ASTRONOMISCHE NACHRICHTEN.

Band 139. № 3324. 12.

Parallax of α Centauri from Meridian Observations 1879-1881.

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The present paper deals with the valuable series of meridian observations made at the Royal Observatory, Cape Town, during the years 1879-1881 and published as an appendix to the Cape Catalogue for 1885. These observations are unreduced for proper motion and orbital motion and as this reduction is a necessary step to their being utilized for most investigations which depend on the observations as data, my first intention was simply to give the reduced positions. But the circumstances under which the observations were made, the skill and care bestowed upon the instrumental adjustments, the experience and ability of the observers, rendered it possible that a discussion of the measures with regard to parallax might yield results of some interest. Further the striking correspondence between the values of the latitude variation during 1880-1881 as obtained by Dr. Chandler from the Pulkova and Greenwich observations, and the agreement between these results and the law of variation as stated in the Astronomical Journal No. 322, reduced the probability of error from this source to a minimum.

The measures were made with the Transit Circle, the method adopted being to observe α_2 and α_1 on alternate days in Right Ascension; in Declination the observer bisects the image of α_2 or α_1, as the case may be, with the micrometer before the star passes the central wire, reads the micrometer, and then bisects the other star with the micrometer which he reads when the transit is over. This method of observation made it necessary to obtain the parallax from the mean results of both stars.

The errors of division of the circle were carefully determined in 1880, and a full account of the method adopted and the results obtained are given in the introduction to the Cape observations, 1879-81 pp. XIII to XXIV.

Before the Declination observations were begun in March 1880, new screws were supplied, and their errors thoroughly investigated.

It was found that these errors were insensible. When the screws were again examined in 1884 by Dr. Gill, it was observed that an error of considerable magnitude affected the run of the microscopes, and, on investigation, the source of error was found to arise from the wearing of the gun metal screws at the portion of the thread most used. For a full account of the whole question we may refer to the Cape observations for 1882-1884 pp. VI to XIII, and to the Monthly Notices of the R. A. S. Vol. XLV p. 69. The places of α_2 and α_1 are corrected for this systematic screw wear.

The other instrumental adjustments &c., are dealt with very fully in the Catalogue, and in the two volumes of observations 1879-81 and 1882-84, and it would only burden the paper to refer to them here.

The equinox is that of the Catalogue, 1885.0, and the Pulkova constants are used in reducing to this date.

Only a few reflex measures were made and as they were not continuous enough to be of any real value in the reduction, they are not considered in this paper.

As already said my first purpose in reducing the observations was to obtain mean places of α_2 and α_1 Centauri. For this purpose three reductions were necessary,

1) Proper motion
2) Orbital motion
3) Parallax.

1) Proper motion. I have adopted the proper motion found by Elkin, viz.

$$\Delta\alpha = -7^{s}.263$$
$$\Delta\delta = +0''.747$$

2) Orbital motion. The corrections for orbital motion to 1885.0 are represented by the expressions,

$$\Delta\alpha = \pm (0^{s}.7342\, t_0 + 0^{s}.0299\, t_0^2 - 0^{s}.0016\, t_0^3)$$
$$\Delta\delta = \pm (0''.481\, t_0 + 0''.0195\, t_0^2 + 0''.0013\, t_0^3)$$

The upper sign applies to observations of α_2 Centauri and the lower to those of α_1 Centauri. In the expressions,

$$t_0 = (1885 - t).$$

3) Parallax. The parallax correction applied to the observations is, $\pi = 0''.75$.

The following are:

1) The date of observation
2) The observer: W. H. Finlay (F), G. W. H. Maclear (M), Robt. T. Pett (P) and J. Freeman (J).
3) The observation as given in the Catalogue
4) The corrections to be applied for the above values of the proper motion, orbital motion and parallax
5) The corrected places of α_2 and α_1 Centauri.

Apart altogether from the subsequent discussion of these places it is hoped, that per se they may have some value and interest. As measures their value does not end with themselves; nor with a parallax discussion.

Declinations of α_2 and α_1 Centauri.

