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FLICKERING IN CATACLYSMIC VARIABLES WITH BRIGHT ACCRETION DISKS *

The phenomenon of flickering is a feature common to all catalysmic variables (CVs). However, it has not won much attention so far. The only attempt to systematically study its properties has recently been undertaken by Bruch (1989)[1]. In an effort to enlarge the statistical base for such investigations it was attempted to obtain flickering light curves of several more CVs. For that purpose a number of objects which are supposed to have accretion disks in a bright state, i.e. classical novae in quiescence and UX UMa type novalike variables, were selected. Due to unfavourable weather conditions only three of them could finally be observed. These are V603 Aql, QU Car and RW Sex.

The observations took place on 1988, April 10 and 11 at the 60–cm–telescope of the Observatório Astrofísico Brasileiro on Pico dos Diaz, Brasopolis, Brazil. A one–channel Texas photometer was used to take sequential measurements in the passbands of the UBV system with integration times of 5^s per channel. Several standard stars selected from the list of Landolt (1973) were observed each night in order to enable a determination of the extinction and a transformation of the observations into the standard system. The data were reduced with the MIRA software system (Bruch 1987) at the Astronomisches Institut Münster.

Intermittent fog forced frequent interruptions of the observations. Therefore, the individual light curves of the observed CVs are all of rather short duration. Mean magnitudes and colours together with their errors calculated from the individual light curves are collected in Tab. 1. Note that the quoted mean errors are not dominantly caused by noise in the data but by the real variations due to the flickering of the systems.

Table 1: Journal of observations

Name	Date 1988 April	Obs.–time UT start	end	Number of integr.	V	$B-V$	$U-B$
V603 Aql	10	5:18	6:20	215	11.92±0.04	−0.06±0.03	−1.05±0.03
QU Car	10	4:10	4:55	162	11.23±0.04	−0.05±0.02	−1.06±0.02
QU Car	11	0:23	1:21	128	11.32±0.04	−0.04±0.02	−1.01±0.02
RW Sex	10	1:18	2:44	293	10.70±0.01	−0.07±0.01	−0.87±0.01

The B band light curves of the observed stars are shown in Fig. 1. All of them reveal the flickering activity typical for CVs. However, there are strong dif-

*based on observations made at the Laboratório Nacional de Astrofísica – LNA/CNPq, Brazil
[1]Copies of this study (in English) are available in a limited number from the author. A condensed version will be published elsewhere.

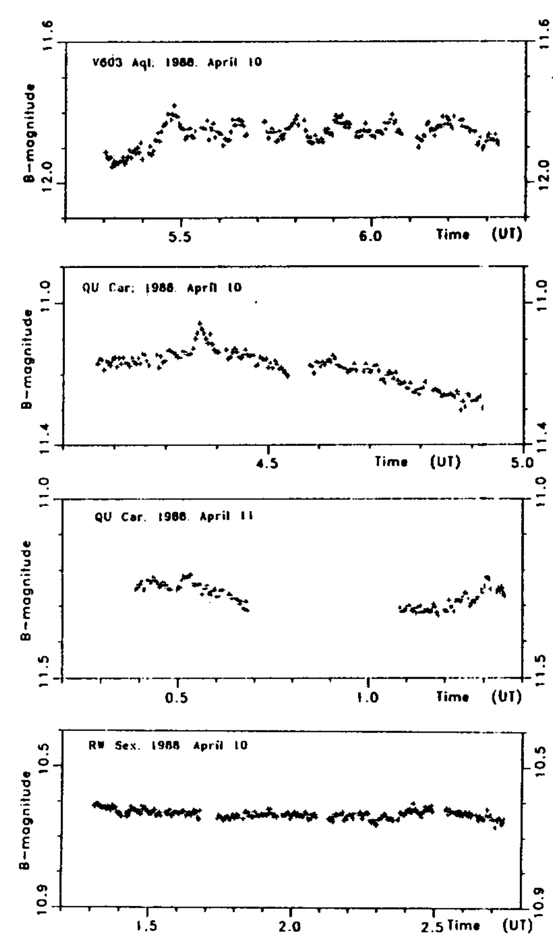

Figure 1 B band light curves of the observed stars

ferences concerning the total amplitude and the activity. The strongest flickering is observed in V603 Aql, while RW Sex shows only slight, albeit significant variations. The flickering in the light curves of V603 Aql and QU Car on April 10 was subjected to a quantitative analysis using techniques developed by Bruch (1989) to which the reader is referred for details. The two sections of the light curve of QU Car of April 11 being too short, and the amplitude of the variations of RW Sex being too small, such an investigation of the flickering was not possible in these cases. The results are summarized in Tab. 2 which contains the following information:

Table 2: Properties of the flickering in V603 Aql and QU Car

	V603 Aql 1988, April 10	QU Car 1988, April 10		unit
$E_{(B-V)}$	0.07	0.16	0.0	mag
number of flares	7	3	3	–
limiting amplitude	0.03	0.02	0.02	mag
total amplitude	0.18	0.25	0.25	mag
flare rate	7.3	4.0	4.0	hour^{-1}
gradient ratio	0.77 ±0.50	2.00 ±1.98	2.00 ±1.98	–
activity a(m)	0.018	0.011	0.011	mag/min
activity $a(F)$	2.82×10^{-15}	4.55×10^{-15}	2.43×10^{-15}	[erg/(sec cm^2 μ)] /min
$F(V)/F(B)$	0.66 ±0.06	0.38 ±0.03	0.56 ±0.06	–
$F(U)/F(B)$	2.48 ±0.31	1.79 ±0.18	1.64 ±0.17	–

1. the interstellar reddening. Some of the properties listed below are distorted by interstellar extinction. These are the activity expressed in flux units and the flux ratios in various bands. To obtain physically meaningful results for these quantities an extinction correction is required. For V603 Aql a colour excess of $E_{(B-V)} = 0.07 \pm 0.01$ was derived as a mean value from five independent measurements (see Bruch 1989). For QU Car a value of $E_{(B-V)}$ = 0.16 was determined by Schild (1969). However, this value – being based on doubtful assumptions – is highly uncertain. Therefore, Tab. 2 contains also results calculated under assuming zero extinction.

2. the total number of individually resolved flares in the flickering upon which the results are based.

3. the limiting magnitude for the flares. Flares with a smaller total amplitude cannot confidently be separated from noise and are therefore not considered.

4. the total amplitude of the variations in the light curve defined as the difference between the faintest and the brightest data points.

5. the flare rate defined as the number of individually resolved flares per time unit.

6. a symmetry parameter defined as the mean ratio of the mean gradients of the rising and declining branches of individual flares. A value <1 indicates a slower rise than decline, a value >1 means that the rise is steeper than the decline.

7. the activity defined as the sum of the absolute values of all brightness variations in flares per time unit on the magnitude scale.

8. the activity as above, but expressed in flux units. The calibration of Hayes (1979) has been used to transform magnitudes into fluxes.

9. the mean flux of the flickering light source (i.e. in the flares) in the V band relative to that in the B band.

10. the mean flux ratio of the flickering light source in the U band relative to that in the B band. Together with the previous item this defines the broad band spectrum of the flickering light source at the locations of the isophote wavelengths in the UBV system, normalized to the B band.

Except for the flux ratios the numerical values in Tab. 2 refer to the B band of the considered light curves. It will not be attempted here to interpret the properties of the flickering in the investigated systems. To do so meaningfully a larger sample of flickering light curves is required. Therefore, the present results may serve as input data for future, more encompassing studies of the flickering.

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