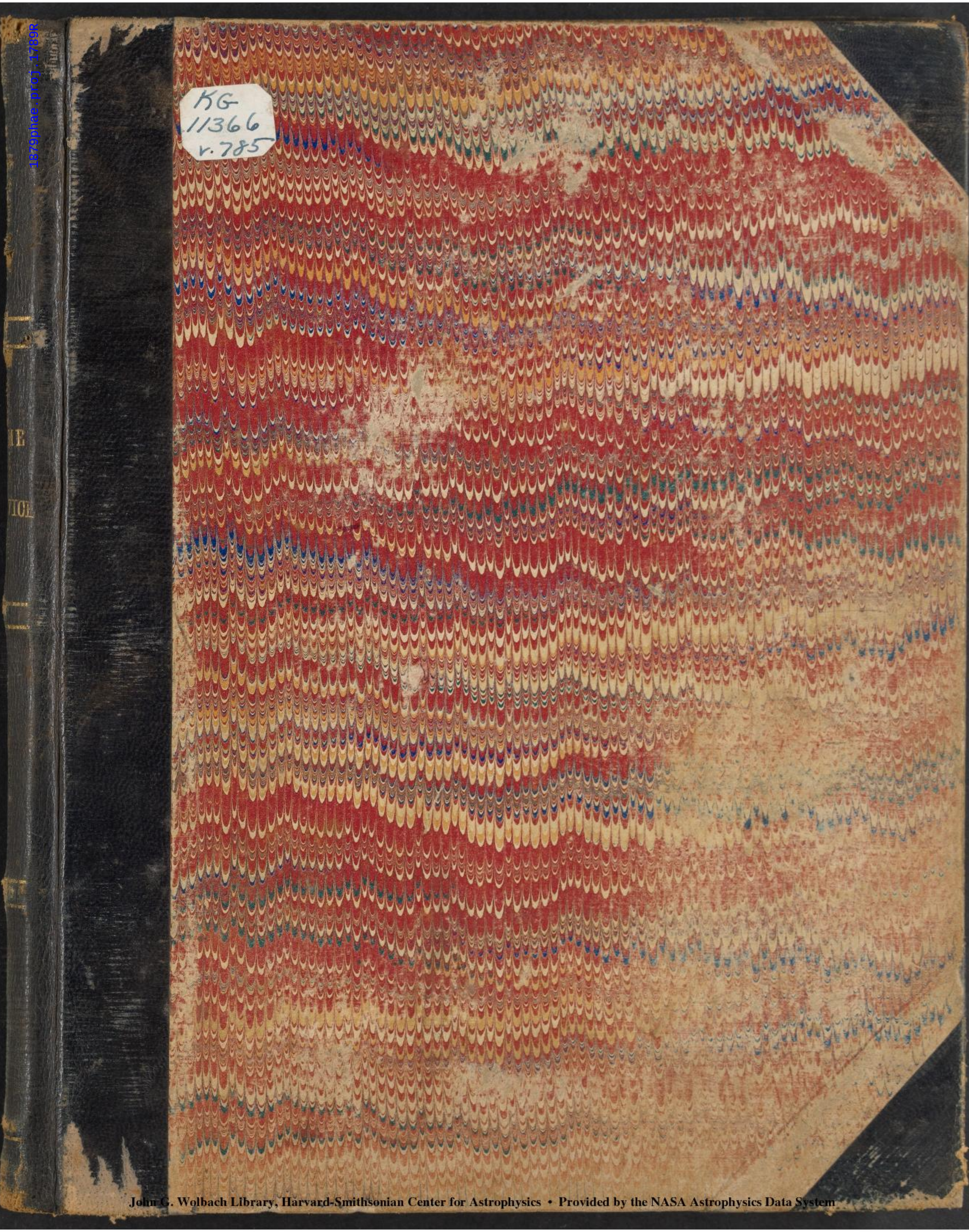

KG
11366
v.785

SMITH & PORTER,
Steam Printers,
Old South Chapel,
Spring Lane,
BOSTON.

