DISTRIBUTION OF RED DWARFS IN GENERAL GALACTIC FIELD ON THE BASIS OF STELLAR STAR STATISTICS

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ABSTRACT. The mathematical expectation for detection of stellar flare on UV Ceti type stars in the solar vicinity during photographic patrol observations with 40" Shcmidt camera of the Byurakan Astrophysical Observatory is estimated. We use the luminosity function of the flaring red dwarfs the assume a uniform distribution in the general galactic field. Comparison with the results of photographic patrol supports this assumption. The numbers and total mass of the flare and non-flare red dwarf stars in the Galaxy for the uniform distribution are determined. They are not in contradiction with Oort's estimate of total mass of red dwarfs.

1. INTRODUCTION

Existing observational data demonstrate beyond doubt the physical similarity of the UV Ceti type flare stars in solar vicinity and flare stars in star clusters and associations [1]. On the other hand the flare stars are in one of the earliest stages of red dwarf evolution [2-4].

Proceeding from these facts two possible hypotheses on the origin of the UV Ceti stars in solar vicinity were suggested, one by Ambartsumian [5] (they were formed together and now are members of a system) and the other by Herbig [6] (they are remnants of already disintegrated systems and constitute a population of general star field in Galaxy).

In the present report an evidence in favour of the last hypothesis is presented.

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2.MATHEMATICAL EXPECTATION OF FLARES CAUSED BY THE FLARE ACTIVITY OF THE UV CETI STARS

The mathematical expectation for detecting N flares caused by the flare activity of the UV Ceti stars during photographic observations assuming the uniform distribution of these stars in Galaxy is equal to [7]

$$N=\frac{1}{3}\omega t\sum_{M} D^{*}(M)\sum_{\Delta m} R^{3}(M,\Delta m)\nu(M,\Delta m) \qquad (1),$$

where ω is the field of the used telescope, t- total time of observations, $D^{*}(M)$- space density of the UV Ceti stars having absolute magnitude M,R(M,Δm)- distance up to which a stellar flare with an amplitude Δm can be detected on these stars, and $\nu(M,\Delta m)$- mean frequency of such flares. In the formula (1) summing up is taken for all values of M and Δm.

As the number of known UV Ceti stars in solar vicinity is not enough to determine directly the luminosity function $D^{*}(M)$ it was calculated using the luminosity function D(M) of emission line red dwarfs which have a common nature with the UV Ceti stars [1,2]. The function D(M) itself was determined on the basis of Gliese's catalogue of nearby stars [8,9]. The observation selection in this catalogue was taken into account by using the limiting distances for which its data are complete [10,11].

The function $\nu(M,\Delta m)$ was determined from Moffett's photoelectric observations of the UV Ceti type flare stars [12].This function is essentially different from that for photoelectric observations became of large differences in integrations times. Not all flares registered by Moffett [12] could be detected by photographic method.

3. RESULTS OF CALCULATIONS

The estimate of the time T during which one can expect a single photographic flare caused by flare activity of the UV Ceti stars with 40" Schmidt camera of the Byurakan Astrophysical Observatory are presented in Table 1.

TABLE 1. Estimates of the time T

Passband	Exposure(min)	T(hours)
B	5	94
"	10	161
U	5	11
"	10	27

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In agreement with these estimates during about 190 hours of photographic observations carried out with the Byurakan 40" Schmidt camera only one flare was detected in general galactic field [13].

4. CONCLUSION

The comparison of mathematical expectations of stellar flare detections on UV Ceti stars with results of photographic observations made by the Byurakan 40" Schmidt camera in general galactic star field allows to conclude that the UV Ceti stars have uniform distribution in Galaxy.Most probably they are remnants of already desintegrated star clusters and associations and constitute now population of galactic star field.

For uniform distribution the numbers of flare and non-flare red dwarf stars in Galaxy are 4.2x10**9 and 2.1x10**10 respectively [14]. Their total mass ~ 10**9 solar mass is not in contradiction with Oort's estimate of the total mass of red dwarf stars in Galaxy [15].

REFERENCES

1. Mirzoyan,L.V. and Hambarian,V.V.(1988) 'Statistical study of flare stars I. UV Ceti type stars of solar vicinity and flare stars in star clusters and associations', Astrofizika, 28, 375-389.
2. Haro,G. and Chavira,E. (1966) 'Flare stars in stellar aggregates of different ages', Vistas in Astronomy, 8, 89-107.
3. Ambartsumian,V.A. and Mirzoyan,L.V.(1971) 'Flare stars', in: New Directions and New Frontiers in Variable Star Research, Veroff. Bamberg, 9,Nr.100, 98-108.
4. Mirzoyan,L.V.(1984) 'Flare stars', Vistas in Astronomy, 27, 77-107.
5. Ambartsumian,V.A.(1957) 'Introductionary remarks',in M.A.Arakelian (ed.),Non-Stable Stars, Armenian Acad. Sci., Yerevan, pp. 9-16.
6. Herbig,G.H.(1962), Symposium of Stellar Evolution, J.Sahade (ed.), Astron. Obs. Nat. Univ. La Plata, p. 45.
7. Mirzoyan,L.V.,Hambarian,V.V.,Garibjanian,A.T. and Mirzoyan,A.L. (1988) 'Statistical study of flare stars II.On the origin of the UV Ceti type stars',Astrofizika, 29, 44-57.
8. Gliese,W.(1969) 'Catalogue of nearby stars',Veroff.Astron. Rechen Inst.Heidelberg,No.22,1-116.
9. Gliese,W. and Jahreiss,H.(1979) 'Nearby star data published 1969-1978', Astron. Astrophys. Suppl. Series, 38,423-448.

10. Arakelian,M.A.(1970) 'On the statistics of flare stars in the solar vicinity', Comm. Byurakan Obs., 41, 56-67.
11. Wielen,R., Jahreiss,H.and Kruger,R.(1983) 'The determination of the luminosity function of nearby stars',in A.G.D.Philip and A.R.Upgren (eds.) The Nearby Stars and the Stellar Luminosities Function,Davis Press, New York, pp.163-169.
12. Moffett,T.J.(1974) 'UV Ceti flare stars: observational data', Astrophys. J. Suppl. Series, 29, 1-42.
13. Chavushian,H.S.(1979) A Study of Flare in the Pleiades Agregate Region, Byurakan Astrophys. Obs..
14. Mirzoyan,L.V.,Hambarian,V.V.,Garibjanian,A.T.,and Mirzoyan,A.L. (1988) 'Statistical study of flare stars III. Flare stars in the general galactic star field', Astrofizika, 29, 531-540.
15. Oort,J.H.(1957) 'Dynamics and evolution of the Galaxy in so far as relevant to the problem of the populations', in D.J.K.O'Connell, S.J.(ed.),Stellar Populations, Vatican Obs.,pp.418-433.