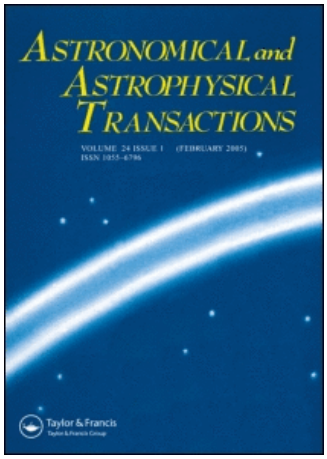

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Stellar files for the NGC 129 cluster

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STELLAR FILES FOR THE NGC 129 CLUSTER†

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Five or seven files (chains) including almost all probable members of the open cluster NGC 129 are found.

KEY WORDS Open clusters (individual): structure

The structure of the NGC 129 cluster, III2mIB class [1], can be presented by two faint nuclei separated by the space almost devoid of stars (the hole), and surrounded by the corona. A more detailed examination is based on the combination of statistical and individual approaches to the stars in the cluster region. We used the Lavdovsky [2] and Piskunov [3] catalogues for the stars brighter than 15 photographical magnitude or visual magnitude $V_0 < 13^m.3$ corrected for absorption.

The attention was paid to the multimodality of the stellar magnitudes, m and V_0, the colour index $(B-V)_0$ and mass M distributions, so as to the bimodality of the distribution of the total relative proper motions μ (Figure 1). They allow to divide the whole totality of the stars into groups.

The majority of stars, attributed in [4] to sure members of cluster, have $\mu < ''.004$, with $\overline{\mu}_x = -''.0011$, $\overline{\mu}_y = ''.0008$ and $\overline{\mu} = ''.0020$. Five smooth spiral-like files of stars can be picked out on identical m and $(B-V)_0$ (Figure 2*a*). Together they form a "curl", beginning in the nucleus I (on $x > 0$, $y < 0$). The curl turns round the nucleus II (on $x < 0, y > 0$) and has its end in the corona.

The totality of stars with $\mu \geq ''.005$, including the stars from [4], have $\overline{\mu}_x = -''.001$, $\overline{\mu}_y = ''.002$ and $\overline{\mu} = ''.006$. They form one more system of five spiral-like files of identical m (Figure 2*b*), and their curl, beginning in the nucleus II. The second system, with an opposite twist, has more stars; it is wider spread than the first one.

Besides the spiral-like files, each μ – subsystem includes four transversal files, fastening the curles in the shape of ringlets or spokes (Figure 2). In the whole the curles are not covering again themselves. But if their intersection at $x > 5'$ have

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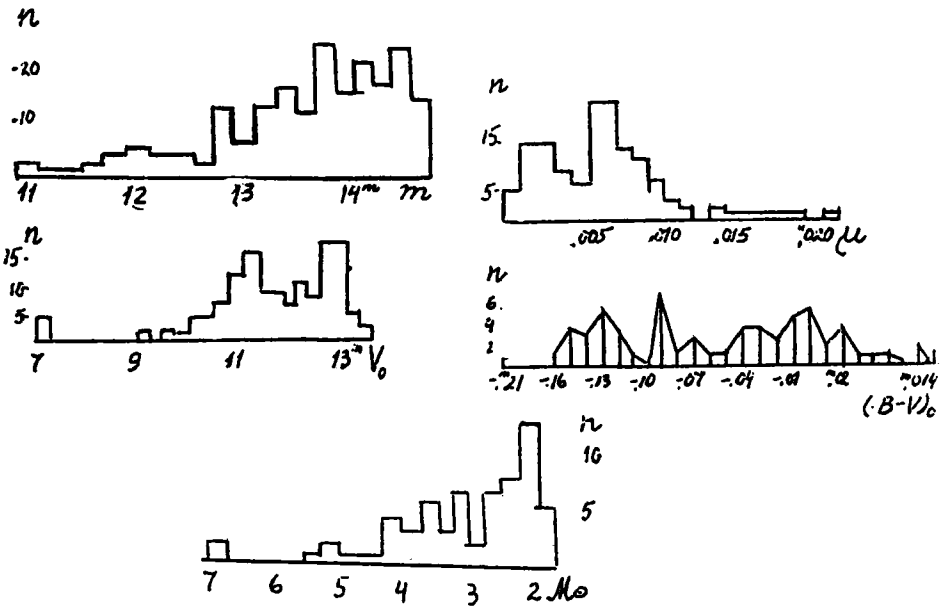

Figure 1 The distribution of visual magnitudes m and V_0, proper motions μ, color-index $(B-V)_0$ and masses M for stars in the clusters region according to the data from [2] and [3].

