Declinations of 162 fundamental stars observed at the Leiden Observatory in the years 1863-1868

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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

Declinations of 162 Fundamental Stars observed at the Leiden Observatory in the years 1863—1868, by *C. H. Hins*.

1. *The programme.*

A publication of results of meridian observations more than sixty years after their mean epoch needs some explanation.

In the course of 1928 a request reached the director of this observatory from Prof. J. RAYMOND of Albany asking if the Leiden Observatory would be willing to transform into declinations the zenith distances of a number of fundamental stars published in Vol. VI of the *Leiden Annals* by the late director of the observatory Prof. Dr. H. G. VAN DE SANDE BAKHUYZEN.

The complete history of these observations and their reductions may be read in the introductions to Vols. I, II and VI.

The programme as designed by the late Prof. F. KAISER, shortly after the foundation of the new Leiden observatory consisted of the 134 fundamental stars given in the *Nautical Almanac* of that time, to which were added 32 other bright stars. Among these stars were α, δ and λ Ursae Minoris, 51 Hev. Cephei and 20 other circumpolar stars.

As to the right ascensions of these stars, the reduction of the observations never came beyond its first stages and has been abandoned definitively [1]).

As to the declinations, Vol. I of the Leiden Annals contains the means of the readings of the microscopes reduced to the meridian and corrected for run and division errors, Vol. II contains a discussion of the results of the circumpolar stars for the determination of the geographical latitude of the observatory and an investigation on the constants of refraction and flexure.

Vol. VI, at last, contains the definitive reductions to zenith distances at the equinox and epoch 1865·0, for which reduction, in consequence of the large number of errors found in the data of Vol. I, the old records have been reconsulted.

[1]) See "Report of the Director of the Leiden Observatory" *B. A. N.* I, **2**, p. 8.

The introduction to Vol. VI, therefore, gives all that is necessary to know about the instrument and its accessories, method of observation, instrumental errors etc., in order to derive for all stars the zenith distances of the individual observation nights.

I have regarded as my only task, maintaining fully the results arrived at in Vol. VI, to transform these zenith distances into declinations, to verify whether the constants of refraction and flexure used needed some special corrections and to derive data regarding the mean error of the resulting star places.

The total number of observations on the catalogue stars without those on the four polar stars is about 9300.

In the computation of the means and the applying of some corrections to be mentioned later on I was assisted by Mr. DE ROOY of this observatory.

2. *The further reductions.*

The zenith distances referred to above have been corrected for the variation of latitude by means of the two following formula's.

14 month term $d\varphi_1 = 0''\cdot16 \cos 2\pi \dfrac{J.D. - 2403390}{432}$

yearly term $d\varphi_2 = 0''\cdot12 \cos 2\pi \dfrac{t - 261}{365}$

Both formulas are almost identical with those derived by Dr. E. F. VAN DE SANDE BAKHUYZEN in *Archives Néerlandaises des Sciences exactes et naturelles*, Série II, Vol. II, pp. 454 etc.

Calling $\Delta\varphi = d\varphi_1 + d\varphi_2$, φ_0 the mean latitude of Leiden and z the instantaneous zenith distance measured, the formulas for δ reduced to the mean pole are:

South of Zenith $\delta = \varphi_0 - (z - \Delta\varphi)$
North of Zenith U. C. $\delta = \varphi_0 + (z + \Delta\varphi)$
North of Zenith L. C, $\delta = 180° - \varphi_0 - (z + \Delta\varphi)$

The value of $\Delta\varphi$ has been tabulated for ten days intervals from 1863—1868 and applied to the individual nights.

The four positions of the instrument in which the observations have been made are the following:

I Clamp East, Direct
II „ „ , Reflected
III „ West, Direct
IV „ „ , Reflected.

Of the 142 non-circumpolar stars 95 have been observed in all the four positions, 45 only in the positions I and III, two stars in another combination.

Generally the stars south of the equator, having thus a zenith distance larger than 52°, are observed only directly.

The same is the case with the circumpolar stars; the U. C.'s except those lying in the extreme neighbourhood of the zenith have been observed in four positions, the L. C.'s however only in the positions I and III, with the exception of two stars. This may be regarded as a serious but inevitable disadvantage in deriving the latitude from the programme itself.

In computing the mean zenith distance of each star in each of the four positions of the instrument an observation during which two circles (8 microscopes) have been read, has received the weight $1\frac{1}{2}$, an observation with one circle (4 microscopes) read the weight 1. The simple mean was then taken of the results given by the different positions. Although this means a loss of weight, remaining systematic errors are better eliminated in this way. The mean epoch was computed correspondingly.

Section 4 gives the complete list of resulting zenith distances in the different positions.

For the 140 stars observed south of the zenith in four or two positions I have computed the differences: position result minus simple mean $\bar{z}$.

The result is:

$$\begin{aligned} I - \bar{z} &= +0''.20 \\ II - \bar{z} &= +0.01 \\ III - \bar{z} &= -0.21 \\ IV - \bar{z} &= 0.00 \end{aligned}$$

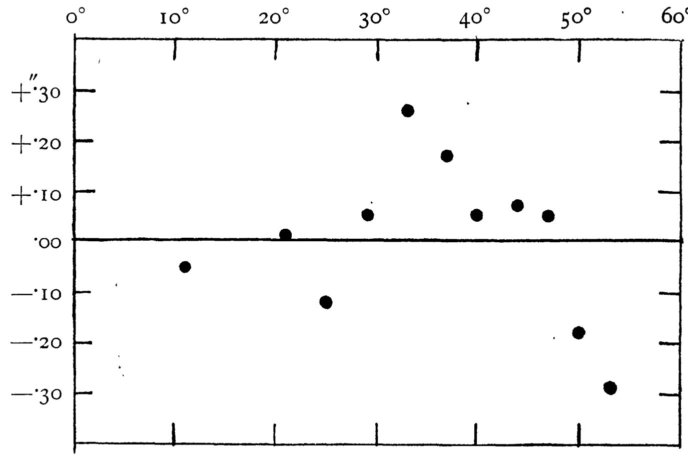
From these numbers we may conclude that the horizontal flexure, i. e. the term in $\sin z$, is eliminated fairly well; the nadir flexure however would be eliminated rather poorly. As, however, all stars have been observed in the positions I and III (except two) this error can not have an important influence on the final results. The lack of observations in the positions II and IV at larger zenith distances made it desirable to verify whether, although the mean value of $\frac{1}{2}$ (I + III) — $\frac{1}{2}$ (II + IV) is zero, there is a dependence of this quantity on the zenith distance.

Including the circumpolar stars 109 of these differences were available covering a range of nearly 50° in zenith distance.

