1872phae.proj.1756R

AC
11366
v.746

Longitude Campaign—
Observations & Reductions
1872 1873

Charles W. Sever, University Bookstore, Cambridge.

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Form of computations.

Having obtained the columns '*t*'−R.A., the following order is observed.

(1) Stars whose declination is less than +60° are to be counted as time stars and are to be arranged in a group designated "time group".

(2) Stars whose declination exceeds 60° are to be counted as polar stars and are to be arranged in a group, designated "Polar Group"

(3) The time Equations are arranged on the left-hand of the page and the polar equations on the right.

The time equations are made up as follows. viz. (a) Approximate R.A. (b) $0 = t' - R.A.$
→ corr. for rate. — Corrected (t'−R.A.) — $A - \frac{\text{Sid}}{\text{Mn}}$ (S) — $\Delta\alpha$ — dT with opposite sign.

(4) Having found the mean t'−R.A. and the mean A, these values are deducted from the corresponding quantities in the polar Equations, as we have

For time equations $0 = (t' - R.A.) + A\alpha$
For polar Equations $0 = (t' - R.A.) + A''$ { α being in all cases zero in Meridian Circle Observations

giving for each pole star a separate determination of α

(5) Having found α, the column $A\alpha$ in the time group is formed and adding $A\alpha$ to (t'−R.A. Corrected), the column $-dT$ is obtained.

(6) On the right of the column $-dT$, are sometimes arranged the residuals from the means and the squares of the residuals.

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Reduction to M.C.O. from Work = 1/60 approx.

Time Determinations for Irene-Atlantis Longitude.

With the Smith Clock.

$b = +0^s.39$

July 24, 1872

Star	Observed T. h m s	hundred ms	x	7h +	Bb s	7h x + Bb. s	R.A. s	T - R.A. s	A
ε Ursæ Min.	16 59 22.46	458	+.114	22.344	+2.22	24.56	16.17	+8.39	−4.75
α Herculis	17 8 54.94	945	.016	54.929	+.35	55.28	50.46	4.82	+.48
β Draconis	17 27 39.39	391	.025	39.366	+.63	40.00	34.64	5.36	−.28
44 Ophiuchi	17 18 39.57	573	.016	39.557	+.17	39.73	35.33	4.40	+1.00
α Ophiuchi	17 29 5.89	891	.015	5.876	+.35	6.23	1.43	4.80	+.51
ω Draconis	17 37 50.45	455	.040	50.415	+.97	51.38	45.27	6.11	−1.23
α' Herculis	17 41 33.33	327	.017	33.310	+.43	33.74	28.86 / 28.81	4.88 / 4.93	+.29
ψ Draconis	17 44 22.08	082	.049	22.033	+1.11	23.14	16.69	6.45	−1.63
γ Draconis	17 53 44.97	973	.025	44.948	+.62	45.57	40.24 / 40.29	5.33 / 5.28	−.26
ζ² Sagittarii	17 57 41.73	727	.018	41.709	+.13	41.84	37.45	4.39	+1.11
δ Ursæ Min.	18 14 2.63	633	.260	2.373	+4.71	7.08	53.30	13.78	−11.79
ι Aquilæ	18 28 20.99	991	.015	20.976	+.25	21.23	16.57	4.66	+.78
α Lyræ	18 32 43.04	036	.018	43.018	+.50	43.52	38.38	5.13	+.08
51 Herculis	18 39 23.19	189	+.320	23.509	−5.17	18.34	25.90	−7.56	+15.95
β Lyræ	18 45 27.85	855	.018	27.837	+.46	28.30	23.34 / 23.30	4.96 / 5.00	+.19
σ Sagittarii	18 47 26.26	263	.017	26.246	+.16	26.41	22.02	4.39	+1.04
50 Draconis	18 50 39.31	311	.059	39.252	+1.29	40.54	34.03	6.51	−2.14

Time Groups

h	m	s	s	s	s
17	09		+4.82	+.48	+.33
17	18		4.40	+1.00	+.73
17	29		4.40	+.51	+.37
17	41		4.88	+.29	+.21
17	53		5.33	−.26	−.19
17	59		4.89	+1.11	+.81
18	28		4.66	+.78	+.57
18	32		5.13	+.08	+.06
18	45		4.96	+.19	+.14
18	47		4.39	1.60	+1.16
Mean 18	00		4.78	+.52	

Hourly rate = −.006

Δt		
−5.17	+.01	1
.13	.03	9
.17	.01	1
.09	.07	49
.14	.02	4
.20	.04	16
.23	.07	49
.19	.03	9
.10	.06	36
.16	.01	1
−6.16		

at 18h 0m

±.009

Polar Group.

$\frac{.0175}{9} = .0019 = .044x$

$.044x\frac{2}{3} = \pm.029$

h	m	s	s	s
16	59		+4.39	−4.75
17	25		+5.38	−1.25
17	38		+6.11	−1.23
17	44		+6.45	−1.63
18	14		+3.78	−11.79
18	39		−7.56	+15.95
18	58		+6.57	−2.14

s	s	s		
c = +3.61	−5.27	a = +.69	4	16
0.58	−.80	+.72	1	1
1.33	−1.75	+.76	3	9
1.67	−2.10	+.78	5	25
2.00	−12.31	+.73	0	0
12.34	−15.43	+.80	7	49
1.73	−2.66	+.65	8	64
				164

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Time Determinations for Trans-Atlantic Longitude.

With the Smith Clock.

July 22, 1872

$b = +.^s 89$

Star	Observed T.	h	x	T+x	Bk.	T'	R.A.	T'-R.A.
	h m s	s	s	s	s	s	s	s
τ Herculis	16 15 59.60	.600	−.022	59.58	+.57	60.15	55.38	+ 4.77 −.11
κ Ophiuchi	16 51 42.72	.727	−.016	42.71	+.33	42.74	38.27	4.47 +.55
		.536					38.31	4.38
d Herculis	16 56 58.75	.755	−.018	58.74	+.46	59.20	54.59	4.61 +.18
							.63	4.54
ε Urs. Min.	16 59 21.89	.889	−.114	21.77	+2.22	23.99	15.91	8.08 −4.75
a Herculis	17 08 54.49	.489	−.016	54.47	+.35	54.82	50.45	4.38 +.48
44 Ophiuchi	17 18 39.24	.245	−.016	39.23	+.17	39.40	35.32	4.08 +.00
α Draconis	17 37 49.84	.836	−.040	49.80	+.97	50.77	45.21	5.56 −1.23
ε Herculis	17 41 32.91	.909	−.017	32.89	+.43	33.32	28.85	4.47 +.29
							28.80	4.52
ν Draconis	17 44 21.45	.455	−.049	21.41	+1.11	22.52	16.60	5.92 −1.63
γ Draconis	17 53 44.64	.636	−.025	44.61	+.62	45.23	40.21	5.02 −.26
							40.26	4.97
δ Urs. Min.	18 14 2.00	.000	−.260	1.74	+4.71	6.45	52.59	13.86 −11.77
α Lyrae	18 32 42.65	.655	−.018	42.64	+.50	43.14	38.38	+4.76 +.08
51 Ophiuchi	18 39 23.96	.964	+.320	24.28	−5.17	19.11	26.44	−7.33 +15.95
β Lyrae	18 45 27.46	.464	−.018	27.45	+.46	27.91	23.33	+4.58 +.19
							23.29	4.62
ο Sagittarii	18 47 25.93	.927	−.017	25.91	+.16	26.07	22.03	4.04 +1.04

Time Group $a = +.^s 72$

			$-dT$			$-dT$
16	16	$o = +4.^s77 - .11 - .08 + 4.69$	.08	64	4.76	
16	52	$+4.47 + .56 + .40$	.87	10	100	78
16	57	$+4.61 + .18 + .13$	.74	3	9	74
17	9	$+4.37 + .48 + .35$	.72	5	25	72
17	19	$+4.08 + 1.00 + .72$	.80	3	9	80
17	42	$+4.47 + .29 + .21$	.68	9	81	68
17	54	$+5.02 - .26 - .19$	.83	4	16	83
18	33	$+4.76 + .08 + .06$	.82	5	25	82
18	45	$+4.58 + .19 + .14$	.72	5	25	72
18	47	$+4.04 + 1.04 + .75$	.79	2	4	79
Mean		$+4.52 + .34$	$4.77 \pm .013$		.0358	4.76
17	37				.00398	
					.0063	
					.042	

Polar Groups.

h	m		
16	59	$o = +^s8.08 - 4.75$	
17	38	$o = +5.56 - 1.23$	
17	44	$+5.92 - 1.63$	
18	14	$+13.86 - 11.79$	
18	39	$- 7.33 + 15.95$	

$o = +^s3.56 - 5.09$	$a = +^s.70$	
$1.04 - 1.57$	$+ .67$	
$1.40 - 1.97$	$+ .71$	
$9.34 - 12.13$	$+ .77$	
$11.85 - 15.61$	$+ .76$	
Mean	$= +.72$	

The corr. for τ Herculis is changed from $+.^s17$ to $+.^s10$ in the finine results.

16	16	$o = 4.^s84 - .11 - .08$	$4.^s76$	0	0
16	52	$4.38 + .55 + .40$	78	2	4
16	57	$4.61 + .18 + .13$	74	2	4
17	9	$4.37 + .48 + .35$	72	4	16
17	19	$4.08 + 1.00 + .72$	80	4	16
17	42	$4.47 + .29 + .21$	68	8	64
17	54	$5.02 - .26 - .19$	83	7	49
18	33	$4.76 + .08 + .06$	82	6	36
18	45	$4.58 + .19 + .14$	72	4	16
18	47	$4.04 + 1.04 + .75$	79	3	9
		$4.51 + .34$	$4.76 \pm .010$		214

h	m		
16	59	$o = +^s8.08 - 4.75$	
17	38	$5.56 - 1.23$	
17	44	$+5.92 - 1.63$	
18	14	$+13.86 - 11.79$	
18	39	$- 7.33 + 15.95$	

$o = +^s3.57 - 5.09$	$a = +^s.70$	2	4	
$+1.05 - 1.57$	$+ .67$	5	25	
$+1.41 - 1.97$	$+ .72$	0	0	
$+9.35 - 12.13$	$+ .77$	5	25	
$+11.84 - 15.61$	$+ .76$	4	16	
	$+.72 \pm .0$		70	

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Time Determinations for Trans-Atlantic Longitude.
With the South Block.

July 23, 1872 — b = +.39

Star	Observed T	h	x	T*	Db	π	R.A.	T − R.A.	A
Polaris (233)	h m s 13 11 58.76	s 7604.640	s 59.40	s −10.65	s 48.75	s 6.68	s −17.93	+31.42	
γ^2 Ursæ Min.	15 21 3.43	.433 − .050	3.38	+1.11	4.49	58.87	+5.62	− 1.64	
α Serpentis	16 21 39.20	.200 − .018	39.18	+.16	39.34	35.52 (35.48)	+3.87 (3.85)	+ 1.04	
η Draconis	16 22 22.00	.000 − .033	21.97	+.78	22.75	17.75	+5.00	− .70	
δ Herculis	16 56 58.60	.600 − .018	58.58	+.46	59.04	54.57 (54.61)	+4.47 (4.43)	+ .18	
ε Ursæ Min.	16 59 21.59	.589 − .114	21.47	+2.22	23.69	15.77	+7.92	− 4.75	

a = +.69

h	m					
16	22	o =	+3.82	+1.04	+.72	+4.54
16	22	=	+ 5.00	− .70	− .48	4.52
16	57	=	+ 4.47	+ .18	+.12	4.59
16	34	Mean	4.43	+.17		4.55 ± .07

h	m			
13	12	o =	s −17.93	+31.42
15	21	=	+5.62	− 1.64
16	59	=	+ 7.92	− 4.75

o = +22.86 − 21.25 a = +.71 + 2
+ 1.19 − 1.81 = +.66 3
+ 3.49 − 4.92 = +.71 2
Mean +.69 ± .08

dT = − 4.55 s at 16 h 34 m

July 24 1873

h	m	dT =	s
13	49		−4.22
14	10		21
14	20		19
14	57		23
15	39		16
16	8		26
			4.21

h	m	dT =	s
16	15		−4.18
16	21		18
16	30		25
16	56		30
17	8		31
17	57		29
			−4.25

h	m	dT =	s
18	28		−4.29
18	32		.25
18	45		.22
18	47		.24
18	59		.19
19	11		.24
19	19		.24
			−4.26

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Time Determinations for Trans-Atlantic Longitude.

With the Smith Clock.

$b = +3^s.38$

July 24, 1872

Star	Observed T.	h	m	s	×	T+	Bk	T'	R.A.	T'−R.A.
Polaris.	+31.42	13	11	59.70	.700	+.640	60.34	−10.38	49.96	7.46	−17.50
η Bootis	+.42	13	48	39.75	.746	−.016	39.73	+.37	40.10	36.17	+3.93
ε Bootis	+.41	14	09	53.83	.927	−.016	53.81	+.37	54.18	50.25	3.93
Θ Bootis	−.29	14	20	55.08	.078	−.025	55.05	+.61	55.66	51.27	4.39
β Ursæ Min.	+2.02	14	51	12.25	.255	−.058	12.20	+1.22	13.42	7.25	5.67
β Bootis.	+.03	14	57	12.36	.364	−.020	12.34	+.51	12.85	8.64	4.21
γ Ursæ Min.	+1.64	15	21	~~27.12~~ 3.12	.122	−.050	3.07	+1.08	4.15	58.81	5.34
α Coronæ.	+.30	15	29	21.02	.018	−.018	21.00	+.41	21.41	17.45	3.96
ζ Ophiuchi	+.72	16	07	43.40	.400	−.015	43.38	+.27	43.65	39.88	3.77
π Herculis	−.11	16	15	59.06	.064	−.022	59.04	+.55	59.59	55.(34) 27	4.25 32
λ Scorpii	+1.04	16	21	38.84	.836	−.018	38.82	+.16	38.98	35.51 35.47	3.47 3.51
ν Draconis	+.70	16	22	21.65	.055	−.033	21.62	+.76	22.38	17.92	4.46
β Ophiuchi	+.81	16	30	11.85	.855	−.016	11.84	+.24	12.08	8.38	3.70
α Herculis	+.18	16	56	58.31	.310	−.018	58.29	+.45	58.74	54.56 54.60	4.18 4.14
ε Ursæ Min.	−.45	16	59	21.04	.044	−.114	20.93	+2.16	23.09	15.64	+7.45
β Draconis	−.28	17	27	38.48	.482	−.025	38.46	+.61	39.07	34.57	+4.50
γ Sagittarii	+.11	17	57	40.85	.855	−.018	40.84	+.13	40.97	37.44	+3.53
δ Ursæ Min.	+1.79	18	13	59.80	.800	−.026	59.77	+4.89	64.37	52.16	+12.21
ι Aquilæ.	+.78	18	28	20.11	.109	−.015	20.09	+.24	20.33	16.57	+3.76
ζ Lyræ.	+.04	18	32	42.10	.100	−.018	42.08	+.49	42.57	38.37	+4.20
51 Cephei	+1.85	18	39	24.14	.144	+.320	24.46	−5.02	19.44	26.93	−7.49
β Lyræ.	+.19	18	45	26.99	.991	−.018	26.97	+.45	27.42	23.33 23.29	+4.09 4.13
σ Sagittarii	+1.04	18	47	25.49	.491	−.017	25.47	+.15	25.62	22.04	3.58
ζ Aquilæ.	+.49	18	59	37.16	.164	−.016	37.15	+.34	37.49	33.63	3.86
α Sagittarii	+.93	19	10	14.44	.436	−.016	14.42	+.19	14.61	11.00	3.61
ζ Draconis	−1.10	19	12	38.54	.544	−.038	38.51	+.90	39.41	34.44	4.97
τ Draconis	+1.76	19	18	8.26	.256	−.05	8.20	+1.12	29.32	3.99	5.33
ζ Aquilæ.	+.64	19	19	8.29	.291	−.015	8.28	+.29	8.57	4.76	3.81

* See note for July 22

$a = +6^s.5$

h	m	s		s
13	49.0	= +3.93	+.42 +.29	4.22
14	1.0	= 3.93	+.41 +.28	4.21
14	20	= 4.39	−.29 −.20	4.12
14	57	= 4.21	+.93 +.02	4.23
15	29	= 3.96	+.30 +.20	4.16
16	8	= 3.77	+.72 +.49	4.26
16	15	= 4.35	−.11 −.07	4.25
16	21	= 3.47	+1.04 +.71	4.18
16	30	= 3.90	+.41 +.25	4.25
16	56	= 4.18	+.15 +.12	4.30
17	28	= 4.50	−.28 −.19	4.31
17	57	= 3.53	+1.11 +.76	4.29
18	28	= 3.76	+.78 +.53	4.29
18	32	= 4.20	+.08 +.05	4.25
18	45	= 4.09	+.19 +.13	4.22
18	47	= 3.18	+1.04 +.71	4.29
18	59	= 3.86	+.49 +.33	4.19
19	11	= 3.61	+.93 +.63	4.24
19	19	= 3.81	+.64 +.43	4.24
16	57		3.63 +.45	4.26
				+.08

13 12	$o = -7^s.50 + 31.42$
14 51	+5.67 − 2.02
15 21	+5.34 − 1.64
16 22	+1.66 − .70
16 56	+7.45 − 4.70
18 14	+12.21 − 11.79
18 39	−7.49 + 16.95
19 13	+4.97 − 1.10
19 18	+5.32 − 1.76

$o = +21.43$	− 30.97	$a = +.69$
1.94	− 2.49	+.70
1.41	− 2.08	+.67
0.93	− 1.15	+.64
3.52	− 5.20	+.68
8.28	− 12.24	+.68
11.42	− 15.50	+.74
1.04	− 1.55	+.67
1.40	− 2.21	+.63
		+.68

h m

$dT = -4^s.24$ at 16 57

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Time Determinations for Trans-Atlantic Longitude.

With the Auth Clock.

$b = +8^{s}$

July 25. 1872

Star.	Observed T	k	×	m + x	Sb.	π	R.A.	m − R.A.
	h m s	s	s	s	s	s	s	s
χ Herculis.	16 15 58.97	.973	−.022	58.95	+.54	59.49	55.81 / 24	+4.18 / 2.15
ζ Scorpii.	16 21 38.88	.878	−.018	38.86	+.15	39.01	35.50 / 35.16	3.51 / 3.55
ν Draconis.	16 22 21.56	.556	−.033	21.52	+.74	22.26	17.68	4.58
N Draconis.	16 28 21.141	.144	−.040	21.10	+.93	22.03	16.87	5.16
κ Ophiuchi.	16 51 41.80	.800	−.016	41.78	+.31	42.09	38.24 / 38	3.85 / 3.81
λ Herculis.	16 56 58.241	.236	−.018	58.22	+.44	58.66	54.55 / 54.59	4.11 / 4.07
ε Ophiuchi.	16 59 20.88	.878	−1.14	20.76	+2.11	22.87	15.49	7.38
ζ Herculis.	17 08 53.941	.936	−.016	53.92	+.34	54.26	50.43	3.83
Gr. 966	17 22 37.97	.967	+.059	38.03	−.66	37.37	35.51	1.86
β Draconis.	17 27 38.32	.318	−.025	38.29	+.60	38.89	34.55	4.34
ζ Ophiuchi.	17 29 4.93	.927	−.015	4.91	+.33	5.24	1.41	3.83
ν Draconis.	17 44 20.61	.611	−.949	20.56	+1.05	21.61	16.46	5.15
γ Draconis.	17. 53 44.08	.082	−.025	44.06	+.59	44.65	40.15 / 40.20	+4.50 / 4.45

h	m	s	s	s
		o =	a =	+6.1
16	16	+4.78	−.11	−.06 +4.18
16	22	3.51	+1.04	+.63 .14
16	52	3.85	+.55	+.24 .19
16	57	4.11	+.18	+.11 .22
17	8	3.83	+.48	+.29 .12
17	28	4.34	−.29	−.18 .17
17	29	3.83	+.51	+.31 .14
17	53	4.50	−.25	−.15 .25
17	03	4.02	+.26	4.18 ± .010

h	m	s
		o =
16	22	+4.58
16	59	−.70
17	28	7.38 −4.75
17	44	1.86 +3.42
		5.65 −1.63

o = +0.56 −.96 a = +.89
+3.36 −5.01 +.67
+2.16 −3.64 +.59 wrong.
+1.13 −1.89 −.60
+.61

$dT + m = -4^{s}.18$ $T = 17^{h}\ 3^{m}$

* See not for July 2 —

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Time Determinations for Trans-Atlantic Longitude.

With the Smith Clock.

$b = +.38^{s}$

July 27, 1872

Star.	Observed T. h m s	b × s	π + s	Bb. s	T' s	R.A. s	T − R.A. s
ζ Coronæ.	16 21 38.73	.727 −.018	38.41	+.14	38.85	35.48	+3.37
N Draconis	16 28 20.67	.667 −.040	20.63	+.87	21.50	16.77	4.73
π Herculis	16 38 35.64	645 −.020	35.62	+.45	36.07	32.15	3.92
κ Ophiuchi.	16 51 41.69	.691 −.016	41.67	+.30	41.97	38.23	3.74
ε Ursæ min.	16 59 20.33	.333 −.114	20.22	+1.99	22.21	15.21	7.00
44 Ophiuchi.	17 18 38.50	.500 −.016	38.48	+.15	38.63	35.29	3.34
ζ Ophiuchi.	17 29 4.77	.773 −.015	4.76	+.31	5.07	1.39	3.68
α Draconis.	17 37 48.89	.889 −.040	48.85	+.87	49.72	45.01	4.71
ι Herculis.	17 41 32.24	.236 −.017	32.22	+.38	32.60	28.81	3.79
γ Draconis	17 44 20.41	.411 −.049	20.36	+.99	21.35	16.37	4.98
β Draconis.	17 53 43.84	.836 −.025	43.81	+.56	44.37	40.12	4.25
ι Sagittarii.	18 06 12.01	.011 −.016	11.99	+.17	12.16	8.69	3.47
93 Tauri.	18 13 57.15	.155 −.260	56.89	+1.24	58.13	51.48	11.65
1 Aquilæ.	18 28 19.91	.909 −.015	19.89	+.22	20.11	16.58	3.53
ζ Lyræ	18 32 41.88	.882 −.018	41.86	+.45	42.31	38.34	3.97
β Lyræ	18 45 26.74	.736 −.018	26.72	+.42	27.14	23.31	3.83
σ Sagittarii	18 47 25.24	.248 −.017	25.23	+.14	25.37	22.05	3.32
58 Draconis.	18 50 37.84	.844 −.057	37.78	+1.16	38.94	33.76	5.18
λ Sagittarii	19 10 11.29	.291 −.016	14.28	+.18	14.46	11.00	3.46
δ Draconis.	19 12 38.21	.211 −.038	38.17	+.83	39.00	34.38	4.62

$a = +.58^{s}$

h	m	s						
16	22	$o = +3.37$	$+1.001$	$+.60$	$+3.97$	.02	.0004	
16	39	$+3.92$	$+.07$	$+.04$	8.96	3	9	
16	52	$+3.44$	$+.55$	$+.32$	4.06	7	49	
17	19	$+3.34$	$+1.00$	$+.58$	3.92	7	49	
17	29	$+3.68$	$+.51$	$+.30$	3.98	1	1	
17	42	$+3.79$	$+.29$	$+.17$	3.96	3	9	
17	53	$+4.25$	$-.26$	$-.15$	4.10	11	121	
18	06	$+3.47$	$+.96$	$+.56$	4.03	4	16	
18	28	$+3.53$	$+.78$	$+.45$	3.98	1	1	
18	38	$+3.97$	$+.08$	$+.05$	4.02	3	9	
18	45	$+3.83$	$+.19$	$+.11$	3.94	5	25	
18	47	$+3.32$	$+1.04$	$+.60$	3.92	7	49	
19	10	$+3.$	$+.93$	$+.54$	4.00			
17	51	$+3.$	$+.55$					

$+3.99 \pm .10$

$.34/2$

$.00472$

h	m	s			
16	28	$o = +4.73$	-1.25		
16	59	$+7.00$	-4.75		
17	37	$+4.71$	-1.23		
17	44	$+4.98$	-1.63		
18	13	$+11.60$	-11.79		
18	50	$+5.18$	-2.14		
19	13	$+4.62$	-1.10		

(+.01)

$o = +1.05$	-1.89	$a = +.58$
$+3.32$	-6.30	$.63$
$+1.03$	-1.28	$.58$
$+1.30$	-2.18	$.60$
$+1.97$	-12.34	$.64$
$+1.50$	-2.69	$.56$
$+0.94$	-1.65	$.57$

$+.58$ (.59)

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Time Determinations for Trans-Atlantic Longitude.

With the Saith Clock.

