techniques. It is not at all difficult to apply the techniques of narrow-band photometry to faint stars in the galactic polar caps. Colour work promises rich returns for our knowledge of the general galactic field of force; the virtual absence of uncertainties created by interstellar absorption encourages one to concentrate increasingly on colour studies. The differentiation between Population I and II stars should be relatively easy in these high latitude studies. Since there are indications for the presence of inequalities in the stellar distribution over the galactic polar caps (Elvius and Upgren), it appears important to cover the largest possible fields, but it should be realized that, for studies of the distribution perpendicular to the galactic plane, we should limit ourselves to fields with galactic latitudes between $\pm 70^\circ$ and $\pm 90^\circ$; the study of stellar distributions between galactic latidudes $\pm 20^\circ$ and $\pm 70^\circ$ is of great interest, but the latter gives information on a totally different set of problems than does the work on the polar caps themselves.

The recent paper by J. M. Basinski and myself (*Mount Stromlo Observatory Memoir* no. 16) illustrates the power of the colour approach. The extreme scarcity of stars with $(B - V) < +0{\cdot}30$, in a survey extending to $V = 16$, shows that the average space density of the A stars at $z = 3200$ pc is only 1/600 of the value derived by Woolley for $z = 250$ pc. From colour data alone, space densities can be derived for stars with $+0{\cdot}30 < B - V < +0{\cdot}60$ to distances $z = 2000$ pc, whereas for these same stars available spectral data reach for F0 stars to $z = 800$ pc and for F8 stars to $z = 400$ pc. The colour work in U, B, V and narrow-band photometry in the same wavelength range, will increasingly have to be supplemented by work in the red and the infra-red, for it is in the far infra-red that one can most readily differentiate the late-type dwarfs, which predominate among the fainter stars.

DISCUSSION

Zwicky. I wonder how your results compare with those of Luyten, Haro and myself. Near the north galactic pole I discovered in 1940 32 high latitude Humason-Zwicky stars. They are brighter than the fifteenth apparent photographic magnitude and for all of them $B - V < 0$. Also, from surveys by myself and others there seem to be rather considerably more faint blue stars than you find per unit area in your field of 14 square degrees at the south galactic pole.

Furthermore, do you know how many of your stars are white dwarfs or blue subdwarfs? The presence of an appreciable number of these would falsify your determination of the space density of stars as a function of the height above the galactic plane.

Bok. Mrs Basinski and I, too, were surprised to find in our survey so few really blue stars to $V = 16{\cdot}25$. As far as we can judge, our survey is complete to our magnitude limit and no stars seem to have been missed. To show the paucity of these stars, I may mention again that there are only three stars with $12{\cdot}5 < V < 14{\cdot}5$ and $B - V < +0{\cdot}30$ in an area of the sky of $8{\cdot}3$ square degrees.

17. THE VALUE OF THE DYNAMICAL PARAMETER C

J. Einasto

The most important galactic parameters, featuring the general structure of the galactic system, are

R_0: The distance of the Sun from the centre of the Galaxy;
A, B: Oort's rotational parameters;
C: Kuzmin's dynamical parameter ($-C^2$ being the gradient of gravitational acceleration in the z-direction at $z = 0$).

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The values of R_0, A and B, obtained by various authors, are mutually consistent. In the new scale of galactic distances they are close to 10 kpc, 15 and −10 km s^{-1} kpc^{-1} respectively. On the other hand the estimates of the parameter C scatter widely. Kuzmin (1952, 1955), Parenago (1952, 1954), Eelsalu (1958, 1961), Sinzi (1962), and Stother and Tech (1964) have obtained values close to Oort's (1932) classical value

$$C = 73 \text{ km s}^{-1} \text{ kpc}^{-1}.$$

On the contrary, Woolley (1957), Hill (1960), Oort (1960), Yasuda (1961), and Jones (1962) have derived values on the average 25 per cent larger than the former, while Schilt (1950) and Nahon (1957) have found still higher estimates.

The parameters A, B and C are connected with the mass density in the solar neighbourhood by Poisson's equation

$$4\pi G\rho = C^2 - 2(A^2 - B^2).$$

The classical value of C, together with the above values of A and B, yields

$$\rho = 0{\cdot}094\, M_\odot \text{ pc}^{-3}$$

in good agreement with the direct estimates of the density $\rho = 0.091\, M_\odot$ pc^{-3} (Einasto, Kutuzov 1964).

In the light of the above facts two questions arise. Firstly, if the true value of C exceeds appreciably the classical result, then the presence of some amount of undetected matter in the solar neighbourhood must be explained. Secondly, we must ask whether the scatter in the results for C reflects only accidental and systematical errors in the observational data and their treatment, or are real differences present in the values of C derived from different galactic subsystems. In the latter case we must conclude that in the Galaxy some subsystems are in a strongly nonsteady state.

We have critically analysed all the determinations of C mentioned above. If any systematic error in the data used has been found, a new corrected value for the parameter was calculated. In Table 1 both the original and new values are given. In general the corrected values lie much closer to Oort's classical value than the original ones, and the remaining differences can be considered as accidental. The overall weighted mean is

$$C = 73 \pm 3 \text{ km s}^{-1} \text{ kpc}^{-1}.$$

These results shows that neither the hypothesis of undetected matter nor the presumption of nonsteadiness need be taken too seriously.

