ON THE DYNAMICS OF YOUNG OPEN STAR CLUSTERS IN THE JOINT FIELD OF THE GALAXY AND OF A STAR FORMATION REGION

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The young open star clusters (OCl) with ages of $10^7 - 10^8$ years in the overwhelming majority of cases are located in the regions of a star formation which are the massive and extensive gas - star complexes (GSC) in our Galaxy. The typical sizes of GSCs are near 600 pc in projection at the Galaxy plane and the masses of such complexes are in range $\sim (10^5 - 10^7) M_\odot$ (Efremov (1989)). It is well known that the old open clusters avoid the regions of an active star formation in our Galaxy. As a result the structural and dynamical parameters of OCls depend on their ages and their locations relatively the nearest GSCs centres.

Two following dependences between the OCls parameters have been recently found by means of the new statistical method of the estimates of open star cluster parameters with nearly 10 % errors (Danilov, Seleznev (1994)): 1-the maximal OCls sizes in the fractions of clusters radii in the Galaxy field increase with the ages of OCls; 2-the maximal young OCls sizes in the fractions of the cubic root of the masses of these clusters decrease inside the complexes with the distance from the GSC centre and such OCls sizes increase outside the complexes.

By the theoretical and numerically - experimental estimates of OCls tidal radii in the joint field of the Galaxy and of a gas - star complex for different GSC models it was shown that both of these dependences may be fully conditioned by the action of the tidal force field of a complex on the young OCls formed in this GSC (Danilov (1991, 1994); Danilov, Beshenov (1992)). Both of these dependences are the arguments in favor of the fact that the complexes are the higher mass density regions in our Galaxy.

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The numerical experiments for OCl's models with the number of stars $N = 500$ for clusters moving in the field of forces of a stationary GSC and of the Galaxy were performed in the paper of Danilov, Beshenov (1992). The tidal radii estimates for OCl models for the set of time moments t in that paper were performed by means of the method of Allen, Richstone (1988). Such estimates of clusters tidal radii in an external field, performed in numerical experiments, lead to the R_t values agreed with the corresponding theoretical estimates of the clusters tidal radii. There are two regions of the higher instability of the solutions for a coarse grained phase density function with respect to small variations of the initial phase coordinates of stars in the OCl models. These instability regions are the central part of OCl and the wide region near the tidal boundary of a cluster. Such instability in the central part of a cluster is conditioned by the stellar encounters action. Such instability near the tidal boundary of a cluster is conditioned by the joint action of stellar encounters and of tidal instability of star orbits in the regular field of the cluster and of the Galaxy.

Main features of OCls dynamical evolution in stationary and nonstationary GSC models were dicussed in papers: Danilov, Beshenov (1992), Danilov (1994). The conditions of the stability of OCls to their disintegration in the tidal field of the Galaxy and of the both stationary and nonstationary GSC were used for the estimations of the total masses of some GSCs from the solar vicinity on the basis of the data of young OCls radii and of the parameters of the Galaxy field for these regions of the star formation (Danilov, Seleznev (1995)). Such "dynamical" estimates lead to the GSCs masses in range of $\sim (10^5 - 10^7) M_\odot$ the same as on the basis of the data of the optical and radio observations of GSCs.

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