RESEARCH OF THE KINEMATIC OF THE GOULD BELT

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ABSTRACT. Using the proper motions, radial velocities and distances of bright O,B stars taken from the FK5/FK5 suppl. stars, the velocity field of the Gould belt stars has been analysed. The results have been compared with that of the FK4 stars given by Fricke and Tsioumis.

1. INTRODUCTION

The investigation of the kinematic of the Gould belt requires the materials of radial velocities, proper motions in a well-defined system and distances of stars. With FK4/FK4 suppl. stars Fricke and Tsioumis(1975) found some irregularities in the velocity field of stars at distances between 70 pc and 300 pc from the sun.

At present the FK5 and FK5 supplement have been published. In this paper we reanalyse these materials with the method given by Fricke and Tsioumis.

2.MATERIALS AND EQUATIONS OF CONDITION

The present investigation has been based on the following data:

The stars in the research are selected from the set of 512 FK4/FK4 suppl. stars given by Fricke(1977). The proper motions are taken from the FK5/FK5 suppl. catalogue. The radial velocities are taken from the Bright Star Catalogue, 5th revised edition(Hoffleit,E.D. et al, 1988). The distances are derived from two sources: (A).directly taken from the Fricke's list of 512 stars which based on the materials of spectral classification and photometric data; (B).taken from the General Catalogue of Trigonometric Stellar Parallaxes(van Altena,et al, 1991) if the parallax can be found in this catalogue.

The calculation consists two cases:

(A).For the radial velocity V_r,following equation is used:

$$V_r=-U\cos l\cos b-V\sin l\cos b-W\sin b+Ar\sin 2(l-l_0)\cos b$$

I.I. Mueller and B. Kołaczek (eds.),
Developments in Astrometry and Their Impact on Astrophysics and Geodynamics, 237–241.

(B).For the centennial proper motion,

$$\cos\delta = -f(X\sin\alpha - Y\cos\alpha) + Q\cos\phi$$
$$+P(\cos 2l \cos b \cos\phi + \tfrac{1}{2}\sin 2l \cos 2b \sin\phi)$$

$$= -f(X\cos\alpha\sin\delta + Y\sin\alpha\sin\delta - Z\cos\delta) + Q\cos b\sin\phi$$
$$+P(\cos 2l \cos b \sin\phi - \tfrac{1}{2}\sin 2l \sin b \cos\phi)$$

The signs used in the above equations are the same as the paper of Fricke and Tsioumis(1975).

3.RESULTS AND DISCUSSION

In Fig 1 and Fig 2,the distributions of the O-B2.5 stars in the distance intervals 70-300 pc and 300-1300 pc with the galactic coordinates(l,b) are given respectively. The solid lines are the fitting results with the least square estimation. It shows that the O-B2.5 stars in the distant group(300< r <1300 pc) are concentrate to the galactic plane while those of the near group(70< r <300 pc),belong to the Gould belt,has an inclination of 19° to the galatic plane.

Table 1 and Table 2 give the results of the stars with distance intervals 70-300pc and 300-1300 pc respectively. The results refer to all stars,A-M stars,later B (B3-B9) stars and O-B2.5 stars respectivly.The distance parameters are taken from the spectroscopic parallax.

Table 3 and Table 4 give the same results, but the distance parameter are taken from the trigonometric parallax.

according to the analysis it shows that:

(a) For all stars there are no significant difference between the distant group and the near group.

(b) For A-M stars there are small difference between the near group and all stars.

(c) Comparisons between the later B stars and all stars show that the motion of the later B stars are normal.

(d) For O-B2.5 stars except the stars farther than 300 pc,the differences between the near group and all stars are significant. It coincides with the results of Fricke and Tsioumis.

Comparision between Table1-2 and Table3-4 shows the results in which the distances are derived from the spectroscopic parallax are better than those of the trigonometric parallax.

For this difference there are two probable reasons: (1). only a few stars having the trigonometric parallax; (2).the significant difference between spectroscopic and trigonometric parallax. In our opinion the later point is even more important.

From the above mentioned discussion,one may ask which parallax system is more fit for this research?

For further research of the motion of the Gould belt,we need more detailed materials of radial velocities,proper motions,distances of the stars, and especially the knowledge of distances.

