

NEW OBSERVATIONS OF FLARE STARS IN THE PLEIADES BY THE
METHOD OF STELLAR TRACKS

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ABSTRACT. In 1984-1986 new observations of flare stars in the Pleiades region were carried out by the method of stellar tracks with 40" Schmidt telescope of the Byurakan observatory. The effective observational time is 100 hours in U-rays (ORWO ZU-21 plates combined with UG-1 filter were used). The stellar tracks have 1-1.5 cm length, the limiting stellar magnitude on the plates is 13^m-14^m , time resolution is 5^s-20^s . 17 flares of 13 stars were detected. Six of these stars were detected as flare stars for the first time. According to the Hertzsprung catalogue all these stars are the Pleiades cluster members. The flare amplitudes reach up to 1.5-3.0 magnitudes, the duration vary from 2.5 to 10.5 seconds.

The observations of flare stars in stellar aggregates up to now were carried out generally by multiexposure method. As a result of this method no information about rapid and faint flares of relatively bright stars was possible to get. Meanwhile, the problem of bright flare stars and rapid flares in aggregates is actual. The method of star tracks, proposed and tested by one of the authors [1], allows to get relatively large information on rapid and faint flares of bright stars by photographic observations on wide-angle telescopes. This method is something between the electro-photometric and photographic multiexposure methods. It makes possible to combine the advantages of the method of survey photographic research of flare stars in aggregates by wide-angle cameras, with those of the detailed research of each star, which is typical for the electrophotometric method.

The observations were carried out in 1984-1986 with 40" Schmidt camera of Byurakan astrophysical observatory. In order to get stellar tracks, the correction mechanism of this telescope was used. It was intended for comets'

observations and allows to move the telescope in any direction during the exposure (with a wide range of velocities). The exposure time and the velocity of the telescope were chosen so, that it was possible to detect the flares of relatively bright stars of 13-14 magnitudes. For our telescope the optimum was 1-1.5 cm length of tracks got during 30 min. The photometry of flare tracks is done as in the case of ordinary photographic observations.

During 100 hours 17 flares of 13 stars were detected. Six of them are new flare stars. The data about these flares are presented in Table 1, where in corresponding columns are given: Haro's [2] catalogue number, Hertzsprung [3] number, U -magnitude at minimum [4], ΔU amplitude of the flare, n - number of all known flares before our observations, t - total duration of the flare, τ - duration of the flash phase, and the date. As an illustration some of the light curves of the detected flares are represented in Fig.1.

For a comparison with the usual multiexposure method it can be noted that according to Haro's catalogue [2] 144 flares of bright stars ($U_{\min} < 15^m$) were detected during 3600 hours of multi exposure observations, whereas we have detected 17 such flares during 100 hours of observations by tracks method. It means that for bright stars this method is much more effective (more than 4 times) than the usual one.

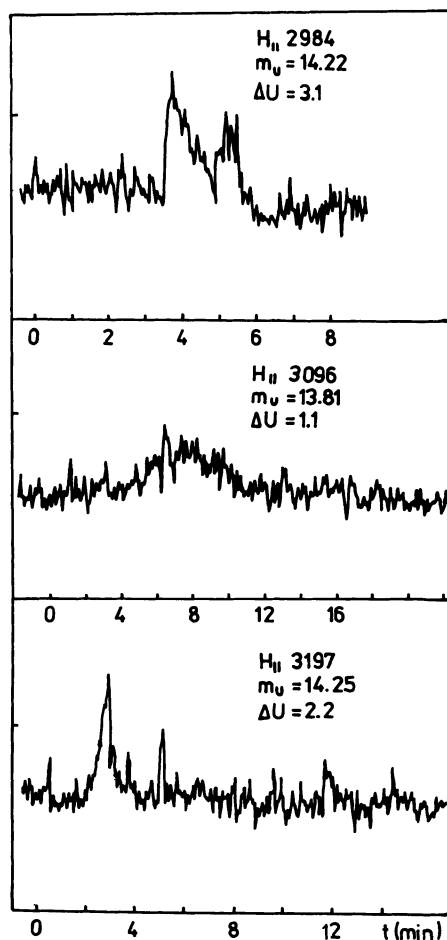


Figure 1. Light curves of some flares obtained by the method of stellar tracks.

Table 1. The flare stars observed by tracks method.

N	HII	U _{min}	ΔU	n	t(min)	τ(min)	Date
85	5	13.46	1.5	2	9	0.9	27.11,84
	738	14.14	1.7	0	7.3	1.0	24,10,84
	1332	14.30	1.4	0	7.7	<0.1	28,10,86
278	1454	14.88	2.3	1	4.4	0.4	23,10,84
290	1553	13.25	1.8	2	7.2	1.5	28,10,86*
"	"	"	1.3	"	3.5	<0.2	"
"	"	"	2.0	"	5.9	0.1	"
331	1883	14.37	1.9	3	8.9	<2.0	03.09,84
"	"	"	1.6	"	3.3	0.2	25,10,84
348	2034	14.20	1.8	1	10.6	2.0	27,08,84
369	2244	14.33	1.2	1	6.8	1.6	23,10,84
	2381	14.50	1.7	0	3.1	1.1	24,10,84
	2870	14.41	1.5	0	2.4	0.3	15,12,84
	2984	14.22	1.4	0	5.1	0.1	15,12,84
	"	"	3.1	"	>1.8	0.1	27,10,84
	3096	13.81	1.1	0	5.7	1.3	24,10,84
448	3197	14.25	2.2	4	5.9	0.3	26,11,84

*) The three mentioned flares of this star have taken place during the same night, the second flare-up was two hours after the first one, and the third was 0.5 hour after the second.

REFERENCES

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2. Haro, G., Chavira E., and Gonzales, G. (1982) 'A catalogue and identification charts of the Pleiades flare stars', Bol. Inst. Tonantzintla 3, No.1, 3-68.
3. Hertzsprung, E. et al (1947) 'Catalogue de 3259 etoiles dans les Pleiades', Ann. Leiden Obs., 19, No. IA.
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BLAAUW: In your search did you investigate all stars occurring on the plate or did you limit it to the known members of the Pleiades?

BROUTIAN: We have investigated all the stars that occur on our plates, but may be a little more attention was payed to the stars of the Hertzsprung catalogue.

BLAAUW: The fact that all flare stars found are cluster members has important implications for the study of the dimensions of the Pleiades. Since for the outer regions there are very few early epoch plates, p.m. cannot be very accurately determined here; so flare stars may be the best approach to this problem.