No.	Date	Observer	α_2 Centauri			α_1 Centauri		
			Unreduced Place (1885)	Reduction	Reduced Place (1885)	Unreduced Place (1885)	Reduction	Reduced Place (1885)
	1880		−60° 21′		−60° 21′	−60° 21′		−60° 21′
1	Mar. 22	F	37″.23	+6″.68	30″.55	43″.04	+1″.52	41″.52
2	» 30	M	35.89	6.68	29.21	43.17	1.53	41.64
3	» 31	P	37.54	6.68	30.86	43.88	1.53	42.35
4	April 2	P	36.73	6.68	30.05	44.29	1.53	42.76
5	» 19	P	35.94	6.60	29.34	43.84	1.52	42.32
6	» 20	M	36.30	6.60	29.70	42.91	1.52	41.39
7	» 23	M	36.20	6.59	29.61	42.49	1.52	40.97
8	» 26	P	37.22	6.59	30.63	43.95	1.51	42.44
9	» 27	M	36.62	6.58	30.04	42.14	1.51	40.63
10	May 1	M	36.60	6.55	30.05	43.19	1.50	41.69
11	» 2	M	36.90	6.54	30.36	42.34	1.50	40.84
12	» 5	P	35.95	6.53	29.42	43.79	1.49	42.30
13	» 7	M	36.05	6.52	29.53	42.22	1.48	40.74
14	» 11	P	35.92	6.48	29.44	42.05	1.46	40.59
15	» 18	M	36.89	6.42	30.47	42.48	1.41	41.07
16	» 19	J	37.71	6.41	31.30	43.83	1.41	42.42
17	» 20	P	36.82	6.40	30.42	43.00	1.40	41.60
18	» 21	J	37.27	6.38	30.89	41.86	1.40	40.46
19	» 25	M	36.21	6.36	29.85	41.54	1.38	40.16
20	» 26	P	35.79	6.35	29.44	42.73	1.37	41.36
21	June 7	P	36.05	6.20	29.85	42.97	1.28	41.69
22	» 11	P	36.69	6.17	30.52	43.06	1.26	41.80
23	» 18	M	35.13	6.09	29.04	41.42	1.18	40.24
24	July 5	M	35.26	5.87	29.39	41.10	1.02	40.08
25	» 24	P	34.83	5.64	29.19	41.73	0.85	40.88
26	» 26	P	36.41	5.60	30.81	42.16	0.83	41.33
27	» 27	M	35.67	5.59	30.08	41.83	0.82	41.01
28	» 28	J	36.34	5.57	30.77	42.69	0.81	41.88
29	» 29	P	36.05	5.56	30.49	42.35	0.80	41.55
30	» 30	P	36.29	5.55	30.74	42.81	0.78	42.03
31	» 31	J	36.08	5.54	30.54	42.29	0.77	41.52
32	Aug. 4	J	35.22	5.49	29.73	41.95	0.74	41.21
33	» 7	M	35.73	5.45	30.28	41.74	0.70	41.04
34	» 10	M	35.42	5.41	30.01	41.16	0.67	40.49
35	» 11	P	36.89	5.40	31.49	41.98	0.66	41.32
36	» 13	M	35.70	5.38	30.32	41.63	0.65	40.98
37	» 14	P	35.61	5.37	30.24	41.56	0.64	40.92
38	» 17	P	36.47	5.34	31.13	42.07	0.61	41.46
39	» 30	J	35.02	5.19	29.83	40.83	0.51	40.32
40	Sept. 1	M	35.03	5.16	29.87	41.21	0.50	40.71
41	» 6	P	35.94	5.12	30.82	41.19	0.47	40.72
42	» 7	M	34.62	5.11	29.51	40.53	0.46	40.07
43	» 8	J	35.35	5.10	30.25	41.19	0.45	40.74
44	» 9	P	35.34	5.09	30.25	41.17	0.45	40.72
45	» 10	M	35.28	5.08	30.20	41.31	0.44	40.87
46	» 11	J	35.58	5.07	30.51	41.36	0.44	40.92
47	» 14	J	34.37	5.05	29.32	40.91	0.42	40.49
48	» 16	M	35.49	5.04	30.45	40.19	0.40	39.79
49	» 21	P	35.17	4.99	30.18	42.28	0.38	41.90
50	» 22	M	35.03	4.98	30.05	41.14	0.38	40.76
51	» 23	J	35.72	4.97	30.75	42.14	0.37	41.77
52	» 30	M	34.90	4.93	29.97	40.46	0.34	40.12