Table 1: Solutions for solar motion and galactic rotation of stars with distance 70< r <300 pc.
Units: km/s in RV solution; 0".01 per century in PM solution; l in degrees.
Errors are standard deviations.
Distances: taken from spectroscopic parallax.

	ALL STARS		A-M STARS		B3-B9 STARS		O-B2 STARS	
	(RV)	(PM)	(RV)	(PM)	(RV)	(PM)	(RV)	(PM)
N	365	723	168	339	188	245	64	122
U	9.8±0.9	1.2±0.1	10.6±1.7	0.7±0.2	9.8±1.3	1.7±0.1	11.6±2.7	1.5±0.1
V	15.5±0.9	1.4±0.1	13.3±1.5	1.2±0.1	18.6±1.4	1.8±0.1	14.7±2.1	1.8±0.1
W	7.5±1.2	0.9±0.1	7.0±1.8	0.8±0.2	7.7±2.1	0.9±0.1	1.6±5.2	1.1±0.1
K	2.4±0.6		0.7±1.0		3.3±0.9		5.2±1.6	
l_o	-3.6±14.0		12.9±18.1		-9.4±12.4		-3.3±93.7	
A,P	11.5±6.1	0.3±0.1	16.0±11.6	0.6±0.2	18.0±8.6	0.4±0.1	3.7±11.8	0.0±0.1
Q		-0.3±0.1		-0.1±0.1		-0.2±0.1		-0.5±0.1

Table 2: The same solutions as Table 1 but with distance 300< r <1300 pc.

	ALL STARS		A-M STARS		B3-B9 STARS		O-B2 STARS	
	(RV)	(PM)	(RV)	(PM)	(RV)	(PM)	(RV)	(PM)
N	124	242	43	84	25	49	66	127
U	10.3±1.5	0.5±0.1	14.8±2.7	0.6±0.1	11.0±2.8	0.4±0.1	8.4±2.0	0.4±0.1
V	15.8±1.4	0.5±0.1	12.5±2.3	0.6±0.1	17.1±2.2	0.3±0.1	16.3±2.0	0.4±0.1
W	5.5±2.8	0.4±0.1	11.5±4.6	0.4±0.1	6.0±7.5	0.3±0.1	4.1±4.0	0.4±0.1
K	2.6±1.0		-3.0±1.8		3.5±1.8		4.9±1.4	
l_o	5.0±5.6		9.5±6.0		-1.6±3.6		-0.8±15.9	
A,P	10.6±2.5	0.2±0.1	14.1±4.5	0.2±0.1	21.3±3.0	0.1±0.1	7.3±3.6	0.2±0.1
Q		-0.2±0.04		-0.2±0.1		-0.2±0.1		-0.2±0.05

Table 3: Solutions for solar motion and galactic rotation of stars with distance 70< r <300 pc.
Units: km/s in RV solution; 0".01 per century in PM solution; l in degrees.
Errors are standard deviations.
Distances: taken from trigonometric parallax.

	ALL STARS (RV)	ALL STARS (PM)	A-M STARS (RV)	A-M STARS (PM)	B3-B9 STARS (RV)	B3-B9 STARS (PM)	O-B2 STARS (RV)	O-B2 STARS (PM)
N	74	143	53	107	17	34	10	20
U	14.2±2.6	1.0±0.2	15.3±3.9	0.6±0.3	5.7±3.9	0.9±0.4	18.6±5.3	1.5±0.3
V	12.9±2.4	0.9±0.2	10.6±2.8	0.5±0.2	6.3±4.1	0.6±0.3	21.5±5.6	1.7±0.3
W	1.8±3.9	0.7±0.2	5.9±0.3	0.8±0.2	-3.1±8.0	0.7±0.3	-24.6±9.6	0.9±0.3
K	-0.7±1.7		-5.0±2.1		-2.8±2.9		3.5±4.3	
$l_\circ$	4.9±9.4		17.6±7.4		-7.1±6.2		22.2±90.4	
A,P	51.1±17.5	0.6±0.2	60.1±22.2	0.5±0.3	107.2±23.4	0.7±0.3	7.9±36.3	-0.2±0.3
Q		-0.3±0.1		-0.1±0.2		0.1±0.3		-0.5±0.3

Table 4: The same solutions as Table 3 but with distance 300< r <1300 pc.