$b = +33^s$

July 28 1872

Star.	Observed T.	i	x	Tx	B	T'	R.A.	T'-R.A.
	h m s	s	s	s	s	s	s	s
τ Herculis.	16 15 58.45	455	-.022	58.43	+.48	58.91	55.18	+3.73
ζ Serpentis.	16 21 38.32	.318	-.018	38.30	+.14	38.44	35.47	2.97
							35.43	2.21
π Draconis.	16 22 20.83	.833	-.033	20.80	+.66	21.46	17.58	3.88
N Draconis.	16 28 20.33	.333	-.040	20.29	+.82	21.11	16.72	4.39
ζ Ophiuchi.	16 30 11.35	.355	-.016	11.34	+.20	11.54	8.35	3.19
π Herculis.	16 38 35.34	.345	-.020	35.32	+.43	35.75	32.14	3.61
κ Ophiuchi.	16 51 41.25	.255	-.016	41.24	+.28	41.52	38.22	3.30
							38.26	3.26
α Herculis.	16 56 57.72	.718	-.018	57.70	+.39	58.09	54.51	3.58
							54.55	3.54
ε Ser. Mer.	16 59 19.70	.703	-.114	19.59	+1.88	21.47	15.06	6.41
ζ Herculis.	17 08 53.47	.473	-.016	53.46	+.30	53.76	50.41	3.35
44 Ophiuchi.	17 18 38.19	.191	-.016	38.18	+.15	38.33	35.29	3.04
β Draconis.	17 27 37.78	.782	-.025	37.76	+.53	38.29	34.49	+3.80

$n = +.05^s$ $\quad a = +.59$

h	m								
16	16	o =	+3.13	-.11	-.06	+3.67	.04	.0016	-.06 +3.64
16	22		+2.97	+1.04	+.59	3.66	7	49	+.66 .58
16	30		+3.19	+.81	+.46	3.65	2	4	+.48 .67
16	38		+3.61	+.07	+.04	3.66	2	4	+.04 .65
16	52		+3.30	+.55	+.31	3.61	2	4	+.32 .62
16	57		+3.58	+.18	+.10	3.68	5	25	+.11 .69
17	9		+3.35	+.48	+.28	3.63	0	0	+.28 .63
17	18		+3.09	+1.00	+.57	3.66	2	4	+.57 .63
17	28		+3.80	-.28	-.16	3.64	1	1	-.17 .63
								107	
16	50		+3.40	+.42		+3.63 ±.008		.00134	+3.63 ±.007

* (16 22 o = +3.88 -.70)
16 28 +4.39 -1.25
16 59 +6.41 -4.75

o = +.99 -1.67 a = +.59+
+3.01 -5.17 .58+
.59

$dT = -3^s.63 \quad dt = 16^h$

π Draconis nine be registered as ? as am not certain whether I observed n_1 n_2 = the mean. J.A.R.

July 29

h	m				
16	16	do = +3.88	+.02	= -3.90	0 .0009
16	22	3.79	+.02	3.81	6 36
16	57	3.89	+.00	3.89	2 4
17	08	3.79	+.00	3.79	8 64
17	18	3.89	-.01	3.88	1 1
17	28	3.91	-.02	3.89	2 4
17	42	3.82	-.02	3.80	7 49
17	54	3.99	-.03	3.96	9 81
					248
h	m				
17	8			-3.87	.00354
				±.014	

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Time Determinations for Trans-Atlantic Longitude.

With the South Clock.

$\delta = +.31^s$

July 29, 1872

Star.	Observed T.	h	x	T + B.	T'	R.A.	T'-R.A.
	h m s	s	s	s	s	s	s
T Herculis	16 15 58.68	.655	-.015	58.64	+.45	59.09	55.16	+8.93
λ Ophii.	16 21 38.55	.555	-.018	38.54	+.13	38.67	35.48 (53.72)	3.21 (2.95)
ν Draconis.	16 22 21.08	.078	-.033	21.04	+.62	21.66	17.54	4.12
A Draconis.	16 28 20.48	.478	-.040	20.44	+.78	21.22	16.67	4.55
d Herculis.	16 56 57.96	.960	-.018	57.94	+.37	58.31	54.51 (54.54)	3.80 (3.77)
ε Ursæ Min.	16 54 19.74	.744	-.114	19.63	+1.76	21.39	14.92	6.47
ζ Herculis.	17 08 53.64	.645	-.016	53.63	+.28	53.91	50.40	3.51
44 Ophiuchi.	17 18 38.47	.473	-.016	38.46	+.14	38.60	35.28	3.32
β Draconis	17 27 38.06	.064	-.025	38.04	+.50	38.54	34.47	4.07
w Draconis.	17 37 48.77	.767	-.040	48.73	+.77	49.50	44.93	4.57
ω Herculis.	17 41 32.14	.136	-.017	32.12	+.34	32.46	28.79 (28.74)	3.67 (3.72)
ν Draconis.	17 44 20.30	.300	-.049	30.25	+.88	31.13	16.27	4.86
γ Draconis.	17 53 42.77	.773	-.025	43.75	+.49	44.24	40.09 (40.14)	4.15 (4.10)

dδT assumed = +.001 per hour. (Corr. to T-R.A.)

	h	m	s	a = +.55
ν	16	16	o = +3.93 -.11 -.06	+3.85
	16	22	+3.21 +1.03 +.57	.78
	16	57	+3.80 +.18 +.10	.90
	16	32	+3.65 +.37	+3.85

	h	m	s	dT	s
#	16	22	o = +4.12	+00	+4.12 -.70
	16	28	+4.55	+00	+4.55 -1.26
	16	59	+6.47	-01	+4.46 -4.75

o = +.47 -1.07 a = +.55
+.90 -1.63 +.55
+2.81 -5.12 +.55

see note July 29

	h	m	s	a = +.54
	17	8	o = +3.51 +.48 +.26	+3.77
	17	18	+3.32 +1.00 +.54	3.86
	17	28	+4.07 -.28 -.14	3.93
	17	42	+3.67 +.28 +.14	3.81
	17	54	+4.15 -.26 -.14	4.01
	17	30	3.74 +.24	+3.88

	h	m	s
	16	59	o = +6.47 +.01 +6.48 -4.75
	17	38	4.57 +.00 +4.57 -1.23

o = +2.74 -4.99 a = +.55
o = +.83 -1.57 +.53

$T_0 = 16^h\ 36^m$ dδT = +.03 per hour. a = +.56

	h	m	s	Cor. dT. s	s	s	dT = -3.85
ν	16	16	o = +3.93	+.01	+3.94 -.11	-.06	+3.88
	16	22	+3.21	+.00	+3.21 +1.04	+.58	3.79
	16	57	+3.80	-.01	+3.79 +.18	+.10	3.87
	16	32			3.65 +.37		3.85

dT = -3.85 / 16h 32m

$T_0 = 17^h\ 30^m$

	h	m	s		s	s	dT = -2.88
	17	08	o = +3.51	+.01	+3.52 +.48	+.27	3.78
	17	18	+3.32	+.01	+3.33 +1.00	+.56	3.89
	17	28	+4.07	+.00	+4.07 -.28	-.16	3.91
	17	42	+3.67	-.01	+3.66 +.28	+.16	3.82
	17	54	+4.15	-.01	+4.14 -.26	-.15	3.99
	17	30			+3.74 +.24		3.88

dT = -2.88 / 17h 30m

	h	m	s	dT	s
	16	28	o = +4.55	+.03	+4.58 -1.25
	16	59	+6.47	+.01	+6.48 -4.75
	17	38	+4.57	+.00	+4.57 -1.23

$T_0 = 16^h\ 30^m$

o = +.90 -1.62 a = +.56
+2.81 -5.12 +.55
+.89 -1.60 +.56
+.56

o = +.84 -1.49 a = +.56
+2.74 -4.99 +.55
+.83 -1.47 +.56

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Time Determinations for Trans-Atlantic Longitude.

With the Smith Clock.

July 30, 1872.

$b = +.^s29$

Star	Observed T.	h	m	s	×	T+x	Bb.	T'	R.A.	T-R.A.
44 Ophiuchi.	17	18	37.56	.564	-.016	39.55	+.13	39.68	35.29	+4.41
β Draconis	17	27	~~28.87~~ 37.145	.873 143	-.025	~~38.85~~ 39.12	+.48	39.32 61	34.45	~~+4.89~~ 5.16
D Draconis.	17	37	49.84	.844	-.040	49.80	+.72	50.52	44.89	+5.63
ε Herculis.	17	41	33.24	.245	-.017	33.23	+.31	33.54	28.78 73	+4.76 4.81
γ Draconis.	17	44	21.42	.422	-.049	21.37	+.82	22.19	16.22	+5.97
γ Draconis.	17	53	44.84	.845	-.025	44.82	+.46	45.28	40.07 40.12	+5.21 5.16
σ² Sagittarii	17	57	41.74	.745	-.018	41.73	+.10	41.83	37.43	+4.40
δ Ophiuchi.	18	14	~~51.17~~	.170	~~-.268~~	59.91	+3.51	3.42	50.62	+12.80
β Aquilae.	18	59	38.15	.155	-.016	38.14	+.26	38.40	33.64	+4.76
δ Draconis.	19	12	39.39	.389	-.038	39.35	+.68	40.03	34.32	+5.71
δ Aquilae.	19	18	9.26	.255	-.015	9.24	+.22	9.46	4.78	+4.68
γ Draconis.	19	19	9.81	.309	-.052	9.26	+.86	10.12	3.82	+6.30

Assume $dT = +.03$ per hour. (Corr to T - R.A.)

h	m					
17	19	$o = +4.41$	$+1.00$	$+.61$	5.02	
17	28		$+.16$	$-.28$	$-.17$	4.99
17	42		$+4.76$	$+.28$	$+.17$	4.93
17	53		$+5.21$	$-.26$	$+.16$	5.05
17	58		$+4.40$	$+1.11$	$+.68$	5.08
17	40		4.72	$+.29$		5.014

$a = +.61$

h	m					
18	59		$+4.76$	$+.49$	$+.30$	5.06
19	18		$+4.68$	$+.64$	$+.39$	5.07
19	08		4.72	$+.56$		5.065

h	m							
17	38	$o = +5.63$	-1.23	$+.00$	$+5.63$	$o = +.89$	$+.62$	$a = +.56$
17	44		$+5.97$	-1.63	$+.00$	$+5.97$	$+1.34$	$+2.02$
18	14		$+12.80$	-11.79	$-.01$	$+12.79$	$+8.06$	$+12.18$

h	m							
18	14	$o = +12.80$	-11.79	$+.03$	$+12.83$	$o = +8.11$	-12.35	$a = +.66$
19	13		$+5.71$	-1.10	$+.00$	$+5.71$	$+.99$	-1.66
19	19		$+6.30$	-1.76	$+.00$	$+6.30$	$+1.58$	-2.32

$+.61$

$dT = -5.014$ at 17 40
$dT = 5.065$ at 19 08
hourly change of $dT = +.035$

---

h	m							
17	19	$b = +4.41$	$+1.00$	$+.61$	$+5.02$	$+.01$	$T = 6.03$	
17	28		$+5.16$	-1.28	$-.17$	4.99	$+.01$	6.00
17	42		$+4.76$	$+.28$	$+.17$	4.93	$+.06$	4.93
17	53		$+5.21$	$-.26$	$-.16$	5.05	$-.01$	5.04
17	58		$+4.40$	$+1.11$	$+.68$	5.08	$-.01$	5.07
17	40		$+4.79$	$+.37$		5.014		

$a = +.61$ $T_0 = 17^h\,40^m$

h	m							
18	59	$o = +4.76$	$+.49$	$+.30$	5.06	$-.04$	5.01	
19	18		$+4.68$	$+.64$	$+.39$	5.07	$-.05$	5.02
19	09		$+4.72$	$+.56$		5.065		5.014

h	m							
17	38	$o = +5.63$	$+.00$	$+5.63$	-1.23			
17	44		$+5.97$	$+.00$	$+5.97$	-1.63		
18	14		$+12.80$	$-.02$	$+12.78$	-11.79		

h	m							
18	14	$o = +12.82$	$+.03$	$+12.85$	-11.79			
19	13		$+5.71$	$+.00$	$+5.71$	-1.10		
19	19		$+6.30$	$+.00$	$+6.30$	-1.76		

$o = +0.84 \quad -1.60 \quad a = +.53$
$+1.76 \quad -2.00 \quad +.59$
$+7.99 \quad -12.16 \quad +.66$

$o = +8.11 \quad -12.35 \quad a = +.66$
$+.99 \quad -1.66 \quad +.60$
$+1.58 \quad -2.32 \quad +.68$

$a = +.53$
$+.59$
$+.66$
$+.60$
$+.68$
$+.61$

dT at $17^h\,40^m = -5.01 \pm .011$

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Time Determinations for Trans-Atlantic Longitude.

With the South Clock.

$b = +,28^s$

Aug. 1, 1872

Star	Observed T	h	+	T+x	Bl.	T'	R.A.	T'-R.A.
	h m s	s	s	s	s	s	s	s
Polaris.	13 12 16.14	.144	+.140	10.78	−7.65	8.13	14.58	−11.45
ε Virginis.	13 18 34.64	.636	−.016	34.62	+.17	34.79	27.58	+7.21
α Ursæ Maj.	13 42 37.53	.533	−.024	37.51	+.43	37.94	30.18	+7.76
α Bootis	13 48 43.29	.289	−.016	43.27	+.27	43.54	36.06	+7.48
β Bootis.	14 57 15.84	.836	−.020	15.82	+.37	16.19	8.48	+7.71
β Librae.	15 10 15.56	.564	−.015	15.55	+.18	15.73	8.38	+7.35
δ Ophiuchi.	16 07 47.041	.045	−.015	47.03	+.20	47.23	39.80	+7.43
λ Draconis.	16 28 24.39	.389	−.040	24.35	+.70	25.05	16.51	+8.54
β Ophiuchi.	16 30 15.68	.682	−.016	15.67	+.17	15.84	8.31	+7.53
κ Ophiuchi.	16 51 45.65	.655	−.016	45.64	+.24	45.88	38.18 (7.66)	+7.70
α Herculis.	16 57 2.01	.009	−.018	1.99	+.33	2.32	54.46 (7.52)	+7.86
ε Ursæ Min.	16 59 23.84	.844	−.114	23.73	+1.59	25.32	14.47	+10.85
ζ Herculis.	17 08 57.772	.718	−.016	57.79	+.25	57.95 (50.04)	50.37	+7.58 (7.67)
ν Herculis.	17 41 36.30	.300	−.017	36.28	+.31	36.59	28.76 (28.71)	+7.83 (7.88)
δ Ursæ Min.	18 14 2.86	.856	+.260	2.60	+3.39	5.99	49.98	+16.01
51 Ophiuchi.	18 39 31.12	.122	+.320	31.44	−3.70	27.74	29.43	−1.69
β Lyrae.	18 45 30.93	.927	−.018	30.91	+.33	31.24	23.28 (23.24)	+7.96 (8.00)
σ Sagittarii.	18 47 29.54	.536	−.017	29.52	+.11	29.63	22.05	+7.58
50 Draconis.	18 50 41.92	.922	−.059	41.86	+.92	42.78	33.53	+9.25
β Aquilae.	18 59 41.23	.227	−.016	41.21	+.25	41.46	33.64	+7.82
ζ Sagittarii.	19 10 18.54	.545	−.016	18.53	+.14	18.67	11.01	+7.66
τ Draconis.	19 18 12.23	.233	−.052	12.18	+.83	13.01	3.75	+9.26
ζ Aquilae.	19 44 42.02	.018	−.016	42.00	+.24	42.24	34.41	+7.83
β Aquilae.	19 48 11.33	.327	−.015	11.31	+.23	11.54	3.67	+7.87
λ Ursæ Min.	19 53 27.83	.833	−.810	27.02	+10.25	37.27	4.60	+32.67

For solution see page of the Aug. 10

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Time Determinations for trans-Atlantic Longitude.

With the Tenth Block.

$b = +2^{s}.7$

Aug 4, 1872

Star	Observed T	$\frac{h}{s}$	$\frac{m}{s}$	$\frac{s}{s}$	$\frac{s}{s}$	$T+\tau$	Bb.	T'	R.A.	T − R.A.
Polaris.	13	12	22.22	.222	+.640	22.86	−.97	15.47	16.79	−1.30
2 Virginis.	13	18	42.04	.036	−.016	42.02	+.16	42.18	27.54	+14.64
2 Bootis	14	10	4.79	.791	−.016	4.77	+.26	5.03	50.10	+14.93
B Bootis.	14	57	23.25	.255	−.020	23.23	+.36	23.59	8.41	+15.18
B Librae.	15	10	23.08	.082	−.015	23.07	+.17	23.24	8.35	+14.89
n Draconis.	16	22	32.50	.500	−.033	32.47	+.54	33.01	17.31	+15.70
ν Ophiuchi	16	30	23.11	.109	−.016	23.09	+.17	23.26	8.27	+14.99
κ Ophiuchi.	16	51	53.17	.173	−.016	53.16	+.23	53.39	38.14 (18)	+15.25 (15.21)
d Herculis	16	57	9.50	.500	−.018	9.48	+.32	9.80	54.40 (44)	+15.40 (15.36)
ε Ursæ Min.	16	59	29.44 (30.14)	.94	−.114	29.83 (30.03)	+1.54	31.37 (67)	14.01	+17.36
B Draconis	17	27	49.64	.645	−.025	49.62	+.43	50.05	34.33	+15.72
ω Herculis.	17	41	43.70 (51)	.903 (89)	−.017	43.88 (79)	+.29	44.17 (108)	28.73 (68)	15.44 (15.40)

$dd\tau = +.11$ $\quad a = +.48$

h	m						h	m				
13	19	$o =$	+14.64	+.81	+.29	+15.03+.20	+15.23	13	10	$o =$	−1.30	+31.42
14	10		+14.93	+.41	+.20	.13+.10	.23	16	23		+15.70	−.70
14	57		+15.18	+.03	+.1	.19+.2	.21					
15	10		+14.89	+.79	+.38	.27−.1	.26					
16	30		+14.99	+.81	+.39	.38−.15	.23					
15	07		+14.95	+.49 (57)		15.28	+15.23					

Reject this solution.

$o = +16.07 - 30.83$ $\quad a = +.52$

$+.58 - 1.19$ $\quad +.49$

h	m						h	m				
16	52	$o =$	+15.25	+.53	+.26	+15.51	+.04	+15.55	16	59	$o =$	+17.56 − 4.78
16	57		+15.40	+.15	+.09	15.49	+.04	.53				
17	28		+15.72	−.28	+.13	15.57	−.02	.57				
17	42		+15.35	+.28	+.13	15.48	−.05	.43				
17	15		+15.45 (41)	+.18				15.52				

h	m						h	m				
15	17	$-dT =$	+15.23									
17	15	$-dT =$	+15.52									
1	58		.29									

$o = +2.44 - 5.13$ $\quad a = +\frac{.42}{143}$ $\quad +.48$

$-dd\tau = +.14$ per hour.

h	m						h	m				
13	19	$o =$	+14.64	+.21	+14.85	+.81	+.37	+15.22	13	10	$o =$	−1.30 +.22 −1.08 +31.42
14	10		14.93	+.9	+15.02	+.41	+.19	+15.21	16	23		+15.70 −.22 +15.48 −.70
14	57		+15.18	+.2	+15.16	+.03	+.1	15.17				
15	10		+14.89	−.5	+14.84	+.79	+.36	15.20				
16	30		+14.99	−.22	+14.76	+.81	+.37	15.13				
14	49				+14.95	+.54		+15.17				

$o = -16.03 + 30.85$ $\quad a = +.52$

$-.53 + 1.27$ $\quad .42$

h	m							h	m				
16	52	$o =$	+15.25	+.05	+15.30	+.55	+.25	+15.55	16	59	$o =$	+17.56	+.04 +17.60 −4.78
16	57		+15.40	+.4	+15.44	+.18	+.8	.52					
17	28		+15.72	−.3	+15.69	+.28	−.13	.56					
17	42		+15.35	−.06	+15.29	+.28	+.13	.42					
17	18				+15.41	+.18		+15.51					

$o = -2.19 + 4.93$ $\quad a = +\frac{.44}{\text{Mean } +.46}$

Hourly changing rate $= -.119$

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1872phae.proj.1750R

Time Determination for Trans-Atlantic Longitude.
With the Smith Clock.

b = +2.5

Aug. 5, 1872

Star.	Observed T.	h ×	T + x	Bk.	T'	R.A.	T − R.A.
	h m s	s	s		s	s	s
2 Herc.	16 21 52.70	.700 −.018	52.68	+.10	52.78	35.38 35.34	+17.40 17.44
(α Draconis.	16 22 34.88	.878 −.033	34.84	+.50	35.34	17.27	18.07)
λ Draconis.	16 28 34.17	.167 −.040	34.13	+.62	34.75	16.30	18.45
π Herculis.	16 38 49.54	.545 −.020	49.52	+.32	49.84	31.99	17.85
k Ophiuchi.	16 51 55.61	.609 −.016	55.59	+.21	55.80	38.13 38.17	17.67 17.63
λ Herculis.	16 57 12.04	.045 −.018	12.03	+.30	12.33	54.39 54.42	17.94 17.90
ε Ursæ Min.	16 59 32.88	.878 −.114	32.76	+1.42	34.18	13.86	20.32
2 Herculis.	17 08 7.84	.845 −.016	7.83	+.23	8.06	50.32	17.74
ii Herculis.	17 41 46.43	.427 −.017	46.41	+.27	46.68	28.72 28.67	17.96 18.01
ψ Draconis	17 44 34.10	.100 −.049	34.05	+.71	34.76	15.88	18.88
γ Draconis.	17 53 57.91	.909 −.025	57.88	+.40	58.28	39.95 40.00	18.33 18.28
g² Sagittarii.	17 57 54.89	.891 −.018	54.87	+.08	54.95	37.38	17.57
ω Sagittarii	18 06 26.20	.201 −.016	26.18	+.12	26.30	8.65	17.65
δ Ursæ Min.	18 14 10.72	.722 −.260	10.46	+3.03	13.49	48.75	24.74

Lower Chain Pendt = −.12

h	m	s	s					h	m	s		
16	21	o = +17.40	+11	+17.51	+1.04	+.52	+18.03	0	0	16	23	o = +18.07 +11 +18.18 −.10
16	35	+17.46	+7	+17.92	+.07	+.31	17.96	7	49	16	29	18.45 +10 +18.55 −1.25
16	52	+17.67	+5	+17.72	+.55	+.28	18.00	3	9	16	57	20.32 +4 +20.36 −4.75
16	57	+17.94	+2	+17.98	+.18	+.9	18.07	4	16			
17	8	+17.74	+2	+17.76	+.48	+.24	18.00	3	9			
16	47	+17.72										
17	42	o = +17.96	−5	+17.91	+.28	+.14	18.05	2	4	17	45	o = +18.88 −6 +18.82 −1.63
17	54	+18.33	−7	+18.26	−.25	−.14	18.12	9	81	18	14	+24.74 −11 +24.63 −11.79
17	58	+17.57	−8	+17.49	+.11	+.5	18.02	1	1			
18	6	+17.65	−10	+17.55	+.96	+.48	18.03	0	0			
17	45	17.88		+17.99	+.49		18.03 ±.010					
17	17											

(o = +0.38 − 1.19) a = +

o = +0.96 − 1.74 + .44
+2.57 − 5.24 + .49
+1.03 − 2.12 + .49
+6.84 − 12.28 + .56
+ .50

h m	−dT =	s	s
	T₀ = 16 00	s	s
13 19		+15.01	+.32 +15.33
14 10		15.12	+.22 .34
14 57		15.19	+.13 .32
15 10		15.25	+.10 .35
16 30		15.36	−.6 .30
16 52		15.50	−.10 .40
16 57		15.48	−.10 .38
17 28		15.55	−.17 .38
17 42		15.48	−.26 .28
	For 16h 0m		15.34
			±.009

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1872phae.proj.1750R

Time Determinations for Trans-Atlantic Longitude.

With the South Clock.

$b = +.^{s}23$

Aug. 6, 1872

Star	Observed T.	x	$T_T x$	Bb.	T'	R.A.	T'-R.A.
	h m s	s	s	s	s	s	s
Polaris.	13 12 27.75	.755	+.640	28.39	−6.28	22.11	18.17	+3.94
ζ Virginis.	13 18 47.09	.091	−.016	47.07	+.14	47.21	27.52	+19.69
η Ursæ Maj.	13 42 49.97	.973	−.024	49.95	+.35	50.30	30.07	+20.23
η Bootis.	13 48 55.74	.745	−.016	55.73	+.22	55.95	36.00	+19.95
ζ Bootis.	14 04 9.82	.818	−.016	9.80	+.23	10.03	50.08	+19.95
η Herculis.	16 38 52.16	.164	−.020	52.14	+.30	52.44	31.97	+20.47
κ Ophiuchi.	16 51 58.23	.227	−.016	58.21	+.20	58.41	38.12 (38.16)	+20.29 (20.25)
ζ Herculis.	16 57 14.60	.600	−.018	14.58	+.27	14.85	54.37 (54.41)	+20.48 (20.44)
ε Ursæ Min.	16 59 35.47	.467	−.114	35.35	+1.31	36.66	13.71	+22.95
ζ' Herculis.	17 09 10.38	.382	−.016	10.37	+.21	10.58	50.31	+20.27
44 Ophiuchi.	17 18 55.18	.182	−.016	55.17	+.10	55.27	35.21	+20.06
β Draconis.	17 27 54.70	.700	−.025	54.68	+.37	55.05	34.28	+20.77
ν Herculis.	17 41 48.89	.891	−.017	48.87	+.25	49.12	28.71 (28.68)	+20.41 (20.46)
ν Draconis.	17 44 36.67	.667	−.049	36.62	+.65	37.27	15.83	+21.44
γ Draconis.	17 54 0.44	.445	−.025	0.42	+.37	0.79	39.93 (39.98)	+20.86 (20.81)
δ Ursæ Min.	18 14 13.23	.233	−.260	12.97	+2.79	15.76	48.47	+27.25
ζ Lyræ	18 32 58.71	.709	−.018	58.69	+.29	58.98	38.25	+20.73
51 Herculis.	18 39 46.79	.789	+.320	47.11	−3.04	44.07	31.21	+12.86
β Lyræ.	18 45 43.66	.656	−.018	43.64	+.27	43.91	23.25 (23.21)	+20.66 (20.70)
σ Sagittarii.	18 47 42.26	.256	−.017	42.24	+.09	42.33	22.03	+21.30
β Aquilæ.	18 59 54.01	.009	−.016	53.99	+.21	54.20	33.62	+20.58
ζ Sagittarii	19 10 31.341	.336	−.016	31.32	+.11	31.43	11.01	+20.42
τ Draconis.	19 18 24.74	.744	−.052	24.69	+.68	25.37	3.56	+21.81
δ Aquilæ	19 19 25.14	.145	−.015	25.13	+.18	25.31	4.78	+20.53
β Aquilæ	19 49 24.10	.100	−.015	24.08	+.49	24.27	3.68	+20.59
λ Ursæ Min.	19 53 34.33	.333	−.810	33.52	+8.42	41.94	1.61	+40.33
π Capricorni	20 20 22.41	.409	−.016	22.39	+.12	22.51	2.02	+20.49
ε Delphini.	20 27 28.54	.545	−.016	28.53	+.20	28.73	7.99	+20.74

For solution see page of Aug 1

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1872phae.proj.1750R

Time Determinations for Trans-Atlantic Longitude.
With the South Clock.

