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021

Copy for H. C. Observatory

of

Longitude Computations

from Coast Survey observations

at the Observatory

in 1869.

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U. S. Coast Survey

Benjamin Peirce, Superintendent

SECTION

Longitude
Computations

Station
Cambridge, Mass.

Year of Obs., 1869
Year of Comp., 1869-70

Obs. A. T. Mosman & F. Blake Jr.

Comp. Isaac Bradford

1 Vol. _____ Vol. 1

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Formulae used in Reductions

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Star Lamp Tallies	
α	
δ	
M	Mean of Threads
Y	" " Thread intervals
log. Y.	
log. sec δ	
log. S	S is the correction for rate, and its log. is 0.000005 for a gain of 1^s daily: 0.00119 for a mean time clock.
log. σ	σ is the sine correction: log. σ being additive to log. F, when F sec δ is less than 2^m it may be neglected
log. R	
R	$R = F$. sec. δ. σ S; and is to be added to M. to obtain the time of transit over the mean of all the threads.
b_0	b_0 = the level correction or time corrected for inequality of pivots: It is positive for west end high.
A	$A = \frac{\sin(\varphi - \delta)}{\cos \delta}$
B	$B = \frac{\cos(\varphi - \delta)}{\cos \delta}$
C	$C = \sec \delta$
	} $180^\circ - \delta$ being used instead of δ when the star is below the pole
x	x = The Diurnal Aberration = $0^s.021 \cos \varphi \sec \delta$: It is (−) in upper, (+) in lower culmination
Bb_0	
T	$T = M + R$
t	$t = T + Bb_0 + K$
w	$w = \alpha - t = \Delta t + Aa \pm C_c$
C_c	
w_0	$w_0 = w \mp C_c$, upper sign for Lamp West.

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Formulae used in Reductions

The collimation constant c is determined from reversals on circumpolar stars, and is to be obtained from the equation:

$$t_E - t_W = w_W - w_E = 2c$$

A is positive except for stars between the Zenith & North pole.
B " " " " " at lower culmination
C " " " " " " " "

The local time and Azimuth are obtained thus: Assume an approximate value of the clock correction = θ for an arbitrary time T_0 and call $w - \theta = w'$. If the collimation is known and the corresponding correction applied, we have only to reduce the value of w_0 for the several stars to the time T_0 by applying the correction for daily rate — Thus: —

$$(w_0) = w_0 + \frac{t - T_0}{24^h} \times \text{daily gain}$$

and we have, putting $\Delta\theta = \Delta t - \theta$

$$-\Sigma\Delta\theta + \Sigma A a = \Sigma w'_0$$

$$\Sigma A.\Delta\theta + \Sigma A_a^2 = \Sigma A w'_0$$

whence we determine a, $\Delta\theta$, and hence Δt for the time T_0

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Pivot Inequality.

C. S. Transit No. 5.

Value Div. of Level = 0".064.

Weather clear — Cambridge, March 17. 1869 — A. T. Mosman Obsr.

Zenith Distance	Sidereal Time	Temp Fahr.	Lamp West Obj glass N. W	Lamp West Obj glass N. E	Level Error B	Lamp East Obj. Glass S. W	Lamp East Obj. Glass S. E	Level Error B'	$\frac{B'-B}{4}$	Corr. Lamp End = for seconds of Time
90	20h 35m	29.0	85.0 98.5 183.5	98.5 85.5 184.0 −0.5	−0.125	96.5 82.0 178.5	87.0 101.5 188.5 −10.0	−2.500	−0.594	−0.038
85	20. 47	30.0	98.0 85.0 183.0 +1.5	84.5 97.0 181.5	+0.375	82.5 96.5 179.0	101.0 86.0 187.0 −8.0	−2.000	−0.594	−0.038
80	20. 55	30.0	83.5 96.5 180.0	98.5 85.5 184.0 −4.0	+1.000	95.5 82.0 177.5	85.5 99.0 184.5 −7.0	−1.750	−0.187	−0.012
75	21 2	30.5	95.0 82.0 177.0	85.0 98.0 183.0 −6.0	−1.500	82.0 95.0 177.0	98.5 85.0 183.5 −6.5	−1.625	−0.031	−0.002
70	21 9	30.5	81.0 95.5 176.5	98.0 83.5 181.5 −5.0	−1.250	81.0 95.0 176.0	98.0 84.0 182.0 −6.0	−1.500	−0.062	−0.004
65	21 18	31.0	82.0 94.0 176.0	95.0 83.0 178.0 −2.0	−0.500	94.0 81.0 175.0	83.5 96.5 180.0 −5.0	−1.250	−0.188	−0.012
60	21 26	31.5	93.5 81.0 174.5	83.0 95.5 178.5 −4.0	−1.000	93.5 81.0 174.5	83.0 95.5 178.5 −4.0	−1.000	0.000	0.000
55	21 33	31.5	93.5 80.0 173.5	82.0 95.0 177.0 −3.5	−0.875	81.0 94.0 175.0	95.0 82.0 177.0 −2.0	−0.500	+0.094	+0.006
50	21 41	32.0	80.5 93.0 173.5	94.0 81.5 175.5 −2.0	−0.500	93.5 80.0 173.5	81.0 94.0 175.0 −1.5	−.0375	+0.031	+0.002
45	21 51	32.5	92.0 79.0 171.0	82.0 95.0 177.0 −6.0	−1.500	81.0 93.0 174.0	93.0 81.0 174.0 0.0	0.000	+0.375	+0.024
40	22 0	32.5	79.0 92.0 171.0	94.5 81.5 176.0 −5.0	−1.250	80.0 92.5 172.5	93.0 80.5 173.5 −1.0	−0.250	+0.250	+0.016
35	22 9	33.0	79.0 90.0 169.0	93.0 82.0 175.0 −6.0	−1.500	92.5 80.0 172.5	80.0 92.5 172.5 0.0	0.000	+0.375	+0.024
								Mean		−0.0028

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Pivot Inequality

C. S. Transit No. 5

Heavy snowstorm

Weather cloudy

Cambridge March 20, 1869

Div. Level = 0.064

J. Blake jr. Obsr.

Zenith Distance	Sidereal Time	Temp. Fahr.	Lamp West Obj. Glass N. Fr.	Lamp West Obj. Glass N. E	Level Error B	Lamp East Obj. Glass S. Fr.	Lamp East Obj. Glass S. B.	Level Error B'	B' − B / 4	Corr. Lamp End = to Seconds of time
90	22h 42m	38.5	92.0 81.0 173.0	81.0 92.0 173.0 0.0	0.000	78.0 92.0 170.0	93.0 79.0 172.0 −2.0	−0.500	−0.125	−0.008
85	23 0	38.0	80.5 91.5 172.0 +8.0	87.5 76.5 164.0	+2.000	89.5 79.0 168.5	80.5 91.0 171.5 −3.0	−0.750	−0.687	−0.044
80	23 23	38.0	90.0 79.0 169.0 +3.0	77.5 88.5 166.0	+0.750	92.5 76.5 169.0 +4.0	74.5 90.5 165.0	+1.000	+0.062	+0.004
75	23 34	38.0	78.0 90.5 168.5 +3.0	89.0 76.5 165.5	+0.750	77.0 90.5 167.5 +1.0	90.0 76.5 166.5	+0.250	−0.125	−0.008
70	23 45	38.0	89.0 78.0 167.0 +2.0	77.0 88.0 165.0	+0.500	91.5 76.0 167.5 +3.0	74.5 90.0 164.5	+0.750	+0.062	+0.004
65	23 55	38.0	76.5 88.5 165.0 +0.0	88.5 76.5 165.0	+0.000	78.0 90.0 168.0 +5.0	87.5 75.5 163.0	+1.250	+0.313	+0.020
60	0 11	38.0	88.0 78.0 166.0 +2.0	77.0 87.0 164.0	+0.500	90.0 75.0 165.0 0.0	75.0 90.0 165.0	0.000	−0.125	−0.008
55	0 23	38.0	77.5 90.0 167.5 +5.0	87.5 75.0 162.5	+1.250	77.0 89.0 166.0 +2.0	88.0 76.0 164.0	+0.500	−0.187	−0.012
50	0 35	38.0	90.0 77.5 167.5 +5.0	75.0 87.5 162.5	+1.250	92.0 77.0 169.0 +8.0	73.0 88.0 161.0	+2.000	+0.187	+0.012
45	0 45	38.0	78.0 88.0 166.0 +1.5	87.5 77.0 164.5	+0.375	77.0 89.0 166.0 +2.0	88.0 76.0 164.0	+0.500	+0.031	+0.002
40	0 56	38.0	88.5 78.0 166.5 +2.0	77.0 87.5 164.5	+0.500	90.5 78.0 168.5 +6.0	75.0 87.5 162.5	+1.500	+0.250	+0.016
35	1 8	38.0	77.5 88.0 165.5	88.5 78.0 166.5 −1.0	−0.250	78.0 89.0 167.0 +3.0	87.5 76.5 164.0	+0.750	+0.250	+0.016
								Mean		−0.0005

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Pivot Inequality

C. S. Transit No 5

Weather cloudy with heavy snow storm

Cambridge, March 15th 1869

Div. Level = 0.064

T. Blake Jr, Obsr

Zenith Distance	Sidereal Time	Temp. Fahr.	Lamp West Obj. Glass S. W	Lamp West Obj. Glass S. E	Level Error B	Lamp East Obj. Glass N. W	Lamp East Obj. Glass N. E	Level Error B'	B' − B / 4	Corr. Lamp End = to Second of Time
90	22h 12m	41.2	87.5 76.0 163.5	78.0 89.5 167.5 −4.0	−1.000	87.0 78.0 165.0 0.0	78.0 87.0 165.0	0.000	+0.250	+0.016
85	22. 22	39.9	74.0 86.5 160.5	89.5 77.0 166.5 −6.0	−1.500	89.5 76.0 165.5 +2.5	75.0 88.0 163.0	+0.625	+0.531	+0.034
80	22 32	39.5	87.5 72.0 159.5	75.5 90.0 165.5 −6.0	−1.500	88.0 78.0 166.0 +8.0	74.0 84.0 158.0	+2.000	+0.875	+0.057
75	22 43	39.5	72.0 84.5 156.5	89.0 76.5 165.5 −9.0	−2.250	78.0 87.5 165.5 +8.0	83.5 74.0 157.5	+2.000	+1.062	+0.068
70	22 49	39.5	84.5 75.5 160.0	76.5 85.5 162.0 −2.0	−0.500	90.0 78.0 168.0 +14.0	71.0 83.0 154.0	+3.500	+1.000	+0.064
65	23 8	39.3	74.5 84.5 159.0	86.5 76.5 163.0 −4.0	−1.000	78.0 86.5 164.5 +7.0	83.0 74.5 157.5	+1.750	+0.688	+0.044
60	23 22	39.3	84.0 76.5 160.5	77.0 85.0 162.0 −1.5	−0.375	90.5 77.0 167.5 +12.0	71.0 84.5 155.5	+3.000	+0.844	+0.054
55	23 27	39.3	75.0 86.0 161.0	87.0 76.0 163.0 −2.0	−0.500	78.0 87.0 165.0 +8.0	83.0 74.0 157.0	+2.000	+0.625	+0.040
50	23 45	39.2	85.0 77.0 162.0	77.0 85.0 162.0 0.0	0.000	88.0 79.0 167.0 +10.0	74.0 83.0 157.0	+2.500	+0.625	+0.040
45	0 4	39.2	85.0 77.0 162.0	77.0 85.0 162.0 0.0	0.000	78.0 86.5 164.5 +5.0	84.0 75.5 159.5	+1.250	+0.312	+0.020
40	0 15	39.2	77.0 85.0 162.0	85.0 77.0 162.0 0.0	0.000	77.5 88.0 165.5 +7.0	84.5 74.0 158.5	+1.750	+0.438	+0.028
35	0 25	39.2	85.0 76.0 161.0	77.0 86.5 163.5 −2.5	−0.625	88.0 78.5 166.5 +9.0	74.0 83.5 157.5	+2.250	+0.719	+0.046
								Mean		+0.0425

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Pivot Inequality

C. S. Transit No 5

Div. Level = 0.064

Weather partially cloudy Cambridge, March 26. 1869 A. T. W. Observer.

Zenith Distance	Sid. Time	Temp. Tube	Lamp West Obj. glass S. W.	Lamp West Obj. glass S. E.	Level Error B	Lamp East Obj. glass N. W.	Lamp East Obj. glass N. E.	Level Error B'	B' − B / 4	Corr. Lamp End = p Seconds of time
90	19h 44m	32.5°	82.5 97.5 180.0 +4.5	95.5 80.0 175.5	+1.125	98.5 82.0 180.5 +7.5	78.5 94.5 173.0	+1.875	+0.187	+0.012
85	19 55	33.0	82.0 97.5 179.5 +8.5	93.5 77.5 171.0	+2.125	83.0 98.0 181.0 +10.0	93.0 78.0 171.0	+2.500	+0.094	+0.006
80	20 5	33.0	95.5 79.5 175.0 +1.5	78.5 95.0 173.5	+0.375	96.5 82.0 178.5 +8.5	78.0 92.0 170.0	+2.125	+0.438	+0.028
75	20 13	33.5	80.5 94.0 174.5 +4.0	92.0 78.5 170.5	+1.000	83.0 95.5 178.5 +10.5	90.5 77.5 168.0	+2.625	+0.406	+0.026
70	20 22	33.5	93.5 80.0 173.5 +3.0	78.5 92.0 170.5	+0.750	94.5 82.0 176.5 +9.0	77.5 90.0 167.5	+2.250	+0.375	+0.024
65	20 31	34.0	80.5 93.5 174.0 +5.0	91.0 78.0 169.0	+1.250	82.0 94.0 176.0 +8.5	90.0 77.5 167.5	2.125	+0.219	+0.014
60	20 40	34.0	93.5 80.0 173.5 +4.5	78.0 91.0 169.0	+1.125	94.0 81.0 175.0 +7.5	77.5 90.0 167.5	+1.875	+0.187	+0.012
55	20 49	34.0	80.5 93.0 173.5 +6.0	90.0 77.5 167.5	+1.500	82.0 94.0 176.0 +10.5	88.5 77.0 165.5	+2.625	+0.281	+0.018
50	21 0	34.5	92.5 80.0 172.5 +5.0	77.5 90.0 167.5	+1.250	93.5 80.0 173.5 +7.5	76.5 89.5 166.0	+1.875	+0.156	+0.010
45	21 10	35.0	79.0 92.5 171.5 +5.0	90.0 76.5 166.5	+1.250	80.5 94.0 174.5 +9.5	89.0 76.0 165.0	+2.375	+0.281	+0.018
40	21 19	35.0	92.5 78.5 171.0 +4.0	76.5 90.5 167.0	+1.000	93.5 81.0 174.5 +11.5	75.0 88.0 163.0	+2.875	+0.469	+0.030
35	21 19	35.5°	80.0 73.0* 153.0 +10.0	88.0 75.0 163.0 −10.0	Rejected	81.0 94.0 175.0 +13.0	87.5 74.5 162.0			
35°	* assumed correction		80.0 93.0 * 173.0	88.0 75.0 163.0				Mean		+0.0180

If Zenith Dist. 35° be used as corrected and rejected the resulting mean value of p = +0.0175

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C. S. Transit, No. 5.

			p
Lamp West, Obj. Glass N.	March 17.	A. T. M.	−0.0028
	" 20.	F. B. jr.	−0.0005
		Mean	−0.0016
Lamp West, Obj. Glass S.	March 15.	F. B. jr.	+0.0425
	" 26	A. T. M.	+0.0180
		Mean	+0.0302

Final Mean = $+0^{s}.014$

That is; the Lamp pivot is the smaller

$p = +0^{s}.014$

To obtain Level constant, b_0 or b_1

Lamp W. ..... $b_0 = (W)\,b + p$

" E ..... $b_1 = (E)\,b - p$

$b_1 = b_0 + 2p$

$b_0 = b_1 - 2p$

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Level Corrections

Value of 1 Div. level = 0.064

Transit No. 5

Cambridge, 1869

Date	Lamp	Sid. Time	Levellings Sp. W.	Levellings Sp. E.	b Div.	b (seconds)	b_0 Sp. W.	b_1 Sp. E.
Feb. 4	W.	4h 38m	91.5 84.0 175.5	86.5 94.0 180.5	−5.0	−.080	−.066	
	E.	5 4	96.0 86.0 182.0	87.5 98.5 186.0	−4.0	−.064		−.078
	W.	5 37	100.0 86.5 186.5	89.5 103.5 193.0	−6.5	−.104	−.090	
	E	5 44	102.5 87.5 190.0	88.0 103.0 191.0	−1.0	−.016		−.030
Feb. 5.	W.	5 23	100.0 86.0 186.0	90.0 104.0 194.0	−8.0	−.128	−.114	
	W.	5 35	99.5 87.0 186.5	91.5 104.5 196.0	−9.5	−.152	−.138	
	E	5 43	88.5 103.0 191.5	103.5 89.5 193.0	−1.5	−.024		−.038
	E	6 51	90.0 106.5 196.5	107.0 91.0 198.0	−1.5	−.024		−.038
	E	7 17	90.0 106.0 196.0	107.5 92.0 199.5	−3.5	−.056		−.070
	W	7 23	103.0 88.5 191.5	93.5 108.5 202.0	−10.5	−.168	−.154	
	W	7 42	88.0 103.0 191.0	108.5 93.5 202.0	−11.0	−.176	−.162	
	W	8 24	103.5 89.0 192.5	94.0 109.0 203.0	−10.5	−.168	−.154	

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Level Corrections

Cambridge - 1869.

Date	Lamp	Sid. Time	Levellings W	Levellings E	l Div.	l Seconds	l_0 Sp. W.	l_1 Sp. E.
Feb. 7.	W	3h 38m	83.5 93.0 176.5	95.5 86.5 182.0	−5.5	−.088	−.074	
	W	3 43	93.0 85.5 178.5	88.0 96.0 184.0	−5.5	−.088	−.074	
	W	4 0	86.0 97.5 183.5	99.0 87.5 186.5	−3.0	−.048	−.034	
	E	4 17	86.5 99.0 185.5	101.0 88.5 189.5	−4.0	−.064		−.078
	E	4 35	87.0 101.0 188.0	103.0 88.5 191.5	−3.5	−.056		−.070
	W	4 53	86.5 99.5 186.0	105.0 92.0 197.0	−11.0	−.176	−.162	
	W	5 18	87.0 100.0 187.0	105.5 92.5 198.0	−11.0	−.176	−.162	
	E	5 30	103.0 87.5 190.5	89.5 105.5 195.0	−4.5	−.072		−.086
	E	11 36	90.5 107.0 197.5	113.5 96.5 210.0	−12.5	−.200		−.214
	E	12 5	91.0 107.0 198.0	113.0 97.0 210.0	−12.0	−.192		−.206
	W	12 20	89.5 105.5 195.0	114.0 98.0 212.0	−17.0	−.272	−.258	
	W	12 35	89.5 106.0 195.5	114.0 97.5 211.5	−16.0	−.256	−.242	

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Level Corrections

Cambridge 1869

Date	Lamp	Sid. Time h m	Levellings W	Levellings E	b Div.	b seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 7	E	12 44	106.5 92.0 198.5	97.5 112.5 210.0	−11.5	−.184		−.198
	W	12 56	104.0 90.5 194.5	100.5 114.0 214.5	−20.0	−.320	−.306	
Feb. 9	W	3 49	82.5 78.5 161.0	84.0 88.0 172.0	−11.0	−.176	−.162	
	Instrument levelled W	4 0	85.5 81.0 166.5	83.0 88.0 171.0	−4.5	−.072	Inst. Levelled −.058	
	E	4 15	87.0 83.5 170.5	83.0 87.0 170.0	+0.5	+.008		−.006
	E	4 36	87.0 83.5 170.5	84.0 88.5 172.5	−2.0	−.032		−.046
	W	5 12	87.0 82.5 169.5	85.0 90.0 175.0	−5.5	−.088	−.074	
Feb. 12	E	4 0	86.0 74.5 160.5	73.5 85.0 158.5	+2.0	+.032		+.018
	E	4 32	77.0 85.5 162.5	84.0 75.5 159.5	+3.0	+.048		+.034
	W	5 2	84.0 76.5 160.5	77.5 85.5 163.0	−2.5	−.040	−.026	
	W	5 39	84.0 77.0 161.0	78.5 85.5 164.0	−3.0	−.048	−.034	
	E	5 50	78.5 85.5 164.0	84.0 77.5 161.5	+2.5	+.040		+.026

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1869phae.proj..354.

Level Corrections

Cambridge 1869

Date	Lamp:	Sid. Time	Levellings W.	Levellings E.	b. Div.	b. Seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 12	W	6h 8m	78.0 85.0 163.0	85.5 78.0 163.5	−0.5	−.008	+.006	
	E	6 18	78.5 86.0 164.5	84.5 77.5 162.0	+2.5	+.040		+.026
Feb. 13	E	4 10	82.5 65.0 147.5	59.5 77.0 136.5	+11.0	+.176		+.162
	E	4 22	65.0 82.0 147.0	77.0 59.5 136.5	+10.5	+.168		+.154
	E	4 35	63.5 80.5 144.0	77.5 60.5 138.0	+6.0	+.096		+.082
	W	4 52	63.5 79.5 143.0	77.5 61.5 139.0	+4.0	+.064	+.078	
	W	5 3	62.0 79.5 141.5	79.0 62.0 141.0	+0.5	+.008	+.022	
	W	5 15	78.0 64.0 142.0	63.5 78.0 141.5	+0.5	+.008	+.022	
	E	5 27	82.5 66.5 149.0	60.5 77.0 137.5	+11.5	+.184		+.170
Feb. 17	W	5 34	87.5 80.0 167.5	77.5 85.0 162.5	+5.0	+.080	+.094	
	E	5 40	82.0 87.0 169.0	84.5 79.5 164.0	+5.0	+.080		+.066
	W	5 51	82.0 86.5 168.5	85.0 81.0 166.0	+2.5	+.040	+.054	

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Level Corrections
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Date	Lamp	Sid. Time	Levellings W	Levellings E	b Div	b seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 17	W	6h 34m	85.0 87.5 172.5	86.0 83.5 169.5	+3.0	+.048	+.062	
	W	6 55	87.0 84.0 171.0	84.5 87.5 172.0	−1.0	−.016	−.002	
	W	7 16	85.0 87.5 172.5	87.0 84.5 171.5	+1.0	+.016	+.030	
	E	7 29	90.5 85.0 175.5	82.0 87.5 169.5	+6.0	+.096		+.082
	E	7 40	85.5 90.0 175.5	87.0 83.0 170.0	+5.5	+.088		+.074
	E	13 35	91.5 85.5 177.0	85.0 91.0 176.0	+1.0	+.016		+.002
Feb. 18	E	7 40	86.5 94.0 180.5	93.5 86.0 179.5	+1.0	+.016		+.002
	E	8 22	96.0 86.0 182.0	86.0 96.0 182.0	0.0	.000		−.014
	W	8 35	96.0 87.0 183.0	86.5 95.5 182.0	+1.0	+.016	+.030	
	W	8 45	86.5 97.0 183.5	96.0 86.0 182.0	+1.5	+.024	+.038	
	E	9 4	97.0 87.0 184.0	86.0 96.0 182.0	+2.0	+.032		+.018
	E	9 28	88.0 98.0 186.0	96.0 86.0 182.0	+4.0	+.064		+.050

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Level Corrections

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Date	Lamp	Sid. Time	Levellings W	Levellings E	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 18	E	12h 16m	102.5 88.0 190.5	87.5 102.0 189.5	+1.0	+.016		+.002
	E	12 30	102.5 88.5 191.0	87.5 101.5 189.0	+2.0	+.032		+.018
	W	12 42	88.0 103.5 191.5	102.0 87.0 189.0	+2.5	+.040	+.054	
	W	13 7	88.5 102.5 191.0	101.5 88.0 189.5	+1.5	+.024	+.038	
	W	13 16	89.0 103.0 192.0	100.5 87.5 188.0	+4.0	+.064	+.078	
	E	13 25	102.5 88.5 191.0	87.5 101.5 189.0	+2.0	+.032		+.018
	W	13 36	88.0 103.0 191.0	102.0 87.0 189.0	+2.0	+.032	+.046	
Feb. 19	W	5 0	93.5 86.0 179.5	86.0 93.5 179.5	0.0	.000	+.014	
	W	5 15	94.5 86.0 180.5	86.5 95.5 182.0	−1.5	−.024	−.010	
	E	5 32	96.5 86.0 182.5	87.0 97.5 184.5	−2.0	−.032	−.074	−.046
	E	5 50	99.0 86.5 185.5	86.5 99.0 185.5	0.0	.000	−.042	−.014
	W	7 2	88.0 99.5 187.5	101.5 90.5 192.0	−4.5	−.072	−.058	

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Level Corrections
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Date	Lamp	Sid Time	Levellings W	Levellings E	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 19	E	7h 16m	88.0 102.5 190.5	102.0 87.5 189.5	+1.0	+.016		+.002
	E	11 25	104.0 88.5 192.5	90.5 106.0 196.5	−4.0	−.064		−.078
	E	11 35	89.0 104.0 193.0	105.0 90.0 195.0	−2.0	−.032		−.046
	E	12 2	89.0 104.0 193.0	105.0 90.0 195.0	−2.0	−.032		−.046
	W	12 17	89.5 104.5 194.0	104.0 89.5 193.5	+0.5	+.008	+.022	
	W	12 32	88.0 104.0 192.0	106.5 90.5 197.0	−5.0	−.080	+.066	
	E	12 41	104.0 88.5 192.5	90.5 106.0 196.5	−4.0	−.064		−.078
	W	13 5	104.0 89.0 193.0	90.5 105.5 196.0	−3.0	−.048	−.034	
Feb. 24	W Level doubtful	5 55	84.5 90.5 175.0	85.5 80.5 166.0	+9.0	+.144	+.158 Reject	
	E	6 9	89.0 86.0 175.0	83.5 87.0 170.5	+4.5	+.072	+.030	+.058
	E	6 25	90.5 86.0 176.5	85.0 90.0 175.0	+1.5	+.024		+.010
	E	6 57	86.5 94.5 181.0	94.0 86.0 180.0	+1.0	+.016		+.002

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Level Corrections
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Date	Lamps	Sid. Time	Levellings W.	Levellings E.	b Div.	b Secnds	b_0 Sp. W.	b_1 Sp. E.
Feb. 24	W	7 22	86.5 95.0 181.5	94.0 86.0 180.0	+1.5	+.024	+.038	
	W	7 40	86.5 95.5 182.0	94.5 86.0 180.5	+1.5	+.024	+.038	
	E	7 51	86.0 96.0 182.0	95.5 86.0 181.5	+0.5	+.008		−.006
	E	12 30	88.5 103.0 191.5	103.5 89.0 192.5	−1.0	−.016		−.030
	W	12 42	88.5 104.5 193.0	102.5 86.5 189.0	+4.0	+.064	+.078	
	W	13 15	103.5 89.0 192.5	87.5 102.5 190.0	+2.5	+.040	+.054	
	E	13 32	103.5 89.0 192.5	87.5 102.0 189.5	+3.0	+.048		+.034
	E	13 55	103.5 89.0 192.5	88.0 102.5 190.5	+2.0	+.032		+.018
	W	14 5	89.0 104.0 193.0	102.5 88.0 190.5	+2.5	+.040	+.054	
	W	14 15	103.0 89.0 192.0	88.5 102.5 191.0	+1.0	+.016	+.030	
Feb. 25	W	4 52	88.5 85.5 174.0	85.0 88.0 173.0	+1.0	+.016	+.030	
	W	5 2	85.5 90.0 175.5	89.0 85.0 174.0	+1.5	+.024	+.038	

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Level Corrections
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Date	Lamp	Sid. Time	Levellings W.	Levellings E.	l Div.	l Seconds	l Sp. W.	l Sp. E
Feb. 25	W	5 14	90.5 86.0 176.5	85.5 90.5 176.0	+0.5	+.008	+.022	
	E	5 18	85.5 92.5 178.0	92.0 85.5 177.5	+0.5	+.008		-.006
	E	5 32	92.5 86.0 178.5	86.0 92.5 178.5	+0.0	.000		-.014
	W	5 42	93.5 86.0 179.5	86.0 93.5 179.5	+0.0	.000	+.014	
	E	5 50	93.0 86.0 179.0	86.5 93.5 180.0	-1.0	-.016		-.030
Feb. 27	W	5 10	92.0 86.0 178.0	86.0 92.0 178.0	0.0	.000	+.014	
	E	5 34	86.5 97.5 184.0	97.5 87.0 184.5	-0.5	-.008		-.022
	W	5 52	99.0 88.0 187.0	88.0 99.0 187.0	0.0	.000	+.014	
	W	6 35	103.0 88.0 191.0	89.0 104.0 193.0	-2.0	-.032	-.018	+.010
	W	6 55	89.5 104.0 193.5	104.0 89.0 193.0	+0.5	+.008	+.022	
	E	7 8	89.0 105.0 194.0	104.5 89.0 193.5	+0.5	+.008		-.006
	W	12 17	108.0 94.0 202.0	95.0 109.0 204.0	-2.0	-.032	-.018	

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Level Corrections
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Date	Lamps	Sid. Time	Levellings W.	Levellings E.	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E.
Feb. 27	W	12 30	108.0 95.0 203.0	95.0 108.0 203.0	0.0	.000	+.014	
	E	12 42	92.5 108.0 200.5	110.0 95.0 205.0	−4.5	−.072		−.086
	E	13 0	107.5 95.0 202.5	95.5 108.5 204.0	−1.5	−.024		−.038
	W	13 25	95.0 108.0 203.0	109.0 96.0 205.0	−2.0	−.032	−.018	
	W	13 58	107.0 95.0 202.0	97.5 109.0 206.5	−4.5	−.072	−.058	
	E	14 5	94.0 108.0 202.0	109.0 95.5 204.5	−2.5	−.040		−.054
	E	14 15	107.0 95.0 202.0	96.5 109.0 205.5	−3.5	−.056		−.070
Feb. 28	E	5 13	86.5 100.0 186.5	100.5 87.5 188.0	−1.5	−.024		−.038
	E	5 22	87.0 102.5 189.5	103.0 88.0 191.0	−1.5	−.024		−.038
	E	5 34	89.0 104.0 193.0	104.0 90.0 194.0	−1.0	−.016		−.030
	W	5 42	89.5 103.5 193.0	105.5 92.5 198.0	−5.0	−.080	−.066	−.038
	W	5 50	89.5 106.5 196.0	107.5 90.5 198.0	−2.0	−.032	−.018	

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Level Corrections

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Date	Lamp	Sid. Time	Levellings W.	Levellings E.	b. Div	b. Seconds	b Sp. W.	b, Sp. E.
Feb. 28	W.	6 56	96.5 109.0 205.5	109.0 96.5 205.5	0.0	.000	+.014	
	W.	7 6	109.5 95.5 205.0	96.5 111.0 207.5	−2.5	−.040	−.026	
	E	13 45	104.0 117.5 221.5	118.0 105.0 223.0	−1.5	−.024		−.038
	E	13 52	104.0 116.5 220.5	117.5 105.5 223.0	−2.5	−.040		−.054
	W	14 5	115.5 104.0 219.5	106.5 118.5 225.0	−5.5	−.088	−.074	
	E	14 34	105.5 116.5 222.0	117.5 107.5 225.0	−3.0	−.048		−.062
	W	14 47	105.5 117.0 222.5	118.0 107.0 225.0	−2.5	−.040	−.026	
Mar. 1	W	5 32	103.5 88.0 191.5	88.5 105.0 193.5	−2.0	−.032	−.018	+.010
	W	5 50	88.0 107.0 195.0	109.0 90.0 199.0	−4.0	−.064	−.050	−.022
	E	5 55	106.5 88.0 194.5	90.5 109.0 199.5	−5.0	−.080		−.094
	W	6 57	96.0 110.5 206.5	111.0 96.5 207.5	−1.0	−.016	−.002	
	E	7 6	109.0 95.0 204.0	97.5 111.5 209.0	−5.0	−.080		−.094

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Level Corrections

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Date	Samp	Sid. Time	Levellings W.	Levellings E.	L. Div.	L. second	L_0 Sp. W.	L_1 Sp. E
Mar. 1	E	7 29	97.0 110.5 207.5	110.5 97.0 207.5	0.0	.000		−.014
Mar. 3.	W	6 35	80.5 91.0 171.5	91.0 81.0 172.0	−0.5	−.008	+.006	
	W	6 45	83.0 88.0 171.0	90.0 85.0 175.0	−4.0	−.064	−.050	
	E	7 30	92.0 85.0 177.0	84.5 91.0 175.5	+1.5	+.024		+.010
	E	7 40	85.0 92.0 177.0	91.0 84.5 175.5	+1.5	+.024		+.010
	E	8 5	86.0 92.5 178.5	91.0 85.0 176.0	+2.5	+.040		+.026
	W	8 18	92.0 85.5 177.5	85.5 92.0 177.5	0.0	.000	+.014	
	W	8 25	85.5 92.5 178.0	92.5 85.0 177.5	+0.5	+.008	+.022	
	E	8 53	92.5 85.5 178.0	86.0 93.5 179.5	−1.5	−.024		−.038
	W	9 0	85.0 93.0 178.0	94.0 86.0 180.0	−2.0	−.032	−.018	
	E	9 34	95.0 86.0 181.0	86.0 95.5 181.5	−0.5	−.008	−.050	−.022
	W	11 17	98.5 86.0 184.5	86.5 99.5 186.0	−1.5	−.024	−.010	

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Level Corrections
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Date	Samp	Ld. Time	Levellings W.	Levellings E.	b Div.	b seconds	b_0 Sp. W.	b_1 Sp. E
Mar. 3	W.	11 28	86.0 99.5 185.5	99.5 86.5 186.0	−0.5	−.008	+.006	
	E.	11 40	99.5 87.0 186.5	86.0 98.0 184.0	+2.5	+.040		+.026
	E.	12 20	99.5 86.0 185.5	87.0 100.5 187.5	−2.0	−.032		−.046
	evidently erroneous E	12 45	86.5 87.0 * 173.5	99.5 99.0 198.5				
	Hypothetical E	12 45	86.5 99.0 * 185.5	99.5 87.0 186.5	−1.0	−.016		−.030
	W	13 32	86.0 102.0 188.0	102.0 86.0 188.0	0.0	.000	+.014	+.042
	W	14 35	86.0 102.5 188.5	103.0 86.5 189.5	−1.0	−.016	−.002	+.026
Mar. 5	W	5 32	90.5 108.0 198.5	109.0 92.0 201.0	−2.5	−.040	−.026	
	E	5 47	109.5 89.5 199.0	91.5 111.5 203.0	−4.0	−.064		−.078
	W	6 10	89.5 113.0 202.5	112.0 88.5 200.5	+2.0	+.032	+.046	
	W	6 20	90.5 112.5 203.0	111.0 89.5 200.5	+2.5	+.040	+.054	
	E	6 35	113.0 92.0 205.0	91.0 112.0 203.0	+2.0	+.032		+.018

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Level Corrections
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Date	Samp	Sid. Time	Levellings W.	Levellings E.	b. Div.	b seconds	b_0 Sp. W.	b_1 Sp. E.
Mar. 5	E	6 58	93.5 111.5 205.0	112.0 94.0 206.0	−1.0	−.016		−.030
	E	7 15	112.0 92.5 204.5	94.0 113.0 207.0	−2.5	−.040		−.054
	E	12 3	113.0 95.0 208.0	95.0 113.0 208.0	0.0	.000		−.014
	W	12 10	94.0 112.0 206.0	114.5 97.5 212.0	−6.0	−.096	−.082	
	E	12 40	115.5 98.0 213.5	97.5 115.5 213.0	+0.5	+.008		−.006
	W	13 30	116.5 99.5 216.0	101.0 119.0 220.0	−4.0	−.064	−.050	
Mar. 7	W	7 30	89.0 108.0 197.0	111.0 92.0 203.0	−6.0	−.096	−.082	
	W	7 43	90.5 108.5 199.0	109.0 91.5 200.5	−1.5	−.024	−.010	
	E	7 54	89.5 110.5 200.0	110.0 89.5 199.5	+0.5	+.008		−.006
	E	8 6	110.5 89.5 200.0	89.5 111.0 200.5	−0.5	−.008		−.022
	W	8 18	90.0 109.0 199.0	111.0 92.0 203.0	−4.0	−.064	−.050	
	E	8 43	91.5 109.5 201.0	110.0 92.5 202.5	−1.5	−.024		−.038

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Date	Samp.	Time	Levellings W.	Levellings E.	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E
Mar. 7	E	8 55	109.5 91.5 201.0	92.5 110.5 203.0	−2.0	−.032		−.046
	E	13 52	112.0 95.0 207.0	95.5 112.5 208.0	−1.0	−.016		−.030
	W	14 6	92.0 110.0 202.0	115.5 97.5 213.0	−11.0	−.176	−.162	
Mar. 9.	W	6 58	80.0 92.0 172.0	92.0 80.0 172.0	0.0	.000	+.014	
	E	7 20	93.0 83.0 176.0	81.0 91.0 172.0	+4.0	+.064		+.050
	W	8 40	83.5 94.0 177.5	94.0 83.5 177.5	0.0	.000	+.014	

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Date	Lamp	Time	Levellings W	Levellings E.	b Div	b Secnds	b_0 Sp. W.	b_1 Sp. E	Obsrs.
Mar. 21	W	7 0	86.0 102.5 188.5	102.5 86.0 188.5	0.0	.000	+.014		A.T.M.
	W	7 16	106.0 86.5 192.5	86.0 106.5 192.5	0.0	.000	+.014		A.T.M.
	E	7 27	109.0 87.0 196.0	86.5 108.5 195.0	+1.0	+.016		+002	F.B. Jr.
	E	7 40	110.0 88.0 198.0	87.0 109.0 196.0	+2.0	+.032		+.018	A.T.M.
	W	7 54	87.5 110.0 197.5	110.0 87.5 197.5	0.0	.000	+.014		A.T.M.
	E	8 20	111.0 88.0 199.0	87.5 110.5 198.0	+1.0	+.016		+.002	F.B. Jr.
	E	8 54	88.5 113.5 202.0	113.0 88.0 201.0	+1.0	+.016		+.002	A.T.M.
	E	9 12	112.5 89.5 202.0	88.5 111.5 202.0	+2.0	+.032		+.018	F.B. Jr.
Mar. 24	W	6 42	88.5 71.0 159.5	72.5 90.0 162.5	-3.0	-.048	-.034		A.T.M.
	W	6 56	75.5 87.5 163.0	86.5 75.0 161.5	+1.5	+.024	+.038		F.B. Jr.
	W	7 6	91.0 74.5 165.5	72.5 89.0 161.5	+4.0	+.064	+.078		A.T.M.
	W	7 16	91.5 73.0 164.5	72.5 91.0 163.5	+1.0	+.016	+.030		F.B. Jr.