No. 1064

When another book like this is required, it will be only necessary to send this number.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 20 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327. Recorder,

	w	e	w	e	w	e	w	e
Object,	γ Virginis.		δ Virginis.					
Circle,	−0.01		+0.21					
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								

		h	m	s	h	m	s	h	m	s	h	m	s
Wire,	I.	12	36	14.8	12	56	52.3			.			.
				16.9			54.4						
	II.			19.0			56.5			.			.
				21.0			58.6						
	III.			23.0		57	0.7			.			.
				25.0			2.8						
	IV.			27.0			4.9			.			.
				29.2			7.0						
	V.			31.1			9.1			.			.
				207.0			246.3						
							240.						
							6.3						
Sum,				.			.			.			.
Mean,		12	36	23.0	12	57	0.7			.			.
Bb,				.			.			.			.
Ce,				.			.			.			.
Aa,				.			.			.			.
Corr'd Transit,				.			.			.			.
R. A.		12	35	34.35	12	56	11.89			.			.
Error of Timepiece,				.			.			.			.

−0° 47′

36 23.0
35 34.35
48.65
1.43
50.08
+.01
50.09
49.95
+50.02 Error 1327.

u = −1.36
from last nights' obs.

57 0.7
56 11.89
48.81
1.43
50.24
−.29
49.95

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 21 1879. Instrument, Mer. Cir Observer, W. a. R.

Timepiece, 1327 Recorder, F.W.

Object,	β Urs. Min 3.64	α Bootis .36	γ Bootis .81	δ Bootis 66
Circle,	+ 74° 39'	+ 19° 49'	+ 38° 50'	+ 33° 46'
Level	w · e	w · e	w · e	w · e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b. = +,14				
	h m s	h m s	h m s	h m s
Wire, I.	31 3 39.1	56.7	0.2	25.8
II.	47.1 54 6	58.9	2.9	28.3
III.	2.5 10 0	1.1	5.5	30.6
IV.	18.4 26.3	3.3	8.0	33.2
V.	34.6	11 5.6	10.8	35.7
Sum,	263 3 240 23.3	12 5.6	27.4	153.6
Mean,	2.59	1.12	5.48	30.72
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	14 51 8.28	14 10 11.52	14 27 15.51	15 10 40.73
Error of Timepiece,				

14
135
540
135
189 0
.19

148
91
148
1332
1.35
19
1.54

54.31 + 3.64 m
49.78 + .58 m
= 4.53 + 3.06 m

3.06) 4.53 (1.48 = m
306
1470
1224
2460

1.48
66
888
888
.9768
1 54
.56

49.60 + .36 m
49.97 + .81 m
157 117

49.78 + .58 m

148
36
888
444
.5328

148
81
148
1184
1.1988
1.20
1 54
.34

49.60 + 1.00 = 50.60
49.97 + .34 = 50.31
49.99 + .56 = 50.55
~~50.45~~
146
+ 50.48
Err of 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 22 1879 Instrument, Mer. Cir Observer, W A R

Timepiece, 1327 Recorder, F W.

Object,	α Bootis	γ Bootis		α Arietis
Circle,	.36	.81		.42
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
				22°53'
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	57.4	0.8	.	10.4
II.	59.5	3.6	.	12.6
III.	1.7	6.2	.	14.9
IV.	4.0	9.0	.	17.2
V.	6.1	11.6	.	19.4
	128 7	31 2		24 5
Sum,	.	.	.	.
Mean,	1.74	6.24	.	13 ~~14~~.9 0
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	14 10 11.52	14 27 15.51	.	2 · 23.07
Error of Timepiece,	.	.	.	.

50.22 + 1.00 = 51.22

50.73 + .34 = 51.07

51.07	148
29	42
51.15	296
48	592
67	6216
	154
	.92

50.83 + .92 = 51.75

.30

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 23 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, G.W.