Aug 7, 1872

Star	Observed T				Bb.	T'	R.A.	T'-R.A.
	h m	s	s		s	s	s	h m s
Polaris	13 12	29.53	.533	+.646	30.17	-.601	24.16	18.88	+5.28
π Ursæ Maj.	13 42	52.80	.800	-.024	52.78	+.34	53.12	30.04	+23.08
π Bootis	13 48	58.50	.500	-.016	58.48	+.21	58.69	35.98	+22.71
ζ Bootis	14 10	12.71	.709	-.016	12.69	+.22	13.91	50.05	+22.86
ε Bootis	14 39	47.36	.360	-.017	47.34	+.24	47.58	24.66	+22.92
β Bootis	14 57	31.16	.164	-.020	31.14	+.29	31.43	8.35	+23.08
π Herculis	16 38	54.94	.945	-.020	54.93	+.28	55.21	31.95	+23.26
κ Ophiuchi	16 52	1.02	.018	-.016	1.00	+.19	1.19	38.11 (38.15)	+23.08 (23.04)
δ Herculis	16 57	17.42	.418	-.018	17.40	+.26	17.66	54.34 (54.41)	+23.32 (23.26)
ε Ursæ Min	16 59	38.25	.255	-.114	38.14	+1.25	39.39	13.55	+25.84
α' Herculis	17 09	13.19	.191	-.016	13.17	+.20	13.37	50.30	+23.07
44 Ophiuchi	17 18	58.08	.101	-.016	57.98	+.10	58.08	35.20	+22.88
β Draconis	17 27	57.54	.536	-.025	57.51	+.35	57.86	34.26	+23.60
γ' Draconis	17 44	39.48	.478	-.049	39.43	+.62	40.05	15.77	+24.28
γ Draconis	17 54	3.29	.291	-.025	3.27	+.35	3.62	39.90 (39.95)	+23.72 (23.67)
γ² Sagittarii	17 58	0.26	.261	-.018	0.25	+.07	0.32	37.37	+22.95
ν' Sagittarii	18 06	31.54	.536	-.016	31.52	+.11	31.63	8.64	+22.99
δ Ursæ Min	18 14	15.42	.422	-.015	15.41	+2.66	18.07	48.19	+29.88
ζ Lyrae	18 33	1.54	.545	-.018	1.53	+.28	1.81	38.23	+23.58
σ Sagittarii	18 47	45.02	.018	-.017	45.00	+.09	45.09	22.03	+23.06

Azimuth - dT = +13ᵏ per hour.

I

13ʰ 43ᵐ	o = +23.05	+.07	+23.15	-.00	-.10	+23.05	13ʰ 12ᵐ	o = +5.28	+.14	+5.42	+31.42
13 49	22.71	+.6	22.77	+.42	+.22	22.99					
14 16	22.86	+.1	22.87	+.41	+.21	23.08					
14 40	22.92	-.5	22.87	+.29	+.15	23.02					
14 57	23.08	-.9	22.99	+.03	+.02	23.01					
14 16			22.93	+.19		+23.03 ± 0.11					

Mountgrade I-II = .121 — o = 47.51 - 01.23 α = +.53 +.52
" " II-III = .167
" " I-III = .130

II

16 39	o = +23.26	+.05	23.31	+.07	+.04	23.35	16 59	o = +25.74	+.01	+25.85	-4.75
16 52	+23.08	+.3	23.11	+.55	+.29	.40	17 45	24.28	-.08	24.20	-1.63
16 54	+23.30	+.1	23.31	+.18	+.9	.39					
17 09	+23.07	-.1	23.06	+.48	+.25	.31				o = +265	-5.08 α = +.52
17 18	+22.88	-.3	22.85	+1.00	+.52	.37				+1.00	-1.96 +.57
17 28	+23.60	-.5	23.55	-.28	-.15	.40					
17 04			23.20	+.33		23.37 ± .09					

III

17 54	+23.72	+.07	23.77	-.25	-.13	23.64	18 14	o = +29.84	+29.88	-11.79
17 58	+22.95	+.4	22.99	+.11	+.58	.57				
18 7	+22.99	+.2	23.01	+.96	+.50	.51				
18 33	+23.58	-.4	23.54	+.08	+.04	.58				o = 6.62 - 12.38
18 48	+23.06	-.7	22.99	+1.04	+.54	.53				+.53
18			23.27	+.57		23.57 ± .05				+.52

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1872phae.proj.1750R

Time Determinations for Trans-Atlantic Longitude.

With the South Clock.

b = +2.ˢ2

Aug. 8, 1872

Star	Observed T.	x	17+x	B.b.	T'	R.A.	T'−R.A.
	h m s	s	s	s	s	s	s
ε Ursæ Min.	16 59 41.42	.422 −.114	41.31	+1.25	42.56	13.39	+29.17
ζ Herculis.	17 09 16.28	.282 −.016	16.27	+.20	16.47	50.29	+26.18
44 Ophiuchi.	17 19 0.98	.982 −.016	0.97	+.10	1.07	35.19	+25.88
β Draconis.	17 28 0.55	.555 −.025	0.53	+.35	0.88	34.23	+26.65
ζ Ophiuchi.	17 29 27.33	.327 −.015	27.31	+.20	27.51	1.29	+26.22
ν Herculis.	17 41 54.72	.718 −.017	54.70	+.24	54.94	28.68 (28.63)	+26.26 (26.31)
η Draconis.	17 44 42.58	.575 −.049	42.53	+.62	43.15	15.71	+27.44
γ Draconis	17 54 6.31	.309 −.025	6.28	+.35	6.63	39.88 (39.93)	+26.75 (26.70)
ν Sagittarii.	18 06 34.55	.550 −.016	34.53	+.11	34.64	~~27.94~~ 8.63	+26.01
ε Lyræ.	18 33 4.48	.482 −.018	4.46	+.28	4.74	38.22	+26.52
51 Cephei.	18 40 53.65	.650 +.320	53.97	−.90	51.07	31.84	+19.23
β Lyræ.	18 45 49.45	.455 −.018	49.44	+.26	49.70	23.23 (23.19)	+26.47 (26.51)
ν Sagittarii.	18 47 ~~48.08~~ 47.931	.082 .081 −.017	48.06 47.97	+.09	48.06	22.03	+26.03

m	m	s	s	s	s								
17	09	o = +26.18	+.09	+26.27	+.48	+.27	+26.54	2	4	17	h	δm	o = +12.917 +.11 +2.928 −.445
17	19	25.88	+.07	25.95	+1.00	+.56	51	1	1	17	14		+27.44 +.82 +27.48 −1.63
17	28	26.65	+.5	26.70	−.28	−.16	54	2	4	18	40		+19.23 +.09 19.14 +15.95
17	29	26.22	+.5	26.27	+.51	+.29	56	4	16				
17	42	26.26	+.3	26.29	+.28	+.16	45	7	49				
17	54	26.75	−.0	26.75	−.25	−.14	61	9	81				
18	7	26.01	−.2	25.99	+.26	+.54	53	1	1				o = +2.97 −5.15 a = +.58
18	33	26.52	−.8	26.44	+.8	+.4	48	4	16				+1.17 −2.03 +.58
18	46	26.47	−.10	26.37	+.19	+.11	48	4	16				+7.17 −15.55 +.46 (1)
18	48	26.03	−.10	25.93	+.04	+.58	.51	1	1				.56
17	55			+ 26.30	+.40		26.52 ±.010						

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1872phae.proj.1750R

Time Determinations for Trans-Atlantic Longitude.
With the Zenith Block.

$b = +2.2$

Aug. 9, 1872

Star.	Observed T			T'	R.A.	T' − R.A.
θ Draconis	13h 12m 36.48s	.478	+.640	37.12	−6.01	31.11	20.46	10.65
ζ Virginis	13 18 55.40	.400	−.016	55.38	+.13	55.51	27.49	28.02
η Herculis	13 42 58.24	.336	−.024	58.31	+.34	58.65	30.00	28.65
π Bootis	13 49 4.06	.064	−.016	4.05	+.20	4.25	35.96	28.29
ζ Bootis	14 10 18.19	.191	−.016	18.17	+.22	18.39	50.03	28.36
θ Bootis	14 21 19.[47]/29	.[473]/291	−.025	19.[55]/27	+.36	19.[81]/63	50.83	28.[78]/80
ε Bootis	14 39 52.87	.867	−.017	52.85	+.24	53.09	24.62	28.47
ζ Coronæ	15 29 45.50	.500	−.018	45.48	+.24	45.72	17.20	28.52
ε Serpentis	15 44 55.56	.555	−.015	55.54	+.18	55.72	27.40	28.32
β Scorpii	15 58 30.37	.367	−.016	30.35	+.11	30.46	1.20	28.[26]0 ✓
τ Herculis	16 16 23.38	.382	−.022	23.36	+.32	23.68	54.80	28.78
ζ Scorpii	16 22 3.35	.353	−.018	3.34	+.09	3.43	35.33 / 35.27	28.10 / 28.14
π Draconis	16 22 45.79	.789	−.033	45.76	+.44	46.20	17.11	29.09

ddT = .12

h m	s	s	s	s	s
13 19	o = +28.02	+.08	+28.10	+.81 +.46	+28.56
13 43	28.65	+.3	28.68	−.20 −.11	57
13 49	28.29	+.2	28.31	+.42 +.24	55
14 10	28.36	−.1	28.35	+.41 +.23	58
14 21	28.80	−.4	28.76	−.29 −.16	60
14 40	28.47	−.8	28.37	+.29 +.16	53
14 00	+28.468		28.48/2 +.24		28.565

a = +.57

h m	s	s	s	s	s
13 13	o = +10.65	+.09	+10.74	+.42	
	o = 17.[28] − 31.18				
	a = +.57				

h m	s	s	s	s	s
15 30	o = +28.52	+.05	+28.57	+.29 +.16	28.73
15 45	28.32	+.3	28.35	+.61 +.35	70
15 59	29.26	+.0	29.26	+.93 +.53	79 ✓
16 16	28.78	−.4	28.[74]	+.11 −.6	68
16 22	28.10	−.5	28.05	+1.04 +.59	64
15h 58m	+28.596		28.[59]/48 +.55		28.71

16 22 o = +29.09 − .08 + 29.06 − .10 + 0.47 − 1.25

− ddT = +.10 per hour.

a = +.57

h m	s	s	s	s	s		
13 19	o = +28.02	+.08	+28.09	+.81 +.46	28.[56]	2	4
13 43	28.65	+.3	28.68	−.20 −.11	57	0	0
13 49	28.29	+.2	28.31	+.42 +.24	55	2	4
14 10	28.36	−.2	28.34	+.41 +.23	57	0	0
14 21	28.80	−.3	28.77	−.29 −.17	60	3	9
14 40	28.47	−.7	28.40	+.29 +.17	57	0	0
14 00					28.57 ±.05		17

h m	s	s	s	s	s		
15 30	28.52	+.[3]	+28.55	+.29 +.17	28.[72]	1	1
15 45	28.32	+.1	28.33	+.61 +.35	68	3	9
15 59	29.26	+.0	29.26	+.93 +.53	79 ✓	8	64
16 16	28.78	−.3	28.76	−.11 −.6	70	1	1
16 22	28.10	−.1	+28.09	+1.04 +.59	68	4	16
15 58					28.71 ±.03		

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Time Determinations for Transc. Atlantic Longitude.

With the South Clock.

b = .22

Aug. 10 1872

Star.	Observed T	h	x	T + x	B.L.	T'	R.A.	T' - R.A.
π Herculis	16h 39m	2.80	.800 −.020	2.78	+.28	8.06	+7.07 38.89	+31.17
κ Ophiuchi	16 52	8.83	.827 −.016	8.81	+.19	9.00	38.05 38.12	38.92 30.88
λ Herculis	16 57	25.26	.264 −.018	25.25	+.26	25.51	54.31 54.35	31.20 31.16
ζ Herculis	17 09	21.06	.056 −.016	21.04	+.20	21.24	50.27	30.98
44 Ophiuchi	17 19	5.78	.782 −.016	5.77	+.10	5.87	35.17	30.70
β Draconis	17 28	5.31	.309 −.025	5.28	+.35	5.63	34.18	31.45
ζ Ophiuchi	17 29	32.11	.109 −.015	32.09	+.20	32.29	1.27	31.02
π Herculis	17 41	59.64	.636 −.017	59.62	+.24	59.86	28.65 28.70	31.21 31.26
γ Draconis	17 44	47.32	.322 −.049	47.27	+.62	47.89	15.59	32.30
β Draconis	17 54	11.08	.082 −.025	11.06	+.35	11.41	39.83 39.88	31.58 31.53
ν Sagittarii	18 06	39.34	.336 −.016	39.32	+.11	39.43	8.62	30.81
S Vir. Min.	18 14	23.03	.033 −.015	23.02	+2.67	25.69	47.30	38.39
ι Aquilae	18 28	47.30	.297 −.015	47.28	+.14	47.42	16.53	30.89
ζ Lyrae	18 33	9.36	.364 −.018	9.35	+.28	9.63	38.19	31.44
β Lyrae	18 45	54.34	.236 −.018	54.32	+.26	54.58	23.21 23.17	31.87 31.41

Hourly change of -.15 = +.93 assumed.

16h 39m	o = +21.17	+31.26	+.07	+.04	+31.30	
16 52	30.92 + 7	+30.99	+.53	+.32	.81	
16 57	31.20 + 5	+31.25	+.18	+.11	.36	
17 9	30.97 + 4	31.01	+.48	+.28	.29	
17 19	30.70 + 3	30.73	+1.00	+.59	.32	
17 28	31.45 + 2	31.47	−.28	−.16	.31	
17 29	31.02 + 2	31.04	+.51	+.30	.54	
17 42	31.21 − 2	31.21	+.28	+.16	.37	
17 54	31.58 − 2	31.56	−.25	−.15	.41	
18 7	30.81 − 4	30.77	+.96	+.57	.34	
18 29	30.89 − 8	30.81	+.78	+.46	.27	
18 33	31.44 − 8	31.36	+.08	+.5	.41	
18 46	31.37 −11	31.26	+.19	+.11	.37	
17h 38m		+31.13	+31.13	+.35	31.34	

17h 45m	o = +32.30	−.01 +32.29 −16.3
18 14	+35.39	−.10 +35.29 −11.99

o = +1.16 − 1.98 a = +.59
+7.21 −12.14 +.57
.59

ddT per hour = +11s T₀ = 17h 38m

16h	39m	o = +31.17	+31.28	+.07	+.04	31.32	2 4
16	52	30.92 + 8	31.00	+.55	+.32	.32	2 4
16	57	31.20 + 7	31.27	+.18	+.11	.38	4 14
17	9	30.97 + 5	31.02	+.48	+.28	.30	4 16
17	19	30.70 + 4	30.74	+1.00	+.59	.33	1 1
17	28	31.45 + 2	31.47	−.28	−.17	.30	4 4
17	29	31.02 + 2	31.04	+.51	+.30	.34	0 0
17	42	31.21 − 1	31.20	+.28	+.17	.37	3 4
17	54	31.58 − 3	31.55	+.25	+.15	.40	6 36
18	7	30.81 − 5	30.76	+.96	+.57	.33	1 1
18	29	30.89 − 9	30.80	+.78	+.46	.26	8 64
18	33	31.44 −10	31.34	+.08	+.5	.39	5 25
18	46	31.37 −12	31.25	+.19	+.11	.36	2 4
17	38		31.13	+.35		31.48	

17h 45m	o = +32.30	−.01 +32.29 −16.3
18 14	+35.39	−.10 +35.29 −11.99

o = +1.16 − 1.98 a = +.59
+1.16 −1.14 +.57
.59

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Assume hourly rate = +.086 for each. Corr to M.-Kk., dα = +.60

h	m	s			s'	s'
13	19	o =	+7.21	+.81	+.49	+7.70
13	43		7.76	−.20	−.12	.64
13	49		7.48	+.42	+.26	.72
Means.	13	37	7.48	+.34		7.69

h	m	s			s'	s'
14	57	o =	+7.71	+.03	+.02	+7.73
15	10		+7.35	+.79	+.47	7.82
16	8		+7.43	+.72	+.43	7.86
16	30		+7.53	+.81	+.49	8.02
16	52		+7.70	+.54	+.32	8.02
16	57		+7.86	+.18	+.11	7.97
17	9		+7.58	+.48	+.29	7.87
Means.	16	15	+7.59	+.51		+7.90

h	m	s			s'	s'
17	42	o =	+7.83	+.28	+.17	8.00
17	46		+7.96	+.19	+.11	8.07
17	47		+7.58	+1.04	+.62	8.20
19	0		+7.82	+.49	+.30	8.12
19	10		+7.66	+.93	+.56	8.22
19	45		+7.83	+.56	+.34	8.17
19	48		+7.87	+.60	+.36	8.23
Means.	19	00	+7.79	+.58		+8.12

From 13h 37m to 16h 15m dΔT = −.080 per hour

From 16 15 to 19 00 dΔT = −.084

From 13 37 to 19 00 dΔT = −.080
−.081

h	m	s			s'	s'
13	19	o =	+7.21	+.81	+.49	+7.70
13	43		7.76	−.20	−.12	.64
13	49		7.48	+.42	+.26	.72
Means.	13	37	7.48	+.34		7.69

h	m	s			s'	s'
14	57	o =	+7.71	+.11	+.07	+7.89
15	10		+7.35	+.79	+.48	7.92
16	8		+7.43	+.72	+.44	7.88
16	30		+7.53	+.81	+.49	8.00
16	52		+7.70	+.54	+.33	7.98
16	57		+7.86	+.18	+.11	7.91
17	9		+7.58	+.48	+.29	7.87
Means.	16	15	+7.59	+.57		+7.98

h	m	s			s'	s'
17	42	o =	+7.83	+.11	+.07	8.01
17	46		+7.96	+.12	+.07	8.15
17	47		+7.58	+1.04	+.63	8.25
19	0		+7.82	+.49	+.30	8.12
19	10		+7.66	+.93	+.57	8.16
19	45		+7.83	+.56	+.34	8.11
19	48		+7.87	+.60	+.37	8.18
Means.	19	00	+7.79	+.58		+8.14

h	m	s			s'	s'
13	19	−dT =	+7.21	+.25	+.16	7.87
13	43		7.76	+.22	+.14	.86
13	49		7.48	+.21	+.13	.82
14	57		7.71	+.11	+.07	.89
15	10		7.35	+.09	+.06	.50
16	8		7.43	+.01	+.01	.45
16	30		7.53	−.02	−.01	.50
16	52		7.70	−.05	−.03	.62
16	57		7.86	−.06	−.04	.76
17	9		7.58	−.08	−.05	.45
17	42		7.83	−.14	−.09	.70
17	46		7.96	−.21	−.13	.78
17	47		7.58	−.21	−.13	.40
19	00		7.82	−.23	−.14	.64
19	10		7.66	−.25	−.15	.66
19	45		7.83	−.30	−.18	.83
19	48		7.87	−.31	−.19	.87

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h	m	s				s'
13	12	o =	−11.45	+3.42	+.03	−11.42+3.42
						a = +.61

h	m	s			s'
16	28	o =	+8.54	−1.25	+.02 +8.56
16	59		+10.85	−4.75	−.06 +10.79

a = +.55
+.61

h	m	s				s'
18	14	o =	+16.01	−11.79	+.06	+15.95
18	40		−1.69	+15.95	+.02	−1.67
18	51		+9.25	−2.14	+.01	+9.26
19	18		+9.26	−1.76	−.02	+9.24
19	53		+32.67	−38.65	−.08	+32.59

o =	+12.37	a = +	a = +.68
	+15.37	+	+.62
−1.47	+2.72	+	+.54
−1.45	+2.34	+	+.62
−24.81	+39.23	+	+.63
			+.60

13h 37m −dΔT = +.081

h	m	s	Corr. dT		s'	s'
13	19	o =	+7.21	+.02	+7.23	+.81 +.49 +7.72
13	43		+7.76	−.01	+7.75	−.26 −.12 .68
13	49		+7.48	−.02	+7.46	+.42 +.26 .72
Means.	13	37			+7.48	+.34 +7.69

13h 12m o = −11.45 +.03 −11.42 +3.42

o = +18.90 − 31.08 a = +.61

h	m	s			s'	s'
14	57	o =	+7.71	+.11	+7.82	+.03 +.02 +7.84
15	10		+7.35	+.09	+7.44	+.78 +.48 7.92
16	8		+7.43	+.01	+7.44	+.72 +.44 7.88
16	30		+7.53	−.02	+7.51	+.81 +.49 8.00
16	52		+7.70	−.05	+7.65	+.54 +.33 7.98
16	57		+7.86	−.06	+7.80	+.18 +.11 7.91
17	9		+7.58	−.08	+7.50	+.48 +.29 7.87
Means.	16	15			+7.59	+.57 +7.98

h	m	s			s'	s'
16	28	o =	+8.54	+.02	+8.56	−1.25
16	59		+10.85	−.06	+10.79	−4.75

o = +.93 − 1.86 a = +.53
+3.20 − 5.26 +.61

h	m	s				s'
17	42	o =	+7.83	+.11	+7.94	+.28 +.17 8.11
17	46		+7.96	+.12	+7.98	+.19 +.12 8.10
17	47		+7.58	+.02	+7.60	+1.04 +.63 8.23
19	0		+7.82	+.00	+7.82	+.49 +.30 8.12
19	10		+7.66	−.02	+7.64	+.93 +.57 8.14
19	45		+7.83	−.06	+7.77	+.56 +.34 8.11
19	48		+7.87	−.06	+7.81	+.60 +.37 8.18
Means.	19	00			+7.79	+.58 +8.14

h	m	s				s'
18	14	o =	+16.01	+.06	+16.07	−11.79
18	40		−1.69	+.03	−1.66	+15.95
18	51		+9.25	+.01	+9.26	−2.14
19	18		+9.26	−.02	+9.24	−1.76
19	53		+32.67	−.07	+32.60	−35.65

o =	+8.28	−12.37	a = +.68
	+9.45	−15.37	+.61
	+1.47	−2.72	+.54
	+1.45	−2.34	+.62
	+24.81	−39.23	+.63
			+.61

π = 16h 15m dΔT = −.083

13h 37m to 16h 15m dΔT = −.080

16h 15m to 19h 00m dΔT = −.080

13h 37m to 19h 00m dΔT = −.083
−.083

dT = −7.92 at 16h 15m
±.009

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Assume $-\delta\Delta T$ per hour $= +.130^s$

$a = +.51^s$

h	m		s	s	s
13	19	o = +19.69 +.06	+19.75 +.81	+41	+20.16
13	43	20.23 +.10	20.23 −.20	−10	.13
13	49	19.95 −.01	19.94 +.42	+21	.15
14	09	19.95 −.05	19.90 +.41	+21	.11
13	45		+19.95 +.36		20.14 ±.007

13h 12m o = +3.94 +.07 +4.01 +31.42 a = s

o = +15.94 − 31.06 +.51

h	m	s	s	s	s
16	39	o = +20.47 +.08	+ 20.55 +.07	+.04	20.59
16	52	20.29 + 5	20.34 +.55	+28	.62
16	57	20.48 + 4	20.52 +.18	+ 9	.61
17	8	20.27 + 1	20.28 +.48	+24	.52
17	19	20.06 − 1	20.05 +1.00	+ 51	.56
17	28	20.77 − 3	20.74 −.28	− 14	.60
17	42	20.41 − 6	20.35 +.28	+ 14	.49
17	54	20.86 − 8	20.78 −.25	− 13	.65
17	15		+20.45 +.25		20.58 ±.012

16h 59m o = +22.95 +.03 +22.98 − 4.75

17 45 o = +21.44 −.6 21.38 −1.63

18 14 +27.29 −.13 27.16 +11.79

o = +2.53 − 5.00 a = +.51

0.93 − 1.88 +.49

6.71 − 12.04 +.56

h	m	s	s	s	s
18	33	20.73 +.10	20.83 +.08	+ 4	20.87
18	46	20.66 + 8	20.74 +.19	+10	.84
18	48	21.30 + 7	21.37 +1.04	+53	.90
19	00	20.58 + 5	20.63 +.49	+25	.88
19	11	20.42 + 2	20.44 +.93	+47	.91
19	19	20.53 + 0	20.53 +.64	+33	.86
19	49	20.59 − 06	20.53 +.60	+31	.84
20	20	20.49 − 13	20.36 +.92	+47	.83
20	27	20.74 − 14	20.60 +.53	+27	.87
19	21		+20.56 +.60		20.87 ±.006

18h 40m o = +12.86 +.09 + 12.95 +15.95 a = +

19 18 +21.81 +.1 21.82 −1.76 +

19 54 +40.33 −.7 40.26 −38.65 +

o = +7.61 − 15.35 a = +.50

+1.26 − 2.36 +.53

+19.70 − 39.25 +.50

+.51

I ΔT at 13h 45m = −20.14s ±.007

II 17 15 = 20.58 ±.012

III 19 21 = 20.87 ±.006

Rate hourly from I–II = −.126s

Rate hourly from II–III = −.138

Rate hourly from I–III = −.130

Special Note. The following corrections to the Nautical Almanac places in the final computations will be adopted

For α Scorpii −.07s instead of −.03s

For χ Ophiuchi +.05 instead of +.01

For d Herculis +.17 instead of +.13

For ω Herculis −.05 instead of −.00

For γ Draconis +.16 instead of −.21

For β Lyrae −.03 instead of +.02

These corrections agreeing almost precisely with the values found at H.C.O. in 1871 and 1872

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For the final reductions then we have the following system of corrections to the American Ephemeris, free from periodic error, viz.