I have grouped these 109 differences in 11 groups according to increasing zenith distance.

Table 1 and fig. 1 gives these 11 means:

FIGURE 1.



Ordinate: Mean difference $\frac{I + III}{2} - \frac{II + IV}{2}$

Abscissa: Zenith distance.

TABLE 1.

Zen. dist.	$\frac{I+III}{2} - \frac{II+IV}{2}$
11°	—0''.05
21	+ 1
25	— 12
29	+ 5
33	+ 26
37	+ 17
40	+ 5
44	+ 7
47	+ 5
50	— 18
53	— 29

I think it is impossible to draw from these numbers any other conclusion regarding the value of these differences at zenith distances 60°—80°, than that there is no reason to suppose them to be large.

In any case it is very satisfactory that the mean value in the interval of nearly 50° is zero.

The corrections — 0''.20 and + 0''.20 to the position results I and III respectively, are not applied to the zenith distances in the catalogue in section 4; for the computation of the mean errors in section 5 they have been taken into account.

Small corrections have been applied for the proper motions used to reduce the positions to the epoch 1865.0. The p. m.'s used now are those of the P. G. C.

3. *The latitude and the constant of refraction.* The fact that 19 stars are contained in the programme which have been observed in upper and lower culmination (the 20th has been cancelled in consequence of the very small number of observations in lower culmination) enables us to derive a value for the latitude of Leiden independent of former and later determinations. I thought it better to treat the programme in this way than by using other values of the latitude, e. g. that found in the Leiden Annals Vol. XIII part 3.

Firstly the Leiden meridian circle and its accessories have undergone some important changes in the time between this programme and the special programme of polar stars, secondly only in this way the results may be regarded as fully fundamental ones.

Table 2 gives the zenith distances of these 19 stars in upper and lower culmination, grouped according to the four positions of the instrument and their simple means. The last column, then, gives the zenith distance of the Pole.

TABLE 2. Zenith distances of circumpolar stars.

star	Upper culmination.							Lower culmination.							Colatitude.		
	I	II	III	IV	mean z.			I	II	III	IV	mean z.					
α Cassiop.	27·10		27·38		3°	38′	27·24	52·93		53·08		72°	2′	53·00	37°	50′	40·12
α Persei	40·44		40·17		2	46	40·30	59·74		60·56		78	27	60·15			39·93
α Camelop.	9·21	8·85	9·33	9·19	13	57	9·14	9·78		10·90		61	44	10·34			39·74
α Aurigae	55·88	55·25	55·73	55·72	6	17	55·64	14·75		15·88		81	59	15·32			39·84
ι Urs. Maj.	10·93		10·68		3	35	10·80	30·73		31·51		79	16	31·12			40·16
ϑ Urs. Maj.	5·99		6·19		0	8	6·09	14·25		14·35		75	33	14·30			40·20
α Urs. Maj.	25·00	25·07	24·97	24·85	10	19	24·97	54·67		55·29		65	21	54·98			39·98
γ Urs. Maj.	23·18		23·06		2	17	23·12	56·65		57·26		73	23	56·96			40·04
η Urs. Maj.	2·68		2·54		2	10	2·61	23·49		23·54		77	51	23·52			40·45
ϑ Boötis	13·03		13·27		0	19	13·15	6·68		7·28		75	22	6·98			40·06
β Urs. Min.	5·94	5·79	6·33	5·97	22	33	6·01	13·86	13·97	14·22	14·38	53	8	14·11			40·06
ζ Urs. Min.	9·27	9·31	9·81	9·56	26	3	9·49	10·38		10·74		49	38	10·56			40·02
η Draconis	54·03	53·86	53·97	54·08	9	39	53·99	26·15		26·08		66	1	26·11			40·05
ε Urs. Min.	55·29	55·62	55·43	55·40	30	5	55·44	24·94	24·85	24·86		45	35	24·88			40·16
γ Draconis	58·40		57·78		0	38	58·09	19·50		18·79		76	20	19·14			40·52
α Cygni	22·57	22·59	22·18	22·42	7	21	22·44	43·44		45·19		83	2	44·31			40·94
α Cephei	31·94	31·93	32·76	32·21	9	51	32·21	48·10		48·27		65	49	48·18			40·20
β Cephei	46·53	46·74	46·94	46·74	17	48	46·74	33·60		33·91		57	52	33·76			40·25
γ Cephei	23·78	24·07	24·33	24·14	24	43	24·08	55·94	55·21	55·86	55·40	50	57	55·60	37	50	39·84
														mean	37	50	40·14
														m. e.			± 0·063

As may be calculated from the residuals the m. e. of the zenith distance given by one position of the instrument is ± 0″·22 for the upper and ± 0″·45 for the lower culmination.

The decrease in accuracy with increasing zenith distance is very marked.

The mean error of one determination of the colatitude is ± 0″·27 derived from the residuals of the last column.

The m. e. of the mean colatitude is ± 0″·063.

Table 3 gives the results for the colatitude grouped according to the declinations of the stars used.

There exists a distinctly marked dependance of the resulting colatitude on the zenith distance, which shows itself clearly by taking the means of three groups of stars with zenith distances at the lower culmination of

$$<70°,\ 70°–80°,\ \text{and}\ >80°.$$

The results are respectively 40″·03 (9 stars), 40″·18 (8 stars), 40″·39 (2 stars).

TABLE 3. Colatitude grouped according to Zenith distance.

	Zen. distance U. C.	Zen. distance L. C.	Colatitude	Colatitude corrected for refraction.	
α Cygni	7°·4 S	83°·0 N	37° 50′ 40″·94	40″·34	39″·84
α Aurigae	6·3	82·0	39·84	39·34	
ι Urs. Maj.	3·6	79·3	40·16	39·77	
α Persei	2·8	78·5	39·93	39·57	
η Urs. Maj.	2·2	77·9	40·45	40·11	
γ Draconis	0·6	76·3	40·52	40·21	39·88
ϑ Urs. Maj.	0·1 N	75·6	40·20	39·91	
ϑ Boötis	0·3	75·4	40·06	39·78	
γ Urs. Maj.	2·3	73·3	40·04	39·79	
α Cassiop.	3·6	72·0	40·12	39·89	
η Draconis	9·7	66·0	40·05	39·87	
α Cephei	9·9	65·8	40·20	40·02	
α Urs. Maj.	10·3	65·4	39·98	39·80	
α Camelop.	14·0	61·7	39·74	39·58	
β Cephei	17·8	57·9	40·25	40·11	39·88
β Urs. Min.	22·6	53·1	40·06	39·93	
γ Cephei	24·7	51·0	39·84	39·71	
ζ Urs. Min.	26·1	49·6	40·02	39·90	
ε Urs. Min.	30·1	45·6	40·16	40·04	
			mean	39·88 ± 0·055	

According to section 2 it is improbable that this dependance must be ascribed to a remaining error in the applied constant of flexure.