No.	Date	Observer	α_2 Centauri			α_1 Centauri		
			Unreduced Place (1885)	Reduction	Reduced Place (1885)	Unreduced Place (1885)	Reduction	Reduced Place (1885)
	1880		−60° 21′		−60° 21′	−60° 21′		−60° 21′
53	Oct. 1	P	35″.27	+4″.92	30″.35	41″.12	+0″.34	40″.78
54	» 2	J	35 03	4.91	30.12	41.18	0.34	40.84
55	» 5	M	35.58	4.90	30.68	41.75	0.33	41.42
56	» 6	P	34.72	4.90	29 82	41.18	0.33	40.85
57	» 8	M	34.48	4.89	29.59	40.63	0.33	40.30
58	» 9	P	33.57	4.89	28.68	41.40	0.33	41.07
59	» 13	M	34.71	4.86	29.85	41.40	0 32	41.08
60	» 14	J	35 52	4.85	30.67	41.58	0.32	41.26
61	» 15	P	34.51	4.85	29.66	41.10	0.32	40.78
62	» 22	J	35.82	4.83	30.99	42.76	0.32	42.44
63	» 23	M	35.62	4.83	30.79	41.43	0.32	41.11
64	» 26	P	35.57	4 82	30.75	41.79	0.33	41.46
65	» 27	J	33 62	4.82	28.80	41.48	0.33	41.15
66	» 29	P	34.13	4.83	29 30	39.63	0.33	39.30
66a	» 31	M	36.63	4.83	31.80	—	—	—
67	Nov. 1	J	34.53	4.83	29.70	41.49	0.34	41.15
68	» 2	P	34.67	4.82	29.85	40.91	0.34	40.57
69	» 4	J	34.30	4.82	29.48	41.78	0.35	41.43
70	» 10	M	35.10	4.82	30.28	41.51	0.37	41.14
71	» 12	P	35.16	4.82	30.34	41.63	0.38	41.25
72	» 17	J	34.92	4.83	30.09	41.97	0.39	41.58
73	» 18	P	34.27	4.84	29.43	40.46	0.40	40.06
74	» 19	M	36.11	4.84	31.27	42.27	0.41	41.86
75	» 21	M	36.71	4.84	31.87	43.08	0.42	42.66
76	» 23	J	33.00	4.84	28.16	40.63	0.43	40.20
77	» 24	M	35.01	4.84	30.17	40.25	0.44	39.81
78	» 25	P	34.17	4 84	29.33	40.95	0.44	40.51
79	» 29	J	34.91	4.85	30.06	41.86	0.46	41.40
80	Dec. 3	P	34.87	4 86	30.01	41.94	0.48	41.46
81	» 7	F	34.75	4.88	29.87	39.97	0.50	39.47
82	» 8	P	33.80	4.89	28.91	41.81	0.52	41.29
83	» 12	M	35.67	4.90	30.77	42.20	0.56	41.64
84	» 14	P	34.88	4.92	29 96	42.55	0.57	41.98
85	» 15	M	36.20	4.93	31.27	43.02	0.58	41.44
86	» 16	F	35.58	4.93	30.65	41.10	0.59	40.51
87	» 22	P	35.49	4.96	30.53	41.85	0.64	41.21
	1881							
88	Jan. 7	P	37.66	5.08	32.58	43.93	0.79	43.14
89	» 11	P	35.29	5.09	30.20	41.91	0.82	41.09
90	» 12	P	35.03	5.10	29.93	41.31	0 84	40.47
91	» 19	P	34.92	5.13	29.79	42.31	0.89	41.42
92	» 20	P	34.93	5.14	29.79	41.88	0.90	40.98
93	Febr. 1	P	36.10	5.21	30.89	43.34	1.02	42.32
94	» 6	P	35.57	5.23	30.34	43.24	1.06	42.18
95	» 9	P	35.65	5.25	30.40	43.07	1.08	41.99
96	» 13	P	35.28	5.27	30.01	44.08	1.11	42.97
97	» 18	M	35.13	5.29	29.84	42.44	1.15	41.29
98	» 23	M	36.61	5.32	31.29	43.83	1.19	42.64
99	» 24	P	33.87	5.32	28.55	42.47	1.20	41.27
100	Mar. 1	M	35.50	5.34	30.16	41.95	1.24	40.71
101	» 6	M	34.62	5.35	29.27	42.91	1.25	41.66
102	Nov. 4	P	32.52	3.51	29.01	—	—	—
103	» 6	P	32.97	3.51	29.46	—	—	—
104	» 7	P	33.63	3.50	30.13	—	—	—