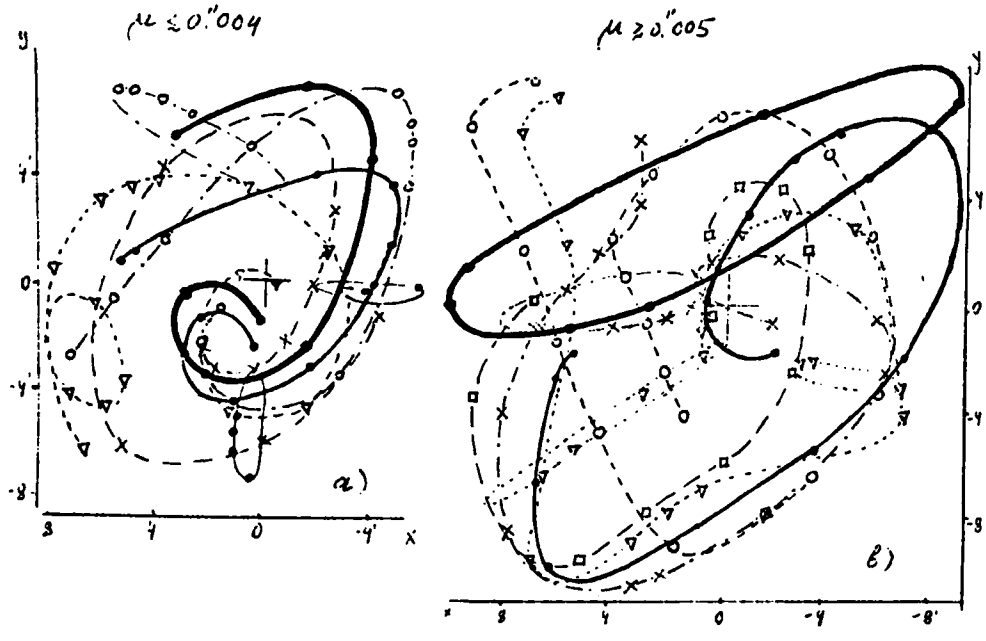

Figure 2 The sequence of files in two μ_1-subsystems by $m \approx 11^{\rm m}.5, 12^{\rm m}.5, 13^{\rm m}.1, 13^{\rm m}.7$ and $14^{\rm m}.1$ and $(B-V)_0 \approx -0^{\rm m}.16, -0^{\rm m}.13, -0^{\rm m}.08, -0^{\rm m}.03$ and $0^{\rm m}.0$.

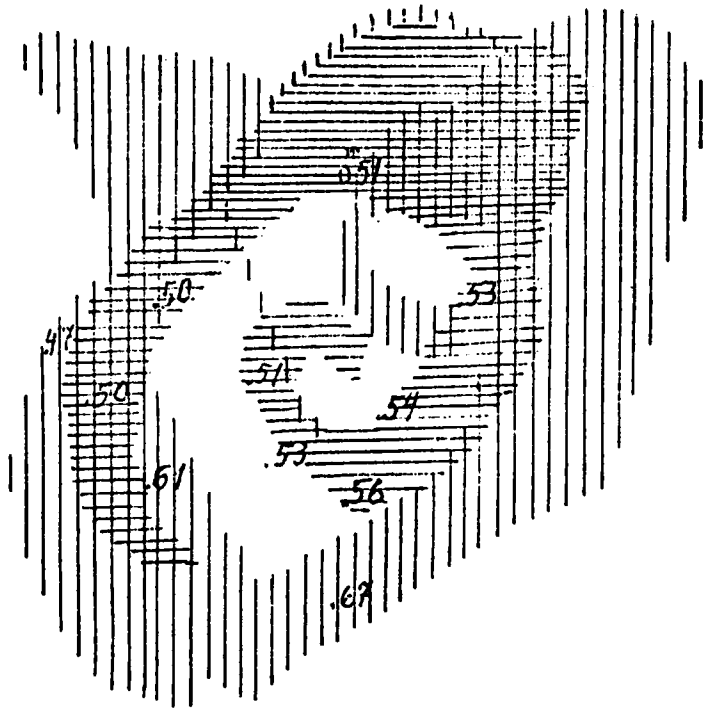

Figure 3 The curles are the systems of files and gap. The horizontal hatching – $\mu_1 \leq 0''.004$, vertical – $\mu_2 \geq 0''.005$. The figures – the color-excesses E_{B-V}, according to the data [4].

happened in the space, then the third condensation of stars is formed. Together with the nuclei I and II, it defines a thin cluster's disk. The extent of spiral-like curles is probably connected with the disk inclination to the picture plane.

Inside the pattern of the two curles, also the spiral-like stripe enters with an extremely low stellar density, including the stars of the background. It cannot be explained by a difference in absorption, if recalling the small variations in E_{B-V} from [4] (Figure 3).

So the presence of two subsystems in the cluster has been demonstrated. Their general motions $(\overline{\mu}_x, \overline{\mu}_y)$ differ within the mean error $\approx \pm''.001$, but $\overline{\mu}$ and the dispersions differ strongly. On the distance of cluster about 1.6 kpc μ correspond the tangential velocities $\overline{v}_1 \approx 15$ and $\overline{v}_2 \approx 45$ km/s.

For stability of the second subsystem, a mass is needed by an order of magnitude larger than for the first one. Besides stars, it can be provided by the dark nebulae Khavtassi 209 [5]. NGC 129 is located at the northern edge of the nebulae in a small hollow.

The coincidence of their distances can be judged basing on the color-excess E_{B-V} on Figure 3. If the minimal value ($0^m.47$) is attributed to the general absorption of the nearby background and ($E_{B-V} - 0^m.47$), to the cluster itself, then the differences

for the first curl stars are $0 \div 0^{m}.09$ and for the second, $0^{m}.14 \div 0^{m}.20$ and they reflect the coincidence of the stellar and dust structures.

Among others kinematic peculiarities there are the differences in the motions (magnitudes and directions) of files and stars in them, exceeding often the mean errors several times. Apparently, the oscillations about the mean positions are displaying in such way. To remain the main features of files and curls, the amplitudes must be small. The oscillations of clusters were predicted by Ossipkov [6] and others.

The delimitation of files in location, motion, physical parameters (colour, brightness, mass) and probably in age means that the elements of cluster are discrete.

The stellar files factor helped to enlarge the list of cluster's members by about two times.

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