Which correction to the constant of refraction has to be applied in order to obtain the same value of the colatitude independant of the zenith distance?

A solution with least squares of the 19 equations of the form:

$$x + \Delta a\,(\tan z.\ l.\ c. \pm \tan z.\ u.\ c.) = \text{residual}$$

in which x is the new value for the colatitude and the minus sign is used for upper culminations south of the zenith, gives:

$$x = 37°50'39''\cdot88 \quad \Delta a = -0''\cdot15$$

The last column of Table 3 gives the individual results corrected for $\Delta a = -0''\cdot15$

The m. e. of this mean is $\pm 0''\cdot055$, almost wholly caused by the two stars with zenith distances $> 80°$. Omitting both, however, a similar result is obtained from the 17 other stars.

The refractions used in the computation of the zenith distances of Vol. VI are those of the *Tabulae Regiomontanae*.

The correction of $-0''\cdot15$ found above to the constant of BESSEL is not at all improbable, the value (BESSEL $-0''\cdot15$) lying nearly half way between the constant of BESSEL and that of Pulkowa.

However the resulting latitude of the Leiden meridian circle so obtained, $52°\,9'\,20''\cdot12$, is somewhat puzzling, being $+0''\cdot3$ larger than the usually adopted one, the more so as OORT [1]) in the discussion of the southern fundamental stars, based on the latitude from the special polar stars [2]), has found that with a correction to the constant of refraction in the same direction as derived here and of nearly the same amount, there would exist an error of $+0''\cdot6$ in the difference of the Leiden and Cape latitudes, which error, assuming the latitude derived above, would still be increased by $+0''\cdot3$.

The latitude derived from the polar stars, taking into account a correction to the constant of refraction as derived in this paper and by OORT, would not surpass $19''\cdot88$, nearly the same value as found here without any correction to the refraction. On the other hand, from almost the same material as used here, with this exception that the zenith distances given in Vol. I of the Leiden Annals, a preliminary constant of flexure and no correction for latitude variation have been used, KAISER has derived in Vol. II the value $19''\cdot99$, including a small correction to the constant of refraction of $-0''\cdot05$.

Other determinations of the latitude of Leiden at that time from observations of α and δ Urs. Min. by KAISER and HENNEKELER have given nearly the same value, so that KAISER in Vol. II derives a final result for the latitude of Leiden of $52°\,9'\,19''\cdot96$, based on BESSEL's constant of refraction.

The comparison of this catalogue with the P.G.C., as given in section 5, shows large positive although very regular deviations from the system of the P.G.C., which could a priori be expected with this unusually high latitude of Leiden.

The consideration, however, that fundamental astronomy and the building up of a better system of star positions is not furthered by shrinking from deviating results, has led me to maintain the latitude and the correction to the constant of refraction as derived from the programme itself.

1) *Leiden Annals*, Vol. XIII, Part 4, Introduction.
2) *Leiden Annals*, Vol. XIII, Part 3.

4. *The catalogue for equinox and epoch 1865.0.*

Latitude of Leiden $52°9'20''\cdot12$; correction to zenith distance $-0''\cdot15$ tan z.

1st column:	Rotating number.
2nd „ :	Name as given in Leiden Annals Vol. VI; especially in the case of double stars there are some deviations from the notations of the P. G. C.
3rd „ :	Boss' number.
4th, 5th, 6th 7th column:	Zenith distance in the four positions of the instrument, corrected for all instrumental errors etc. according to Vol. VI, and for the variation of the latitude.
8th column:	Simple mean of I, II, III and IV.
9th „ :	Mean epoch valid for the 8th column.
10th „ :	Total number of observations in the four positions.
11th „ :	Refraction correction; in this value the small correction of some hundredths of a second for proper motion is included.
12th „ :	Corrected zenith distance.
13th „ :	Final declination.
14th „ :	Difference Leiden — P. G. C. for the equinox and epoch 1865·0.

