A PREDICTION OF THE FLARE ACTIVITY OF STELLAR AGGREGATES

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ABSTRACT. The problem of the statistical prediction of flare activity of a group of flare stars in stellar aggregates is considered.

1. INTRODUCTION

Two important problems were put forward by Ambartsumian [1,2] connected with the existence of flare stars in stellar aggregates: on the estimation of the complete quantity of flare stars, and the determination of the distribution of flare stars according to flare frequency. Both problems are certainly connected with of incomplete data, and being reverce problems they are somewhat incorrect, so their accurate solutions seem actually impossible.

Thus we turn here to another more correct (and at the same time more general) statement of the problem - a prediction into future as much as possible of the flare activity of stellar aggregates. Namely, the prediction for the future time number $n_k(t)$- the quantity of aggregate's flare stars showing k flares in time t.

2. PREDICTION FORMULAE

We suppose that the flare activity of stellar aggregate is stationary in time and that observed flares for each star and different stars take place irrespective of each other. None other supposition for the distribution function is made.

If for the present time T of the observations we have a statistics $n_k(T)$, the theoretical formulas defining the behaviour $n_r(t)$ are given by expressions [3-5]:

L. V. Mirzoyan et al. (eds.), Flare Stars in Star Clusters, Associations and the Solar Vicinity, 113–116.

$$n_r(t) = \sum_{k=r}^{\infty} n_k(T) C_k^r \left(\frac{t}{T}\right)^r \left(1-\frac{t}{T}\right)^{k-r}, \quad r=1,2,\ldots \qquad (1)$$

where C_k^r are the binomial coefficients.

The complete number n(t)of the aggregate's flare stars discovered for the moment of time t, is equal to

$$n(t) = \sum_{k=1}^{\infty} n_k(T)\left[1-\left(1-\frac{t}{T}\right)^k\right] \qquad (2)$$

It is of interest that these formulae give an exact analytical behaviour of the statistics both for the past time and for the future time according to the data available for the present moment T only. The problem is completely coming to a possible more exact definition of the data $n_k(T)$.

3. THE METHOD OF LINEAR REGRESSION

As far as the observational numbers $n_k(T)$ have errors of natural fluctuations, for their more exact definition we use the known chronological behaviour $n_r(t)$ for the past time of observations (t<T). Putting this observational chronology into the left part of the formulae (1-2), we consider these formulas as linear algebraic equations relative to numbers $n_k(T)$ and use the classical method of linear reggression.

4. COMPARISON OF THEORY WITH OBSERVATIONS

The problem put forward by us still continues to remain incorrect enough and the time interval of the prediction is quite restricted. It can be proved that principally the prediction cannot be made for times, exceeding the double time of the observations 2T.

In the Figure 1 the observational values for the Pleiades [6] and Orion [7] aggregates are marked by different symbols and the continuous curves are constracted according to the theoretical formula (1-2). If the data be changed slightly, the prediction curves greatly begin to diverge from one to another.

The comparison of the theoretical and observational curves $n_k(t)$ shows that though they are in good agreement with one another, there exists a systematical divergence, i.e. a selection of observational data. The reason for such divergence may be in disturbance of the suggestions on stationarity of the aggregate activity or the independance of the flares from one another. However, similarity of the behaviour of these divergenses in time for Orion and Pleiades aggregates and our study showed that there is the selection made by the observers, who had a nonstandard approach towards detection of flares and flare stars at different observational times. It seems to us that it is necessary to make an inspection of the plates to remove selection factors for further corrections of the prediction.

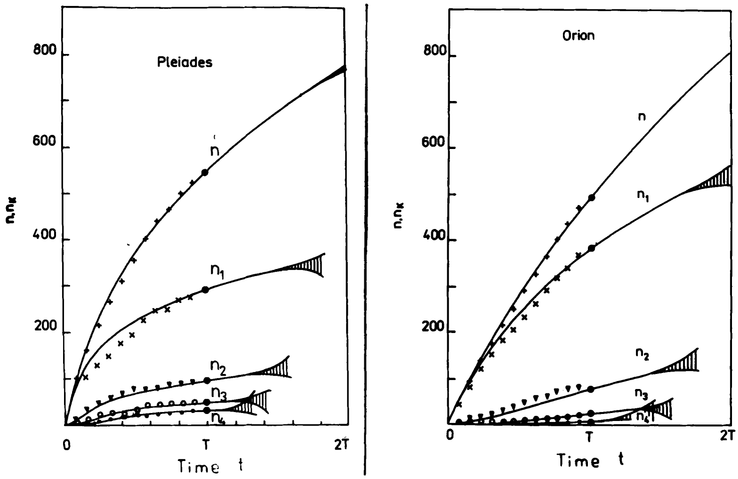

Figure 1.The observation values of the numbers n(t) and n_k(t) for Pleiades and Orion (different symbols) for the past time (t<T), and the theoretical behaviour (continuous curves) of them for the past and future (the prediction) times.

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