ANALYSIS OF THE MACHINE-READABLE VERSION OF THE TONANTZINTLA CATALOGUE OF THE PLEIADES FLARE STARS

M.K.TSVETKOV, K.Y.STAVREV, K.P.TSVETKOVA

Department of Astronomy and National Astronomical Observatory
Bulgarian Academy of Sciences, Sofia

The results of the intensive observations of the Pleiades flare stars for more than 20 years ($\approx 3000^{h}$ effective observational time) were compiled and published by G.Haro and collaborators in a catalogue (Haro et al.,1982) including the flare stars discovered in the Pleiades region up to 1981. The catalogue contains the data for 519 flare stars.

In the frame of the international programme for the study of flare stars in stellar aggregates the Department of Astronomy and the National Astronomical Observatory have carried out patrol observations in the Pleiades since 1979.Parallel to the observations, work on the creation of machine-readable versions of the published flare stars catalogues has begun. As a firststep, a machine-readable version of the Tonantzintla catalogue (TC) of the Pleiades flare stars has been prepared (Tsvetkov et al., 1987).

An attempt for a preliminary analysis of the comparatively nonhomogeneous observational material in the Tonantzintla catalogue is made in the present paper aiming at its further supplementing and statistical processing.

The data in the TC was first examined by sorting the data file of the machine-readable version by various parameters of the flare stars and flare events (flare star magnitude, flare event amplitudes, membership in the Pleiades cluster, observatory,etc.).

The examination of the TC data shows that it is nonhomogeneous in respect to the included flare stars and detected flare events. This fact is due to the specific conditions and criteria for detection of the flare events applied by the different observatories and some cases of duplications of the observations.

The distribution by magnitudes at maximum of the flare events shows that the TC contains some flare events which are not detec-

https://doi.org/10.1017/S0252921100154028 Published online by Cambridge University Press

ted by the usual multiexposure method but on direct plates. One should have in mind that using the multiexposure photographical method with wide-angle telescope we study first of all the flare activity of stars showing relatively large flare-event amplitudes. Usually the accepted criterion for detected flare events by this method is not different from the accepted one for photoelectric observations of the solar neighbourhood flare stars and it is $4\,\sigma \leq \Delta m \leq 7\,\sigma$ (Oskanian and Terebiz,1971). Having this in mind,we can try to draw out of the TC a more homogeneous sample of flare stars and events. We can base such a homogeneization on the following assumptions:

a) Mean limiting *Pg* and *U*-magnitudes for 5 - 15^{min} exposure made with wide-angle telescopes are adopted for the different observatories which apply the multiexposure photographic method.

b) The average dependence $\sigma(m)=0.248-0.080m_{lim}+0.0098m_{lim}^2$ is adopted, where $\sigma(m)$ is the standard error in dependence of the limiting magnitude of observations (m_{lim}). This relation has been obtained from repeated measurements of separete flare events, detected by the multiexposure photographic method in Byurakan and Rozhen.

c) The criterion $\Delta m > 5\sigma(m)$,where Δm is the flare-event amplitude,is applied to extract from the catalogue a more homogeneous sample of flare events.

Applyng this procedure, we have obtained the following results:

1. 38 TC stars (7.3%) do not satisfy the criterion $\Delta m > 5\,\sigma(m)$. 33 of them have shown only one flare event, 3 stars have two flare events each, one star has 3 flare events and also one star has 4 flares. 15 of these stars are with known proper motions and all of them are not members of the cluster.

2. 202 flare events (13.2%) are rejected by the criterion $\Delta m > 5\,\sigma(m)$. So the homogeneous sample contains 1329 flare events for 481 stars.

3. The distribution of flare stars by the number of observed flare events after applying the criterion $\Delta m > 5\sigma(m)$ is given in Table 1. Applying Ambartsumian's (1969) statistical formula for estimating the lower limit of the total number of flare stars (N) we obtain N = 840 which is by 80 less than the estimate done before applying the criterion.

