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THE MOTIONS OF TWELVE LATE TYPE STARS

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SUMARIO

Entre las estrellas del Catálogo de Estrellas Brillantes, Mendoza y Johnson han estudiado 12 objetos de tipo tardío cuyas paralajes trigonométricas son mayores que sus paralajes espectroscópicas. Con el objeto de probar el promedio de las paralajes trigonométricas, hemos empleado los métodos estadísticos. Podemos concluir que nuestros resultados son consistentes con la hipótesis de que las estrellas de la Tabla 1 son gigantes de tipo tardío, pertenecientes a la frontera inferior de la clase de luminosidad III en el sistema de Yerkes.

Among the stars of the Bright Star Catalogue there are twelve late type stars, studied by Mendoza and Johnson (1965), which appear to have larger trigonometric parallaxes than their spectra would suggest. Three of them, contained in both catalogues of stellar parallaxes (Jenkins 1952 and 1963), show a very poor agreement between the two values. Furthermore, the majority of these stars have only one parallax measurement. We have, therefore, employed the usual methods of statistical parallaxes for these stars, adopting the standard solar apex, to test the average trigonometric parallax value.

We have listed these stars in Table 1. The columns of this Table give, first, the Bright Star Catalogue numbers (BS); second, the constellation name; third, the visual magnitude; fourth and fifth, the 1900 coordinates; sixth and seventh, the GC proper motions; eight and ninth, the secular parallax factors (van Rhijn and Bok, 1931 — R. A. = 18 hr, Dec = + 31°), in right ascension and declination, respectively; tenth, the angular distance from the antapex; eleventh, the position angle of the antapex (Smart, 1923 — R. A. = 6 hr 0 min, Dec = — 34°); twelfth, the radial velocity (Wilson, 1952); and thirteenth, the trigonometric parallax value (Jenkins, 1952 and 1963).

TABLE 1

Mendoza and Johnson's (1965) Stars

BS	*Name*	*V*	α (1900)	δ	$\mu_\alpha \cos\delta$ (1900)	μ_δ	*P*	*P'*	λ	χ	*R. V.*	*p*
1355	ε Ret	4.44	4h 14m 45s	−59°33′	−0.055	−0.165	+0.38	+0.39	31°	42°	+ 29.3	0″058
4671	ε Mus	4.16	12 12 10	−67 24	−0.234	−0.036	−0.86	−0.24	60	253	+ 7.1	0.038
4949	40 Com	5.62	13 01 31	+23 09	+0.025	−0.055	−0.83	−0.39	115	242	− 5.1	0.042
5192	2 Cen	4.20	13 43 39	−33 57	−0.047	−0.064	−0.77	−0.63	89	228	+ 40.7	0.025
5603	σ Lib	3.26	14 58 13	−24 53	−0.073	−0.052	−0.62	−0.72	107	218	− 4.3	0.056
5824	42 Lib	4.95	15 34 22	−23 30	−0.021	−0.024	−0.50	−0.74	113	212	− 21.8	0.042
5924	—	5.45	15 50 10	+20 36	−0.082	+0.039	−0.46	−0.24	148	238	− 60.9	0.023
5932	2 Her	5.37	15 51 18	+43 26	−0.036	+0.057	−0.46	+0.12	153	280	− 10.3	0.031
7120	ν² Sgr	4.98	18 49 4	−22 48	+0.100	−0.029	+0.18	−0.79	122	168	−109.9	0.034
7317	—	6.08	19 13 18	−15 43	−0.097	−0.268	+0.27	−0.71	128	161	− 17.8	0.033
7429	μ Aql	4.44	19 29 12	+ 7 12	+0.211	−0.157	+0.33	−0.41	147	146	− 23.9	0.038
9089	30 Psc	4.41	23 56 50	− 6 34	+0.048	−0.033	+0.86	−0.53	87	123	− 11.8	0.007

The following mean secular parallax values (from the stars in Table 1) are found:

from the proper motions in R. A., + 0″.098
from the proper motions in Dec., + 0″.102
COMBINED SOLUTION, + 0″.100

The mean secular parallax from the upsilon-components, i e., the components toward the antapex, becomes + 0″.097, in excellent agreement with the proper motion values, which is, of course, to be expected.

