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ANALYSIS OF SPACE MOTION OF STARS FROM ARIHIP CATALOGUE

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Abstract. A sample of nearby stars with available space velocities and qualitative kinematical data from the Arihip Catalogue (total of 90,842 stars) is formed. Line-of-sight velocities are available for only 17.5% of Arihip stars. Stars suspected to be multiple or variable are not taken into account. Only stars closer than 200 pc (parallax ≤ 5 mas) are included into sample. In this way a sample containing 4614 stars is selected. The components of the solar motion with respect to the dynamical local standard of rest, the elements of the velocity ellipsoid (the intensity and spatial distribution) and the value of the asymmetric drift are obtained in two different ways: according to color index and space velocity.

After removing the stars with space velocity greater than 100 km s^{-1} (8.4%), which typically belong to the halo or thick disc, the sample is divided into 8 groups with color index intervals not less than 0.05 magnitudes. In addition, one more group is formed, Parenago's group, with color index greater than 0.61. The velocity components of solar motion, obtained by averaging over all groups, are: $(U_\odot, V_\odot, W_\odot) = (9.6, 6.8, 7.4) \pm 0.1$ km s^{-1}. The result agree very well with the values for the thin disc stars found in the literature.

The behaviour of the space velocity cumulative distribution curve is thoroughly examined. The inclination of the curve, being almost equal to 90° at very low velocities, is decreased to less than 10° at the value of 100 km s^{-1} where it has an abrupt change to become very low at higher velocities. The fraction of stars with the heliocentric space velocities less than 100 km s^{-1} is 91.6%. These stars could belong to the thin disc. The lowest value of the curvature radius occurs at the space velocity of about 180 km s^{-1}. At velocity values higher than this one the increment of the cumulative number is very low. Such behavior is expected for stars from the galactic halo and the sample contains 2.2% such a stars. If these two fractions (91.6% and 2.2%) are accepted for the thin disc and halo, then the remaining stars should belong to the thick disc. Their fraction is 6.2%. For thin disc stars the obtained mean solar motion is: $(U_\odot, V_\odot, W_\odot) = (8.2, 5.7, 6.6) \pm 0.1$ km s^{-1}.

The fractions of galactic subsystems are verified by analyzing the shape and size of the galactocentric orbits of the sample stars, i.e. by analyzing their planar (e_p) and vertical (e_v) eccentricities. The orbits, according to their shapes and sizes, can roughly comprise three cases which correspond to the thin disc, thick disc and halo. For the stars belonging to the thin disc we establish the upper limits: ($e_p < 0.5$) and ($e_v < 0.08$). We find 92.2% such a sample stars. For stars of the thick disc the established eccentricity limits are ($0.5 < e_p < 0.8$) and ($0.08 < e_v < 0.3$), i.e. fraction of 5.9% sample stars belong to the thin disc. The remaining 1.9% sample stars have very chaotic orbits, thus they belong to the halo.

These values seem reasonable, but the fraction of the halo might be too high. The number of halo stars in the solar neighbourhood is generally very small so the true halo fraction is still very uncertain. This may be a task for future studies.