No.	Date	Observer	α_2 Centauri			α_1 Centauri		
			Unreduced Place (1885)	Reduction	Reduced Place (1885)	Unreduced Place (1885)	Reduction	Reduced Place (1885)
	1881		−60° 21′		−60° 21′			
105	Nov. 8	P	33.″14	+3.″50	29.″64	—	—	—
106	» 13	P	33.08	3.51	29.57	—	—	—
107	» 18	P	33.28	3.52	29.76	—	—	—
108	» 24	P	32.84	3.53	29.31	—	—	—
109	» 28	P	33.40	3.53	29.87	—	—	—
110	Dec. 1	P	34.15	3.54	30.61	—	—	—
111	» 4	P	32.79	3.55	29.24	—	—	—
112	» 8	P	33.54	3.56	29.98	—	—	—
113	» 9	P	34.05	3.57	30.48	—	—	—
114	» 13	P	33.52	3.59	29.93	—	—	—

Right Ascension Measures.

α_2 Centauri.

No.	Date	Observer	Unreduced Measures	Reduction	Reduced Measures
	1879		217° 57′		217° 56′
1	June 21	M	35.″55	−34.″26	61.″29
2	» 28	P	32.40	34.05	58.35
3	July 3	M	33.60	33.90	59.70
4	» 7	F	34.35	33.78	60.57
5	» 8	P	36.30	33.75	62.55
6	» 9	M	31.50	33.72	57.78
7	» 11	P	35.55	33.67	61.88
8	» 19	F	31.80	33.48	58.32
9	» 23	F	31.95	33.39	58.56
10	» 25	P	34.95	33.35	61.60
11	» 31	M	33.90	33.26	60.64
12	Aug. 1	F	33.45	33.23	60.21
13	» 2	J	34.65	33.20	61.45
14	» 8	P	34.05	33.06	60.99
15	» 14	F	35.10	33.00	62.10
16	» 15	M	32.10	32.99	59.11
17	» 16	P	33.00	32.98	60.02
18	» 22	P	36.30	32.94	63.36
19	» 23	P	33.15	32.93	60.22
20	» 25	F	30.45	32.91	57.54
21	» 28	M	35.10	32.88	62.22
22	» 29	P	33.75	32.88	60.87
23	» 30	J	32.40	32.87	59.53
24	Sept. 5	M	33.30	32.85	60.45
25	» 10	J	30.15	32.84	57.31
26	» 15	P	31.65	32.83	58.82
27	» 16	J	30.00	32.83	57.17
28	» 20	F	30.60	32.82	57.78
29	» 22	P	30.75	32.83	57.92
30	» 26	J	36.75	32.84	63.91
31	» 27	P	34.20	32.84	61.36
32	Oct. 4	P	32.85	32.87	59.58
33	» 6	M	34.50	32.88	61.62
34	» 11	J	28.20	32.91	55.89
35	» 13	M	32.40	32.92	59.48
36	» 20	P	33.30	32.95	60.35
37	Nov. 27	J	32.85	33.26	59.59
38	Nov. 28	M	34.″50	−33.″26	61.″24
39	Dec. 7	F	29.10	33.29	55.81
40	» 18	F	35.10	33.32	61.78
41	» 21	M	35.10	33.31	61.79
42	» 26	F	30.90	33.30	57.60
	1880				
43	Jan. 2	F	31.65	33.28	58.37
44	» 9	F	32.10	33.22	58.78
45	» 18	F	30.90	33.12	57.78
46	» 25	F	27.90	33.02	54.88
47	» 26	F	32.10	33.00	59.10
48	» 28	M	34.50	32.97	61.53
49	Febr. 3	M	31.80	32.89	58.91
50	» 5	M	35.25	32.85	62.40
51	» 10	M	35.25	32.74	62.51
52	» 14	M	26.25	32.64	53.61
53	» 23	F	30.45	32.40	58.05
54	» 25	M	30.15	32.36	57.79
55	Mar. 4	M	32.55	32.10	60.45
56	» 11	M	25.50	31.88	53.62
57	» 21	M	29.10	31.52	57.58
58	» 22	F	28.05	31.48	56.57
59	» 31	P	31.35	31.18	60.27
60	April 4	M	30.00	31.00	59.00
61	» 16	F	33.45	30.52	62.93
62	» 19	P	33.30	30.40	62.90
63	» 20	M	33.00	30.35	62.65
64	» 27	M	30.75	30.07	60.68
65	May 3	M	30.60	29.80	60.80
66	» 5	P	33.30	29.72	63.58
67	» 7	M	28.50	29.65	58.85
68	» 19	J	31.35	29.16	61.19
69	» 20	P	31.50	29.11	62.39
70	» 25	M	33.75	28.91	64.84
71	» 26	P	32.40	28.87	63.53
72	June 11	P	29.40	28.26	61.14
73	July 5	M	24.15	27.50	56.65
74	» 24	P	30.30	27.05	63.25