Object,	τ Virginis	ε Bootis	β Urs Min.	α Arietis
Circle,	.04	.52	3.64	.42
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
			+74°39′	+22°53′
Sums,	. | .	.	. | .	. | .
Difference,				
b.	+2°8′	+27°35′		.
	h m s	h m s	h m s	h m s
Wire, I.	18.8	31.9	33.3 41.0	.0
II.	20.9	34.1	49.0 56.4	.1
III.	22.9	36.5	4.3	.2
IV.	25.0	38.9	12.2 20.0	.8
V.	27.0	41.2	27.7 35.6	.9
Sum,	114.6	182.6	279.5 240. 39.5	
Mean,	22.92	36.52	4.39	.
Bb,	.	.	.	
Cc,	.	.	.	
Aa,	.	.	.	
Corr'd Transit,	.	.	.	.
R. A.	13 55 32.35	14 39 45.30	14 51 08.17	2 0 23.11
Error of Timepiece,	.	.	.	.

157
91
157
1403
1.42
19
1.61

50.57 + .04
51.22 + .52
1.79

50.90 + .28
56.22 3.64
5.32 3.26

326) 5.32 (1.5
326
2060
0

56.22 + 3.64
50.57 + .04
5.65 + 3.60

360) 5.65 (1.57 = u
360
205
180
250
252

4
8

157
52
314
785
.8164
16
.80

50.57 + 1.55 = 52.12
51.22 + .80 = 52.02
+ 52.07

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 23 1879. Instrument, Mer. Ci. Observer,

Timepiece, 1320f Recorder,

Object, Circle,	γ Androm			
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.	+41°45'			
	h m s	h m s	h m s	h m s
Wire, I.	16.33			
II.	19.0			
III.	21.7			
IV.	24.5			
V.	27.3			
Sum,	8 18			
Mean,				
Bb, Cc, Aa,				
Corr'd Transit,				
R. A.	1 56 30.32			
Error of Timepiece,				

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 24 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object,	τ Virginis	ε Bootis		
Circle,	.04	.52		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	56 19.5	32.5		
II.	21.6	34.9		
III.	23.6	37.2		
IV.	25.7	39.5		
V.	27.8	41.9		
Sum,	18.2	36.0		
Mean,	23.64	37.20		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	13 $\underset{55}{56}$ 32.33	14 39 45.27		
Error of Timepiece,				

51.31 + 1.55 = 52.86

51.93 + .80 = 52.73

179

+52.85 E. of 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 25 1879. Instrument, Mer. Cir Observer, W.A.R.

Timepiece, 1327 Recorder,

Object,	τ Virginis	ε Bootis	β Urs. Min.	
Circle,	.04	.52	3.64	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	20.0	33.3	34.7 42.5	.
II.	22.1	35.6	50.0 58.0	.
III.	24.3	38.0	05 13.6	.
IV.	26.3	40.3	21.3 29.2	.
V.	28.4	40 42.5	36.7	.
Sum,	21 1	189.7	291.8 240 51.8	.
Mean,	24.22	37.94	05.76	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	13 55 32.33	14 39 45.27	14 51 8.03	.
Error of Timepiece,	.	.	.	.

51.92 + 1.55 = 53.47 7.73

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 26.8 1879. Instrument, ………… Observer, …………

Timepiece, ………… Recorder, …………

Object,	γ Androm.			
Circle,	89			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,	41 45			
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	19.1			
II.	21.9			
III.	24.7			
IV.	27.5			
V.	30.1			
Sum,	123.3			
Mean,	24.66			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 56(?) 30.46			
Error of Timepiece,				

157
89
141 3
1256
1.397 3
1.40
1.61
.20

54.2.0 + .21 = 54.41
53.47
.94
.60

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, June 30.3 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object,	α Virginis	γ Bootis	β Urs Min.	
Circle,	-.17	.80	3.64	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
	-10°32′	+38°50′		
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	19 40.1	3.9	35.1 43.0	.
II.	42.3	6.5	50.6 58.5	.
III.	44.3	9.2	6.1 14.2	.
IV.	46.4	12.0	21.8 29.9	.
V.	48.5	14.6	37.8	.
	21 6	46 2	347 0 ~~340~~	
Sum,	.	.	570	.
Mean,	44.32	9.24	6.33	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	13 18 52.01	14 27 15.89	14 51 07.72	.
Error of Timepiece,	.	.	.	.

52.31 -.17m
53.85 +.80m

52.31 + 1.98 = 54.29
53.85 + .34 = 54.19
+ 54.25
1327.