No.	Name	No. P.G.C.	Instrumental position I	II	III	IV	Mean	Epoch	n	Corr.	Zenith distance	Declination	Lei — P.G.C.
			″	″	″	″	″			″	° ′ ″	° ′ ″	″
1	α Andromedae	10	38.02	37.71	37.47	37.45	37.66	1865.42	119	— .07	23 48 37.59	28 20 42.53	+ 0.71
2	γ Pegasi	27	21.53	21.12	21.50	20.98	21.28	5.35	92	— 12	37 43 21.16	14 25 58.96	+ 0.67
3	ι Sculptoris	59	2.11		2.60		2.36	6.28	34	— 1.09	81 53 1.27	— 29 43 41.15	+ 0.68
4	12 Ceti	90	33.34		32.78		33.06	5.87	41	— 23	56 51 32.83	— 4 42 12.71	+ 0.48
5	α Cass. U.C.	135	27.10		27.38		27.24	5.17	82	— 01	3 38 27.23	55 47 47.35	+ 0.20
	α Cass. L.C.		52.93		53.08		53.00	6.74	30	— 45	72 2 52.55	47.33	+ 0.18
	mean											47.35	+ 0.20
6	β Ceti	147	1.56		1.15		1.36	6.05	39	— 42	70 53 0.94	— 18 43 40.82	+ 0.57
7	ε Piscium	226	34.18	34.51	34.14	33.94	34.19	6.21	43	— 16	44 59 34.03	7 9 46.09	+ 0.96
8	ϑ Ceti	313	11.77		11.16		11.46	6.34	31	— 28	61 2 11.18	— 8 52 51.06	+ 0.57
9	η Piscium	335	24.36	23.99	23.81	23.61	23.94	6.56	34	— 12	37 30 23.82	14 38 56.30	+ 0.73
10	ν Piscium	378	8.21	7.85	7.90	7.37	7.83	6.19	43	— 16	47 21 7.67	5 48 12.45	+ 0.75
11	β Arietis	428	31.85	31.04	31.52	31.43	31.46	5.86	51	— 10	32 0 31.36	20 8 48.76	+ 0.71
12	α Arietis	477	59.13	58.86	58.60	58.56	58.79	5.30	126	— 8	29 19 58.71	22 49 21.41	+ 0.57
13	67 Ceti	518	5.19		4.07		4.63	6.30	30	— 25	59 12 4.38	— 7 2 44.26	+ 0.54
14	ξ² Ceti	560	8.55	7.64	7.57	7.56	7.83	6.03	42	— 15	44 18 7.68	7 51 12.44	+ 0.95
15	ν Ceti	589	11.77	11.05	10.60	10.51	10.98	6.04	42	— 16	47 9 10.82	5 0 9.30	+ 0.84
16	γ Ceti	622	25.92	25.51	25.02	25.52	25.49	6.05	40	— 17	49 29 25.32	2 39 54.80	+ 0.71
17	α Ceti	691	50.80	50.36	50.27	50.58	50.50	5.91	65	— 17	48 35 50.33	3 33 29.79	+ 0.71
18	δ Arietis	718	30.41	29.71	30.01	29.92	30.01	6.26	42	— 11	32 56 29.90	19 12 50.22	+ 0.73
19	α Persei U.C.	772	40.44		40.17		40.30	5.20	98	— 1	2 46 40.29	49 22 39.83	+ 0.17
	α Persei L.C.		59.74		60.56		60.15	6.44	39	— 72	78 27 59.43	40.45	+ 0.79
	mean											39.95	+ 0.29
20	ε Eridani	814	22.57		21.97		22.27	6.22	36	— 28	62 4 21.99	— 9 55 1.87	+ 0.18
21	η Tauri	869	13.95	13.61	13.75	13.71	13.76	6.23	51	— 9	28 28 13.67	23 41 6.45	+ 0.57
22	γ Eridani	915	1.22		0.60		0.91	6.36	25	— 35	66 3 0.56	— 13 53 40.44	+ 0.74
23	ο¹ Eridani	963	51.31		51.05		51.18	6.36	34	— 26	59 20 50.92	— 7 11 30.80	+ 0.38
24	γ Tauri	1000	24.25	23.99	24.12	23.89	24.06	6.56	37	— 11	36 51 23.95	15 17 56.17	+ 0.53
25	ε Tauri	1044	39.13	38.79	38.73	38.72	38.84	6.45	35	— 11	33 16 38.73	18 52 41.39	+ 0.49
26	α Tauri	1077	14.50	14.10	13.90	14.01	14.13	5.53	107	— 11	35 55 14.02	16 14 6.10	+ 0.51
27	α Camelop.U.C.	1139	9.21	8.85	9.33	9.19	9.14	7.21	20	— 3	13 57 9.11	66 6 29.23	+ 0.06
	α Camelop.L.C.		9.78		10.90		10.34	8.40	18	— 29	61 44 10.05	29.83	+ 0.66
	mean											29.35	+ 0.18
28	ι Aurigae	1167	24.21	24.26	23.93	23.96	24.09	5.99	44	— 7	19 12 24.02	32 56 56.10	+ 0.22
29	ε Leporis	1211	36.66		35.94		36.30	6.80	22	— 55	74 42 35.75	— 22 33 15.63	+ 1.14
