OPEN CLUSTER SYSTEM : KINEMATICS, ORBITS

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1. Introduction. This study is based on the catalogue of 69 open clusters by Barkhatova *et al.* (1987) and cluster distances taken from Hagen (1970). Most of the dimensionless characteristics discussed here are insensitive to the distance scale. Galactocentric cylindrical coordinates of clusters and the corresponding velocities have been calculated with the accepted galactocentric distance of the Sun $R_\odot = 8.2$ kpc and the galactocentric velocity of the Sun $s_R = -9$ km/s, $s_\theta = 228$ km/s, $s_z = 7$ km/s.

2. Rotation law. The galactic rotation of the open cluster system has been studied by many authors, e.g. by Dzigvashvili *et al.* (1987) and by Hron (1987). We found the rotation velocity for $R \in (7.5,\ 10.0)$ kpc. Young clusters with $\log \tau \leq 7.5$ (where τ is the cluster age in years) and old clusters ($\log \tau > 7.5$) were considered separetely. The results are given below.

TABLE 1. Galactic rotation velocity of open clusters, km/s

R, kpc	*Young clusters*	*Old clusters*	*All clusters*
[7.5, 8.0)	221± 14	230± 3	226± 3
[8.0, 8.5)	217± 7	223± 3	220± 4
[8.5, 9.0)	229± 3	219± 3	220± 7
[9.0, 10.0)	228± 3	218± 9	223± 7

3. Velocity ellipsoid . There have been only two attempts to find the local velocity ellipsoid for open clusters, namely by Barkhatova (1949) and

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by Barkhatova & Pavlovskaya (1975). Recently Lyngå& Palouš (1987) obtained the radial velocity residuals for young and old clusters. We found the local ellipsoid of residual velocities by applying the method of extrapolating to the zeroth distance (Agekyan & Ogorodnikov 1974; Ogorodnikov & Ossipkov 1978) excluding the influence of the so - called distance effect (Ogorodnikoff 1936) on values of local averages. The following values were found : $\sigma_R = 15 \pm 1$ km/s, $\sigma_\theta = 9 \pm 1$ km/s , $\sigma_z = 7 \pm 1$ km/s.

4. Orbit calculations. To calculate cluster orbits we adopted a two - component model of our Galaxy (Kutuzov & Ossipkov 1992). All orbits were found to be box ones. We considered two dimensionless orbital elements, $e = (R_a - R_p)/(R_a + R_p)$, $c = 2z_m/(R_a - R_p)$. Their average values are equal to 0.07 and 0.50 respectively.

Also we found the initial values of the adiabatic invariant of vertical motion J defined by the formulae $J = (1/2)[V_z^2 + C^2(R)z^2]/C(R)$ (Ossipkov 1976, Villumsen & Binney 1985) where $C^2(R) = -\partial^2\Phi(R,z)/\partial z^2|_{z=0}$, and calculated the quantity $\delta J = (J_{max} - J_{min})/(J_{max} + J_{min})$ along cluster orbits (Kutuzov & Ossipkov, 1992). For $J < 1$ (km/s)/kpc, $\delta J < 0.04$. If $e < 0.025$ then $\delta J < 0.02$.

5. Correlations of orbital elements. We studied correlations between orbital elements, metallicity [Fe/H] and age τ. Only the objects nearer than 1 kpc were considered. We found that corr (e, $\log\tau$)=+0.28, corr (e, [Fe/H])=+0.65, corr (c, $\log\tau$)=–0.14, corr (e, [Fe/H])=–0.20. So we see that orbital elements do not depend on cluster ages.

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