	ALL STARS (RV)	ALL STARS (PM)	A-M STARS (RV)	A-M STARS (PM)	B3-B9 STARS (RV)	B3-B9 STARS (PM)	O-B2 STARS (RV)	O-B2 STARS (PM)
N	21	42	8	16	9	18	6	12
U	4.6±5.9	1.7±0.3	-4.6±12.9	0.8±0.6	1.0±4.4	2.2±0.5	126.7±32.5	2.2±0.6
V	12.1±3.6	2.2±0.3	18.1±12.7	2.0±0.5	13.6±6.8	1.2±0.5	21.5±5.6	3.6±0.5
W	11.7±7.8	0.9±0.3	9.4±6.5	0.2±0.5	27.6±13.8	0.9±0.5	-75.1±26.8	1.2±0.4
K	7.3±3.1		11.8±7.9		6.9±8.3			
$l_\circ$	221.3±2.3		-3.5±2.0		303.1±13.0		168.3±10.4	
A,P	12.9±8.1	-0.2±0.4	36.2±44.4	0.3±0.7	19.4±17.7	0.7±0.5	116.0±99.6	-2.1±0.6
Q		-0.2±0.3		0.6±0.4		-0.2±0.4		-1.4±0.6

Fig 1. O–B2 stars in 70≦ r <300 pc

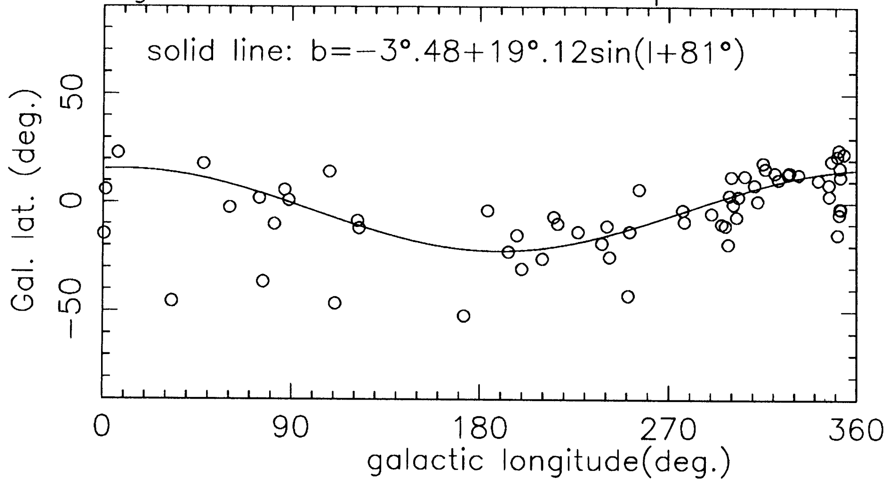
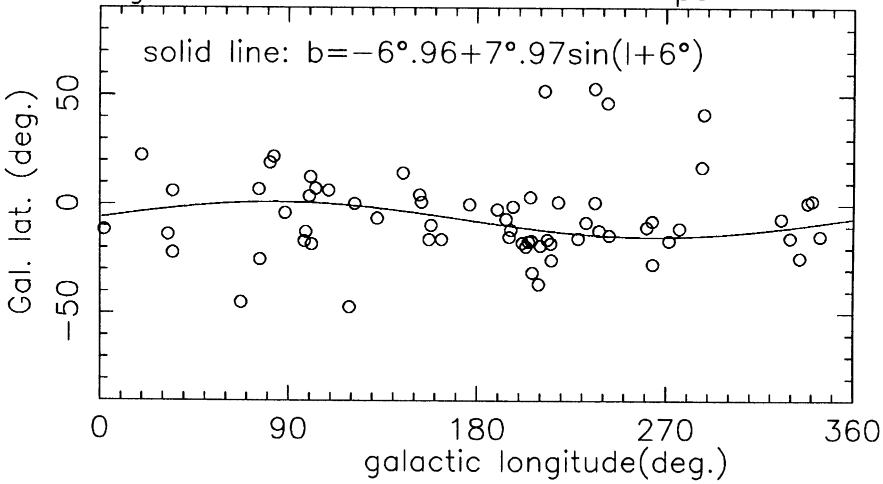


Fig2. O–B2 stars in 300≦ r <1300 pc



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