EVOLUTION OF GLOBULAR CLUSTERS

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Any contemporary theory of the origin of galaxies predicts the formation of stellar systems with masses typical of globular clusters and dwarf galaxies, at some stage of evolution of the proto-galaxy. In principle the dimensions and masses of globular clusters, their chemical composition, the distribution and character of the motions in the Galaxy contain considerable information on the conditions in which the clusters originated. However, in order to compare the observed characteristics of clusters with the conclusions of cosmogenic theories, it is important to establish to what extent the system of globular clusters has evolved dynamically from the time of its origin. It is necessary to determine the region in the Galaxy and in the cluster mass spectrum (or in other characteristics) in which the effect of the dynamic evolution was minimal: the clusters in this region could prove to be standards for verifying the theories of origin of galaxies and of the clusters themselves. We have published a series of papers (Rastorguyev and Surdin, 1978, 1980; Surdin 1978, 1979a,b,c; Surdin and Charikov, 1977, 1981); on the analysis of the spatial distribution and motions of clusters in the Galaxy, as well as the fundamental dynamic effects responsible for the disintegration of globular clusters.

Dynamic friction affects the motions of massive clusters located in the central part of the Galaxy. Finally, the clusters lose energy and fall into the galactic centre. The analysis of the dynamics and chemical composition of globular clusters, as well as the galactic core indicates that the core with a radius of 3 - 5 pc originated from the dense central parts of massive globular clusters, which lost their orbital momentum due to dynamic friction.

Dynamic friction, together with dissipation and tidal disintegration lead to the complete disappearance of clusters whose orbits were originally located in the central part of the Galaxy, with a radius of 1 kpc. Curiously enough, this result will remain numerically unchanged for any other galaxy, independent of its mass. This enables us to explain the lack of globular clusters in some dwarf galaxies of the Local Group and their lack in the central parts of giant galaxies (e.g. in the Andromeda).

Tidal disintegration and dissipation of globular clusters enabled us to explain the relation between the degree of concentration and mass of the cluster, as well as the jump in their luminosity functions at $M_V = 7\overset{m}{.}2$. By reconstructing the mass spectra of globular clusters we were able to determine their initial number in the Galaxy at about 2000 with a total mass of $3x10^8$ $M_\odot$. Consequently, all population II stars of the Galaxy population could not have been formed due to the disintegration of purely stellar globular clusters. A scenario of evolution of protoglobular clusters, originating from gaseous fragments with masses of about 10^8 $M_\odot$, has been developed. The interaction of young stars with the gas of proto-clusters leads to its substantial disintegration and to the origination of globular clusters, as well as of the field stars in the Galaxy halo. The initial number of globular clusters and the mass of the stellar Galaxy halo, mentioned above within the scope of this scenario, agree very well with observations.

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