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Date	Lamp	Sid. Time	Levellings W.	Levellings E.	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E	Obsrs
Mar. 24	E	7 22	92.0 74.5 166.5	72.5 89.5 162.0	+4.5	+.072		+.058	A.T.M.
	E	7 34	88.0 78.5 166.5	76.0 86.0 162.0	+4.5	+.072		+.058	T.B.Jr.
	E Level doubtful	7 43	93.0 77.5 170.5	72.5 87.0 159.5	+11.0 Reject				A.T.M.
	W Reject	7 53	77.5 88.0 165.5	88.5 77.5 166.0	−0.5				A.T.M.
	W	8 8	92.0 78.0 170.0	75.0 89.0 164.0	+6.0	+.096	+.110		A.T.M.
	E	8 18	78.5 92.0 170.5	88.0 75.0 163.0	+7.5	+.120		+.106	T.B.Jr.
	E	8 42	81.0 92.0 173.0	88.0 77.0 165.0	+8.0	+.128		+.114	A.T.M.
	E	8 56	81.5 92.5 174.0	88.0 77.5 165.5	+8.5	+.136		+.122	T.B.Jr.
	W	9 6	91.5 82.0 173.5	78.5 88.0 166.5	+7.0	+.112	+.126		T.B.Jr.
Mar 25.	W	6 44	86.5 73.0 159.5	73.0 87.0 160.0	−0.5	−.008	+.006		T.B.Jr.
	W	6 58	76.0 87.0 163.0	85.5 74.5 160.0	+3.0	+.048	+.062		A.T.M. Ra 4h 13p
	W	7 15	77.5 91.0 168.5	85.5 73.0 158.5	+10.0	+.160	+.174		A.T.M.

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Date	Lamp	Sid. Time	Levellings W.	Levellings E.	b Div.	b Seconds	b_0 Sp. W.	b_1 Sp. E.	Obers.
Mar. 26	E	7 25	78.5 90.0 168.5	85.0 74.5 159.5	+9.0	+.144		+.130	T.B. Jr.
	E	7 35	78.5 92.5 171.0	86.0 73.0 159.0	+12.0	+.192		+.178	A.T.M.
	E	7 42	78.0 91.0 169.0	87.5 74.5 162.0	+7.0	+.112		+.098	T.B Jr Fr. A.T.M.
	W	7 54	89.0 78.5 167.5	76.5 87.0 163.5	+4.0	+.064	+.078		T.B Jr.
	W	8 7	89.0 80.5 169.5	78.0 86.5 164.5	+5.0	+.080	+.094		T.B.Jr.
	E	8 18	81.0 91.0 172.0	87.0 77.0 164.0	+8.0	+.128		+.114	A.T.M.
	E	8 43	83.0 92.0 175.0	86.0 76.5 162.5	+12.5	+.200		+.186	T.B.Jr.
	E	8 54	82.0 93.0 175.0	88.5 77.5 166.0	+9.0	+.144		+.130	A.T.M.
	W	9 3	92.0 80.0 172.0	78.5 90.5 169.0	+3.0	+.048	+.062		A.T.M.

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1869phae.proj..354.

Thread Intervals – C. S. Transit, No. 5. Cambridge, 1869

Ober. A. S. M. — S Ursae Minoris, L. C. — δ = +86° 36′ 6.9″, cos δ = 8.7728567

		Time of Transit Mar. 14. E	Interval Mar. 14.	t	log t	log. corr.
B	1	6h 3m 53.80s	+10 15.1816	+615.1816	+2.7890033	0.0001448
	2	4 36.00	9 32.9816	572.9816	.7581407	1253
	3	5 20.80	8 48.1816	528.1816	.7227833	1068
	4	6 2.83	8 6.1516	486.1516	.6867717	904
	5	6 47.35	7 21.6316	441.6316	.6450602	747
C	1	8 15.30	5 53.6816	353.6816	.5486125	477
	2	8 59.61	5 9.3716	309.3716	.4904804	366
	3	9 45.30	4 23.6816	263.6816	.4210798	268
	4	10 27.51	3 41.4716	221.4716	.3453181	188
	5	11 11.79	2 57.1916	177.1916	2.2484431	120
D	1	12 39.79	1 29.1916	89.1916	1.9503239	30
	2	13 26.90	+0 42.0816	+42.0816	+1.6240923	8
	3	14 10.70	−0 1.7184	−1.7184	−0.2351243	0
	4	14 52.90	0 43.9184	43.9184	1.6426466	8
	5	15 37.65	1 28.6684	88.6684	1.9477689	30
E	1	17 4.32	2 55.3384	175.3384	2.2438770	118
	2	17 47.70	3 38.7184	218.7184	2.3398853	184
	3	18 32.60	4 23.6184	263.6184	.4209758	266
	4	19 16.59	5 7.6084	307.6084	.4879981	363
	5	19 59.77	5 50.7884	350.7884	.5450452	471
F	1	21 29.41	7 20.4284	440.4284	.6438753	741
	2	22 13.09	8 4.1084	484.1084	.6849427	897
	3	23 1.36	8 52.3784	532.3784	.7262204	1084
	4	23 43.37	9 34.3884	574.3884	.7592057	1262
	5	24 28.10	−10 19.1184	−619.1184	−2.7917737	0.0001467
		6 14 8.9816				

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1869phae.proj...354.

Thread Intervals
Ursae Minoris L.C.

		log. f	f
B	1	+1.5617152	+36.457
	2	.5308721	33.953
	3	.4955332	31.299
	4	.4595380	28.810
	5	.4178422	26.172
C	1	.3214215	20.961
	2	.2633005	18.336
	3	.1939097	15.628
	4	.1181560	13.127
	5	1.0212876	10.502
D	1	0.7231776	5.287
	2	+0.3969482	+2.494
	3	-9.0079810	-0.102
	4	0.4155025	2.603
	5	0.7206226	5.256
E	1	1.0167219	10.393
	2	.1127236	12.964
	3	.1938059	15.624
	4	.2608185	18.231
	5	.3178548	20.790
F	1	.4166579	26.101
	2	.4577097	28.689
	3	.4989687	31.548
	4	.5319362	34.036
	5	-1.5644837	-36.685
			+243.020 -243.022

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Thread Intervals

Ober. A. T. M. — U. S. C. 1879. L. C.

δ = +80° 3′ 23.1″
cos δ = 9.2372380

		Transit Mar. 16 E	Intervals Mar. 16	t	log. t	log. corr
B	1	8h 49m 24.63s	+3 31.2636	+211.2636	+2.3248247	0.0000171
	2	49 39.66	3 16.2336	196.2336	.2927734	148
	3	49 54.30	3 1.5936	181.5936	.2591005	125
	4	50 8.70	2 47.1936	167.1936	.2232196	107
	5	50 24.79	2 31.1036	151.1036	.1792748	87
C	1	50 54.80	2 1.0936	121.0936	.0831212	56
	2	51 9.91	1 45.9836	105.9836	2.0252387	42
	3	51 25.00	1 30.8936	90.8936	1.9585333	31
	4	51 41.10	1 14.7936	74.7936	.8738645	21
	5	51 55.31	1 0.5836	60.5836	.7823550	14
D	1	52 25.28	0 30.6136	30.6136	.4859144	4
	2	52 41.00	+0 14.8936	+14.8936	+1.1729997	1
	3	52 56.40	−0 0.5064	−0.5064	−9.7044937	0
	4	53 10.90	0 15.0064	15.0064	1.1762765	1
	5	53 26.16	0 30.2664	30.2664	.4809607	4
E	1	53 56.30	1 0.4064	60.4064	.7810830	14
	2	54 11.17	1 15.2764	75.2764	.8766588	22
	3	54 25.91	1 30.0164	90.0164	1.9543207	31
	4	54 41.30	1 45.4064	105.4064	2.0228670	42
	5	54 56.00	2 0.1064	120.1064	.0795562	53
F	1	55 27.42	2 31.5264	151.5264	.1804883	87
	2	55 41.79	2 45.8964	165.8964	.2198370	104
	3	55 58.30	3 2.4064	182.4064	.2610400	127
	4	56 13.10	3 17.2064	197.2064	.2949209	150
	5	56 28.11	−3 32.2164	−212.2164	−2.3267789	0.0000172
		8h 52m 55.8936s				

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1869phae.proj..354.

Thread Intervals
L.Y.C. 1879. L.C.

		log. f	f
B	1	+1.5620456	+36.479
	2	.5299966	33.884
	3	.4963260	31.356
	4	.4604469	28.870
	5	.4165041	26.092
C	1	.3203536	20.910
	2	.2624725	18.301
	3	.1957682	15.695
	4	.1111004	12.915
	5	1.0195916	10.461
D	1	0.7231520	5.286
	2	+0.4102376	+2.572
	3	-8.9417317	-0.087
	4	0.4135144	2.591
	5	0.7181983	5.226
E	1	1.0183196	10.431
	2	.1138946	12.998
	3	.1915556	15.544
	4	.2601008	18.201
	5	.3167987	20.739
F	1	.4177176	26.165
	2	.4570646	28.646
	3	.4982653	31.497
	4	.5321439	34.052
	5	-1.5639997	-36.644
			+242.821 -242.821

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Obsrs.
Mar. 9. F. B. fr.
other dates. A. T. M.

Thread Intervals
x Cephei. L. C.

$\delta = +77° 18' 44".0$
$\cos\delta = 9.3417077$

		Transits				Intervals
		Mar. 9 W.	Mar. 16 E.	Mar. 17 E.	Mar. 18 E.	Mar. 9
B	1	8h 15m 36.20	8h 10m 0s.08	8h 9m 59s.63	8h 9m 58s.05	+2 45.7992
	2	15 25.24	10 11.90	10 11.82	10 10.00	2 34.8392
	3	15 12.90	10 23.12	10 23.77	10 21.70	2 22.4992
	4	15 1.59	10 35.30	10 34.87	10 33.10	2 11.1892
	5	14 49.93	10 47.51	10 46.50	10 44.60	1 59.5292
C	1	14 26.00	11 10.74	11 10.30	11 9.02	1 35.5992
	2	14 14.80	11 23.19	11 22.31	11 21.00	1 23.6992
	3	14 1.60	11 34.22	11 33.55	11 32.41	1 11.1992
	4	13 49.11	11 46.54	11 45.79	11 45.00	0 58.7092
	5	13 38.00	11 58.71	11 57.53	11 56.33	0 47.5992
D	1	13 14.00	12 22.45	12 22.10	12 20.60	0 23.5992
	2	13 2.29	12 34.10	12 34.48	12 33.12	+ 11.8892
	3	12 50.40	12 46.68	12 46.69	12 44.87	− 0.0008
	4	12 37.80	12 58.22	12 57.37	12 57.00	0 12.6008
	5	12 26.00	13 10.47	13 9.61	13 8.80	0 24.4008
E	1	12 3.32	13 33.45	13 32.80	13 32.17	0 47.0808
	2	11 51.49	13 45.29	13 44.91	13 43.70	0 58.9108
	3	11 39.69	13 57.26	13 56.70	13 55.78	1 10.7108
	4	11 27.39	14 8.90	14 8.40	14 7.99	1 23.0108
	5	11 16.30	14 20.60	14 20.46	14 18.99	1 34.1008
F	1	10 51.22	14 45.30	14 44.66	14 43.42	1 59.1808
	2	10 39.64	14 56.00	14 56.38	14 55.86	2 10.7608
	3	10 26.90	15 8.79	15 8.62	15 8.52	2 23.5008
	4	10 15.72	15 21.22	15 20.53	15 20.30	2 34.6808
	5	10 3.19	15 33.23	15 32.40	15 31.60	−2 47.2108
		8 12 50.4008	8 12 46.1308	8 12 45.6873	8 12 44.5573	

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1869phae.proj...354.

Thread Intervals

x Cephei - L. C.

		Intervals			t	log t.
		Mar. 16	Mar. 17	Mar. 18		
B	1	+2 46.0508	+2 46.0572	+2 46.5072	+166.1036	+2.2203790
	2	2 34.2308	2 33.8672	2 34.5572	154.3736	.1885730
	3	2 23.0108	2 21.9172	2 22.8572	142.5711	.1540315
	4	2 10.8308	2 10.8172	2 11.4572	131.0736	.1175152
	5	1 58.6208	1 59.1872	1 59.9572	119.3236	2.0767263
C	1	1 35.3908	1 35.3872	1 35.5372	95.4786	1.9799061
	2	1 22.9408	1 23.3772	1 23.5572	83.3936	.9211327
	3	1 11.9108	1 12.1372	1 12.1472	71.8486	.8564183
	4	0 59.5908	0 59.8972	0 59.5572	59.4386	.7740686
	5	0 47.4208	0 48.1572	0 48.2272	47.8511	.6798919
D	1	0 23.6808	0 23.5872	0 23.9572	23.7061	.3748601
	2	+ 12.0308	+ 11.2072	+ 11.4372	+ 11.6411	+1.0659940
	3	− 0.5492	− 1.0028	− 0.3128	− 0.4664	-9.6687585
	4	0 12.0892	0 11.6828	0 12.4428	12.2039	1.0864987
	5	0 24.3392	0 23.9228	0 24.2428	24.2264	.3842889
E	1	0 47.3192	0 47.1128	0 47.6128	47.2814	.6746903
	2	0 59.1592	0 59.2228	0 59.1428	59.1089	.7716529
	3	1 11.1292	1 11.0128	1 11.2228	71.0189	.8513740
	4	1 22.7692	1 22.7128	1 23.4328	82.9814	.9189808
	5	1 34.4692	1 34.7728	1 34.4328	94.4439	1.9751739
F	1	1 59.1692	1 58.9728	1 58.8628	119.0464	2.0757163
	2	2 9.8692	2 10.6928	2 11.3028	130.6564	.1161307
	3	2 22.6592	2 22.9328	2 23.9628	143.2639	.1561368
	4	2 35.0892	2 34.8428	2 35.7428	155.0889	.1905807
	5	−2 47.0992	−2 46.7128	−2 47.0428	− 167.0164	-2.2227590

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1869phae.proj..354.

Thread Intervals
x Cephei, L.C.

		log. corr.	log f.	f.
B	1	0.0000105	+1.5620762	+ 36.482
	2	92	.5302715	33.906
	3	78	.4957314	31.313
	4	65	.4592164	28.788
	5	55	.4184285	26.208
C	1	35	.3216103	20.971
	2	27	.2628377	18.316
	3	.20	.1981240	15.781
	4	14	.1157749	13.055
	5	9	1.0215987	10.510
D	1	3	0.7165675	5.207
	2	1	+0.4077016	+ 2.557
	3	0	−9.0104662	− 0.102
	4	1	0.4282063	2.680
	5	3	0.7259963	5.321
E	1	9	1.0163971	10.385
	2	14	.1133552	12.982
	3	20	.1930797	15.598
	4	27	.2606858	18.226
	5	35	.3168781	20.743
F	1	55	.4174185	26.147
	2	65	.4578319	28.697
	3	78	.4978367	31.466
	4	92	.5322792	34.063
	5	0.0000107	−1.5644560	− 36.682
				+243.094 −243.092

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Thread Intervals $\delta = +75^\circ 16' 26.''2$

50 Draconis, L. C. $\cos\delta = 9.4051718$

Ober. A. T. M.

		Transit Mar. 14 S	Intervals Mar. 14	t	log. t	log. corr.
B	1	6h 47m 45s.00	+2 23.2936	+ 143.2936	+2.1562268	0.0000078
	2	47 54.64	2 13.6536	133.6536	.1259806	68
	3	48 5.00	2 3.2936	123.2936	.0909405	58
	4	48 14.75	1 53.5436	113.5436	.0551627	49
	5	48 25.49	1 42.8036	102.8036	2.0120083	40
C	1	48 46.17	1 22.1236	82.1236	1.9144680	26
	2	48 56.70	1 11.5936	71.5936	.8548742	20
	3	49 6.31	1 1.9836	61.9836	.7922768	15
	4	49 16.78	0 51.5136	51.5136	.7119219	10
	5	49 27.20	0 41.0936	41.0936	.6137742	7
D	1	49 48.19	0 20.1036	20.1036	1.3032739	2
	2	49 58.30	+ 9.9936	+ 9.9936	+0.9997220	1
	3	50 8.50	− 0.2064	− 0.2064	−9.3147097	0
	4	50 18.40	0 10.1064	10.1064	1.0045965	1
	5	50 29.18	0 20.8864	20.8864	.3198636	2
E	1	50 49.40	0 41.1064	41.1064	.6139094	7
	2	50 59.09	0 50.7964	50.7964	.7058329	10
	3	51 9.37	1 1.0764	61.0764	.7858734	15
	4	51 19.90	1 11.6064	71.6064	.8549518	20
	5	51 30.13	1 21.8364	81.8364	1.9129465	26
F	1	51 50.83	1 42.5364	102.5364	2.0108781	40
	2	52 0.90	1 52.6064	112.6064	.0515631	48
	3	52 12.42	2 4.1264	124.1264	.0938641	57
	4	52 22.12	2 13.8264	133.8264	.1265418	68
	5	52 32.57	−2 24.2764	− 144.2764	−2.1591953	0.0000079
		6 5 0 8.2936				

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Thread Intervals

50 Draconis L.C.

		log. f	f.
B	1	+1.5613908	+36.424
	2	.5311456	33.974
	3	.4961065	31.341
	4	.4603296	28.862
	5	.4171761	26.132
C	1	.3196372	20.876
	2	.2600440	18.199
	3	.1974471	15.756
	4	.1170927	13.095
	5	1.0189453	10.446
D	1	0.7084455	5.110
	2	+0.4048937	+2.540
	3	-8.7198815	-0.052
	4	0.4097682	2.589
	5	0.7250352	5.309
E	1	1.0190805	10.449
	2	.1114037	12.912
	3	.1910437	15.525
	4	.2601216	18.202
	5	.3181157	20.803
F	1	.4160459	26.064
	2	.4567301	28.624
	3	.4990300	31.552
	4	.5317068	34.018
	5	-1.5643592	- 36.674
			+242.755 -242.753

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1869phae.proj..354.

Thread Intervals — $\delta = +73^\circ 6' 28''.2$

T. Draconis, L. C. — $\cos\delta = 9.4632528$

Obsr. A. T. M.

Transits

		Mar. 1 E	Mar. 14 E	Mar. 16 W	Mar. 17 E.	Mar. 18 W.
B	1	7h 15m 38.80s	7h 15m 30.60s	7h 19m 41.55s	7h 15m 18.71s	7h 19m 39.32s
	2	15 47.33	15 39.68	19 32.67	15 37.50	19 30.59
	3	15 56.40	15 48.59	19 23.67	15 46.60	19 22.00
	4	16 5.10	15 56.91	19 15.18	15 55.48	19 13.31
	5	16 13.72	16 6.05	19 6.59	16 4.20	19 4.36
C	1	16 31.81	16 24.40	18 48.23	16 22.32	18 45.78
	2	16 41.29	16 33.00	18 39.21	16 31.61	18 37.15
	3	16 50.00	16 42.29	18 29.90	16 40.63	18 28.00
	4	16 59.42	16 51.43	18 21.10	16 49.23	18 18.63
	5	17 7.75	17 0.09	18 12.00	16 58.45	18 10.11
D	1	17 25.98	17 18.52	17 54.21	17 16.58	17 52.20
	2	17 35.24	17 27.46	17 44.88	17 25.67	17 42.70
	3	17 44.40	17 36.89	17 35.62	17 34.50	17 33.51
	4	17 53.12	17 45.65	17 26.89	17 43.70	17 25.00
	5	18 2.19	17 54.33	17 17.98	17 52.80	17 15.78
E	1	18 19.90	18 12.27	17 0.40	18 10.40	16 57.81
	2	18 28.93	18 21.00	16 51.24	18 19.00	16 49.21
	3	18 37.50	18 30.02	16 42.46	18 28.35	16 40.40
	4	18 46.71	18 39.10	16 33.17	18 37.19	16 31.41
	5	18 55.60	18 47.92	16 24.09	18 45.59	16 22.32
F	1	19 13.90	19 6.32	16 6.00	19 4.30	16 4.27
	2	19 22.90	19 15.08	15 57.08	19 13.38	15 55.79
	3	19 32.60	19 24.70	15 47.68	19 22.98	15 45.59
	4	19 41.19	19 34.10	15 38.79	19 31.87	15 36.90
	5	19 50.50	19 42.80	15 29.65	19 40.77	15 27.81
		7h 17m 44.0912s	7h 17m 36.3680s	7h 17m 36.0096s	7h 17m 34.4724s	7h 17m 33.9980s

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Thread Intervals
T Draconis, L.C.

		Intervals									
		Mar. 1		Mar. 14		Mar. 15		Mar. 17		Mar. 18	
B	1	+2	5.2912	+2	5.7680	+2	5.5404	+2	5.7624	+2	5.3220
	2	1	56.7612	1	56.6880	1	56.6604	1	56.9724	1	56.5920
	3	1	47.6912	1	47.7780	1	47.6604	1	47.8724	1	48.0020
	4	1	38.9712	1	39.4580	1	39.1704	1	38.9924	1	39.3120
	5	1	30.3712	1	30.3180	1	30.5804	1	30.2724	1	30.3620
C	1	1	12.2812	1	11.9680	1	12.2204	1	12.1524	1	11.7820
	2	1	2.8012	1	3.3680	1	3.2004	1	2.8624	1	3.1520
	3	0	54.0912	0	54.0780	0	53.8904	0	53.8424	0	54.0020
	4	0	44.6712	0	44.9380	0	45.0904	0	45.2424	0	44.6320
	5	0	36.3412	0	36.2780	0	35.9904	0	36.0224	0	36.1120
D	1	0	18.1112	0	17.8480	0	18.2004	0	17.8924	0	18.2020
	2	+0	8.8512	+	8.9080	+	8.8704	+	8.8024	+	8.7020
	3	−	0.3088	−	0.3220	−	0.3896	−	0.0276	−	0.4880
	4	0	9.0288	0	9.2820	0	9.1196	0	9.2276	0	8.9980
	5	0	18.0988	-0	17.9620	0	18.0296	0	18.3276	0	18.2180
E	1	0	35.8088	0	35.9020	0	35.6096	0	35.9276	0	36.1880
	2	0	44.8388	0	44.6320	0	44.7696	0	44.5276	0	44.7880
	3	0	53.4088	0	53.6520	0	53.5496	0	53.8776	0	53.5980
	4	1	2.6188	1	2.7320	1	2.8396	1	2.7176	1	2.5880
	5	1	11.5088	1	11.5520	1	11.9196	1	11.1176	1	11.6780
F	1	1	29.8088	1	29.9520	1	30.0096	1	29.8276	1	29.7280
	2	1	38.8088	1	38.7120	1	38.9296	1	38.9076	1	38.2080
	3	1	48.5088	1	48.3320	1	48.3296	1	48.5076	1	48.4080
	4	1	57.0988	1	57.7320	1	57.2196	1	57.3976	1	57.0980
	5	-2	6.4088	-2	6.4320	-2	6.3596	-2	6.2976	-2	6.1880

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1869phae.proj...354.

Thread Intervals
T Draconis, L.C.

		t	log. t.	log. corr.	log. f.	f.
B	1	+ 125.5368	+2.0987710	0.0000060	+1.5620178	+36.477
	2	116.7348	.0672004	51	.5304481	33.919
	3	107.8008	2.0326220	44	.4958704	31.324
	4	99.1848	1.9964451	37	.4596942	28.820
	5	90.3808	.9560761	31	.4193258	26.262
C	1	72.0808	.8578196	20	.3210704	20.945
	2	63.0768	.7998696	15	.2631209	18.328
	3	53.9808	.7322393	12	.1954909	15.685
	4	44.9148	.6523895	8	.1156415	13.051
	5	36.1488	.5580939	6	1.0213461	10.504
D	1	18.0508	1.2564965	2	0.7197491	5.245
	2	+ 8.8268	+0.9458033	1	+0.4090560	+ 2.565
	3	− 0.3472	−9.5405797	0	−9.0038325	− 0.101
	4	9.1312	0.9605279	1	0.4237806	2.653
	5	18.1272	1.2583307	2	0.7215833	5.267
E	1	35.8872	.5549396	6	1.0181918	10.428
	2	44.7112	.6504166	8	.1136686	12.992
	3	53.6172	.7293041	12	.1925557	15.580
	4	62.6992	.7972620	15	.2605133	18.219
	5	71.5552	.8546412	20	.3178920	20.792
F	1	89.8652	.9535916	30	.4168414	26.112
	2	98.7132	1.9943753	37	.4576244	28.683
	3	108.4172	2.0350982	45	.4983465	31.503
	4	117.3092	.0693321	52	.5325797	34.086
	5	− 126.3372	−2.1015313	0.0000061	−1.5647780	− 36.709
						+ 243.125 − 243.125

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1869phae.proj..354.

Obers.
Mar. 9 L.B. fr.
" 16 & 18 A.T.M.

Thread Intervals
Groombridge 3241 L.C

δ = +72° 5' 4".9
cos δ = 9.4880016

	Transits			Intervals	
	Mar. 9 W.	Mar. 16 E	Mar. 18. E	Mar. 9.	Mar. 16
B 1	8h 32m 6.83	8h 28m 6.20	8h 28m 4.62	+1 58.0276	+1 58.4292
2	31 58.82	28 14.26	28 12.68	1 50.0176	1 50.3692
3	31 50.40	28 23.00	28 21.13	1 41.5976	1 41.6292
4	31 42.41	28 30.62	28 29.60	1 33.6076	1 34.0092
5	31 34.10	28 39.49	28 37.86	1 25.2976	1 25.1392
C 1	31 16.86	28 56.52	28 55.18	1 8.0576	1 8.1092
2	31 7.98	29 5.40	29 3.89	0 59.1776	0 59.2292
3	30 59.98	29 13.63	29 12.30	0 51.1776	0 50.9992
4	30 51.49	29 22.23	29 20.92	0 42.6876	0 42.3992
5	30 42.84	29 30.70	29 28.74	0 34.0376	0 33.9292
D 1	30 26.00	29 47.30	29 46.00	0 17.1976	0 17.3292
2	30 16.60	29 56.34	29 54.80	+ 7.7976	0 8.2892
3	30 8.60	30 4.60	30 3.28	− 0.2024	+ 0.0292
4	30 0.28	30 13.29	30 11.61	0 8.5224	− 8.6608
5	29 51.79	30 21.69	30 19.78	0 17.3124	0 17.0608
E 1	29 34.97	30 38.43	30 37.00	0 33.8324	0 33.8008
2	29 26.89	30 46.80	30 44.80	0 41.9124	0 42.1708
3	29 18.38	30 55.10	30 53.79	0 50.4224	0 50.4708
4	29 9.62	31 3.83	31 2.30	0 59.1824	0 59.2008
5	29 1.79	31 12.10	31 10.82	1 7.0124	1 7.4708
F 1	28 44.10	31 29.30	31 28.10	1 24.7024	1 24.6708
2	28 35.62	31 37.90	31 36.33	1 33.1824	1 33.2708
3	28 26.22	31 47.29	31 45.70	1 42.5824	1 42.6608
4	28 18.40	31 55.40	31 53.89	1 50.4024	1 50.7708
5	28 9.39	32 4.31	32 2.70	−1 59.4124	−1 59.6808
	8 30 8.8024	8 30 4.6292	8 30 3.1124		

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Thread Intervals

Crombridge, 3241 L.C.

		Interval Mar. 18	t	log. t.	log. cor.	log. f.
B	1	+1 58.4924	+118.3164	+2.0730450	0.0000053	+1.5610413
	2	1 50.4324	110.2731	.0424696	48	.5304664
	3	1 41.9824	101.7364	2.0074763	39	.4954740
	4	1 33.5124	93.7097	1.9717845	34	.4597827
	5	1 25.2624	85.2331	.9306083	28	.4186071
C	1	1 7.9324	68.0331	.8327202	18	.3207200
	2	0 59.2224	59.2097	.7723929	14	.2603931
	3	0 50.8124	50.9964	.7075395	10	.1955401
	4	0 42.1924	42.4264	.6276362	8	.1156370
	5	0 34.3724	34.1131	.5329212	5	1.0209223
D	1	0 17.1124	17.2131	1.2358591	2	0.7238605
	2	+ 8.3124	+ 8.1331	+0.9102561	1	+0.3982576
	3	− 0.1676	− 0.1136	−9.0553783	0	−8.5433799
	4	0 8.4976	8.5603	0.9324890	1	0.4204905
	5	0 16.6676	17.0136	1.2307962	2	0.7187976
I	1	0 33.8876	33.8403	.5294342	5	1.0174353
	2	0 41.6876	41.9236	.6224586	8	.1104594
	3	0 50.6776	50.5236	.7034943	12	.1914947
	4	0 59.1876	59.1903	.7722505	14	.2602507
	5	1 7.7076	67.3969	.8286400	18	.3166398
E	1	1 24.9876	84.7869	.9283288	27	.4163277
	2	1 33.2176	93.2236	1.9695259	33	.4575242
	3	1 42.5876	102.6103	2.0111910	40	.4991886
	4	1 52.7776	110.6503	.0439526	46	.5319496
	5	−1 59.5876	−119.5603	−2.0775870	0.0000055	−1.5655831

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Thread Intervals
Frombridge 3241 L.C.

		f
B	1	+36.395
	2	33.921
	3	31.295
	4	28.826
	5	26.218
C	1	20.928
	2	18.213
	3	15.687
	4	13.051
	5	10.494
D	1	5.295
	2	+ 2.502
	3	− 0.035
	4	2.633
	5	5.234
E	1	10.410
	2	12.896
	3	15.542
	4	18.208
	5	20.732
F	1	26.081
	2	28.676
	3	31.564
	4	34.037
	5	− 36.778
		+242.825 −242.826

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1869phae.proj..354.

Thread Intervals $\delta = +69^\circ\ 55'\ 49.''1$

ε Draconis: E.C. $\cos\delta = 9.5355003$

Uber. A. S. M.

		Transits			Intervals	
		Mar. 16 W.	Mar. 17 E.	Mar. 18 W.	Mar. 16	Mar. 17
B	1	7h 49m 55.s10	7h 46m 21.s00	7h 49m 52.s96	+1 46.2204	+1 46.4520
	2	49 47.96	46 28.69	49 45.50	1 39.0804	1 38.7620
	3	49 40.24	46 36.21	49 38.26	1 31.3604	1 31.2420
	4	49 33.00	46 43.57	49 30.79	1 24.1204	1 23.8820
	5	49 25.18	46 51.20	49 23.30	1 16.3004	1 16.2520
C	1	49 9.94	47 6.42	49 7.90	1 1.0604	1 1.0320
	2	49 2.09	47 14.00	49 0.20	0 53.2104	0 53.4520
	3	48 54.30	47 21.72	48 52.59	0 45.4204	0 45.7320
	4	48 46.76	47 29.47	48 44.80	0 37.8804	0 37.9820
	5	48 39.80	47 36.80	48 37.19	0 30.9204	0 30.6520
D	1	48 24.00	47 52.40	48 22.19	0 15.1204	0 15.0520
	2	48 16.39	48 0.09	48 14.40	+ 7.5104	+ 7.3620
	3	48 8.60	48 7.92	48 6.58	− 0.2796	− 0.4680
	4	48 1.21	48 15.25	47 59.40	0 7.6696	0 7.7980
	5	47 53.81	48 22.88	47 51.63	0 15.0696	0 15.4280
E	1	47 38.60	48 37.54	47 36.44	0 30.2796	0 30.0880
	2	47 30.50	48 44.96	47 28.99	0 38.3796	0 37.5080
	3	47 23.81	48 52.82	47 21.50	0 45.0696	0 45.3680
	4	47 15.97	49 0.60	47 13.90	0 52.9096	0 53.1480
	5	47 8.21	49 7.88	47 6.21	1 0.6696	1 0.4280
F	1	46 52.95	49 23.48	46 51.00	1 15.9296	1 16.0280
	2	46 45.12	49 31.10	46 43.46	1 23.7596	1 23.6480
	3	46 37.12	49 39.50	46 34.83	1 31.7596	1 32.0480
	4	46 29.39	49 46.60	46 27.42	1 39.4896	1 39.1480
	5	46 21.94	49 54.20	46 19.64	−1 46.9396	−1 46.7480
		7h 48m 8.s8796	7h 48m 7.s4520	7h 48m 6.s8432		

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1869phae.proj..354.

Thread Intervals
ε Draconis, L.C.

		Intervals Mar. 18	t	log. t.	log. corr.	log f
B	1	+1 46.1168	+106.2631	+2.0263824	0.0000043	+1.5618784
	2	1 38.6568	98.8331	1.9949024	37	.5303990
	3	1 31.4168	91.3397	.9606596	32	.4961567
	4	1 23.9468	83.9831	.9241919	27	.4596895
	5	1 16.4568	76.3364	.8827317	23	.4182297
C	1	1 .0568	61.0497	.7856836	15	.3211824
	2	0 53.3568	53.3397	.7270506	11	.2625498
	3	0 45.7468	45.6331	.6592850	9	.1947794
	4	0 37.9568	37.9397	.5790940	6	.1145937
	5	0 30.3468	30.6397	.4862846	4	1.0217845
D	1	0 15.3468	15.1731	1.1810744	2	0.7165745
	2	+ 7.5568	+ 7.4764	+0.8736925	1	+0.4091927
	3	− 0.2632	− 0.3369	−9.5275010	0	−9.0630013
	4	0 7.4432	7.6369	0.8829171	1	0.4184173
	5	0 15.2132	15.2369	1.1828966	2	0.7183967
E	1	0 30.4032	30.2569	.4808245	4	1.0163244
	2	0 37.8532	37.9139	.5787985	6	.1142982
	3	0 45.3432	45.2603	.6557174	9	.1912168
	4	0 52.9432	53.0003	.7242783	11	.2597775
	5	1 0.6332	60.5769	.7823071	14	.3178060
F	1	1 15.8432	75.9336	.8804340	23	.4159320
	2	1 23.3832	83.5969	.9221902	27	.4576878
	3	1 32.0132	91.9403	.9635059	32	.4990030
	4	1 39.4232	99.3536	1.9971837	38	.5326802
	5	−1 47.2032	−106.9636	−2.0292401	0.0000043	−1.5647361

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1869phae.proj...354.

Thread Intervals
ε Draconis, L. C

		f
B	1	+36.465
	2	33.916
	3	31.344
	4	28.820
	5	26.196
C	1	20.950
	2	18.304
	3	15.660
	4	13.019
	5	10.514
D	1	5.207
	2	+2.566
	3	−0.116
	4	2.621
	5	5.229
E	1	10.383
	2	13.011
	3	15.532
	4	18.188
	5	20.788
F	1	26.057
	2	28.687
	3	31.550
	4	34.094
	5	−36.706
		+242.961
		−242.962

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1869phae.proj..354.

Thread Intervals

3 Ursae Majoris (+1) M.C

$\delta = +68^\circ 51' 26''.8$

$\log \cos \delta = 9.5571337$

Obsr. A. T. M.

		Transits Mar. 16 E	Transits Mar. 18 E	Intervals Mar. 16	Intervals Mar. 18	t
B	1	7h 60m 59.82s	7h 60m 58.83s	+1 40.8332	+1 41.0668	+100.9500
	2	60 53.27	60 52.20	1 34.2832	1 34.4368	94.3600
	3	60 45.79	60 44.80	1 26.8032	1 27.0368	86.9200
	4	60 38.72	60 37.00	1 19.7332	1 19.2368	79.4850
	5	60 31.31	60 30.58	1 12.3232	1 12.8168	72.5700
C	1	60 17.31	60 15.68	0 58.3232	0 57.9168	58.1200
	2	60 10.00	60 8.66	0 51.0132	0 50.8968	50.9550
	3	60 2.50	60 1.00	0 43.5132	0 43.2368	43.3750
	4	59 55.21	59 54.05	0 36.2232	0 36.2368	36.2300
	5	59 48.00	59 47.09	0 29.0132	0 29.3268	29.1700
D	1	59 33.32	59 32.11	0 14.3332	0 14.3468	14.3400
	2	59 26.29	59 24.61	+ 7.3032	+ 6.8468	+ 7.0750
	3	59 18.70	59 17.49	− 0.2868	− 0.2732	− 0.2800
	4	59 11.59	59 10.52	0 7.3968	0 7.2432	7.3200
	5	59 4.40	59 3.02	0 14.5868	0 14.7432	14.6650
E	1	58 50.24	58 49.10	0 28.7468	0 28.6632	28.7050
	2	58 42.79	58 41.90	0 36.1968	0 35.8632	36.0300
	3	58 35.69	58 34.51	0 43.2968	0 43.2532	43.2750
	4	58 28.79	58 27.40	0 50.1968	0 50.3632	50.2800
	5	58 21.30	58 19.89	0 57.6868	0 57.8732	57.7800
F	1	58 6.84	58 5.59	1 12.1468	1 12.1732	72.1600
	2	57 59.50	57 58.40	1 19.4868	1 19.3632	79.4250
	3	57 51.50	57 50.30	1 27.4668	1 27.4632	87.4650
	4	57 44.65	57 43.40	1 34.3368	1 34.3632	94.3500
	5	57 37.12	57 36.00	−1 41.8668	−1 41.7632	−101.8150
		7 59 18.9868	7 59 17.7632			

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1869phae.proj...354.

Thread Intervals

3 Mus. Majoris (H) U.C.

		log. t.	log. cor	log. f.	f.
B	1	+2.0041063	0.0000039	+1.5612361	+ 36.411
	2	1.9747879	34	.5319182	34.034
	3	.9391197	29	.4962505	31.351
	4	.9002852	25	.4574164	28.669
	5	.8607571	20	.4178888	26.175
C	1	.7643256	13	.3214580	20.963
	2	.7071868	10	.2643195	18.379
	3	.6372395	8	.1943724	15.645
	4	.5590683	6	.1162014	13.068
	5	.4649364	4	1.0220697	10.521
D	1	1.1565492	1	0.7136828	5.172
	2	+0.8497264	1	+0.4068600	+2.552
	3	−9.4471580	0	−9.0042917	−0.101
	4	0.8645111	1	0.4216447	2.640
	5	1.1662821	1	0.7234157	5.290
E	1	.4579576	4	1.0150909	10.354
	2	.5566643	6	.1137974	12.996
	3	.6362371	8	.1933700	15.609
	4	.7013953	10	.2585280	18.135
	5	.7617775	13	.3189099	20.841
F	1	.8582965	20	.4154282	26.027
	2	.8999572	24	.4570885	28.648
	3	.9418343	29	.4989651	31.548
	4	1.9747419	34	.5318722	34.031
	5	−2.0078118	0.0000039	−1.5649416	− 36.723
					+242.940 −242.943

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Obsrs.
Mar. 9 H.B. Jr.
" 16, 17, 18 } A.T.M.