30	α Aurigae U.C.	1246	55.88	55.25	55.73	55.72	55.64	5.68	72	— 2	6 17 55.62	45 51 24.50	+ 0.39
	α Aurigae L.C.		14.75		15.88		15.32	7.54	14	— 1.08	81 59 14.24	25.64	+ 1.53
	mean											24.60	+ 0.49
31	β Orionis	1250	57.13		56.46		56.80	5.94	50	— 27	60 30 56.53	— 8 21 36.41	+ 0.42
32	β Tauri	1304	56.22	55.53	55.60	55.84	55.80	5.74	72	— 7	23 39 55.73	28 29 24.39	+ 0.58
33	δ Orionis	1339	27.20	26.90	26.83	26.68	26.90	6.73	44	— 20	52 33 26.70	— 0 24 6.58	+ 0.38
34	α Leporis	1347	37.03		36.35		36.69	6.59	4	— 42	70 4 36.27	— 17 55 16.15	+ 0.73
35	ε Orionis	1370	47.83	47.64	47.39	47.41	47.57	6.83	39	— 21	53 26 47.36	— 1 17 27.24	+ 0.28
36	α Columbae	1401	17.03		14.78		15.90	6.25	9	— 2.31	86 18 13.59	— 34 8 53.47	— 0.97
37	α Orionis	1468	36.51	36.07	36.19	35.84	36.15	5.80	79	— 16	44 46 35.99	7 22 44.13	+ 0.26
38	ν Orionis	1525	27.21	26.75	27.46	26.28	26.92	7.03	34	— 17	37 22 26.75	14 46 53.37	+ 0.15
39	η Geminorum	1561	46.38	45.89	46.48	46.36	46.28	7.50	24	— 12	29 36 46.16	22 32 33.96	+ 0.52
40	μ Geminorum	1604	33.02	32.83	33.26	32.17	32.82	5.69	4	— 9	29 34 32.73	22 34 47.39	+ 1.03
41	ν Geminorum	1635	40.72	40.23	40.27	39.70	40.23	6.41	13	— 11	31 51 40.12	20 17 40.00	+ 0.46
42	γ Geminorum	1690	39.55	38.54	38.82	38.71	38.90	6.54	36	— 13	35 38 38.77	16 30 41.35	+ 0.57
43	α Can. Maj.	1732	20.39		20.33		20.36	5.48	66	— 39	68 41 19.97	— 16 31 59.85	+ 0.42[1])
44	e Geminorum	1778	33.59	34.03	33.83	32.68	33.53	6.79	22	— 14	38 48 33.39	13 20 46.73	+ 0.32
45	ε Can. Maj.	1804	46.45		46.11		46.28	6.92	18	— 97	80 56 45.31	— 28 47 25.19	+ 0.22
46	γ Can. Maj.	1819	30.64		30.19		30.42	6.46	22	— 38	67 35 30.04	— 15 26 9.92	+ 0.33
47	51 Geminorum	1856	14.09	14.40	13.90	14.31	14.18	6.70	34	— 14	35 46 14.04	16 23 6.08	+ 0.05
48	δ Geminorum	1898	40.12	39.87	39.58	39.35	39.73	6.94	5	— 13	29 55 39.60	22 13 40.52	+ 0.49
49	ι Geminorum	1931	32.93	33.21	32.58	33.28	33.00	7.25	29	— 10	24 5 32.90	28 3 47.22	— 0.06
50	α² Geminorum	1979	27.55	27.28	27.47	27.52	27.46	6.26	57	— 12	19 58 27.34	32 10 52.78	+ 0.54[2])
51	α Can. Min.	2008	14.41	14.19	14.41	14.30	14.33	5.93	59	— 16	46 35 14.17	5 34 5.95	+ 0.33[3])
52	β Geminorum	2031	22.47	22.49	22.09	22.46	22.38	6.24	66	— 8	23 48 22.30	28 20 57.82	+ 0.41
53	ξ Navis	2065	43.55		42.90		43.22	7.28	13	— 68	76 40 42.54	— 24 31 22.42	+ 0.39
54	6 Cancri	2131	8.66	7.37	7.67	8.41	8.03	6.87	39	— 9	23 59 7.94	28 10 12.18	+ 0.32
55	15 Argus	2153	21.57		21.05		21.31	6.96	23	— 64	76 4 20.67	— 23 55 0.55	+ 0.84
56	β Cancri	2195	23.53	22.89	22.91	23.00	23.08	6.85	35	— 16	42 33 22.92	9 35 57.20	+ 0.36
57	d¹ Cancri	2218	32.80	32.27	32.34	32.12	32.38	6.80	48	— 12	33 23 32.26	18 45 47.86	+ 0.73
58	η Cancri	2271	29.91	28.87	28.97	29.67	29.36	6.70	50	— 10	31 15 29.26	20 53 50.86	+ 0.53
59	ε Hydrae	2354	37.09	37.26	36.87	36.52	36.94	6.50	51	— 20	45 14 36.74	6 54 43.38	+ 0.54
60	ι Urs. Maj. U.C.	2404	10.93		10.68		10.80	6.00	55	— 1	3 35 10.79	48 34 9.33	+ 0.15
	ι Urs. Maj. L.C.		30.73		31.51		31.12	6.44	28	— 79	79 16 30.33	9.55	+ 0.37
	mean											9.37	+ 0.19