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Personal Equation Observations by W. A. Rogers.

Sept 19, 1872 $b = +7^{s}.48 + 16$

Star	Observed T	×	T + ×	Bb.	T'	R.A.	T' − R.A.	A.	B.
	h m s		s	s	s	s	s		
ζ Aquilae	18 59	36.044	−.016	36.03	+.14	36.17	33.24	+2.93	+.49 +.90
ι Lyrae	19 02	48.356	.17	48.34	+.20	48.54	45.59	+2.95	+.12 1.23
α Sagittarii	19 10	13.422	.16	13.41	+.08	13.49	10.72	+2.77	+.93 +.50
ζ Draconis	19 12	35.600	.38	35.56	+.38	35.94	32.65	+3.29	−1.10 +2.36
τ Draconis	19 18	4.767	.52	4.71	+.47	5.18	1.55	+3.63	−1.76 +2.96
β Cygni	19 25	38.078	.17	38.06	+.18	38.24	35.23	+3.01	+.28 +1.10
κ Aquilae	19 30	5.033	.15	5.02	+.10	5.12	2.28	+2.84	+.77 +.65
δ Cygni	19 33	4.911	.24	4.89	+.25	5.14	2.11	+3.03	−.20 +1.54
γ Aquilae	19 40	14.989	.16	14.97	+.14	15.11	12.32	+2.79	+.54 +.86
λ Aquilae	19 44	36.889	.16	36.87	+.13	37.00	34.17	+2.83	+.56 +.84
ε Draconis	19 48	40.511	.41	40.47	+.41	40.88	37.64	+3.24	−1.35 +3.58
δ Aquilae	20 04	46.778	.15	46.76	+.12	46.88	44.08	+2.80	+.69 +.72
κ Cephei	20 13	15.344	.70	15.27	+.60	15.87	12.08	+3.79	−2.61 +3.73
β Cygni	20 17	42.811	.20	42.79	+.21	43.00	39.95 40.00	+3.05 3.00	+.05 +1.30
π Capricorni	20 20	4.556	.16	4.54	+.08	4.62	1.93	+2.69	+.92 +.51
ε Delphini	20 27	10.600	.16	10.58	+.14	10.72	7.87	+2.85	+.53 +.87
Gr. 3241.	20 30	38.156	−.049	38.11	+.45	38.56	35.33	+3.23	−1.61 +2.82

t	m	s			s				
18	59	o = +2.93	+.49	−.14	+2.89 +.13	+3.02	2	4	
19	3	2.95	+.14	−.13	2.92 +.04	2.96	4	16	
19	10	2.77	+.93	−.13	2.74 +.24	2.98	2	4	
19	25	3.01	+.28	−.14	3.00 +.07	3.07	7	49	
19	30	2.84	+.77	−.14	2.83 +.20	3.03	3	9	
19	34	3.03	−.20	−.14	3.02 −.05	2.97	3	9	
19	40	2.79	+.54	+.02	2.79 +.15	2.94	6	36	
20	4	2.80	+.69	+.24	2.82 +.18	3.00	0	0	
20	18	3.05	+.05	+.39	3.08 +.01	3.09	9	81	
20	20	2.69	+.92	+.39	2.72 +.24	2.96	4	16	
20	27	2.85	+.53	+.46	2.89 +.14	3.03	3	9	
19	41	2.88	+.47		2.88	+3.00 ± .04			

Equal rate = +.06

3.002

t	m	s			
19	13	o = +3.29	−.02	+3.27	−1.10
19	19	3.68	−.24	+3.68	−1.76
19	49	3.24	+.01	+3.25	−1.35
20	13	3.79	+.03	+3.82	−2.61
20	31	3.23	+.04	+3.27	−1.61

o		a	
+.39	−1.57	+.26	
+.73	−2.23	+.33	
+.37	−1.82	+.20	
+.94	−3.08	+.31	
+.39	−2.08	+.19	
		a = +.26	

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Personal Equation Observations by Prof. Wm. Harkness.

Sept. 10/72 $b = +.16$ Greenwich Star

Star	Observed T	x	T+x	Bl.	T'	R.A.	T'-R.A.	Royer-Harkness
	h m s	s	s	s	s	s	s	
ζ Aquilae	18 59 36.020	-.16	35.86	+.14	36.14	33.24	+2.90	+.02
ι Lyrae	19 02 48.330	17	48.31	+.20	48.51	45.59	2.92	+.03
α Capricorni	19 10 13.420	16	13.40	+.08	13.48	10.72	2.76	+.00
ζ Draconis	19 12 35.310	38	35.27	+.38	35.65	32.65	3.00	
τ Draconis	19 18 4.686	52	4.63	+.47	5.10	1.55	3.55	
β Cygni	19 25 38.033	17	38.02	+.18	38.20	35.23	2.97	+.04
κ Aquilae	19 30 5.020	15	5.00	+.10	5.10	2.28	2.82	+.01
α Cygni	19 33 4.870	24	4.85	+.25	5.10	2.11	2.99	+.04
δ Aquilae	19 40 15.030	16	15.01	+.14	15.15	12.32	2.83	-.04
λ Aquilae	19 44 36.840	16	36.82	+.13	36.95	34.17	2.78	+.05
ε Draconis	19 48 40.480	41	40.44	+.41	40.85	37.64	3.21	(+.03)
θ Aquilae	20 04 46.770	15	46.75	+.12	46.87	44.08	2.79	+.01
κ Cephei	20 13 15.300	70	15.23	+.60	15.83	12.08	3.75	
γ Cygni	20 17 42.700	20	42.68	+.21	42.89	39.95	2.94	+.11
π Capricorni	20 20 4.490	16	4.47	+.08	4.55	1.93	2.62	+.07
ε Delphini	20 27 10.550	16	10.53	+.14	10.67	7.87	2.80	+.05
Gr. 3241	20 30 37.840	-.49	37.79	+.45	38.24	35.33	2.91	

Mean +.033

h	m						h	m			
18	59	o = +2.90	-.04	+2.86	+.49	+.10	2.96	2	4	19	13
19	3		2.92	-.03	2.89	+.14	+.3	2.92	2	4	19	19
19	10		2.76	-.3	2.73	+.23	+.20	2.93	1	1	19	49
19	25		2.97	-.1	2.96	+.28	+.16	3.02	8	14	20	13
19	30		2.82	-.1	2.81	+.77	+.15	2.96	2	4	20	31
19	34		2.99	-.1	2.98	-.20	-.4	2.94	0	0		
19	40		2.83	+.0	2.83	+.51	+.11	2.94	0	0		
19	44		2.78	+.0	2.78	+.56	+.11	2.89	5	25		
19	48		2.79	+.2	2.81	+.68	+.14	2.95	4	16		
20	18		2.94	+.3	2.97	+.05	+.1	2.83	11	121		
20	20		2.62	+.3	2.65	+.92	+.18	2.95	1	1		
20	27		2.84	+.4	2.84	+.53	+.11					
19	41				2.84	+.47		2.94 ± .09				

2.939
3.002
+.063 = R - h

o = +3.00 -.02 + 2.98 -.110
3.05 -.2 3.03 -.176
3.21 +.1 3.20 -.135
3.45 +.3 3.78 -.261
+2.91 +.4 +2.95 -.161

o = +.14 -1.57
+.69 -2.23
+.38 -1.82
+.94 -3.08
+.11 -2.08

a = +.09
.31
.21
.30
.05

a = +.20
.19

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Personal Equation Observations by W. A. Rogers.

Sept. 12, 1872 $b = +.23$ A. B.

Star	Observed T	x	T+x	Bz.	T'	R.A.	T-R.A.		
ζ Aquilae	18 59	33.733	-.016	33.72	+.21	33.93	33.21	+0.72	+.49	+.90
ε Lyrae	19 02	46.089	-.019	46.07	+.28	46.35	45.55	+0.80	+.14	+1.23
λ Sagittarii	19 10	11.167	.016	11.15	+.11	11.26	10.69	+0.57	+.93	+.50
κ Aquilae	19 30	2.811	.015	2.80	+.15	2.95	2.26	+0.69	+.77	+.45
61 Cygni	19 33	2.756	.024	2.73	+.35	3.08	2.06	+1.02	-.20	+1.54
γ Aquilae	19 40	12.822	.016	12.81	+.20	13.01	12.30	+0.71	+.54	+.80
α Aquilae	19 44	34.667	.016	34.65	+.19	34.84	34.15	+0.69	+.56	+.84
ε Draconis	19 48	38.289	.041	38.25	+.59	38.84	37.53	+1.31	-.35	+2.58
Γ Aquilae	19 57	55.661	.015	55.65	+.19	55.84	55.17	+0.67	+.58	+.82
δ Aquilae	20 04	44.544	.015	44.53	+.17	44.70	44.06	+0.64	+.69	+.72
κ Cephei	20 13	12.789	.70	12.72	+.86	13.58	11.91	+1.67	-2.61	+3.73
γ Cygni	20 17	40.544	.20	40.52	+.30	40.82	39.92 (39.77)	+0.90 (.85)	+0.05	+1.30
π Capricorni	20 20	2.311	.16	2.29	+.12	2.41	1.91	+0.50	+.92	+.51
ε Delphini	20 27	8.344	.16	8.33	+.20	8.53	7.85	+0.68	+.53	+.84
Gr. 3241	20 30	35.911	.49	35.86	+.65	36.51	35.23	+1.28	-1.61	+2.82
2 Cygni	20 37	6.689	.22	6.67	+.32	6.99	6.08	+0.91	-.06	+1.41
ε Cygni	20 41	4.500	.18	4.48	+.27	4.75	3.91	+0.84	+.19	+1.18
Sept. 1879	20 53	23.744	.29	23.65	+1.06	24.71	22.98	+1.73	-3.54	+4.55

h	m		s	s	s	Mean	n		
						s			
18	59	o =	+.72	+.04	+.68	+.49	+.14	4	16
19	2		+.80	-.03	+.77	+.14	+.04	5	25
19	10		+.57	-.03	+.54	+.33	+.21	5	25
19	30		+.69	-.02	+.67	+.77	+.22	3	9
19	33		+1.02	-.01	+1.01	-.20	+.06	9	81
19	40		+.71	-.01	+.70	+.54	+.16	0	0
19	44		+.69	-.01	+.68	+.52	+.16	2	4
19	57		+.67	+.00	+.67	+.58	+.17	2	4
20	4		+.64	+.01	+.65	+.69	+.20	1	1
20	17		+.90	+.01	+.91	+.05	+.01	6	36
20	20		+.50	+.02	+.52	+.92	+.27	7	49
20	27		+.68	+.02	+.70	+.53	+.16	0	0
20	37		+.91	+.03	+.94	-.06	-.02	6	36
20	41		+.84	+.03	+.87	+.19	+.06	7	49
19	50		+.74		+.74	+.44		93	

+0.86 ± .09

h	m		s	s	s	n	
19	49	o =	+.131	+.00	+1.31	-1.35	
20	13		+1.67	+.01	+1.68	-2.61	
20	37		+1.28	+.03	+1.31	-1.61	
20	53		+1.73	+.04	+1.77	-3.54	

o = +.57 - 1.79 a = +.32 3
+.14 - 2.05 +.31 2
+.57 - 2.05 +.28 1
+1.09 - 3.98 +.26 4
+.29

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Diurnal Equation Observations by Prof. Wm. Harkness.

Sept 12, 1872 $b = +.23$

Star	Observed T'	Δ	$T+\Delta$	Bb.	T'	R.A.	$T-$R.A.	R − A
	h m s	s	s	s	s	s	s	s
3 Aquilae	18 59 33.780	−.16	33.73	+.21	33.94	33.21	+0.73	−.03 −.02
i Lyrae	19 02 46.040	−.19	46.02	+.28	46.30	45.55	0.75	+.05 +.05
d Sagittarii	19 10 11.140	.16	11.12	+.11	11.23	10.69	0.54	+.01 +.03
k Aquilae	19 29 2.730	.15	2.71	+.15	2.86	2.26	0.60	+.07 +.08
8 Cygni	19 33 2.740	−.24	2.72	+.35	3.07	2.06	1.01	−.01 +.02
γ Aquilae	19 40 12.850	.16	12.83	+.20	13.03	12.30	0.73	−.04 −.03
λ Aquilae	19 44 34.630	.16	34.61	+.19	3.80	34.15	0.65	+.02 +.04
ε Draconis	19 48 38.280	.41	38.24	+.59	38.83	37.53	1.30	+.05 +.06
T Aquilae	19 57 55.600	.15	55.58	+.19	55.77	55.17	0.60	+.04 +.05
δ Aquilae	20 04 44.490	.15	44.47	+.17	44.64	44.06	0.58	+.01 +.01
κ Cephei	20 13 12.820	.70	12.75	+.86	13.61	11.91	1.70	−.03 −.01
γ Cygni	20 17 40.550	.20	40.53	+.30	40.83	39.92 (39.57)	0.91 (.86)	+.08 +.10
π Capricorni	20 20 2.210	.16	2.19	+.12	2.31	1.91	0.40	+.01 +.02
ε Delphini	20 27 8.320	.16	8.30	+.20	8.50	7.85	0.65	
Gr. 3241	20 30 35.760	.49	35.71	+.65	36.36	35.23	1.13	+.10 +.12
α Cygni	20 37 6.570	.22	6.55	+.32	6.87	6.08	0.79	+.05 +.07
ε Cygni	20 41 4.430	.18	4.41	+.27	4.68	3.91	0.77	
79 Cygni	20 53 23.840	−.089	23.75	+1.06	24.81	22.98	1.83	+.025 +.041

s	s	s	s	s		
o = +.73	−.04	+.69	+.49	+.14	+.83	1 1
+.75	−.03	.72	+.14	+.04	.76	5 25
+.54	−.03	.51	+.43	+.27	.78	4 16
+.60	−.02	.58	+.37	+.22	.80	2 4
+1.01	−.01	1.00	−.20	−.06	.94	12 144
+.73	−.01	.72	+.51	+.16	.88	4 16
+.65	−.01	.64	+.56	+.16	.80	2 4
+.60	+.00	.60	+.58	+.17	.77	5 25
+.58	+.01	.59	+.69	+.20	.79	3 9
+.90	+.01	.92	+.05	+.01	.93	11 121
+.90	+.02	.42	+.92	+.27	.69	13 169
+.65	+.02	.67	+.53	+.16	.83	1 1
+.70	+.03	.82	−.08	−.02	.80	2 4
+.74	+.03	.80	+.19	+.06	.86	4 16
		+.69	+.44		+.82	±.12

s	s	s		
o = +1.30	+.00	+1.30	−1.35	x =
+1.70	+.01	+1.71	−2.61	
+1.13	+.03	+1.16	−1.61	
+1.83	+.04	+1.87	−3.54	

s	s
o = +.61	−1.79
+.40	−3.05
+.47	−2.05
+1.14	−3.98

s	s	
o = +.34		5
.98	✓	4
.21	✓	8
+.28	✓	1
+.29		

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Between single & double lines.

Personal Equation Observations by W. A. Rogers

Sept 18, 1872

Star	Observed T
γ Cygni	20 17 32.622
π Capricorni	20 19 54.650
Gr. 3241	20 20 27.666
ε Cygni.	20 40 56.633
Z. C. 1879	20 53 15.479
61 Cygni.	21 01 4.633

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Personal Equation Observations by ~~Prof.~~ ~~Wm.~~ Harkness

N. F. R. between single & double lines

Sept. 18, 1872

Star	Observed T
γ Cygni	20 17 32.630
π^2 Capricorni	20 19 54.580
Gr. 3241	20 30 27.740
ε Cygni	20 40 56.630
12 χ Cygni	20 53 15.460
61 Cygni	21 01 4.660

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Personal Equation Observations by W. A. Rogers.

Sept 19. 1872 $b = +.30$

Star	Observed π	+	π_1	x	B6.	π'	R.A.	T-R.A.	A	B.
	h m s	s	s		s	s	s	s	s	s
η Aquarii	22 28 41.033	−.015	41.02		+.22	41.24	49.13	− 7.89	+.68	+.73
10 Lacertae	22 33 25.611	−.020	25.59		+.38	25.97	33.65	7.68	+.09	+1.27
(13 Lacertae	22 38 16.311	−.020	16.29		+.40	16.69	25.58	~~8.89~~	+.03	+1.33)
ν Pegasi	22 43 43.911	−.017	43.89		+.31	44.20	52.00	7.80	+.35	+1.04
2 Pegasi.	22 58 17.378	−.016	17.36		+.27	17.63	25.55	7.92	+.48	+.91
Br. 3077	23 07 2.667	−.528	2.64		+.53	3.17	10.66	7.49	−.42	+1.06
χ Piscium	23 10 26.167	−.016	26.15		+.23	26.38	34.33	7.95	+.64	+.77
~~ε~~ Cephei	23 13 18.267	−.038	18.23		+.71	18.94	26.20	7.26	−1.10	+2.36
~~4 Lacertae~~ ν Pegasi	23 18 53.933	−.032	53.90		+.59	54.49	~~12.80~~ 2.02	~~+8.31~~ 7.53	−.69	+1.97
λ Decorum	23 23 37.111	+.041	37.15		−.34	36.81	45.25	8.44	+2.71	−1.12
52 Pegasi.	23 27 30.755	−.018	30.74		+.34	31.08	38.73	7.65	+.24	+1.14
λ Andromedae	23 31 12.933	−.022	12.91		+.43	13.34	20.98	7.60	−.08	+1.43
β Cephei	23 38 4.222	−.069	4.15		+1.09	5.24	12.03	−6.79	−2.50	+3.64

Comp. rate $= +.015$

h	m		s	s	s		s		h	m		s	s	s
22	29	o = −	7.89	+.02	−7.91	+.68	+.23	−7.68	2	4	23	13	o = −7.26	+.00	−7.26	−1.10
22	33		7.68	+.1	7.69	+.09	+.03	66	4	14	23	24	−8.44	+.01	−8.43	+2.71
(22	38		7.67	+.1	7.68	+.03	)				23	33	−6.79	+.02	−6.77	−2.80
22	44		7.80	+.1	7.80	+.35	+.12	66	4	16						
22	58		7.92	+.0	7.82	+.48	+.16	76	6	36						
23	7		7.49	+.1	7.49	−.44	−.15	64	6	36						
23	10		7.95	+.0	7.95	+.64	+.22	73	3	9						
23	18		7.53	+.0	7.53	−.69	+.23	76	6	36						
23	28		7.65	+.1	7.74	+.24	+.08	66	4	16						
23	31		7.60	+.2	~~7.78~~ 7.68	−.08	−.03	71	1	1						
			−.10							180						
22	00				−7.74	+.13										
					7.72	+.14		7.69±.011								
								7.70±.010								

o =	+.48	−1.24	a = +.39
	+.69	−2.58	.27
	+.97	−2.63	.37
			+.34

o =	+.46	−1.25	a = +.37
	+.71	−2.57	+.28
	+.95	−2.64	+.36
			+.34

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Personal Equation Observations by Prof. Wm. Harkness.

Sept. 19, 1872 $b = +3^{s}.0$

Star	Observed T.	x	T+x	Bl.	T'	R.A.	T'−R.A.	R−M.
	h m s	s	s	s	s	s	s	s
η Aquarii	22 28 41.088	−.015	40.99	+.22	+41.21	49.13	−7.92	+.03
10 Lacertae	22 33 25.550	−.020	25.53	+.38	25.91	33.65	7.74	+.06
13 Lacertae	22 38 16.280	−.020	16.26	+.40	16.66	25.58	8.92	+.03
α Pegasi	22 43 43.880	−.017	43.86	+.31	44.17	52.00	7.83	+.03
ζ Pegasi	22 58 17.400	−.016	17.38	+.27	17.65	25.55	7.90	−.02
Br. 3077	23 07 2.610	−.028	2.58	+.53	3.11	10.66	7.55	+.06
δ Piscium	23 10 26.160	−.016	26.14	+.23	26.37	34.33	7.96	+.01
ο Cephei	23 13 18.140	−.038	18.10	+.71	18.81	26.20	7.39	
4 Cass.	23 18 53.930	−.032	53.90	+.59	54.49	~~12.80~~ 2.02	~~18.31~~ 7.53	+.00
λ Ceti	23 23 36.700	+.041	36.74	−.34	36.40	45.25	8.85	
72 Pegasi	23 27 30.670	−.018	30.65	+.34	30.99	38.73 38.83	7.74 7.84	+.09
λ Androm.	23 31 12.900	−.022	12.88	+.43	13.31	20.94 21.04	7.63 7.73	+.03
γ Cephei	23 33 4.030	−.019	3.96	+1.09	5.05	12.03	6.98	

Mean +.032

	s'	s	s	s'	s'	s	s'	s'
o =	−7.92	−.02	−7.94	+.68	+.23	−7.71	2	o = −7.37 + 6 7.39 −1.10
	7.74	−.1	−7.45	+.29	+.3	7.72	1	8.85 + 1 8.84 + 2.71
								6.98 + 2 6.96 − 2.50
	7.83	− 0	7.83	+.35	+.12	7.71	2	
	7.90	− 0	7.90	+.18	+.16	7.74	1	
	8.05	+ 0	7.55	−.44	−.10	7.70	3	
	7.96	+ .0	7.96	+.64	+.22	7.74	1	o = +.37 −1.25 a = + .30
	7.53	+ 0	7.53	−.69	−.23	7.76	3	+1.08 −2.57 + .42
	7.74	+ 1	7.73	+.24	+.08	7.75	2	+ .80 −2.64 + .30
	7.62	+ 2	7.61	−.08	−.03	7.74	1	+ .34
			7.76	+.14		−7.73	+.03	

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Final Reductions.

July 20 1872

$a = +.73^s$

h	m							
17	9	$o =$	$+4.82$	$+.48$	$+.35$	$+5.17$	1	1
17	18		$+4.40$	$+.00$	$+.23$	$+.13$	3	9
17	29		$+4.80$	$+.51$	$+.37$	$+.17$	1	1
17	41		$+4.93$	$+.28$	$+.21$	$+.14$	2	4
17	53		$+5.28$	$-.26$	$-.19$	$+.09$	7	49
17	57		$+4.39$	$+1.11$	$+.81$	$+.20$	4	16
18	28		$+4.66$	$+.78$	$+.57$	$+.23$	7	49
18	32		$+5.13$	$+.08$	$+.6$	$+.19$	3	9
18	45		$+5.00$	$+.19$	$+.14$	$+.14$	2	4
18	47		$+4.39$	$+1.04$	$+.77$	$+.16$	0	0
								.2142
18	20		$+4.78$	$+.52$		$5.16 \pm .008$		.0016

$dT = -5.16^s$ at $18^h\ 0^m$

h	m			
16	59	$o =$	$+8.39$	-4.45
17	28		$+5.36$	$-.28$
17	38		$+6.11$	-1.23
17	44		$+6.45$	-1.63
18	14		$+13.78$	-11.79
18	39		-7.56	$+15.95$
18	51		$+6.51$	-2.14

$o =$	$+3.61$	-5.27	$a = +.69^s$	4	16
	$+0.58$	$-.80$	.72	1	1
	$+1.33$	-1.85	.76	3	9
	$+1.69$	-2.15	.78	5	25
	$+9.00$	-12.31	.73	0	0
	$+12.34$	-15.43	.80	7	49
	$+1.73$	-2.66	.65	8	64
			$.73 \pm .03$		164
					.0027

$a = +.72^s$

July 22 1872

h	m							
16	16	$o =$	$+4.84$	$-.11$	$-.08$	$+4.76$	0	0
16	52		4.34	$+.55$	$+.40$	.74	2	4
16	58		4.57	$+.18$	$+.13$	.70	6	36
17	9		4.37	$+.48$	$+.35$	.72	4	16
17	19		4.08	$+1.00$	$+.72$	.80	4	16
17	42		4.52	$+.28$	$+.21$	.73	3	9
17	54		4.97	$-.26$	$-.18$	.78	2	4
18	33		4.46	$+.08$	$+.06$	.82	6	36
18	45		4.62	$+.19$	$+.14$	.76	0	0
18	47		4.04	$+1.04$	$+.75$	.79	3	9
								.0130
17	37		$+4.51$	$+.34$		$+4.76 \pm .005$		.00144

$dT = -4.76^s$ at $17^h\ 37^m$

h	m			
16	59	$o =$	$+8.08$	-4.75
17	38		$+5.36$	-1.23
17	44		$+5.92$	-1.63
18	14		$+13.86$	-11.79
18	39		-7.33	$+15.95$

$o =$	$+3.57$	-5.09	$a = +.70^s$	2	4
	$+1.05$	-1.57	.67	5	25
	$+1.41$	-1.97	.72	0	0
	$+9.35$	-12.13	.77	5	25
	$+11.84$	-15.61	.76	4	16
					.0070
			$.72 \pm .02$		.00175

July 23 1872

$a = +.69^s$

h	m					
16	22	$o =$	$+3.86$	$+1.04$	$+.72$	4.58
16	22					
16	57		$+4.43$	$+.18$	$+.12$	4.55
16	40		4.14	$+.61$		$+4.56$

$dT = -4.56^s$ at $16^h\ 40^m$

h	m			
13	12	$o =$	-17.93	$+21.42$
15	21		$+5.62$	-1.64
16	59		$+7.92$	-4.75

$o =$	$+22.07$	-30.81	$a = +.72^s$	3	9
	1.48	-2.25	$+.66$	3	9
	3.78	-5.36	$+.70$	1	1
			$+.69 \pm .02$		.0019
					.0007

July 24 1872

$-ddT = +.01^s$ per hour.