Thread Intervals
δ² Urs. Majoris. U.C.

		Transits				Intervals
		Mar. 9 W	Mar. 16 E	Mar. 17 E	Mar. 18 E	Mar. 9
B	1	8h 56m 52.80	8h 60m 0.79	8h 60m 0.17	8h 59m 59.31	+1 35.7376
	2	56 59.49	59 53.99	59 53.41	59 52.82	1 29.0476
	3	57 6.33	59 47.40	59 46.67	59 45.70	1 22.2076
	4	57 12.72	59 40.59	59 39.85	59 39.24	1 15.8176
	5	57 19.80	59 33.70	59 33.00	59 32.65	1 8.7376
C	1	57 33.50	59 20.08	59 19.40	59 18.79	0 55.0376
	2	57 40.39	59 12.80	59 12.70	59 11.80	0 48.1476
	3	57 47.19	59 6.00	59 5.28	59 4.70	0 41.3476
	4	57 54.19	58 58.80	58 58.57	58 58.39	0 34.3476
	5	58 0.91	58 52.39	58 51.72	58 51.11	0 27.6276
D	1	58 14.83	58 38.60	58 37.91	58 37.56	0 13.7076
	2	58 21.90	58 31.50	58 31.10	58 30.29	+ 6.6376
	3	58 28.71	58 24.60	58 24.31	58 23.41	− 0.1724
	4	58 35.35	58 17.99	58 17.41	58 16.80	0 6.8124
	5	58 42.59	58 10.88	58 10.59	58 9.54	0 14.0524
E	1	58 55.97	57 56.81	57 56.92	57 56.11	0 27.4324
	2	59 2.70	57 50.49	57 50.39	57 49.40	0 34.1624
	3	59 9.33	57 43.91	57 43.20	57 42.74	0 40.7924
	4	59 16.39	57 36.99	57 36.40	57 35.62	0 47.8524
	5	59 23.10	57 29.80	57 29.30	57 28.62	0 54.5624
F	1	59 37.28	57 15.98	57 15.45	57 14.86	1 8.7424
	2	59 43.81	57 9.18	57 9.00	57 8.20	1 15.2724
	3	59 51.49	57 1.66	57 1.33	57 0.65	1 22.9524
	4	59 57.67	56 55.10	56 54.40	56 54.00	1 29.1324
	5	60 5.00	56 48.00	56 48.19	56 46.83	−1 36.4624
		8 58 28.5376	8 58 24.7212	8 58 24.2668	8 58 23.5656	

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Thread Intervals

δ^2 Urs. Majoris. U. C.

Intervals						t	log. t.
Mar. 16		Mar. 17		Mar. 18			
+1	36.0688	+1	35.9032	+1	35.7444	+ 95.8635	+1.9816533
1	29.2688	1	29.1432	1	29.2544	89.1785	.9502601
1	22.6788	1	22.4032	1	22.1344	82.3560	.9156952
1	15.8688	1	15.5832	1	15.6744	75.7360	.8793024
1	8.9788	1	8.7332	1	9.0844	68.8835	.8381153
0	55.3588	0	55.1332	0	55.2244	55,1885	.7418487
0	48.0788	0	48.4332	0	48.2344	48.2235	.6832587
0	41.2788	0	41.0132	0	41.1344	41.1935	.6148287
0	34.0788	0	34.3032	0	34.8244	34.3885	.5364133
0	27.6688	0	27.4532	0	27.5444	27.5735	.4404919
0	13.8788	0	13.6432	0	13.9944	13.8060	1.1400679
+	6.7788	0	6.8332	+	6.7244	+ 6.7435	+0.8288854
−	0.1212	+	0.0432	−	0.1556	− 0.1015	−9.0064660
0	6.7312	−	6.8568	0	6.7656	6.7915	0.8319657
0	13.8412	0	13.6768	0	14.0256	13.8990	1.1429836
0	27.9112	0	27.3468	0	27.4556	27.5365	.4399088
0	34.2312	0	33.8768	0	34.1656	34.1090	.5328690
0	40.8112	0	41.0668	0	40.8256	40.8740	.6114471
0	47.7312	0	47.8668	0	47.9456	47.8490	.6798729
0	54.9212	0	54.9668	0	54.9456	54.8490	.7391687
1	8.7412	1	8.8168	1	8.7056	68.7515	.8372822
1	15.5412	1	15.2668	1	15.3656	75.3615	.8771496
1	23.0612	1	22.9368	1	22.9156	82.9665	.9189028
1	29.6212	1	29.8668	1	29.5856	89.5465	.9520486
−1	36.7212	−1	36.0768	−1	36.7356	− 96.4990	−1.9845228

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Thread Intervals
δ^2 Ms. Majoris, U.C

		log. corr.	log. f.	f.
B	1	0.0000035	+1.5614746	+36.431
	2	31	.5300818	33.891
	3	26	.4955174	31.298
	4	22	.4591250	28.782
	5	18	.4179383	26.178
C	1	12	.3216723	20.974
	2	9	.2630826	18.327
	3	7	.1946528	15.655
	4	5	.1162376	13.069
	5	3	1.0203164	10.479
D	1	1	0.7198926	5.247
	2	1	+0.4087101	+2.563
	3	0	-8.5862908	−0.039
	4	1	0.4117904	2.581
	5	1	0.7228083	5.282
E	1	3	1.0197333	10.465
	2	5	.1126933	12.963
	3	7	.1912712	15.534
	4	9	.2596968	18.184
	5	12	.3189923	20.845
F	1	18	.4171052	26.128
	2	22	.4569722	28.640
	3	26	.4987250	31.530
	4	31	.5318703	34.031
	5	0.0000035	-1.5643441	− 36.673
				+242.894 −242.895

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Thread Intervals

equal weights

		S Urs. Min	No. Obs.	T. Y. C. 1879	No. Obs.	χ Cephei	No. Obs.	50 Draconis	No. Obs.	I Draconis	No. Obs.
B	1	+36.451	1	+36.479	1	+36.482	4	+36.424	1	+36.477	5
	2	33.953		33.884		33.906		33.974		33.919	
	3	31.299		31.356		31.313		31.341		31.324	
	4	28.810		28.870		28.788		28.862		28.820	
	5	26.172		26.092		26.208		26.132		26.262	
C	1	20.961		20.910		20.971		20.876		20.945	
	2	18.336		18.301		18.316		18.199		18.328	
	3	15.628		15.695		15.781		15.756		15.685	
	4	13.127		12.915		13.053		13.095		13.051	
	5	10.502		10.461		10.510		10.446		10.504	
D	1	5.287		5.286		5.207		5.110		5.245	
	2	+ 2.494		+ 2.572		+ 2.557		+ 2.540		+ 2.565	
	3	− 0.102		− 0.087		− 0.102		− 0.052		− 0.101	
	4	2.603		2.591		2.680		2.569		2.653	
	5	5.256		5.226		5.321		5.309		5.267	
E	1	10.393		10.431		10.385		10.449		10.428	
	2	12.964		12.998		12.982		12.912		12.992	
	3	15.624		15.544		15.598		15.525		15.580	
	4	18.231		18.201		18.226		18.202		18.219	
	5	20.790		20.739		20.743		20.803		20.792	
F	1	26.101		26.165		26.147		26.064		26.112	
	2	28.689		28.646		28.697		28.624		28.683	
	3	31.548		31.497		31.466		31.552		31.503	
	4	34.036		34.052		34.063		34.018		34.086	
	5	− 36.685		− 36.644		− 36.682		− 36.674		− 36.709	
		+243.020 −243.022		+242.821 −242.821		+243.094 −243.092		+242.755 −242.753		+243.125 −243.125	

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Thread Intervals

Equal weights

		Groomb. 3241	No. Obs.	E Draconis	No. Obs.	3 Urs. Maj.	No. Obs.	δ^2 Urs. Maj	No. Obs.	Mean of the 24 observations
B	1	+36.395	3	+36.465	3	+36.411	2	+36.431	4	+36.450
	2	33.921		33.916		34.034		33891		33.924
	3	31.295		31.344		31.351		31.298		31.320
	4	28.826		28.820		28.669		28.782		28.800
	5	26.218		26.196		26.175		26.178		26.202
C	1	20.928		20.950		20.963		20.974		20.950
	2	18.213		18.304		18.379		18.327		18.307
	3	15.687		15.660		15.645		15.655		15.691
	4	13.051		13.019		13.068		13.069		13.051
	5	10.494		10.514		10.521		10.479		10.498
D	1	5.295		5.207		5.172		5.247		5.232
	2	+2.502		+2.566		+2.532		+2.563		+2.551
	3	−0.035		−0.116		−0.101		−0.039		−0.082
	4	2.633		2.621		2.640		2.581		2.630
	5	5.234		5.229		5.290		5.282		5.271
E	1	10.410		10.383		10.354		10.465		10.413
	2	12.896		13.011		12.996		12.963		12.972
	3	15.542		15.532		15.609		15.534		15.565
	4	18.208		18.188		18.135		18.184		18.201
	5	20.732		20.788		20.841		20.845		20.787
F	1	26.081		26.057		26.027		26.128		26.102
	2	28.676		28.687		28.648		28.640		28.671
	3	31.564		31.550		31.548		31.530		31.522
	4	34.037		34.094		34.031		34.031		34.057
	5	−36.778		−36.706		−36.723		−36.673		−36.703
		+242.825 −242.826		+242.961 −242.962		+242.940 −242.943		+242.894 −242.895		+242.976 −242.976

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Thread Intervals
C. S. Transit, No. 5
Cambridge 1869

		Intervals	Tallies	Sums	Means	log. means
B	1	+36.450				
	2	33.924	B	+156.696	+31.339	+1.49609
	3	31.320	C	+78.497	+15.699	+1.19587
	4	28.800	D	−0.200	−0.040	−8.60206
	5	26.202	E	−77.938	−15.588	−1.19279
C	1	20.950	F	−157.055	−31.411	−1.49708
	2	18.307				
	3	15.691				
	4	13.051	BC	+235.193	+23.519	+1.37142
	5	10.498	BCD	+234.993	+15.666	+1.19496
D	1	5.232	BCDE	+157.055	+7.853	+0.89504
	2	+2.531				
	3	−0.082				
	4	2.630	CD	+78.297	+7.830	+0.89376
	5	5.271	CDE	+0.359	+0.024	+8.38021
E	1	10.413	CDEF	−156.696	−7.835	−0.89404
	2	12.972				
	3	15.565				
	4	18.201	DE	−78.138	−7.814	−0.89287
	5	20.787	DEF	−235.193	−15.680	−1.19535
F	1	26.102				
	2	28.671				
	3	31.522	EF	−234.993	−23.499	−1.37105
	4	34.057				
	5	−36.703				
		+242.976				
		−242.976				

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$\varphi = +42^\circ\ 22'\ 48.1''$ · Star Constants

Star	$\frac{\delta}{180^\circ - \delta \text{ for } L.C.}$	$\varphi - \delta$	Sin $(\varphi - \delta)$	cos $(\varphi - \delta)$	Cos. δ
δ Persei	+47° 22′ 0″	−4° 59′ 12″	8.93914 n	9.99835	9.83078
η Tauri	+23 41 48	+18 41 0	9.50561	9.97649	9.96175
ζ Persei	+31 29 30	+10 53 18	9.27622	9.99211	9.93080
γ Eridani	−13 53 15	+56 16 3	9.919935	9.74454	9.98712
Groom. 2320. L.C.	+111 50 54	−69 28 6	9.97150 n	9.54496	9.57072 n
γ Tauri	+15 18 25	+27 4 23	9.65813	9.94960	9.98431
ε Tauri	+18 53 9	+23 29 39	9.60060	9.96242	9.97597
α Tauri	+16 14 29	+26 8 19	9.64399	9.95315	9.98231
α Camelop. (a.c.)	+66 7 4	−23 44 16	9.60482 n	9.96161	9.60730
ι Aurigæ	+32 57 19	+9 25 29	9.21419	9.99410	9.92381
11 Orionis	+15 13 1	+27 9 47	9.65946	9.94925	9.98450
Capella	+45 51 42	−3 28 54	8.78340 n	9.99920	9.84285
β Tauri	+28 29 34	+13 53 14	9.38023	9.98712	9.94393
Groom. 966 U.C.	+74 57 10	−32 34 22	9.73108 n	9.92568	9.41433
δ Orionis	−0 24 8	+42 46 56	9.83201	9.86566	9.99999
α Leporis	−17 55 23	+60 18 11	9.93885	9.69497	9.97840
ε Orionis	−1 17 30	+43 40 18	9.83918	9.85932	9.99989
α Columbæ	−34 9 6	+76 31 54	9.98789	9.36718	9.91780
ω Draconis L.C.	+111 11 8	−68 48 20	9.96958 n	9.55815	9.55798 n
ψ Draconis (a.c.)	+107 47 28	−65 24 40	9.9587152 n	9.61920	9.4850789 n
α Orionis	+7 22 37	+35 0 11	9.75862	9.91335	9.99639
22 Camelop. U.C.	+69 21 46	−26 38 58	9.65679 n	9.94995	9.54710
μ Geminor	+22 34 35	+19 48 13	9.52994	9.97352	9.96538
γ Geminor	+16 30 22	+25 52 26	9.63988	9.95413	9.98172

The δ is taken for a date intermediate between the extreme dates on which the star is used in the Time Comp[illegible]

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Cambridge, 1869

$K = -0^s.021 \cos\phi \sec\delta$

$\log K = [8.19068] \log\sec\delta$

Star	A	B	C	K	A^2
δ Persei	−0.128	+1.471	+1.476	−.023	0.016
η Tauri	+0.350	+1.035	+1.092	−.017	0.122
ξ Persei	+0.222	+1.152	+1.173	−.018	0.049
χ Eridani	+0.857	+0.572	+1.030	−.016	0.734
Groom. 2320 L.C.	+2.516	−0.942	−2.687	+.042	6.332
χ Tauri	+0.472	+0.923	+1.037	−.016	0.223
ε Tauri	+0.421	+0.969	+1.057	−.016	0.178
α Tauri	+0.459	+0.935	+1.042	−.016	0.211
α Camel. U.C (9)	−0.994	+2.261	+2.470	−.038	0.989
ι Aurigae	+0.195	+1.176	+1.192	−.018	0.038
11 Orionis	+0.473	+0.922	+1.036	−.016	0.224
Capella	−0.087	+1.433	+1.436	−.022	0.008
β Tauri	+0.273	+1.105	+1.138	−.018	0.075
Groom. 966 U.C.	−2.074	+3.246	+3.852	−.060	4.300
δ Orionis	+0.679	+0.734	+1.000	−.016	0.461
α Leporis	+0.913	+0.521	+1.051	−.016	0.833
ε Orionis	+0.691	+0.723	+1.000	−.016	0.477
α Columbae	+1.175	+0.281	+1.208	−.019	1.381
ω Draconis, L.C.	+2.580	−1.000	−2.767	+.043	6.656
χ' Draconis (pr.) L.C.	+2.976	−1.362	−3.273	+.051	8.857
α Orionis	+0.578	+0.826	+1.008	−.016	0.335
22 Camel. U.C. (H)	−1.287	+2.528	+2.837	−.044	1.657
M Geminor	+0.367	+1.019	+1.083	−.017	0.135
γ Geminor	+0.455	+0.938	+1.043	−.016	0.207

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Star Constants

Star	δ	180° − δ for L.C	Φ − δ	Sc (φ − δ)	Cos (φ − δ)	cos δ
Sirius	−16° 32′ 37″		+58° 55′ 25″	9.93272	9.71280	9.98164
ε Can. Maj.	−28 48 4		+71 10 52	9.97614	9.50863	9.94265
δ Can. Maj.	−26 11 31		+68 34 19	9.96889	9.56269	9.95295
δ Geminor.	+22 13 9		+20 9 39	9.53739	9.97254	9.96649
P VII. 67, U.C.	+68 43 46		−26 20 38	9.64723 n	9.95236	9.55963
J Draconis, L.C.	+106 53 30		−64 30 42	9.95553 n	9.63380	9.46324 n
α Can. Min.	+ 5 33 19		+36 49 29	9.77789	9.90335	9.99796
β Geminor.	+28 20 19		+14 8 29	9.38493	9.98683	9.94456
φ Geminor.	+27 6 3		+15 16 45	9.42082	9.98437	9.94949
ε Draconis L.C.	+110 4 8		−67 41 20	9.96621 n	9.57937	9.53548 n
3 Urs. Maj. (H) U.C.	+68 51 18		−26 28 30	9.64915 n	9.95189	9.55718
15 Argus	−23 56 0		+66 18 48	9.96178	9.69324	9.96095
χ Cephei L.C.	+102 41 13		−60 18 25	9.93887 n	9.69497	9.34168 n
Groomb. 3241 L.C.	+107 54 49		−65 32 1	9.95914 n	9.61717	9.48796 n
ε Hydrae	+ 6 53 42		+35 29 6	9.76379	9.91077	9.99685
ι Urs. Maj.	+48 33 12		− 6 10 24	9.03156 n	9.99747	9.82081
52 Urs. Maj. U.C.	+67 39 49		−25 17 1	9.63053 n	9.95627	9.57983
χ Cancri	+11 11 29		+31 11 19	9.71421	9.93220	9.99166
1 Draconis (H) U.C.	+81 54 9½		−39 31 21½	9.80371862	9.88726	9.14877 92
θ Urs. Maj.	+52 16 16		−9 53 28	9.23496 n	9.99350	9.78670
ε Leonis	+24 22 26		+18 0 22	9.49012	9.97819	9.95946
11 Cephei L.C.	+109 17 35		−66 54 47	9.96375 n	9.59343	9.51904 n

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Star	A	B	C	x	A^2
Sirius	+0.893	+0.538	+1.043	−.016	0.798
ε Can. Maj.	+1.080	+0.368	+1.141	−.018	1.167
δ Can. Maj.	+1.037	+0.407	+1.114	−.017	1.076
δ Geminor.	+0.372	+1.014	+1.080	−.017	0.139
P VII 67 U.C.	−1.223	+2.470	+2.757	−043	1.497
T Draconis L.C.	+3.107	−1.481	−3.442	+.053	9.651
α Can. Min.	+0.602	+0.804	+1.005	−.016	0.363
β Geminor	+0.276	+1.102	+1.136	−.018	0.076
γ Geminor	+0.296	+1.084	+1.123	−.017	0.088
ε Draconis L.C.	+2.696	−1.106	−2.914	+.045	7.269
3 Urs. Maj (H) U.C.	−1.236	+2.481	+2.772	−.043	1.527
15 Argus	+1.002	+0.440	+1.094	−.017	1.004
χ Cephei L.C.	+3955	−2.255	−4.553	+.071	15.645
Groomb. 3241. L.C.	+2.959	−1.346	−3.251	+.050	8.757
ε Hydrae	+0.585	+0.820	+1.007	−.016	0.342
ζ Urs. Maj.	−0.162	+1.502	+1.511	−.023	0.026
δ^2 Urs. Maj. U.C.	−1.124	+2.379	+2.631	−.041	1.263
χ Cancri	+0.528	+0.872	+1.019	−.016	0.279
1 Draconis (H) U.C.	−4.518	+5.476	+7.099	−.110	20.412
θ Urs. Maj.	−0.281	+1.610	+1.634	−.025	0.079
ε Leonis	+0.339	+1.044	+1.098	−.017	0.115
11 Cephei, L.C.	+2.784	−1.187	−3.027	+.047	7.752

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Star Constants

Star	$\frac{\delta}{180-\delta \text{ for } L.C}$	$\varphi - \delta$	$\sin(\varphi-\delta)$	$\cos(\varphi-\delta)$	$\cos\delta$
δ Cratetis	−14° 4′ 18″	+56° 27′ 6″	9.92086	9.74244	9.98677
τ Leonis	+ 3 34 32	+38° 48′ 16″	9.79703	9.89170	9.99915
91 (μ) Leonis	− 0 6 8	+42 28 56	9.82954	9.86775	0.00000
γ Cephei L.C.	+103 5 54	−60 43 6	9.94063 n	9.68940	9.35580 n
β Leonis	+15 18 8	+27 4 40	9.65820	9.94958	9.98432
γ Urs. Maj.	+54 25 12	−12 2 24	9.31930 n	9.99034	9.76480
ο Virginis	+ 9 27 32	+32 55 16	9.73519	9.92398	9.99405
4 Draconis (H) U.C	+78 20 29	−35 57 41	9.76882 n	9.90817	9.30552
η Virginis	+ 0 3 37	+42 19 11	9.82819	9.86888	0.00000
β Corvi	−22 40 17	+65 3 5	9.95746	9.62511	9.96508
21 Cassiop. U.C	+105 43 38	−63 20 50	9.95121 n	9.65184	9.43306 n
12 Can. Ven.	+ 39 1 25	+ 3 21 23	8.76750	9.99925	9.89036
θ Virginis	− 4 50 22	+47 13 10	9.86567	9.83199	9.99845
A (38) Cassiop. L.C	+110 24 − 32	−68 1 44	9.96725 n	9.57303	9.54247 n
γ Virginis	+ 0 4 26	+42 18 22	9.82807	9.86897	0.00000
η Urs. Maj.	+49 57 53	− 7 35 5	9.12055 n	9.99618	9.80839
η Bootis	+19 3 13	+23 19 35	9.59766	9.96297	9.97553
α Dracon. U.C	+64 59 56	−22 37 8	9.58501 n	9.96524	9.62597
α Bootis	+19 51 49	+22 30 59	9.58314	9.96556	9.97336
θ Bootis	+52 27 14	−10 4 26	9.24283 n	9.99325	9.78490
5 Urs. Minll. C.	+76 16 28	−33 53 40	9.74637 n	9.91911	9.37525
ε Bootis	+27 37 31	+14 45 17	9.40600	9.98544	9.94743
α² Librae	−15 29 41	+57 52 29	9.92783	9.72573	9.98392

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Star	A	B	C	x	A^2
δ Cratevis	+0.859	+0.570	+1.031	−.016	0.738
T Leonis	+0.628	+0.781	+1.002	−.016	0.394
91(ν) Leonis	+0.675	+0.737	+1.000	−.016	0.456
χ Cephei L.C.	+3.849	−2.158	−4.413	+.068	14.813
β Leonis	+0.472	+0.923	+1.037	−.016	0.223
χ Urs. Maj.	−0.359	+1.681	+1.719	−.027	0.129
o Virginis	+0.551	+0.851	+1.014	−.016	0.304
4 Draconis(H)U.C.	−2.906	+4.005	+4.949	−.077	8.445
η Virginis	+0.673	+0.739	+1.000	−.016	0.453
β Corvi	+0.983	+0.457	+1.084	−.017	0.966
21 Cassiop. L.C.	+3.297	−1.655	−3.689	+.057	10.872
12 Can. Ven.	+0.075	+1.285	+1.287	−.020	0.006
θ Virginis	+0.737	+0.682	+1.004	−.016	0.543
A(38) Cassiop. L.C.	+2.659	−1.073	−2.868	+.044	7.072
ε Virginis	+0.673	+0.740	+1.000	−.016	0.453
η Urs. Maj.	−0.205	+1.541	+1.555	−.024	0.042
η Bootis	+0.419	+0.971	+1.058	−.016	0.175
α Draconis, U.C.	−0.910	+2.184	+2.366	−.037	1.828
α Bootis	+0.407	+0.982	+1.063	−.016	0.166
θ Bootis	−0.287	+1.616	+1.641	−.025	0.082
5 Urs. Min. U.C.	−2.350	+3.498	+4.215	−.065	5.524
ε Bootis	+0.287	+1.091	+1.129	−.018	0.083
α^2 Librae	+0.879	+0.552	+1.038	−.016	0.772

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Daily and Hourly approximate rate of clock as obtained from Field Time Book –

(Used for correcting Co for rate)

	Daily rate for interval	Date	Approximate Daily rate (at time of observations)	Hourly rate
Feb 2	s – 0.54	Feb. 4	– 0.41	– .017
" 4	– 0.28	" 5	– 0.40	– .017
" 5	– 0.51	" 7	– 0.60	– .025
" 7	– 0.69	" 9	– 0.58	– .024
" 9	– .047	" 12	– 0.45	– .019
" 12	– 0.43	" 13	– 0.46	– .019
" 13	– 0.49	" 17	– 0.12	– .005
" 17	– 0.03	" 18	– 0.03	– .001
" 18	– 0.03 – 0.26	" 19	– 033	– .014
" 19	– 0.40	"24	– 0.50	– .021
" 24	– 0.60	"25	– 0.49	– .020
"25	– 0.38	"27	– 0.38	– .016
" 27	– 0.38 – 0.58	"28	– 0.56	– .023
"28	– 0.54	Mar. 1	– 0.63	– .026
Mar. 1	– 0.72	" 3	– 0.67	– .028
" 3	– 0.63	" 5	– 0.68	– .028
" 5	– 0.74	" 7	– 0.73	– .030
" 7	– 0.72	" 9	– 0.76	– .032
" 9	– 0.79			
" 18	– 0.32	" 21	– 0.46	– .019
" 21	– 0.61	" 24	– 0.73	– .030
" 24	– 0.85	" 25	– 0.85	– .035
" 25				

clock losing throughout

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1869phae..proj..354.

Clock

and

Instrumental corrections

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Time and Instrumental Corrections

Cambridge, 1869

February 4

	α Camelop. M.C.		ζ Aurigæ	11 Orionis	Capella	β Tauri
Lamp	W.	E	E	E	E	E
Tallies	B. C.	C 5432	E D C 521	E D C	E D C	E D C
α	4h 41m 3.64s		4 48 28.30	4 57 5.48	5 7 1.53	5 18 1.20
δ	+66° 7′ 3″.3		+32° 57′ 19″	+15 13 1	+45 51 41.4	+28 29 33.4
M	4 39 59.301	4 41 33.538	4 48 19.661	4 56 59.250	5 6 5.5431	5 17 54.991
f	+23.519	−14.387	+2.183	−0.024	−0.024	−0.024
log f	1.37142	1.15797n	0.33.905	8.38021n	8.38021n	8.38021n
log sec δ	0.39269	0.39269	0.07619	0.01550	0.15714	0.05607
log ρ						
log σ						
log R	1.76411	1.55066n	0.41524	8.39571n	8.53735n	8.43628n
R	+58.091	−35.535	+2.602	−.025	−.034	−.027
l_0	−.066	−.078	−.078	−.078	−.078	−.078
A	−.994		+.195	+0.473	−0.087	+0.273
B	+2.261		+1.176	+0.922	+1.433	+1.105
C	+2.470		+1.192	+1.036	+1.436	+1.138
x	−0.038	−0.038	−0.018	−0.016	−.022	−.018
B l_0	−0.149	−0.176	−.092	−.072	−.112	−.086
T	4 40 57.392	4 40 58.003	4 48 22.263	4 56 59.225	5 6 55.397	5 17 54.964
t	4 40 57.205	4 40 57.789	4 48 22.153	4 56 59.137	5 6 55.263	5 17 54.860
w	+6.435	+5.851	+6.147	+6.343	+6.267	+6.340
C_c			+.166	+.144	+.200	+.158
w_0	+6.143		+6.313	+6.487	+6.467	+6.498
$\{w_0\}$	+6.151		+6.319	+6.491	+6.468	+6.496

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1869phae.proj.:.354:

February 4th

C = +0.139
Umly rate = −0.017

Star	Gromb. 966 U.C		α Leporis	ε Ouinis	δ Draconis, L.C.	
damp	E	W	W	W	W	E
Tallies	F. E	D_{345} E F	C D E	C D E	F E	E F
α	5h 22m 16.08s		5h 26m 57.75	5h 29m 34.48	5h 37m	40.83s
δ	+74°	57′ 8.″8	−17° 55′ 22″	−1° 17′ 29.″6	+68° 48′	54.″7
M	5 20 39.491	5 23 21.005	5 26 51.106	5 29 27.925	5 36 29.908	5 38 39.119
Z	+23.499	−18.6905	+0.024	+0.024	+23 499	−23.499
log Z	1.37105	1.27162n	8.38021	8.38021	1.37105	1.37105n
log sec δ	0.58566	0.58566	0.02160	0.00011	0.44204	0.44204
log ρ						
log σ						
log R	1.95671	1.85728n	8.40181	8.38032	1.81309	1.81309n
R	+1 30.513	−1. 11.991	+.025	+.024	+1 5.026	−1 5.026
b_0	−.078	−.090	−.090	−.090	−.090	−.030
A	+2.074		+.913	+.691	+2.	580
B	+3.246		+.521	+.723	−1.	000
C	+3.852		+1.051	+1.000	−2.	767
x	−.060	−.060	−.016	−.016	+.043	+.043
Bb_0	−.253	−.292	−.047	−.065	+.090	+.030
T	5 22 10.004	5 22 9.014	5 26 51.131	5 29 27.949	5 37 34.934	5 37 34.093
t	5 22 9.691	5 22 8.662	5 26 51.068	5 29 27.868	5 37 35.067	5 37 34.166
w	+6.389	+7.418	+6.682	+6.612	+5.763	+6.664
C_c			−.146	−.139		
w_0	+6	904	+6.536	+6.473	+6.	213
(w_0)	+6.	901	+6.531	+6.467	+6	205

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1869phae.proj..354.

February 4th 1869

Collimation

Star	Time	C_c	C	c
α Camelop. U.C	4h 41m	+0.292	+2.470	+0.118
Groomb. 966 U.C	5h 22m	+0.5145	+3.852	+0.133
ω Dracnis, L.C.	5 38m	−0.4505	−2.762	+0.163

$T = 5^h 12^m$

$\theta = +6.540$

Clock and Azmuth Corrections. Observer A.T.W.

Star	Lamp	(w_0)	A	w_0'	A^2	Aw_0'	Na	Δt
α Camelop. U.C	W-E	+6.151	−.994	−.389	.989	+.387	+.088	+6.063
ι Aurigae	E	6.319	+.195	−.221	.038	−.043	−.017	6.336
11 Orionis	E	6.491	+.473	−.049	.224	−.023	−.042	6.533
Capella	E	6.468	−.087	−.072	.008	+.006	+.008	6.460
β Tauri	E	6.496	+.273	−.044	.075	−.012	−.024	6.520
Groomb. 966, U.C.	E-W	6.901	−2.074	+.361	4.300	−.749	+.185	6.716
α Leporis	W	6.531	+.913	−.009	.833	−.008	−.081	6.612
ε Orionis	W	6.467	+.691	−.073	.477	−.050	−.061	6.528
ω Dracnis L.C.	W-E	6.205	+2.580	−.335	6.656	−.864	−.230	6.435
			+1.970	−0.831	+13.600	−1.356		+6.467

$$+9\,\Delta\theta + 1.970\,a = -0.831$$

$$+\quad 1.970\,\Delta\theta + 13.600\,a = -1.356$$

$$\Delta\theta + 0.2189\,a = -0.0923$$

$$+1.970\,\Delta\theta + 0.431\,a = -.182$$

$$+13.169\,a = -1.174$$

$$a = -.089$$

$$\Delta\theta + 2189a = -0.0923$$

$$\Delta\theta - .0195 = -0.0923$$

$$\Delta\theta = -0.073$$

$$\theta + 6.467$$

$\Delta t = +6.467 \pm .042$

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1869phae.proj.:.354:

February 4th 1869

Rejecting α Camelop.

$A = +2.964$

$\omega'_0 = -0.442$

$A^2 = +12.611$

$A\omega'_0 = -1.743$

$a = -.137$

	Δa	Δt
ν Aurigæ	−.027	+6.346
11 Oriouis	−.065	6.556
Capella	+.012	6.456
β Tauri	−.037	6.533
Groom. 966 UC	+.284	6.617
α Leporis	−.125	6.656
ε Oriouis	−.095	6.562
ω Tauri Lo	−.353	6.558
		+6536

$+8\Delta\theta + 2.964\,a = -0.442$

$+2.964\Delta\theta + 12.611\,a = -1.743$

$\Delta\theta + .3705\,a = -0.05525$

$+2.964\Delta\theta + 1.098\,a = -0.164$

$+11.513\,a = -1.579$

$a = -.137$

$\Delta\theta - .0507 = -.05525$

$\Delta\theta = -.0045$

$\Delta t = +6.536 \pm .017$ Value adopted

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1869phae.proj..354.

February 5, 1869

Star	β Tauri	δ Orionis	α Leporis	ε Orionis	d Draconis,	L. C.
Lamp	W	W	W	W	W.	E
Vallies	C D E	C_{2345} D E	C D E	C D E	F. E	E. F.
α	5h 18m 1.19	5h 25m 19.34	5h 26m 57.74	5h 29m 34.46	5h 37m	40.88
δ	+28° 29′ 33.″4	−0 24 7.7	−17 55 22.1	−1 17 29.7	+68 48	54.5
M	5 17 54.439	5 25 14.000	5 26 50.895	5 29 27.680	5 36 29.673	5 38 39.000
t	+0.024	−1.471	+0.024	+0.024	+23.499	−23.499
log. t.	8.38021	0.16761n	8.38021	8.38021	1.37105	1.37105n
Sec δ	0.05607	0.00001	0.02160	0.00011	0.442038	0.442038
Log. ρ						
log. σ						
log. R	8.43628	0.16762n	8.40181	8.38032	1.813088	1.813088n
R	+.027	−1.471	+.025	+.024	+1m 5s.026	−1 5.026
b_0	−.114	−.118	−.120	−.127	−.138	−.038
A	+.273	+.679	+.913	+.691	+2.580	
B	+1.105	+.734	+.521	+.723	−1.000	
C	+1.138	+1.000	+1.051	+1.000	−2.767	
x	−.018	−.016	−.016	−.016	+.043	
Bb_0	−.126	−.087	−.063	−.092	+.138	+.038
T	5 17 54.466	5 25 12.529	5 26 50.920	5 29 27.704	5 37 34.699	5 37 33.974
t	5 17 54.322	5 25 12.426	5 26 50.841	5 29 27.596	5 37 34.880	5 37 34.055
w	+6.868	+6.914	+6.899	+6.864	+6.000	+6.825
C_c	−.158	−.139	−.146	−.139		
w_0	+6.710	+6.775	+6.753	+6.725	+6.413	
(w_0)	+6.729	+6.790	+6.768	+6.740	+6.425	

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1869phae.proj..354.

February 5th 1869

Star	α Orionis	ε Can. Maj.	δ Can. Maj	δ Geminin	P VII 67. U.C	
Samp	E	E	E	E	E	W
Tallies	E D C	E D C	E D C	E D C	F E	E F
		Doubtful				
α	5 48 5.35	6 53 29.79	7 3 5.01	7 12 18.69	7 17 15.71	
δ	+7 22 37.9	-28 48 0.0	-26 11 27.1	+22 13 8.1	+68 43 42.2	
M	5 47 58.921	6 53 23.562	7 2 58.624	7 12 12.270	7 16 4.355	7 18 13.396
Y	-0.024	-0.024	-0.024	-0.024	+23.499	-23.499
log Y	8.38021 n	8.38021 n	8.38021 n	8.38021 n	1.37105	1.37105 n
Sec δ	0.00361	0.05734	0.04705	0.03351	0.440345	0.440345
log S						
log σ						
log R	8.38382 n	8.43755 n	8.42726 n	8.41372 n	1.811395	1.811395 n
R	-.024	-.027	-.027	-.026	+1. 4.773	-1 4.773
b_o	-.038	-.038	-.053	-.064	-.069	-.154
A	+.578	+1.080	+1.037	+.372	-1.223	
B	+.826	+.368	+.407	+1.014	+2.470	
C	+1.008	+1.141	+1.114	+1.080	+2.757	
x	-.016	-.018	-.017	-.017	-.043	-.043
Bb_o	-.031	-.014	-.022	-.065	-.170	-.380
T	5 47 58.897	6 53 23.535	7 2 58.597	7 12 12.244	7 17 9.128	7 17 8.623
t	5 47 58.850	6 53 23.503	7 2 58.558	7 12 12.162	7 17 8.915	7 17 8.200
w	+6.500	+62 87	+6.452	+6.528	+6.795	+7.510
C_c	+.140	+.159	+.155	+.150		
w_o	+6.640	+6.446	+6.607	+6.678	+7.152	
(w_o)	+6.650	+6.437	+6.595	+6.664	+7.137	
		Reject				

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c = +0.139
Hourly rate = −.017

February 5th " 1869

Star	α Can. Min	β Geminor.
Lamp	Pr.	Pr
Fellow	C. D. E.	C. D. E
α	7h 32m 27.526	7 37 18.696
δ	+5° 33′ 19″8	+28·20 17.7
M	7 32 20.607	7 37 11.851
γ	+0.024	+0.024
log. r.	8.38021	8.38021
Sec. δ	0.00204	0.05544
log ρ		
log. σ		
log. R	8.38225	8.43565
R	+.024	+.027
l_0	−.158	−.160
A	+.602	+.276
B	+.804	+1.102
C	+1.005	+1.136
K	−.016	−.018
$2b_0$	−.127	−.176
T	7 32 20.631	7 37 11.878
t	7 32 20.488	7 37 11.684
w	+7.038	+7.012
C_c	−.140	−.158
w_0	+6.898	+6.854
(w_0)	+6.878	+6.832

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1869phae.proj..354.