No.	Name	No. P.G.C.	Instrumental position I	II	III	IV	Mean	Epoch	n	Corr.	Zenith distance	Declination	Lei — P.G.C.
			″	″	″	″	″			″	° ′ ″	° ′ ″	″
61	83 Cancri	2501	47·45	46·99	47·10	47·20	47·18	1866·46	51	−0·10	33 52 47·08	18 16 33·04	+0·27
62	α Hydrae	2533	50·93		50·52		50·72	5·72	67	− 28	60 13 50·44	− 8 4 30·32	+0·04
63	ϑ Urs.Maj.U.C.	2552	5·99		6·19		6·09	5·80	31	− 1	0 8 6·08	52 17 26·20	+0·23
	ϑ Urs.Maj.L.C.		14·25		14·35		14·30	6·61	27	− 56	75 33 13·74	26·14	+0·17
	mean											26·18	+0·21
64	ε Leonis	2618	40·74	40·57	40·46	40·78	40·64	5·64	69	− 9	27 45 40·55	24 23 39·57	+0·46
65	μ Leonis	2648	51·86	51·91	51·75	51·99	51·88	5·85	67	− 9	25 30 51·79	26 38 28·33	+0·27
66	π Leonis	2680	54·63	54·71	54·39	54·61	54·58	5·78	65	− 15	43 27 54·43	8 41 25·69	−0·05
67	α Leonis	2698	47·64	47·31	47·32	47·65	47·48	5·39	134	− 13	39 31 47·35	12 37 32·77	+0·28
68	γ¹ Leonis	2742	56·69	56·14	56·19	56·72	56·44	5·37	112	− 10	31 37 56·34	20 31 23·78	+0·53
69	ρ Leonis	2804	18·97	18·68	18·59	18·90	18·78	5·50	86	− 14	42 9 18·64	10 0 1·48	+0·64
70	34 Sextantis	2851	5·03	5·10	4·87	5·24	5·06	5·92	63	− 18	47 52 4·88	4 17 15·24	−0·03
71	l Leonis	2883	48·34	48·29	48·34	48·40	48·34	5·78	69	− 14	40 53 48·20	11 15 31·92	+0·66
72	α Urs.Maj.U.C.	2933	25·00	25·07	24·97	24·85	24·97	5·40	118	− 3	10 19 24·94	62 28 45·06	+0·38
	α Urs.Maj.L.C.		54·67		55·29		54·98	6·18	25	− 33	65 21 54·65	45·23	+0·55
	mean											45·09	+0·41
73	χ Leonis	2942	25·50	25·21	25·33	25·98	25·50	5·93	48	− 16	44 5 25·34	8 3 54·78	+0·29
74	δ Leonis	2972	33·61	33·49	33·21	33·76	33·52	5·50	85	− 11	30 53 33·41	21 15 46·71	+0·48
75	δ Hydrae	2989	14·02		14·19		14·10	5·95	52	− 35	66 12 13·75	− 14 2 53·63	+0·51
76	τ Leonis	3021	22·66	22·62	22·22	22·54	22·51	5·50	81	− 18	48 33 22·33	3 35 57·79	+0·10
77	υ Leonis	3058	2·77	3·41	2·45	3·38	3·00	5·64	60	− 20	52 14 2·80	− 0 4 42·68	+0·56
78	β Leonis	3101	44·35	44·17	43·73	44·24	44·12	5·85	91	− 13	36 49 43·99	15 19 36·13	+0·41
79	β Virginis	3105	48·71	48·71	48·17	48·83	48·60	5·64	60	− 19	49 37 48·41	2 31 31·71	+0·33
80	γ Urs.Maj.U.C.	3117	23·18		23·06		23·12	5·75	70	− 1	2 17 23·11	54 26 43·23	−0·05
	γ Urs.Maj.L.C.		56·65		57·26		56·96	5·94	32	− 50	73 23 56·46	43·42	+0·14
	mean											43·27	−0·01
81	π Virginis	3139	18·55	18·77	17·75	18·77	18·46	5·65	73	− 16	44 47 18·30	7 22 1·82	+0·36
82	ε Corvi	3172	27·71		27·13		27·42	5·96	47	− 53	74 1 26·89	− 21 52 6·77	+0·87
83	η Virginis	3210	18·54	19·14	17·87	18·45	18·50	5·88	73	− 19	52 4 18·31	0 5 1·81	+0·57
84	β Corvi	3280	19·18		18·69		18·94	5·94	50	− 56	74 48 18·38	− 22 38 58·26	+0·70
85	γ¹ Virginis	3307	48·28	48·93	47·67	48·22	48·28	6·38	51	− 24	52 51 48·04	− 0 42 27·92	+0·75[4])
86	35 Virginis	3331	42·26	42·24	42·15	42·27	42·23	7·23	32	− 18	47 50 42·05	4 18 38·07	+0·44
87	12 Can. Ven.	3371	26·91	27·39	26·81	27·01	27·03	6·44	55	− 7	13 6 26·96	39 2 53·16	+0·10
88	ϑ Virginis	3409	23·41		22·83		23·12	6·52	35	− 24	56 58 22·88	− 4 49 2·76	−0·03
89	α Virginis	3476	40·59		40·37		40·48	5·52	79	− 30	62 36 40·18	− 10 27 20·06	+0·30
90	ζ Virginis	3508	36·45	36·42	36·47	36·78	36·53	6·50	54	− 22	52 3 36·31	0 5 43·81	+0·34
91	m Virginis	3534	34·40		33·61		34·00	6·44	25	− 27	60 10 33·73	− 8 1 13·61	+0·43
92	η Urs.Maj.U.C.	3566	2·68		2·54		2·61	5·29	75	− 1	2 10 2·60	49 59 17·52	+0·41
	η Urs.Maj.L.C.		23·49		23·54		23·52	5·86	28	− 71	77 51 22·81	17·07	−0·04
	mean											17·43	+0·32
93	η Boötis	3596	47·70	46·74	47·02	47·18	47·16	5·91	58	− 12	33 4 47·04	19 4 33·08	+0·64
94	τ Virginis	3612	22·81	22·94	22·51	22·78	22·76	6·37	62	− 17	49 57 22·59	2 11 57·53	+0·34
95	d Boötis	3635	22·76	22·44	22·20	22·56	22·49	5·76	62	− 6	26 25 22·43	25 43 57·69	+0·50
96	α Boötis	3662	8·07	7·71	7·71	7·55	7·76	5·31	155	− 10	32 16 7·66	19 53 12·46	+0·67
97	ϑ Boötis U.C.	3704	13·03		13·27		13·15	6·01	44	+ 1	0 19 13·16	52 28 33·28	+0·08
	ϑ Boötis L.C.		6·68		7·28		6·98	7·55	11	− 59	75 22 6·39	33·49	+0·29
	mean											33·31	+0·11
98	ρ Boötis	3717	24·27	24·59	24·25	23·99	24·28	5·84	78	− 7	21 11 24·21	30 57 55·91	+0·37
99	Pi 14ʰ, 145	3748	22·37	22·03	22·51	22·41	22·33	5·86	64	− 16	38 2 22·17	14 6 57·95	−0·16
100	ε Boötis	3771	38·34	38·04	37·68	38·36	38·10	5·79	83	− 6	24 30 38·04	27 38 42·08	+0·30
101	α¹ Librae	3784	21·91		22·01		21·96	6·06	21	− 35	67 35 21·61	− 15 26 1·49	+0·25
102	α² Librae	3787	3·88		3·19		3·54	6·14	38	− 36	67 38 3·18	− 15 28 43·06	+0·31
103	β Urs.Min.U.C.	3809	5·94	5·79	6·33	5·97	6·01	5·26	106	− 6	22 33 5·95	74 42 26·07	+0·01
	β Urs.Min.L.C.		13·86	13·97	14·22	14·38	14·11	5·30	89	− 20	53 8 13·91	25·97	−0·09
	mean											26·04	−0·02
104	ψ Boötis	3842	47·36	47·40	46·86	47·27	47·22	5·88	62	− 8	24 40 47·14	27 28 32·98	+0·35
105	β Librae	3890	17·36		16·90		17·13	5·37	66	− 28	61 2 16·85	− 8 52 56·73	+0·48
106	ζ¹ Librae	3935	56·13		55·85		55·99	5·80	45	− 38	68 23 55·61	− 16 14 35·49	+0·46
107	α Coronae	3961	4·67	4·47	3·94	4·38	4·36	5·27	117	− 7	24 59 4·29	27 10 15·83	+0·68
108	α Serpentis	4001	10·67	10·18	10·60	10·74	10·55	5·36	109	− 16	45 18 10·39	6 50 9·73	+0·61
109	ζ Urs.Min.U.C.	4035	9·27	9·31	9·81	9·56	9·49	6·30	63	− 7	26 3 9·42	78 12 29·54	+0·05
	ζ Urs.Min.L.C.		10·38		10·74		10·56	6·46	14	− 17	49 38 10·39	29·49	+0·00
	mean											29·53	+0·04
110	β¹ Scorpii	4086	19·63		18·85		19·24	5·50	60	− 45	71 35 18·79	− 19 25 58·67	+0·49
111	δ Ophiuchi	4134	58·96		58·57		58·76	5·59	67	− 23	55 29 58·53	− 3 20 38·41	+0·72
112	σ Scorpii	4158	17·37		16·55		16·96	6·07	60	− 70	77 25 16·26	− 25 15 56·14	+0·26
113	η Draconis U.C.	4192	54·03	53·86	53·97	54·08	53·98	6·32	53	− 4	9 39 53·94	61 49 14·06	+0·45
	η Draconis L.C.		26·15		26·08		26·12	6·78	29	− 32	66 1 25·80	14·08	+0·47
	mean											14·06	+0·45
114	α Scorpii	4193	6·06		5·86		5·96	6·11	69	− 73	78 17 5·23	− 26 7 45·11	+0·11