No.	Date	Observer	Unreduced Measures	Reduction	Reduced Measures
	1880		217° 57′		217° 56′
75	July 28	J	29″.40	−26″.97	62″.43
76	» 29	P	31.65	26 95	64.70
77	Aug. 4	J	25.65	26.86	58.79
78	» 7	M	30.90	26.80	64.10
79	» 13	M	25.20	26.71	58.49
80	» 14	P	28.65	26 69	61.96
81	Sept. 6	P	26.85	26.52	60.33
82	» 7	M	26.25	26 52	59.73
83	» 8	J	25.20	26.52	58.68
84	» 14	J	22.35	26.52	55.83
85	» 16	M	22.35	26.52	55.83
86	» 30	M	23.40	26.55	56.85
87	Oct. 2	J	26.25	26.56	59.69
88	» 6	P	28 80	26.57	62.23
89	» 8	M	25.80	26.59	59.21
90	» 15	P	25.05	26.63	58.42
91	» 19	M	25.35	26.65	58.70
92	» 22	J	26.10	26.67	59.43
93	» 29	P	24.45	26.79	57.68
94	» 31	M	21.60	26.77	54.83
95	Nov. 1	J	28.95	26.77	62.18
96	» 12	P	27 30	26 77	60.45
97	» 17	J	25.20	26.85	58.31
98	» 19	M	26.55	26.89	59 75
99	» 24	M	25.20	26.90	58.27
100	» 25	P	25.05	26.93	58.11
101	» 29	J	22.05	26.94	55.11
102	Dec. 7	F	24.60	26.98	57.62
103	» 8	P	24.90	26.98	57.92
104	» 15	M	21.45	27.00	54.45
105	» 22	P	25.20	27.00	58.20
	1881				
106	Jan. 7	P	24.00	26.94	57.06
107	» 12	P	24.45	26.89	57.56
108	» 19	P	23.70	26.80	56.90
109	» 21	F	24.30	26.76	57.54
110	Febr. 1	P	21.45	26.60	54.85
111	» 9	P	22.80	26.43	56.37
112	» 18	M	25.65	26.21	59.44
113	» 24	P	21.45	26.04	55.41
114	Mar. 1	M	19.80	25.89	53.91

α_1 Centauri.

