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U and I band observations of stellar flares

Introduction:

Most photometric observations of stellar flares were obtained with a time resolution of about 10s, allowing for successive measurements in different spectral bands (e.g. UBV). In the case of the observations reported here, we preferentially observed only in one given band in order to obtain well defined light curves and study the flare fine structure. This allowed us to discover two new types of stellar flares of great interest that will be investigated elsewhere (see also Houdebine, 1990).

Observations:

The observations were acquired in March 1990 with the 1m telescope at the European Southern Observatory equipped with its standard photometer. 4 and 2 nights were dedicated to observations respectively in the U and I Johnson's bands. Weather conditions were good to excellent. We give a compendium of the flare observations in Table 1. The second column gives the total duration of the observations for a given star. The sky count level is given in the last column. The flare magnitudes were computed with respect to the stellar quiescent level prior to a given flare. Only one flare was observed in the I band. In the U band the time exposure was 3s and the effective time resolution lies between 4 and 5 seconds due to the data printing time delay. In the I-band, the exposure time was 1s which was almost equal to the effective time resolution.

Other stars were observed on which no flare were detected: CC Eri, Gl 182, Gl 494, Gl 516 AB, Ross 845 and V371 Ori were observed in the U-band respectively for 0.77h (on the 06/03-1991), 0.78h (07/03), 0.7h (04/03) and 1.0h (06/03), 1.25h (05/03) and 1.15h (07/03), 1.5h (06/03), 1.4h (06/03). Similarly, Ross 614, AD Leo, Gl 494, V371 Ori, Wolf 424 AB, YZ CMi were observed in the I-band for respectively 2.3h (08/03), 0.9h (08/03) and 2.9h (09/03), 1.45h (09/03), 1.9h (08/03), 0.9h (08/03) and 2.1h (09/03).

The light curves of the main flares are shown in Figure 1. Note that the ordinate axis only gives the photon count rate. We refer to Table 1 for the sky count level. During the night of the 6 March 1990, Ross 614 exhibited an almost permanent flaring state. The largest flare (in magnitude) was observed on YZ CMi with a 2.87 mag increase. The maximum brightness is reached only 28 seconds after the flare onset. Before this major event, two flare precursors were detected at 09:04:17 and 09:07:36 Sidereal Time.

Wolf 424 AB and Gl 644 AB large flares exhibit secular light curves. The former displays evidence for periodic changes in brightness, and the latter seems a combination of homologous