No.	Name	No. P.G.C.	Instrumental position I	II	III	IV	Mean	Epoch	*n*	Corr.	Zenith distance	Declination	Lei — P.G.C.
			″	″	″	″	″			″	° ′ ″	° ′ ″	″
115	ζ Herculis	4246	23·15	22·72	22·17	22·76	22·70	1865·63	75	—0·08	20 18 22·62	31 50 57·50	+0·75[5]
116	21 Ophiuchi	4285	24·57	25·06	24·11	24·67	24·60	6·12	60	— 21	50 42 24·39	1 26 55·73	+0·66
117	κ Ophiuchi	4315	5·41	4·92	4·91	5·12	5·09	5·96	72	— 17	42 34 4·92	9 35 15·20	+0·85
118	ε Urs. Min. U.C.	4327	55·29	55·62	55·43	55·40	55·44	7·63	41	— 9	30 5 55·35	82 15 15·47	+0·35
	ε Urs. Min. L.C.		24·94	24·85	24·86		24·88	7·51	14	— 15	45 35 24·73	15·15	+0·03
	mean											15·39	+0·27
119	α Herculis	4373	31·90	32·07	31·53	31·88	31·84	5·73	85	— 12	37 36 31·72	14 32 48·40	+0·51
120	ϑ Ophiuchi	4399	1·44		0·89		1·16	6·41	38	— 64	77 1 0·52	—24 51 40·40	+0·34
121	*d* Ophiuchi	4421	49·43		49·43		49·43	6·18	49	—1·07	81 53 48·36	—29 44 28·24	—0·18
122	β Draconis	4443	48·96		49·46		49·21	6·46	42	0	0 14 49·21	52 24 9·33	+0·26
123	α Ophiuchi	4459	40·96	40·44	40·18	41·01	40·65	5·58	87	— 12	39 29 40·52	12 39 39·60	+0·74
124	μ Herculis	4497	14·00	13·53	13·11	13·67	13·58	6·18	72	— 7	24 21 13·51	27 48 6·61	+0·53
125	γ Draconis U.C.	4541	58·40		57·78		58·09	5·58	59	0	0 38 58·09	51 30 22·03	+0·62
	γ Draconis L.C.		19·50		18·79		19·14	6·90	13	— 62	76 20 18·52	21·36	—0·05
	mean											21·89	+0·48
126	μ¹ Sagittarii	4604	47·04		46·92		46·98	6·05	41	— 51	73 14 46·47	—21 5 26·35	+0·46
127	α Lyrae	4722	44·88	45·11	44·21	44·46	44·66	5·26	77	— 1	13 29 44·65	38 39 35·47	+0·35
128	β Lyrae	4776	52·17	51·96	51·36	51·78	51·82	5·20	45	— 5	18 56 51·77	33 12 28·35	+0·27
129	64 Serpentis	4813	41·76		41·52		41·64	6·76	15	— 22	49 47 41·42	2 21 38·70	+0·50
130	ζ Aquilae	4858	25·09	24·61	24·68	25·33	24·93	5·29	47	— 12	38 29 24·81	13 39 55·31	+0·79
131	ω Aquilae	4914	4·32	4·01	4·09	4·69	4·28	5·28	52	— 13	40 48 4·15	11 21 15·97	+0·49
132	δ Aquilae	4953	26·72	26·78	26·22	26·81	26·63	5·38	56	— 18	49 18 26·45	2 50 53·67	+0·44
133	*h*² Sagittarii	4999	2·86		2·43		2·64	5·42	41	— 68	77 20 1·96	—25 10 41·84	+0·29
134	γ Aquilae	5047	8·61	7·92	8·06	7·92	8·13	5·36	50	— 13	41 52 8·00	10 17 12·12	+0·63
135	α Aquilae	5062	29·31	28·91	28·95	28·88	29·01	5·47	69	— 14	43 38 28·87	8 30 51·25	+0·44
136	β Aquilae	5093	0·94	1·00	0·70	0·61	0·81	5·32	52	— 15	46 5 0·66	6 4 19·46	+0·87
137	α¹ Capricorni	5197	42·84		42·66		42·75	5·82	31	— 34	65 4 42·41	—12 55 22·29	+0·43
138	α² Capricorni	5202	59·07		58·43		58·75	5·70	34	— 33	65 6 58·42	—12 57 38·30	+0·63
139	ρ¹ Capricorni	5244	46·46		46·70		46·58	5·46	38	— 43	70 24 46·15	—18 15 26·03	+0·82
140	α Cygni U.C.	5320	22·57	22·59	22·18	22·42	22·44	5·40	87	— 2	7 21 22·42	44 47 57·70	+0·48
	α Cygni L.C.		43·44		45·19		44·32	8·06	16	—1·24	83 2 43·08	56·80	—0·42
	mean											57·62	+0·40
141	32 Vulpeculae	5379	34·99	35·10	34·56	35·22	34·97	5·27	55	— 7	24 36 34·90	27 32 45·22	+0·69
142	61¹ Cygni	5433	5·12	6·11	5·49	5·71	5·61	5·54	50	— 3	14 4 5·58	38 5 14·54	+0·71
143	ζ Cygni	5452	50·72	50·68	50·37	50·57	50·58	5·82	45	— 5	22 28 50·53	29 40 29·59	+1·00
144	α Cephei U.C.	5480	31·94	31·93	32·76	32·21	32·21	5·91	51	— 5	9 51 32·16	62 0 52·28	+0·64
	α Cephei L.C.		48·10		48·27		48·18	5·43	53	— 32	65 49 47·86	52·02	+0·38
	mean											52·23	+0·59
145	β Aquarii	5527	8·43		8·18		8·30	6·34	32	— 25	58 19 8·05	— 6 9 47·93	+0·20
146	β Cephei U.C.	5532	46·53	46·74	46·94	46·74	46·74	6·08	48	— 7	17 48 46·67	69 58 6·79	+0·25
	β Cephei L.C.		33·60		33·91		33·76	5·54	46	— 23	57 52 33·53	6·35	—0·19
	mean											6·68	+0·14
147	ε Pegasi	5584	52·64	52·64	52·60	52·25	52·53	5·73	52	— 15	42 53 52·38	9 15 27·74	+0·83
148	16 Pegasi	5627	51·66	51·42	51·14	51·40	51·40	5·93	49	— 8	26 51 51·32	25 17 28·80	+0·73
149	α Aquarii	5676	47·87	48·08	47·56	48·16	47·92	5·32	67	— 20	53 7 47·72	— 0 58 27·60	+0·28
150	ϑ Aquarii	5744	35·06		34·95		35·00	5·60	46	— 27	60 36 34·73	— 8 27 14·61	+0·78
151	π Aquarii	5777	43·39	43·65	43·20	43·91	43·54	5·57	54	— 19	51 27 43·35	0 41 36·77	+0·45
152	η Aquarii	5824	4·42	4·50	4·47	4·62	4·50	5·47	46	— 20	52 58 4·30	— 0 48 44·18	+0·39
153	ζ Pegasi	5853	40·73	40·30	40·44	41·04	40·63	5·92	49	— 13	42 1 40·50	10 7 39·62	+0·69
154	τ² Aquarii	5884	35·23		34·82		35·02	5·39	41	— 34	66 27 34·68	—14 18 14·56	+0·84
155	α Pisc. Austr.	5916	33·51		33·65		33·58	5·66	41	—1·14	82 29 32·44	—30 20 12·32	+0·34
156	α Pegasi	5944	33·61	33·72	33·43	33·32	33·52	5·11	73	— 12	37 40 33·40	14 28 46·72	+0·61
157	γ Piscium	5988	37·14	37·20	36·89	37·63	37·22	5·72	47	— 18	49 36 37·04	2 32 43·08	+0·65
158	κ Piscium	6031	19·25	19·52	18·50	19·16	19·11	5·52	46	— 19	51 38 18·93	0 31 1·19	+0·39
159	ι Piscium	6077	38·06	38·11	37·96	38·14	38·07	5·43	48	— 16	47 15 37·91	4 53 42·21	+0·92
160	γ Cephei U.C.	6078	23·78	24·07	24·33	24·14	24·08	6·31	50	— 10	24 43 23·98	76 52 44·10	—0·30
	γ Cephei L.C.		55·94	55·21	55·86	55·40	55·60	6·73	58	— 15	50 57 55·45	44·43	+0·03
	mean											44·21	—0·19
161	δ Sculptoris	6110	56·66		55·57		56·12	5·68	30	— 94	81 1 55·18	—28 52 35·06	+0·98
162	ω Piscium	6156	22·61	23·11	22·26	22·51	22·62	5·52	42	— 15	46 2 22·47	6 6 57·65	+0·49

