Flare Activity Among Nearby Stars

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I selected the common objects from our Data Base on 234 UV Cet Flare Stars and Related Objects and the Third Catalogue of Nearby Stars by Gliese & Jahreiss (CNS-3). It is found that manifestation of flare activity (FA) (flares in any spectral region or photometric variability caused by spots) is observed on 143 flare stars (FS) out of the 3803 CNS-3 stars within 25 pc of the Sun with absolute magnitudes M_V from 5.2 (Sp G2 V) to 18.8 (Sp dM5e – dM6e).

Magnitudes and spectra of flare stars: For each M_V-interval, Table 1 gives the "mean" spectral class (Sp), the number of FS (N_f) and the portion of FS among other red dwarf stars from CNS-3 (N_f/N). Absolutely fainter stars include a higher portion of known FS. However, observational selection effects can cause this dependence, because the probability is higher to register flares over the background radiation of a faint star. The observed portion of FS among all red dwarfs from CNS-3, which are fainter than M_v=5, is about 5 %.

M_V	Sp	N_f	N_f/N
5 : 6.99	G2	18	0.03
7 : 8.99	K5	28	0.05
9 :10.99	M0	36	0.05
11 :12.99	M3	25	0.03
13 :14.99	M4	21	0.12
15 :16.99	M5	11	0.18
17 :18.99	M6	4	0.30

In the quiet spectrum of most FS from our Data Base H I or Ca II emission is present, but in 10 % of FS these features are absent, and their quiet spectra differ in no way from spectra of normal red dwarfs.

Binary systems among flare stars. 28 from 143 FS are components of close visual binary systems, and flare activity was observed in the total light of both components. In addition, on 13 visual binaries the flare activity was observed on both components separately. Also, on 7 visual binaries the flare activity was observed only on the bright component, and on 4 only on the faint component. Morever, on 4 stellar systems the flares were observed on the third (C) component. Only 77 objects among the FS, or 53 % are not known as visual binaries. The appropriate portion of single stars in the same M_v range and Sp from CNS-3 is 78 %. Thus, among FS the portion of visual binary systems is higher then among normal stars, and in these systems the flare activity can be observed on the bright as well as on the faint components.

Mean density of flare stars in the solar neighbourhood Following Arakelian (1968) I have arranged the above 143 FS in order of their increasing dis-

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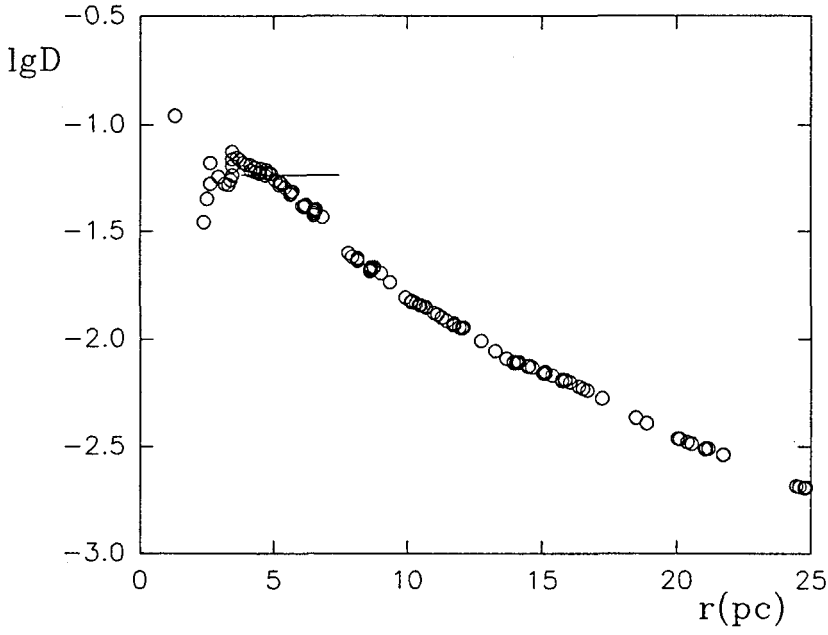

Fig. 1. Determination of the mean density of FS in the solar neighbourhood.

tance from the Sun and have estimated their mean density from the formula $D(r) = 3k/4\pi r_k^3$, (r is the distance from the Sun to the kth star).

The $D(r)$ values based on these data are given in Fig. 1. The first point corresponds to the flare star Proxima Cen, which is the nearest star to the Sun. The next group of two dozen points form a plateau, and beginning from 5 pc $D(r)$ decreases monotonically. It is suspected that beyond this distance more and more low luminosity stars remain undetected. The plateau allows to estimate the mean density of flare stars to be ~ 0.056 star pc^{-3}. Earlier, with only 67 objects, Gershberg & Shakhovskaya (1976) using the some method have estimated the mean density of flare stars to be ~ 0.045 star pc^{-3}. It is possible to think that the real number of FS is considerably higher because FA is found on even distant active stars. Thus, the new value $D = 0.056$ star pc^{-3} should be considered as a lower limit of the mean density of FS in the solar neighbourhood.

The total density of all stars in the solar neighbourhood is $0.111 - 0.118$ star pc^{-3} according to Arakelian (1968). Therefore it is possible to suggest that at least half of the stars in the solar neighbourhood are objects of the UV Cet type.

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References

Arakelian M.A., 1968, Astrofiz. 4, 617
Gershberg R.E., Shakhovskaya N.I., 1976, ApSS 44, 463