$a = +.69^s$

	h	m							
I	13	49	$+3.93$	$+.01$	$+3.94$	$+.42$	$+.29$	$+4.33$	3	9
	14	10	$+3.93$	$+0$	3.93	$+.41$	$+.28$	.21	1	1
	14	20	$+4.39$	$+0$	4.39	$-.29$	$-.20$	.19	1	1
	14	57	$+4.21$	$+0$	4.21	$+.03$	$+.2$	.23	3	9
	15	29	$+3.96$	-1	3.95	$+.29$	$+.20$	.15	5	25
	14	33			$+4.08$	$+.17$		$+4.20$		.0045
								$\pm .010$		.0112
II	16	8	$+3.77$	$+.01$	$+3.78$	$+.72$	$+.50$	$+4.28$	1	1
	16	15	$+4.32$	$+1$	$+4.23$	$-.11$	$-.08$	.25	2	4
	16	21	$+3.51$	$+0$	$+3.51$	$+1.04$	$+.72$	.23	4	16
	16	30	$+3.70$	$+0$	$+3.70$	$+.81$	$+.56$	.26	1	1
	16	56	$+4.14$	-0	$+4.14$	$+.18$	$+.12$	.26	1	1
	17	28	$+4.50$	-1	$+4.49$	$+.29$	$+.20$	.30	3	9
	17	57	$+3.53$	-1	$+3.52$	$+1.11$	$+.77$	.29	2	4
	16	45			3.92	$+.60$		$+4.27 \pm .006$		.0036
										.0066
III	18	28	$+3.76$	$+0$	$+3.76$	$+.78$	$+.54$	$+4.30$	4	16
	18	32	$+4.20$		$+4.20$	$+.08$	$+.05$	.25	1	1
	18	45	$+4.13$		$+4.13$	$+.19$	$+.13$	.26	0	0
	18	47	$+3.58$		$+3.58$	$+1.04$	$+.72$	.30	4	16
	18	59	$+3.86$		$+3.86$	$+.49$	$+.34$	.20	6	36
	19	11	$+3.61$		$+3.61$	$+.93$	$+.64$	.25	1	1
	19	19	$+3.81$	$+0$	$+3.81$	$+.64$	$+.44$	.25	1	1
	18	51						$+4.26 \pm .008$		

h	m			
18	12	$o =$	-17.50	$+21.42$
14	51		$+5.67$	-2.02
15	21		$+5.34$	-1.64

$o =$	$+21.51$	-31.25	$a = +.69^s$	
	$+1.59$	-2.19	$+.73$	
	$+1.25$	-1.81	$+.69$	

h	m				
16	59	$o =$	$+7.45$	$+0$	$+7.45 - 4.75$

$dT = (I)\ -4.20 - .02 = -4.22$

$(II)\ 4.27 + .00 = 4.27$

$(III)\ 4.26 + .02 = 4.24$

421

$dt = 16^h\ 45^m$

$o = +3.53 - 5.35$ $a = +.66^s$

$o =$	$+8.36$	-12.37	$a = +.68^s$	
	$+11.34$	-15.37	$+.74$	
	$+1.12$	-1.68	$+.17$	
	$+1.48$	-2.84	$+.23$	
			$+.69$	
			$\pm .009$	

h	m				
18	14	$o =$	$+12.21$	$+0$	$+12.21 - 11.79$
18	39		-7.49		$-7.49 + 15.95$
19	13		$+4.97$		$+4.97 - 1.10$
19	18		$+5.33$	-0	$+5.33 - 1.76$

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July 25 1872

$a = +.65^s$

h	m							
16	16	$o = +4.20^s$	$-.11$	$-.07$	4.18^s	1	1
16	22	$+3.55$	$+1.04$	$+.68$	.27	4	16
16	52	3.81	$+.53$	$+.36$	.17	2	4
16	57	4.07	$+.18$	$+.12$	.19	0	0
17	8	3.83	$+.48$	$+.31$	.14	5	25
17	28	4.34	$-.29$	$-.19$	.15	4	16
17	29	3.83	$+.51$	$+.33$	.16	3	9
17	53	4.45	$-.26$	$-.16$	.29	10	100
17	03	$+4.02$	$+.26$		$4.19 \pm .012$		.0171 .00244

h	m		
16	58	$o = +7.38$	-4.75^s
17	23	$+1.86$	$+3.42$
17	44	$+6.15$	-1.63

$v = +3.86$	-5.01	$a = +.65^s$
$+2.16$	-3.16	$+.68$
$+1.13$	-1.89	$+.60$
		$.65 \pm .017$

$\Delta T = -4.19 \pm .012$ at 17h 03m

July 27 1872

$a = +.60^s$

h	m							
16	22	$o = +3.41$	$+1.04$	$+.62$	$+4.03$	3	9
16	39	$+3.92$	$+.07$	$+.4$	3.96	4	16
16	52	3.74	$+.55$	$+.33$	4.07	7	49
17	19	3.34	$+1.00$	$+.60$	3.94	6	36
17	29	3.68	$+.31$	$+.31$	3.99	1	1
17	42	3.84	$+.29$	$+.17$	4.01	1	1
17	54	4.20	$-.25$	$-.15$	4.05	5	25
17	06	3.47	$+.96$	$+.58$	4.05	5	25
18	28	3.83	$+.78$	$+.47$	4.00	0	0
18	33	3.97	$+.08$	$+.5$	4.02	2	4
18	45	3.87	$+.19$	$+.11$	3.98	2	4
18	47	3.82	$+1.04$	$+.62$	3.94	6	36
19	10	3.46	$+.93$	$+.56$	4.02	2	4
17	51	$+3.64$	$+.55$		$+4.00 \pm .008$		

$\Delta T = -4.00 \pm .008$ at 17h 51m.

h	m		
16	28	$o = +4.73$	-1.25^s
16	59	$+7.00$	-4.75
17	37	$+4.71$	-1.23
17	44	$+4.98$	-1.63
17	10	$+11.65$	-11.79
18	57	$+5.18$	-2.14
19	13	$+4.62$	-1.10

$o = +1.06$	-1.80^s	$a = +.59^s$
$+3.33$	-5.30	$+.63$
$+1.04$	-1.78	$+.58$
$+1.31$	-2.18	$+.60$
$+7.98$	-12.34	$+.65$
$+1.51$	-2.69	$+.56$
$+.95$	-1.65	$+.58$
		$+.60 \pm .008$

July 28 1872

$a = +.60^s$

h	m							
16	16	$o = +3.73$	$-.11$	$-.07$	$+3.66^s$	2	4
16	22	$+3.01$	$+1.04$	$+.62$	.63	1	1
16	30	3.19	$+.81$	$+.49$	.68	4	14
16	38	3.61	$+.07$	$+.4$	.65	1	1
16	52	3.26	$+.55$	$+.33$	.59	5	25
16	57	3.54	$+.18$	$+.11$	.65	1	1
17	9	3.35	$+.48$	$+.29$	.64	0	0
17	18	3.04	$+1.00$	$+.60$	.64	0	0
17	28	3.80	$-.29$	$-.17$	.63	1	1
16	50	$+3.39$	$+.41$		$3.64 \pm .006$		.0049 .00061

h	m		
16	28	$o = +4.39$	-1.25^s
16	59	$+6.41$	-4.75

$o = +1.00$	-1.66^s	$a = +.60^s$
$+3.02$	-5.16	$+.59$
		$+.60$

July 29 1872

$-d\Delta T = +.02^s$ per hour.

$a = +.56^s$

h	m							
16	16	$o = +3.93$	$+.01$	$+3.94$	$-.11$	$-.06$	$+3.88^s$	
16	22	$+3.25$	$+0$	$+3.25$	$+1.04$	$+.58$	.83	
16	57	$+3.77$	-1	$+3.76$	$+.18$	$+.10$	.86	
16	32			$+3.65$	$+.31$		$+3.86 \pm .010$	
17	8	$+3.51$	$+1$	$+3.52$	$+.48$	$+.27$	3.79	4 81
17	18	$+3.32$	$+1$	$+3.33$	$+1.00$	$+.56$	.89	1 1
17	28	$+4.07$	$+0$	$+4.07$	$-.29$	$-.16$	.91	3 9
17	42	$+3.72$	-1	$+3.71$	$+.29$	$+.16$	.87	1 1
17	54	$+4.10$	-2	$+4.08$	$-.20$	$-.14$	.94	6 36
17	30			3.74	$+.25$		$+3.88 \pm .017$	.6125 .0032

h	m			
16	28	$o = +4.55^s$	$+0$	$+4.55 - 1.25^s$
16	59	$+6.47$	-2	$+6.45 - 4.75$
17	38	$+4.57$	-4	$+4.53 - 1.23$

h	m			
16	28	$o = +4.55^s$	$+.01$	$+4.56 - 1.25^s$
16	59	$+6.47$	$+2$	$+6.49 - 4.75$
17	38	$+4.57$	$+0$	$+4.57 - 1.23$

$o = +.90$	-1.62^s	$a = +.56^s$
$+2.80$	-5.12	$+.58$
$+.88$	-1.60	$+.55$
$o = +.85$	-1.50	$+.57$
$+2.75$	-5.00	$+.58$
$+.83$	-1.48	$+.56$
		$+.56$

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July 30 1872 — $-\Delta\alpha = +.04$ per hour.

	h	m	s	s'	s		$a = +.62$ s	s
	17	19	$a = +4.41$	$+.01$	$+4.42$	$+.00$	$+.62$	$+5.04$
	17	28	$+5.16$	$+1$	$+5.17$	$-.29$	$-.18$	4.99
	17	42	$+4.81$	$+.0$	$+4.81$	$+.29$	$+.18$	4.99
	17	54	$+5.16$	-1	$+5.15$	$-.25$	$-.16$	4.99
	17	58	$+4.40$	-1	$+4.39$	$+.11$	$+.69$	5.08
	17	40			$+4.79$	$+.37$		$+5.02 \pm .012$

	h	m	s	s'	s			s
	18	59	$+4.76$	$+1$	$+4.77$	$+.49$	$+.30$	$+5.07$
	19	18	$+4.68$	$+1$	$+4.67$	$+.64$	$+.40$	5.07
	19	8			4.72	$+.56$		$+5.07 \pm .00$

	h	m	s	s'	s			s
	17	38	$a = +5.63$	$+0$	$+5.63$	-1.23		
	17	44	$+5.97$	$+0$	$+5.97$	-1.63		
	18	14	$+12.80$	-2	$+12.78$	-11.79		

$0 = +.84 - 1.60$ $\quad a = +.53$
$+1.18 - 2.00$ $\quad +.59$
$+2.99 - 12.16$ $\quad +.66$

	h	m	s	s'	s			s
	18	14	$0 = +12.80$	$+4$	$+12.84$	-11.79		
	19	13	$+5.71$	$+0$	$+5.71$	-1.10		
	19	19	$+6.30$	-1	$+6.29$	-1.76		

$0 = +.812 - 12.35$ $\quad a = +.66$
$+.99 - 1.66$ $\quad +.60$
$+1.57 - 2.32$ $\quad +.68$
$+.62 \pm .015$

Aug 1 1872 — $-\Delta\alpha$ per hour $= +.080$, $a = +.60$

	h	m	s		s'	s		s
	13	19	$0 = +7.21$	$+.81$	$+.02$	$+7.23$	$+.49$	$+7.72$
I	13	43	$+7.76$	$-.20$	-1	7.75	$-.12$	$.63$
	13	49	$+7.48$	$+.42$	-2	7.46	$+.25$	$.71$
	13	37		$+.34$		$+7.48$		$+7.69 \pm .019$

	h	m	s		s'	s		s
	13	12	$0 = -11.45$	$+3.14$	$+.03$	-11.42		

$0 = -1.890 + 3.108$ $\quad a = +.61$

	h	m	s		s'	s		s
	14	57	$0 = +7.71$	$+.03$	$+.18$	$+7.81$	$+.02$	7.83
	15	16	$+7.35$	$+.79$	$+.9$	7.44	$+.47$	7.91
	16	8	$+7.43$	$+.72$	$+.1$	7.44	$+.43$	7.87
II	16	30	$+7.53$	$+.81$	-2	7.51	$+.49$	8.00
	16	52	$+7.66$	$+.55$	-8	7.61	$+.33$	7.94
	16	57	$+7.82$	$+.18$	-6	7.78	$+.11$	7.89
	17	9	$+7.67$	$+.48$	-7	7.60	$+.29$	7.89
	16	15		$+.51$		$+7.60$		$7.90 \pm .015$

	h	m	s		s'	s		s
	16	28	$0 = +8.54$	-1.25	$-.02$	$+8.52$		
	16	59	$+10.35$	-4.75	-6	$+10.79$		

$0 = +.092 - .176$ $\quad a = +.52$
$+3.19 - 5.26$ $\quad +.61$

	h	m	s		s'	s		s
	17	42	$0 = +7.88$	$+.29$	$+.10$	$+7.98$	$+.17$	8.15
	18	46	$+8.00$	$+.19$	$+.2$	8.02	$+.11$	$.13$
	18	47	$+7.88$	$+1.04$	$+.2$	7.60	$+.62$	$.22$
III	19	0	$+7.82$	$+.49$	$+.8$	7.82	$+.29$	$.11$
	19	10	$+7.66$	$+.93$	-1	7.65	$+.56$	$.21$
	19	45	$+7.83$	$+.56$	-6	7.77	$+.34$	$.11$
	19	48	$+7.87$	$+.59$	-6	7.81	$+.35$	$.16$
	19	00		$+.58$		$+7.81$		$8.16 \pm .00$

	h	m	s		s'	s		s
	18	19	$0 = +16.01$	-11.19	$+.06$	$+16.07$	$+.57$	
	18	40	-1.69	$+15.95$	$+.03$	-1.66	$.62$	
	18	57	$+9.25$	-2.14	$+1$	$+9.26$		
	19	18	$+9.26$	-1.76	-2	$+9.24$		
	19	53	$+32.67$	-38.65	-7	$+32.60$		

Hourly rate $= -.083$

$0 = +8.26 - 12.37$ $\quad a = +.67$
$+9.47 - 15.37$ $\quad +.62$
$+1.45 - 2.72$ $\quad +.53$
$+1.43 - 2.34$ $\quad +.61$
$+24.79 - 39.23$ $\quad +.63$
$+.60$

Δt at $16^h\ 15^m$ =
I -7.91
II -7.90
III -7.99
-7.91

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Aug. 4 1872 — Hourly change of rate = −.12

	h	m	s	s	s	s	s		h	m	s	s	s
	13	19	o = +14.64	+.18	+14.82	+.81	+.39	+15.21	1	13	12	o = −1.30	+.19	−1.11	+31.42
	14	10	+ 14.93	+ 8	15.01	+ 41	+ 20	.21	1						
I	14	57	+ 15.18	− 2	15.16	+ 02	+ .01	.17	4						
	15	10	+ 14.89	− 4	14.85	+ 79	+ .38	.25	5			o = +1.604	−3.685	a = +.52	
	16	30	+ 14.99	−26	14.79	+.81	+.39	.18	2						
	14	49			14.93	+.57		+15.20	±.010						

	h	m	s	s	s	s		h	m	s	s	s
	16	52	o = +15.21	+.05	+15.25	+.55	+.26	15.51	2	16	39	o = +17.56	+.53	+17.59	−4.75
	16	57	+ 15.36	+ 4	15.40	+ 18	+ 9	.49	2						
II	17	28	+ 15.72	− 2	15.70	− 29	− 14	.56	5						
	17	42	+ 15.40	− 5	15.35	+ .29	+ .14	.49	2			o = +2.17	−4.93	a = +.44	
	17	15			15.42	+ .18		15.51	±.012						.48

17 h 16 m { I, II } dT = −15.49 − 15.51 − 15.50 — Hourly rate = −.120

Aug. 5 1872 — Hourly change of rate = −.120 — a = +.50

	h	m	s	s	s	s		h	m	s	s	s
	16	21	o = +17.44	+.05	+17.49	+.04	+.52	+18.01	6	16	29	o = +18.45	+.41	+18.49	−1.25
	16	39	17.85	+ 2	17.87	+ .07	+ .21	17.91	4	16	59	+ 20.32	−.02	+20.30	−4.75
I	16	52	17.63	− 1	17.62	+ .55	+ .28	17.90	5						
	16	57	17.90	− 2	17.88	+ .18	+ .9	17.97	2						
	17	8	17.74	− 4	17.70	+ .48	+ .24	17.94	1			o = +.78	−1.71	a = +.46	
	16	47			+17.71	+.96		+17.95	±.013			+2.59	−5.21		+.50

	h	m	s	s	s	s		h	m	s	s	s
	17	42	o = +18.01	+.03	+18.04	+.29	+.14	18.18	4	17	45	o = +18.88	+.02	+18.90	−1.63
	17	54	18.28	+ 0	18.28	− .25	− .13	18.06	6	18	14	+ 24.74	−.03	+24.71	−11.79
II	17	58	17.57	− 1	17.58	+.11	+ .55	18.11	1						
	18	6	17.65	− 2	17.63	+.96	+.48	18.11	1			o = +1.02	−2.16	a = +.44	
	17	55			+17.88	+.58		18.12	±.014			+6.83	−12.32		−.55
															+.50

17 h 55 m { I, II } dT = −18.09 − 18.12 − 18.11 — Hourly change of rate = −.120

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$-\frac{dT}{dt} = +0.^s130$ per hour.

$a = +.51$

Aug. 6 1872

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
I	13	19		+19.69	+.06	+19.75	+.81 +.41	+20.16	13	12	+8.94	+.07	+3.01 +3.42
	13	43		20.26	+.0	20.23	−.20 −.10	.13					
	13	49		19.90	−.1	19.84	+.42 +.21	.15					
	14	9		19.95	−.5	19.90	+.41 +.21	.11					
	13	45				19.96	+.36	20.14 ± .008					

o = +15.95 − 31.06 a = +.51

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
II	16	39		20.47	+.08	+20.55	+.07 +.04	20.59	16	59	+22.95	+.04	+22.99 −4.45
	16	52		20.25	+.5	20.30	+.55 +.28	.58	17	43	21.44	+.6	+21.38 −1.63
	16	57		20.44	+.4	20.48	+.18 +.09	.57	17	14	27.29	−.13	+27.16 −11.79
	17	8		20.27	+.1	20.28	+.48 +.24	.52					
	17	19		20.06	−.1	20.05	+.00 +.51	.56					
	17	28		20.77	−.3	20.74	−.29 −.15	.59					
	17	42		20.46	−.4	20.40	+.29 +.15	.55					
	17	54		20.81	−.8	20.73	−.25 −.13	.60					
	17	15				+20.44	+.25	20.57 ± .006					

o = +2.55 − 5.00 a = +.51
+.94 − 1.88 +.50
+6.72 − 12.04 +.56

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
III	18	33		20.73	+.10	20.83	+.08 +.04	20.87	18	40	+12.86	+.09	+12.95 −1.95
	18	46		20.70	+.8	20.78	+.19 +.10	.88	19	18	+21.81	+.1	+21.82 −1.76
	18	48		20.30	+.7	20.37	+.04 +.53	.90	19	57	+40.33	−.7	+40.26 −38.65
	18	00		20.38	+.5	20.63	+.49 +.25	.88					
	19	11		20.42	+.2	20.44	+.93 +.47	.91					
	19	19		20.53	+.0	20.53	+.64 +.33	.86					
	19	49		20.59	−.7	20.52	+.60 +.31	.83					
	20	20		20.49	−.12	20.37	+.92 +.47	.84					
	20	27		20.74	−.14	20.60	+.53 +.27	.87					
	19	21				20.56	+.60	20.87 ± .006					

o = +7.61 − 15.35 a = +.50
+1.26 − 2.36 +.53
+19.70 − 39.25 +.50
+.51

17 h 15 m { I, II, III } $\frac{dT}{dt} = -$ 20.59, 20.57, 20.60

− 20.59

Aug. 7 1872

Hourly change of $\frac{dT}{dt} = -.13^s$ a = +.53

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
I	13	43		+23.08	+.07	+23.15	−.20 −.11	+23.04	1 1	13	12	+5.28	+.14 +5.42 +31.42
	13	45		22.91	+.5	22.97	+.42 +.22	23.09	4 4				
	14	10		23.86	+.1	22.87	+.41 +.22	23.09	6 3				
	14	40		22.92	−.5	22.87	+.29 +.15	23.02	1 1				
	14	57		23.08	−.9	22.99	+.03 +.02	23.01	2 4				
	14	15				22.93	+.19	23.03 ± .012	58				

o = +1.85 − 31.23 a = +.56

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
II	16	39		+23.26	+.05	+23.31	+.07 +.04	+23.35	1	16	59	+25.84	+.01 +25.85 −4.75
	16	52		23.04	+.3	23.07	+.55 +.29	23.36	0	17	43	24.28	−.08 +24.20 −1.63
	16	57		23.26	+.2	23.28	+.18 +.10	23.38	2				
	17	9		23.07	−.1	23.06	+.48 +.25	23.31	5				
	17	18		22.88	−.3	22.85	+1.00 +.53	23.38	2				
	17	28		23.60	−.5	23.55	−.29 −.15	23.40	4				
	17	24				+23.19	+.33	+23.36 ± .009					

o = +2.66 − 5.08 a = +.52
+1.01 − 1.96 +.52

	h	m	o =	s	s	s	s	h	m	o =	s	s	s
III	17	54		+23.07	+.5	23.72	−.25 −.13	+23.59	3	18	14	+29.88	+.0 +29.88 −11.79
	17	58		22.95	+.4	22.99	+1.11 +.59	.58	2				
	18	7		22.99	+.2	23.01	+.96 +.57	.62	4				
	18	33		23.50	−.4	23.54	+.08 +.04	.58	2				
	18	48		23.06	−.7	22.99	+1.04 +.55	.54	2				
	18	16				+23.25	+.59	+23.56 ± .009					

o = +6.63 − 12.38 a = +.54
+.53

17 h 4 m { I, II, III } $\frac{dT}{dt} = -$ 23.39, 23.36, 23.40

Hourly change of $\frac{dT}{dt} = -.13^s$

− 23.38

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Aug. 8 1872 — Hourly change of dT = −.12s a = +.56s

h m						
17 9	0 = +26.18	+09	+26.27	+48	+27	+26.54
17 19	25.88	+ 7	25.95	+1.00	+.56	26.51
17 28	26.65	+ 5	26.70	−.29	−.16	26.54
17 29	26.22	+ 5	26.27	+.51	+.29	26.56
17 42	26.31	+ 3	26.34	+.29	+.16	26.50
17 54	26.70	+ 0	26.70	−.25	−.14	26.56
18 7	26.01	− 2	25.99	+.96	+.54	26.53
18 23	26.52	− 8	26.44	+.08	+.04	26.48
18 46	26.51	−10	26.41	+.19	+.11	26.55
18 48	26.03	−10	25.93	+1.04	+.58	26.51
17 55			26.30	+.40		+26.53 ± .006

h m	
17 0	0 = +29.17 +.11 +29.28 −4.75
17 44	+27.44 +.02 +27.46 −1.63
18 40	+19.23 −.09 +19.14 +15.95 wt = 1/3

0 = +2.88 − 5.15 a = +.56
+1.16 − 2.03 + .57
+7.16 − 15.55 + .46 1/3
+.56

Aug. 9 1872 — ddT per hour = −.100s a = +.57s

I

h m								
13 19	0 = +28.02	+07	+28.09	+.81	+.46	+28.55	2	13
13 43	28.65	+ 3	28.68	−.20	−.11	.57	0	
13 49	28.29	+ 2	28.31	+.42	+.24	.55	2	
14 10	28.36	− 2	28.34	+.41	+.23	.57	0	
14 21	28.80	− 4	28.76	−.29	−.16	.60	3	
14 40	28.47	− 5	28.42	+.29	+.16	.58	1	
14 00	28.43		28.48	+.24		+28.57 ± .005		

13 0 = +10.65 +.05 +10.70 +81.42
0 = +17.73 − 31.18 a = +.57

II

h m							
15 30	0 = +28.52	+.00	28.57	+29	+16	+28.73	1
15 45	28.32	+ 2	28.34	+61	+.35	.69	3
15 59	28.26	+ 0	28.26	+93	+53	.79	7
16 16	28.78	− 3	28.75	−11	−.06	.69	3
16 22	28.14	− 4	28.10	+1.04	+.59	.69	3
15 58			28.40	+.55		+28.72 ± .013	

0 = +10.65 +.28 +10.93 +31.42
0 = 17.47 + 30.87 a = +.57

15h 58m { I dT = −28.75
{ II = −28.72
−28.73

ddT per hour = −.098s

Aug. 10 1872 — ddT per hour = −.105s a = +.59s

I

h m							
16 39	0 = +31.17	+05	+31.22	+07	+.04	31.26	0
16 52	30.88	+ 3	30.91	+.55	+.32	.23	3
16 57	31.16	+ 2	31.18	+.18	+.11	.29	3
17 9	30.97	+ 0	30.97	+.48	+.28	.25	1
17 19	30.70	− 2	30.68	+1.00	+.59	.27	1
17 28	31.45	− 3	31.42	−.29	−.17	.25	1
17 29	+31.02	− 4	30.98	+.51	+.30	.28	2
17 08			31.05	+.36		31.26 ± .005	

17h 45m 0 = +32.30 +.04 +32.26 −1.63
18 14 + 38.89 −.09 +38.30 −11.79

0 = +1.21 − 1.88 a = +.60
7.25 − 12.15 +.60

II

h m							
17 42	0 = +31.26	+.06	+31.32	+.29	+.17	31.49	7
17 54	31.53	+ 2	31.55	−.25	−.15	.40	7
18 7	30.81	+ 1	30.82	+.96	+.57	.39	3
18 29	30.89	− 2	30.87	+.78	+.46	.33	9
18 33	31.44	− 3	31.41	+.08	+.05	.46	4
18 46	+31.41	− 5	31.36	+.19	+.11	.47	5
18 15			31.22	+.34		31.42 ± .017	

17h 45m 0 = +32.30 +.05 +32.35 −1.63
18 14 + 38.39 +.00 +38.39 −11.79

0 = +1.13 − 1.97 a = +.57
7.17 − 12.13 + .59
+.59

17h 42m { I dT = −31.32
{ II dT = −31.36
−31.34

ddT = −.100s

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Personal Equation Observations

