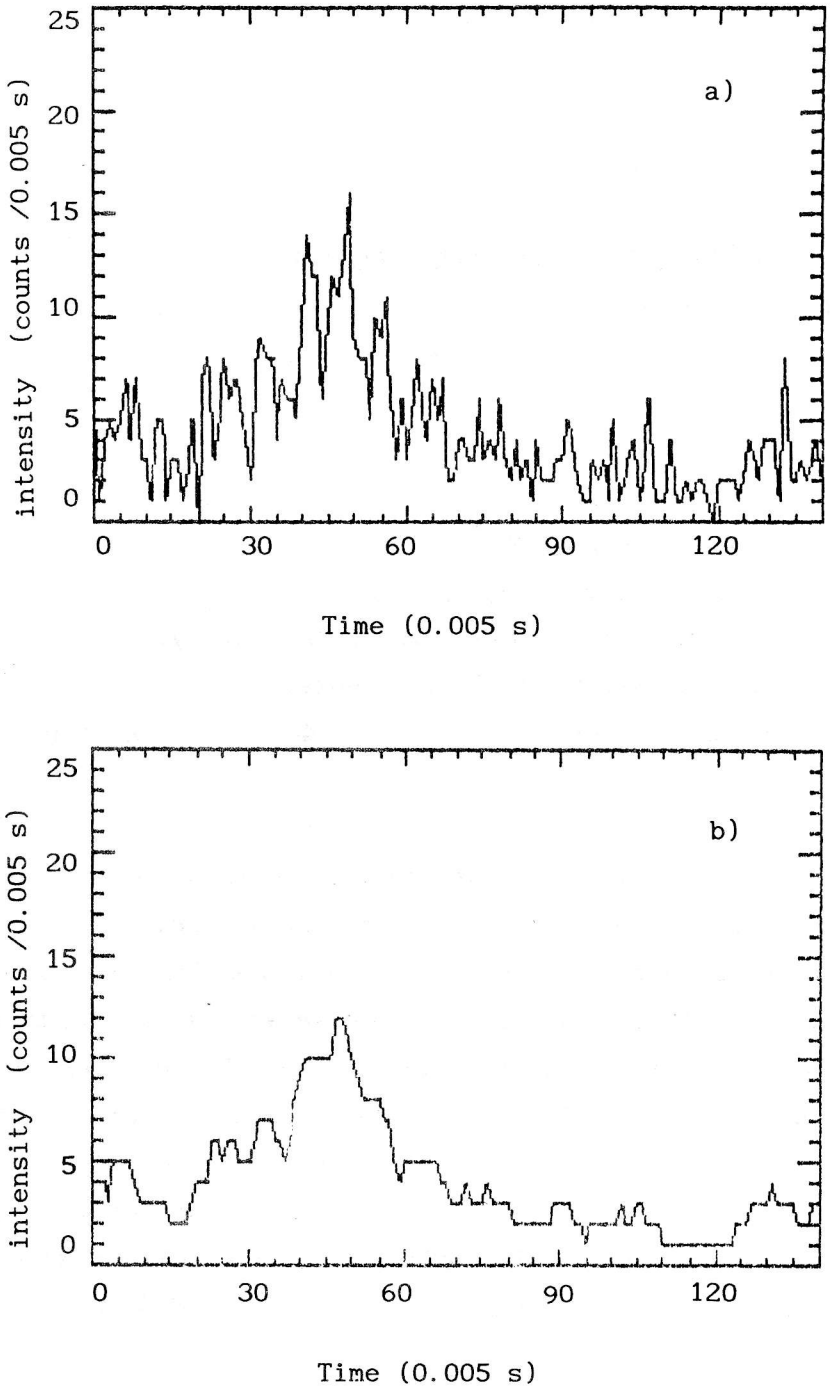

Fig. 2. a) Initial light curve;
b) Smoothed light curve.