February 5th 1869

Collimation

Star	Time	Cc	C	c
ω Draconis L.C.	5h 38m	−0.4125	−2.767	+.149
P VII 67. U.C	7 17	+0.3575	+2.757	+.130

$\Sigma_0 = 6^h 21^m$

$\theta = +6^s.830$

Obsr. a. T.M.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Δa	Δt
β Tauri	W	+6.729	+.273	−.101	.075	−.028	−.049	+6778
δ Ursæ	W	6.790	+.679	−.040	.461	−.027	−.122	6.912
α Leonis	W	6.768	+.913	−.062	.833	−.057	−.164	6.932
ε Ursæ	W	6.740	+.691	−.090	.477	−.062	−.124	6.864
ω Draconis, L.C.	W-E	6.425	+2.580	−.405	6.656	−1.045	−.464	6.889
α Ursæ	E	6.650	+.578	−.180	.335	−.104	−.104	6.754
δ Can. Maj.	E	6.595	+1.037	−.235	1.076	−.244	−.187	6.782
δ Geminor	E	6.664	+.372	−.166	.139	−.062	−.067	6.731
P VII. 67. U.C.	E-W	7.137	−1.223	+.307	1.497	−.375	+.220	6.917
α Can. Min	W	6.878	+.602	+.048	.363	+.029	−.108	6.986
β Geminor	W	6.832	+.276	+.002	.076	+.001	−.050	6.882
			+6.778	−.922	11.988	−1.974		+6.857

$11\Delta\theta + 6.778\,a = -.922$

$+6.778\Delta\theta + 11.988\,a = -1.974$

$\Delta\theta + .6162\,a = -.0838$

$+6.778\Delta\theta + 4.171\,a = -.568$

$+7.811\,a = -1.406$

$a = -.180$

$\Delta\theta - .1109 = -.0838$

$\Delta\theta = +.027$

$\Delta t = +6.857 \pm .017$

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1869phae.proj..354.

February 7th 1869

Star	δ Persei	η Tauri	ζ Persei	γ' Eridani	Groomb. 2320. L.C	
Samp	W	W	W	W	W	E
Tallies	C D E	C D E	C D E	C D E	F. E	E F
α	3 33 36.39	3 39 41.97	3 45 54.12	3 51 54.98	4 51	56.91
δ	+47 22 0.1	+23 41 47.6	+31 29 29.7	−13 53 15.2	+68 9	6 5
M	3 33 28.621	3 39 34.033	3 45 46.207	3 51 46.953	4 4 46.345	4 6 51.617
Z	+0.024	+0.024	+0.024	+0.024	+23.499	−23.499
log. Z	8.38021	8.38021	8.38021	8.38021	1.37105	1.37105n
Sec. δ	0.16922	0.03825	0.06920	0.01288	0.42984	0.42984
log. S						
log. σ						
log. R	8.54943	8.41846	8.44941	8.39309	1.80033	1.80033n
R	+.035	+.026	+.028	+.025	+1 3.144	−1 3.144
l_o	−.074	−.074	−.067	−.054	−.034	−.078
A	−.128	+.350	+.222	+.857	+2.516	
B	+1.471	+1.035	+1.152	+.572	−.942	
C	+1.476	+1.092	+1.173	+1.030	−2.687	
K	−.023	−.017	−.018	−.016	+.042	+.042
Bl_o	−.109	−.077	−.077	−.031	+.032	+.073
T	3 33 28.656	3 39 34.059	3 45 46.235	3 51 46.978	4 5 49.489	4 5 48.473
t	3 33 28.524	3 39 33.965	3 45 46.140	3 51 46.931	4 5 49.503	4 5 48.588
w	+7.866	+8.005	+7.980	+8.049	+7.347	+8.322
C_c	−.232	−.171	−.184	−.162		
w_o	+7.634	+7.834	+7.796	+7.887	+7.834	
(w_o)	+7.651	+7.848	+7.807	+7.896	+7.837	

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1869phae.proj.:354

February 7th 1869

Star	γ Tauri	ε Tauri	α Tauri	α Camelop. M. C.		ι Aurigae
Samp	E	E	E	E	W	W
Value	E D C	E D C	E D C	γ_2, E D_{54}	E W	C D E
α	4 12 20.49	4 20 58.28	4 28 24.51	4 41 3.51	4 41 3.51	4 48 28.25
δ	+15 18 24.9	+18 53 8.7	+16 14 29.4	+66	7 3.6	+32 57 18.9
M	4 12 12.960	4 20 50.718	4 28 16.825	4 40 17.837	4 41 53.885	4 48 20.309
Z	−0.024	−0.024	−0.024	+15.624	−23.499	+0.024
log. Z	8.38021 n	8.38021 n	8.38021 n	1.193792	1.37105 n	8.38021
sec δ	0.01569	0.02403	0.01769	0.392696	0.392696	0.07619
log S						
log δ						
log. R	8.39590 n	8.40424 n	8.39790 n	1.586488	1.763746 n	8.45640
R	−.025	−.025	−.025	+38.591	−58.042	+.029
l_0	−.078	−.077	−.073	−.070	−.162	−.162
A	+.472	+.421	+.459	−.994		+.195
B	+.923	+.969	+.935	+2.261		+1.176
C	+1.037	+1.057	+1.042	+2.470		+1.192
χ	−.016	−.016	−.016	−.038	−.038	−.018
Bl_0	−.072	−.075	−.068	−.158	−.366	−.191
T	4 12 12.935	4 20 50.693	4 28 16.800	4 40 56.428	4 40 55.843	4 48 20.338
t	4 12 12.851	4 20 50.682	4 28 16.716	4 40 56.232	4 40 55.439	4 48 20.129
w	+7.639	+7.678	+7.794	+7.278	+8.071	+8.121
C_c	+.163	+.166	+.164			−.187
w_0	+7.802	+7.844	+7.958	+7.675		+7.934
(w_0)	+7.802	+7.841	+7.951	+7.663		+7.919

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1869phae.proj..354.

February 7th 1869

C = +.157

Hourly rate = −.025

Star	11 Cygni	Groomb. 966, U.C	
Lamp	Tr	Tr	E
Tallies	C D E	B C	D_2 C B
	h m s		(v. ft.)
α	4 57 5.44	5 22	15.89
δ	15° 13′ 0.″9	+74° 57′	9.″3
M	4 56 57.435	5 20 37.176	5 23 31.723
x	+0.024	+23.519	−21.613
log x	8.38021	1.37142	1.334715n
sec δ	0.01550	0.585665	0.585665
log S			
log o		03	03
log R	8.39571	1.957088	1.920383n
R	+.025	+1 30.592	−1 23.250
b_0	−.162	−.162	−.086
A	+.473	−2.074	
B	+.922	+3.246	
C	+1.036	+3.852	
x	−.016	−.060	−.060
Bb_0	−.149	−.526	−.279
T	4 56 57.460	5 22 7.768	5 22 8.473
t	4 56 57.295	5 22 7.182	5 22 8.134
w	+8.145	+8.708	+7.756
C_c	−.163		
w_0	+7.982	+8.232	
(w_0)	+7.964	Reject for time	

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February 7th 1869 (before exchange)

Collimation

Star	Time	C_c	C	c
Groomb. 2320 L.C.	$4^h\ 6^m$	-0.4875	-2.687	+.181
α Camelop. U.C.	4 41	+0.3965	+2.470	+.161
Groomb. 966 U.C.	5 22	+0.476	+3.852	+.124

$T_0 = 4^h 13^m$

$\theta = +7.820$

Clock and Azimuth Corrections Obs. A.T.U.

Star	Lamp	(w_c)	A	w_0'	A^2	Aw_0'	Δa	Δt
δ Persei	W	+7.651	-.128	-.169	.016	+.022	-.007	+7.658
η Tauri	W	7.848	+.350	+.028	.122	+.010	+.019	7.829
ζ Persei	W	7.807	+.222	-.013	.049	-.003	+.012	7.795
γ' Eridani	W	7.896	+.857	+.076	.734	+.065	+.045	7.851
Groom. 2320, L.C.	W-E	7.837	+2.576	+.017	6.332	+.043	+.133	7.704
γ Tauri	E	7.802	+.472	-.018	.223	-.008	+.025	7.777
ε Tauri	E	7.841	+.421	+.021	.178	+.009	+.022	7.819
α Tauri	E	7.951	+.459	+.131	.211	+.060	+.024	7.927
α Camelop. U.C.	E-W	7.663	-.994	-.157	.989	+.156	-.053	7.716
ι Aurigae	W	7.919	+.195	+.099	.038	+.019	+.010	7.909
11 Orionis	W	7.964	+.473	+.144	.224	+.068	+.025	7.939
			+4.843	+.159	9.116	+.441		+7.811

$11\,\Delta\theta + 4.843a = +.159$

$+4.843\,\Delta\theta + 9.116a = +.441$

$\Delta\theta + .4403a = +.0145$

$+4.843\,\Delta\theta + 2.132a = +.070$

$+6.984\ a = +.371$

$a = +.053$

$\Delta\theta + .0233 = +.0145$

$\Delta\theta = -.009$

$\Delta t = +7.811 \pm .019$

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February 7 1869

Star	9 Leonis	β Leonis	γ Urs Maj	o Virginis	4 Draconis (H) U.C	
Lamp	E	E	E	E	E	γ
Tallies	E D C	E D C	E D C	E D C	γ_{321} E	δ_{345} E γ
					(Doubtful Lp. E.)	
α	11h 30m 15.27s	11 42 23.18	11 46 56.29	11 58 32.73	12 6	4.08
δ	−0° 6′ 6″8	+15 18 8.8	+54 25 11.1	+9 27 33.0	+78 20	25.7
M	11 30 7.495	11 42 15.442	11 46 49.019	11 58 24.994	12 4 15.569	12 7 28.092
γ	−0.024	−0.024	−0.024	−0.024	+20.529	−18.6905
log Δ	8.38021n	8.38021n	8.38021n	8.38021n	1.312368	1.27162n
Sec δ	0.00000	0.01568	0.23519	0.00595	0.694443	0.694443
log ρ						
log σ					04	03
log R	8.38021n	8.39589n	8.61540n	8.38616n	2.006815	1.966066n
R	−.024	−.025	−.041	−.024	+1 41.582	−1 32.484
b_0	−.214	−.212	−.211	−.208	−.206	−.258
A	+.675	+.472	−.359	+.551	−2.906	
B	+.737	+.923	+1.681	+.851	+4.005	
C	+1.000	+1.037	+1.719	+1.014	+4.949	
x	−.016	−.016	−.027	−.016	−.077	−.077
Bb_0	−.158	−.196	−.355	−.177	−.825	−1.033
T	11 30 7.471	11 42 15.417	11 46 48.978	11 58 24.970	12 5 57.151	12 5 55.608
t'	11 30 7.297	11 42 15.205	11 46 48.596	11 58 24.777	12 5 56.249	12 5 54.498
w	+7.973	+7.975	+7.894	+7.953	+7.831	+9.582
C_c	+.157	+.163	+.270	+.159		
w_0	+8.130	+8.138	+8.164	+8.112	+8.706	
(w_0)	+8.148	+8.151	+8.175	+8.119	+8.709	

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February 7th 1869

C = +.157
Annulyatic = -.025

Star	η Virginis	β Corvi	21 Cassiop. L. C.		12 Can. Ven.	θ Virginis
Samp.	W	W	W	E	W	W
Tallies	C D E	C D E	4321 E	E 4	C D E	C D E
α	12h 13m 12.85s	12 27 31.36	12 37 0.74		12 49 54.09	13 3 10.57
δ	+0° 3' 38".1	-22 40 14.4	+.74	16 25.3	+39 1 24.0	-4 50 20.4
M	12 13 4.861	12 27 23.399	12 35 32.024	12 38 19.052	12 49 46.099	13 3 2.637
f	+0.024	+0.024	+22.032	-23.499	+0.024	+0.024
log. f	8.38021	8.38021	1.343054	1.37105n	8.38021	8.38021
sec. δ	0.00000	0.03492	0.566963	0.566963	0.10964	0.00155
log. ρ						
log. σ			03	03		
log. R	8.38021	8.41513	1.910020	1.938016n	8.48985	8.38176
R	+.024	+.026	+1 21.287	-1 26.699	+.031	+.024
l_0	-.238	-.250	-.242	-.198	-.306	-.306
A	+.673	+.983	+3.297		+.075	+.737
B	+.739	+.457	-1.655		+1.285	+.682
C	+1.000	+1.084	-3.689		+1.287	+1.004
x	-.016	-.017	+.057	+.057	-.020	-.016
Bl_0	-.191	-.114	+.401	+.328	-.393	-.209
T	12 13 4.885	12 27 23.425	12 36 53.311	12 36 52.353	12 49 46.130	13 3 2.661
t	12 13 4.678	12 27 23.294	12 36 53.769	12 36 52.738	12 49 45.717	13 3 2.436
w	+8.172	+8.066	+6.971	+8.002	+8.373	+8.134
C_c	-.157	-.170			-.202	-.158
w	+8.015	+7.896	+7.487		+8.171	+7.976
(w_0)	+8.015	+7.890	+7.477		+8.156	7.953

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February 7th 1869

Collimation

Star	Time	C_c	C	c
4 Dracnis, U.C.	12h 6m	+0.8755	+4.979	+.177
21 Cassiop. L.C	12 37	-0.5155	-3.689	+.140

$t_0 = 12^h\ 13^m$

$\theta = +8.020$

Ober. A.T.M.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
91 Leonis	E	+8.148	+.675	+.128	.456	+.086	-.133	+8.281
β Leonis	E	8.151	+.472	+.131	.223	+.062	-.093	8.244
γ Ms. Maj.	E	8.175	-.359	+.155	.129	-.056	+.071	8.104
ο Virginis	E	8.119	+.551	+.099	.304	+.055	-.109	8.228
4 Dracnis, U.C	E-W	8.709	-2.906	+.689	8.445	-2.002	+.572	8.137
η Virginis	W	8.015	+.673	-.005	.453	-.003	-.133	8.148
β Corvi	W	7.890	+.983	-.130	.966	-.128	-.194	8.084
21 Cassiop. L.C.	W-E	7.477	+3.297	-.543	10.872	-1.790	-.650	8.127
12 Can. Ven.	W	8.156	+.075	+.136	.006	+.010	-.015	8.171
θ Virginis	W	7.955	+.737	-.065	.543	-.048	-.145	8.100
			+4.198	+.595	22.397	-3.814		+8.162

$10\,\Delta\theta + 4.198a = +.595$

$+4.198\Delta\theta + 22.397a = -3.814$

$\Delta\theta + .4198a = +.0595$

$+4.198\Delta\theta + 1.762a = +.250$

$+20.635a = -4.064$

$a = -.197$

$\Delta\theta - .0827 = +.0595$

$\Delta\theta = +.142$

$\Delta t = +8.162 \pm .014$

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February 9^{d} 11^{h} 1869

Star	ζ Persei	γ Eridani	Groomb. 2320 L.C		ϑ Tauri	ε Tauri
Lamp	W	W	W	E	E	E
Tellier	C D E	C D E	F E	E F	E D C	E D C
α	3 45 54.08	3 51 54.95	4	5 57.04	4 12 20.46	4 20 58.25
δ	+31 29 29.7	−13 53 5.3	+68	9 6.3	+15 18 24.8	+18 53 8.7
M	3 45 45.022	3 51 45.787	4 4 44.978	4 6 50.407	4 12 11.343	4 20 49.122
f	+0.024	+0.024	+23.499	−23.499	−0.024	−0.024
log. f.	8.38021	8.38021	1.37105	1.37105$_n$	8.38021$_n$	8.38021$_n$
Sec. δ	0.06920	0.01288	0.429283	0.429283	0.01569	0.02403
log. ρ						
log. σ						
log. k	8.449941	8.393309	1.800333	1.800333$_n$	8.39590$_n$	8.40424$_n$
κ	+.028	+.025	+13.144	−13.144	−.025	−.025
l_0	−.162	−.162	−.058	−.006	−.006	−.018
A	+.222	+.857	+2.516		+.472	+.421
B	+1.152	+.572	−.942		+.923	+.969
C	+1.173	+1.030	−2.687		+1.037	+1.057
x	−.018	−.016	+.042	+.042	−.016	−.016
Bl_0	−.187	−.093	+.055	+.006	−.006	−.017
T	3 45 45.050	3 51 45.812	4 5 48.122	4 5 47.263	4 12 11.318	4 20 49.097
t	3 45 44.845	3 51 45.703	4 5 48.219	4 5 47.311	4 12 11.296	4 20 49.064
w	+9.235	+9.247	+8.821	+9.729	+9.164	+9.186
Cc	−.198	−.174			+.175	+.179
ν_0	+9.037	+9.073	+9.275		+9.339	+9.365
(ν_0)	+9.053	+9.086	+9.282		+9.344	+9.366

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February 9th 1869

C = +.169

Hourly rate = -.024

Star	α Tauri	ε Aurigae	11 Aurigae	Capella
Samp	E	E	E	Yr
Tellis	E D321 C	E D	5 Ss.	B45 C D E F
	v ft. doubtful			* ft.
α	4 28 24.48	4 48 28.22	4 57 5.41	5 7 1.43
δ	+16 14 29.4	+32 57 18.9	+15 13 0.9	+45 57 41.8
M	4 28 16.170	4 48 9.973	4 56 56.293	5 6 58.9.5
L	-0.635	+7.814	0.000	-4.6225
log. L.	9.80277n	0.89287	-∞	0.66488n
sec. δ	0.01769	0.07619	0.01550	0.15715
log. S				
log. σ				
log. R.	9.82046n	0.96906	-∞	0.82203n
R	-0.661	+9.312	0.000	-6.638
l_0	-.030	-.046	-.046	-.074
A	+.459	+.195	+.473	-.087
B	+.935	+1.176	+.922	+1.433
C	+1.042	+1.192	+1.036	+1.436
x	-.016	-.018	-.016	-.022
B_0	-.028	-.054	-.042	-.106
T	4 28 15.509	4 48 19.285	4 56 56.293	5 6 52.277
t	4 28 15.465	4 48 19.213	4 56 56.235	5 6 52.149
w	+9.015	+9.007	+9.175	+9.281
C_c	+.176	+.201	+.175	-.243
w_0	+9.191	+9.208	+9.350	+9.038
(w_0)	+9.189 Retain	+9.198	+9.337	+9.021

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1869phae.proj...354.

February 9th 1869

Collimation

Star	Time	C_c	C	c
Groomb. 2320 $\mathcal{L}$C	$4^h\ 6^m$	-0.454	-2.687	+.169

$\mathcal{L}_0 = 4^h 24^m$

$\theta = +9.200$

Ober. A. T. M.

Clock and Azimuth corrections

Star	Lamp	(z₀)	A	w'₀	A²	Aw'₀	Δa	Δt
ζ Persei	W	+9.053	+.222	-.147	.049	-.033	+.012	+9.041
γ Eridani	W	9.086	+.857	-.114	.734	-.098	+.045	9.041
Groomb. 2320 $\mathcal{L}$C	W-E	9.282	+2.516	+.082	6.332	+.206	+.133	9.149
γ Tauri	E	9.344	+.472	+.144	.223	+.068	+.025	9.319
ε Tauri	E	9.366	+.421	+.166	.178	+.070	+.022	9.344
α Tauri	E	9.189	+.459	-.011	.211	-.005	+.024	9.165
ζ Aurigae	E	9.198	+.195	-.002	.038	-.000	+.010	9.188
11 Aurigae	E	9.337	+.473	+.137	.224	+.065	+.025	9.312
Capellae	W	9.021	-.087	-.179	.008	+.016	-.005	9.026
			+5.528	+.076	7.997	+.289		+9.176

$9\,\Delta\theta + 5.528\,a = +.076$

$5.528\,\Delta\theta + 7.997\,a = +.289$

$\Delta\theta + .6144\,a = +.00844$

$+5.528\,\Delta\theta + 3.396\,a = +.046$

$+4.601\,a = +.243$

$a = +.053$

$\Delta\theta + .0326 = +.0084$

$\Delta\theta = -.024$

$\Delta t = +9.176 \pm .028$

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February 12. 1869

Star	γ Tauri	ε Tauri	α Tauri	Capella	β Tauri	α Leporis
Lamp	E	E	E	W	W	W
Tallies	D C B	E D C	E D C	5 Ys.	C_{45} D_{1234} E_{345} F	5 Ys.
	* Doubtful					* Doubtful
α	4 12 20.41	4 20 58.20	4 28 24.43	5 7 1.37	5 18 1.085	5 26 57.64
δ	+15 18 24.7	+18 53 8.6	+16 14 29.3	+45 51 42.0	+28 29 33.6	−17 55 22.8
M	4 12 25.975	4 20 47.395	4 28 13.599	5 6 50.931	5 18 5.343	5 26 46.502
γ	−15.666	−0.024	−0.024	0.000	−13.0705	0.000
log. γ	1.19496$_n$	8.38021$_n$	8.38021$_n$	−∞	1.11629$_n$	−∞
sec δ	0.01569	0.02403	0.01769	0.15715	0.05607	0.02160
log. β						
log. δ						
log. R.	1.21065$_n$	8.40424$_n$	8.39790$_n$	−∞	1.17236$_n$	−∞
R.	−16.242	−.025	−.025		−14.872	
b_0	+.024	+.028	+.032	−.027	−.030	−.031
A	+.472	+.421	+.459	−.087	+.273	+.913
B	+.923	+.969	+.935	+1.433	+1.105	+.521
C	+1.037	+1.057	+1.042	+1.436	+1.138	+1.051
x	−.016	−.016	−.016	−.022	−.018	−.016
Bb_0	+.022	+.027	+.030	−.039	−.033	−.016
T	4 12 9.733	4 20 47.370	4 28 13.574	5 6 50.931	5 17 50.471	5 26 46.502
t	4 12 9.739	4 20 47.381	4 28 13.588	5 6 50.870	5 17 50.420	5 26 46.470
w	+10.671	+10.819	+10.842	+10.500	+10.665	+11.170
C_c	+.013	+.014	+.014	−.019	−.015	−.014
w_0	+10.684	+10.833	+10.856	+10.481	+10.650	+11.156
(w_0)		+10.853	+10.874	+10.487	+10.652	+11.155
	Reject					

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1869phae.proj.:.354:.

February 12$^{\text{d}}$ 1869

Star	ε Orionis	α Columbae	ψ^1 Draconis pr.		α Orionis
Samp	W	W	W	E	E
Tallies	5 Typ.	C J E	E Y	D_{345} E Y	5 Typ.
α	5 29 34.37	5 34 54.98	5 44	14.015	5 48 5.264
δ	−1 17.30.1	−34° 9′ 4.″6	+72 12	33.9	+7 22 37.6
M	5 29 23.412	5 34 43.679	5 42 45.011	5 45 2.938	5 47 54.308
p	0.000	+0.024	+23.499	−18.6905	0.000
log p	−∞	8.38021	1.37105	1.27162$_n$	−∞
sec δ	0.00011	0.08220	0.514934	0.514934	0.00361
log ρ					
log σ			02		
log R	−∞	8.46241	1.885986	1.786554$_n$	−∞
R		+.029	+1 16.911	−1 1.172	
l_0	−.032	−.033	−.034	+.026	+.026
A	+.691	+1.175	+2.976		+.578
B	+.723	+.281	−1.362		+.826
C	+1.000	+1.208	−3.273		+1.008
x	−.016	−.019	+.051	+.051	−.016
Bl_0	−.023	−.009	+.046	−.035	+.021
T	5 29 23.412	5 34 43.708	5 44 1.922	5 44 1.766	5 47 54.308
t	5 29 23.373	5 34 43.680	5 44 2.019	5 44 1.782	5 47 54.313
w	+10.997	+11.300	+11.996	+12.233	+10.951
C_C	−.013	−.016			+.013
w_0	+10.984	+11.284	+12.115		+10.964
(w_0)	+10.983	+11.281	+12.109		+10.957

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C = +.013

Hourly rate = -.019

Star	22 Camelop. U.C		11 Geminor
Samp	E	W	E
Tallies	I_{4321} E	D_{345} E I	5 Typ
	7.4 ft.		
α	6 4 25.88		6 15 2.71
δ	+69	21 44.0	+22 34 34.5
M	6 3 13.592	6 5 9.239	6 14 51.848
I	+22.032	−18.6905	0.000
log. I.	1.343054	1.27162n	− ∞
Sec. δ	0.45289	0.45289	0.03462
log. S			
log. σ			
log. R.	1.795944	1.72451n	− ∞
R	+1 2.509	−53.029	
l_0	+.026	+.006	+.026
A	−1.287		+.367
B	+2.528		+1.019
C	+2.837		+1.083
κ	−.044	−.044	−.017
Bl_0	+.066	+.015	+.026
T	6 4 16.101	6 4 16.210	6 14 51.848
t	6 4 16.123	6 4 16.181	6 14 51.857
w	+9.757	+9.699	+10.853
C_c			+.014
w_0	+9.728		+10.867
(w_0)	+9.715		+10.851

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February 12th 1869

Collimation

Star	Time	C_c	C	c
ψ' Draconis L.C	$5^h\ 44^m$	-0.1185	-3.273	+.036
22 Camelop. U.C	6 4	-0.029	+2.837	-.010

$\gamma_0 = 5^h\ 25^m$

$\theta = +10.620$

Obs. A. T. W.

Clock and Azimuth corrections

Star	Lamp	(W)	A	W'_0	A^2	AW'_0	Aa	Δt
ε Tauri	E	+10.853	+.421	+.233	.178	+.098	+.237	10.616
α Tauri	E	10.874	+.459	+.254	.211	+.117	+.258	10.616
Capella.	W	10.487	-.087	-.133	.008	+.012	-.049	10.536
β Tauri	W	10.652	+.273	+.032	.075	+.009	+.153	10.499
α Leporis	W	11.155	+.913	+.535	.833	+.488	+.513	10.642
ε Orionis	W	10.983	+.691	+.363	.477	+.251	+.388	10.595
α Columbae	W	11.281	+1.175	+.661	1.381	+.777	+.660	10.621
ψ' Draconis (ps) L.C	W-E	12.109	+2.976	+1.489	8.857	+4.431	+1.673	10.436
α Orionis	E	10.957	+.578	+.337	.335	+.195	+.325	10.632
22 Camelop. U.C	E-W	9.715	-1.287	-.905	1.657	+1.165	-.723	10.438
μ Geminor	E	10.851	+.367	+.231	.135	+.085	+.206	10.645
			+6.479	+3.097	14.147	+7.628		+10.571

$11\Delta\theta + 6.479a = +3.097$

$+6.479\Delta\theta + 14.147a = +7.628$

$\Delta\theta + .589a = +.2815$

$+6.479\Delta\theta + 3.816a = +1.824$

$+10.331a = +5.804$

$a = +.562$

$\Delta\theta + .3310 = +.2815$

$\Delta\theta = -.049$

$\Delta t = +10.571 \pm .016$

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1869phae.proj..354.

February 13th 1869

Star	ζ Tauri	ε Tauri	κ Tauri	α Camelop. U. C	
Samp	E	E	E	E	W
Tallies	E D C	E D C	E D C	Y_{5421} E	E. F.
α	$4^h\ 12^m\ 20^s.396$	4 20 58.19	4 28 24.42	* H.n J 4 41 3.26	
δ	+15° 18′ 24.7	+18 53 8.6	+16 14 29.3	+ 66	7 4.2
M	4 12 9.364	4 20 47.086	4 28 13.262	4 39 56.387	4 41 50.362
Y	−0.024	−0.024	−0.024	+22.608	−23.499
log.Y	8.38021n	8.38021n	8.38021n	1.35426	1.37105n
Sec δ	0.01569	0.02403	0.01769	0.39270	0.39270
log.S					
log.δ					
log.R	8.39590n	8.40424n	8.39790n	1.74696	1.76375n
R	−.025	−.025	−.025	+55.842	−58.043
b_0	+.161	+.155	+.121	+.082	+.078
A	+.472	+.421	+.459	−.994	
B	+.923	+.969	+.935	+2.261	
C	+1.037	+1.057	+1.042	+2.470	
x	−.016	−.016	−.016	−.038	−.038
Bb_0	+.149	+.150	+.113	+.185	+.176
T	4 12 9.339	4 20 47.061	4 28 13.237	4 40 52.229	4 50 52.319
t	4 12 9.472	4 20 47.195	4 28 13.334	4 40 52.376	4 50 52.457
w	+10.924	+10.995	+11.086	+10.884	+10.803
C_c	−.001	−.001	−.001		
w_0	+10.923	+10.994	+11.085	+10.843	
(w_0)	+10.935	+11.003	+11.092	Reject	

see the next page

* α Camelop. is rejected when the Transits are reduced by the Chronometers

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1869phae.proj..354.

February 13th 1869

Star	α Camelop. U. C.		ι Aurigæ	11 Ursæ	β Tauri
Lamp	E	W	W	W	W
Tallies	E *	E *	C D E	C D E	C D E
α	4 1	41 2 3.26	4 48 28.15	4 57 5.35	5 18 1.07
δ			+32 57 19.0	+15 13 0.8	+28 29 33.4
M	4 40 13.736	4 41 30.754	4 48 17.119	4 56 54.257	5 17 50.005
I	−15.588	−15.588	+0.024	+0.024	+0.024
log. I.	1.19279	1.19279 n	8.38021	8.38021	8.38021
Sec δ	0.39270	0.39270	0.07619	0.01550	0.05607
log. S					
log. σ					
log. R	1.58549	1.58549 n	8.45640	8.39571	8.43628
R.	+38.503	−38.503	+.029	+.025	+.027
l_0			+.078	+.052	+.022
A			+.195	+.473	+.273
B			+1.176	+.922	+1.105
C			+1.192	+1.036	+1.138
x	−.038	−.038	−.018	−.016	−.018
B l_0	+.185	+.176	+.092	+.048	+.024
T	4 40 52.239	4 40 52.251	4 48 17.148	4 56 54.282	5 17 50.032
t	4 40 53.386	4 40 52.389	4 48 17.222	4 56 54.314	5 17 50.038
w	+10.874	+10.871	+10.928	+11.036	+11.032
C_c			+.001	+.001	+.001
w_0	+10.	873	+10.929	+11.037	+11.033
(w_0)	corr +10.	876	+10.930	+11.035	+11.034

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February 13th 1869

Star	Bomb. 966 U.C		δ Ursæ
Lamp	W	E	E
Tallies	C	C	E D C
α	5 22	15.52	5 25 19.24
δ	+74 57	10.2	+0 24 7.7
M	5 21 3.664	5 23 4.106	5 25 8.221
h	+15.699	−15.699	−0.024
log. h.	1.19587	1.19587n	8.38021n
Sec. δ.	0.585672	0.585672	0.00001
log. ρ			
log. σ			
log. R	1.781542	1.781542n	8.38022n
R	+1 0.470	−1 0.470	−.024
b;	+.022	+.170	+.170
A	−2.074		+.679
B	+3.246		+.734
C	+3.852		+1.000
x	−.060	−.060	−.016
Bc₀	+.071	+.552	+.125
T	5 22 4.134	5 22 3.636	5 25 8.197
t	5 22 4.145	5 22 4.128	5 25 8.306
w	+11.375	+11.392	+10.934
C_c			−.001
w₀	+11.384		+10.933
(w₀)	+11.374		+10.922

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1869phae.proj..354.

February 13th 1869

Star	Time	C_c	$C_.$	c_0
α Camelop. U.C.	$4^h\ 41^m$	−.0 015	+2.470	−.0005
Groomb. 966 U.C	$5^h\ 22^m$	−.0085	+3.852	−.002

$T_0 = 4^h\ 50^m$

$\theta = +11.040$

Obs. A. S. M

Clock and Azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
γ Tauri	E	+10.935	+.472	−.105	.223	−.050	−.048	10.983
ε Tauri	E	11.003	+.421	−.037	.178	−.016	−.048	11.046
α Tauri	E	11.092	+.459	+.052	.211	+.024	−.047	11.139
α Camelop. U.C.	E-W	10.876	−.994	−.164	.989	+.163	+.101	10.775
ε Aurigae	W	10.930	+.195	−.110	.038	−.021	−.020	10.950
11 Orionis	W	11.035	+.473	−.005	.224	−.002	−.048	11.083
β Tauri	W	11.024	+.273	−.016	.075	−.004	−.028	11.052
Groomb. 966 U.C.	W-E	11.374	−2.074	+.334	4.300	−.693	+.212	11.162
δ Orionis	E	10.922	+.679	−.118	.461	−.080	−.069	10.991
			−.096	−.169	6.699	−.679		+11.020

$9\,\Delta\theta - .096\,a = -.169$

$-.096\,\Delta\theta + 6.699\,a = -.679$

$\Delta\theta - .01067a = -.0188$

$-.096\,\Delta\theta + .001\,a = +.002$

$+6.698\,a = -.681$

$a = -.102$

$\Delta\theta + .0011 = -.0188$

$\Delta\theta = -.020$

$\Delta t = +11.020 \pm .026$

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February 17th, 1869

Star	ω Draconis, L. C		ψ Draconis (pr) L. C.		α Aurigæ	ζ Geminor
Lamp	W	E	E	W	W	W
Tallies	L E	E F	B_2 345 C	C B	C D E	C D E
α	5 37	41.56	5 44	14.35	5 48 5.20	6 30 9.21
δ	+68 48	52.0	+72 12	32.9	+7 22 37.5	+16 30 22.4
M	5 36 24.346	5 38 34.368	5 42 49.900	5 45 19.295	5 47 52.714	6 29 56.682
f	+23.499	−23.499	+22.083	−23.519	+0.024	+0.024
log. f	1.37105	1.371052	1.344058	1.37142n	8.38021	8.38021
sec δ	0.442024	0.442024	0.514927	0.514927	0.00361	0.01828
log. S						
log. σ			02	02		
log. R	1.813074	1.813074n	1.858987	1.886349n	8.38382	8.39849
R	+1 5.024	−1 5.024	+1 12.275	−1 16.975	+.024	+.025
l_0	+.094	+.066	+.066	+.054	+.054	+.061
A	+2.580		+2.976		+.578	+.456
B	−1.000		−1.362		+.826	+.938
C	−2.767		−3.273		+1.008	+1.043
x	+.043	+.043	+.051	+.051	−.016	−.016
B l_0	−.094	−.066	−.090	−.074	+.045	+.057
T	5 37 29.370	5 37 29.344	5 44 2.175	5 44 2.320	5 47 52.738	6 29 56.707
t	5 37 29.319	5 37 29.321	5 44 2.136	5 44 2.297	5 47 52.767	6 29 56.748
w	+12.241	+12.239	+12.214	+12.053	+12.433	+12.462
C_c					−.012	−.013
w_0	+12.240		+12.134		+12.421	+12.449
(w_0)	+12.246		+12.139		+12.426	+12.450

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February 17th 1869

{ C = +.012
Hourly rate = −.005

Star	ε Can. Maj.	δ Can. Maj.	δ Geminor	α Can. Min.	β Geminor	ψ Geminor
Samp	W	W	W	E	E	E
Tallies	C D E	C D E	5 Typ	E D C	E D E	E D C
α	6 53 29.63	7 3 4.87	7 12 18.60	7 32 27.46	7 37 18.63	7 45 29.50
δ	−28 48 2.2	−26 11 29.3	+22 13 8.4	+5 33 19.2	+28 20 18.6	+27 6 2.0
M	6 53 17.152	7 2 52.422	7 12 6.104	7 32 14.944	7 37 6.096	7 45 16.975
Y	+0.024	+0.024	0.000	−0.024	−0.024	−0.024
log Y	8.38021	8.38021	−∞	8.38021	8.38021	8.38021
sec δ	0.05735	0.04705	0.03351	0.00205	0.05544	0.05051
log S						
log σ						
log K	8.43756	8.42726	−∞	8.38226$_n$	8.43565$_n$	8.43072$_n$
R	+.027	+.027		−.024	−.027	−.027
b_o	+.004	+.010	+.024	+.080	+.076	+.074
A	+1.080	+1.037	+.372	+.602	+.276	+.296
B	+.368	+.407	+1.014	+.804	+1.102	+1.084
C	+1.141	+1.114	+1.080	+1.005	+1.136	+1.123
x	−.018	−.017	−.017	−.016	−.018	−.017
$B b_o$	+.002	+.004	+.024	+.064	+.084	+.080
T	6 53 17.179	7 2 52.449	7 12 6.104	7 32 14.920	7 37 6.069	7 45 16.948
t	6 53 17.163	7 2 52.436	7 12 6.111	7 32 14.968	7 37 6.135	7 45 17.011
w	+12.467	+12.434	+12.489	+12.492	+12.495	+12.489
Cc	−.014	−.013	−.013	+.012	+.014	+.013
w_o	+12.453	+12.421	+12.476	+12.504	+12.509	+12.502
(w_o)	+12.452	+12.420	+12.474	+12.500	+12.505	+12.497

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1869phae.proj..354.

February 17th 1869

Collimation

Star	Time	Cc	C	c
ω Draconis L.C.	5h 37m	+.001	-2.767	-.0004
ψ¹ Draconis L.C.	5 44	-.0805	-3.273	+.0246

$\gamma_0 = 6^h 46^m$

$\theta = +12.550$

Ober. A. Ill.