Sept. 10 1872 — H.H. observer — Hourly rate = +0.s10

h	m						h	m			
18	59	0 = +2.90	+04	+2.86	+.49	+.09	+2.95	19	13	0 = +3.00	-.02	+2.98	-1.10
19	3	2.92	-3	2.89	+.14	+.03	2.92	19	19	3.55	-2	3.53	-1.76
19	10	2.76	-3	2.73	+.93	+.18	2.91	19	49	3.21	+1	3.21	-1.35
19	25	2.97	-1	2.96	+.28	+.05	3.01	20	13	3.75	+3	3.78	-2.61
19	30	2.82	-1	2.81	+.77	+.15	2.96	20	31	2.91	+4	2.95	-1.61
19	34	2.99	-1	2.98	-.20	-.04	2.94						
19	40	2.83	+0	2.83	+.54	+.10	2.93						
19	44	2.78	+0	2.78	+.56	+.11	2.89						
20	5	2.79	+2	2.81	+.69	+.13	2.94						
20	18	2.89	+3	2.92	+.08	+.01	2.93						
20	20	2.62	+3	2.65	+.92	+.17	2.82						
20	27	2.80	+4	2.84	+.53	+.10	2.94						
19	41	2.87		+2.84	+.47		+2.93						

0 =	+.14	-1.57
	+.69	-2.23
	+.37	-1.82
	+.94	-3.08
	+1.11	-2.08

a =	+.09
	+.31
	+.20
	+.30
	+.05
	+.19

Sept. 10 1872 — W.A.R. observer

h	m						h	m			
18	59	0 = +2.93	-.04	+2.89	+.49	+.13	3.02	19	13	0 = +3.29	-.02	+3.27	-1.10
19	3	+2.95	-3	2.92	+.14	+.04	2.96	19	19	+3.63	-2	3.61	-1.76
19	10	+2.77	-3	2.74	+.93	+.24	2.98	19	49	+3.24	+1	3.25	-1.35
19	25	+3.01	-1	3.00	+.28	+.07	3.07	20	13	+3.79	+3	3.82	-2.61
19	30	+2.84	-1	2.83	+.77	+1.20	3.03	20	31	+3.23	+4	3.27	-1.61
19	34	+3.03	-1	3.02	-.20	-.05	2.97						
19	40	+2.79	+0	2.79	+.54	+1.14	2.93						
19	44	+2.83	+0	2.83	+.56	+.15	2.98						
20	5	+2.80	+2	2.82	+.69	+.18	3.00						
20	18	+3.00	+3	3.03	+.08	+.01	3.04						
20	20	+2.69	+3	2.72	+.92	+.24	2.96						
20	27	+2.85	+4	2.89	+.53	+.14	3.03						
19	41	+2.87		+2.87	+.47		+2.99						

0 =	+.40	-1.57
	+.74	-2.23
	+.38	-1.82
	+.95	-3.08
	+.40	-2.08

a =	+.26
	+.33
	+.21
	+.31
	+.19
	+.26

Sept. 12 1872 — W.A.R. observer. dα = +0.s40 per hour

h	m						h	m			
18	59	0 = +0.72	-.03	+.69	+.49	+.14	+.83	19	49	0 = +1.31	-.00	+1.31	-1.35
19	3	+.80	-3	.77	+.14	+.04	.81	20	13	+1.67	+1	1.68	-2.61
19	10	+.57	-3	.54	+.93	+.27	.81	20	31	+1.28	+3	1.31	-1.61
19	30	+.69	-1	.68	+.77	+.22	.90	20	53	+1.73	+4	1.77	-3.04
19	33	+1.02	-1	1.01	-.20	-.05	.96						
19	40	+.71	-1	.70	+.54	+.16	.86						
19	44	+.69	-0	.69	+.56	+.16	.85						
19	57	+.67	+0	.67	+.68	+.17	.84						
20	04	+.64	+1	.65	+.69	+.20	.85						
20	17	+.85	+2	.87	+.05	+.01	.88						
20	20	+.50	+2	.52	+.92	+.27	.79						
20	27	+.68	+2	.70	+.53	+.16	.85						
20	34	+.91	+3	.94	-.06	-.02	.92						
20	41	+.84	+3	.87	+.19	+.06	.93						
19	51	+.74		+.74	+.44		+.86						

0 =	+.57	-1.79
	+.94	-3.05
	+.57	-2.05
	+1.63	-3.98

a =	+.32
	.31
	.28
	.26
	+.29

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Sept. 12 1872 — N. N. observer.

h	m	s'	s	s	s	s
18	59	+0.73	−03	+.70	+.49	+15	+.85
19	3	+.90	−3	.72	+.14	+04	.76
19	10	+.54	−3	.87	+.93	+28	.79
19	30	+.60	−1	.59	+.77	+23	.82
19	33	+1.01	−1	1.00	−.20	−06	.94
19	40	+.73	−1	.72	+.54	+16	.88
19	44	+.65	+0	.65	+.56	+17	.82
19	54	+.60	+0	.60	+.58	+17	.77
20	4	+.58	+1	.59	+.69	+21	.80
20	17	+.86	+2	.88	+.05	+02	.90
20	20	+.40	+2	.42	+.92	+28	.70
20	27	+.65	+2	.67	+.53	+16	.83
20	37	+.79	+3	.82	−.06	−02	.80
20	41	+.77	+.03	.80	+.12	+.06	.86
19	51	+.69		+.69	+.44		+0.82

h	m	s	s	s
19	49	+1.30	−.00	+1.30	−1.35
20	13	+1.70	+1	+1.71	−2.61
20	31	+1.13	+3	+1.16	−1.61
20	53	+1.13	+4	+1.17	−3.54

s	s'
+.61	−1.79
+1.02	−3.05
+.77	−2.05
+1.18	−3.98

a = +.34, +.33, +.23, +.80, +.80

Sept. 19 1872 — W. A. R. observer — ddt per hour = +.015

h	m	s'	s	s	s	s
22	29	−7.89	+02	−7.91	+.68	+24	−7.67
22	33	−7.68	+1	7.69	+09	+.03	.66
22	44	−7.80	+0	7.80	+35	+12	.68
22	58	−7.92	+0	7.92	+48	+17	.75
23	07	−7.49	+0	7.49	−44	−15	.64
23	10	−7.95	+0	7.95	+64	+22	.73
23	18	−7.03	+0	7.53	+69	+24	.77
23	28	−7.70	+1	7.74	+24	+.08	.66
23	31	−7.70	+1	7.69	−.08	−.03	.72
23	02	−7.75		−7.75	+.14		−7.90

h	m	s	s	s
23	13	−7.26	+00	−7.26	−1.10
23	29	−8.44	+1	−8.43	+2.71
23	33	−6.99	+1	−6.98	−2.50

s	s
+.49	−1.24
+.68	−2.57
+.97	−2.64

a = +.40, +.27, +.87, +.35

Sept. 19 1872 — N. N. observer.

h	m	s'	s	s	s	s
22	29	−7.92	−02	−7.94	+.68	+23	−7.71
22	33	−7.74	−1	7.75	+.09	+.3	.72
22	49	−7.83	−0	7.83	+.35	+12	.71
22	58	−7.90	−0	7.90	+.48	+16	.74
23	07	−7.55	+0	7.55	−.44	−15	.70
23	10	−7.96	+0	7.96	+.64	+.22	.74
23	18	−7.53	+0	7.53	−.69	−23	.76
23	28	−7.74	+1	7.73	+.24	+08	.75
23	31	−7.73	+.01	7.72	−.08	−03	.70
23	02	−7.78		−7.78	+.14		−7.93

h	m	s	s	s
23	13	−7.39	+0	−7.39	−1.10
23	29	−8.85	+1	−8.84	+2.71
23	33	−6.98	+1	−6.97	−2.50

s	s
+.39	−1.24
+1.06	−2.57
+.81	−2.64

a = +.31, +.41, +.81, .34

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Resumé of Results.

T		ΔT	dΔT, hourly	a	b	Date
18h	0m	− 5.16 ± .008	+.008	+.73	+.39	July 20 1872
17	37	− 4.76 ± .008	+.009	+.72	+.39	July 22
16	40	− 4.56 ± .010	+.016	+.69	+.39	July 23
14	83	− 4.20 ± .010	+.014	+.69	+.38	July 24
16	45	− 4.27 ± .006	+.014	+.69	+.38	" "
18	67	− 4.26 ± .009	+.014	+.69	+.38	" "
17	3	− 4.19 ± .012	+.003	+.65	+.37	July 25
17	51	− 4.00 ± .008	+.016	+.60	+.35	July 27
16	50	− 3.64 ± .006	−.009	+.60	+.33	July 28
16	32	− 3.86 ± .010	+.020	+.56	+.31	July 29
17	30	− 3.88 ± .017	−.020	+.56	+.31	" "
17	40	− 5.02 ± .012	−.033	+.62	+.29	July 30
19	09	− 5.07 ± .010	−.033	+.62	+.29	" "
13	37	− 7.69 ± .009	−.087	+.60	+.28	Aug. 1
16	15	− 7.90 ± .015	−.087	+.60	+.28	" "
19	00	− 8.16 ± .009	−.087	+.60	+.28	" "
14	49	− 15.20 ± .010	−.132	+.48	+.27	Aug. 4
17	15	− 15.51 ± .012	−.132	+.48	+.27	" "
16	47	− 17.95 ± .013	−.152	+.50	+.25	Aug. 5
17	55	− 18.12 ± .014	−.152	+.50	+.25	" "
13	45	− 20.14 ± .008	−.130	+.51	+.23	Aug. 6
17	15	− 20.57 ± .006	−.130	+.51	+.23	" "
19	21	− 20.87 ± .006	−.130	+.51	+.23	" "
14	16	− 23.08 ± .012	−.123	+.53	+.22	Aug. 7
17	04	− 23.36 ± .009	−.133	+.53	+.22	" "
18	16	− 23.56 ± .009	−.133	+.53	+.22	" "
17	55	− 26.53 ± .006	−.101	+.56	+.22	Aug 8
14	00	− 28.57 ± .005	−.154	+.59	+.22	Aug. 9
14	58	− 28.72 ± .013	−.154	+.59	+.22	" "
17	8	− 31.26 ± .005	−.143	+.59	+.22	Aug. 10
18	15	− 31.42 ± .017	−.143	+.59	+.22	" "

± .010 = mean.

Under the headings dT the first column is formed from the derived values of dT whenever there are two or more groups. Where there is but one group, the value of ddT is that derived by comparing the value for the given date and that for the subsequent one.

In the second column the values given are the means of the values derived by comparing any date with the preceding and the following.

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Resumé

Personal Equations observations between William A. Rogers and Prof. William Harkness.

T	dT(R)	dT(H)	(R−H)	a	b	Date.
				R. H.		
19h 41m	− 2.99s	− 2.93s	− .06s	+.26s +.19	+.16s	Sept. 10 1872
19 51	− 0.86	− 0.82	− .04	+.29 +.30	+.23	Sept. 12
23 02	+ 7.70	+ 7.73	− .03	+.35 +.34	+.30	Sept. 19
		Mean	− .043s			

The Equations derived from the comparison of separate stars, are.

Sept. 10 1872 R − H = +.033s
Sept. 12 = +.041
Sept. 19 = +.032
+.035

Where R and H indicate the observed times of transit for the observers R and H.

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Observations and Reductions.

Longitude Campaign.

West Point and Harvard College Observatory.

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Sept. 9, 1873 W. A. K. Obs. Circle West

Star	A.	B.	C.	Obs. T	x T + x	Bb. T'	R.A.	T'-RA.
S Ursae Min.	11.7976	12.119	16.913	18 13		23.556		
δ Lyrae.	.085	1.28	1.283	32		41.608		
ζ Aquilae.	.49	.90	1.03	59		37.795		
δ Sagittarii.	.921	.505	1.056	19 10		16.189		
S Draconis.	1.099	2.358	2.603	12		34.783		
T Draconis.	1.757	2.963	3.445	18		02.985		
		C. E.						
T Draconis.	1.757	2.963	3.445	17		59.842		
β Cygni.	.276	1.090	1.125	25		38.707		
γ Aquilae.	.540	.869	1.020	40		16.290		
α Aquilae.	.560	.840	1.015	44		38.267		
ε Draconis.	1.3496	2.583	2.914	48		37.354		
θ Aquilae.	.686	.728	1.002	20 04		48.348		
δ Capricornii	.834	.580	1.032	11		03.899		
κ Cephei	2.598	3.746	4.560	13		09.580		
γ Cygni.	.063	1.298	1.310	17		43.009		
π Capricornii	.920	.510	1.0545	20		06.815		
ε Delphini	.536	.868	1.024	27		12.018		
Groombridge 3241	1.613	2.826	3.253	30		34.247		
		C. W.						
Groombridge 3241	1.613	2.826	3.253	30		38.189		
α Ursae Maj (57)	2.745	1.153	2.980	21 23		13.464		
β Cephei	1.355	2.587	2.920	27		06.113		
ε Pegasi	.550	.848	1.018	38		01.073		
11 Cephei	1.430	2.670	3.03	40		08.652		
μ Capricornii.	.850	.570	1.03	46		26.852		
79 Draconis.	1.75	2.96	3.44	51		22.872		
α Aquarii.	.683	.727	1.00	59		19.973		
ν Pegasi.	.60	.807	1.012	2 03		51.839		
ζ Cephei	.491	1.79	1.868	06		31.583		
		C. E.						
ζ Cephei	.491	1.79	1.868	06		30.233		
γ Aquarii.	.706	.718	1.004	15		09.534		
3 Lacertae	.256	1.59	1.607	18		37.338		
226 Cephei (B)	2.20	3.343	4.008	30		05.301		
ζ Pegasi	.543	.86	1.02	35		11.506		
η Pegasi	.256	1.112	1.145	37		06.465		
λ Pegasi.	.364	1.024	1.084	40		28.623		
ι Cephei	.947	2.22	2.413	45		13.156		
ι Cephei	.947	2.22	2.413	45		14.818	a.w.	

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Sept. 11, 1873, W. A. R. obs. Circle West.

Star.	A	B.	C.	Obs. T.	x	T+x	B.C.	T'	R.A.	T'-R.A.
α Lyrae.	.085	1.28	1.282	18h 32m					41.600s	
β Cygni.	.278	1.095	1.125	19 25					39.523	
γ Aquilae.	.54	.859	1.02	40					16.917	
δ Aquilae.	.56	.84	1.015	44					38.817	
ε Draconis.	1.3496	2.583	2.914	48					40.373	
θ Aquilae.	.686	.728	1.002	20 04					48.819	
κ Cephei.	2.598	3.746 C. E.	4.56	13					13.651	
κ Cephei.	2.598	3.746	4.56	13					11.100	
γ Cygni.	.063	1.298	1.31	17					42.931	
π Capricornii	.92	.51	1.0545	20					06.233	
ε Delphini.	.536	.868	1.024	27					11.722	
λ Cygni.	.06	1.4065	1.4065	37					08.925	
ε Cygni.	.185	1.185	1.202	41					07.283	
η Cephei.	.675	1.9896	2.156	42					45.296	
12 Yr. Cat. 1879	3.55	4.59 C. W.	5.80	53					20.785	
12 Yr. Cat. 1879	3.55	4.59	5.80	53					20.860	
ζ Cygni	.253	1.11	1.147	21 07					35.833	
α Cephei	.716	2.007	2.134	15					37.797	
β Cephei.	1.355	2.5875	2.92	27					06.913	
ε Pegasi.	.55	.848	1.018	38					00.921	
ν Cephei	1.43	2.67	3.03	40					09.619	
μ Capricornii	.85	.57	1.03	46					26.356	
79 Draconis.	1.75	2.96	3.44	51					24.301	
λ Aquarii	.683	.727	1.00	59					19.675	
ϑ Pegasi.	.60	.807 C. E.	1.01	22 03					51.669	
γ Aquarii	.706	.718	1.004	15					09.206	
3 Lacertae.	.256	1.59	1.607	18					37.673	
η Aquarii	.68	.73	1.000	28					53.300	
α Pegasi.	.483	.914	1.04	58					29.398	

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Sept. 30. 1873. W.A.R. obs. Circle West.

Star.	A.	B.	C.	Obs T.	x	T+x	B.b.	T'	R.A.	T'-R.A.
η Aquilae	.542	.86	1.02	h 19	m 40	s 23.166				
λ Aquilae	.565	.84	1.016		44	45.059				
ε Draconis	1.348	2.576	2.912		48	45.875				
39 Urs. Maj (S.P.)	2.585	1.003	2.77	20	00	17.183				
θ Aquilae	.687	.73	1.00		04	55.074				
λ_2 Capricorni	.845	.583	1.03		11	10.525				
κ Cephei	2.598	3.737	456		13	19.111				
γ Cygni	.06	1.30	1.31		17	50.172				
ε Delphini	.527	.868	1.02		27	18.783				
Groombridge 3241	1.581	2.824	3.256		30	43.832				
λ Cygni	.062	1.4065	1.4065		37	16.320				
η Cephei	.675	1.97	2.087		42	52.898				
12 Yr. Cat. 1879	3.55	4.59 C.E.	5.80		53	29.341				
12 Yr. Cat. 1879	3.55	4.59	5.80		53	24.079				
ζ_2 Ursae Maj (S.P.)	2.47	.894	2.626		59	2a816				
ζ Cygni	.25	1.12	1.147	21	07	41.295				
τ Cygni	.106	1.26	1.262		09	52.674				
λ Cephei	.716	2.005	2.134		15	41.975				
1 Draconis (S.P.)	5.78	4.087	7.0797		18	56.024				
α Ursae Maj (S.P.)	2.745	1.153	2.98		23	21.689				
β Cephei	1.355	2.5875	2.92		27	10.302				
ε Pegasi	.55	.845	1.02		38	06.701				
11 Cephei	1.436	2.67	3.03		40	12.520				
μ Capricorni	.865	.57	1.04		46	32.506				
9 Draconis (S.P.)	3.70	2.036	4.227	22	24	21.754				
η Aquarii	.682	.728	1.00		28	59.798				
ζ Pegasi	.543	.857	1.02		35	17.754				
η Pegasi	.256	1.117	1.145		37	12.950				
λ Pegasi	.36	1.025	1.085		40	34.946				

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Oct. 1, 1873. W. A. R. obs. Circle West.

Star	N.	B.	C.	Q-Lc.	T'	x	T+x	B-b.	T'	R.A	T'-RA
				h	m	s					
29 Ure. Maj (SP)	2.5978	.99	2.7720		00	18.038					
17 Aquilae	.686	.726	1.00		04	55.481					
α_2 Capricornii	.834	.583	1.03		11	10.995					
K Cephei	2.613	3.7358	4.56		13	19.051					
γ Cygni	.06	1.30	1.305		17	50.606					
π Capricornii	.9245	.5145	1.0545		20	13.833					
ϵ Delphini	.532	.868	1.023		27	19.301					
Groombridge 3241	1.614	2.824	3.2556		30	43.795					
α Cygni	.06	1.4065	1.4065		37	16.715					
ϵ Cygni	.55888	.84388	1.202		41	14.924					
π Cephei	.675	1.971	2.086		42	53.258					
12 Vr. Cat. 1879	3.55	4.59	5.80		53	29.453					
		C.E.									
12 Vr. Cat 1879	3.55	4.59	5.80		53	25.481					
Z Cygni	.253	1.125	1.146621		07	41.822					
T Cygni	.1073	1.25	1.2623		09	53.181					
α Cephei	.7176	2.0074	2.134		15	42.624					
1 Draconis (SP)	3.78	4.0874	7.07976		18	56.744					
α Ure. Maj (SP)	2.745	1.153	2.98		23	21.822					
B Cephei	1.355	2.5875	2.92		27	10.991					
ϵ Pegasi	.551	.8485	1.02		38	07.060					
11 Cephei	1.436	2.67	3.03		40	13.860					
α Capricornii	.8615	.568	1.036		46	32.901					
79 Draconis	1.754	2.954	3.44		51	27.326					
α Aquarii	.684	.728	1.00		59	26.068					
θ Pegasi	.6035	.8075	1.0122		03	58.157					
Z Cephei	.491	1.796	1.868		06	37.289					
		C.W.									
Z Cephei	.491	1.796	1.868		06	38.845					
γ Aquarii	.702	.718	1.004		15	16.920					
3 Lacertae	.256	1.568	1.608		18	45.684					
9 Draconis (SP)	3.7176	2.0385	4.238		24	20.583					
η Aquarii	.681	.728	1.00		29	00.873					
22.6 Cephei (B)	2.20	3.36	4.004		30	16.217					
Z Pegasi	.542	.858	1.02		35	18.810					
η Pegasi	.2565	1.114	1.145		37	14.198					
λ Pegasi	.364	1.0186	1.085		40	36.111					
ι Cephei	948	2.22	2.413		45	22.410					

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Oct. 2 1873. W. A. K. obs. Circle West.

Star	A.	B.	b.	Obs. T'	x	T'+x	B.b	T'	A.R.	T'-A.R
				h m	s					
η Aquilae	.541	.86	1.02	19 40	24.103					
α Aquilae	.565	.84	1.015	44	45.939					
ε Draconis	1.35	2.585	2.916	48	46.875					
θ Aquilae	.69	.73	1.00	20 04	55.988					
α_2 Capricornii	.845	.58	1.03	11	11.571					
κ Cephei	2.614	3.74	4.56	13	19.943					
γ Cygni	.08	1.29	1.30	17	51.384					
π Capricornii	.925	.515	1.055	20	14.178					
ε Delphini	.532	.867	1.02	27	19.923					
α Delphini	.47	.92	1.04	33	55.496					
α Cygni	.06	1.40	1.40	37	17.307					
ε Cygni	.18	1.185	1.202	41	15.477					
ν Cephei	.675	1.97	2.08	42	53.810					
12 Yr. Cat 1879	3.55	4.59 b. E.	5.80	53	30.123					
12 Yr. Cat. 1879	3.55	4.59	5.80	53	26.771					
61 Cygni	.095	1.27	1.2757	21 01	22.881					
ζ Cygni	.252	1.13	1.146	07	42.197					
τ Cygni	.106	1.265	1.265	09	53.669					
α Cephei	.717	2.011	2.134	15	43.085					
l Draconis (S.P)	5.78	4.0874	7.07976	18	57.040					
α Ursæ Maj (S.P)	2.745	1.152	2.98	23	22.362					
β Cephei	1.355	2.5875	2.92	27	11.483					
ε Pegasi	.551	.849	1.02	38	07.679					
11 Cephei	1.435	2.67	3.03	40	14.289					
α Aquarii	.684	.729	1.00	59	26.634					
θ Pegasi	.60	.81	1.01	22 03	58.499					
ζ Cephei	.491	1.798	1.87	06	37.749					
γ Aquarii	.702	.718	1.00	15	16.757					
3 Lacertæ	.256	1.58	1.606	18	45.025					

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1872

Bregg 7

B Ursae Majoris

10h 5m 2s + 57° 3'

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1872phae.proj.1750R

1880
May 27

β Ursæ Majoris
h m
10 55
+57° 2'

ζ Ursæ Majoris
h m
10 56
+62° 24'

γ Ursæ Majoris
h m
11 25
45° 9'

ι Leonis
h m
11 7
-0° 13'
+11 13

υ Leonis
h m
11 31
-0° 8'

χ Ursæ Majoris
h m
11 39
+48° 25'

39' —	8.00
—	11.15
—	14.30
—	17.45
—	20.60
	23.70
39.35	26.72
42.40	29.70
45.53	33.00
48.70	
51.80	

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1872phae.proj.1750R

1880

May 27

β Virginis

h m
11 44

° ′
+ 2 28

11 43	41.91	54.22
	43.89	56.28
	45.78	58.30
	48.05	0.37
	50.05	2.43
		4.48
	14.85	6.55
	16.90	8.62
	18.95	10.70
	21.03	
	23.02	

ο Virginis

h m
11 59

° ′
+ 9 26

58	20.52	33.48
	23.10	35.54
	25.00	37.67
	27.28	39.70
	29.33	41.86
		44.00
	54.33	46.00
	56.30	48.05
	58.65	50.28
	0.70	
	2.80	

α Corvi

h m
12 2

° ′
− 24 2

12 1	26.02	37.57
	28.28	41.70
	30.45	44.05
	32.80	46.30
	35.00	48.65
		50.80
	2.14	53.18
	4.31	55.30
	6.70	57.60
	9.00	
	11.00	

ε Corvi

h m
12 4

° ′
− 21 53

12 3	10.12	23.57
	12.37	25.73
	14.60	28.00
	16.80	30.20
	19.18	32.38
		34.64
	45.80	36.89
	48.00	39.03
	50.20	41.38
	52.50	
	54.70	

4 Hydrae

h m
12 6

° ′
+ 7 8 19

5	40.05	
	43.48	
	46.85	
	50.40	
	53.70	
	57.37	
	0.90	
	3.50	
	7.06	
	10.60	
	14.28	
	17.77	
	20.77	
	24.06	
	27.80	
	31.30	
	34.72	
	38.10	
	41.50	
	44.75	
	48.05	
	51.33	
	54.80	
	58.18	
	1.75	

γ Corvi

h m
12 9

° ′
− 16 57

8	52.17	5.00
	54.20	7.05
	56.35	9.20
	58.48	11.40
	0.60	13.42
		15.70
	24.36	17.90
	29.60	20.02
	30.75	22.06
	32.97	
	35.00	

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1872phae.proj.1750R

1880 May 27

6 Can Ven.

h m
12 20

° ′
+39 43

12	19	6.38
		9.60
		12.20
		14.50
		17.60
		49.30
		52.50
		55.17
		57.91
		0.50
		23.00
		25.70
		28.20
		30.90
		33.60
		36.28
		39.00
		41.70
		44.38

8 Corvi

h m
12 23

° ′
−15 44

22	52.40	
	55.60	
	57.70	
	59.90	
	2.05	
	27.70	
	29.90	
	32.00	
	34.20	
	36.35	
		6.27
		8.45
		10.60
		12.75
		14.80
		17.00
		19.06
		21.30
		23.40