Table 1

Material	Method of determining σ_z	Method of determining ζ	C Original (km s^{-1} kpc^{-1})	C Corrected (km s^{-1} kpc^{-1})	References
All types	V_r	A(m)	73	70 ± 6	Oort, 1932
All types	V_z	z	650		Schilt, 1950
A; gK	μ_b	A(m)	62 ± 5	64 ± 7	Kuzmin, 1952, 1955
Variables	V_z	z	73 ± 14	74 ± 14	Parenago, 1952, 1954
All types	V_z	A(m)	115		Nahon, 1957
A	V_r	A(m)	95		Woolley, 1957
All types	V_r	A(m)	66 ± 3	66 ± 6	Eelsalu, 1958, 1961
g K	V_z	A(m)	91	78 ± 8 (Hill, Oort, Yasuda combined)	Hill, 1960
g K	V_z	A(m)	92		Oort, 1960
g K	V_z	A(m)	86		Yasuda, 1961
Ao	V_z	z	92	73 ± 8	Jones, 1962
Cep	V_r	z	74 ± 8		Sinzi, 1962
O; B	V_z	z	74	71 ± 10	Stother, Tech, 1961

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Some comments on the individual determinations of C are necessary.

The parameter C can be calculated from the dispersions of the z-velocities, σ_z^2, and z-co-ordinates, ζ^2, of flat subsystems according to the relation

$$C = \frac{\sigma_z}{\zeta}.$$

The velocity dispersion σ_z^2 can be determined

1. from the proper motions perpendicular to the galactic plane, μ_b, for stars in the galactic belt;

2. from the radial velocities, V_r, of stars in the regions of the galactic polar caps;

3. from the z-components of stellar space velocities, V_z.

The dispersion ζ^2 can be determined

1. from the apparent magnitude distribution, A(m), in the regions of the polar caps;

2. from the distribution of individual values of z-co-ordinates of stars; in this case both σ_z and ζ can be derived from the same material.

Kuzmin's (1953, 1955) value of σ_z was slightly increased (cf. Eelsalu, Jôeveer, 1964). The mean error of the result was also increased to take into account some uncertainties in the statistical treatment. The correction of Oort's (1932) result was made according to Kuzmin (1955).

We found that the values, obtained by Schilt (1950), Nahon (1957) and Woolley (1957), are probably greatly influenced by various systematic errors in the systems of the observational data. As it was difficult to estimate all the necessary corrections, these determinations were not included in the final value of C.

The determinations made by Hill (1960), Oort (1960), and Yasuda (1961) were based essentially on identical observational data of K-giants, and were not independent from each other. The attention of the authors was concentrated on the evaluation of the z-acceleration, K_z, for a large interval of z. The gradient $(\partial K_z/\partial z)_{z=0} = -C^2$ was then found from the change of the acceleration in a certain interval of z.

The derivation of the K_z curve is, however, rather sensitive to various uncertainties in the observational data. Moreover, for subsystems which are not flat enough (the disk and intermediate population II subsystem of K-giants), the theoretical expressions used are not sufficiently rigorous (Kuzmin, 1955). But the explicit use of the run of K_z is not necessary. The gradient of z-acceleration can be determined directly from velocity and co-ordinate dispersions.

The distribution of z-co-ordinates was derived by Hill, Oort and Yasuda from van Rhijn's apparent magnitude distribution A(m). In the critical interval van Rhijn's function is systematically too low, as the comparison with more reliable data shows (Eelsalu, 1958). As a result the authors obtained an underestimated ζ and an overestimated gradient $\partial K_z/\partial z$. Further, the uncertainty is increased by the fact that the fraction of K-giants in the distribution was determined from the Bergedorfer Spektraldurchmusterung, where great ambiguity is present as Hill (1960) stated himself.

In Sinzi's (1962) paper the distance scale is very uncertain. His determination cannot be used. In Jones's (1962) investigation the dispersion for Ao stars is overestimated. Corrected kinematical data give a smaller value for C.

Stother and Tech's (1964) result has been slightly corrected for the accidental errors in distances.

The mean error of Eelsalu's (1958) result has been considerably increased to allow for the uncertainties of the statistical treatment in the luminosity function, as only the cosmic error is included in the author's value.

In conclusion we should like to point out that the best method for estimating C consists in the use of the same stars for determining both the dispersion in z-velocity and in z-co-ordinates. Otherwise it is difficult to exclude various distortions in the data used. Especially the presence of halo stars may spoil the results by distorting the velocity and co-ordinate dispersions in different amounts.

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18. ON THE LOCAL DYNAMICS OF THE GALAXY

K. F. Ogorodnikov

In the papers presented at this discussion properties of the behaviour of the stars in the local surroundings of the Sun have been discussed and this is a kind of challenge to theoretically minded astronomers to draw up a theory explaining these properties. Unfortunately very little work has been done until now in this respect since in the usual Stellar Dynamics the galaxies are treated as a whole. A few years ago the writer of these lines made an attempt to fill up this gap between the observations on one side and the observations on the other.

He considered the bearing of the so-called Local System of stars within which the Sun is lying. The LS consists of a large number of O and B stars and its existence was first connected by Harlow Shapley with the phenomenon of Gould's Belt. Nowadays, in connection with Ambartsumian's ideas, we may think of the LS as a result of the disintegration of stellar associations which presumably are concentrated along the galactic spiral arms. The newly born OB stars dissipate in the surrounding star field and are lost in it, the more so since within a few million years they drastically change their spectral type. On the whole this phenomenon is stationary in time since the outbound stars are continuously replaced by newly born ones.

From the point of view of Stellar Dynamics this is a cause of a quite unique situation when an observer situated within the LS will always observe within the LS the same kind of 'labelled' stars since the number of outbound stars will be always larger than the number of inbound ones.

This permits us to explain the first of the observed discrepancies between the theory and observation, viz. the deviation of the vertex, since under the above conditions the stars will be subject to Coriolis forces which will rotate the vectors of their residual velocities with an angular velocity twice as large as the local angular velocity of the Galaxy.

Another consequence of the above dynamical situation will be the action of tidal gravitational forces upon the motions of the stars. While the Coriolis forces will cause a rotation of the local