Clock and Azimuth corrections

Star	Samp	(w₀)	A	w'₀	A²	Aw'₀	Aa	Δt
ω Draconis L.C.	W-E	+12.246	+2.580	-.304	6.656	-.784	-.312	12.558
ψ Draconis (pr.) L.C.	E-W	12.139	+2.976	-.411	8.857	+1.223	-.360	12.499
α Orionis	W	12.426	+.578	-.124	.335	-.072	-.070	12.496
γ Geminor	W	12.450	+.455	-.100	.207	-.046	-.055	12.505
ε Can. Maj.	W	12.452	+1.080	-.098	1.167	-.106	-.131	12.583
δ Can. Maj.	W	12.420	+1.037	-.130	1.076	-.135	-.125	12.545
δ Geminor	W	12.474	+.372	-.076	.139	-.028	-.045	12.519
α Can. Min.	E	12.500	+.602	-.050	.363	-.030	-.073	12.573
β Geminor	E	12.505	+.276	-.045	.076	-.012	-.033	12.538
ζ Geminor	E	12.497	+.296	-.053	.088	-.016	-.036	12.533
			+10.252	-1.391	18.964	-2.452		+12.535

$10\Delta\theta + 10.252\,a = -1.391$

$+10.252\Delta\theta + 18.964\,a = -2.452$

$-\Delta\theta + 1.0252\,a = -.1391$

$+10.252\Delta\theta + 10.510\,a = -1.426$

$+8.454\,a = -1.026$

$a = -.121$

$\Delta\theta - .1240 = -.1391$

$\Delta\theta = -.015$

$\Delta t = +12.535 \pm .007$

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February 18th, 1869

Star	β Geminor	Groomb. 32	41 L.C	ε Hydrae	ι Ursæ Maj.
Samp	E	E	Yr	Yr	Yr
Values	5 Typ.	B C	C B	C D E	C D E
α	7 37 18.62	*ft. 8h 30m	30s.06	8 39 51.20	8 50 14.77
δ	+28 20 18.6	+ 72	5 11.3	+6 53 42.1	+48 33 9.0
M	7 37 5.968	8 29 1.187	8 31 34.427	8 39 38.608	8 50 2.281
Y	0.000	+23.519	−23.519	+0.024	+0.024
log. Y	−∞	1.37142	1.37142n	8.38021	8.38021
sec. δ	0.05544	0.51204	0.51204	0.00315	0.17919
log. S					
log. σ					
log. K	−∞	1.88346	1.88346n	8.38336	8.55940
R		+1 16.465	−1 16.465	+.024	+.036
l_0	+.002	−.014	+.030	+.034	+.038
A	+.276	+2.959		+.585	−.162
B	+1.102	−1.346		+.820	+1.502
C	+1.136	−3.251		+1.007	+1.511
k	−.018	+.050	+.050	−.016	−.023
Bl_0	+.002	+.019	−.040	+.028	+.057
T	7 37 5.968	8 30 17.652	8 30 17.962	8 39 38.632	8 50 2.317
t	7 37 5.952	8 30 17.721	8 30 17.972	8 39 38.644	8 50 2.351
w	+12.668	+12.339	+12.088	+12.556	+12.419
C_c	−.022			+.019	+.029
w_0	+12.646	+12.214		+12.575	+12.448
(w_0)	+12.647	+12.214		+12.575	+12.448

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February 18$^{th}_{11}$ 1869

Star	σ^2 Urs. Maj. U.C.		θ Urs. Maj.	ε Lemis
Camp.	W	E	E	E
Tallies	B C	C B	5 Typ	E D C
α	8 58 51.89		9 24 6.08	9 38 25.67
δ	+67	39 44.8	+52 16 16.0	+24 22 26.0
M	8 57 37.482	8 59 40.607	9 23 53.409	9 38 13.094
x	+23.519	−23.519	0.000	−.024
log. χ	1.37142	1.37142n	−∞	8.38021n
Sec δ	0.420145	0.420145	0.21330	0.04054
log. ρ				
log. σ				
log. R	1.791565	1.791565n	−∞	8.42075n
R	+1 1.882	−1 1.882		−.026
b_0	+.038	+.018	+.045	+.050
A	−1.124		−.281	+.339
B	+2.379		+1.610	+1.044
C	+2.631		+1.634	+1.098
x	−.041	−.041	−.025	−.017
Bb_0	+.090	+.043	+.074	+.052
T	8 58 39.364	8 58 38.925	9 23 53.409	9 38 13.068
t	8 58 39.413	8 58 38.927	9 23 53.458	9 38 13.103
w	+12.477	+12.963	+12.622	+12.567
C_c			−.031	−.021
w_0	+12.720		+12.591	+12.546
(w_0)	+12.720		+12.590	+12.545

C = −.019

Hourly rate = −.001

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February 18th 1869

Collimation

Star	Time	Cc	C	c
Groomb. 3241, L.C.	$8^h\ 30^m$	-.1255	-3.251	+.0386
σ^2 Ursæ Maj. M.C.	8 59	-.243	+2.631	-.0924

$\gamma_0 = 8^h\ 48^m$

$\theta = +12.580$

Ober. A.T.M.

Clock and Azimuth corrections

Star	Samp	(w_0)	A	w'_0	A^2	$A w'_0$	Aa	Δt
β Geminor	E	+12.647	+.276	+.067	.076	+.018	-.031	12.678
Groomb. 3241. L.C.	E-W	12.214	+2.959	-.366	8.757	-1.083	-.334	12.548
ε Hydrae	W	12.575	+.585	-.005	.342	-.003	-.066	12.641
ζ Ursæ Maj.	W	12.448	-.162	-.132	.026	+.021	+.018	12.430
σ^2 Ursæ Maj. M.C.	W-E	12.720	-1.124	+.140	1.263	-.157	+.127	12.593
δ Ursæ Maj.	E	12.590	-.281	+.010	.079	-.003	+.032	12.538
ε Lemnis	E	12.545	+.339	-.035	.115	-.012	-.038	12.583
			+2.592	-.321	10.658	-1.219		+ 12.576

$7\,\Delta\theta + 2.592\,a = -.321$

$+2.592\,\Delta\theta + 10.658\,a = -1.219$

$\Delta\theta + .3703\,a = -.0459$

$+2.592\,\Delta\theta + .960\,a = -.119$

$+9.698\,a = -1.100$

$a = -.113$

$\Delta\theta - .0418 = -.0459$

$\Delta\theta = -.004$

$\Delta t = +12.576 \pm .020$

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February 18 1869

Star	η Virginis	β Corvi	21 Cassiop. L.C		12 Can. Ven.	θ Virginis
Samp	E	E	E	Fr	Fr	Fr
Tallies	E D C	E D C	B C	C B	C D E	C D E
α	12 13 13.07	12 27 31.61	12 37	0.144	12 49 54.40	13 3 10.84
δ	+0 3 36.7	-22 40 17.0	+74 16	22.8	+39 1 24.5	-4 50 22.0
M	12 13 0.448	12 27 19.068	12 35 21.505	12 38 14.940	12 49 41.783	13 2 58.379
k	−0.024	−0.024	+23.519	−23.519	+0.024	+0.024
log. k	8.38021 n	8.38021 n	1.37142	1.37142 n	8.38021	8.38021
sec δ	0.00000	0.03492	0.566944	0.566944	0.10964	0.00135
log. S						
log. σ			03	03		
log. k	8.38021 n	8.41513 n	1.938367	1.938367 n	8.48985	8.38176
R	−.024	−.026	+1 26.769	−1 26.769	+.031	+.024
L_0	+.006	+.015	+.018	+.054	+.049	+.041
A	+.673	+.983	+3.297		+.075	+.737
B	+.739	+457	−1.655		+1.285	+.682
C	+1.000	+1.084	−3.689		+1.287	+1.004
x	−.016	−.017	+.057	+.057	−.020	−.016
BL_0	+.004	+.007	−.030	−.089	+.063	+.028
τ	12 13 0.424	12 27 19.042	12 36 48274	12 36 48.171	12 49 41814	13 2 58.403
t	12 13 0.412	12 27 19.032	12 36 48.301	12 36 48.139	12 49 41.857	13 2 58.415
w	+12.658	+12.578	+11.843	+12.005	+12.543	+12.425
C_c	−.019	−.021			+.024	+.019
w_0	+12.639	+12.557	+11.924		+12.567	+12.444
(w_0)	+12.640	+12.558	+11.924		+12.567	+12.444

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1869phae.proj...354.

February 18th 1869

Star	η Cassiop. L.C		ξ Tugnis	η Ma. Maj.
Lamp	W	E	E	W
Talkie	J E	E J	E D C	5 Typ.
α	13 21 29.75		13 28 1.69	13 42 23.045
δ	+ 69	35 28.5	+0 4 27.1	+49 57 51.9
M	13 20 10.390	13 22 25.109	13 27 49.133	13 42 10.464
f	+23.499	−23.499	−0.024	0.000
log. f.	1.37105	1.37105$_n$	8.38021$_n$	−∞
Sec. δ	0.45753	0.45753	0.00000	0.19161
log. S				
log. σ				
log. R.	1.82858	1.82858$_n$	8.38021$_n$	−∞
R	+1 7.388	−1 7.388	−.024	
l_o	+.078	+.018	+.018	+.046
A	+2.659		+.673	−.205
B	−1.073		+.740	+1.541
C	−2.868		+1.000	+1.555
x	+.044	+.044	−.016	−.024
Bl_o	−.084	−.019	+.013	+.071
T	13 21 17.778	13 21 17.721	13 27 49.109	13 42 10.464
t	13 21 17.738	13 21 17.746	13 27 49.106	13 42 10.511
w	+12.012	+12.004	+12.584	+12.534
C_c			−.019	+.030
w_o	+12.008		+12.565	+12.564
(w_o)	+12.008		+12.564	+12.563

c = −.019

Hourly rate = −.001

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February 18th 1869

Collimation

Star	Time	Cc	C	c
21 Cassiop. L.C.	12h 37m	+0.081	-3.689	-.022
A Cassiop. L.C.	13 21m	+0.004	-2.868	-.0014

$\gamma_0 = 12^h\ 58^m$

$\theta = +12.650$.

Obs. A.T.M.

Clock and Azimuth corrections

Star	Lamp	(n)	A	n'o	A²	An'o	Δa	Δt
γ Virginis	E	+12.640	+.673	-.010	.453	-.007	-.144	12.784
β Corvi	E	12.558	+.983	-.092	.966	-.090	-.210	12.768
21 Cassiop. L.C.	E-W	11.924	+3.297	-.726	10.872	-2.394	-.706	12.630
12 Can. Ven.	W	12.567	+.075	-.083	.006	-.006	-.016	12.583
θ Virginis	W	12.444	+.737	-.206	.543	-.152	-.158	12.602
A Cassiop. L.C.	W-E	12.008	+2.659	-.642	7.072	-1.707	-.569	12.577
ζ Virginis	E	12.564	+.673	-.086	.453	-.058	-.144	12.708
γ Ursa Maj.	W	12.563	-.205	-.087	.042	+.018	+.044	12.519
			+8.892	-1.932	20.407	-4.396	+	12.646

$8\Delta\theta + 8.892a = -1.932$

$+8.892\Delta\theta + 20.407a = -4.396$

$\Delta\theta + 1.1115a = -.2415$

$+8.892\Delta\theta + 9.882a = -2.147$

$+10.525a = -2.249$

$a = -.214$

$\Delta\theta - .2378 = -.2415$

$\Delta\theta = -.004$

$\Delta t = +12.646 \pm .023$

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Star	11 Aurigæ	Capella	β Tauri	Groomb. 966	U. C.	α Leporis
Lamp	W	W	W	W.	E	E
Tallies	C D E	C_{45} D E	C D E	B. C	C B	E D C
α	4 57 5.25	5 7 1.21	5 18 0.97	5 22	15.10	5 26 57.52
δ	+15 13 0.8	+45 51 42.4	+28 29 33.7	+74 57	10.9	−17° 55′ 23″.3
M	4 56 52.612	5 6 55.176	5 17 48.271	5 20 31.807	5 23 32.185	5 26 44.831
Y	+.024	−4.549	+0.024	+23.519	−23.519	−0.024
log. Y	8.38021	0.65792 n	8.38021	1.37142	1.37142 n	8.38021 n
sec δ	0.01530	0.15715	0.05607	0.585677	0.585677	0.02160
log. S						
log. σ				03	03	
log. R	8.39571	0.81507 n	8.43628	1.957100	1.957100 n	8.40181 n
R	+.025	−6.532	+.027	+1 30.594	−1 30.594	−.025
l_0	+.014	+.003	−.010	−.010	−.046	−.046
A	+.473	−.087	+.273	−2.074		+.913
B	+.922	+1.433	+1.105	+3.246		+.521
C	+1.036	+1.436	+1.138	+3.852		+1.051
k	−.016	−.022	−.018	−.060	−.060	−.016
Bl_0	+.013	+.004	−.011	−.032	−.149	−.024
T	4 56 52.637	5 6 48.644	5 17 48.298	5 22 2.401	5 22 1.591	5 26 44.806
t	4 56 52.634	5 6 48.626	5 17 48.269	5 22 2.309	5 22 1.382	5 26 44.766
w	+12.616	+12.584	+12.701	+12.791	+13.718	+12.754
C_c	+.045	+.062	+.049			−.045
w_0	+12.661	+12.646	+12.750	+13.255		+12.709
(w_0)	+12.672	+12.655	+12.756	+13.260		+12.713

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Star	ε Ursæ Min.	ω Draconis, L. C.		ψ¹ Draconis per L. C.		α Ursæ Min.
Samp.	E	E	W	W	E	E
Tallies	E D_{5431} C	B C_{12}	C B	T_{4321} E	E T	E D B
		(Nowest level taken)				
α	5 29 34.27	5 37	41.68	5 44 14.485		5 48 5.17
δ	−1 17 30.4	+68 48	51.7	+72	12 32.6	+7 22 37.4
M	5 29 21.441	5 36 11.876	5 38 34.152	5 42 50.094	5 45 19.123	5 47 52.492
γ	+0.1565	+27.993	−23.519	+22.032	−23.499	−0.024
log γ	9.19451	1.44705	1.37142n	1.34305	1.37105n	8.38021n
Sec δ	0.00011	0.442023	0.442023	0.514925	0.514925	0.00361
log S						
log σ		02	02	02	02	
log R	9.19462	1.889075	1.813445n.	1.857977	1.885977n	8.38382n
R	+.157	+1 17.460	−1 5.080	+1 12.107	−1 16.909	−.024
l_0	−.046	−.046	−.063	−.054	−.014	−.014
A	+.691	+2.	580	+2.	976	+.578
B	+.723	−1.	000	−1.	362	+.826
C	+1.000	−2.	767	−3.	273	+1.008
x	−.016	+.043	+.043	+.051	+.051	−.016
Bl_0	−.033	+.046	+.063	+.074	+.019	−.012
T	5 29 21.578	5 37 29.336	5 37 29.072	5 44 2.201	5 44 2.214	5 47 52.468
t	5 29 21.549	5 37 29.425	5 37 29.178	5 44 2.326	5 44 2.284	5 47 52.440
w	+12.721	+12.255	+12.502	+12.159	+12.201	+12.730
C_c	−.043					−.043
w_0	+12.678	+12.	379	+12.	180	+12.687
(w_0)	+12.681	+12.	381	+12.	180	+12.686

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Star	δ Can. Maj	δ Geminor
Lamp	Yr	E
Tables	D E F	E D C
α	7h 3m 5s 4.84	7 12 18.58
δ	-26 11 29.6	+22 13 8.5
M	7 3 9.645	7 12 5.843
F	-15.680	-0.024
log. F	1.19535n	8.38021n
sec δ	0.04705	0.03351
log. S		
log. σ		
log. R	1.24240n	8.41372n
R	-17.474	-.026
t_0	-.058	+.002
A	+1.037	+.372
B	+.407	+1.014
C	+1.114	+1.080
κ	-.017	-.017
Bt_0	-.024	+.002
T	7 2 52.171	7 12 5.817
t	7 2 52.130	7 12 5.802
w	+12.710	+12.778
C_c	+.048	-.046
w_0	+12.758	+12.732
(w_0)	+12.740	+12.712

C = -.043

Hourly rate = -.014

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Collimation

Star	Time	Cc	C	c
Gromb. 966 U.C.	$5^h\ 22^m$	−.4635	+3.852	−.120
ω Dracnis, L.C.	5 37	+.1235	−2.767	−.045
ψ Dracnis L.C	5 44	−.021	−3.273	+.006

$\gamma_0 = 5^h\ 44^m$

$\theta = +12^s.820$

Obs. A. T. M.

Clock and Azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
11 Ursae	W	+12.672	+.473	−.148	.224	−.070	−.089	+12.761
Capella	W	12.655	−.087	−.165	.008	+.014	+.016	12.639
β Tauri	W	12.756	+.273	−.064	.075	−.017	−.051	12.807
Gromb. 966. U.C.	W-E	13.260	−2.074	+.440	4.300	−.913	+.390	12.870
α Leporis	E	12.713	+.913	−.107	.833	−.098	−.172	12.885
ε Ursae	E	12.681	+.691	−.139	.477	−.096	−.130	12.811
ω Dracnis, L.C.	E-W	12.381	+2.580	−.439	6.656	−1.133	−.485	12.866
ψ Dracnis per L.C.	W-E	12.180	+2.976	−.640	8.857	−1.905	−.559	12.739
α Ursae	E	12.686	+.578	−.134	.335	−.077	−.109	12.795
δ Can. Maj.	W	12.740	+1.037	−.080	1.076	−.080	−.195	12.935
δ Geminor	E	12.712	+.372	−.108	.139	−.040	−.070	12.782
			+7.732	−1.584	22.980	−4.418		+12.808

$11\Delta\theta + 7.732a = -1.584$

$+7.732\ \Delta\theta + 22.980a = -4.418$

$\Delta\theta + .7029a = -.144$

$+7.732\Delta\theta + 5.435a = -1.113$

$+17.545a = -3.305$

$a = -.188$

$\Delta\theta - .1321 = -.144$

$\Delta\theta = -.012$

$\Delta t = +12.808 \pm .016$

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February 19th 11 1869

Star	T Leonis	g1 Leonis	β Leonis	J Mus. Maj.	o Virginis	
Lamp	E	E	E	E	E	
Tallies	5 Trys	E D C	E D C	E D C	E D_{4321} C	
α	11 21 12.95	11 30 15.47	11 42 23.40	11 46 56.83	11 58 32.96	
δ	+3 34 32.1	−0 6 8.3	+15 18 8.3	+54 25 13.1	+9 27 32.1	
M	11 21 0.238	11 30 2.813	11 42 10.724	11 46 44.007	11 58 20.629	
Z	0.000	−0.024	−0.024	−0.024	−0.402	
log Z	−∞	8.38021n	8.38021n	8.38021n	9.60423n	
sec δ	0.00085	0.00000	0.01568	0.23520	0.00595	
log S						
log σ						
log R	−∞	8.38021n	8.39589n	8.61541n	9.61018n	
R		−.024	−.025	−.041	−.408	
l_0	−.078	−.062	−.046	−.046	−.046	
A	+.628	+.675	+.472	−.359	+.551	
B	+.781	+.737	+.923	+1.681	+.851	
C	+1.002	+1.000	+1.037	+1.719	+1.014	
x	−.016	−.016	−.016	−.027	−.016	
Bb_0	−.061	−.046	−.042	−.077	−.039	
σ	11 21 0.238	11 30 2.789	11 42 10.699	11 46 43.966	11 58 20.221	
t	11 21 0.161	11 30 2.727	11 42 10.641	11 46 43.862	11 58 20.166	
w	+12.789	+12.743	+12.759	+12.968	+12.794	
C_c	−.043	−.043	−.045	−.074	−.044	
w_0	+12.746	+12.700	+12.714	+12.894	+12.750	
(w_0)	+12.756	+12.708	+12.719	+12.898	+12.751	

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February 19th 1869

C = −.043

Hourly rate = −.014

Star	4 Draconis (N) M.C.		β Corvi	21 Cassiop. L.C		θ Virginis
Lamp	E	W	W	W	E	W
Tallies	L E	E L	C D E	L E	E L	C D E
α	12 6	5.02	12 27 31.63	12 37	0.096	13 3 10.86
δ	+ 78 20	28.4	−22 40 17.2	+74 16	22.6	−4 50 22.1
M	12 3 54.978	12 7 47.899	12 27 19.059	12 35 21.533	12 38 14.862	13 2 58.226
Z	+23.499	−23.499	+0.024	+23.499	−23.499	+.024
log Z.	1.37105	1.37105n	8.38021	1.37105	1.37105n	8.38021
sec δ.	0.694471	0.694471	0.03493	0.566943	0.566943	0.00155
log ρ						
log. σ	05	05		03	03	
log. R.	2.065526	2.065526n	8.41514	1.937996	1.937996n	8.38176
R	+1 56.286	−1 56.286	+.026	+1 26.695	−1 26.695	+.024
l_0	−.046	+.022	−.037	−.066	−.078	−.034
A	−2.906		+.983	+3.297		+.737
B	+4.005		+.457	−1.655		+.682
C	+4.949		+1.084	−3.689		+1.004
x	−.077	−.077	−.017	+.057	+.054	−.016
Bl_0	−.184	+.088	−.017	+.109	+.129	−.023
T	12 5 51.264	12 5 51.613	12 27 19.088	12 36 48.228	12 36 48.167	13 2 58.250
t	12 5 51.003	12 5 51.624	12 27 19.051	12 36 48.394	12 36 48.353	13 2 58.211
w	+14.017	+13.396	+12.579	+11.702	+11.743	+12.649
C_c			+.047			+.043
w_0	+13.706		+12.626	+11.723		+12.692
(w_0)	+13.705		+12.620	+11.715		+12.678

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Collimation

Star	Time	Cc	C	c
4 Draconis, U.C	12h 6m	-.3105	+4.949	-.0627
21 Cassiop. L.C	12 37	-.0205	-3.689	+.0056

$Y_0 = 12^h\ 3^m$ W

$\delta = +12.850$

Ober. A. Ill.

Clock and Azimuth corrections

Star.	Lamp	(w_0)	Δ	w'_0	Δ^2	$\Delta w'_0$	Δa	Δt
σ Leonis	E	+12.756	+.628	-.094	.394	-.059	-.195	12.951
91 Leonis	E	12.708	+.675	-.142	.456	-.096	-.210	12.918
β Leonis	E	12.719	+.472	-.131	.223	-.062	-.147	12.866
ζ Urs. Maj.	E	12.898	-.359	+.048	.129	-.017	+.112	12.780
o Virginis	E	12.751	+.551	-.099	.304	-.055	-.171	12.922
4 Draconis (14) U.C	E-W	13.705	-2.906	+.855	8.445	-2.485	+.904	12.801
β Corvi	W	12.620	+.983	-.230	.966	-.226	-.306	12.926
21 Cassiop. L.C	W-E	11.715	+3.297	-1.135	10.872	-3.742	-1.025	12.740
θ Virginis	W	12.678	+.737	-.172	.543	-.127	-.229	12.907
			+4.078	-1.100	22.332	-6.869		+ 12.869

$9\Delta\theta + 4.078\,a = -1.100$

$+4.078\Delta\theta + 22.332\,a = -6.869$

$\Delta\theta + .4531\,a = -.1222$

$+4.078\Delta\theta + 1.848\,a = -.498$

$+20.484\,a = -6.371$

$a = -.311$

$\Delta\theta - .1409 = -.1222$

$\Delta\theta = +.019$

$\Delta t = +12.869 \pm .017$

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Star	22 Camelop. U. C		μ Geminor	ϳ Geminor	ε Can. Maj	δ Can. Maj
Lamp	W	E	E	E	E	E
Tallies	B C	C B	E D C	E D C	E D C	E D E
α	6 4 25.355		6 15 2.54	6 30 9.11 * v. fb.	6 53 29.52	7 3 4.77
δ	+69	21 45.9	+22 34 34.8	+16 30 22.4	-28 48 3.3	-26 11 30.4
M	6 3 3.997	6 5 17.307	6 14 47.748	6 29 54.422	6 53 14.927	7 2 50.179
Z	+23.519	-23.519	-0.024	-0.024	-0.024	-0.024
log. f	1.37142	1.37142n	8.38021n	8.38021n	8.38021n	8.38021n
Sec. δ	0.45290 2	0.452902	0.03462	0.01828	0.05735	0.04705
log. S						
log. σ						
log. R	1.824322	1.824322n	8.41483n	8.39849n	8.43756n	8.42726n
R	+1 6.730	-1 6.730	-.026	-.025	-.027	-.027
b_0	+.030	+.058	+.040	+.009	+.003	+.002
A	-1.287		+.367	+.455	+1.080	+1.037
B	+2.528		+1.019	+.938	+.368	+.407
C	+2.837		+1.083	+1.043	+1.141	+1.114
x	-.044	-.044	-.017	-.016	-.018	-.017
B b_0	+.076	+.147	+.041	+.008	+.001	+.001
T	6 4 10.727	6 4 10.577	6 14 47.722	6 29 54.397	6 53 14.900	7 2 50.152
t	6 4 10.759	6 4 10.680	6 14 47.746	6 29 54.389	6 53 14.883	7 2 50.136
w	+14.596	+14.675	+14.794	+14.721	+14.637	+14.634
Cc			-.057	-.055	-.060	-.059
w_0	+14.636		+14.737	+14.666	+14.577	+14.575
(w_0)	+14.657		+14.755	+14.678	+14.581	+14.576

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Star	δ Geminor	T Draconis L. C.		α Can. Min.	β Geminor	φ Geminor
Samp	E	E	Fr	Fr	Fr	Fr
Values	E D C	B C	C B	C D E	C D E	C D E
α	7 12 18.53	7 18	0.80	7 32 27.39	7 37 15.56	7 45 29.44
δ	+22 13 8.7	+73 6	30.9	+5 33 18.9	+28 20 19.0	+27 6 2.4
M	7 12 .3743	7 16 25.510	7 19 7.112	7 32 12.469	7 37 3.625	7 45 14.531
Y	−0.024	+23.519	−23.519	+0.024	+0.024	+0.024
log.Y	8.38021n	1.37142	1.37142n	8.38021	8.38021	8.38021
Sec.δ	0.03357	0.536766	0.536766	0.00204	0.05544	0.05051
log.S						
log.σ		03	03			
log.R	8.41372n	1.908189	1.908189n	8.38225	8.43565	8.43072
R	−.026	+1 20.945	−1 20.945	+.024	+.027	+.027
l_o	+.002	+.002	+.038	+.038	+.038	+.038
A	+.372	+3.107		+.602	+.276	+.296
B	+1.014	−1.481		+.804	+1.102	+1.084
C	+1.080	−3.442		+1.005	+1.136	+1.123
x	−.017	+.053	+.053	−.016	−.018	−.017
Bl_o	+.002	−.003	−.056	+.031	+.042	+.041
T	7 12 3.717	7 17 46.455	7 17 46.167	7 32 12.493	7 37 3.652	7 45 14.538
t	7 12 3.702	7 17 46.505	7 17 46.164	7 32 12.508	7 37 3.676	7 45 14.582
w	+14.828	+14.295	+14.636	+14.882	+14.884	+14.858
Cc	−.057			+.053	+.060	+.060
w_o	+14.771	+14.466		+14.935	+14.944	+14.918
(w_o)	+14.768	+14.462		+14.926	+14.933	+14.904

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Star	ε Draconis. L. B	
Samp	W	E
Tallies	F E	E F
α	7 48	33.715
δ	+69 55	53.5
ll	7 47 10.592	7 49 27.957
f	+23.499	−23.499
log. f	1.37105	1.37105n
sec δ	0.464525	0.464525
log. ρ		
log. R	1.835575	1.835575n
R	+1 8.482	−1 8.482
b_0	+.038	−.006
A	+2.696	
B	−1.106	
C	−2.914	
x	+.045	+.045
Bb_0	−.042	+.007
T	7 48 19.074	7 48 19.475
t	7 48 19.077	7 48 19.527
w	+14.638	+14.181
Cc		
w_0	+14.413	
(w_0)	+14.398	

C = −.053

Hourly rate = −.021

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Collimation.

Star	Time	Cc	c	c
22 Camelop. U.C	6h 4m	-.0395	+2.837	-.0140
σ Draconis, L.C.	7 18	+.1705	-3.442	-.0496
ε Draconis, L.C.	7 48	+.225	-2.914	-.0773

$T_0 = 7^h\ 5^m$

$\theta = +14.860$

Aber. A. S. U

Clock and azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
22 Camelop. U.C	W-E	+14.657	-1.287	-.203	1.657	+.261	+.125	14.532
μ Geminor	E	14.755	+.367	-.105	.135	-.039	-.036	14.791
ζ Geminor	E	14.678	+.455	-.182	.207	-.083	-.044	14.722
ε Can. Maj.	E	14.581	+1.080	-.279	1.167	-.301	-.105	14.686
δ Can. Maj.	E	14.576	+1.037	-.284	1.076	-.295	-.101	14.675
δ Geminor	E	14.768	+.372	-.092	.139	-.034	-.036	14.804
σ Draconis L.C.	E-W	14.462	+3.107	-.398	9.651	-1.237	-.301	14.763
α Can. Min.	W	14.926	+.602	+.066	.363	+.040	-.058	14.984
β Geminor	W	14.933	+.276	+.073	.076	+.020	-.027	14.960
ζ Geminor	W	14.904	+.296	+.044	.088	+.013	-.029	14.933
ε Draconis, L.C.	W-E	14.398	+2.696	-.462	7.269	-1.246	-.261	14.659
			+9.001	-1.822	21.828	-2.901	+	14.774

$+11\,\Delta\theta + 9.001\,a = -1.822$

$+9.001\,\Delta\theta + 21.828\,a = -2.901$

$\Delta\theta + .8183\,a = -.1656$

$+9.001\,\Delta\theta + 7.365\,a = -1.491$

$+14.463\,a = -1.410$

$a = -.097$

$\Delta\theta - .0794 = -.1656$

$\Delta\theta = -.086$

$\Delta t = +14.774 \pm .029$

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February 24th 1869

Star	β Corvi	21 Cassiop.	α. C	12 Can. Ven.	θ Virginis
Samp.	E	E	W	W	W
Tallies	E D C	B. C	C B	C D E	C. D E
α	12 27 31.73	12 36	59.86	12 49 54.56	13 3 10.97
δ	-22 40 18.3	+74 16	21.4	+39 1 24.9	-4 50 22.7
M	12 27 17.106	12 35 19.030	12 38 12.404	12 49 39.516	13 2 56.025
Z	-0.024	+23.519	-23.519	+0.024	+0.024
log.Z	8.38021n	1.37142	1.37142n	8.38021	8.38021
sec.δ	0.03493	0.566934	0.566934	0.10964	0.00155
log.S					
log.σ		03	03		
log.K	8.41514n	1.938357	1.938357n	8.48985	4.38176
R	-.026	+1 26.767	-1 26.767	+.031	+.024
L_s	-.030	-.030	+.078	+.072	+.063
A	+.983	+3.	297	+.075	+.737
B	+.457	-1.	655	+1.285	+.682
C	+1.084	-3.	689	+1.287	+1.014
x	-.017	+.057	+.057	-.020	-.016
Bl_0	-.014	+.050	-.129	+.092	+.043
T	12 27 17.080	12 36 45.797	12 36 45.637	12 49 39.547	13 2 56.049
t	12 27 17.049	12 36 45.904	12 36 45.565	12 49 39.616	13 2 56.076
w	+14.681	+13.956	+14.295	+14.941	+14.894
C_0	-.057			+.068	+.053
w_0	+14.624	+14.	126	+15.009	+14.947
(w_0)	+14.645	+14.	143	+15.022	+14.955

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February 24th 1869

Star	A, Cassiop. L.C.		ζ Virginis	η Urs. Maj.	η Bootis
Lamp	Hr	E	E	E	E
Tallies	Y E	Y	E D C	E D C	E D C
α	13h 21m	29s.48	13 28 1.83	13 42 23.26	13 48 27.37
δ	+69° 35′	27″.3	+0 4 26.4	+49 57 52.4	+19 3 12.6
M	13 20 7.651	13 22 45.384	13 27 47.225	13 42 8.106	13 48 12.367
Y	+23.499	−31.411	−0.024	−0.024	−0.024
log. Y	1.37105	1.49708n	8.38021n	8.38021n	8.38021n
sec. δ	0.457522	0.457522	0.00000	0.19161	0.02447
log. S					
log. σ		03			
log. R.	1.828572	1.954605n	8.38021n	8.57182n	8.40468n
R	+1 7.386	−1 30.075	−.024	−.037	−.025
l_0	+.054	+.034	+.034	+.027	+.023
A	+2.659		+.673	−.205	+.419
B	−1.073		+.740	+1.541	+.971
C	−2.868		+1.000	+1.555	+1.058
x	+.044	+.044	−.016	−.024	−.016
Bl_0	−.058	−.036	+.025	+.042	+.022
T	13 21 15.037	13 21 15.309	13 27 47.201	13 42 8.069	13 48 12.342
t	13 21 15.023	13 21 15.317	13 27 47.210	13 42 8.087	13 48 12.348
w	+14.457	+14.163	+14.620	+15.173	+15.022
C_c			−.053	−.082	−.056
w_0	+14.310		+14.567	+15.091	+14.966
(w_0)	+14.312		+14.566	+15.085	+14.958

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February 24 h 11 1869

Star	α Draconis U.C		α Bootis	θ Bootis
Transit	E	W	W	W
Tallies	ℱ E	E ℱ	C D E	C D E
α	14 0	51.48	14 9 41.60	14 20 44.64
δ	+64 59	54.7	+19 51 49.0	+52 27 13.2
M	13 59 40.422	14 1 31.922	14 9 26.636	14 20 29.693
Z	+23.499	−23.499	+0.024	+0.024
log. Z	1.37105	1.37105n	8.38021	8.38021
Sec. δ	0.374028	0.374028	0.02664	0.21510
log. S				
log. σ				
log. k	1.745078	1.745078n	8.40685	8.59531
B	+55.600	−55.600	+.026	+.039
L_0	+.018	+.054	+.043	+.030
A	−.910		+.407	−.287
B	+2.184		+.982	+1.616
C	+2.366		+1.063	+1.641
x	−.037	−.037	−.016	−.025
BL_0	+.039	+.118	+.042	+.048
τ	14 0 36.022	14 0 36.322	14 9 26.662	14 20 29.732
t	14 0 36.024	14 0 36.403	14 9 26.688	14 20 29.755
w	+15.456	+15.077	+14.912	+14.885
C_c			+.056	+.087
w_0	+15.266		+14.968	+14.972
(w_0)	+15.254		+14.953	+14.953

C = −.053

Hourly rate = −.021

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February 24th 1869

Collimation

Star	Time	Cc	C	c
21 Cassiop. L.C	12h 37m	+.1695	-3.689	-.046
A Cassiop. L.C	13h 21m	+.1470	-2.868	-.051
α Draconis, U.C	14h 1m	-.1895	+2.366	-.080

$T_o = 13^h\ 26^m$

$\theta = +14^s.990$

Obsr. A. S. M.

Clock and Azimuth Corrections

Star	Lamp	(a_o)	A	w'o	A^2	Aw'o	Δa	Δt
β Corvi	E	+14.645	+.983	-.345	.966	-.339	-.256	+14.901
21 Cassiop. L.C	E-W	14.143	+3.297	-847	10.872	-2.793	-.857	15.000
12 Can. Ven.	W	15.022	+.075	+.032	.006	+.002	-.020	15.042
θ Virginis	W	14.953	+.737	-.035	.543	-.026	-.192	15.147
A Cassiop. L.C	W-E	14.312	+2.659	-.678	7.072	-1.803	-.691	15.003
ζ Virginis	E	14.566	+.673	-.424	.453	-.285	-.175	14.741
η Ursæ Maj.	E	15.085	-.205	+.095	.042	-.019	+.053	15.032
η Bootis	E	14.958	+.419	-.032	.175	-.013	-.109	15.067
α Draconis, U.C.	E-W	15.254	-.910	+.264	.828	-.240	+.237	15.017
α Bootis	W	14.953	+.407	-.037	.166	-.015	-.106	15.059
θ Bootis	W	14.953	-.287	-.037	.082	+.011	+.075	14.878
			+7.848	-2.044	21.205	-5.520		+14.990

$11\Delta\theta + 7.848a = -2.044$

$+ 7.848\Delta\theta + 21.205a = -5.520$

$\Delta\theta + .7135a = -.1858$

$+7.848\Delta\theta + 5.599a = -1.458$

$+15.606a = -4.062$

$a = -.260$

$\Delta\theta - .1855 = -.1858$

$\Delta\theta = 0.000$

$\Delta t = +14.990 \pm .023$

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1869phae.proj..354.

February 25th 1869

Star	ι Aurigae	11 Orionis	Capella	β Tauri	δ Orionis	α Leporis
Lamp	W	W	W	W	E	E
Tallies	C D E	C D E	C D E	C D E	E D C	E D E
α	4 48 27.90	4 57 5.14	5 7 1.05	5 18 0.85	5 25 19.04	5 26 57.41
δ	+32 57 19.0	+15 13 0.6	+45 51 42.7	+28 29 33.8	-0 24 8.7	-17 55 23.7
M	4 48 12.573	4 56 49.746	5 6 45.697	5 17 45.498	5 25 3.666	5 26 42.104
Y	+0.024	+0.024	+0.024	+0.024	−0.024	−0.024
log.Y.	8.38021	8.38021	8.38021	8.38021	8.38021n	8.38021n
sec.δ	0.07619	0.01550	0.15715	0.05607	0.00001	0.02161
log.ρ						
log.σ						
log.R	8.45640	8.39571	8.53736	8.43628	8.38022n	8.40182n
R	+.029	+.025	+.034	+.027	−.024	−.025
l_0	+.030	+.033	+.031	+.022	−.010	−.011
A	+.195	+.473	−.087	+.273	+.679	+.913
B	+1.176	+.922	+1.433	+1.105	+.734	+.521
C	+1.192	+1.036	+1.436	+1.138	+1.000	+1.051
x	−.018	−.016	−.022	−.018	−.016	−.016
Bb_0	+.035	+.030	+.044	+.024	−.007	−.006
J	4 48 12.602	4 56 49.771	5 6 45.731	5 17 45.525	5 25 3.642	5 26 42.079
t	4 48 12.619	4 56 49.785	5 6 45.753	5 17 45.531	5 25 3.619	5 26 42.057
w	+15.281	+15.353	+15.297	+15.319	+15.421	+15.353
C_c	+.024	+.021	+.029	+.023	−.020	−.021
w_0	+15.305	+15.376	+15.326	+15.342	+15.401	+15.332
(w_0)	+15.316	+15.384	+15.331	+15.343	+15.400	+15.330

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February 25th 1869

c = −.020
Hourly rate = −.020

Star	ε Ursæ Min.	ω Draconis, L. C.		ψ¹ Draconis (fr.) L. C.		α Ursæ Min.
Lamp	E	E	W	W	E	E
Tallies	E D C	B C	C B	X E	E X	E D C
α	5 29 34.17	5 37	42.06	5 44	14.91	5 48 5.07
δ	−1 17 30.6	+68 48	50.6	+72 12	31.6	+7 22 37.2
M	5 29 18.891	5 36 22.028	5 38 32.091	5 42 43.059	5 45 16.935	5 47 49.902
F	−0.024	+23.519	−23.519	+23.499	−23.499	−0.024
log F	8.38021n	1.37142	1.37142n	1.37105	1.37105n	8.38021n
sec δ	0.00011	0.44202	0.44202	0.514919	0.514919	0.00361
log S						
log σ				02	02	
log R	8.38032n	1.81344	1.81344n	1.885971	1.885971	8.38382
R	−.024	+1 5.079	−1 5.079	+1 16.908	−1 16.908	−.024
l₀	−.012	−.014	+.014	+.014	−.030	−.030
A	+.691	+2.580		+2.976		+.578
B	+.723	−1.000		−1.362		+.826
C	+1.000	−2.767		−3.273		+1.008
κ	−.016	+.043	+.043	+.051	+.051	−.016
B l₀	−.009	+.014	−.014	−.019	+.041	−.025
T	5 29 18.867	5 37 27.107	5 37 27.012	5 43 59.967	5 44 0.027	5 47 49.878
t	5 29 18.842	5 37 27.164	5 37 27.041	5 43 59.999	5 44 0.119	5 47 49.837
w	+15.328	+14.896	+15.019	+14.911	+14.791	+15.233
Cc	−.020					−.020
w₀	+15.308	+14.958		+14.851		+15.213
(w₀)	+15.306	+14.953		+14.844		+15.204

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1869phae.proj..354.