No.	Date	Observer	Unreduced Measures	Reduction	Reduced Measures
	1879		217° 57′		217° 56′
1	June 27	M	36″.60	−43″.63	52″.97
2	July 2	P	36.30	43.46	52.84
3	» 10	G	32.70	43.19	49.51
4	» 12	F	34.80	43.13	51.67
5	» 17	F	34.80	42.98	51.82
6	» 21	P	34.95	42.87	52.08
7	» 26	F	34.65	42.73	51.92
8	» 28	M	35.55	42.68	52.87
9	Aug. 4	F	35.40	42.52	52.88
10	Aug. 6	P	33″.45	−42″.48	50″.97
11	» 7	M	37.50	42.46	55.04
12	» 13	P	34.65	42.34	52.31
13	» 18	F	31.35	42.26	49.09
14	» 19	M	32.85	42.24	50.61
15	» 20	P	32.70	42.22	50.48
16	» 26	P	37.65	42.12	55.53
17	» 27	M	32.85	42.12	50.73
18	Sept. 1	F	32.40	42.08	50.32
19	» 2	P	31.95	42.07	49.88
20	» 3	J	31.65	42.06	49.59
21	» 4	M	32.10	42.05	50.05
22	» 13	J	33.60	41.98	51.62
23	» 17	P	29.85	41.95	47.90
24	» 24	J	32.10	41.93	50.17
25	» 25	P	31.65	41.93	49.72
26	» 30	J	32.25	41.92	50.34
27	Oct. 1	P	30.75	41.92	48.83
28	» 10	M	33.45	41.91	51.54
29	» 16	M	29.25	41.91	47.34
30	» 24	J	38.55	41.94	56.61
31	Nov. 7	P	34.95	41.96	52.99
32	» 9	M	33.90	41.98	51.92
33	Dec. 2	J	33.30	42.00	51.30
34	» 15	F	32.25	41.98	50.27
35	» 22	F	29.85	41.93	47.92
36	» 28	M	30.30	41.88	48.42
	1880				
37	Jan. 1	F	32.70	41.84	50.86
38	» 4	F	31.20	41.82	49.38
39	» 14	F	30.30	41.67	48.63
40	» 19	F	32.40	41.60	50.80
41	Febr. 2	M	28.80	41.30	47.50
42	» 6	M	32.25	41.20	51.05
43	» 11	M	30.90	41.06	49.84
44	» 24	F	35.25	40.66	54.59
45	» 27	M	27.00	40.56	46.44
46	Mar. 7	M	28.20	40.24	47.96
47	» 14	M	25.80	39.95	45.85
48	» 30	M	30.75	39.27	51.48
49	April 2	P	29.25	39.14	50.11
50	» 15	M	28.70	38.58	50.12
51	» 23	M	26.85	38.20	48.65
52	» 26	P	31.95	38.05	53.90
53	May 1	M	28.65	37.88	50.77
54	» 11	P	31.05	37.35	53.70
55	» 18	M	30.30	37.04	53.26
56	» 21	J	27.00	36.90	50.10
57	June 7	P	28.50	36.07	52.43
58	» 18	M	26.10	35.69	50.41
59	July 26	P	27.00	34.49	52.51
60	» 27	M	25.05	34.47	50.58
61	» 31	J	25.20	34.38	50.82
62	Aug. 10	M	22.50	34.15	48.35
63	» 11	P	23.70	34.13	49.57

No.	Date	Observer	Unreduced Measures	Reduction	Reduced Measures
	1880		217° 57′		217° 56′
64	Aug. 17	P	26″.70	−34″.04	52″.66
65	» 30	J	23.40	33.85	49.55
66	Sept. 1	M	23.55	33.84	49.71
67	» 9	P	28.35	33 78	54.57
68	» 10	M	26.10	33.78	52.32
69	» 21	P	21.45	33.72	47.73
70	» 22	M	23.55	33.72	49.83
71	» 23	J	21.60	33.72	47.88
72	Oct. 1	P	24.60	33.70	50.90
73	» 5	M	32.55	33.69	48.86
74	» 9	P	25.65	33.69	51.96
75	» 13	M	22.65	33.69	48.96
76	» 14	J	16.95	33.70	43.25
77	» 23	M	23.70	33.72	49.98
78	» 26	P	23.70	33.73	49.97
79	» 27	J	27.45	33.74	53.71
80	Nov. 2	P	23.25	33.75	49.50
81	» 4	J	31.80	33.76	58.04
82	Nov. 10	M	25″.50	−33″.77	51″.73
83	» 18	P	27.00	33.79	53.21
84	» 21	M	21.30	33.79	47.51
85	» 23	J	24.75	33.79	50.96
86	Dec. 3	P	22.20	33.77	48.43
87	» 12	M	23.85	33.76	50.09
88	» 14	P	22.35	33.76	48.59
89	» 16	F	20.55	33.75	46.80
90	» 30	M	23.55	33.62	49.93
	1881				
91	Jan. 11	P	22.05	33.52	46.53
92	» 20	P	22.20	33.36	48.84
93	Febr. 6	P	22.65	32.97	49.68
94	» 13	P	22.50	32.79	49.71
95	» 23	M	23.00	32.49	50.51
96	» 27	P	22.65	32.35	50.30
97	Mar. 6	M	22.80	32.10	50.70