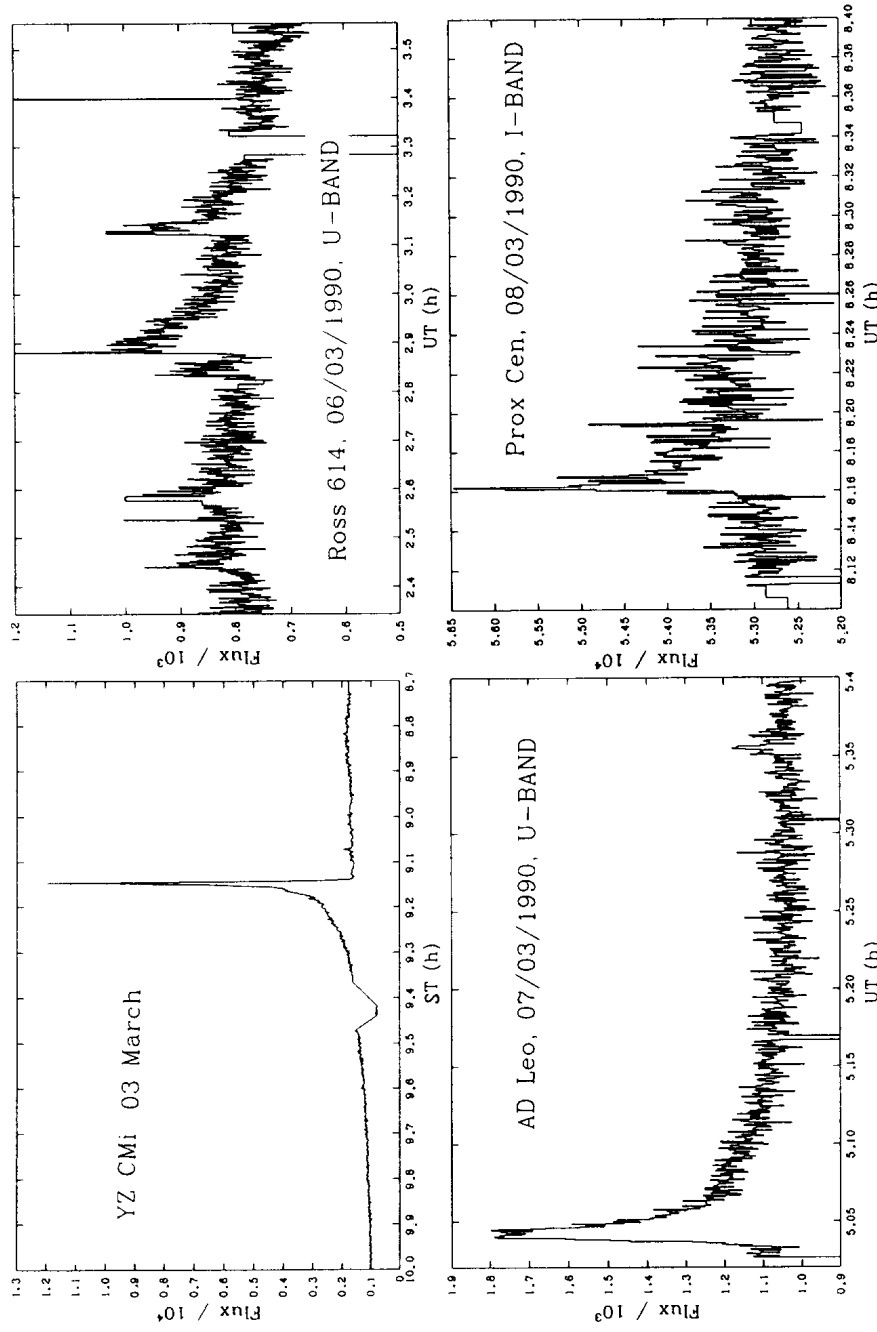


fig. 1: Flare light curves.

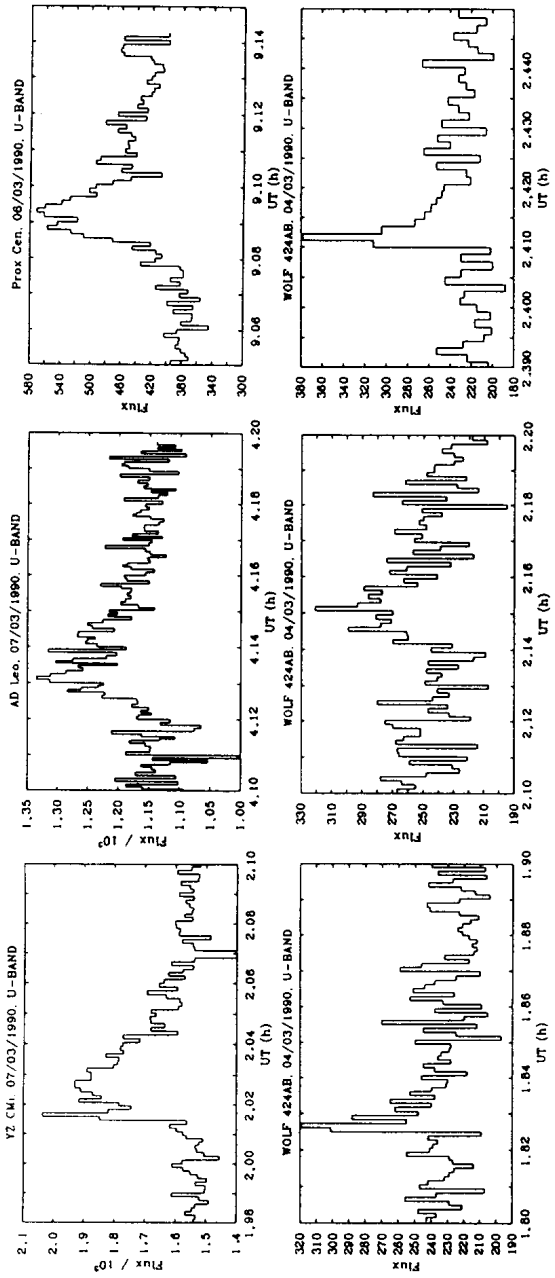


fig. 1 continued:

and sympathetic flares. These flares will be discussed in forthcoming studies (see also Houdebine, 1990).

Table 1: Magnitude, observed duration, and decay time of the flares.

star name	Obs. (h)	Date UT	$t_{1/e}$ (min)	Duration (min)	mag.	UT h : min : s	Band	Sky
AD Leo	3.45	04/03	-	2.3	0.04	23:37:53	U	103
dM4.5e		05/03	2.376	15	1.18	00:36.0*	U	"
		06/03	-	-	-	-	U	268
		07/03	0.95	2.2	0.21	04:07:31	U	252
		"	-	0.9	0.07	04:21:21	U	"
		"	-	1	0.07	04:29:29	U	"
		"	0.552	7	0.66	05:02:06	U	"
		"	-	0.6	0.18	05:21:03	U	"
GL 644AB	2.5	07/03	0.787	60	1.20	07:27:45	U	45
dM3.5e		07/03	0.428	60	1.67	07:39:33	U	"
Prox Cen	1.85	05/03	-	-	-	-	U	130
dM5e	0.8	06/03	0.9	4	0.59	09:04:40	U	122
	2.1	08/03	-	9	0.10	08:07:00	I	340
Ross 614	0.5	05/03	-	-	-	-	U	260
dM4.5e	1.15	06/03	-	2.5	0.27	02:25:59	U	387
		06/03	-	2.2	0.35	02:34:34	U	"
		06/03	-	2.1	0.32	02:49:55	U	"
		06/03	-	9.7	0.60	02:52:40	U	"
		06/03	-	3.7	0.52	03:07:11	U	"
Wolf 424	1.9	04/03	1.43	60	2.50	01:27:47	U	113
dM5.5e		04/03	-	-	1.16	01:49:30	U	"
		04/03	-	-	1.12	02:00:31	U	"
		04/03	-	-	1.03	02:09:05	U	"
		04/03	-	-	1.42	02:24:42	U	"
		04/03	-	-	0.59	02:56:48	U	"
YZ CMi	1.3	04/03	0.94	21.7	2.87	09:08:22**	U	791
dM4.5e		04/03	-	-	0.36	09:04:08**	U	"
	0.9	07/03	2.17	-	0.64	02:00:32	U	1030

* at maximum

** Sidereal Time

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Reference :

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