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SOME REMARKS CONCERNING THE TIME-DISTRIBUTION OF FLARES OF UV CETI TYPE STARS

In a recent paper of the authors (1) it was shown that the sequences of flares ($\Delta m > 0.15$ mag.) of the stars YZ CMi and UV Cet are near to Poisson series with mean flare frequencies $\nu = 0.00379$ min^{-1} and $\nu = 0.01190$ min^{-1}, respectively. This conclusion was based on the consideration of the time-intervals between flares and partly of the number of flares, occurring in a given small time-interval. By such an approach, accounting mainly the small scale structure of flare sequences, the possible excess flare groupings relative to the Poisson law could be detected only indirectly. Therefore, it would be desirable to investigate the flare sequences in a way which would take into consideration the probability of appearance of each given group of flares.

When the time-intervals of continuous observation of a star are small and of different duration, then the simplest approach to this question is to consider the distribution of the quantity N_k, the number of intervals of continuous observation containing a given number, k=0.1.2.... of flares, and to compare the so obtained distribution with the one expected for a Poisson sequence.

In order to find out the above mentioned distribution we employed the same, rather homogeneous set of B colour flare observations of YZ CMi and UV Cet made in 1967-1970, and already used in (1). In the first, second and fourth columns of Table 1 are presented the number of flares (k) and the numbers of time-intervals containing k flares for both stars under consideration.

As it was said above, the different duration of time-intervals of continuous observations should be taken into account when considering the corresponding quantities for a Poisson process. Therefore, let us denote by g(t)dt the part of time-intervals the duration of which lies between t and t+dt, and by $p_k(t)$ the probability of occurrence of k flares during a time-interval t. If the number of flares occurring in non-overlapping time-intervals are mutually independent, then according to the full probability formula, the probability w_k to find k flares in a randomly taken time-interval is given by

$$w_k = \int_0^\infty g(t)p_k(t)dt \qquad k = 0.1,2..... \qquad (a)$$

Table 1

k	YZ CMi N_k	YZ CMi $N_k^{(p)}$	UV Cet N_k	UV Cet $N_k^{(p)}$
0	209	209.0	120	104
1	46	45.8	24	37.0
2	14	13.8	14	16.3
3	5	4.7	3	8.7
4	2	1.7	7	4.8
5	0	0.55	4	2.8
6	0	0.28	0	1.6
7			1	0.89
8			1	0.53
9			0	0.35
10			2	0.18
11			1	0.09
N	276		177	

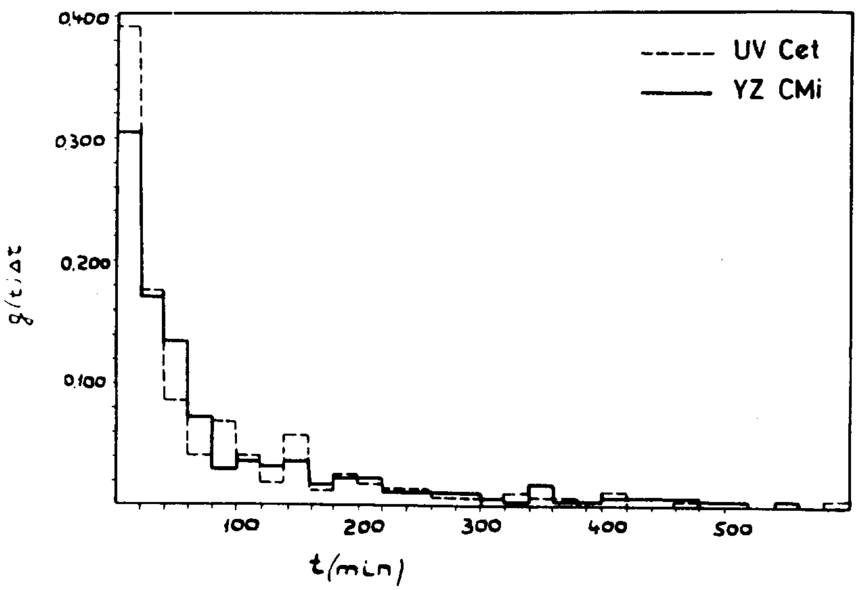
Supposing now that $p_k(t)$ is defined by the Poisson formula we obtain the following expression, giving the expected number of time-intervals containing k flares:

$$N_k^{(p)} = Nw_k = N \int_0^\infty g(t) e^{-\nu t} \frac{(\nu t)^k}{k!} \qquad k = 0,1,2.... \quad \text{(b)}$$

where N the whole number of intervals of continuous observation, is equal to 276 for YZ CMi and 177 for UV Cet.

The function g(t) presented on the Figure slightly differs from the one used in (1). This is caused by the fact that in the present case we are not interested in the moments of flare occurrence inside the time-intervals. This difference is, however, not substantial for our further conclusions.

The quantities $N_k^{(p)}$ for a Poisson process are calculated by formula (b) using the above given frequencies and are presented in the third and fifth columns of Table 1. The comparison of these quantities with the corresponding observational ones shows for YZ CMi a very good and for UV Cet a fairly satisfactory, $P(\chi^2 > \chi^2_{obs}) = 0.06$ agreement. It should be stressed, that the number of time-intervals containing relatively large numbers of flares corresponds well to the expected ones. A significant difference could be noticed only for $k \geq$ 10-11 (this fact was discussed in (1)) but this could mostly be due to fluctuations owing to the small number of events.



The present discussion permits to infer that the observational data do not contradict to the supposition that the flare sequences on the stars YZ CMi and UV Cet are near to the Poissonian one, and in this way confirms the conclusion made in the previous paper.

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Reference

(1) Oskanian,V. and Terebizh,V. 1971, Astrofizika Vol.7. No.1.