HIPPARCOS: SEARCH FOR THE STELLAR GROUPS

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ABSTRACT. The local overdensities technique was applied to identify stellar groups of different scales in phase space. The stars from HIPPARCOS with known radial velocities within 125 pc from the Sun were under investigation. 11 groups in the coordinate space and 5 moving groups in the velocity space have been found. The estimation of the statistical significance of detected groups has been done. The distribution in the velocity space of the identified in the coordinate space cluster members was analyzed.

1. DESCRIPTION OF THE METHOD

In our study we applied local overdensities technique to the stars from Hipparcos with observed radial velocities within 125 pc (N=9324) in coordinate space and to the stars from this sample with heliocentric velocities less than 100 km/s (N=8785).

Let us consider two heliocentric orthonormal frames: (X,Y,Z) and (U,V,W). Axes X,U are toward the galactic center, Y,V in the direction of galactic rotation, Z,W-toward the north galactic pole.

The local overdensities technique is based on calculations of the mutual distances between the stars. We compute the number of stars around every star from our sample within sphere of radius r and compare the results with those that expected in case of random distribution. Varying the meaning of r we can identify the groups of different scales.

We obtained the star density function within 125 pc from the Sun approximated with polinom of 4-th degree for the estimation of the expected number of stars in (X,Y,Z). An expected number of stars in the velocity space was computed for the superposition of three gaussians.

2. RESULTS

The identified clusters in coordinate space are shown on Fig. 1. The detected moving groups are on Fig.2.

Besides well known clusters - Hyades, UMa, Coma, Pleiades - with probability 95% seven new clusters I-VII were detected. But analysis of the distribution of the stars from new clusters in the velocity space showed that velocities of stars are essentially different and there is only small groupings. Four new clusters in coordinate space are likely the fluctuations in the star

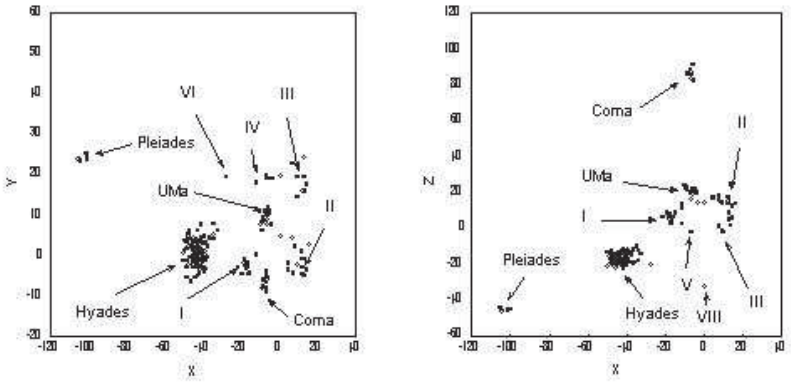

Figure 1: Star clusters in coordinate space detected using local overdensities technique with

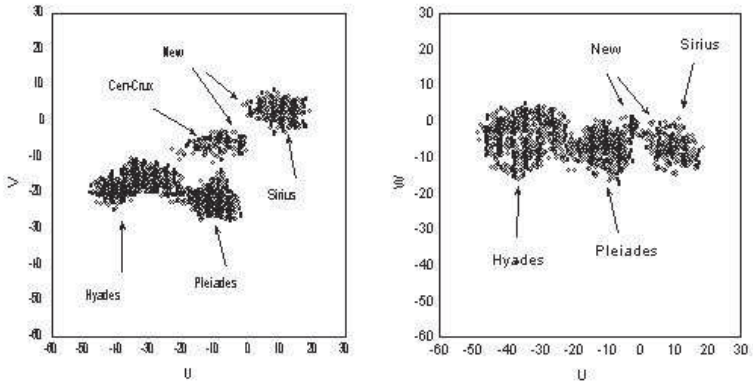

Figure 2: Moving groups detected using local overdensities technique with r=5km/s in velocity space within 100 km/s.

distribution but some of them are the poor clusters because they contain kinematically connected stars.

The analysis of the membership of the identified clusters had been carried out. There is a predominance of high luminosity stars in Hyades and UMa. On the contrary the new clusters consist on the whole of low luminosity stars.

The Monte-Carlo method was used to estimate the influence of random errors in parallaxes on the results obtained .

It must be noticed that the stars from our sample are on the whole the giants and high luminosity stars. And for the investigation of the phase space distribution of faint stars Tycho2 data complemented with the radial velocities data must be used.