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FLARE STARS IN THE REGION OF NGC 7000

Systematic observations of the area embracing the emission nebulae NGC 7000, IC 5070, S 81 and S 85 were started in June 1972 at the Byurakan Astrophysical Observatory in order to discover and investigate flare stars and other nonstable objects in the region.

There are a great number of objects in this region showing H α -line in emission. Some of them are T Tauri type stars (1), (2). There is - in evolutionary sense - a very interesting star, as well: the Foor V 1057 Cygni (3), (4).

Therefore, one can expect that our observations make it possible to discover some flare stars connected with the above mentioned complex objects.

It is important to note that among the regions in which flare stars have ever been searched this area is the nearest one to the galactic plane ($b=-1^\circ$). Our observations can add some more informations about the red dwarfs among the foreground stars as well.

The observations were carried out with the 40 in./50 in. and 21 in./21 in. telescopes of the Byurakan Astrophysical Observatory by the method of multiple exposures. Each of our exposures was equal to 10 minutes.

The star BD+41 $^\circ$ 3922 ($RA_{1950.0}=20^h51^m6$, $D_{1950.0}=+42^\circ13'$), situated in a region of comparatively low star density was chosen as center of our region in order to avoid a great number of confusions which could take place with our observational method.

The flare stars discovered by Haro and Chavira (5) are in the region, partly overlapping ours.

The result of the preliminary examination of the most part of the obtained observational material is given in this note.

The number of plates and exposures as well as the effective time of observations for each telescope are presented in Table 1.

Table 1

Telescope	Number of Plates	Number of Exposures	t eff.
40 in.	166	944	157 ^h 20 ^m
21 in.	168	978	163 ^h 00 ^m

We used Eastman Kodak 103 aO or ORWO ZU 2 plates with 2mm Schott UG2 ultraviolet filter (40in.), or without filter (21 in.). The average limiting magnitudes were $\sim 18^m 0$ U and $\sim 16^m 7$ pg, respectively. A number of plates, $t_{\text{eff}} = 39^h 25^m$, have been obtained with both telescopes simultaneously. From such observations it is possible to obtain some information of the colours of the flares. The data of observed flares are summarized in Table 2.

Table 2

Designation	RA 1950.0	D	m_{pg}	$m_{\text{pg/U}}$	Date of Flare-up	Telescope
B1	20 ^h 48 ^m 8	+40 ^o 43'	19 ^m 5	3 ^m 5	10.07.1972	21 in.
T1	21 00.7	42 08	17.0	1.3	11.07.1972	21
B2	21 00.0	42 26	19.0	3.7	11.07.1972	21
B3	20 53.9	44 09	18.5	3.1	3.10.1972	21
B4	20 50.5	41 26	20.0	3.9	11.10.1972	21
T1	21 00.7	42 08	17.0	1.7	24.11.1972	21
B5	20 54.0	43 31	19.5	4.0U	4.07.1973	40,21
B6	20 43.9	42 41	20.0	4.5U	27.07.1973	40
B7	20 47.1	41 02	19.5	4.5U	27.07.1973	40
T5	20 58.2	43 20	18.0	2.0U	29.07.1973	40
B8	20 55.6	43 39	18.5	2.5U	30.07.1973	40
T5	20 58.5	43 20	18.0	1.5U	1.08.1973	40
T5	20 58.2	43 20	18.0	1.5U	17.08.1973	40
B9*	20 49.2	44 04	17.5	3.0U	24.08.1973	40,21
B10	20 48.5	41 33	14.5	0.7U	23.09.1973	40
B11	20 48.7	41 46	20.5	6.4	19.10.1973	21

*The light curve is very peculiar

Table 2 contains the following data:

Column 1. The serial number of the flare stars discovered at Byurakan (B) and Tonantzintla (T) Observatories.

Columns 2 and 3. Coordinates for 1950.0

Column 4. The approximate photographic magnitudes at minimum

Column 5. The observed amplitude in pg or in U light.

Columns 6 and 7. The date of the flare-up and the telescope used.

In this way we have found 16 flare-events in 13 different flare stars for $t_{\text{eff}} = 280^h 55^m$. The flare stars T1 and T5 discovered by Haro and Chavira (5) have shown 2 and 3 outbursts, respectively. All other flare stars have been discovered in the course of this work. It should be mentioned that the flare activity in the direction of NGC 7000 is comparatively low (for instance, in comparison with the Pleiades).

This does not contradict Haro and Chavira's conclusions (5).

It is interesting to say that no conspicuous flare-event was discovered for the stars known to have H α emission.

It may be added that, contrary to the H α objects listed in (1) and (2), the flare stars do not show any concentration toward NGC 7000 or IC 5070. They are apparently distributed all over this region.

The results of more detailed investigations of the discovered flare stars, including the identification charts, will be published later on.

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