February 25th 1869

Collimation

Star	Time	Cc	C	C
ω Draconis L.C	5h 37m	+.0615	-2.767	-.022
φ' Draconis L.C	5 44	+.060	-3.273	-.018

$\gamma_0 = 5^h 22^m$

$\theta = +15^s.410$

Obs. A.T.M.

Clock and Azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	$A w'_0$	A a	Δt
ι Aurigae	W	+15.316	+.195	-.094	.038	-.018	-.034	15.350
11 Orionis	W	15.384	+.473	-.026	.224	-.012	-.081	15.465
Capella	W	15.331	-.087	-.079	.008	+.007	+.015	15.316
β Tauri	W	15.343	+.273	-.067	.075	-.018	-.047	15.390
δ Orionis	E	15.400	+.679	-.010	.461	-.007	-.117	15.517
α Leporis	E	15.330	+.913	-.080	.833	-.073	-.157	15.487
ε Orionis	E	15.306	+.691	-.104	.477	-.072	-.119	15.425
ω Draconis, L.C.	E-W	14.953	+2.580	-.457	6.656	-1.179	-.444	15.397
φ' Draconis (fr.) L.C.	W-E	14.844	+2.976	-.566	8.857	-1.684	-.512	15.356
α Orionis	E	15.204	+.578	-.206	.335	-.119	-.099	15.303
			+9.271	-1.689	17.964	-3.175	+	15.401

$10\,\Delta\theta + 9.271\,a = 1.689$

$+9.271\,\Delta\theta + 17.964\,a = -3.175$

$\Delta\theta + .9271\,a = -.1689$

$+9.271\,\Delta\theta + 8.595\,a = -1.566$

$+9.369\,a = -1.609$

$a = -.172$

$\Delta\theta - .1595 = -.1689$

$\Delta\theta = -.009$

$\Delta t = +15.401 \pm .015$

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February 27 1869

Star	Capella	β Tauri	Groomb. 966. U. C.		δ Orionis	α Leporis
Lamp.	W	W	W	E	E	E
Lattice	C D E	C D E	B C	C B	D	E D C
					(Doubtful)	
α	5 7 1.00	5 18 0.81	5 22	14.51	5 25 19.01	5h 26m 57.37
δ	+45 51 42.7	+28 29 33.8	+74 57	11.7	-0 24 8.8	-17 55 23.8
M	5 6 44.873	5 17 44.720	5 20 27.540	5 23 28.548	5 25 3.048	5 26 41.411
f	+0.024	+0.024	+23.519	-23.519	+0.040	-0.024
log. f	8.38021	8.38021	1.37142	1.37142n	8.60206	8.38021n
sec δ	0.15715	0.05607	0.585683	0.585683	0.00001	0.02161
log. S						
log. σ			03	03		
log. P.	8.53736	8.43628	1.957106	1.957106n	8.60207	8.40182n
R	+.034	+.027	+1 30.595	-1 30.595	+.040	-.025
b_0	+.014	+.014	+.014	-.022	-.022	-.022
A	-.087	+.273	-2.074		+.679	+.913
B	+1.433	+1.105	+3.246		+.734	+.521
C	+1.436	+1.138	+3.852		+1.000	+1.051
κ	-.022	-.018	-.060	-.060	-.016	-.016
Bb_0	+.020	+.015	+.045	-.071	-.016	-.011
T	5 6 44.907	5 17 44.747	5 21 58.135	5 21 57.953	5 25 3.088	5 26 41.386
t	5 6 44.905	5 17 44.744	5 21 58.120	5 21 57.822	5 25 3.056	5 26 41.359
w	+16.095	+16.066	+16.390	+16.688	+15.954	+16.011
C_c	+.078	+.061			-.054	-.057
w_0	+16.173	+16.127	+16.539		+15.900	+15.954
(w_0)	+16.185	+16.136	+16.547		Reject	+15.961

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February 27th 1869

Star	α Columbae	ψ¹ Draconis (Kr.) L.C		α Orionis	ρ Geminor	ε Can. Maj.
Samp	E	O	W	W	E	W
Tallies	E D C	B C	C B	C D E	E D C	C D E
α	5 34 54.66	5 44	15.06	5 48 5.03	6 30 9.06	6 53 29 47
δ	-34 9 6.1	+72 12	31.4	+7 22 37.2	+16 30 22.5	-28 48 3.7
M	5 34 38.711	5 42 42.076	5 45 15.860	5 47 48.898	6 29 53.079	6 53 13.223
f	-0.024	+23.519	-23.519	+0.024	-0.024	+0.024
log. f	8.38021n	1.37142	1.37142n	8.38021	8.38021n	8.38021
sec δ	0.08220	0.514917	0.514917	0.00361	0.01828	0.05735
log. σ						
σ		02	02			
log. R	8.46241n	1.886339	1.886339n	8.38382	8.39849n	8.43756
R	-.029	+1 16.973	-1 16.973	+.024	-.025	+.027
r_0	-.022	-.022	+.014	+.014	+.010	+.022
A	+1.175	+2.976		+.578	+.455	+1.080
B	+.281	-1.362		+.826	+.938	+.368
C	+1.208	-3.273		+1.008	+1.043	+1.141
x	-.019	+.051	+.051	-.016	-.016	-.018
$B r_0$	-.006	+.030	-.019	+.012	+.009	+.008
T	5 34 38.682	5 43 59.049	5 43 58.887	5 47 48.922	6 29 53.054	6 53 13.250
t	5 34 38.657	5 43 59.130	5 43 58.919	5 47 48.918	6 29 53.047	6 53 13.240
w	+16.003	+15.930	+16.141	+16.112	+16.013	+16.230
C_c	-.065			+.054	-.056	+.062
w_0	+15.938	+16.036		+16.166	+15.957	+16.292
(w_0)	+15.943	+16.038		+16.167	+15.947	+16.270

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Star	δ Geminor
Lamp	E
Tallies	E D C
α	7 12 18.49
δ	+22 13 8.8
M	7 12 2.453
p	-0.024
log Δ	8.38021n
sec δ	0.03351
log p	
log σ	8.41372
log R	-.026
R	
t_0	-.006
A	+.372
B	+1.014
C	+1.080
x	-.017
$13t_0$	-.006
σ	7 12 2.427
t	7 12 2.404
w	+16.086
Cc	-.058
w_0	+16.028
(w_0)	+16.007

C = -.054

Hourly rate = -.016

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February 27th 1869

Collimation

Star	Time	Cc	C	c
Gromb. 966. U.C	5h 22m	-.149	+3.852	-.0387
ψ Draconis, L.C.	5 44	+.1055	-3.273	-.0322

$\gamma_0 = 5^h 53^m$

$\theta = +16.180$

Ober. A.T.M.

Clock and Azimuth corrections

Star	Lamp	(w)	A	w_0	A^2	Aw_0	Aa	Δt
Capella	W	+16.185	-.087	+.005	.008	-.000	+.009	16.176
β Tauri	W	16.136	+.273	-.044	.075	-.012	-.027	16.163
Gromb. 966. U.C.	W. E	16.547	-2.074	+.367	4.300	-.761	+.207	16.340
α Leporis	E	15.961	+.913	-.219	.833	-.200	-.091	16.052
α Columbae	E	15.943	+1.175	-.237	1.381	-.278	-.118	16.061
ψ Draconis fr. P.C	E-W	16.038	+2.976	-.142	8.857	-.423	-.298	16.336
α Orionis	W	16.167	+.578	-.013	.335	-.008	-.058	16.225
γ C. Seminor	E	15.947	+.455	-.233	.207	-.106	-.045	15.992
ε Can. Maj.	W	16.276	+1.080	+.096	1.167	+.104	-.108	16.384
δ C. Seminor	E	16.007	+.372	-.173	.139	-.064	-.037	16.044
			+5.661	-0.593	17.302	-1.748	+	16.177

$10\Delta\theta + 5.661a = -0.593$

$+5661\ \Delta\theta + 17.302a = -1.748$

$\Delta\theta + .5661a = -.0593$

$+5661\ \Delta\theta + 3.205a = -336.$

$+14.097a = -1.412$

$a = -.100$

$\Delta\theta - .0566 = -.0593$

$\Delta\theta = -.003$

$\Delta t = +16.177 \pm .030$

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February 27th 1869

Star	η Virginis	β Comæ	21 Cassiop. L. C.		12 Can. Ven.	θ Virginis
Lamp	W	W	W	E	E	E
Tallies	C D E	C D E	W E	E W	E D C	E D C
α	12 13 13.22	12 27 31.78	12 36	59.754	12 49 54.62	13 3 11.024
δ	+0 3 35.8	-22 40 18.9	+74 16	20.5	+39 1 25.4	-4 50 23.1
M	12 12 57.153	12 27 15.713	12 35 17.06	12 38 10.728	12 49 38.468	13 2 54.931
b	+0.024	+0.024	+23.499	-23.499	-0.024	-0.024
log. b	8.38021	8.38021	1.37105	1.37105n	8.38021n	8.38021n
sec. δ	0.00000	0.03493	0.566927	0.566927	0.10964	0.00155
log. S						
log. σ			03	03		
log. R	8.38021	8.41514	1.937980	1.937980n	8.48985n	8.38176n
R	+.024	+.026	+1 26.692	-1 26.692	-.031	-024
b_0	-.018	+.007	+.014	-.086	-.066	-.038
A	+.673	+.983	+3.	297	+.075	+.737
B	+.739	+.457	-1.	655	+1.285	+.682
C	+1.000	+1.084	-3.	689	+1.287	+1.004
x	-.016	-.017	+.057	+.057	-.020	-.016
Bb_0	-.013	+.003	-.023	+.142	-.085	-.026
T	12 12 57.177	12 27 15.739	12 36 43.753	12 36 44.036	12 49 38.437	13 2 54.907
t	12 12 57.148	12 27 15.725	12 36 43.787	12 36 44.235	12 49 38.332	13 2 54.865
w	+16.072	+16.053	+15.967	+15.519	+16.288	+16.159
Cc	+.054	+.059			-.069	-.054
w_0	+16.126	+16.114	+15.	743	+16.219	+16.105
(w_0)	+16.144	+16.128	+15.	755	+16.227	+16.110

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Star	α Cassiop.		ξ Virginis	γ Ursæ Maj.	η Bootis
Camp	E	W	W	W	W
Tallies	B C	C B	C D E	C D E	C D E_5
α	13 21 29.374		13 28 1.89	13 42 23.35	13 48 27.444
δ	+69	35 26.6	+0 4 26.2	+49 57 52.7	+19 3 12.6
M	13 20 6.237	13 22 20.798	13 27 45.920	13 42 7.232	13 48 5.715
Y	+23.519	−23.519	+.024	+0.024	+5.228
log. Y.	1.37142	1.37142n	8.38021	8.38021	0.71834
sec. δ	0.457518	0.457518	0.00000	0.19161	0.02447
log. S					
log. σ					
log. K	1.828938	1828938n	8.38021	8.57182	0.74281
R	+1 7.443	−1 7.443	+.024	+.037	+5.531
l_0	−.038	−.018	−.021	−.038	−.046
A	+2.659		+.673	−.205	+.419
B	−1.073		+.740	+1.541	+.971
C	−2.868		+1.000	+1.555	+1.058
x	+.044	+.044	−.016	−.024	−.016
Bl_0	+.041	+.019	−.016	−.059	−.045
T	13 21 13.680	13 21 13.355	13 27 45.944	13 42 7.269	13 48 11.246
t	13 21 13.765	13 21 13.418	13 27 45.912	13 42 7.186	13 48 11.185
w	+15.609	+15.956	+15.978	+16.164	+16.259
C_C			+.054	+.084	+.057
w_0	+15.783		+16.032	+16.248	+16.316
(w_0)	+15.783		+16.030	+16.242	+16.308

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c = −.054

Hourly rate = −.016

Star	α Draconis M.C.		α Bootis	θ Bootis
Lamp	W	E	E	E
Tallies	B C	C B	E D C	E D C
α	14 h 0 m	51.s62	14 9 41.67	14 20 44.74
δ	+64 59	55.2	+19 51 49.0	+52 27 13.6
M	13 59 39.781	14 1 30.689	14 9 25.568	14 20 28.465
Y	+23.519	−23.519	−0.024	−0.024
log Y	1.37142	1.37142n	8.38021n	8.38021n
sec δ	0.37403	0.37403	0.02664	0.21510
log S				
log σ				
log R	1.74545	1.74545n	8.40685n	8.59531n
R	+55.648	−55.648	−.026	−.039
t_0	−.058	−.054	−.061	−.070
A	−.910		+.407	−.287
B	+2.184		+.982	+1.616
C	+2.366		+1.063	+1.641
x	−.037	−.037	−.016	−.025
Bt_0	−.126	−.118	−.060	−.113
T	14 0 35.429	14 0 35.041	14 9 25.542	14 20 28.426
t	14 0 35.266	14 0 34.886	14 9 25.466	14 20 28.288
w	+16.354	+16.734	+16.204	+16.452
Cc			−.057	−.089
w_0	+16.544		+16.147	+16.363
(w_0)	+16.533		+16.134	+16.347

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February 27th 1869

Collimation

Star	Time	Cc	C	c
21 Cassiop. L.C.	12h 37m	+.224	-3.689	-.0607
A Cassiop. L.C.	13 21	+.1735	-2.868	-.0605
α Draconis U.C.	14 1	-.190	+2.366	-.0804

$\gamma_0 = 13^h\ 20^m$

$\theta = +16^s.360$

Ober. A. Ill

Clock and Azimuth Corrections

Star	Lamp	(w₀)	A	w₀	A²	Aw₀	Aa	Δt
η Virginis	W	+16.144	+.673	-.216	.453	-.145	-.118	16.262
β Corvi	W	16.128	+.983	-.232	.966	-.228	-.172	16.300
21 Cassiop L.C.	W. E	15.755	+3.297	-.605	10.872	-1.995	-.577	16.332
12 Can. Ven.	E	16.227	+.075	-.133	.006	-.010	-.013	16.240
θ Virginis	E	16.110	+.737	-.250	.543	-.184	-.129	16.239
A Cassiop. L.C.	E-W	15.783	+2.659	-.577	7.072	-1.534	-.465	16.248
ζ Virginis	W	16.030	+.673	-.330	.453	-.222	-.118	16.148
η Ursæ Maj.	W	16.242	-.205	-.118	.042	+.024	+.036	16.206
η Bootis	W	16.308	+.419	-.052	.175	-.022	-.073	16.381
α Draconis U.C.	W. E	16.533	-.910	+.173	.828	-.157	+.159	16.374
α Bootis	E	16.134	+.407	-.226	.166	-.092	-.071	16.205
θ Bootis	E	16.347	-.287	-.013	.082	+.004	+.050	16.297
			+8.521	-2.579	21.658	-4.561	+	16.269

$12\Delta\theta + 8.521a = -2.579$

$+8.521\Delta\theta + 21.658a = -4.561$

$\Delta\theta + .7101a = -.2149$

$+8.521\Delta\theta + 6.050a = -1.831$

$+15.608a = -2.730$

$a = -.175$

$\Delta\theta - .1243 = -.2149$

$\Delta\theta = -.091$

$\Delta t = +16.269 \pm .014$

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February 28th 1869

Star	Capella	β Tauri	δ Orionis	α Leporis	ε Orionis
Lamp	E	E	E	E	E
Tallies	E D C	E D C	E D C	E D C	E D C
α	5 7 0.98	5 18 0.79	5 25 18.99	5 26 57.35	5 29 34.12
δ	+45 51 42.7	+28 29 33.8	−0 24 8.8	−17 55 23.9	−1 17 30.7
M	5 6 44.401	5 17 44.155	5 25 2.434	5 26 40 849	5 29 17.485
Y	−0.024	−0.024	−0.024	−0.024	−0.024
log.Y	8.38021n	8.38021n	8.38021n	8.38021n	8.38021n
Sec.δ	0.15715	0.05607	0.00001	0.02161	0.00011
log.S					
log.σ					
log.R	8.53736n	8.43628n	8.38022n	8.40182n	8.38032n
R	−.034	−.027	−.024	−.025	−.024
b_o	−.038	−.038	−.036	−.035	−.033
A	−.087	+.273	+.679	+.913	+.691
B	+1.433	+1.105	+.734	+.521	+.723
C	+1.436	+1.138	+1.000	+1.051	+1.000
x	−.022	−.018	−.016	−.016	−.016
Bb_o	−.054	−.042	−.026	−.018	−.024
T	5 6 44.367	5 17 44.128	5 25 2.410	5 26 40.824	5 29 17.461
t	5 6 44.291	5 17 44.068	5 25 2.368	5 26 40.790	5 29 17.421
w	+16.689	+16.722	+16.622	+16.560	+16.699
C_c	−.050	−.040	−.035	−.037	−.035
w_o	+16.639	+16.682	+16.587	+16.523	+16.664
(w_o)	+16.658	+16.696	+16.599	+16.534	+16.674

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Star	ω Draconis L. C.		ψ¹ Draconis (pr.) L. C.		α Ursæ Min.	ε Can. Maj.
Samp	E	W	W	E	W	W
Tallies	B C	C B	F E	E F	C D E	C D E
α	5 37	42.245	5 44	15.13	5 48 5.02	6 53 29.435
δ	+68 48	50.3	+72 12	31.3	+7 22 37.2	-28 48 3.8
M	5 36 20.810	5 38 30.686	5 42 41.986	5 45 16.043	5 47 48.400	6 53 12.857
I	+ 23.519	- 23.519	+23.499	- 23.499	+ 0.024	+ 0.024
log I.	1.37142	1.37142n	1.37105	1.37105n	8.38021	8.38021
sec δ	0.442015	0.442015	0.514917	0.514917	0.00361	0.05735
log. S						
log. σ			02	02		
log. R	1.813435	1.813435n	1.885969	1.885969n	8.38382	8.43756
R	+1 5.078	-1 5.078	+1 16.908	-1 16.908	+ .024	+ .027
L_0	- .030	- .066	- .066	- .038	- .018	+ .014
A	+ 2. 580		+ 2. 976		+ .578	+ 1.080
B	- 1. 000		- 1. 362		+ .826	+ .368
C	- 2. 767		- 3. 273		+ 1.008	+ 1.141
x	+ .043	+ .043	+ .051	+ .051	- .016	- .018
Bl_0	+ .030	+ .066	+ .090	+ .052	- .015	+ .005
T	5 37 25.888	5 37 25.608	5 43 58.894	5 43 59.135	5 47 48.424	6 53 12.884
t	5 37 25.961	5 37 25.717	5 43 59.035	5 43 59.238	5 47 48.393	6 53 12.871
w	+ 16.284	+ 16.528	+ 16.095	+ 15.892	+ 16.627	+ 16.579
Cc					+ .035	+ .040
w_0	+ 16. 406		+ 15. 993		+ 16.662	+ 16.619
(w_0)	+ 16. 413		+ 15. 998		+ 16.665	+ 16.597

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February 28th 1869

Star	δ Can. Maj	δ Geminor
Lamp	W	W
Tallies	C D E	C D E
α	7 3 4.70	7 12 18.47
δ	-26 11 30.8	+22 13 8.9
M	7 2 48.047	7 12 1.927
Z	+0.024	+0.024
log.Z.	8.38021	8.38021
sec.δ	0.04705	0.03351
log.S		
log.σ		
log.R	8.42726	8.41372
R	+.027	+.026
b_o	−.013	−.026
A	+1.037	+.372
B	+.407	+1.014
C	+1.114	+1.080
x	−.017	−.017
Bb_o	−.005	−.026
T	7 2 48.074	7 12 1.953
t	7 2 48.052	7 12 1.910
w	+16.648	+16.560
Cc	+.039	+.038
w_o	+16.687	+16.598
(w_o)	+16.661	+16.569

C = −.035

Hourly rate = −.023

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February 28th 1869

Collimation

Star	Time	Cc	C	c
ω Draconis L.C.	5h 37m	+.122	-2.767	-.044
φ' Draconis (pr.) L.C.	5 44	+.1015	-3.273	-.031

$\gamma_0 = 5^h\ 55^m$

$\theta = +16^s.760$

Aber. A. T. M.

Clock and azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	A a	Δt
Capella	E	+16.658	-.087	-.102	.008	+.009	+.016	16.642
β Tauri	E	16.696	+.273	-.064	.075	-.017	-.050	16.746
δ Orionis	E	16.599	+.679	-.161	.461	-.109	-.125	16.724
α Leporis	E	16.534	+.913	-.226	.833	-.206	-.168	16.702
ε Orionis	E	16.674	+.691	-.086	.477	-.059	-.127	16.801
ω Draconis, L.C.	E-W	16.413	+2.580	-.347	6.656	-.895	-.475	16.888
φ' Draconis (pr.) L.C.	W-E	15.998	+2.976	-.762	8.857	-2.268	-.549	16.547
α Orionis	W	16.665	+.578	-.095	.335	-.055	-.106	16.771
ε Can. Maj.	W	16.597	+1.080	-.163	1.167	-.176	-.199	16.796
δ Can. Maj.	W	16.661	+1.037	-.099	1.076	-.103	-.191	16.852
δ Geminor	W	16.569	+.372	-.191	.139	-.071	-.068	16.637
			+11.092	-2.296	20.084	-3.950	+	16.737

$11\Delta\theta + 11.092\,a = -2.296$

$+11.092\,\Delta\theta + 20.084\,a = -3.950$

$\Delta\theta + 1.0084\,a = -.2087$

$+11.092\,\Delta\theta + 11.185\,a = -2.315$

$+8.899\,a = -1.635$

$a = -.184$

$\Delta\theta - .1855 = -.2087$

$\Delta\theta = -.023$

$\Delta t = +16.737 \pm .020$

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February 28th 1869

Star	Ursæ Maj.	η Bootis	α Draconis, U. C.		α Bootis	θ Bootis
Lamp	E	E	E	W	W	W
Tallies	E 543 D C	E D C	W E	E W	C D E	C D E
α	13 42 23.38	13 48 27.47	14 0 51.664		14 9 41.696	14 20 44.775
δ	+49 57 52.9	+19 3 12.6	+64 59 55.3		+19 51 49.0	+52 27 13.7
M	13 42 9.367	13 48 10.577	13 59 13.988	14 1 30.116	14 9 24.937	14 20 28.109
F	−1.8265	−0.024	+23.499	−23.499	+0.024	+0.024
log F.	0.26162n	8.38021n	1.37105	1.37105n	8.38021	8.38021
sec δ	0.19161	0.02447	0.37403	0.37403	0.02664	0.21510
log ρ						
log σ						
log R	0.45323n	8.40468n	1.74508	1.74508n	8.40685	8.59531
R	−2.839	−.025	+55.601	−55.601	+.026	+.039
l_0	−.038	−.045	−.054	−.074	−.074	−.074
A	−.205	+.419	−.910		+.407	−.287
B	+1.541	+.971	+2.184		+.982	+1.616
C	+1.555	+1.058	+2.366		+1.063	+1.641
μ	−.024	−.016	−.037	−.037	−.016	−.025
Bl_0	−.059	−.044	−.118	−.161	−.073	−.120
T	13 42 6.528	13 48 10.552	14 0 34.589	14 0 34.515	14 9 24.963	14 20 28.148
t	13 42 6.445	13 48 10.492	14 0 34.434	14 0 34.317	14 9 24.874	14 20 28.003
w	+16.935	+16.976	+17.230	+17.347	+16.822	+16.772
C_c	−.054	−.037			+.037	+.057
w_0	+16.881	+16.941	+17.289		+16.859	+16.829
(w_0)	+16.893	+16.951	+17.294		+16.861	+16.826

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Star	5 Urs. Min.		ε Bootis	α² Librae
Lamp	W	E	E	W
Tallies	B C	C B	E D C	C D E
α	14 27 51.57		14 39 16.35	14 43 38.604
δ	+ 76	16 28.0	+27 37 31.4	-15 29 41.3
M	14 25 55.287	14 29 12.751	14 38 59.638	14 43 22.081
r	+23.519	-23.519	-0.024	+0.024
log r.	1.37142	1.37142 n	8.38021 n	8.38021
sec δ	0.624755	0.624755	0.05257	0.01608
log S				
log σ	03	03		
log k	1.996178	1.996178 n	8.43278 n	8.39629
k	+1 39.124	-1 39.124	-.027	+.025
t_0	-.074	-.062	-.062	-.026
x	-2.350		+.287	+.879
b	+3.498		+1.091	+.352
ℓ	+4.215		+1.129	+1.038
x	-.065	-.065	-.018	-.016
Bb_0	-.259	-.217	-.068	-.014
T	14 27 34.411	14 27 33.627	14 38 59.611	14 43 22.106
t	14 27 34.087	14 27 33.345	14 38 59.525	14 43 22.076
w	+17.483	+18.225	+16.825	+16.528
Ce			-.040	+.036
w_0	+17.854		+16.785	+16.564
(w_0)	+17.849		+16.775	+16.553

c = -.035

Hourly rate = -.023

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February 28th 1869

Collimation

Star	Time	Cc	C	c
α Draconis U.C.	14h 1m	+.0385	+2.366	+.0248
5 Urs. Min. U.C.	14 28	−.371	+4.215	−.0879

$\gamma_0 = 14^h 14^m$

$\theta = +16^s.950$

Obs. A.T.M.

Clock and Azimuth corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
γ Urs. Maj.	E	+16.893	−.205	−.057	.042	+.012	+.077	16.816
η Bootis	E	16.951	+.419	+.001	.175	.000	−.157	17.108
α Draconis U.C.	E–W	17.294	−.910	+.344	.828	−.313	+.340	16.954
α Bootis	W	16.861	+.407	−.089	.166	−.036	−.152	17.013
θ Bootis	W	16.826	−.287	−.124	.082	+.036	+.107	16.719
5 Urs. Min. U.C.	W–E	17.849	−2.350	+.899	5.524	−2.113	+.879	16.970
ε Bootis	E	16.775	+.287	−.175	.083	−.050	−.107	16.882
α^2 Librae	W	16.553	+.879	−.397	.772	−.349	−.329	16.882
			−1.760	+.402	7.672	−2.813	+	16.918

$8\Delta\theta - 1.760a = +.402$

$-1.760\Delta\theta + 7.672a = -2.813$

$\Delta\theta - .220a = +.05025$

$-1.760\Delta\theta + .387a = -.088$

$+7.285a = -2.725$

$a = -.374$

$\Delta\theta + .0823 = +.0503$

$\Delta\theta = -.032$

$\Delta t = +16.918 \pm .029$

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March 1st, 1869

Star	δ Chamis	α Lepois	ε Chamis	ω Draconis, L. C.	
Lamp	W	W	W	W	E
Tallies	C D E	C D E	C D E	Y. E	E Y.
α	5 25 18.97	5 26 57.33	5 29 34.10	5 37	42.31
δ	-0 24 8.8	-17 55 23.9	-1 17 30.7	+ 68 48	50.3
M	5 25 1.703	5 26 40.019	5 29 16.791	5 36 20.011	5 38 30.083
Y.	+0.024	+0.024	+0.024	+23.499	-23.499
log. Y.	8.38021	8.38021	8.38021	1.37105	1.37105n
sec. δ	0.00001	0.02161	0.00011	0.442015	0.442015
log. S					
log. σ					
log. R	8.38022	8.40182	8.38032	1.813065	1.813065n
R	+.024	+.025	+.024	+1 5.023	-1 5.023
b_0	-.018	-.018	-.018	-.018	-.001
A	+.679	+.913	+.691	+ 2.	580
B	+.734	+.521	+.723	-1.	000
C	+1.000	+1.051	+1.000	- 2.	767
x	-.016	-.016	-.016	+.043	+.043
B b_0	-.013	-.009	-.013	+.018	+.001
T	5 25 1.727	5 26 40.044	5 29 16.815	5 37 25.034	5 37 25.040
t	5 25 1.698	5 26 40.019	5 29 16.786	5 37 25.095	5 37 25.084
w	+17.272	+17.311	+17.314	+17.215	+17.226
Cc	-.002	-.002	-.002		
w_0	+17.270	+17.309	+17.312	+ 17.	221
(w_0)	+17.287	+17.325	+17.327	+ 17.	232

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March 1st 1869

c = +.002
Hourly rate = -.026

Star	ψ' Draconis (pr.) L. C.		α Ursæ	ε Can. Maj.	δ Can. Maj.	δ Geminor
Lamp	E	W	W	W	E	E
Tallies	B C	B	C D E	C D E	E D C	E D C
α	5 44	15.20	5 48 5.00	6 53 29.43	7 3 4.68	7 12 18.46
δ	+72 12	31.2	+7 22 37.2	-28 48 3.9	-26 11 30.9	+22 13 8.9
M	5 42 41.094	5 45 40.592	5 47 47.757	6 53 12.081	7 2 47.643	7 12 1.107
Z	+23.519	-31.339	+.024	+0.024	-.024	-0.024
log. r.	1.37142	1.49609n	8.38021	8.38021	8.38021n	8.38021n
Sec. δ	0.514916	0.514916	0.00361	0.05735	0.04705	0.03351
log. S						
log. σ		04				
log. K.	1.886336	2.011010n	8.38382	8.43756	8.42726n	8.41372n
R	+1 16.973	-1 42.568	+.024	+.027	-.027	-.026
l_0	-.007	-.050	-.050	-.002	-.094	-.073
A	+2.976		+.578	+1.080	+1.037	+.372
B	-1.362		+.826	+.368	+.407	+1.014
C	-3.273		+1.008	+1.141	+1.114	+1.080
x	+.051	+.051	-.016	-.018	-.017	-.017
Bl_0	+.010	+.068	-.041	-.001	-.038	-.074
T	5 43 58.067	5 43 58.024	5 47 47.781	6 53 12.108	7 2 47.616	7 12 1.081
t	5 43 58.128	5 43 58.143	5 47 47.724	6 53 12.089	7 2 47.561	7 12 0.990
w	+17.072	+17.057	+17.276	+17.341	+17.119	+17.470
Cc			-.002	-.002	+.002	+.002
w_0	+17.065		+17.274	+17.339	+17.121	+17.472
(w_0)	+17.074		+17.281	+17.318	+17.096	+17.443

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March 1 $^{St}_{II}$ 1869

Collimation

Star	Time	Cc	C	c
ω Draconis L.C.	$5^h\ 37^m$	-.0055	-2.767	+.002
ψ Draconis (fr) L.C.	5 44	-.0075	-3.273	+.002

$\gamma_0 = 6^h\ 4^m$

$\theta = +17^s.310$

Obs. A. T. M

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
δ Ursæ	W	+17.287	+.679	-.023	.461	-.015	-.058	17.345
α Leporis	W	17.325	+.913	+.015	.833	+.014	-.079	17.404
ε Ursæ	W	17.327	+.691	+.017	.477	+.012	-.059	17.386
ω Draconis L.C.	W-E	17.232	+2.580	-.078	6.656	-.201	-.222	17.454
ψ Draconis (fr) L.C.	E-W	17.074	+2.976	-.236	8.857	-.702	-.256	17.330
α Ursæ	W	17.281	+.578	-.029	.335	-.017	-.050	17.331
ε Can. Maj.	W	17.318	+1.080	+.008	1.167	+.009	-.093	17.411
δ Can. Maj.	E	17.096	+1.037	-.214	1.076	-.222	-.089	17.185
δ Geminor	E	17.443	+.372	+.133	.139	+.049	-.032	17.475
			+10.906	-.407	20.001	-1.073	+	17.369

$9\Delta\theta + 10.906\,a = -.407$

$+10.906\,\Delta\theta + 20.001\,a = -1.073$

$\Delta\theta + 1.2118\,a = -.0452$

$+10.906\,\Delta\theta + 13.216\,a = -.4929$

$+6.785\,a = -.5801$

$a = -.086$

$\Delta\theta - .1042 = -.0452$

$\Delta\theta = +.059$

$\Delta t = +17.369 \pm .019$

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March 3d 1869

Star	Sirius	ε Can. Maj.	δ Can. Maj.	δ Geminor	α Can. Min.	β Geminor
Camp	W	W	W	W	E	E
Tallies	C D E	C D E	C D E	C D E	E D C	E D C
	* large, diff. Tens					
α	6 39 22.95	6 53 29.39	7 3 4.644	7 12 18.43	7 32 27.31	7 37 18.474
δ	-16 32 36.1	-28 48 4.1	-26 11 31.1	+22 13 9.0	+5 33 18.8	+28 20 19.5
M	6 39 3.668	6 53 10.244	7 2 45.629	7 11 57.532	7 32 8.287	7 36 59.600
L	+0.024	+0.024	+0.024	+0.024	−0.024	−0.024
log. Y.	8.38021	8.38021	8.38021	8.38021	8.38021n	8.38021n
sec. δ	0.01836	0.05735	0.04705	0.03351	0.00404	0.05544
log. ρ						
log. σ						
log. R	8.39857	8.43756	8.42726	8.41372	8.38225n	8.43565n
R	+.025	+.027	+.027	+.026	−.024	−.027
l_0	−.016	−.050	−.050	−.050	+.010	+.010
A	+.893	+1.080	+1.037	+.372	+.602	+.276
B	+.538	+.368	+.407	+1.014	+.804	+1.102
C	+1.043	+1.141	+1.114	+1.080	+1.005	+1.136
x	−.016	−.018	−.017	−.017	−.016	−.018
$B l_0$	−.009	−.018	−.020	−.051	+.008	+.011
T	6 39 3.693	6 53 10.271	7 2 45.656	7 11 59.558	7 32 8.263	7 36 59.573
t	6 39 3.668	6 53 10.235	7 2 45.619	7 11 59.490	7 32 8.255	7 36 59.566
w	+19.282	+19.155	+19.025	+18.940	+19.053	+18.908
Cc	+.041	+.044	+.043	+.042	−.039	−.044
w_0	+19.323	+19.199	+19.068	+18.982	+19.016	+18.864
(w_0)	Reject	+19.231	+19.095	+19.005	+19.029	+18.876

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March 3d 11h 1869

Star	ζ Geminor	χ Cephei I. C		ε Hydrae	ζUrs. Maj.
Samp	8	E	W	E	E
Tallies	E D C	C	C	E D C	E D C
		χ ft. doubtful			
α	7 45 29.36	8 13	11.625	8 39 51.13	8 50 14.68
δ	+27 6 2.9	+77 18	46.3	+6 53 41.8	+48 33 11.4
M	7 45 10.524	8 11 40.344	8 14 2.890	8 39 32.225	8 49 55.983
Z	−0.024	+15.699	−15.699	−0.024	−0.024
log Z	8.38021n	1.19587	1.19587n	8.38021n	8.38021n
sec δ	0.05051	0.658314	0.658314	0.003155	0.17919
log S					
log σ					
log K	8.43072n	1.854184	1.854184n	8.38336n	8.35940n
K	−.027	+1 11.480	−1 11.480	−.024	−.036
b_o	+.013	+.026	+.014	−.038	−.038
A	+.296	+3.955		+.585	−.162
B	+1.084	−2.255		+.820	+1.502
C	+1.123	−4.553		+1.007	+1.511
x	−.017	+.071	+.071	−.016	−.023
Bb_o	+.014	−.059	−.032	−.031	−.057
T	7 45 10.497	8 12 51.824	8 12 51.410	8 39 32.201	8 49 55.947
t	7 45 10.494	8 12 51.836	8 12 51.449	8 39 32.154	8 49 55.867
w	+18.866	+19.789	+20.176	+18.976	+18.813
Cc	−.044			−.039	−.059
w_o	+18.822	+19.983		+18.937	+18.754
(w_o)	+18.829	Reject for time		+18.919	+18.731

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March 3d 4h 1869

c = - .039

Hourly rate = - .028

Star	σ^2 Urs. Maj. U. C		11 Cephei. L. C	
Samp.	E	W	E	W
Tallies	7 E	E 7	B C	C B
α	$8^h\ 58^m\ 51^s.73$		9 39 56.90	
δ	+67 39 48.2		+70 42 24.7	
M	8 57 31.431	8 59 35.365	9 38 26.417	9 40 48.522
λ	+23.499	- 23.499	+23.519	- 23.519
log. r.	1.37105	1.37105n	1.37142	1.37142n
sec δ	0.420162	0.420162	0.480958	0.480958
log. ρ				
log. σ				
log. R.	1.791212	1.791212n	1.852378	1.852378n
R	+1 1.832	-1 1.832	+1 11.183	-1 11.183
l_0	- .038	- .018	- .022	- .050
A	- 1.124		+ 2.784	
B	+ 2.379		- 1.187	
C	+ 2.631		- 3.027	
x	- .041	- .041	+ .047	+ .047
Bl_0	- .090	- .043	+ .026	+ .059
T	8 58 33.263	8 58 33.533	9 39 37.600	9 39 37.339
t	8 58 33.132	8 58 33.449	9 39 37.673	9 39 37.445
w	+18.598	+18.281	+19.227	+19.455
δ_c				
w_0	+18.439		+19.341	
(w_0)	+18.412		+19.295	

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March 3d 1869

Collimation

Star	Time	Cc	C	c
χ Cephei L.C.	8h 13m	+.1935	-4.553	-.0425
σ² Urs. Maj. L.C	8 59	-.1585	+2.631	-.0603
11 Cephei L.C	9 40	+.114	-3.027	-.0377

$\gamma_0 = 8^h\ 1^m$

$\theta = +18^s.830$

Ober. T. B. Jr.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	$A w'_0$	Aa	Δt
ε Can. Maj.	W	+19.231	+1.080	+.401	1.167	+.433	+.252	18.979
δ Can. Maj.	W	19.095	+1.037	+.265	1.076	+.275	+.242	18.853
δ Geminor	W	19.005	+.372	+.175	.139	+.065	+.087	18.918
α Can. Min.	E	19.029	+.602	+.199	.363	+.120	+.140	18.889
β Geminor	E	18.876	+.276	+.046	.076	+.013	+.064	18.812
φ Geminor	E	18.829	+.296	-.001	.088	.000	+.069	18.760
ε Hydrae	E	18.919	+.585	+.089	.342	+.052	+.136	18.783
ι Urs. Maj.	E	18.731	-.162	-.099	.026	+.016	-.038	18.769
σ² Urs. Maj. N.C	E-W	18.412	-1.124	-.418	1.263	+.470	-.262	18.674
11 Cephei, L.C.	E-W	19.295	+2.784	+.465	7.752	+1.295	+.649	18.646
			+5.746	+1.122	12.292	+2.739	+	18.808

