WHICH KIND OF SPIRAL STRUCTURE CAN FIT THE OBSERVED GRADIENT OF VERTEX DEVIATION?

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We analyse the distribution of peculiar velocities of stars within 200 pc of the Sun in terms of space variations of the velocity ellipsoid.

1. THE SAMPLES

A sample of 757 stars, most brighter than $m_V = 6.5$, have been selected on the basis of existing data: for all of them we got uvby beta photometry, proper motions and radial velocities. From the photometric data we derive distances and age estimates. Ages are based on evolutionary tracks of Hejlesen et al. (1972).

2. THE ESTIMATION METHOD

The sample has been divided according to ages as indicated in Table 1. Kinematic data in each subsample has been processed in a maximum-likelihood solution including the classical parameters of the velocity ellipsoid plus gradients of those parameters in the galactic plane.

3. THE RESULTS

Table 1 shows the decrease of the vertex deviation with σ_π and age.

TABLE 1

Sample	Size	log age yr	σ_π kms^{-1}	Vertex Dev.	Significant Gradient?
1	130	8.2 -8.4	16.2	10 deg	NO
2	225	8.4 -8.7	16.3	30	YES
3	113	8.7 -8.9	17.1	28	NO
4	56	8.9 -9.0	17.3	14	NO
5	103	9.0 -9.18	22.5	8	NO
6	130	9.18-9.5	24.7	0	NO

H. van Woerden et al. (eds.), The Milky Way Galaxy, 273–274.

Due to the very large error bars on derived gradients, no significant ones can be obtained but for sample 2. In this sample, the vertex deviation is shown to vary deeply within the small portion of space involved.

The estimated gradients can be used to draw lines of constant vertex deviation in the solar neighborhood. Whatever may be the dynamical cause of the quoted deviation, isodeviation lines ought to be interpreted as isoperturbation lines.

4. WHICH KIND OF PERTURBATION?

Spiral density waves are non-axisymmetric perturbations and have been considered as an acceptable cause of the vertex deviation. The observed isodeviation line turns out to follow more or less the direction $l = 30^{o}$, $l = 210^{o}(\pm 20^{o})$. This is in acceptable agreement with the direction of the Orion Arm, but conflicts definitely with interpretations of the local kinematics in terms of perturbation by a tightly wound spiral wave.

One cannot reconcile local kinematic observations with the large-scale spiral structure unless admitting at least two spiral modes with very different pitch angles. In this case, the mode driving non-axisymmetric behaviour in the solar neighborhood should be an open one.

REFERENCES

Hejlesen, F., Jorgensen, H., Peterson, J., Roncke, L.: 1972, IAU Coll. 17, "On stellar ages", G. Cayrel de Strobel and A.M. Delplace (eds.), Observatoire de Paris, p. XVII-1.
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