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UNUSUAL DISTRIBUTION OF FLARE STARS IN PLEIADES

The distribution of stars of different classes in stellar associations and clusters is a source of important information on their evolution. From this point of view the study of the distribution of flare stars in Pleiades is of some interest.

According to the statistics the total number of flare stars in Pleiades exceds 700(1). Due to the intense observations of the Pleiades region carried out in Tonanzintla, Byurakan, Asiago and Budapest Observatories during the recent years 207 of them have been discovered (1-6). The data on these flare stars have been used to determine the distribution of their partial density in the Pleiades system. The main result of this study is the following:

The distribution of the space partial density of flare stars in Pleiades have been determined on the basis of their apparent distribution on the sky. The solution of Abel's equation has been obtained by the method given in (7). It has been supposed that the distribution of the flare stars in the system is a spheric-symmetrical one, the centre of the system being the geometrical centre of the known flare stars. It is almost coinciding with Alcyone.

The calculated distribution of the partial density of flare stars in Pleiades (number of flare stars per pc^3) as a function of the distance from the centre of the system (in pc) is presented in Fig.1. During our calculations the value of 125pc (8) has been taken for the distance of the centre of the Pleiades system. The corresponding radius of the subsystem of flare stars in Pleiades is about 6 pc.

Fig.1 shows that the flare stars are almost full, absent in the central region of Pleiades. The radius of this cavity is 1.4 pc. The density of the flare stars has a maximum near the limit of the cavity, at the distance 1.5 pc from the centre and is then decreasing with the distance more rapidly than $\sim r^{-2}$.

This result concerning the absence of flare stars in the central region of Pleiades we obtained already in summer 1969 using the data on about 100 known flare stars. Some indications on the similar phenomenon have been noticed earlier for the system NGC 7023 (9).But we have been inclined to think that in both cases this result has been duc

to the scarcity of observational data. Therefore with the discovery of new flare stars in Pleiades this problem has been rediscussed several times using 145,184 and 207 flares stars, respectively. It turned out that the conclusion of the existence of a cavity of flare stars becomes more and more definite with the increase of the statistical material.

It must be noted, that in our calculations we supposed that all observed flare stars in Pleiades belong to the system. If one takes into account the possible existence of background stars among them, then it must be concluded that the real cavity is even greater.

The probable number of flare stars inside the sphere with a radius of 1.4 pc around the centre of the Pleiades system can be 5-8. In order to move away the observed cavity it is necessary to have at least 30 additional flare stars in this sphere. It means that in the circle of the radius of 1.4 pc around Alcyone in projection on the sky we must observe about 80 flare stars instead of 44 observed.

The absence of such a number of flare stars in the central part of Pleiades is unlikely to be the result of the influence of the absorbing matter, which is small and almost uniformly distributed (10), or of serious difficulties in detecting the flare stars on the plates in the nearest neighbourhood of bright stars concentrated in the central region of Pleiades. The calculations show that such a cavity is present in the case of comparatively bright flare stars as well.

The appearance of such a false cavity as a result of fluctuations, connected with the random nature of the detecting process of flare stars is very unprobable. The probability of this event is less than one hundredth.

Here is not a place to discuss all possible interpretations of the existence of the observed cavity of flare stars in Pleiades. It is interesting to note only that the explanation of this unusual phenomenon can perhaps be found in the frames of the idea of expansion of stellar associations (9, 11, 12).

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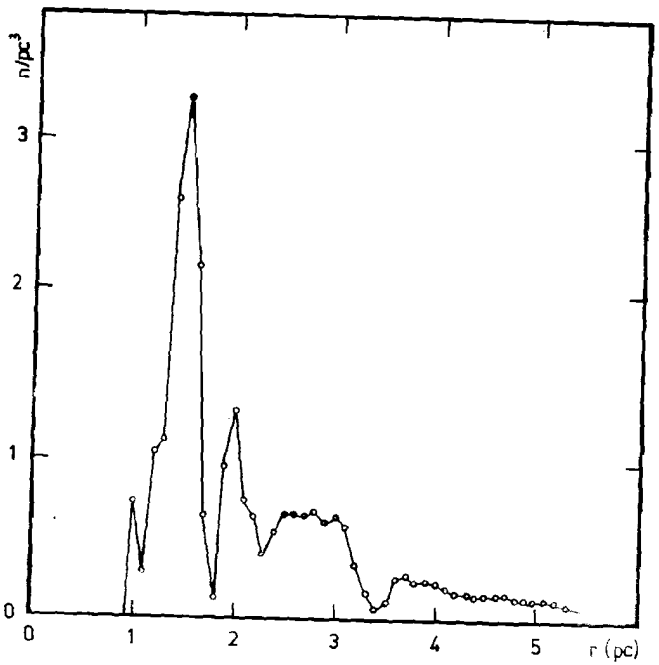

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