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TABLE 1

Flare Star Distribution by the Number of Flare-Ups before and after Applying the Criterion $\Delta m > 5\,\sigma(m)$

Number of Flare-Ups	Number of TC Flare Stars	Total Number of Fl.- Ups	Number of TC Fl.Stars in the HS*	Total Number of Flare-Ups in the HS*
1	267	267	244	244
2	89	178	83	166
3	48	144	50	150
4	35	140	32	128
5	16	80	13	65
6	19	114	19	114
7	9	63	8	56
8	10	80	14	112
9	9	81	6	54
10	3	30	3	30
11	5	55	2	22
12	3	36	2	24
13	1	13	2	26
14	1	14		
18	1	18		
23			1	23
32	1	32		
48			1	48
66	1	66		
67			1	67
120	1	120		
Total	519	1531	481	1329

* HS - homogeneous sample

4. The distribution function of the flare mean frequency changed especially for the stars with high frequency of flare events. For instanse, the star TC 377 with 120 flare events preserves only 67(56%) of them after applying the criterion $\Delta m > 5\,\sigma$.

5. Additional information about the Byurakan observations has been added to the machine-readable version of the TC which allows to distinguish between the two telescopes (1.00/1.30 m and 0.53/0.53 m) used in the observatory for patrol observations. In Fig.1. the dependence $m_{Pg\min}/m_{Pg\max}$ for the 1.00/1.30 m Byurakan (40") Schmidt telescope and the application of the criterion $\Delta m > 5\,\sigma(m)$ for the flare events discovered in this case are represented.

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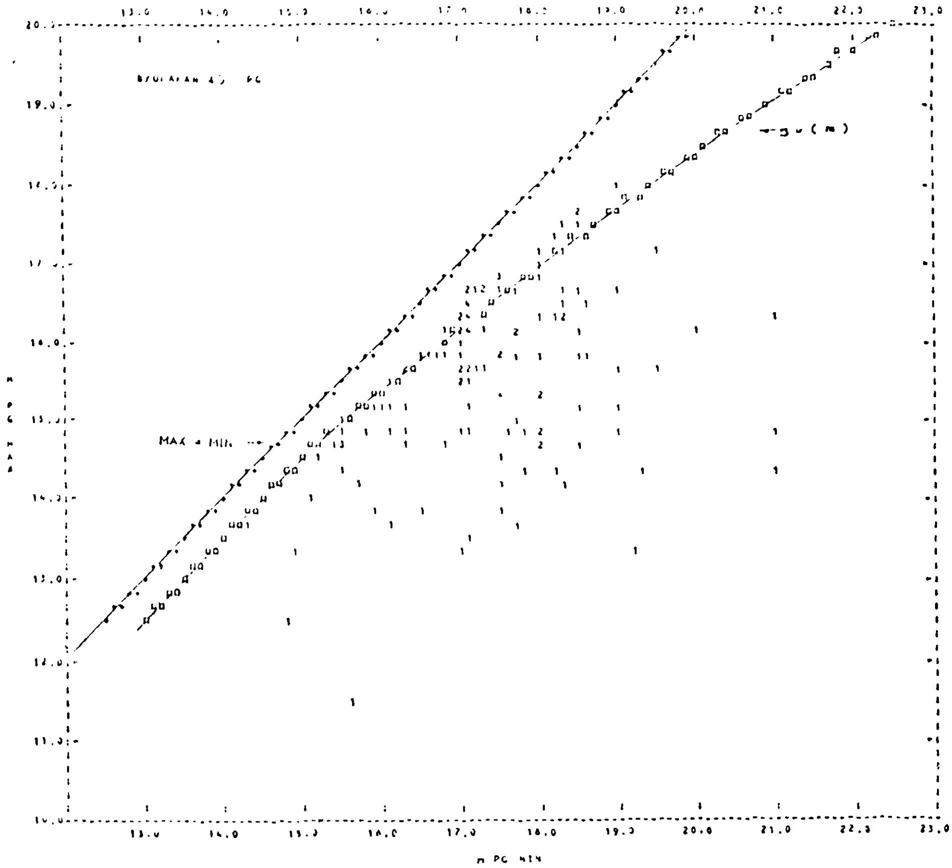

[illegible] 1. [illegible] of the application of the criterion Δm [illegible] for the flare events detected in Pg [illegible] with 40" Byurakan Schmidt telescope.

[illegible] than ≈ [illegible] new [illegible] have been discovered in the [illegible] the publication of the Tonantzintla catalogue. [illegible] supplementing of the machine-readable version of the catalogue [illegible] precise for statistic- [illegible] complete study of the flare [illegible].

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