58.61 + 3.64
52.31 - .17
6.30 + 3.81m

3.81) 6.30 (1.765
381
2490
2286
2040

-1.65m.

1.65
.91
165
1485
15015
19
1.70m.

1.65
.17
1155
165
.2805

1.70
8
1.36
170
.34

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 1st 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, G. H.

Object,	α Virginis			
Circle,	-.17			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	40.0			
II.	42.0			
III.	44.0			
IV.	46.1			
V.	19 48.3			
Sum,	4			
Mean,	17 44.08			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	3 18 51.98			
Error of Timepiece,				

52.10 + 1.98 = +54.08 Err of 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 2 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	δ Bootis			
Circle,	.67			
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
	+33°46			
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	28.6	.	.	.
II.	31.2	.	.	.
III.	33.7	.	.	.
IV.	36.1	.	.	.
V.	38.5	.	.	.
Sum,	.	.	.	.
Mean,	33.62	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	15 10 40.60	.	.	.
Error of Timepiece,	.	.	.	.

165
67
1155
990
1.1055
1.20
.60

53.02
60
53.60 Erof. 1327.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 28 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1324 Recorder, A.W.

Object,	γ Androm	α Arietis	β Androm. Lc.	
Circle,	.89	.42	− 3.64	
	w . e .	w . e .	w . e .	w . e .
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	41°45 . .	+22°54' . .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	18.6	11 .5	9.6	.
II.	21.3	13.8	17.7	.
III.	24.2	16.0	25.0 ~~30.6~~	.
IV.	27.0	18.2	40.6 – ~~48.8~~	.
V.	29.8	20.4	56.0	.
	20 9	29 9	.4.2 11.6 164 7 120. 284 7	
Sum,	.	.	.	.
Mean,	24.18	15.98	40.67	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	1 56 30.67	2 0 23.39	2 51 07.50	.
Error of Timepiece,	.	.	.	.

53.17 − 3.64n
.52.59

53.51 +.89n
52.59 +.42n

53.51 + .23 = 53.74
52.59 + 1.01 = 53.60
53.67

89
1.65
445
534
89
1.4685

1.47
1.70
.23

164
42
328
656
.6888

1.70
69
1.01

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 5 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object,	β Librae			
Circle,	.15			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,	-8°56′			
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	21.1			
II.	25.2			
III.	25.1			
IV.	27.4			
V.	29.4			
Sum,	26 2			
Mean,	25.24			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	~~14~~ 15 ~~57~~ 10 ~~26.27~~ 33.25			
Error of Timepiece,				

52.00 +1.95 = 53.95

165
15
825
165
.247

.25
1.70
1.95

HARVARD COLLEGE OBSERVATORY· TIME SERVICE.

Date, July 6-3 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, A. W.

Object,	δ Bootis			
Circle,	+.66			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
	+33°46′			
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	29.5			
II.	32.0			
III.	34.5			
IV.	37.0			
V.	39.4			
	22 4			
Sum,				
Mean,	34.48			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	15 10 40.55			
Error of Timepiece,				

1.65
66
990
990
1.0890
1.09
1.70
.61

53.93
.61
54.54

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 6.8 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	α Arietis			
Circle,	42			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,	+22°53′			
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	13.2			
II.	15.6			
III.	17.8			
IV.	20.0			
V.	22.2			
Sum,	88.8			
Mean,	17.76			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	20 0 23.65			
Error of Timepiece,				

165
42
330
660
.693
1.70
1.00

54.11 + 1.00 = 55.11

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 79 187 9 Instrument, Observer,

Timepiece, Recorder,

Object,	δ Ophiuchi		δ Ophiuchi	
Circle,			-.06	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
	-3° 23'			
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	57.7	11.8	53.8	
II.	59.9	13.9	55.8	
III.	1.8	16.0	57.9	
IV.	4.0	18.1	59.8	
V.	6.1	20.2	2.0	
	.95		393	
Sum,				
Mean,	1.86		7.86	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	16 8 3.92		16 8 3.92	
Error of Timepiece,				

57.88 + +53.94 + 1.80 = 55.70

165
6
990

.10
170
180

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 10 187 . Instrument, Observer,