1) The position of the P.G.C. has been corrected for orbital motion (+ 1″·32).

2) The position of the P.G.C. has been corrected for orbital motion (— 0″·62); the Leiden catalogue place is that of α¹ Geminorum in the notation of the P.G.C.

3) The position of the P.G.C. has been corrected for orbital motion (— 1″·26).

4) The position of the P.G.C. has been corrected for orbital motion (+ 2″·03); the Leiden catalogue place seems to be that of the "companion" in the P.G.C. notation.

5) No correction has been applied to the P.G.C. position.

5. *The mean error and the comparison with the P.G.C.* In the computation of the mean error of a catalogue place I have treated the results in each position of the instrument as single observations; in the following the term "one observation", thus, must be understood as one position result.

We may compute the mean error for each star individually from its own two or four observations; the result would then be seriously affected by accidental circumstances.

On the other hand the computation of the mean error from all the residuals does not take account of the certainly existing decrease in accuracy with increasing zenith distance nor of the total number of nights on which each star has been observed. The latter, however, will not be of so much importance, as by the taking of simple means there is always a loss of weight in this sense that the mean error will depend chiefly on the observation with the minimum number of nights.

The mean error of one observation computed from 140 non-circumpolar stars giving 470 residuals is $\pm 0''\cdot26$.

This gives for a catalogue place with four observations a m. e. of $\pm 0''\cdot13$, and for a catalogue place with two observations a m. e. of $\pm 0''\cdot19$.

In section 3 the corresponding value for the circumpolar stars has been given, so that:

upper culmination	with four obs.	has a m. e. of	$\pm 0''\cdot11$
,,	,, two ,,	,, ,, ,, ,,	$\pm 0''\cdot16$
lower	,, four ,,	,, ,, ,, ,,	$\pm 0''\cdot23$
,,	,, two ,,	,, ,, ,, ,,	$\pm 0''\cdot32$

To verify the dependence of the mean error on the zenith distance for all stars observed south of the zenith I have grouped the mean errors directly computed for the individual stars in the declination groups $<-20°$, $-20°$ to $-10°$, $-10°$ to $-0°$, $0°$ to $15°$, $15°$ to $36°$ and $30°$ to $45°$.

The resulting mean errors in these groups are respectively:

$\pm 0''\cdot30, \pm 0''\cdot17, \pm 0''\cdot15, \pm 0''\cdot14, \pm 0''\cdot12$ and $\pm 0''\cdot13$.

The large value in the first group is chiefly caused by the few stars below $-30°$. This agrees very well with the general solution, the stars of north declination being all observed in four positions, the stars south of $-10°$ all in two positions, while the stars between $0°$ and $-10°$ belong to both groups.

The somewhat smaller value for the circumpolar stars in upper culmination may be ascribed to the larger number of nights on which they have been observed.

The mean values of the declinations of the circumpolar stars from both culminations have been computed with their proper weights.

Table 4 gives the mean errors to be ascribed to each star of the catalogue:

TABLE 4. Mean errors.

Decl.	U. C.	L. C.
$<-30°$	$\pm 0''\cdot35$	
-30 to -20	$\pm$ 22	
-20 to -10	$\pm$ 17	
-10 to 0	$\pm$ 15	
0 to 45	$\pm$ 13	
$>45°$	$\pm \cdot11$ or $\pm \cdot16$	$\pm 0''\cdot23$ to $\pm 0''\cdot32$

Table 5 gives the differences Lei—P. G. C. for the upper culminations in groups of declination, the number of stars in each group and the mean error of *one* difference.

At the bottom the differences Lei—P. G. C. for the mean value of the circumpolar stars are given.

TABLE 5. Differences Lei—P. G. C.

Decl.	Diff.	n	m. e.
$<-20°$	$+0''\cdot40$	16	$\pm 0''\cdot51$
-20 to -10	+ 48	15	$\pm$ 27
-10 to 0	+ 41	19	$\pm$ 22
0 to 10	+ 52	33	$\pm$ 23
10 to 20	+ 51	26	$\pm$ 21
20 to 30	+ 51	24	$\pm$ 20
30 to 40	+ 40	8	$\pm$ 22
40 to 50	+ 34	5	$\pm$ 12
50 to 70	+ 27	11	$\pm$ 19
$>70°$	$+0\cdot02$	4	$\pm 0\cdot18$
40 to 50	$+0''\cdot34$	5	
50 to 70	+ 27	10	
$>70°$	+ 2	4	

The systematic differences Lei—P. G. C. are large, as mentioned already before, but they are remarkably regular. No discontinuity exists at the zenith of Leiden, nor is there any important change at the lower declinations. If there were a remaining effect of refraction or flexure it certainly would manifest itself in the preceding table.

Very satisfying, and apt to increase our confidence in the adopted latitude is the fact that both systems meet each other at the Pole, also when the results for the upper culminations are considered separately.

The accidental differences on the other hand are small and fully corresponding to the values that could be expected a priori by combining the mean errors from table 4 with the mean errors of the positions of the P. G. C.

The large number in the first line of the last column in table 5 is again wholly caused by some of the stars below -30°.

It is astonishing that the latitude of the Leiden observatory, existing nearly 70 years, shows itself to be a problem, but apart from this the observations made in the years 1863—68 at Leiden and the care with which they have been reduced instrumentally to the results published in Vol. VI, may be regarded as being of a very high standard and as belonging to the best observations and reductions ever made.

I am glad to have had the opportunity, by deriving the final results of these observations, to pay a small tribute of thanks to the old Leiden meridian school.

These discrepancies may give ground to the presumption that the declinations of the Boss system on its mean epoch as represented by the P. G. C., are not free from systematic errors. The important consequence of this will be that we are not justified in ascribing all deviations of the modern catalogues from the P. G. C. to its proper motions only, as is done by Prof. EICHELBERGER [1]) and others.

The consequence and danger of such a treatment would be that after say another twenty-five years the extrapolated catalogue of EICHELBERGER would show deviations from the then modern catalogues in the opposite direction, a danger the greater as then perhaps the problem of the curvature in the proper motions will be attacked.

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[1]) Prof. W. S. EICHELBERGER, *Astr. Papers American Ephemeris* etc., Vol. X, Part. I, p. 21.