7 Corvi

h m
12 26

° ′
−15 30

25	7.30	
	9.50	
	11.60	
	13.65	
	15.85	
	41.60	
	43.66	
	45.70	
	48.04	
	50.20	
		20.02
		22.26
		24.48
		26.57
		28.70
		30.50
		32.03
		35.15
		37.30

K Drac:

h m
12 28

° ′
+70 29

12	27	39.00
		41.20
		43.25
		45.30
		47.38
		49.35
		51.40
		53.40
		55.55
		57.56
		59.60
		1.50
		3.80
		5.90
		8.00
		9.72
		11.77
		14.03
		16.20
		18.16
		20.28
		22.15
		24.15
		26.40
		28.48

21 Cass

h m
0 37

° ′
+105 42

35	54.20	
	2.00	
	9.50	
	17.20	
	24.70	
37	56.60	
	4.12	
	11.80	
	19.20	
	27.00	
36		40.18
		42.80
		45.25
		47.58
		50.30
		52.90
		55.30
		57.70
		0.55
		2.80
		5.60
		8.05
		10.78
		13.30
		15.70
		18.25
		20.77
		23.20
		25.75
		28.03
		31.03
		33.79
		36.20
		38.65
		41.10

12 Can Ven

h m
12 50

° ′
+39 0

49	36.50	
	38.40	
	41.20	
	44.00	
	46.60	
	18.35	
	21.00	
	23.68	
	26.28	
	29.00	
		51.80
		54.55
		57.05
		59.70
		2.40
		5.18
		7.78
		10.50
		13.17

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1872phae.proj.1750R

1880 May 27

α Andromedæ		δ Pegasi	
h	m	h	m
0	2	0	7
+ 28°	25′	+ 14°	31′

1880 May

α Andromedæ		δ Pegasi	
h	m	h	m
0	2	0	7
+ 28°	25′	+ 14°	31′

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1872phae.proj.1750R

1880

May 31

O Virginis

α 11 49

δ +9 26

11 58	30.55	33.03
	32.60	35.05
	34.70	37.25
	36.90	39.40
	38.70	41.55
		43.50
	54.00	45.60
	56.15	47.70
	58.05	49.85
	0.37	
	2.39	

α Corvi

α 12 1

δ −24 2

12 1	25.74	39.20
	27.05	41.50
	30.33	43.70
	32.40	46.05
	34.67	47.05
		50.57
	1.78	52.83
	4.03	55.05
	6.37	57.25
	8.65	
	10.95	

ε Corvi

α 12 4

δ −21 55

3	9.80	23.10
	12.04	25.40
	14.28	27.70
	16.40	29.90
	18.10	32.05
		34.25
	45.48	36.53
	47.68	38.75
	49.90	41.04
	52.05	
	54.40	

4 Hydrae.

α 12 6

δ +7 8 19

12 5	33.20	
	41.90	
	42.35	
	43.70	
	51.88	
	53.40	
	57.00	
	2.22	
	5.70	
	8.70	
	12.30	
	15.90	
	19.62	
	22.30	
	26.60	
	29.25	
	32.40	
	36.06	
	39.27	
	42.50	
	46.48	
	49.54	
	52.77	
	56.30	
	59.95	

γ Corvi

α 12 9

δ −16 51

8	57.55	4.48
	59.70	6.70
	63.90	8.85
	55.00	11.02
	0.20	13.22
		15.32
	26.05	17.57
	28.28	19.67
	30.40	21.80
	32.50	
	34.70	

η Virginis

α 12 14

δ +0 2

13	0.35	13.25
	2.90	15.36
	5.00	17.30
	7.05	19.37
	9.07	21.40
		23.47
	32.90	25.53
	35.70	27.65
	38.00	29.78
	40.05	
	42.05	

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1872phae.proj.1750R

1880

May 31

6 Com Bor.

h m
12 20
° '
+39 43

12	19	6.20	22.35
		9.00	25.00
		11.60	27.75
		14.35	30.40
		17.05	33.20
			35.70
		41.20	38.45
		51.90	41.20
		54.60	43.87
		57.27	
		0.00	

ν Corvi

h m
12 23
° '
−15 49

22	53.50	6.00
	55.23	8.03
	57.32	10.20
	59.35	12.35
	1.52	14.40
		16.70
	27.35	18.80
	29.50	20.95
	31.65	23.00
	33.50	
	36.05	

γ Corvi

h m
12 26
° '
−15 30

25	6.96	19.74
	9.04	21.84
	11.10	24.07
	13.26	26.15
	15.50	28.36
		30.54
	41.20	32.60
	43.35	34.90
	45.45	36.92
	47.67	
	49.80	

21 Cass. Lal.

h m
0 37
° '
+105 42

0	35	55.50	36	41.35
		2.80		43.76
		10.75		46.40
		18.40		48.70
		25.25		51.60
				54.20
	37	58.10		56.65
		5.45		59.30
		12.70		1.50
		20.70		4.78
		28.20		6.88
				9.57
				11.60
				14.60
				17.05
				19.34
				21.87
				24.40
				26.75
				29.60
				32.20
				34.50
				37.20
				39.75
				42.36

12 Cass. Bor reg

h m
12 50
° '
+39 0

49	35.30	51.30
	37.92	53.90
	40.62	56.55
	43.30	59.25
	45.90	1.90
		4.50
	17.87	7.15
	20.48	10.00
	23.20	12.50
	25.75	
	28.50	

ε Virginis

h m
12 56
° '
+11 38

55	27.15	39.80
	29.25	42.05
	31.40	44.05
	33.50	46.30
	35.70	48.40
		50.40
		52.55
	0.90	54.60
	3.05	56.75
	5.05	
	7.20	
	9.30	

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1872phae.proj.1750R

1880 May 31

64.

44 H Cephei L.C.

h m
0 2
° '
+101 0

0	—	0	—
	—		—
	—		—
	—		—
	—		—
			—
2	23.92		—
	36.45		—
	47.20		—
	58.45		9.70
	8.70		12.80
			17.30
			20.70
			24.25
			27.18
			31.48
			35.10
			38.70
			42.68
			46.00
			49.87
			53.40
			56.60
			0.45
			3.75

43 Cornae

h m
13 6
° '
+43 21

6	35.00	51.95
	37.77	54.78
	40.70	57.62
	43.40	—
	46.30	3.30
		6.00
	20.17	8.90
	23.23	11.80
	25.95	14.50
	28.80	
	31.64	

Gr. 366 L.C.

h m
2 34
° '
+112 43

47 H Cephei L.C.

h m
2 50
° '
+101 5

2	47	47.70	48 52.04
		55.05	55.78
		8.80	57.20
		19.95	2.50
		30.28	6.00
			9.55
		—	13.57
		—	17.50
		—	20.70
		—	24.05
		—	26.88
			31.03
			35.00
			38.35
			42.20
			45.80
			49.32
			52.65
			56.55
			59.90
			3.65
			7.00
			10.27
			13.77
			17.50

β Ors. Min

h m
14 51
° '
+74 40

		—	50 —
		—	—
		—	—
		—	—
		—	—
			—
57	34.48		32.20
	42.30		35.00
	50.00		37.50
	58.05		40.05
	6.00		42.50
			44.90
			47.60
			50.30
			53.30
			55.57
			58.05
			0.70
			3.05
			6.05
			8.50
			11.15
			13.40
			16.20
			19.00

S Librae

h m
14 54
° '
−8 1

53	49.27	1.55
	51.30	3.55
	53.18	5.77
	55.30	7.75
	57.50	10.00
		12.05
	22.40	14.02
	24.45	16.12
	26.60	18.10
	28.68	
	30.75	

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1870 May 31

β Bootis

h m
14 37
° ′
+40 53

14	36 35.78	52.25
	38.55	53.80
	41.25	57.70
	44.00	0.50
	46.75	3.22
		6.00
	19.38	8.60
	22.30	11.40
	25.00	14.15
	27.70	
	30.50	

3 Serpentis

h m
15 9
° ′
+5 24

15	8 29.10	41.65
	31.25	43.75
	33.38	45.50
	35.70	47.35
	37.40	49.85
		51.75
	2.38	54.00
	4.53	56.03
	6.55	58.27
	8.53	
	10.70	

β Librae

h m
15 10
° ′
−8 13

9	48.45	1.00
	50.50	3.00
	52.48	5.15
	54.68	7.30
	56.75	9.30
		11.38
	31.85	13.38
	33.90	15.50
	35.96	17.63
	38.00	
	30.20	

μ Bootis

h m
15 20
° ′
+37 49

15	19 8.90	24.48
	11.37	27.03
	13.95	29.68
	16.58	32.30
	19.28	34.95
		37.53
	50.63	40.04
	53.23	42.77
	55.80	45.35
	58.48	
	1.20	

γ Urs. Min.

h m
15 21
° ′
+72 17

	—	20 —
	—	—
	—	—
	—	—
	—	—
21	18.65	24.38
	25.30	26.95
	32.35	28.98
	38.80	31.50
	45.68	33.50
		35.80
		38.02
		40.50
		42.80
		45.00
		47.00
		49.33
		51.48
		53.57
		56.20
		58.60
		0.71
		2.90
		5.30

ν, ² Bootis

h m
15 26
° ′
+41 16

25	47.28	3.80
	50.03	6.50
	52.85	9.20
	55.50	12.05
	58.28	14.67
		17.60
	31.24	20.30
	34.04	23.00
	36.65	25.65
	39.50	
	42.25	

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1880 May 31

Q Bootis

h m
15 33
° '
+40 46

15 32 41.38	57.70
44.05	0.48
46.70	2.30
49.60	5.95
52.30	8.65
	11.40
25.05	14.00
27.82	16.75
30.45	19.50
33.25	
35.90	

ζ Cor. Bor. var.

h m
15 35
° '
+37 3

34 3.05	18.60
5.70	21.25
8.30	23.80
11.00	26.50
13.55	29.00
	31.56
44.50	34.05
47.04	36.70
49.67	39.28
52.27	
54.80	

5 Herculis Lalande

h m
3 37
° '
+109 3

36 45.35	
47.40	
49.70	
51.72	
54.20	
56.25	
58.52	
0.70	
2.50	
4.70	
7.00	
8.85	
11.10	
13.00	
15.32	
17.27	
19.25	
21.44	
23.78	
26.07	
27.80	
30.00	
32.05	
34.03	
36.40	

μ Serpentis

h m
15 43
° '
-3 3

42 37.12	47.50
39.00	51.60
41.28	53.80
43.38	55.77
45.50	57.95
	6.00
10.30	2.10
12.30	4.00
14.38	6.10
16.50	
18.58	
24.35	
26.20	
28.50	
29.90	
31.65	

ε Serpentis

h m
15 45
° '
+4 37

44 5.80	18.30
7.85	20.28
10.00	22.35
12.00	24.40
14.20	26.55
	28.80
39.00	30.80
41.05	32.80
42.30	34.80
45.25	
47.32	

ζ Ursæ Min.

h m
15 49
° '
+78 11

46 27.45	47 23.20
37.10	31.60
47.80	34.90
58.05	38.05
8.20	41.38
	45.15
49 8.70	48.44
18.70	52.04
29.15	55.50
39.80	58.80
48.80	1.90
	5.00
	8.80
	11.70
	15.00
	18.30
	21.70
	25.00
	28.60
	31.45
	34.70
	38.75
	42.03
	45.40
	48.80

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1880

May 31

δ Serpentis

h m
15 53

° ′
−22 15

15	52	28.22	41.50
		30.40	43.70
		32.68	46.00
		34.90	48.32
		37.10	50.55
			52.50
		4.00	55.05
		6.30	57.27
		8.35	59.50
		10.60	
		12.50	

β Serpentis pr.

h m
15 58

° ′
+19 27

57		42.50	55.70
		44.04	57.30
		46.45	59.55
		48.63	1.70
		50.75	3.90
			6.50
		17.15	8.00
		19.30	10.60
		21.40	12.75
		23.60	
		25.80	

α Andromedæ

h m
0 2

° ′
+28 25

		37.30	
		39.75	
		42.05	
0	1	23.30	44.38
		25.52	46.74
		27.78	49.00
1	33.2	30.30	51.40
	34.5	32.70	53.80
	36.0		56.15
	37.7	0.76	
	39.1	3.03	
		5.50	
		7.85	
		10.20	

β Pegasi

h m
0 7

° ′
+14 31

	6	17.15	30.00
		19.30	32.18
		21.48	34.25
6	1.2	23.65	36.40
	8.5	25.80	38.60
	10.2		40.70
	11.6	51.40	42.85
	13.4	53.55	45.00
		55.70	47.20
		57.75	
		59.75	

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1880 June 2

α Andromedæ

h m
0 2
° ′
+28 25

0	2	24.00	33.03
		26.40	40.55
		28.75	42.57
		31.15	45.10
		33.38	47.45
			49.85
		1.60	52.23
		3.90	54.60
		6.30	56.70
		8.70	
		11.05	

γ Pegasi

h m
0 7
° ′
+14 31

7	18.00	30.77
	20.13	33.00
	22.30	35.18
	24.35	37.25
	26.55	39.35
		41.55
	52.05	43.70
	54.30	45.80
	56.30	47.80
	58.60	
	0.70	

β Arietis

h m
1 48
° ′
+20 13

1	48	14.40	27.65
		16.70	29.90
		18.90	32.18
		21.05	34.30
		23.25	36.45
			38.68
		49.70	40.98
		51.95	43.05
49	14.4	54.00	45.28
	16.5	56.22	
	18.6	58.40	
	20.8		
	21.5		

γ Andromedæ

h m
1 56
° ′
+41 45

56		41.00	57.50
		43.80	0.35
		46.65	3.05
		49.45	5.70
		52.05	8.80
			11.40
		25.30	14.27
		28.00	16.98
57	44.0	30.90	19.80
	46.4	33.80	
	48.2	36.35	
	50.4		
	52.6		

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1880 June 3.

ε Serpentis

h m
15 45

° '
+ 4 51

15 41	6.65	19.05
	8.70	21.27
	10.82	23.30
	13.00	25.75
	14.90	27.50
		29.65
	39.50	31.60
	42.50	33.75
	44.05	35.90
	46.20	
	48.05	

ζ Ophiuchi

h m
15 49

° '
+ 78 11

46	27.40	47 —
	38.90	39.50
	42.68	43.60
	0.10	58.18
	8.60	9.15
		19.58
49	9.80	28.30
	20.02	37.45
	29.60	49.30
	39.80	
	48.00	

σ Scorpii

h m
15 53

° '
− 22 15

52	29.27	42.60
	31.43	44.85
	33.78	47.05
	35.88	49.19
	38.05	51.58
		53.76
	5.00	55.80
	7.06	58.18
	9.25	0.56
	11.30	
	13.66	

β Serpentis pr.

h m
15 58

° '
− 19 27

15 57	42.70	56.00
	45.05	58.05
	47.38	0.30
	49.50	2.50
	51.70	4.75
		7.00
	17.85	9.05
	20.20	11.40
	22.38	13.50
	24.48	
	26.65	

φ Herculis

h m
16 5

° '
+ 45 6

5	37.30	
	39.70	
	42.70	
	45.75	
	48.90	

ζ Ophiuchi

h m
16 8

° '
− 3 22

7	20.08	32.27
	22.06	34.40
	24.05	36.60
	26.05	38.65
	28.20	40.80
		42.58
	52.80	44.70
	55.05	46.70
	57.05	48.80
	59.18	
	1.32	

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1880

June 3

19 Ursæ Min

h m
16 14

° '
+76 11

16 14	9.56	53.00
	18.02	1.90
	26.60	9.68
	34.20	18.25
		27.00

T Herculis

h m
16 16

° '
+46 31

16	10.90
	13.65
	16.65

η Ursæ Min.

h m
16 21

° '
+76 3

19	21.30	20	11.94
	32.46		19.80
	38.20		28.35
	46.40		37.30
	55.50		46.33
			54.62
21	37.83		3.62
	46.05		—
	54.03		—
	3.06		
	11.96		

η Herculis

h m
16 39

° '
+39 10

16 37	58.37	14.66
	1.23	17.30
	3.90	19.90
	6.55	22.58
	9.32	25.22
		28.05
	41.05	30.75
	43.88	33.30
	46.62	35.86
	49.25	
	51.82	

g Camel. Lc.

h m
4 42

° '
+113 42

41	40.30	
	46.00	
	51.33	
	56.57	
	1.90	

γ Cephi

h m
28 34

° '
+76 56

	—	33	
	—		—
	—		—
	—		49.50
	—		58.80
			7.70
35	2.90		17.20
	12.28		26.05
	21.28		35.30
	29.80		44.40
	39.15		

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1880 June 3

α Androm.

h m
0 2
° ′
+28 25

0	1	24.18	38.28
		26.35	40.50
		29.70	42.90
		31.05	45.20
		33.35	47.50
			49.80
		1.74	52.37
		4.02	54.70
		6.30	56.80
		8.80	
		11.04	

γ Pegasi

h m
0 7
° ′
+14 31

	6	18.00	31.00
		20.24	33.03
		22.47	35.19
		24.60	37.35
		26.70	39.56
			41.40
		52.30	43.68
		54.40	45.85
		56.55	47.70
		58.70	
		0.80	

i Ceti

h m
0 13
° ′
−9 31

	12	33.00	45.77
		35.20	47.90
		37.40	50.00
−		39.40	52.02
		41.50	54.03
			56.20
		6.65	58.37
		8.75	0.40
		11.03	2.60
		13.00	
		15.60	

S Androm.

h m
0 23
° ′
+30 11

0		—	32 —
		—	—
		—	—
		—	28.94
		—	31.20
		45.40	36.00
		47.95	38.50
		50.30	40.70
		52.70	
		55.05	

α Cass.

h m
0 33
° ′
+53 37

	33	52.88	
		56.65	

η Cass.

h m
0 42
° ′
+57 9

	42	3.05	
		6.70	

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1880 June 3

γ Cass

h m
0 49
° '
+60 2

0	48	25.00	
		28.97	
		33.40	
		37.40	
		41.55	
	49	21.39	
		25.47	
		29.47	
		43.70	
		49.00	
	48	49.95	
		51.20	
		52.60	
		54.00	
		55.30	
		56.98	
		58.28	
		59.57	
		0.90	
		2.10	
		3.70	
		5.00	
		6.65	
		7.88	
		9.30	
		10.60	
		11.88	
		13.48	
		15.00	
		16.20	
		17.50	
		18.87	
		20.38	
		21.70	
		23.50	

β Androm.

h m
1 3
° '
+34 54

2		27.29
		29.88
		32.48
		34.97
		37.50
		40.15
	52.90	42.44
	55.23	45.05
	57.65	47.60
	0.17	
	2.65	

Polaris N.C.

h m
1 13
° '
+88 40

9	14.38		
	20.32		
	25.05		
9	44.53		
	48.32		
	53.90		
10	14.05		
	19.18		
	25.65		
10	42.80		
	48.50		
	53.15		
11	14.50		
	19.05		
	24.05		
11	41.90		
	47.72		
	53.85		
12	13.35		
	18.60		
	23.77		
12	38.30		
	45.50		
	53.35		
13	8.95		
	18.15		
	23.77		
13	42.63		
	47.53		
	53.95		
14	10.55		
	16.55		
	22.40		
14	40.00		
	47.95		
	52.05		
15	7.60		
	13.22		
	19.75		
15	40.80		
	45.30		
	51.53		
16	8.95		
	15.00		
	19.85		
16	36.80		
	43.23		
	49.50		
17	7.50	18	7.50
	13.05		13.35
	20.53		18.17
17	34.30	18	36.90
	43.40		42.15
	49.80		48.63
		19	7.55
			13.37
			19.80
		19	37.38
			42.58
			47.72
		20	6.00
			12.40
			17.40
		20	36.05
			43.05
			48.90
		21	4.80
			12.28
			18.30

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1880 June 4

γ Virginis

h m
12 14
° '
+ 0 2

12		—	13 14.50
		—	16.85
		—	19.30
		—	20.97
		—	22.90
			25.00
13	35.13		26.95
	37.40		29.00
	39.40		31.20
	41.35		
	43.48		

η Corvi

h m
(15 30)?
° '
−15 30

25	8.13	21.20
	10.30	23.30
	12.40	25.38
	14.50	27.55
	16.80	29.55
		31.80
	42.55	33.87
	44.65	36.15
	46.90	38.20
	49.05	
	51.15	

8 Can. Ven.

h m
12 28
° '
+ 42 2

27	13.00	29.78
	15.70	32.85
	18.60	35.53
	21.40	38.04
	24.20	40.75
		43.60
	57.55	46.50
	0.30	49.30
	3.20	52.95
	5.85	
	8.55	

γ Virginis

h m
12 35
° '
− 0 47

12	34 50.85	3.28
	52.95	5.70
	55.05	7.32
	57.30	9.50
	59.20	11.60
		13.66
	33.80	15.70
	26.05	17.87
	28.05	19.14
	30.23	
	32.30	

21 Cass. Sl. G.

h m
0 37
° '
+ 105 42

γ Cass. Sl. G.

h m
0 49
° '
+ 119 56

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Preliminary Corrections to the Right Ascensions of the American Ephemeris.

The corrections are derived from the following authorities, viz:

Greenwich I. being the assumed places of fundamental stars used in the reductions of the Greenwich observations for 1869

Greenwich II Greenwich observations for 1869–70

Edinburgh. Edinburgh observations for 1869

Oxford Oxford observations for 1869–70

Washington Washington observations for 1869–70

H. C. O. Harvard College observations for 1871

For difference of Equinox the following corrections have been applied:—

Greenwich I.	+.02^s
Greenwich II	+.03^s
Oxford.	+.02^s
Edinburgh	+.02^s

Put. The corrections are found by direct comparison with the Nautical Almanac places. These residuals are then corrected by applying corrections depending on the declination taken from the following table.

Corrections (to be applied to the residuals given in Appendix)

	Greenw.	Wash.	Edinb.	Note O.	Oxford.
−30°	+.015^s	−.012	+.074	−.040	−.009
−20	+.011	−.009	+.059	−.033	−.008
−10	+.007	−.007	+.041	−.025	−.006
+0	+.003	−.004	+.023	−.016	−.004
+10	−.001	−.001	+.005	−.007	−.002
+20	−.005	+.001	−.015	+.003	+.000
+30	−.009	+.004	−.034	+.012	+.001
+40	−.013	+.007	−.051	+.021	+.004
+50	−.016	+.009	−.068	+.030	+.006
+60	−.020	+.012	−.083	+.037	+.008
+70	−.022	+.013	−.094	+.044	+.009
+80	−.023	+.015	−.103	+.048	+.010
+90	−.024	+.016	−.106	+.050	+.011

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Having applied the corrections depending on ν and taken the means, the periodic errors depending on the right Ascension are computed from the mean equation.

$$\# - \sin x + \cos x = z.$$

and applied to his means.