Timepiece, Recorder,

Object,	α Virginis	ε Virginis	δ Virgin.	β Androm. β Urs. Min
Circle,			.67	
	w | e	w | e	w | e	w | e
Level Direct,				
Reversed,				
Sums,	−10° 32′	+11° 36′	+4° 03′	
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.			24.9	
II.			27.0	
III.			28 ~~29~~.0	
IV.			31.1	
V.			33.1	
Sum,			45 1	
Mean,			29.02	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.		12 56 11.71	12 49 33.01	14 51
Error of Timepiece,				

165
.07
1155
120
159

56.01 + 1.59 = 57.60

HARVARD COLLEGE OBSERVATORY· TIME SERVICE.

Date, July 10.8 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	γ Androm.	α Arietis		
Circle,	89	42		
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. | .	. | .	. | .	. | .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	22.5	.	.	.
II.	25.3	.	.	.
III.	28.1	.	.	.
IV.	30.9	.	.	.
V.	33.7	.	.	.
Sum,	40 5	.	.	.
Mean,	28.10	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	1 56 31.06	.	.	.
Error of Timepiece,	.	.	.	.

165
~~89~~
~~20~~
1495
1320
1.4695
170
23

57.04 +.23 = 57.27

4221
3656
5 25

57.27

.75
2
150

57.27
1.50
.35
59.12

59.03
57.27
3.7 1.76 ±.48
148
280.

29.65
35.65
5 6.00
valof 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sunday July 1879. Instrument, ... Observer, ...

Timepiece, 3457 Recorder, ...

Object, Circle,	11.4 17 20.3			
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.				
II.				
III.				
IV.				
V.				
Sum, Mean,				
Bb, Cc, Aa,				
Corr'd Transit, R. A.				
Error of Timepiece,				

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 14 1879. Instrument, Russ. Tr. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,	π Herculis	α Ophiuchi	ψ Draconis	
Circle,	E	E	E	E
Level Direct, Reversed,	w | e	w 19.0 | e 6.0	w | e	w | e
Sums, Difference, b. +76	+36° 56' 18.3 27 3 15 54.2	12° 39'	72° 12'	
	h m s	h m s	h m s	h m s
Wire, I.		34 6.3	I 55.8	II 5.0
II.	16 20.7	28.0	6.8	16.7
III.	47.3	50.0	18.4	48 28.3
IV.	14.2	11.7	29.8	48 39.5
V.	23.1	35 33.6	47 41.6	48 51.3
Sum,	205.1 145.1	129.6 120 249.6	152.4 +60 92.4	140.8
Mean,	20.73	49.92	18.48	28.16
Bb,	1.25 .95	.89 .67	2.84 2.16	2.16
Cc,	1.25 +.12	1.03 +.10	3.27 +.32	.32
Aa,	.12 +.13	.51 .58	-1.62	
Corr'd Transit,	21.93	51.27		
R. A.	17 10 53.30	17 29 22.65	17 44 8.58	
Error of Timepiece,	+ 5 28.63	+ 5 28.62		

21.258
.162
42516
127548
21258
34.43796

assume c = +.10 C.E.

21.258
327
148806
42516
63774
69.51366

139.03

20.96
69.51
30.47
9.51
39.98

30.64
69.51
40.15
98
41.13
39.06 mean.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 14 1879. Instrument, Russ. L. Observer, F.W.

Timepiece, 3451 Recorder, D.W.

Object,		W.	67 oph.	72 oph.
Circle,		ξ Herculis	W	W
	w | e	w | e	w | e	w | e
Level Direct,	. | .	17.7 | 7.8	. | .	. | .
Reversed,	. | .	19.0 | 6.0	. | .	. | .
Sums,	. .	~~+19+15~~ 36.7 | 13.8	. .	. .
Difference,		13.8 3|22.9		
b. +76		+.76		
	h m s	h m s	h m s	h m s
Wire, I.	.	57 46.4	.	6 25.0
II.	.	10.8	.	46.7
III.	.	35.3	0 6.3	8.3
IV.	.	59.6	.	7 29.7
V.	.	59 24.0	.	51.3
Sum,	.	176.1	.	161.0 120 41
Mean,	.	35.22	.	8.20
Bb,	.	1.12 .85	.	85 .64
Cc,	.	1.15 −.11	.	1.02 −.10
Aa,	.	.26 .29	.	55 .63
Corr'd Transit,	.	36.25	.	9.37
R. A.	.	17 53 7.11	.	18 1 40.52
Error of Timepiece,	.	29.14	.	+ 5 28.85