Declination Measures.

In reducing these observations for parallax the usual method adopted is to form equations of condition of the type

$$\alpha \Delta\pi + \beta \Delta k + v t_0 + w t_0^2 + x = 0 .$$

In the present case the following was the method adopted.

1) Any correction to the assumed parallax will be of the form

$$0.75\, \Delta\pi \cos (\odot - 23^\circ 11')$$

2) Similarly the correction to the aberration constant will be

$$0.75\, \Delta k \cos (\odot - 113^\circ 11')$$

3) Uncorrected errors of a systematic nature will usually be of the form

$$m \cos (\odot - M) + n \cos (2\odot - N)$$

4) Latitude variation. The 427 day term of this variation is according to Chandler of the form

$$\varphi - \varphi_0 = - r_1 \cos ((t - T_0)\theta - \Delta T\theta)$$

where by equation (18) Astr. Journal No. 277

$$T_0 = 1880 \text{ Aug. } 10$$

The annual term is

$$\varphi - \varphi_0 = - r_2 \cos (\odot - G)$$

5) The corrections for proper motion will be

$$v t_0 + w t_0^2 .$$

If now we put

$$\begin{aligned} a &= 0.70\, \Delta\pi - 0.30\, \Delta k + m \cos M - r_2 \cos G \\ b &= 0.30\, \Delta\pi + 0.70\, \Delta k + m \sin M - r_2 \sin G \\ c &= n \cos N \\ d &= n \sin N \\ \psi &= (t - 1880 \text{ Aug. } 10)\,\theta \\ x &= - r_1 \cos \Delta T\theta \\ y &= - r_1 \sin \Delta T\theta \\ \delta_0 &= \delta_0' - \Delta\delta \end{aligned}$$

the general type of the equations of condition becomes

$$a \cos \odot + b \sin \odot + c \cos 2\odot + d \sin 2\odot + x \cos \psi + y \sin \psi + v t_0 + w t_0^2 + \Delta\delta + \delta - \delta_0' = 0$$

The values of δ_0' adopted in the equations is

for α_2 $-60^\circ 21' 30''$ (1885)

α_1 $-60\ 21\ 41$

The solution of the equations of condition involved no little labour, inasmuch as they were solved separately for each observer in order to ascertain the relative weight of each result.

The values of x and y are, in the case of the 1880–1881 measures of α Centauri, indeterminate. They can however be expressed as functions of a and b and their values obtained from other sources. In the present instance their values were deduced from the equations of latitude variation given in the Astronomical Journal No. 322. From the same set of equations the values of $- r_2 \cos G$ and $- r_2 \sin G$ were obtained.

Unfortunately $m \cos M$ and $m \sin M$ had to be neglected. Either m or M must be known before a solution can be effected. But the sources of error are so mixed and so indefinite that no reliable conclusion can be come to either as to the amplitude, m, or the point, M. This is extremely to be regretted as there can be little doubt but that $m \cos (\odot - M)$ is a real sensible quantity, inasmuch as all the solutions give a small but definite value

of $n \cos(2\odot - N)$. My own opinion would lead me to consider the terms

$$m \cos(\odot - M) + n \cos(2\odot - N)$$

as directly due to temperature, or rather to an erroneous value of the refraction depending on the temperature.

This is a question however whose solution must be found apart from a problem that also includes the parallax, for the two are so related that it is impossible to distinguish their action on any set of measures.