$+10\,\Delta\theta + 5.746\,a = +1.122$

$+5.746\,\Delta\theta + 12.292\,a = +2.739$

$\Delta\theta + .5746a = +.1122$

$+5.746\,\Delta\theta + 3.302\,a = +.644$

$+8.990\,a = +2.095$

$a = +.233$

$\Delta t = +18.808 \pm .022$

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March 3d 1869

Star	δ Crateris	γ Leonis	γ Cephei. L. C.		β Leonis.	σ Virginis.
Lamp	W	W	W	E	E	E
Tallies	C D	C D E	γ E	E 45 γ	E D C	E D C
α	11 12 48.804	11 21 13.08	11 33	55.54	11 42 23.56	11 58 33.136
δ	-14 4 18.3	+ 3 34 31.3	+76 54	6.1	+15 18 8.3	+9 27 31.7
M	11 12 21.679	11 20 54.007	11 31 51.751	11 35 39.233	11 42 4.627	11 58 14.235
Y	+7.830	+0.024	+23.499	-28.006	-0.024	-0.024
log. Y	0.89376	8.38021	1.37105	1.44725n	8.38021n	8.38021n
sec δ	0.01323	0.00085	0.64470	0.64470n	0.01568n	0.00595n
log. S						
log. σ			.04	06		
log. R	0.90699	8.38106	2.01575 4	2.09195 6n	8.39589n	8.38616n
R	+8.072	+.024	+1 43.694	-2 3.582	-.025	-.024
b_o	-.010	-.004	+.006	+.026	+.022	-.006
A	+.859	+.628	+3.849		+.472	+.551
B	+.570	+.781	-2.158		+.923	+.851
C	+1.031	+1.002	-4.413		+1.037	+1.014
x	-.016	-.016	+.068	+.068	-.016	-.016
Bb_o	-.006	-.003	-.013	-.056	+.020	-.005
T	11 12 29.751	11 20 54.031	11 33 35.445	11 33 35.651	11 42 4.602	11 58 14.211
t	11 12 29.729	11 20 54.012	11 33 35.500	11 33 35.663	11 42 4.606	11 58 14.190
w	+19.075	+19.068	+20.040	+19.877	+18.954	+18.946
Cc	+.040	+.039			-.040	-.040
w_o	+19.115	+19.107	+19.958		+18.914	+18.906
(w_o)	+19.153	+19.141	+19.986		+18.938	+18.923

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March 3d, 1869

Star	β Corvi	12 Can. Ven.	o Virginis	ζ Virginis	η Ursæ Maj.	α Bootis
Lamp	E	E	E	W	W	E
Vallis	E D C	E D C	E D C	C D E	C D E	E D C
				doubtful		
α	12 27 31.84	12 49 54.70	13 3 11.096	13 28 1.97	13 42 23.47	14 9 41.77
δ	-22 40 19.7	+39° 1' 25".8	-4 50 23.5	+0 4 25.8	+49 57 52.7	+19 51 49.0
M	12 27 12.771	12 49 35.936	13 2 52.152	13 27 42.866	13 42 4.461	14 9 22.831
k	−0.024	−0.024	−0.024	+0.024	+0.024	−0.024
log. k	8.38021n	8.38021n	8.38021n	8.38021	8.38021	8.38021n
sec δ	0.03493	0.10964	0.00155	0.00000	0.19161	0.02664
log. ρ						
log. σ						
log. R	8.41514n	8.48985n	8.38176n	8.38021	8.57182	8.40685n
R	−.026	−.031	−.024	+.024	+.037	−.026
l_0	−.042	−.030	−.030	+.014	+.014	+.032
A	+.983	+.075	+.737	+.673	−.205	+.407
B	+.457	+1.285	+.682	+.740	+1.541	+.982
C	+1.084	+1.287	+1.004	+1.000	+1.555	+1.063
x	−.017	−.020	−.016	−.016	−.024	−.016
Bl_0	−.019	−.039	−.020	+.010	+.022	+.031
T	12 27 12.745	12 49 35.905	13 2 52.128	13 27 42.890	13 42 4.498	14 9 22.805
t	12 27 12.709	12 49 35.846	13 2 52.092	13 27 42.884	13 42 4.496	14 9 22.820
w	+19.131	+18.854	+19.004	+19.086	+18.974	+18.950
Cc	−.042	−.050	−.039	+.039	+.061	−.041
w_0	+19.089	+18.804	+18.965	+19.125	+19.035	+18.909
(w_0)	+19.092	+18.797	+18.952	reject	+19.003	+18.864

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March 3d 1869

Star	θ Boötis
Lamp	E
Tallies	E D C
α	14 20 44.88
δ	+52 27 14.0
M	14 20 26.097
f	−0.024
log. f	8.38021 n
sec. δ	0.21510
log ρ	
log σ	
log. R	8.59531
R	−.039
l_o	+.030
A	−.287
B	+1.616
l	+1.641
x	−.025
Bl_o	+.048
T	14 20 26.058
t	14 20 26.081
w	+18.799
Cc	−.064
w_o	+18.735
(w_o)	+18.685

C = −.039

Hourly rate = −.028

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March 3d, 1869

Collimation

Star	Time	Cc	Cc	C
γ Cephei, L.C	11h 34m	+.0815	-4.413	-.0185

$\gamma_0 = 12^h 34^m$

$\theta = +18^s.960$

Ober. F. B. Jr.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
δ Cratéris	W	+19.153	+.859	+.193	.738	+166	+.253	18.900
τ Leonis	W	19.141	+.628	+.181	.394	+.114	+.185	18.956
γ Cephei L.C.	W-E	19.986	+3.849	+1.026	14.813	+3.949	+1.132	18.854
β Leonis	E	18.938	+.472	-.022	.223	-.010	+.139	18.799
o Virginis	E	18.923	+.551	-.037	.304	-.020	+.162	18.761
β Comæ	E	19.092	+.983	+.132	.966	+.130	+.289	18.803
12 Can. Ven.	E	18.797	+.075	-.163	.006	-.012	+.022	18.775
θ Virginis	E	18.952	+.737	-.008	.543	-.006	+.217	18.735
γ Urs. Maj.	W	19.003	-.205	+.043	.042	-.009	-.060	19.063
α Boötis	E	18.864	+.407	-.096	.166	-.039	+.120	18.744
θ Boötis	E	18.685	-.287	-.275	.082	+.079	-.084	18.769
			+8.069	+0.974	18.277	+4.342		+18.833

$11\Delta\theta + 8.069a = +0.974$

$+8.069\Delta\theta + 18.277a = +4.342$

$\Delta\theta + .7335a = +.0885$

$+8.069\Delta\theta + 5.919a = +.714$

$+12.358a = +3.628$

$a = +.294$

$\Delta\theta + .2156 = +.0885$

$\Delta\theta = -.127$

$\Delta t = +18.833 \pm .021$

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March 5th " 1869

"Night unfavorable for observing. – Stars very unsteady".

Star	ε Orionis	α Columbae	ψ' Draconis (pr.) L. C.		α Orionis
Camp	W	W	W	E	E
Tallies	C D E	C D E	J E	E J	E D C
α	5 29 34.03	5 34 54.51	5 44 15.495		5 48 4.93
δ	-1 17 30.8	-34 9 6.4	+72° 12' 30".7		+7 22 37.2
M	5 29 13.930	5 34 34.403	5 42 38.227	5 45 11.779	5 47 44.867
L	+0.024	+0.024	+23.499	-23.499	-0.024
log L	8.38021	8.38021	1.37105	1.37105n	8.38021n
sec δ	0.00011	0.08220	0.51491	0.51491	0.00361
log S					
log σ					
log k	8.38032	8.46241	1.88596	1.88596n	8.38382n
R	+.024	+.029	+1 16.906	-1 16.906	-.024
l_0	-.026	-.026	-.026	-.078	-.078
A	+.691	+1.175	+ 2.976		+.578
B	+.723	+.281	- 1.362		+.826
C	+1.000	+1.208	- 3.273		+1.008
x	-.016	-.019	+.051	+.051	-.016
Bl_0	-.019	-.007	+.035	+.106	-.064
T	5 29 13.954	5 34 34.432	5 43 55.133	5 43 54.873	5 47 44.843
t	5 29 13.919	5 34 34.406	5 43 55.219	5 43 55.030	5 47 44.763
w	+20.111	+20.104	+20.276	+20.465	+20.167
Cc	+.001	+.001			-.001
w_0	+20.112	+20.105	+20.371		+20.166
(w_0)	+20.134	+20.125	+20.386		+20.180

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March 5th 1869

Star	22 Camelop. U.C.		μ Geminor	ϝ Geminor	Sirius	ε Can. Maj
Samp	E	W	W	W	E	E
Tallies	J. E	E2345 J	C D E	C D E	J C B3	E D C
α	6 4	24.89	6 15 2.38	6 30 8.97	6 39 22.91	6 53 29.35
δ	+69 21	46 8	+22 34 35.0	+16 30 22.5	-16 32 36.2	-28 48 4.4
M	6 2 58.387	6 5 15.910	6 14 42.155	6 29 48.759	6 39 19.031	6 53 9.297
f	+23.499	-24.953	+0.024	+0.024	-15.666	-0.024
log f	1.37105	1.39712n	8.38021	8.38021	1.19496n	8.38021n
sec δ	0.45291	0.45291	0.03462	0.01828	0.01836	0.05735
log S						
log σ						
log R	1.82396	1.85003n	8.41483	8.39849	1.21332n	8.43756n
R	+1 6.575	-1 10.799	+.026	+.025	-16.343	-.027
l_0	-.078	+.046	+.050	+.054	+.003	-.012
A	-1.287		+.367	+.455	+.893	+1.080
B	+2.528		+1.019	+.938	+.538	+.368
C	+2.837		+1.083	+1.043	+1.043	+1.141
I	-.0414	-.044	-.017	-.016	-.016	-.018
Bl_0	-.197	+.116	+.051	+.051	+.002	-.004
T	6 4 5.062	6 4 5.111	6 14 42.181	6 29 48.784	6 39 2.688	6 53 9.270
t	6 4 4.821	6 4 5.183	6 14 42.215	6 29 48.819	6 39 2.674	6 53 9.248
w	+20.069	+19.707	+20.165	+20.151	+20.236	+20.102
Cc			+.001	+.001	-.001	-.001
w_0	+19.888		+20.166	+20.152	+20.235	+20.101
(w_0)	+19.894		+20.167	+20.146	+20.225	+20.084

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March 5th 1869

Star	δ Can. Maj.	δ Geminor
Camp	E	E
Tallies	E D C	E D C
α	7 3 4.61	7 12 18.404
δ	-26 11 31.4	+22 13 9.1
M	7 2 44.571	7 11 58.223
f	-0.024	-0.024
log. f.	8.38021n	8.38021n
sec. δ	0.04705	0.03351
log. S		
log. s		
log. R	8.42726n	8.41372n
R	-.027	-.026
l_0	-.037	-.050
A	+1.037	+.372
B	+.407	+1.014
b	+1.114	+1.080
x	-.017	-.017
Bl_0	-.015	-.051
of	7 2 44.544	7 11 58.197
t	7 2 44.512	7 11 58.129
w	+20.098	+20.275
Cc	-.001	-.001
w_0	+20.097	+20.274
(w_0)	+20.076	+20.248

C = -.001

Hourly rate = -.028

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1869phae.proj..354.

March 5th 1869

Collimation

Star	Time	cc	C	c
ψ' Draconis, L. C.	5h 44m	-.0945	-3.273	+.0289
22 Camelop. U. C.	6 4	-.181	+2.837	-.0638

$Y_0 = 6^h 17^m$

$\theta = +20^s.050$

Ober. A. T. M.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Δa	Δt
ε Ursæ	W	+20.134	+.691	+.084	.477	+.058	+.067	20.067
α Columbæ	W	20.125	+1.175	+.075	1.381	+.088	+.114	20.011
ψ' Draconis (p.) L. C.	W-E	20.386	+2.976	+.336	8.857	+1.000	+.289	20.097
α Ursæ	E	20.180	+.578	+.130	.335	+.075	+.056	20.124
22 Camelop. U. C.	E-W	19.894	-1.287	-.156	1.657	+.201	-.125	20.019
μ Geminor	W	20.167	+.367	+.117	.135	+.043	+.036	20.131
γ Geminor	W	20.146	+.455	+.096	.207	+.044	+.044	20.102
Sirius	E	20.225	+.893	+.175	.798	+.156	+.087	20.138
ε Can. Maj.	E	20.084	+1.080	+.034	1.167	+.037	+.105	19.979
δ Can. Maj.	E	20.076	+1.037	+.026	1.076	+.027	+.101	19.975
δ Geminor	E	20.248	+.372	+.198	.139	+.074	+.036	20.212
			+8.337	+1.115	16.229	+1.803	+	20.078

$$11\,\Delta\theta + 8.337a = +1.115$$

$$+8.337\,\Delta\theta + 16.229a = +1.803$$

$$-\Delta\theta + .7579a = +.1014$$

$$+8.337\,\Delta\theta + 6.319a = +.845$$

$$+9.910a = +.958$$

$$a = +.097$$

$$\Delta\theta + .0735 = +.1014$$

$$\Delta\theta = +.028$$

$$\Delta t = +20.078 \pm .015$$

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Star	δ Virginis	4 Draconis, M. C.		η Virginis	β Corvi
Samp	E	E	W	W	W
Tallies	E D C	W E	E W	B345 E W	C D E
		* b. unsteady			
α	11 58 33.16	12 6 5.78		12 13 13.306	12 27 31.874
δ	+9 27 31.6	+78 20 32.2		+0 3 35.3	−22 40 20.1
M	11 58 12.969	12 3 48.477	12 7 41.622	12 13 11.935	12 27 11.625
Y	−0.024	+23.499	−23.499	−18.6905	+0.024
log Y	8.38021n	1.37105	1.37105n	1.27162n	8.38021
sec δ	0.00595	0.69451	0.69451	0.00000	0.03493
log f					
log σ		05	05		
log R	8.38616n	2.06556 5	2.06556 5n	1.27162n	8.41514
R	−.024	+1 56.296	−1 56.296	−18.690	+.026
L_0	−.014	−.014	−.082	−.082	−.082
A	+.551	−2.906		+.673	+.983
B	+.851	+4.005		+.739	+.457
C	+1.014	+4.949		+1.000	+1.084
x	−.016	−.077	−.077	−.016	−.017
BL_0	−.012	−.056	−.328	−.061	−.037
T	11 58 12.945	12 5 44.773	12 5 45.326	12 12 53.245	12 27 11.651
t	11 58 12.917	12 5 44.640	12 5 44.921	12 12 53.168	12 27 11.597
w	+20.243	+21.140	+20.859	+20.138	+20.277
Cc	−.001			+.001	+.001
w_0	+20.242	+21.000		+20.139	+20.278
(w_0)	+20.263	+21.017		+20.153	+20.285

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March 5th 1869

C = −.001
Amly rate = −.028

Star	21 Cassiop. L. C.		12 Can. Ven.	θ Virginis	ζ Virginis	η Ursæ Maj.
Lamp	W	E	E	E	W	W
Vallies	F E	E F	E D C	E D C	C D E	C D E
α	12 36 59.54		12 49 54.744	13 3 11.13	13 28 2.01	13 42 23.53
δ	+74 16	18.8	+39 1 26.1	−4 50 23.7	+0 4 25.7	+49 57 53.5
M	12 35 13.108	12 38 6.166	12 49 34.403	13 2 50.930	13 27 41.713	13 42 3.263
f	+23.499	−23.499	−0.024	−0.024	+0.024	+0.024
log. f	1.37105	1.37105n	8.38021n	8.38021n	8.38021	8.38021
sec. δ	0.56691	0.56691	0.10964	0.00155	0.00000	0.19162
log. ρ						
log. σ						
log. R	1.93796	1.93796n	8.48985n	8.38176n	8.38021	8.57183
R	+1 26.688	−1 26.688	−.031	−.024	+.024	+.037
b_0	−.082	−.006	−.006	−.006	−.050	−.050
A	+3.	297	+.075	+.737	+.673	−.205
B	−1.	655	+1.285	+.682	+.740	+1.541
C	−3.	689	+1.287	+1.004	+1.000	+1.555
k	+.057	+.057	−.020	−.016	−.016	−.024
Bb_0	+.136	+.010	−.008	−.004	−.037	−.077
Y	12 36 39.796	12 36 39.478	12 49 34.372	13 2 50.906	13 27 41.737	13 42 3.300
t	12 36 39.989	12 36 39.546	12 49 34.344	13 2 50.886	13 27 41.684	13 42 3.199
w	+19.551	+19.995	+20.400	+20.244	+20.326	+20.331
C_c			−.001	−.001	+.001	+.002
w_0	+19.	773	+20.399	+20.243	+20.327	+20.333
(w_0)	+19.	776	+20.396	+20.234	+20.306	+20.306

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March 5th 1869

Collimation

Star	Time	Cc	C	c
4 Draconis, U.C.	12h 6m	-.1405	+4.949	-.0284
21 Cassiop. L.C.	12 37	-.222	-3.689	+.0602

$\gamma_0 = 12^h 43^m$

$\theta = +20^s.200$

Obs. A.T.M.

Clock and Azimuth corrections

Star	Lamp	(w_0)	A	w_0	A^2	Aw_0	Aa	Δt
o Virginis	E	+20.263	+.551	+.063	.304	+.034	-.108	+20.371
4 Draconis, U.C.	E-W	20.017	-2.906	+.817	8.445	-2.374	+.570	20.440
η Virginis	W	20.153	+.673	-.047	.453	-.032	-.132	20.285
β Corvi	W	20.285	+.983	+.085	.966	+.084	-.193	20.478
21 Cassiop. L.C.	W-E	19.776	+3.297	-.424	10.872	-1.398	-.646	20.422
12 Can. Ven.	E	20.396	+.075	+.196	.006	+.015	-.015	20.411
θ Virginis	E	20.234	+.737	+.034	.543	+.025	-.144	20.378
ε Virginis	W	20.306	+.673	+.106	.453	+.071	-.132	20.438
η Urs. Maj.	W	20.306	-.205	+.106	.042	-.022	+.040	20.266
			+3.878	+0.936	22.084	-3.597	+	20.388

$9\Delta\theta + 3.878a = +.936$

$+3.878\Delta\theta + 22.084a = -3.597$

$\Delta\theta + .4309a = +.104$

$+3.878\Delta\theta + 1.671a = +.403$

$+20.413a = -4.000$

$a = -.196$

$\Delta\theta - .0844 = +.104$

$\Delta\theta = +.188$

$\Delta t = +20.388 \pm .016$

(Continued on next page.)

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1869phae.proj..354.

March 5th 11 1869

Rejecting 4 Draconis.

$A = +6.784$

$w'_0 = +0.119$

$A^2 = +13.639$

$A w'_0 = -1.223$

$8\Delta\theta + 6.784a = +0.119$

$+6.784\Delta\theta + 13.639a = -1.223$

$\Delta\theta + .848a = +.0149$

$+6.784\Delta\theta + 5.753a = +0.1011$

$+7.886a = -1.324$

$a = -.168$

$\Delta\theta - .1425 = +.0149$

$\Delta\theta = +.157$

$\Delta t = +20.357 \pm .016$

Value adopted

Obsr. A. S. M.

θ Virginis	−.093	20.356
η Virginis	−.113	20.266
β Corvi	−.165	20.450
21 Cassiop. L. C.	−.337	20.330
12 Can. Ven.	−.013	20.409
θ Virginis	−.124	20.358
ξ Virginis	−.113	20.419
η Ms. Maj.	+.034	20.272
	+	20.357

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1869phae..proj..354.

March 7th 11 1869

Star	α Can. Min.	β Geminor	φ Geminor	ε Draconis, L. C.		15 Argus
Samp	W	W	W	W	E	E
Tallies	C D E	C D E	C D E	F E 54	E F	E D C
α	7 32 27.25	7 37 18.414	7 45 29.30	7 48	34.25	8 1 58.904
δ	+5 33 18.7	+28 20 19.8	+27 6 3.2	+69 55	50.9	-23 55 58.6
M	7 32 5.486	7 36 56.813	7 45 7.594	7 46 50.526	7 49 20.854	8 1 37.349
Y	+0.024	+0.024	+0.024	+28.006	-23.499	-0.024
log Y	8.38021	8.38021	8.38021	1.44725	1.37105n	8.38021n
sec δ	0.00204	0.05544	0.05051	0.46451	0.46451	0.03904
log ρ						
log σ						
log R	8.38225	8.43565	8.43072	1.91176	1.83356n	8.41925n
R	+.024	+.027	+.027	+1 21.613	-1 8.479	-.026
l_0	-.071	-.044	-.010	-.010	-.006	-.017
A	+.602	+.276	+.296	+2.	696	+1.002
B	+.804	+1.102	+1.084	-1.	106	+.440
C	+1.005	+1.136	+1.123	-2.	914	+1.094
x	-.016	-.018	-.017	+.045	+.045	-.017
Bl_0	-.057	-.048	-.011	+.011	+.007	-.007
Y	7 32 5.510	7 36 56.840	7 45 7.621	7 48 12.139	7 48 12.375	8 1 37.323
t	7 32 5.437	7 36 56.774	7 45 7.593	7 48 12.195	7 48 12.427	8 1 37.299
w	+21.813	+21.640	+21.707	+22.055	+21.823	+21.605
C_c	+.001	+.001	+.001			-.001
w_0	+21.814	+21.641	+21.708	+21.	939	+21.604
(w_0)	+21.833	+21.658	+21.721	+21.	950	+21.608

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1869phae.proj..354.

March 7th 11 1869

c = -.001
Hourly rate = -.030

Star	κ Cephei, L. C.		ε Hydrae	ι Ursæ Maj.	κ Cancri
Lamp	E	W	E	E	E
Tallies	B C	C B	E D C	E D C	E D C
α	8 13	11.89	8 39 51.10	8 50 14.64	9 0 39.856
δ	+77 18	45.3	+6 53 41.7	+48 33 12.2	+11 11 28.6
M	8 11 2.554	8 14 36.649	8 39 29.514	8 49 53.094	9 0 18.329
F	+23.519	-23.519	-0.024	-0.024	-0.024
log F	1.37142	1.37142n	8.38021n	8.38021n	8.38021n
sec δ	0.658305	0.658305	0.00315	0.17919	0.00834
log f					
log σ	04	04			
log R	2.029729	2.029729n	8.38336n	8.55940n	8.38855n
R	+1 47.085	-1 47.085	-.024	-.036	-.024
l_0	-.022	-.050	-.038	-.043	-.046
A	+3.955		+.585	-.162	+.528
B	-2.255		+.820	+1.502	+.872
C	-4.553		+1.007	+1.511	+1.019
x	+.071	+.071	-.016	-.023	-.016
Bl_0	+.050	+.113	-.031	-.065	-.040
T	8 12 49.639	8 12 49.564	8 39 29.490	8 49 53.058	9 0 18.305
t	8 12 49.760	8 12 49.748	8 39 29.443	8 49 52.970	9 0 18.249
w	+22.130	+22.142	+21.657	+21.670	+21.607
Cc			-.001	-.002	-.001
w_0	+22.136		+21.656	+21.668	+21.606
(w_0)	+22.135		+21.641	+21.648	+21.581

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March 7th 11 1869

Collimation

Star	Time	Cc	C	c
ε Draconis L.C.	7h 48m	+.116	-2.914	-.0398
κ Cephei, L.C.	8 13	+.006	-4.553	-.0013

$\gamma_0 = 8^h\ 10^m$

$\theta = +21^s.580$

Obsr. A. T. M.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
α Can. Min.	W	+21.833	+.602	+.253	.363	+.152	+.074	21.759
β Geminor	W	21.658	+.276	+.078	.076	+.022	+.034	21.624
φ Geminor	W	21.721	+.296	+.141	.084	+.042	+.036	21.685
ε Draconis, L.C.	W-E	21.950	+2.696	+.370	7.269	+.998	+.332	21.618
15 Argus	E	21.608	+1.002	+.028	1.004	+.028	+.123	21.485
κ Cephei L.C.	E-W	22.135	+3.955	+.555	15.645	+2.195	+.486	21.649
ε Hydrae	E	21.641	+.585	+.061	.342	+.036	+.072	21.569
ζ Urs. Maj.	E	21.648	-.162	+.068	.026	-.011	-.021	21.668
κ Cancri	E	21.581	+.528	+.001	.279	+.001	+.065	21.516
			+9.778	+1.535	25.092	+3.463	+	21.619

$9\,\Delta\theta + 9.778a = +1.555$

$+9.778\,\Delta\theta + 25.092a = +3.463$

$\Delta\theta + 1.0864a = +.1728$

$+9.778\,\Delta\theta + 10.623a = +1.690$

$+14.469a = +1.773$

$a = +.123$

$\Delta\theta + .1336 = +.1728$

$\Delta\theta = +.039$

$\Delta t = +21.619 \pm .019$

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March 7th 11 1869

C = −.001
Hourly rate = −.030

Star	η Ursæ Majoris	η Boötis	α Draconis N.P.	
Lamp	E	E	E	W
Telies	E D C	E D C	f. E	E f
			*fo. thro. clouds	
α	13 42 23.58	13 48 27.624	14 0	51.98
δ	+49 57 53.9	+19 3 12.6	+64 59	56.5
M	13 42 1.803	13 48 5.823	13 59 34.610	14 1 25.926
L	−0.024	−0.024	+23.499	−23.499
log f.	8.38021n	8.38021n	1.37105	1.37105n
sec. δ	0.19162	0.02447	0.37404	0.37404
log. p				
log. σ				
log. R	8.57183n	8.40468n	1.74509	1.74509n
C	−.037	−.025	+55.602	−55.602
b_0	−.030	−.030	−.030	−.162
A	−.205	+.419	−.910	
B	+1.541	+.971	+2.184	
C	+1.555	+1.058	+2.366	
x	−.024	−.016	−.037	−.037
Bb_0	−.046	−.029	−.066	−.354
T	13 42 1.766	13 48 5.798	14 0 30.212	14 0 30.324
t	13 42 1.696	13 48 5.753	14 0 30.109	14 0 29.933
w	+21.884	+21.871	+21.871	+22.047
Cc	−.002	−.001		
w_0	+21.882	+21.870	+21.959	
(w_0)	+21.887	+21.872	+21.955	

"Clouds prevented further observations"

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March 7th 11 1869

Collimation

Star	Time	Cc	C	c
α Draconis, U.C.	14h 1m	+.088	+2.366	+.0372

$T_o = 13^h\ 52^m$

$\theta = +21.760$

Ober. A. T. M.

Clock and Azimuth Corrections

Star	Lamp	(w_o)	A	w'o	A^2	Aw'o	Aa	Δt
η Ursæ Maj	E	+21.887	−.205	+.127	.042	−.026	+.013	21.874
η Bootis	E	21.872	+.419	+.112	.175	+.047	−.026	21.898
α Draconis, U.C	E−W	21.935	−.910	+.195	.828	−.177	+.056	21.899
			−.696	+.434	1.045	−.156	+	21.890

$3\Delta\theta - .696a = +.434$

$-.696\Delta\theta + 1.045a = -.156$

$\Delta\theta - .232a = +.1447$

$-.696\Delta\theta + .161a = -.1007$

$+.884a = -.0553$

$a = -.062$

$\Delta\theta + .0144 = +.1447$

$\Delta\theta = +.130$

$\Delta t = +21.890 \pm .006$

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March 9th 11 1869

C = -.138
Hourly rate = -.032

Star	ε Can. Maj	δ Can. Maj	δ Geminor	P. VII 67		α Can. Min.
Lamp	W	W	W	W	E	E.
Tallies	C D E	C D E_{2345}	C D E	C	C B	E D C_{5421}
α	6 53 29.26	7 3 4.53	7 12 18.344	7 17	14.67	7 32 27.22
δ	-28 48 4.6	-26 11 31.8	+22 13 9.2	+68 43	48.9	+5 33 18.7
M	6 53 6.673	7 2 41.132	7 11 55.433	7 16 8.236	7 17 55.495	7 32 3.121
I	+0.024	+0.769	+0.024	+15.699	-23.519	+1.095
log. I.	8.38021	9.88593	8.38021	1.19587	1.37142n	0.03941
sec. δ	0.05735	0.04705	0.03351	0.44038	0.44038	0.00204
log. S						
log. σ						
log. K	8.43756	9.93298	8.41372	1.63625	1.81180n	0.04145
R	+.027	+.857	+026	+43.276	-1 4.834	+1.100
t_0	+.014	+.014	+.014	+.014	+.050	+.050
A	+1.080	+1.037	+.372	-1.223		+.602
B	+.368	+.407	+1.014	+2.470		+.804
C	+1.141	+1.114	+1.080	+2.757		+1.005
x	-.018	-.017	-.017	-.043	-.043	-.016
Bt_0	+.005	+.006	+.014	+.035	+.124	+.040
T	6 53 6.700	7 2 41.989	7 11 55.459	7 16 51.512	7 16 50.661	7 32 4.221
t	6 53 6.687	7 2 41.978	7 11 55.456	7 16 51.504	7 16 50.742	7 32 4.245
w	+22.573	+22.552	+22.888	+23.166	+23.928	+22.975
Cc	+.157	+.154	+.149			-.139
w_0	+22.730	+22.706	+23.037	+23.547		+22.836
(w_0)	+22.740	+22.710	+23.037	+23.544		+22.825

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March 9th 1869

Collimation

Star	Time	Cc	C	c
P. VII 67, U.C.	$7^h\ 17^m$	−.381	+2.757	−.138

$\gamma_0 = 7^h\ 11^m$

$\theta = +22^s.990$

Obsr. T.B. Jr

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Δa	Δt
ε Can. Maj.	W	+22.740	+1.080	−.250	1.167	−.270	−.391	23.131
δ Can. Maj.	W	22.710	+1.037	−.280	1.076	−.290	−.375	23.085
δ Geminor	W	22.037	+.372	+.047	.139	+.017	−.135	23.172
P VII 67, U.C.	W-E	22.544	−1.223	+.554	1.497	−.678	+.443	23.101
α Can. Min.	E	22.825	+.602	−.165	.363	−.099	−.218	23.043
			+1.868	−.094	4.242	−1.320		+ 23.106

$5\Delta\theta + 1.868a = -.094$

$+1.868\Delta\theta + 4.242\ a = -1.320$

$\Delta\theta + .3736a = -.0188$

$+1.868\Delta\theta + .698\ a = -.035$

$+3.544\ a = -1.285$

$a = -.362$

$\Delta\theta - .1352 = -.0188$

$\Delta\theta = +.116$

$\Delta t = +23.106 \pm .015$

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Personal Equation

between

Observers A. S. Mosman
and S. Blake Jr.

Observations were made upon the nights of March 21, 24 and 25, for the purpose of determining the Personal Equation existing between Observers A. S. Mosman and S. Blake, Jr.

The stars were observed alternately - Each observer's record has been worked up separately - The two clock corrections thus obtained have been reduced to a common time T_0, (as was intended,) and the Personal Equation has been thus deduced, in the following pages.

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Obsr. A. J. M. March 21 $\frac{85}{11}$ 1869 c = +.047
Hourly rate = −.019

Star	δ Geminor	β Geminor	ε Draconis L. C.		ι Urs. Maj.
Lamp.	W	E	E	W	E
Tallies	C D, 23	E D C	B C	C B	E D C
α	7 12 18.13	7 37 18.18	7 48	35.05	8 50 14.40
δ	+22 13 9.7	+28 20 20.8	+69 55	48.5	+48 33 14.5
M	7 11 37.679	7 36 49.339	7 46 57.404	7 49 14.770	8 49 45.599
Z	+10.775	−0.024	+23.519	−23.519	−0.024
log Δ	1.03242	8.38021n	1.37142	1.37142n	8.38021n
Sec δ	0.03351	0.05544	0.46450	0.46450	0.17920
log S					
log σ					
log k	1.06593	8.43565n	1.83592	1.83592n	8.55941n
R	+11.639	−.027	+18.536	−18.536	−.036
b_0	+.014	+.018	+.018	+.014	+.002
A	+.372	+.276	+2.696		−.162
B	+1.014	+1.102	−1.106		+1.502
C	+1.080	+1.136	−2.914		+1.511
x	−.017	−.018	+.045	+.045	−.023
$13b_0$	+.014	+.020	−.020	−.015	+.003
T	7 11 49.318	7 36 49.312	7 48 5.940	7 48 6.234	8 49 45.563
t	7 11 49.315	7 36 49.314	7 48 5.965	7 48 6.264	8 49 45.543
w	+28.815	+28.866	+29.085	+28.786	+28.857
Cc	−.051	+.053			+.071
w_0	+28.764	+28.919	+28.936		+28.928
(w_0)	+28.777	+28.924	+28.937		+28.910

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1869phae.proj..354.

March 21st 1869

Collimation

Star	Time	Cc	C	c
ε Draconis L.C.	7h 48m	−.1495	−2.914	+.0513

$\gamma_0 = 7^h\ 52^m\ 00^s$

$\theta = +28^s.910$

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	$A w'_0$	Aa	Δt
δ Geminor	W	+28.777	+.372	−.133	.139	−.049	+.007	28.770
β Geminor	E	28.924	+.276	+.014	.076	+.004	+.005	28.919
ε Draconis L.C.	E-W	28.937	+2.696	+.027	7.269	+.073	+.054	28.883
ι Ursæ Maj.	W	28.910	−.162	.000	.026	.000	−.003	28.913
			+3.182	−.092	7.510	+.028	+	28.871

$4\Delta\theta + 3.182\,a = -.092$

$+ 3.182\,\Delta\theta + 7.510\,a = +.028$

$\Delta\theta + .7955a = -.023$

$+3.182\,\Delta\theta + 2.531\,a = -.073$

$+4.979a = +.101$

$a = +.020$

$\Delta\theta + .0159 = -.023$

$\Delta\theta = -.039$

$\Delta t = +28.871 \pm .024$

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1869phae.proj:.354:

March 24th, 1869

Star	Sirius	Clau. Maj.	τ Draconis, L. C.		β Geminor
Samp.	W	W	W	E	E
Tallies	C D E	C D E	T E	E T	E D C
	* ρ.				
α	6 39 22.54	7 3 4.22	7 18	2.715	7 37 18.126
δ	-16 32 36.9	-26 11 32.6	+73 6	26.4	+28 20 21.0
M	6 38 51.657	7 2 33.351	7 16 11.230	7 18 52.422	7 36 47.453
Y	+0.024	+0.024	+23.499	-23.499	-0.024
log Y	8.38021	8.38021	1.37105	1.37105n	8.38021n
sec δ	0.01836	0.04705	0.53673	0.53673	0.05544
log ρ					
log σ					
log R	8.39857	8.42726	1.90778	1.90778n	8.43565n
R	+.025	+.027	+1 20.869	-1 20.869	-.027
l_0	-.034	+.078	+.030	+.058	+.058
A	+.893	+1.037	+3.107		+.276
B	+.538	+.407	-1.481		+1.102
C	+1.043	+1.114	-3.442		+1.136
x	-.016	-.017	+.053	+.053	-.018
Bl_0	-.018	+.032	-.044	-.086	+.064
y	6 38 51.682	7 2 33.378	7 17 32.099	7 17 31.553	7 36 47.426
t	6 38 51.648	7 2 33.393	7 17 32.108	7 17 31.520	7 36 47.472
w	+30.892	+30.827	+30.607	+31.195	+30.654
Cc	-.048	-.051			+.052
w_0	+30.844	+30.776	+30.901		+30.706
(w_0)	+30.872	+30.792	+30.910		+30.705

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1869phae.proj..354.

March 24th 11 1869

Star	ε Draconis, L. C.		15 Argus	ε Hydrae
Samp	E	W	W	E
Tallies	03 C	C 03	C D E	E D C
α	7 48	35.23	8 1 58.616	8 39 50.90
δ	+69 55	48.1	-23 56 0.3	+6 53 41.7
M	7 46 55.644	7 49 13.033	8 1 27.639	8 39 20.144
f	+23.519	-23.519	+0.024	-0.024
log. f	1.37142	1.37142 n	8.38021	8.38021 n
sec. δ	0.46449	0.46449	0.03905	0.00315
log. ρ				
log. σ				
log. k	1.83591	1.83591 n	8.41926	8.38336 n
k	+1 8.535	-1 8.535	+.026	-.024
b_0	+.058	+.110	+.110	+.114
A	+2.	696	+1.002	+.585
B	-1.	106	+. 440	+.820
C	-2.	914	+1.094	+1.007
x	+.045	+.045	-.017	-.016
Bb_0	-.064	-.122	+.048	+.093
V	7 48 4.179	7 48 4.498	8 1 27.665	8 39 20.120
t	7 48 4.160	7 48 4.421	8 1 27.696	8 39 20.197
w	+31.070	+30.809	+30.920	+30.703
Cc			-.050	+.046
w_0	+30.	940	+30.870	+30.749
(w_0)	+30.	933	+30.857	+30.717

C = +.046

Hourly rate = -.030

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1869phae.proj..354.

March 24th, 1869

Collimation

Star	Time	Cc	C	c
τ Draconis, L. C.	7h 18m	-.294	-3.442	+.0854
ε Draconis, L. C.	7h 48m	-.1305	-2.914	+.0448

$T_0 = 7^h 35^m$

$\theta = +30^s.730$

Ober. A. T. M.