α′ − α
44 8.58
29 22.65
~~5~~45.93

t′ − t
49 39.06
50.69
48.37
45.93
−2.13 | 2.44 | +1.15 = ⓐ
213
310
213
970

5 28.63
28.62
28.85
210
+ 5 28.70 Err of 3451

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 17 1879. Instrument, ... Observer, ...

Timepiece, 3451 Recorder, ...

Object,	ι Herculis	μ Herculis	35 Draconis	
Circle,	W	W	W	
	w e	w e	w e	w e
Level Direct,		18.6 8.0		
Reversed,				
Sums,	46°4′	27°47′	76°59′	
Difference,				
b. +68				
	h m s	h m s	h m s	h m s
Wire, I.	40 39.7	33.2	I	
II.	10.4	46 57.1	8.5	
III.	41 41.2	~~21.8~~	24.5	
IV.	11.7	45.5	40.5	
V.	42.3	48 9.2	57 55.5	
Sum,	145 3 205.3	145.0 ~~16 6 8~~ 850 ~~10 6.8~~ 21.25	73 5	
Mean,	21.06	~~21.36~~	57 24.5	
Bb,	1.44 +.95	1.10 +.72	3.67 2 42	
Cc,	1.44 −.15	1.13 −.11	4.45 −.44	
Aa,	−.09 +.15	+.28 +.47	−2.53	
Corr'd Transit,	21.71	22.33		
R. A.	17 36 6.48	17 41 46.79	17 54 54.92	
Error of Timepiece,	+5 35.23	+5 35.54		

21.258
4 45
106290
85032
85032
94.59810
2
189.20
9.20

54 54.92
36 6.48
18 48.44

~~54~~ 26.48
3 9.20
~~00~~ 35.68
41 21.86
19 13.82
48.44

α′−α
54 54.92
41 46.79
13 08.13

57 26.48
3 9.20
00 35.68
47 21.86
13 13.82
8.13
5.79

2.81) 5.79 (+1.70
2.81
19.80
1684
24

@

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 17 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	72 oph.							
Circle,	ε							
	w	e	w	e	w	e	w	e
Level Direct,	18.5	8.6	18.5	8.6	.	.	.	.
Reversed,	.	.	18.6	8.0	.	.	.	.
	+9°33		37 1	16 6				
Sums,	.	.	16.6	.	.	.	.	.
Difference,			3 | 20 5					
b. ,68			.68					

	h m s	h m s	h m s	h m s
Wire, I.	31.4	.	.	.
II.	6 52.7	.	.	.
III.	14.2	.	.	.
IV.	35.7	.	.	.
V.	18 7 57.4	.	.	.
	19 1 4			
Sum,	71.4	.	.	.
Mean,	14.28	.	.	.
	,86 .56			
Bb,	.	.	.	.
Cc,	1,02 +.10	.	.	.
Aa,	54 .92	.	.	.
	15.86			
Corr'd Transit,	.	.	.	.
R. A.	18 1 40.51	.	.	.
Error of Timepiece,	+ 5 35.35	.	.	.

+5 15.35
15.23
15.54
1.12
5 35.37
28.70
3 | 16.67 | 2.22

4 | 2.22 | .093
216
60

28
18
10

.97
35.37
5 36.34

5 35.37
2.22
.90
5 38.49

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 19 1879. Instrument, Mer. Ci. Observer, W.

Timepiece, 1377 Recorder, F.W.

