FACTOR ANALYSIS OF GALACTIC GLOBULAR CLUSTERS ON STRUCTURAL PARAMETERS

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Principal component method is used to study galactic globular clusters in 7- and 8-axis space of structural parameters. It is shown that the manifold properties of clusters with this set of parameters is determined mainly by two independent factors. This result may be useful for the theory of formation and evolution of clusters.

In our paper [2], the factor analysis (principal component method) of globular clusters on some main physical parameters was performed. It was shown that the manifold properties of clusters is determined mainly by two independent factors. The first of them is metallicity which is connected with the distance to Galaxy center, and the second one reflects the richness of the cluster. Analogous studies were performed by Broche and Lendes [1], and later by Djorgovski and Meylan [3] and Djorgovski [4].

In this paper we return to this problem with some other set of parameters, different not only from our former set but also from the set used by Djorgovski and Meylan. The database was the catalogue of 125 clusters [6] with the following parameters of clusters: concentration c, core-radius r_c, a half-light radius r_h, and other fraction-of-light radii r_{10}, r_{20}, r_{30}, r_{40}. In the second case the quantity $\mu_V(0)$, central surface brightness, was also included. The details of calculation one may find either in our cited paper or in [5].

The correlation matrix is given in Table 1.

Table 1: Matrix of the correlation coefficients

	r_c	r_{10}	r_{20}	r_{30}	r_{40}	r_h	c
r_c	1.000	.848	.773	.712	.661	.619	−.687
r_{10}	.848	1.000	.989	.971	.951	.930	−.420
r_{20}	.773	.989	1.000	.994	.983	.969	−.331
r_{30}	.712	.971	.994	1.000	.997	.989	−.262
r_{40}	.661	.951	.983	.997	1.000	.997	−.207
r_h	.619	.930	.969	.989	.997	1.000	−.163
c	−.687	−.420	−.331	−.262	−.207	−.163	1.000

Eigenvalues (characteristic roots) are the following: $\lambda_1 = 5.635$, $\lambda_2 = 1.180$, $\lambda_3 = 0.170$, $\lambda_4 = 0.012$, $\lambda_5 = 0.002$, $\lambda_6 = 0.001$, $\lambda_7 = 0.000$. We see that these roots decrease rapidly enough, and we shall confine ourselves to the first two roots. The matrix of factor projections is the following (Table 2):

Table 2: Matrix of the factor projections

	r_c	r_{10}	r_{20}	r_{30}	r_{40}	r_h	c
F_1	0.825	0.996	0.994	0.982	0.967	0.950	−0.415
F_2	−0.472	−0.023	0.094	0.178	0.241	0.289	0.880

This may be illustrated by Fig. 1.

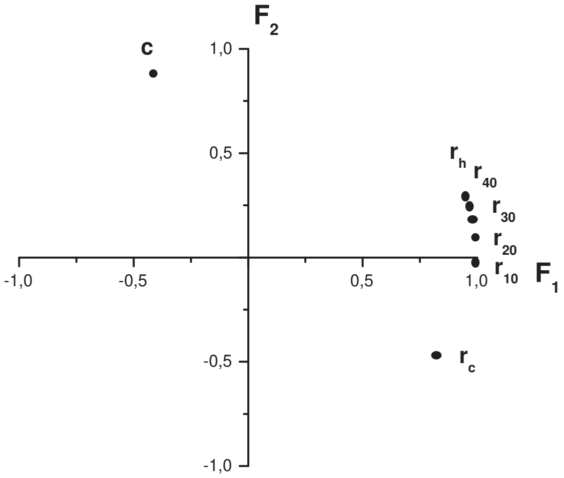

Figure 1: Diagram $F_1 - F_2$ for 7 parameters

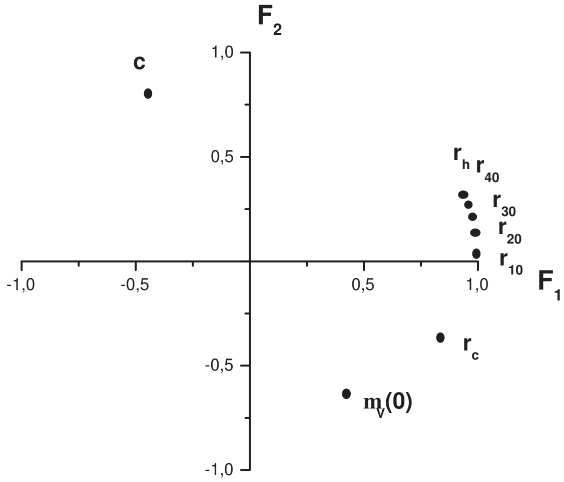

Figure 2: Diagram $F_1 - F_2$ for 8 parameters

If we include the central surface brightness $\mu_V(0)$, the picture becomes more complicated (Fig. 2). So, this brightness is determined simultaneously by both two factors.

We see that the manifold properties of clusters is determined mainly by two independent factors. This result may be useful for the theory of formation and evolution of globular clusters.

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