Clock and Azimuth Corrections

Star	Lamp	(w-s)	A	w'_0	A^2	Aw'_0	Δa	Δt
Sirius	W	+30.872	+.893	+.142	.798	+.127	+.061	30.811
Can. Maj.	W	30.792	+1.037	+.062	1.076	+.064	+.071	30.721
τ Draconis, L. C.	W-E	30.910	+3.107	+.180	9.657	+.559	+.211	30.699
β Geminor	E	30.705	+.276	-.025	.076	-.007	+.019	30.686
ε Draconis, L. C.	E-W	30.933	+2.696	+.203	7.269	+.547	+.183	30.750
15 Argus	W	30.857	+1.002	+.127	1.004	+.127	+.068	30.789
ε Hydrae	E	30.717	+.585	-.013	.342	-.008	+.040	30.677
			+9.596	+.676	20.216	+1.409	+	30.733

$7\Delta\theta + 9.596a = +.676$

$+9.596\Delta\theta + 20.216a = +1.409$

$\Delta\theta + 1.3709a = +.0966$

$+9.596\Delta\theta + 13.147a = +.9270$

$+7.069a = +.4820$

$a = +.068$

$\Delta\theta + .0932 = +.0966$

$\Delta\theta = +.003$

$\Delta t = +30.733 \pm .013$

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March 25th & 1869

Obs. A. T. M

Star	ε Can. Maj	δ Geminor	α Can. Min.	φ Geminor	x Cephei	L. C.
Lamp	Yr	Yr	E	E	Yr	E
Value	C. D E	C D E	E D C	E_5 D C	Y E	E Y
α	6 53 28.92	7 12 18.06	7 32 26.96	7 45 29.00	8 13	13.365
δ	-28 48 5.5	+22 13 9.9	+5 33 18.6	+27 6 4.3	+77 18	41.7
M	6 52 57.357	7 11 46.479	7 31 55.381	7 45 3.429	8 10 55.731	8 14 28.843
Z	+0.024	+0.024	−0.024	−5.228	+23.499	−23.499
log. Z.	8.38021	8.38021	8.38021n	0.71834n	1.37105	1.37105n
sec. δ	0.05735	0.03351	0.00204	0.05051	0.65827	0.65827
log. ρ						
log. σ					04	04
log. R	8.43756	8.41372	8.38225n	0.76885n	2.02932	2.02932n
R	+.027	+.026	−.024	−5.873	+1 46.985	−1 46.985
t_0	+.062	+.174	+.178	+.098	+.094	+.114
A	+1.080	+.372	+.602	+.296	+3.955	
B	+.368	+1.014	+.804	+1.084	−2.255	
C	+1.141	+1.080	+1.005	+1.123	−4.553	
x	−.018	−.017	−.016	−.017	+.071	+.071
Bt_0	+.023	+.176	+.143	+.106	−.212	−.257
Y	6 52 57.384	7 11 46.505	7 31 55.357	7 44 57.556	8 12 42.716	8 12 41.858
t	6 52 57.389	7 11 46.664	7 31 55.484	7 44 57.645	8 12 42.575	8 12 41.672
w	+31.531	+31.396	+31.476	+31.355	+30.790	+31.693
Cc	−.104	−.098	+.091	+.102		
w_0	+31.427	+31.298	+31.567	+31.457	+31.241	
(w_0)	+31.464	+31.323	+31.581	+31.463	+31.231	

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1869phae.proj...354.

March 5th/11. 1869

Star	ι Ursæ maj.	σ^2 Ursæ Maj. U.C.	
Lamp	E	E	W
Tallies	E D C	J E	E J
α	8 50 14.32	8 58	51.07
δ	+48 33 15.1	+67 39	53.2
M	8 49 42.916	8 57 17.688	8 59 21.253
I	−0.024	+23.499	−23.499
log. I	8.38021 n	1.37105	1.37105 n
sec. δ	0.17920	0.42019	0.42019
log. S			
log. σ			
log. R	8.55941 n	1.79124	1.79124 n
R	−.036	+1 1.836	−1 1.836
l_0	+.130	+.130	+.062
A	−.162	−1.	124
B	+1.502	+2.	379
C	+1.511	+2.	631
x	−.023	−.041	−.041
Bl_0	+.195	+.309	+.147
T	8 49 42.880	8 58 19.524	8 58 19.417
t	8 49 43.052	8 58 19.792	8 58 19.523
w	+31.268	+31.278	+31.547
Cc	+.138		
w_0	+31.406	+31.	413
(w_0)	+31.374	+31.	376

$c = +.091$

Diurnal rate $= -.035$

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1869phae.proj..354.

March 25th 1869

Collimation

Star	Time	Cc	C	c
x Cephei, L.C.	8h 13m	-.4515	-.4553	+.0992
σ² Ms. Maj. U.C.	8 58	+.1345	+2.631	+.0512

$\gamma_0 = 7^h 55^m$

$\theta = +31^s.490$

Obs. A.T.M.

Clock and Azimuth Corrections

Star	Lamp	(w₀)	A	w'₀	A²	Aw'₀	Aa	Δt
ε Can. Maj.	W	+31.464	+1.080	-.026	1.167	-.028	-.035	31.499
δ Geminor	W	31.323	+.372	-.167	.139	-.062	-.012	31.335
α Can. Min.	E	31.581	+.602	+.091	.363	+.055	-.019	31.600
γ Geminor	E	31.463	+.296	-.027	.088	-.008	-.009	31.472
x Cephei L.C.	W-E	31.231	+3.955	-.259	15.645	-1.024	-.127	31.358
ε Ms. Maj.	E	31.374	-.162	-.116	.026	+.019	+.005	31.369
σ² Ms. Maj. U.C.	E-W	31.376	-1.124	-.114	1.263	+.128	+.036	31.340
			+5.019	-.618	18.691	-.920	+	31.425

$7\Delta\theta + 5.019a = -.618$

$+5.019\Delta\theta + 18.691a = -.920$

$\Delta\theta + .717a = -.0883$

$+5.019\Delta\theta + 3.599a = -.443$

$+15.092a = -.477$

$a = -.032$

$\Delta\theta - .022\,9 = -.0883$

$\Delta\theta = -.065$

$\Delta t = +31.425 \pm .026$

Value adopted

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1869phae..proj...354.

L. B. Jr.

March 21st 1869

C = +.047
Hourly rate = −.019

Star	Mon. Maj.	φ Geminor	15 Argus	χ Cephei	L. C.	χ Cancri
Samp.	W	E	W	W	E	E
Tallies	C D C	E D C	E D C	7 C	C 7	E D C
α	7h 3m 4.s28	7 45 29.07	8 1 58.67	8 13	13.02	9 0 39.72
δ	−26° 11′ 32.″5	+27 6 4.1	−23 56 0.1	+77 18	42.4	+11 11 29.0
M	7 2 35.345	7 45 0.247	8 1 29.695	8 10 56.773	8 14 30.330	9 0 10.974
Σ	+0.024	−0.024	+0.024	+23.499	−23.499	−0.024
log. f.	8.38021	8.38021n	8.38021	1.37105	1.37105n	8.38021n
sec. δ	0.04705	0.05051	0.03905	0.658277	0.658277	0.00834
log. S						
log. σ				04	04	
log. R	8.42726	8.43072n	8.41926	2.029331	2.029331n	8.38855n
R	+.027	−.027	+.026	+1 46.987	−1 46.987	−.024
l_0	+.014	+.018	+.014	+.014	+.002	+.018
A	+1.037	+.296	+1.002	+3.955		+.528
B	+.407	+1.084	+.440	−2.255		+.872
C	+1.114	+1.123	+1.094	−4.553		+1.019
x	−.017	−.017	−.017	+.071	+.071	−.016
Bl_0	+.006	+.020	+.006	−.032	−.005	+.016
T	7 2 35.372	7 45 0.220	8 1 29.721	8 12 43.760	8 12 43.343	9 0 10.950
t	7 2 35.361	7 45 0.223	8 1 29.710	8 12 43.799	8 12 43.409	9 0 10.950
w	+28.919	+28.847	+28.960	+29.221	+29.611	+28.770
C_c	−.052	+.053	−.051			+.048
w_0	+28.867	+28.900	+28.909	+29.416		+28.818
(w_0)	+28.885	+28.905	+28.909	+29.412		+28.799

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1869phae.proj..354.

March 21st 1869

Collimation

Star	Time	Cc	C	c
x Cephei L.C.	$8^h\ 13^m$	-.195	-4.533	+.0428

$t_o = 8^h\ 0^m$

$\theta = +28^s.830$

Asst. L.B. Jr.

Clock and Azimuth Corrections

Star	Lamp	(w_o)	A	w'_o	A^2	Aw'_o	Aa	Δt
δ Can. Maj.	W	+28.885	+1.037	+.055	1.076	+.057	+.166	28.719
ρ Geminor	E	28.905	+.296	+.075	.088	+.022	+.047	28.858
15 Argus	W	28.909	+1.002	+.079	1.004	+.079	+.160	28.749
x Cephei L.C.	W-E	29.412	+3.955	+.582	15.645	+2.302	+.633	28.779
x Cancri	E	28.799	+.528	-.031	.279	-.016	+.084	28.715
			+6.818	+.760	18.092	+2.444	+	28.764

$$5\Delta\theta + 6.818a = +.760$$
$$+6.818\Delta\theta + 18.092a = +2.444$$
$$\Delta\theta + 1.3636a = +.152$$
$$+6.818\Delta\theta + 9.295a = +1.036$$
$$+8.797a = +1.408$$
$$a = +.160$$

$$\Delta\theta + .2182 = +.152$$
$$\Delta\theta = -.066$$

$$\Delta t = +28.764 \pm .018$$

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March 24th 1869

Ober. L. B. Jr.

Star	ε Can. Maj.	δ Geminor	α Can. Min.	φ Geminor	x Aphei. & C.	
Samp	W	W	E	E	W	E
Tallies	C D E	C D E	E D C.	E D C	L E	E L
α	6 53 28.944	7 12 18.076	7 32 26.98	7 45 29.016	8 13	13.28
δ	-28 48 5.5	+22 13 9.8	+5 33 18.6	+27 6 4.3	+77 18	41.9
M	6 52 58.079	7 11 47.219	7 31 56.218	7 44 58.432	8 10 55.302	8 14 28.960
x	+0.024	+0.024	-0.024	-0.024	+23.499	-23.499
log. x	8.38021	8.38021	8.38021n	8.38021n	1.37105	1.37105n
sec δ	0.05735	0.03351	0.00204	0.05051	0.658273	0.658273
log. s						
log. o					04	04
log. R	8.43756	8.41372	8.38225n	8.43072n	2.029327	2.029327n
R	+.027	+.026	-.024	-.027	+1 46.986	-1 46.986
l_o	+.038	+.030	+.058	+.058	+.110	+.106
A	+1.080	+.372	+.602	+.296	+3.	955
B	+.368	+1.014	+.804	+1.084	-2.	255
C	+1.141	+1.080	+1.005	+1.123	-4.	553
x	-.018	-.017	-.016	-.017	+.071	+.071
Bl_o	+.014	+.030	+.047	+.063	-.248	-.239
Y	6 52 58.106	7 11 47.245	7 31 56.194	7 44 58.405	8 12 42.288	8 12 41.974
t	6 52 58.102	7 11 47.258	7 31 56.225	7 44 58.451	8 12 42.111	8 12 41.806
w	+30.842	+30.818	+30.755	+30.565	+31.169	+31.474
Cc	-.052	-.050	+.046	+.052		
w_o	+30.790	+30.768	+30.801	+30.617	+31.	321
(w_o)	+30.821	+30.790	+30.813	+30.622	+31.	312

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March 24$^{h}_{II}$ 1869

Star	ℓ Mus. Maj.	δ^2 Mus. Maj. M.C.	
Samp	E	E	W
Tallies	E D C	F E	E F
α	8 50 14.34	8 58	51.105
δ	+48 33 15.0	+67 39	53.0
M	8 49 43.725	8 57 18.753	8 59 22.313
y	−0.024	+23.499	−23.499
log.r.	8.38021n	1.37105	1.37105n
sec.δ	0.17920	0.42019	0.42019
log.S			
log σ			
log.R	8.55941n	1.79124	1.79124n
R	−.036	+1 1.836	−1 1.836
b_o	+.122	+.122	+.126
A	−.162	−1.	124
B	+1.502	+2.	379
C	+1.511	+2.	631
x	−.023	−.041	−.041
Bb_o	+.183	+.290	+.300
T	8 49 43.689	8 58 20.589	8 58 20.477
t	8 49 43.849	8 58 20.838	8 58 20.736
w	+30.491	+30.267	+30.369
C_c	+.070		
w_o	+30.561	+30.	318
(ω_o)	+30.534	+30.	286

C = +.046
Hourly rate −.030

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1869phae.proj...354.

March 24th 1869

Collimation

Star	Time	Cc	C	c
x Cephei L.C.	8h 13m	-.1525	-4.553	+.0335
σ² Ms. Maj. U.C.	8 58	+.051	+2.631	+.0194

$\gamma_0 = 7^h\ 55^m$

$\theta = +30^s.600$

Obsr. T.B.Jr.

Clock and Azimuth Corrections

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
ε Can. Maj.	W	+30.821	+1.080	+.221	1.167	+.239	+.210	30.611
δ Geminor	W	30.790	+.372	+.190	.139	+.071	+.072	30.718
L Can. Min.	E	30.813	+.602	+.213	.363	+.128	+.117	30.696
φ Geminor	E	30.622	+.296	+.022	.088	+.007	+.057	30.565
x Cephei L.C.	W-E	31.312	+3.955	+.712	15.645	+2.816	+.767	30.545
ι Ms. Maj.	E	30.534	-.162	-.066	.026	+.011	-.031	30.565
σ² Ms. Maj. U.C.	E-W	30.286	-1.124	-.314	1.263	+.353	-.218	30.504
			+5.019	+.978	18.691	+3.625	+	30.601

$7\Delta\theta + 5.019a = +.978$

$+5.019\Delta\theta + 18.691a = +3.625$

$\Delta\theta + .717a = +.1397$

$+5.019\Delta\theta + 3.599a = +.701$

$+15.092a = +2.924$

$a = +.194$

$\Delta\theta + .1391 = +.1397$

$\Delta\theta = +.001$

$\Delta t = +30.601 \pm .025$

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1869phae.proj..354.

March 25th 1869

Star	Sirius	ζ Can. Maj.	τ Draconis, L. C.		β Geminor
Samp	W	W	W	E	E
Tallies	C D E	C D E	T E	E T	E D_{5421} C
α	6 39 22.52	7 3 4.196	7 18	2.796	7 37 18.11
δ	-16 32 36.9	-26 11 32.7	+73 6	26.3	+28 20 21.0
M	6 38 50.993	7 2 32.735	7 16 10.494	7 18 51.805	7 36 46.656
Z	+0.024	+0.024	+23.499	-23.499	-0.0315
log r.	8.38021	8.38021	1.37105	1.37105n	8.49831n
sec δ	0.01836	0.04705	0.53673	0.53673	0.05544
log. S					
log. σ					
log. R	8.39857	8.42726	1.90778	1.90778n	8.55375n
R	+.025	+.027	+1 20.869	-1 20.869	-.036
l_o	+.006	+.092	+.174	+.130	+.098
A	+.893	+1.037	+3.	107	+.276
B	+.538	+.407	-1.	481	+1.102
C	+1.043	+1.114	-3.	442	+1.136
x	-.016	-.017	+.053	+.053	-.018
Bl_o	+.003	+.037	-.258	-.192	+.108
Y	6 38 51.018	7 2 32.762	7 17 31.363	7 17 30.936	7 36 46.620
t	6 38 51.005	7 2 32.782	7 17 31.158	7 17 30.797	7 36 46.710
w	+31.515	+31.414	+31.638	+31.999	+31.400
Cc	-.095	-.101			+.103
w_o	+31.420	+31.313	+31.	818	+31.503
(w_o)	+31.453	+31.332	+31.	828	+31.502

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c = +.091
Amalgate = -.035

Star	ε Gracilis, L.C.		15 Argus	ε Hydrae
Lamp	E	W	W	E
Tallies	B C	C B	C D E	E D C
α	7 48	35.29	8 1 58.60	8 39 50.89
δ	+69 55	47.9	-23° 56′ 0″.4	+6 53 41.7
M	7 46 55.217	7 49 13.207	8 1 27.162	8 39 19.439
I	+23.519	-23.519	+0.024	-0.024
log I.	1.37142	1.37142n	8.38021	8.38021n
sec. δ	0.46449	0.46449	0.0 3905	0.00315
log. ρ				
log. σ				
log. R.	1.83591	1.83591n	8.41926	8.38336n
R	+1 8.535	-1 8.535	+.026	-.024
l_0	+.098	+.078	+.086	+.186
A	+2. 696		+1.002	+.585
B	-1. 106		+.440	+.820
C	-2. 914		+1.094	+1.007
K	+.045	+.045	-.017	-.016
Bl_0	-.108	-.086	+.038	+.153
T	7 48 3.752	7 48 4.672	8 1 27.188	8 39 19.415
t	7 48 3.689	7 48 4.631	8 1 27.209	8 39 19.532
w	+31.601	+30.659	+31.391	+31.338
Cc			-.100	+.092
w_0	+31. 130		+31.291	+31.430
(w_0)	+31. 122		+31.276	+31.393

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March 25th/71 1869

Collimation

Star	Time	Cc	C	c
τ Dracnis, L.C.	7h 18m	-.1805	-3.442	+.0524
ε Dracnis, L.C	7 48	-.471	-2.914	+.1620

$T_o = 7^h\ 35^m$

$\theta = +31^s.560$

Obs. T.B.J.

Clock and Azimuth Corrections

Star	Lamp	(w₀)	A	w'₀	A²	Aw'₀	Δa	Δt
Sirius	W	+31.453	+.893	-.107	.798	-.096	+.039	31.414
δ Can. Maj.	W	31.332	+1.037	-.228	1.076	-.236	+.046	31.286
τ Dracnis, L.C.	W-E	31.828	+3.107	+.268	9.651	+.833	+.137	31.691
β Geminor	E	31.502	+.276	-.058	.076	-.016	+.012	31.490
ε Dracnis L.C.	E-W	31.122	+2.696	-.438	7.269	-1.181	+.119	31.003
15 Argus	W	31.276	+1.002	-.284	1.004	-.287	+.044	31.232
ε Hydrae	E	31.393	+.585	-.167	.342	-.098	+.026	31.367
			+9.596	-1.014	20.216	-1.081	+	31.355

$7\Delta\theta + 9.596a = -1.014$

$+9.596\Delta\theta + 20.216a = -1.081$

$\Delta\theta + 1.3709a = -.1449$

$+9.596\Delta\theta + 13.146a = -1.390$

$+7.070a = +.309$

$a = +.044$

$\Delta\theta + .0603 = -.1449$

$\Delta\theta = -.205$

$\Delta t = +31.355 \pm .055$

Value adopted

omitting ε Dracnis

$a = +.152 : \Delta t = +31.289$

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Note

In the Field "Time Book", Mar. 25$^{th}_{11}$, L.B. Jr, τ Draconis was omitted in the Summation, for no other reason, apparently, than that the constants A. B. C were discovered to be erroneous = Without it, we obtain; $\Delta t = +31.507 \pm .015$ $a = -.149$, agreeing pretty nearly with the Δt so deduced in the Field Book.

It would appear, however, from the large collimation (c) obtained from ε Draconis, same date, that the Azimuth had suffered a change in the reversal upon this latter star. Rejecting this value of c in the determination of the daily mean Collimation, Mar. 25$^{th}_{11}$; and re-working the observations of this date (both A. T. M's and L. B. Jrs.) with the new value of c, thus obtained, $[\frac{1}{3}(+.0524 + .0992 + .0512) = +.067]$. Further, dividing the observations into two series — three preceding and three taken after the reversal upon ε Draconis — the following results are had; not so satisfactory, however, as those before obtained.

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A. T. M.

March 25th 71.

Before Kerwesalon & Dracmis}

$c = +.067$

$\zeta = -.035$

Star / Lamp	ε Can. Maj. W	δ Geminor W	α Can. Min. E	γ Geminor E
t	6 52 57.389	7 11 46.664	7 31 55.484	7 44 57.645
w	+31.531	+31.396	+31.476	+31.355
Cc	−.076	−.072	+.067	+.075
w_0	+31.455	+31.324	+31.543	+31.430
(w_0)	+31.471	+31.328	+31.536	+31.416

$\gamma_0 = 7^h 20^m$

$\theta = +31.400$

Star	Lamp	(w_0)	A	w'_0	A^2	Aw'_0	Aa	Δt
ε Can. Maj.	W	+31.471	+1.080	+.071	1.167	+.077	+.138	31.333
δ Geminor	W	31.328	+.372	−.072	.139	−.027	+.048	31.280
α Can. Min.	E	31.536	+.602	+.136	.363	+.082	+.077	31.459
γ Geminor	E	31.416	+.296	+.016	.088	+.005	+.038	31.378
			+2.350	+.151	1.757	+.137	+	31.363

$4\Delta\theta + 2.350\, a = +.151$

$+2.350\,\Delta\theta + 1.757\, a = +.137$

$\Delta\theta + .5875\, a = +.0378$

$+2.350\,\Delta\theta + 1.380\, a = +.0888$

$+.377\, a = +.0482$

$a = +.128$

$\Delta\theta + .0752 = +.0378$

$\Delta\theta = -.037$

$\Delta t = +31.363 \pm .081$

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A. T. M.

March 25th/11

After Reversal on ε Draconis

Star	x Cephei, L.C.		ι Ursæ Maj.	σ² Ursæ Maj. U.C.	
Samp	W	E	E	E	W
t	8 12 42.575	8 12 41.672	8 49 43.052	8 58 19.792	8 58 19.523
w	+30.790	+31.693	+31.268	+31.278	+31.547
Cc			+.101		
w_0	+31.241		+31.369	+31.413	
(w_0)	+31.257		+31.363	+31.403	

$T_0 = 8^h 40^m$

$\theta = +31^s.400$

	Samp	(w_0)	A	$w\acute{o}$	A^2	$Aw\acute{o}$	$\cdot Aa$	Δt
x Cephei, L.C.	W-E	+31.257	+3.953	−.143	15.645	−.566	−.103	31.360
ι Ursæ Maj.	E	31.363	−.162	−.037	.026	+.006	+.004	31.359
σ² Ursæ Maj. U.C.	E-W	31.403	−1.124	+.003	1.263	−.003	+.029	31.374
			+2.669	−.177	+16.934	−.533		+31.364

$3\Delta\theta + 2.669a = -.177$

$+2.669\Delta\theta + 16.934a = -.533$

$\Delta\theta + .8897a = -.059$

$+2.669\Delta\theta + 2.375a = -.157$

$+14.559a = -.376$

$a = -.026$

$\Delta\theta - .0231 = -.059$

$\Delta\theta = -.036$

$\Delta t = +31.364$

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Y. B. Jr.

March 25th

Before Reversal on ε Draconis

Star	Sirius	δ Can. Maj.	T Draconis	L. C.	β Geminor	ε Draconis
Samp	W	W	W	E	E	E
t	6 38 51.005	7 2 32.782	7 17 31.158	7 17 30.797	7 36 46.710	7 48 3.689
w	+31.515	+31.414	+31.638	+31.999	+31.400	+31.601
Cc	−.070	−.075			+.076	−.195
w_0	+31.445	+31.339	+31.	818	+31.476	+31.406
(w_0)	+31.466	+31.346	+31.	818	+31.464	+31.389

$Y_0 = 7^h\ 16^m$

$\theta = +31.^s500$

Star	Samp	(w_0)	A	w'_0	A^2	Aw'_0	Δa	Δt
Sirius	W	+31.466	+.893	−.034	.798	−.030	+.076	31.390
δ Can. Maj.	W	31.346	+1.037	−.154	1.076	−.160	+.088	31.258
T Draconis, L.C.	W-E	31.818	+3.107	+.318	9.651	+.988	+.264	31.554
β Geminor	E	31.464	+.276	−.036	.076	−.010	+.023	31.441
ε Draconis, L.C.	E	31.389	+2.696	−.111	7.269	−.299	+.229	31.160
			+8.009	−.017	18.870	+.489	+	31.361

$5\Delta\theta + 8.009a = -.017$

$+8.009\Delta\theta + 18.870a = +.489$

$\Delta\theta + 1.6018a = -.0034$

$+8.009\Delta\theta + 12.829a = -.0272$

$+6.041a = +.5162$

$a = +.085$

$\Delta\theta + .1361 = -.0034$

$\Delta\theta = -.1395$

$\Delta t = +31.361 \pm .050$

omitting ε Draconis from Time

$\Delta t = +31.411$

omitting ε Draconis altogether

$\Delta t = +31.330$ $\quad a = +.146$

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J. B. Jr.

March 25th 11

After Reversal on ε Draconis

Star =	Draconis, L.C	15 Argus	ε Hydrae
Lamp	W	W	E
t	7 48 4.631	8 1 27.209	8 39 19.552
w	+30.659	+31.391	+31.338
Cc	+.195	−.073	+.067
w_o	+30.854	+31.318	+31.405
(w_o)	+30.867	+31.323	+31.388

$C = +.067$

$S = -.035$

$T_o = 8^h\ 10^{mo}$

$\theta = +31^s.500$

Star	Lamp	(w_o)	A	w'_o	A^2	Aw'_o	Aa	Δt
ε Draconis, L.C.	W	+30.867	+2.696	−.633	7.269	−1.706	−.679	31.546
15 Argus	W	31.323	+1.002	−.177	1.004	.177	−.253	31.576
ε Hydrae	E	31.388	+.585	−.112	.342	.066	−.147	31.535
			+4.283	−.922	8.615	−1.949	+	31.552

$3\Delta\theta + 4.283a = -.922$

$+4.283\Delta\theta + 8.615a = -1.949$

$\Delta\theta + 1.4277a = -.3073$

$+4.283\Delta\theta + 6.109a = -1.3160$

$+2.506a = -0.633$

$a = -.252$

$\Delta\theta - .3598 = -.3073$

$\Delta\theta = +.052$

$\Delta t = +31.552$

omitting ε Draconis from Time

$\Delta t = +31.378$

omitting ε Draconis altogether -

$\Delta t = +31.309$ $\quad a = -.158$

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Personal Equation
between A. T. M. & F. B. Jr.

Obsr.	Date	no. Stars	Sid. Time	a	Clock correction Δt	Probable error r_0	Hourly rate p
A.T.M	Mar. 21	4	7 52	+.020	+28.871	± .024	−.0260
"	" 24	7	7 35	+.068	+30.733	± .013	−.0285
"	" 25	7	7 55	−.032	+31.425	± .026	
F. B. Jr.	Mar. 21	5	8 0	+.160	+28.764	± .018	−.0255
"	" 24	7	7 55	+.194	+30.601	± .025	−.0318
"	" 25	7	7 35	+.044	+31.355	± .055	

Obsr.	Date	T_0	corr. of Δt	Corrected Δt for T_0	r_0	r_0^2
A.T.M.	Mar. 21	7 56	+.002	+28.873	± .024	.000576
"	" 24	7 45	+.005	+30.738	± .013	169
"	" 25	7 45	−.005	+31.420	± .026	676
F.B.Jr.	Mar. 21	7 56	−.002	+28.762	± .018	.000324
"	" 24	7 45	−.005	+30.596	± .025	625
"	" 25	7 45	+.005	+31.360	± .055	3025

$$\left[\begin{matrix}\text{A. T. M's}\\ \Delta t\end{matrix}\right] - \left[\begin{matrix}\text{F. B. Jr's}\\ \Delta t\end{matrix}\right]$$

Mar. 21 .... $+.111 \pm \sqrt{(.024)^2+(.018)^2} = +.111 \pm \sqrt{900}$

Mar. 24 .... $+.142 \pm \sqrt{(.013)^2+(.025)^2} = +.142 \pm \sqrt{794}$

Mar. 25 .... $+.060 \pm \sqrt{(.026)^2+(.055)^2} = +.060 \pm \sqrt{3701}$

$$\text{Sum} = +.111 + .142 + .060 \pm \sqrt{900+794+3701}$$

$$= +.313 \pm .073$$

$$\tfrac{1}{3}\,\text{Sum} = +.104 \pm .024$$

To F. B. Jr's Δts add $+.104 \pm .024$ to reduce Observations to A. T. M's standard

F. B. Jr. records an event later than A. T. M.

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Equal weights

Collimation Corrections

Transit No. 5 — Cambridge, 1869

Date	Star	No. Threads W.	No. Threads E.	C	Cc	c	Nightly means
Feb. 4	α Camelop. U. C.	10	4	+2.470	+.292	+118	+.0.138
	Groomb. 966, U. C.	13	10	+3.852	+.5145	+.133	
	w Draconis, L. C.	10	10	-2.767	-.4505	+.163	
Feb. 5	w Draconis, L. C.	10	10	-2.767	-.4125	+.149	+0.1395
	P. VII. 67 U. C.	10	10	+2.757	+.3575	+.130	
Feb. 7	Groomb. 2320, L. C.	10	10	-2.687	-.4875	+.181	+0.157
	α Camelop. U. C.	10	9	+2.470	+.3965	+.161	
	Groomb. 966, U. C.	10	11	+3.852	+.476	+.124	
	4 Draconis, U. C.	13	8	+4.949	+.8755	+.177	
	21 Cassiop. L. C.	9	10	-3.689	-.5155	+.140	
Feb. 9	Groomb. 2320, L. C.	10	10	-2.687	-.454	+.169	+.0.169
Feb. 12	ψ' Draconis (per) L. C.	10	13	-3.273	-.1185	+.036	collimation adjusted +0.013
	22 Camelop. U. C.	13	9	+2.837	-.029	-.010	
Feb. 13	α Camelop., U. C.	5	5	+2.470	-.0015	-.0005	-0.001
	Groomb. 966, U. C	5	5	+3.852	-.0085	-.002	
Feb. 17	w Draconis, L. C.	10	10	-2.767	+.001	-.0004	+0.012
	ψ' Draconis, L. C.	10	9	-3.273	-.0805	+.0246	
Feb. 18	Groomb. 3241 L. C.	10	10	-3.251	-.1255	+.0386	-0.019
	σ^2 Ursæ Maj. U. C.	10	10	+2.631	-.243	-.0924	
	21 Cassiop. L. C.	10	10	-3.689	+.081	-.022	
	4 Cassiop. L. C.	10	10	-2.868	+.004	-.0014	

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Collimation Corrections

Date	Star	No. Threads Sp.	E	C	Cc	c	Nightly means
Feb. 19	Groomb. 966. U. C.	10	10	+3.852	-.4635	-.120	
	ω Draconis, L. C.	10	7	-2.767	+.1235	-.045	
	ψ' Draconis (pr.) L. C.	9	10	-3.273	-.021	+.006	-0.043
	4 Draconis (H) U. C.	10	10	+4.949	-.3105	-.0627	
	21 Cassiop. L. C	10	10	-3.689	-.0205	+.0056	
Feb. 24	22 Camelop. U. C.	10	10	+2.837	-.0395	-.0140	
	σ Draconis, L. C.	10	10	-3.442	+.1705	-.0496	
	ε Draconis. L. C.	10	10	-2.914	+.225	-.0773	
	21 Cassiop. L. C.	10	10	-3.689	+.1695	-.046	-0.053
	Λ Cassiop. L. C.	10	5	-2.868	+.1470	-.051+	
	α Draconis, U. C.	10	10	+2.366	-.1895	-.080+	
Feb. 25	ω Draconis, L. C.	10	10	-2.767	+.0615	-.022	-0.020
	ψ' Draconis (pr.) L. C.	10	10	-3.273	+.060	-.018	
Feb. 27	Groomb. 966, U. C.	10	10	+3.852	-.149	-.0387	
	ψ' Draconis (pr.) L. C.	10	10	-3.273	+.1055	-.0322	
	21 Cassiop, L. C.	10	10	-3.689	+.224	-.0607	-0.054
	Λ Cassiop. L. C.	10	10	-2.868	+.1735	-.0605	
	α Draconis, U. C.	10	10	+2.366	-.190	-.0804	
Feb. 28.	ω Draconis, L. C.	10	10	-2.767	+.122	-.044+	
	ψ' Draconis (pr.) L. C.	10	10	-3.273	+.1015	-.031	-0.035
	α Draconis U. C.	10	10	+2.366	+.0585	+.0248	
	5 Urs. Min. U. C.	10	10	+4.215	-.371	-.0879	

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Collimation Corrections

Date	Star	no. Threads W.	no. Threads E.	C	Cc	c	Nightly Means
March 1	ω Draconis, L. C.	10	10	-2.767	-.0055	+.002	+0.002
	ψ' Draconis (pr.) L. C.	5	10	-3.273	-.0075	+.002	
March 3	χ Cephei, L. C. (Doubtful)	5	5	-4.553	+.1935	-.0425	-0.039 rejecting χ Cephei mean. -0.039
	σ^2 Ms. Maj. U. C.	10	10	+2.631	-.1585	-.0603	
	11 Cephei, L. C.	10	10	-3.027	+.114	-.0377	
	γ Cephei, L. C.	10	7	-4.413	+.0815	-.0185	
March 5	ψ' Draconis (pr.) L. C.	10	10	-3.273	-.0945	+.0289	-0.001
	22 Camelop. U. C.	9	10	+2.837	-.181	-.0638	
	(Stars unsteady)						
	4 Draconis, U. C.	10	10	+4.949	-.1405	-.0284	
	21 Cassiop, L. C.	10	10	-3.689	-.222	+.0602	
March 7	ε Draconis, L. C.	7	10	-2.914	+.116	-.0398	-0.001
	χ Cephei, L. C.	10	10	-4.553	+.006	-.0013	
	α Draconis, U. C	10	10	+2.366	+.088	+.0372	
March 9	P. VII. 67. U. C.	5	10	+2.757	-.381	-.138	-0.138
A.M.'s Observations	Mar. 21	ε Draconis, L. C.	10	10	-2.914	-.1495	+.0513	+.051
	Mar. 24	T Draconis, L. C.	10	10	-3.442	-.294	+.0854	+.065
		ε Draconis L. C.	10	10	-2.914	-.1305	+.0448	
	Mar. 25	χ Cephei L. C.	10	10	-4.553	-.4515	+.0992	+.075
		σ^2 Ms. Maj. U. C.	10	10	+2.631	+.1345	+.0512	
W.B.P.'s Obs.	Mar. 21	χ Cephei, L. C.	10	10	-4.553	-.195	+.0428	+.043

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Collimation Corrections

Date		Star	No. Threads W.	No. Threads E.	C	Cc	c	Nightly means
9.13 fr. Observations	Mar. 24	x Cephei, L. C.	10	10	-4.553	-.1525	+.0335	+0.026
		δ^2 Urs. Maj. U. C.	10	10	+2.631	+.051	+.0194	
	Mar. 25	τ Draconis, L. C.	10	10	-3442	-.1805	+.0524	+0.107
		ε Draconis, L. C.	10	10	-2.914	-.471	+.1620	

Mean Collimation Corrections of obs. of A. T. M. & W. B. Jr.

Date		Nightly means
Mar. 21	$\frac{1}{2}$ (+.051 +.043)	+0.047
Mar. 24	$\frac{1}{2}$ (+.065 +.026)	+.0.046
Mar. 25	$\frac{1}{2}$ (+.075 +.107)	+0.091

Collimation values adopted.

Feb. 4	+0.139	Feb. 25	-0.020
" 5		" 27	-0.054
" 7	+0.157	" 28	-0.035
" 9	+0.169	Mar. 1	+0.002
" 12	+0.013	" 3	-0.039
" 13	-0.001	" 5	-0.001
" 17	+0.012	" 7	
" 18	-0.019	" 9	-0.138
" 19	-0.043	" 21	+0.047
" 24	-0.053	" 24	+0.046
		" 25	+0.091

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Cambridge, 1869

Azimuth and Clock Corrections

Obsr.	Date	No. of Stars	Sid. Time	a	Clock Correction Δt	Probable error Δt	Hourly rate (−) clock correction ρ	Prob. error ρ	Daily rate (clock corr.)
A.T.M.	Feb. 4	8	5h 12m	−.137	+6.536	±.017			
							+.013	±.001	+.31
A.T.M.	Feb. 5	11	6 21	−.180	+6.857	±.017			
							+.021	±.001	+.50
A.T.M.	Feb. 7	11	4 13	+.053	+7.811	±.019			
							+.044	±.003	+1.05
		10	12 13	−.197	+8.162	±.014			
							+.025	±.001	+.60
A.T.M.	Feb. 9	9	4 24	+.053	+9.176	±.028			
							+.019	±.000	+.46
A.T.M.	Feb. 12	11	5 25	+.562	+10.571	±.016			
							+.019	±.001	+.46
A.T.M.	Feb. 13	9	4 50	−.102	+11.020	±.026			
							+.016	±.000	+.37
A.T.M.	Feb. 17	10	6 46	−.121	+12.535	±.007			
							+.002	±.001	+.04
A.T.M.	Feb. 18	7	8 48	−.113	+12.576	±.020			
							+.017	±.007	+.40
		8	12 58	−.214	+12.646	±.023			
							+.010	±.002	+.23
A.T.M.	Feb. 19	11	5 44	−.188	+12.808	±.016			
							+.010	±.004	+.23
		9	12 3	−.311	+12.869	±.017			
							+.017	±.000	+.40

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Azimuth and Clock Corrections

Obsr.	Date	No. of Stars	Sid. Time	a	Clock correction Δt	Probable Error Δt	Hourly rate δ	Prob error δ	Daily rate
A.T.M.	Feb 24	11	7h 5m	-.097	+14.774	±.029			
							+.034	±.006	+.82
		11	13 26	-.260	+14.990	±.023			
							+.026	±.002	+.62
A.T.M.	Feb 25	10	5 22	-.172	+15.401	±.015			
							+.016	±.001	+.38
A.T.M.	Feb 27	10	5 53	-.100	+16.177	±.030			
							+.012	±.004	+.30
		12	13 20	-.175	+16.269	±.014			
							+.028	±.001	+.67
A.T.M.	Feb 28	11	5 55	-.184	+16.737	±.020			
							+.022	±.004	+.52
		8	14 14	-.374	+16.918	±.029			
							+.028	±.002	+.68
A.T.M.	Mar 1	9	6 4	-.086	+17.369	±.019			
							+.031	±.001	+.74
F.B.P.	Mar. 3	10	8 1	+.233	+18.808	±.022			
		11	12 34	+.294	+18.833	±.021			
Reduced to A.T.M.					+18.912	±.033			
							+.006	±.010	+.13
					+18.937	±.032			
							+.027	±.001	+.66

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Azimuth and Clock Corrections

Obsr	Date	No. of Stars	Sid. Time	a	Clock Corrections Δt	Probable error of Δt	Hourly rate β	Prob. error of β	Daily rate
A.T.M.	Mar. 5	11	6 17	+.097	+20.078	±.015			
							+.043	±.003	+1.02
		8	12 43	−.168	+20.357	±.016			
	(Including 4 Draconis "after exchange", we have during interval of exchange							β=.048	±.003)
							+.029	±.001	+.70
A.T.M.	Mar. 7	9	8 10	+.123	+21.619	±.019			
							+.047	±.003	+1.14
		3	13 52	−.062	+21.890	±.006			
	(Rejecting observations after exchange, we have between Mar. 7 and Mar. 9, β =							±.034 Daily rate ±.81	±.001)
							+.032	±.001	+.77
L.B.Jr. Reduced to A.T.M.	Mar. 9	5	7 11	−.362	+23.106	±.015			
					+23.210	±.028			

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