Object,	β Serpentis			χ Serpentis			γ Herculis			Gr. 848		
Circle,	.28						.35			-3.92		
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
	15°48'			18°31			~~16°3'~~			75°43'		
Sums,	.		.	.		.	19°26		.	.		.
Difference,										.		
b. +.14												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			34.2			.			~~31.0~~			17.9 21.0
II.			36.3			.			33.1			23.7 26.3
III.			38.6			.			35.3			29.4 32.4
IV.			40.6			.			37.6 39.6			35.0 38.0
V.			42.9			.			41.8			40.7
			192.6						37.4			264.4
Sum,			.			.			.			.
Mean,			38.52			.			37.48			29.38
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	15	40	39.37	15	43	20.76	16 ~~15~~	16 ~~50~~	38.19 ~~55.10~~	4	32	37.48
Error of Timepiece,			.			.			.			.

1.72
91
1.72
1548
1.56
19
1.75

59.15 +.28m
59.29 +.35m
59.26 +.40m
70 103
59.23 +.34m

1.72
34
688
516
.5848
1.75
1.17

51.90 - 3.92
59.23 + .34
- ~~.67~~
-7.33 - 4.26m

426) 7.33 (-1.72 = m.
426
3070
2982
880

59.23
1.17
60.40

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date,..................................187 . Instrument,.................................... Observer,....................................

Timepiece,.................................... Recorder,....................................

Object,	β Herculis.			
Circle,	.4°			
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	21° 45' . .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	59.1	.	.	.
II.	1.5	.	.	.
III.	3.7	.	.	.
IV.	5.9	.	.	.
V.	8.0	.	.	.
Sum,	18.2	.	.	.
Mean,	3.64	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	16 25 4.38	.	.	.
Error of Timepiece,	.	.	.	.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 21 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object, Circle,	~~δ Bootis~~ β Librae −.16			
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.	−8° 56′			
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	24 2 26.54 28.5 30 5 32.5 34 6 36.8 38.8 40.8			
Sum, Mean,	293 1 32.57			
Bb, Cc, Aa,				
Corr'd Transit, R. A.	15 10 33.11			
Error of Timepiece,				

172
16
1032
172
.27
1.75
2.02

59.46 + 2.02 = 1 01.48
1 00.30
1.18
1.22

Error 3451
1 01.48
29
1 01.76

1 01.48
60.40
2 | 1.08
.54

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 23 1879. Instrument, R.D. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,				110 Hercules
Circle,				N
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				20° 26'
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.				45 34.6
II.				57.3
III.				46 19.8
IV.	11 24.3 8.46	17 24.00 8 46		42.4
V.	5 58.41	4.55		18 47 5.3
Sum,	4.55 95.72	39 01 35.72		159 4 99.4
Mean,	17 35.72	1473		19.88
Bb,		17 37.36		.99 +.70
Cc,	2'.2 18 36.05 18 11 24.44	24 25.78		1.06 −.29
Aa,	7 11.61	6 48.42 11.61		.41 +.81
Corr'd Transit,		12.52 | 23.19 | +1.84 @. 125 1069 1000 690		11.10
R. A.				18 40 30.97
Error of Timepiece,				+ 5 40.13

21.258
11.76

21258
16.86
127548
170064
127548
21258
358.40988

12.09
7
84 63

20.29

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 23 1879. Instrument, R. T. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,	~~F~~ 72 Ophiuchi		δ Urs. mi.		δ Urs. min.		109 Herculis	
Circle,	E		E		E		E	
	w	e	w	e	w	e	w	e
Level Direct,	19.5	7.3	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	+9°33'				+86° 36'.5		21°43'	
Difference,								
b. +.70								

	h m s	h m s	h m s	h m s
Wire, I.	6 46.0	II .	II 15 ~~76~~.~~26~~	39.0
II.	7.4	10 25.0	16 ~~74~~.~~54~~	24 1.7
III.	29.3	11 23.0	17 24.	24.8
IV.	50.6	12 25.0	18 23.	47.7
V.	8 12.4	13 25.0	19 23.	25 10.7
Sum,	145 7	13 0	20	123 9
Mean,	29.14	11 24.3	17 24.00	24.78
Bb,	,85 +.60	12.09	8 46	1.01 +.71
Cc,	1.02 +.27	16.86	.	1.08 +.29
Aa,	,53 +1.04	-11.76	.	.38 +.74
Corr'd Transit,	31 05	.	.	6.52
R. A.	18 01 40.50	.	18 11 24 44	18 18 36 05
Error of Timepiece,	+ 5 50.55	.	.	+ 5 50.47

