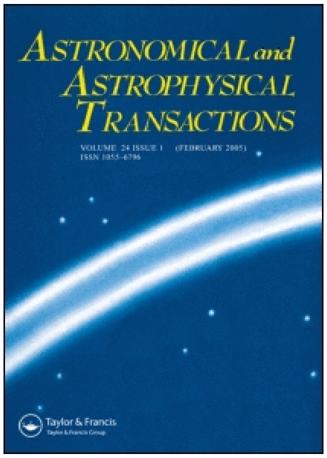

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THE APPLICATION OF ADDITIONAL PARAMETERS IN CLUSTER ANALYSIS†

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A method is proposed to differentiate between "physical" clusters and random condensations. The method is based on the introduction of additional parameters that show the similarity of objects in a physical cluster. The method is tested on star clusters, Cepheids and star complexes for which such additional parameters as radial velocities, period and some characteristics of age are used.

KEY WORDS **Stellar statistics: methods, clustering**

The cluster analysis is widely used in astronomy being an efficient method to study inhomogeneities in the distribution of matter. The aim of the analysis can be formulated in the following way.

Let there be a set of N objects each of them being described by k parameters $x, y, z, \ldots$, i.e. by a k-dimensional vector or a point in a k-dimensional space. This set should be divided into subsets (clusters or taxons) so that every object enters one and only one cluster and objects in the cluster are similar in some sense while objects in different clusters are non-similar (Duran and Odell, 1974).

As a measure of the similarity, the Euclidean distance between the objects is often used. Then the objects that are close in this space are considered to be similar.

Finding such clusters is a final step for a mathematician but not for an astronomer. Actually, clusters will be found in any distribution of points including random ones. How can we differentiate between "physical" and random condensations?

Usually a statistical simulation is used and the characteristics of the clusters found are compared with the model ones. But this approach meets some obvious difficulties. Instead, we have proposed another method (Ejgenson and Yatsyk, 1987, 1988a, b, 1989).

Besides the parameters entering the metric we propose to use some other parameters that also characterize the similarity of the objects. The idea is that, if the objects in the cluster are connected by some physical unity, they may or must also have some other common features, e.g. common motion, or close values of age, etc.

Comparing the dispersions of these parameters in the cluster with the total dispersions of the sample one can find the clusters for which the differences in

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these dispersions are significant. These clusters are considered to be "physical" or non-random condensations.

This method was tested on star clusters, Cepheids, and star complexes. Radial velocities, periods, ages and some other parameters were used as the additional parameters. It is obvious that the use of all possible independent parameters will give more confidence about the reality of the condensations.

References

Duran, B. S. and Odell, P. L. (1974) *Cluster analysis*. Berlin-Heidelberg-New York: Springer-Verlag.

Ejgenson, A. M. and Yatsyk, O. S. (1987) *Astron. Zh.* **64**, 965.

Ejgenson, A. M. and Yatsyk, O. S. (1988a) *Astron. Zh.* **65**, 330.

Ejgenson, A. M. and Yatsyk, O. S. (1988b) *Astron. Zh.* **65**, 1244.

Ejgenson, A. M. and Yatsyk, O. S. (1989) *Pis'ma v Astron. Zh.* **15**, 223.

DISCUSSION

Ossipkov: We regret Drs. A. Ejgenson and O. Yatsyk cannot attend the conference. I wish to say some words about another result of them. Some of you may know that for several years ago Professor Barkhatova, Professor Kutuzov and myself studied the kinematics of open clusters and Professor Barkhatova suggested the existence of groups or complexes of open clusters. No statistical criterion was suggested by her and complexes were revealed mainly intuitively. Recently, Ejgenson and Yatsyk used the method of cluster analysis and found the following. When only positions and radial velocities are taken into account, their complexes practically coincide with Barkhatova's ones. This result does not depend on the distance scale. Then positions and so-called quasi-residual velocities are taken into account then their complexes are found to be practically coinciding with Barkhatova's ones and partially with groups of clusters of Pavlovskaya and Filippova.