Adopting the standard solar motion $V_\odot$ = + 20 km/sec, a mean annual parallax of 0″.024 is found. From the small number of stars, it is difficult to assign a probable error to this value; a faint idea of the uncertainty may be obtained by noting that the omission of μ Aql, one of the largest proper motion stars in Table 1, reduces the mean parallax value from 0″.024 to 0″.020. Another uncertainty lies in the adopted value of the solar velocity. It would be futile to attempt to

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determine both apex and solar velocity from the radial velocities of only twelve stars. However, by adopting the standard solar apex, the observed radial velocities lead to a solar velocity of + 45 km/sec. Adopting a mean secular parallax of 0".10, the mean annual parallax is reduced to 0".010. On the other hand, the omission of the large radial velocity star ν^2 Sgr, reduces the solar velocity to + 33 km/sec, with a corresponding change in the mean annual parallax to 0".014 (mean secular parallax = 0".10).

Another statistical determination of the mean anual parallax may be made from the tau-components, i. e., the proper motion components perpendicular to the parallactic motion. The absolute average $|\overline{\tau}|$ is found to be ± 0".058, any correction for observational errors being negligible.

Correcting the observed radial velocities for solar velocities of + 45 km/sec and the standard value + 20 km/sec, the following average absolute values of the individual radial velocities are obtained: $|\overline{V}_i|$ = ± 22.2 km/sec and $|\overline{V}_i|$ = ± 20.8 km/sec, respectively. Combining these values with the value of ± 0".058 for $|\overline{\tau}|$, we obtain values of 0".012 and 0".013 for the mean annual parallax. We see that this value of $|\overline{V}_i|$ is not very sensitive to changes in the solar velocity; however, it is very much affected by ν^2 Sgr. If we exclude it, we find: $|\overline{V}_i|$ = ± 13.7 km/sec and $|\overline{\tau}|$ = ± 0".055, leading to a mean annual parallax of 0".019.

The results, in summary, are given in Table 2. The columns of this Table contain, first, the mean annual parallax; second, a "no" or a "yes" to indicate if all stars in Table 1 have been used or ν^2 Sgr has been omitted, respectively; third, the adopted solar velocity; and last, the technique employed.

TABLE 2

Mean Annual Parallax

$\overline{p}\,(=\overline{1/r})$	*ν^2 Sgr omitted*	*V_o (km/sec)*	*Method*
0".036	no	—	OBSERVED DIRECTLY
0".024	no	20	Proper motions in R. A. and Dec.
0".024	no	20	Upsilon-components
0".024	yes	20	Upsilon-components
0".019	yes	20	Tau-components
0".014	yes	33	Upsilon-components
0".013	no	20	Tau-components
0".012	no	45	Tau-components
0".010	no	45	Upsilon-components

Taking into consideration the exceedingly limited material, the various results show a not unexpected range, from 0".010 to 0".036; we note that the highest value, 0".036, holds for the mean of the direct parallax determinations and that this value is hardly confirmed by the different values derived above. Our highest computed value, 0".024, comes from the mean secular parallax, based on all stars and the standard value of the sun's velocity, and yet, is 33% smaller than the average trigonometric parallax. This value comes from almost identical values, namely, 0".098 (proper motions in R. A.), 0".102 (proper motions in Dec.) and 0".097 (upsilon-components). Thus, it probably carries a higher weight. Therefore, we may conclude that our results are consistent, to some extent, with the hypothesis of the stars in Table I being late type lower border-line giants.

We should like to make a strong plea for additional parallax determinations of the stars in Table 1, several of which have only one determination.

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