Solving therefore independently of $m \cos(\odot - M)$, and adopting the aberration constant determined by Chandler, 20".50, I found from Declination measures alone that the parallax of α Centauri was

$$0''.81 \pm 0''.05 .$$

The mean error of a single observation is 0".62.

Right Ascension Measures.

In dealing with the Right Ascension measures a similar type of equation was adopted as in the Declination measures, the type being

$$a_1 \cos\odot + b_1 \sin\odot + c_1 \cos 2\odot + d_1 \sin 2\odot + v_1 t_0 + w_1 t_0^2 + \Delta\alpha + \alpha - \alpha_0' = 0$$

where

$$a_1 = -1.24\,\Delta\pi - 1.46\,\Delta k + m_1 \cos M$$
$$b_1 = +1.46\,\Delta\pi - 1.24\,\Delta k + m_1 \sin M$$
$$c_1 = n_1 \cos N_1$$
$$d_1 = n_1 \sin N_1$$
$$\alpha_0 = \alpha_0' - \Delta\alpha$$

The equations were divided into two sets one from June 21, 1879 to Nov. 19, 1880, and the other from Nov. 21, 1880 to March 6, 1881. This was made necessary by the fact that an alteration was made on the eye-piece of the telescope on Nov. 20, 1880.

The result from the RA. measures is

$$\pi = 0''.66 .$$

Solving for both coordinates, Right Ascension and Declination, we obtain the following values of the parallax and aberration constant

$$\pi = +0''.71 \pm 0''.05$$
$$k = 20''.45 \pm 0''.04 .$$

The positions of α_2 and α_1 Centauri resulting from the equations for the epoch 1880, are

	α_2 Centauri		α_1 Centauri	
Observer	RA.	Decl.	RA.	Decl.
Maclear	$14^h 31^m 27^s.54$	$-60° 20' 17''.54$	$14^h 31^m 27^s.48$	$-60° 20' 22''.89$
Pett	27.63	17.44	27.55	23.35
Finlay	27.49	17.75	27.53	22.22
Freeman	27.55	17.52	27.54	23.40

Lovedale, South Africa, 1895 Aug. 16. *Alex. W. Roberts.*

Ueber einen unsichtbaren Begleiter des Doppelsterns 70 Ophiuchi.

Von *W. Schur*.

In Nr. 358 des Astron. Journal macht Dr. T. J. J. See die überraschende Mittheilung, dass sich in der Bewegung des Begleiters von 70 Ophiuchi um den Centralstern Anomalien gezeigt haben, die von Störungen durch einen unsichtbaren dritten Körper herrühren, indem die von Hough, Comstock und See in 13 Nächten angestellten Beobachtungen für 1895.66 gegen meine Bahnberechnung (Astr. Nachr. 3220) eine Abweichung im Sinne Beob. — Rechn. von $-4°.7$ und $-0''.31$ ergeben. Diese Bemerkung hat mich veranlasst, meine neuesten Beobachtungen dieses Doppelsterns zu berechnen und mit der Ephemeride zu vergleichen, und ich benutze diese Gelegenheit die Beobachtungen hier in derselben Weise wie in Astr. Nachr. 3220 mitzutheilen.

1894	Sternzeit			Ruhe	Schärfe
Juli 5	$17^h 5^m$	313°.5	2".29	4	4
23	18 11	304.1	2.24	3	3
24	17 50	306.2	2.35	3	3
Oct. 12	19 49	301.6	2.17	3	3
	1894.603	306.35	2.263		

1895	Sternzeit			Ruhe	Schärfe
Mai 28	$15^h 1^m$	305°.3	2".22	3	3
29	17 2	303.2	2.40	3	3
31	16 28	300.9	2.43	3	3
Juli 13	17 1	303.0	2.22	3	3
Oct. 24	20 0	295.7	2.27	3	3
	1895.512	301.62	2.308		

Mit Berücksichtigung der Reduction für Praecession auf 1850, die für diese beiden Epochen $+0°.25$ beträgt, erhält man nun für die ganze Reihe der von mir am Göttinger Heliometer angestellten Beobachtungen die nachfolgende Vergleichung mit meiner Bahnberechnung, wobei der bisherige meinen Beobachtungen entsprechende Werth der Halbaxe $a = 4''.333$ beibehalten worden ist.