The seperate equations are;-

For Greenwich $z =$

For Washington $z =$

For Oxford $z =$

For Edinburgh. $z =$

For Harvard College. $z =$

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Table I Corrections to American Ephemeris

Time Stars (in hundredths of seconds of time)

Declination less than +60°

Star.	M.R. 1871.0 h m s	Wash. 1869	Wash. 1870	Edinb. 1869	Greenw. 1869	Greenw. 1869	Greenw. 1870	Oxford 1869	Oxford 1870	H.G.O. 1871	Means.
α Andromedae	0 1 43	−.03s	+.02s	+.00s	+.02s	+.01	+.02s	−.01s	+.01s	−.02s	
	+28°23′	−3	+2	+3	+3	+2	+3	−1	+1	−3	+.009
γ Pegasi	0 6 36	−.01	+.07	+.00	+.00	+.02	−.04	−.02	+.08	−.01	
	+14°28′	−1	+7	+1	+0	+2	−4	−2	+8	−1	+.011
α Cassiopeiae	0 33 12	−.12				−.00	−.11		−.13	−.10	
	+55°50′	−13				+2	−9		−14	−13	−.094
β Ceti	0 37 7	−.03	+(21)		+.00	+.07	+.01	+.01			
	−18°42′	−2	+(22)		−1	+6	+0	+2			+.010
ε Piscium	0 56 15		+.06		−.02	−.04	−.02	−.08	−.04	+.03	
	7°12′		+6		−2	−4	−2	−7	−4	+4	−.014
δ Ceti	1 17 35		+.09	−.01	−.03	+.02	+.02				
	−8°51′		+10	−5	−4	+1	+1				+.006
η Piscium	1 24 35		+.04	+.12	+.06	+.06	+.05	+.04	+.00	+.04	
	+14°41′		+4	+12	+6	+6	+5	+4	+0	+4	+.051
ο Piscium	1 38 35	+.00	−.08			−.12	−.04	−.13	−.06	−.07	
	+8°30′	+00	−8			−12	−4	−13	−6	−6	−.090
β Aristis	1 47 31	+.00	+.00	+.01	−.04	+.04	+.02	+.04	−.02	+.00	
	+20°11′	+0	+0	+3	−3	+5	+3	+4	−2	+0	+.011
α Aristis	1 59 54	−1	+2	−2	+0	−2	+0	+(13)	+6	−4	
	+22°57′	−1	+2	+0	+1	−1	+1		+6	−4	+.005
ξ Ceti	2 6 10	+6	—	—	—	+4	−2	−6	+(13)	—	
	+8°14′	+6				+4	−2	−6			+.005
γ Ceti	2 36 37	−2	—	−2	−1	−8	−9	+0	+1	+3	
	+2°41′	−2		−4	−1	−8	−9	+0	+1	+4	−.024
α Ceti	2 55 32	+5	+5	−4	−2	−2	−1	−6	−6	+2	~~−.010~~
	+3°35′	+5	+5	−6	−2	−2	−1	−6	−6	+3	−.011
ζ Aristis	3 7 29	−5	—	—							
	+20°34′	−5									−.050

* The values in red ink are the corrections in blue + corr. depending on

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	Wash. 1869	Wash. 1870	Edinb. 1869	Gr. I 1869	Gr. II 1869	Gr. II 70	Clifford 1869	Clifford 1870	R.G.O. 1871	
2 Persei	+7	+11	—	—	+4	−6	—	+2	−3	s
3 15 07 +49°.24	+6	+10			+6	−4		+1	−6	+03
3 Persei	+(22)	+(26)							+9	
3 33 45 +47°.22									+6	+.060
η Tauri	−1	+4	+4	+3	+8	+4	+13	+10	+0	+.057
3 39 49 +23°.42	−1	+4	+7	+4	+9	+5	+13	+10	+0	
ζ Persei		+11							+0	
3 46 11 +31°.30		+11							−1	+050
γ Eridani	−3			−1	+0		+3	−(18)		
3 52 01 −13°.53	−2			−2	−1		+4			−.002
γ Tauri				+4	+0	−1	−4	+3	+0	
4 12 27 +15°.19				+4	+0	−1	−4	+3	+0	+053
ε Tauri			+8	+0	+6	+4		−1	+1	
4 21 05 +18°.54			+9	+0	+6	+4		−1	+1	+032
2 Tauri	−1	−1	−2	+0	−2	+0	−2	−4	−4	
4 28 31 +16°.15	−1	−1	−1	+0	−2	+0	−2	−4	−4	−017
ι Aurigae	−3	+2	+2	+1	+2	+2		−8	−4	
4 48 36 +32°.58	−3	+2	+5	+2	+3	+3		−8	−5	−.001
11 Orionis	−7	−10			−5					
4 57 12 +15°.13	−7	−10			−5					−.073
2 Aurigae	−10	+6			−4	−10	+2	−6	−8	
5 07 10 +45°.52	−11	+5			−3	−9	+3	−7	−10	−047
β Orionis	+5	+2	−1	−1	−1	−4		−2	+1	
5 08 20 −8°.21	+6	+3	−4	−2	−2	−5		−1	+3	−.002
β Tauri	−2	+3	+5	+6	+0	+3	−3	−1	−1	
5 18 08 +28°.30	−2	+3	+8	+7	+1	+4	−3	−1	−2	+017
ι Orionis	−1	−4	−5	−1	−3	−3		+1	−3	
5 25 25 −0°.24	−1	−4	−7	−1	−3	−3		+1	−2	−.025
2 Lebrun	+8			−5	−7	−8				
5 27 03 −17°.55	+9			−6	−8	−9				−.035
ε Orionis	+3	+1	−3	−3	+1	−3		−2	+3	
5 29 40 −1°.17	+3	+1	−5	−3	+1	−3		−2	+5	−.004

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	Wash. 1869	Wash. 1870	Edin. 1869	Green. I 1869	Green. II 1869	Green. II 1870	Oxford 1869	Oxford 1870	H.C.O. 1871	
ζ Orionis	+0	−3	+2	+1	−(12)	−4	+(13)	−4	−1	
5 48 11 −2°.7 +7°.23	+0	−3	+1	+1		−4		−4	+0	−.011
ζ Geminorum		+1		+1	−1	+2		+0		
6 15 09 +22°.35		+1		+2	+0	+3		+0		+.012
β Geminorum	−1	−2	−1	−3	+2	−2	+3	+0	+1	
6 30 16 +66°.30	−1	−2	+0	−3	+2	−2	+3	+0	+1	−.002
ζ Can. Maj.	−10	−1			−7	−12	−12	−9		
6 39 28 −16°.32	−9	+0			−8	−13	−11	−8		−.082
ε Can. Maj.	−1	−6		−3	−7	+2		+1		
6 53 33 −28°.48	+0	−5		−6	−8	+1		+2		−.027
δ Can. Maj.	−1	−9				−6				
7 03 09 −26°.11	+0	−8				−7				−.050
δ Geminorum	−4	−5	+4	+2	−5	−5	+2	+1	−2	
7 12 25 +22°.13	−4	−5	+6	+3	−4	−4	+2	+1	−2	−.008
ε Geminorum	+.24	+.28	+.31	+.32	+.27	+.27	+.31	+.26	+.28	
7 26 22 +32°.10	+24	+28	+34	+33	+28	+28	+31	+26	+27	+.284
ζ Can. Min.	−.9	−.14	−.12	−.03	−.12	−.13	−.7	−.14	−.13	
7 32 33 +5°.33	−9	−14	−13	−3	−12	−13	−7	−14	−12	−.108
β Geminorum	+0	−2	+0	+0	−2	+1	+3	+1	−3	
7 37 25 +28°.20	+0	−2	+3	+1	−1	+2	+3	+1	−4	+.003
γ Geminorum	−3	−8								
7 45 36 +27°.06	−3	−8								−.055
15 Argus	−2	−5		−4		−5	−(18)	−(16)		
8 02 03 −23°.56	−1	−4		−5		−6				−.040
ε Hydrae	−3	−8	−5	−4	−4	−10	−5	−(16)	−4	
8 39 57 +6°.53	−3	−8	−6	−4	−4	−10	−5	−16	−3	−.054
ι Ursae Maj.	+1	−1			−4	−0	+(11)			
8 50 22 +48°.33	+0	−2			−3	+1				−.010
κ Cancri	+2	−7		+4	+4	+0	−2			
9 00 45 +11°.11	+2	−7		+4	+4	+0	−2			+.002
α Hydrae	+0	+2	−5	−3	+0	+0	−1	−6	+0	
9 21 15 −8°.6	+1	+3	−8	−4	−1	−1	−1	−6	+2	−.014

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	Wash. 1869	Wash. 1870	Edm. 1869	Grant 1869	Green II 1869	Green II 1870	Oxford 1869	Oxford 1870	U.S.G.O. 1871	.5
α Ursae Maj.					+0 −2		+(30)			
9 24 13 +52°16					+2 +0					+.010
ε Leonis	−3	−6	−1	+2	+2 −2		+(17)	+1	−3	
9 36 32 +24°22	−3	−6	+1	+3	+3 −1			+1	−4	−.008
ω Leonis	+5	+3		+8	+(3) +4		+(3)	+8	+0	
9 45 25 +26°37	+5	+3		+9	+5			+8	−1	+.048
ζ Leonis	−3	−4	−7	−2	−5 −4		−0	−8	−6	
10 01 30 +12°36	−3	−4	−7	−2	−5 −4		+0	−8	−5	−.042
γ Leonis	+3	−1	+5	+2	+1 +0		+6	+2		
10 12 51 +20°30	+3	−1	+6	+3	+2 +1		+6	+2		+.028
ι Leonis	−5	−3	−7	−2	−1 −4		−3	−5	−6	
10 26 01 +9°58	−5	−3	−7	−2	−1 −4		−3	−5	−5	−.039
κ Leonis	+7	−1	+9	+5	+12 +3		+4	+8	+0	
10 42 28 +11°14	+7	−1	+9	+5	+12 +3		+4	+8	+1	+.053
λ Leonis	−6	−8	−3	−1	−5 −6		−1	−2	−6	
11 07 15 +21°14	−6	−8	−1	−0	−4 −6		−1	−2	−6	−.037
λ Coratis	+1	+2		+0	+0		+1	+4		
11 12 54 −14°5	+2	+3		+1	+1		+2	+5		+.023
τ Leonis	+2	−3		−5	+0 +2			−8		
11 21 18 +3°34	+2	−3		−5	+0 +2			−8		−.020
ν Leonis	−2	−2	−2	−5	−3 −8		+(6)	−3	−4	
11 30 21 −0°3	−2	−2	−4	−5	−3 −8			−3	−2	−.032
β Leonis	+3	−1	−1	+0	+2 +1		+(0)	−3	−4	
11 42 29 +15°18	+3	−1	−1	+0	+2 +1			−3	−4	−.004
γ Ursae Maj.	+(2)	−1			−1 −4		−5	−6	−8	
11 47 02 +64°25		−2			+1 −4		−6	−7	−11	−.053
δ Virginis	−7	−6			+0				−6	
11 58 38 +9°27	−7	−6			+0				−5	−.045
η Virginis	−1	−2	+4	−2	−1 −1		−3	−0	−1	
12 13 18 +0°3	−1	−2	+2	−2	−1 −1		−3	−0	+0	−.009
β Comæ	+10	−1		+3	+3		−3	−10	+0	
12 17 37 −22°41	+11	+0		+2	+2		−2	−9	+05	+.010

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	Wash 1869	Wash 1870	Elm. 1869	Grant I. 1869	Grant II 1869 '70	Oxford 1869	Oxford 1870	R.C.O. 1871	
12 Com. Ven.	−3	−3			−4 −2	+(3)		−5	
12 49 39 +39°01	−2	−2			−3 −1			−4	−.038
δ Virginis	−5	−4	−1	−4	+3 −3			−1	
13 03 16 −4°51	−5	−4	−4	−4	+3 −3			+1	−.023
ε Virginis	−3	−5		−4	−1 −10	−7	+3	−7	
13 18 24 −10°27	−2	−4		−5	−2 −11	−6	+4	−4	−.038
ζ Virginis	−2	−3	+1	+1	−0 −2	+2	+6	+2	
13 25 07 +0°44	−2	−3	−1	+1	−0 −2	+2	+6	+3	+.004
η Ursae Maj.	+(7)	−8			−2 −9	−3	+(6)	−10	
13 42 27 +49°57		−7			+0 −7	−4		−13	−.062
ε Bootis	−5	−9	−1	−0	−3 −1	−0	−9	−3	
13 46 33 +17°03	−5	−9	+0	−0	−3 −1	−0	−9	−3	−.033
α Bootis	+4	+1	+3	+4	+1 −2	+4	+0	+1	
14 09 47 +19°51	+4	+1	+4	+4	+1 −2	+4	+0	+1	+.019
θ Bootis	+(4.7)	+2			+5	−4		+1	
14 28 48 +52°27		+1			+4	−5		−2	+.002
ε Bootis	+2	−1	+0	+0	−3 +2	+2	−1	−3	
14 39 21 +27°37	+2	−1	+3	+1	−2 +3	+2	−1	−4	+.003
α$_2$ Librae	+4	+0		+1	+4 +3	+4	+3	+3	
14 43 45 −15°30	+5	+1		+0	+3 +2	+5	+4	+6	+.033
β Bootis	+3	+1			+2	+(0)	+3	+0	
14 57 05 +40°54	+2	+0			+3		+2	−2	+.010
β Librae	−2	−5	−4	−3	+1 −2	−2	−1	−6	
15 10 04 −8°54	−1	−4	−7	−4	+0 −3	−1	+0	−4	−.027
μ Bootis	+2	−4			+2 −4				
15 19 37 +37°50	+1	−5			+3 −3				−.010
α Coronae	+2	+1	+4	+3	+1 −2	+2	+3	−3	
15 29 14 +27°09	+2	+1	+4	+4	+2 −1	+2	+3	−4	+.018
α Serpentis	+5	+2	+0	+2	−1 +0	+6	+1	+2	
15 37 55 +6°50	+5	+2	−1	+2	−1 +0	+6	+1	+3	+.020
ε Serpentis	−3	−3		−0	−3 −4	−8	+3	−2	
15 44 23 +4°52	−3	−3		−0	−3 −4	−8	+3	−1	−.024

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	Wash. 1869	Wash. 1870	Edin. 1869	Greenwich I 1869	Greenwich II 1869 70	Oxford 1869	Oxford 1870	N.G.G. 1871	Means
ζ Coronae	−6	−6		−6	−6				s
15 52 15 +27°15	−6	−6		+5	−5				−0.55
ν Scorpii	+1	+2		+2					
15 52 43 −22°15	+2	+3		+1					+0.20
β Scorpii	+5	−4		+3	+7 +3	+4	−3	+3	
15 57 56 −19°27	+6	−3		+2	+6 +2	+5	−2	+6	+0.28
δ Ophiuchi	+5	+0	−4	−1	+3 +0	+1	+1	+4	
16 07 35 −3°22	+6	+1	−6	−1	+3 +0	+2	+2	+6	+0.14
τ Herculis	+18	+14		+14	+23	+18			
16 15 52 +46°37	+17	+13		+15	+24	+17			+1.72
ζ Scorpii	+0	−9		−2	−3 +0	+2	−7	−6	
16 21 30 −26°09	+1	−8		−3	−4 −1	+3	−6	−2	−0.25
ζ Ophiuchi	−11	+2		−2	−4 −0	−3	−4	−1	
16 30 03 −10°18	−10	+3		−3	−5 −1	−2	−3	+1	−0.25
π Herculis	+14	−7				−7		+6	
16 38 28 +39°10	+13	−8				−7		+4	+0.05
κ Ophiuchi	+6	+2	+3	+1	+2 +8	−8	(+6)	+4	
16 51 34 +9°35	+6	+2	+2	+1	+2 +8	−8		+4	+0.21
δ Herculis	+14								
16 56 50 +33°45	+13								+1.30
ε Herculis	+4	−1	+1	+4	+4 +4	+5	−1	−1	
17 08 46 +14°32	+4	−1	+1	+4	+4 +4	+5	−1	−1	+0.21
44 Ophiuchi	+(5)	−1		−4				+2	
17 18 30 −24°03	+0			−5				+5	+0.00
β Draconis				+8	+9	−6	+6	+8	
17 27 31 +52°24				+10	+11	−7	+5	+5	+0.48
ε Ophiuchi	+1	+2	−2	+2	+5 +4	+2	+8	+3	
17 28 57 +2 39	+1	+2	−2	+2	+5 +4	+2	+8	+3	+0.28
ν Herculis	−1	−4	+3	+3	+4 +2	+4	−3	−3	
17 41 25 +27°48	−1	−4	+5	+4	+5 +3	+4	−3	−4	+0.10
γ Draconis	−11			−22	−5	−32	−32	−20	
17 53 27 +51°30	−12			+20	+3	−33	−33	−23	−0.20

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	Wash. 1859	1870	Edinb. 1869	Green. I 1869	Green. II 1869	1870	Oxford 1869	1870	N. C. O. 1871	Means
17² Sagittarii	−6				+(35)					
17 57 31 −20°23	−5									−.050
18 Sagittarii	−3	−3		−3	+7	+1	−0	−4		
18 06 03 −21°05	−2	−2		−4	+6	+0	+1	−3		−.006
20 Scientia	+7			+4	+8		−(5)	+4	+10	
18 14 38 −2°56	+7			+4	+8		+4		+12	+.070
1 Aquilae	+2	+7							+6	
18 28 11 −8°20	+3	+8							+8	+.063
2 Lyrae	+1	−1	+2	+3	+2	−2	−2	−3	+0	
18 32 24 +38°40	+0	−2	+6	+4	+3	−1	−2	−3	−2	+.003
6 Lyrae	+0	+3	+10	+4	+4	+2		+2	−2	
18 45 19 +33°13	−1	+2	+14	+5	+5	+3		+2	−3	+.034
9 Sagittarii	−7								−2	
18 47 16 −26°27	−6								+1	−.025
3 Aquilae	+2	+6	+9	+3		+10	+0	+12	+6	
18 59 29 +13°40	+2	+6	+9	+3		+10	+0	+12	+6	+.072
4 Sagittarii	+2						−2		+4	
19 10 05 −19°11	+3						−1		+4	+.030
5 Aquilae	+9		+3	+2		+6	+5	−1	+8	
19 19 00 +2°52	+9		+2	+2	+	6	+5	−1	+9	+.046
8 Aquilae	+6								+8	
19 29 57 −7°19	+6								+10	+.080
9 Aquilae	+10	+3	−4	+4	+3	−1	+3	+3	+2	
19 40 08 +10°18	+10	+3	−4	+4	+3	−1	+3	+3	+3	+.024
12 Aquilae	+8	+1	+0	+3	+5	+2	+2	+1	−1	
19 44 29 +8°32	+8	+1	−1	+3	+5	+2	+2	+1	+0	+.023
16 Aquilae	+(3)	+5	+3	+2	+4	+1	+1	+5	+2	
19 48 59 +6°05	−	+5	+2	+2	+4	+1	+1	+5	+3	+.029
21 Aquilae	+4									
19 57 50 +6°55	+4									+.040
2² Capricorni	+4		+9	+0	+5	+6	−3	+3		
20 10 54 −12°57	−5		+4	−1	+4	+5	−2	+4		+.027

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	Wash. 1869	Wash. 1870	Edinb. 1869	Green I 1869	Green II 1869	Green II 1870	Oxford 1869	Oxford 1870	R.A.S. 1871	Means
ν Capricorni		+3								
20 19 56 −18 38		+4								+.040
ζ Delphini		+4		+1	+13	+3	−6	+1	+1	
20 27 03 +19 52		+4		+1	+13	+3	−6	+1	+2	+.026
α Cygni	+10	−7	+.15		−1	+13	−6	−6	−1	
20 37 02 +44 49	+9	−8	(+21)		+0	+14	−6	−6	−3	+.000
μ Aquarii		+13							+11	
20 45 −9 28 42		+14							+14	+.140
δ Cygni		+3							+1	
20 52 22 +40 40		+2							−1	+.005
61 Cygni		−6			+0	+3			−4	
21 01 07 +38 07		−7			+1	+4			−6	−.020
ζ Cygni	−7	+9	+3	+2	+3	+1	+(15)	−2	+1	
21 07 27 +29 42	−7	−9	+6	+3	+4	+2		−2	+0	−.004
ι Pegasi		−6						+6		
21 16 07 +19 15		−6						+6		+.000
β Aquarii	+0	+1	−(17)	−4	−0	−2	−4	−2	+6	
21 24 46 −6 08	+0	+1		−4	−0	−2	−4	−2	+8	−.004
ε Aquarii		−1		−2	+2	+3	+5	+3		
21 30 53 −8 26		+0		−3	+1	+2	+6	+3		+.015
ε Pegasi	−4	+2	+1	+2	−1	−2	−(5)	+4	−1	
21 37 57 +9 17	−4	+2	+1	+2	−1	−2		+4	−1	+.001
ω Capricorni		+0			−2	+3		−4		
21 46 16 −14 09		+1			−3	+2		−3		−.008
λ Aquarii	+4	+5	−6	−3	+1	+3	+0	+0	+3	
21 59 09 −0 57	+4	+5	−8	−3	+1	+3	+0	+0	+5	+.008
θ Aquarii		−4	−7	−2	−1	−1	−2	−6	+2	
22 10 2 −6 25		−3	−10	−3	−2	−2	−1	−5	+4	−.028
π Aquarii		+3								
22 16 41 +0 43		+3								+.030
ν Aquarii	−(9)	+2	−6	−2	+2	+4	+6		+6	
22 28 44 −0 47		+2	−8	−2	+2	+4	+6		+7	+.016

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	Wash. 1869	Wash. 1870	Edinb. 1869	Greenw. I 1869	Greenw. II 1870	Oxford 1869	Oxford 1870	U.S.C.S. 1871	Means
ζ Pegasi	−(8)	+11	+5	+3	+14	+6	+1	−(15)	+9	
22 35 02 +10°10		+11	+5	+3	+14	+6	+1		+9	+.061
λ Aquarii		+3		+0	+7	+2		+1	+8	
22 45 53 −8.16		+4		−1	+6	+1		+2	+10	+.037
2 Piscium		+10		−4	+0	+3	−7	−2	+6	
22 55 31 −3°18		+11		−5	−1	+2	−6	−1	+10	+.014
2 Pegasi	+5	+4	+1	+0	−3	+1	+0	+1	+2	
22 58 20 +14°31	+5	+4	+2	+0	−3	+1	+0	+1	+2	+.013
6 Piscium		+9							+7	
23 21 25 +9°40		+9							+8	+.085
1 Piscium		−5	−7	−5	−1	−7	−10	−12	−0	
23 33 19 +4°56		−5	−8	−5	−1	−7	−10	−12	+1	−.059
4 Piscium		−4	−2	−2	−4	−2	−10	−5	−0	
23 52 41 +6°09		−4	−3	−2	−4	−2	−10	−5	+1	−.036

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Table II

Polar Stars

The observations on which the corrections found in this list depend, are,

Washington, from 1866 to 1870, inclusive.
Greenwich, from 1866 to 1870 inclusive.
Harvard College Observatory for 1871

The results given are the means for the whole period of observation.

Star	A.R. 1871.0	Wash.	Green.	A.66.	
21 Cassiopeiae	0h 36m 18s	+.11s	+.23s	+.39s	
	+74°17	+10	+25	+38	+.233
Polaris	1 11 38	+.63	+.35	+.24	
	+88°37	+61	+37	+19	+.390
A Cassiopeiae	1 21 40	+.18	+.38	−.04	
	+69°36	+17	+10	−.8	+.063
50 Cassiopeiae	1 52 28	+.01	+.12	−.08	
	+71°48	+0	+14	−12	+.007
ι Cassiopeiae	2 18 28	+.24	+.20	+.22	
	+66°49	+23	+22	+18	+.210
48 Cassiopeiae	3 04 02	+.05	+.24	+.08	
	+77°15	+4	+26	+4	+.113
2 Camelopardal.	4 41 14	+.15	+.02	+.09	
	+66°07	+14	+04	+5	+.077
Groom. 966	5 22 30	−.30	−.22	−.35	
	+74°57	−31	−20	−31	−.270
22 Camelopard.	6 04 37	+.26	+.27	+.16	
	+69°22	+25	+29	+12	+.220
51 Lyncis	6 39 13	+.51	+.17	+.45	
	+87°14	+50	+19	+40	+.363
Piazzi VII. 67	7 17 26	−11			
	+68°43	−12			−120

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	A. R. 1871.0	Wash.	Greenw. M. G. O.	Means.
	h m s	s	s	
23 Ursæ Maj.	7 59 57	−.15	−.16	
	+68° 31	−16	−14	−.150
22 Ursæ Maj.	8 59 01	−.05	−.04	−.04
	+67° 39	−6	−2	−8 −.053
1 Draconis	9 18 29	−.11	−.19	−.13
	+81° 53	−12	−17	−18 −.157
(d) 24 Ursæ Maj.	9 23 02	+.17	−.01	+.12
	+70° 24	+16	+1	+8 +.083
32 Ursæ Maj.	10 08 38	+.02		
	+65° 45	+1		+.010
9 Draconis	10 24 04	−.13	−.14	−.31
	+76° 23	−14	−12	−35 −.203
ζ Ursæ Maj.	10 55 45	−.01	−.05	−.08
	+62° 27	−2	−3	−12 −.057
λ Draconis	11 23 43	+.15	+.09	+.06
	+70° 03	+14	+11	+4 +.097
4 Draconis	12 06 08	−.19	−.27	−.16
	+78° 20	−20	−25	−20 −.217
κ Draconis	12 27 58	−.08	−.20	−.18
	+70° 30	−9	−18	−22 −.163
32 Camelopard.	12 48 12	−.06	−.26	
	+84° 07	−7	−24	−.155
ε Draconis	14 00 54	−.04	+.02	−.03
	+65° 00	−5	+4	−7 −.027
5 Ursæ Min.	14 27 50	+.05	+.05	−.05
	+76° 16	+4	+7	−9 +.007
β Ursæ Min.	14 51 06	+.07	+.00	+.04
	+74° 41	+6	+2	−1 +.023
γ2 Ursæ Min.	15 20 57	−.01	+.05	+.03
	+72° 18	−2	+7	−1 +.013
γ Ursæ Min.	15 48 43	+.06	−.15	−.01
	+78° 11	+5	−13	−5 −.043

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	A.R. 1871.0	Bash.	Groom.	N.G.C.	Means.
	h m s	s	s		
Groom. 2320	16 05 59	+2.0	+2.1		
	+68° 09	+19	+23		+.210
π Draconis	16 22 15	−.09	+.04	−.10	
	+61° 48	−10	+5	−14	−.060
A Draconis	16 28 15	−.03	−.23		
	+69° 03	−4	−21		−.125
ε Ursae Min.	16 59 16	−.17	+.25	−.12	
	+82° 15	−19	+27	−16	−.027
α Draconis	17 37 43	+.02	+.00		
	+68° 49	+1	+2		+.015
ψ¹ Draconis	17 44 14	+.03	+.07	+.00	
	+72° 13	+2	+9	−4	+.023
S Ursae Min.	18 13 57	−.09	−.07	−.07	
	+86° 36	−11	−5	−12	−.093
55 Draconis	18 50 31	+.19	+.30	+.28	
	+75° 17	+18	+32	+24	+.247
S Draconis	19 12 31	+.06	−.02	+.02	
	+67° 26	+5	−0	−2	+.010
T Draconis	19 18 01	+.11	−.16		
	+73° 07	+10	−14		−.020
ε Draconis	19 48 36	+.17	+.08	+.12	
	+69° 56	+16	+10	+8	+.113
λ Urs. Min.	19 53 18	−.44	−.78	+.92	
	+88 55	−46	−76	+87	−.117
κ Cephei	20 13 11	+.19	+.07	+.05	
	+77° 19	+18	+7	+1	+.093
Groom. 3241	20 30 33	+.26	+.35		
	+72° 06	+25	+37		+.310
12 Year Cat. 1879	20 53 22	+.39	−.03	+.12	
	+80° 04	+37	−1	+7	+.143
ζ Cephei	21 15 30	−.04	−.07	−.09	
	+62° 02	−5	−5	−13	−.077

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	A.R. 1871.0	Wash.	Greenw.	M.C.Q.	Means
	h m s	s	s	s	
δ Cephei	21 26 59	+.15	+.00	+.04	
	+70° 00	+14	+2	+0	+.053
ζ Cephei	21 40 01	−.07	−.01	−.09	
	+70° 43	−8	+1	−13	−.067
79 Draconis	21 51 16	+.00	+.00		
	+73° 06	−1	+2		+.005
226 Cephei	22 30 00	−.13	−.09	−.05	
	+75° 34	−14	−7	−9	−.100
ι Cephei	22 45 06	+.08	+.12		
	+65° 31	+7	+14		+.105
ο Cephei	23 13 20	−.09	−.07		
	+67° 24	−10	−5		−.075
γ Cephei	23 34 04	+.23	+.13	+.15	
	+76° 55	+22	+15	+11	+.160
Groom. 4163	23 48 35	−.01	−.04		
	+73° 42	−2	−2		−.020

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