1686
27
11802
3372
45522

5 50,13
50,55
50 47
50,35
150

+ 5 50,38

11.76
74
12.50

α' - α
18 46 30.97
23 17.10
17 13.87
17 9.73
+2.10 | +4.14 | +1.97 @.
2.10
20 4"
189
150
147

46 20.29 t'
29 10.56 t
17 9.73

29 9.7

42 23 3 402 23 10 42 3 4 329

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 23 1879. Instrument, R.T. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,	χ Draconis	χ Draco	χ Draco	α Lyrae
Circle,	E	W	W	W
	w e	w e	w e	w e
Level Direct,	. .	18.0 9.1	. .	. .
Reversed,	. .	19.5 7.3	. .	. .
	72° 41′	37 5 16 4		38° 40′
Sums,	. .	16.4	. .	. .
Difference,		3)21		
b. +.70		-7.0		
	h m s	h m s	h m s	h m s
Wire, I.	I 21.0	IV 56.8	V 8.5	37 48.6
II.	32.7	9.0	20.4	16.2
III.	44.7	20.5	32.5	43.2
IV.	56.5	37.3	44.3	10.5
V.	27 8.8	30 44.5	31 56.0	37.7
	163 7	163 1	161 7	156 2
Sum,	.	.	.	216.2
Mean,	44.74	20.62	32.34	43.24
Bb,	2.90 2.03	+2.03	.	1.50 +1.05
Cc,	3.36 .	-.94	.	1.50 -.40
Aa,	-1.69 .	.	.	.16 +.32
Corr'd Transit,	.	.	.	4 21
R. A.	18 23 17.10	.	.	18 32 53.86
Error of Timepiece,	.	.	.	+5 40.35

21.258
336
127548
63774
63774
71.42688
2
ν ν ν.85

~~46.77~~
44.74
22.85
07.59

20.62
11.43
9.19
9.75
.94
9.47
7.59
1.88
336|.94 |.27 ⊙ + C.C.
672
2680

32.34
22.59
9.75

9.47
1.09
10.56

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 21 1879. Instrument, R.T. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,	ξ Herculis	72 Ophiuchi	δ Urs. Min.	δ Urs. Min.
Circle,	W	W	W	W
	w e	w e	w e	w e
Level Direct,	18.4 8.2	. .	. .	. .
Reversed,	. .	. .	. .	. .
	29° 15			
Sums,	. .	. .	. .	. .
Difference,				
b. +.74				
	h m s	h m s	h m s	h m s
Wire, I.	9.8	48.4	II 33.	III 15 32.
II.	~~34.4~~	10.2	10 33.	16 32.5
III.	58 58.5	7 31.7	33.	17 32.0
IV.	—	53.2	32.	18 33.0
V.	59 47.5	14.7	.	19 31.5
Sum,	1158 175.8	158.2	8	110
Mean,	58.60	31.64	11 32.67	17 32.20
Bb,	1.12 .83	.85 .62	12.09 8.95	.
Cc,	1.14 −.11	1.02 ~~1.08~~ −.09	16.90 −1.43	.
Aa,	.26 +.50	.53 1.02	-11.76 .	.
Corr'd Transit,	59.82	3.20	.	.
R. A.	17 53 7.08	18 01 40.50	18 11 24.23	.
Error of Timepiece,	+ 5 52.74	+ 5 52.70	.	.

358.41

5m 58s.41
11 32.67
17m 31.08
32.~~20~~
3 24 m.
mean 17 31.64
30.47
2|1.17
.16 .59 |−.04 c.m.

22. 28.17
5 58.41
17 29.76
.85
17 28.91

29 28.00
11 56.82
17 31.18
~~29.76~~
~~0.94~~
17 ~~30.47~~
1.70
29.48
28.91
39
29.20

31.93
32.20
13
17 32.06 W
17 29.20 E
2|2.86
16.90 |1.43 |+.09 c.e.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 21 1879 Instrument, R. T. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,			α Lyrae	110 Herculis
Circle,	E.	E	E	2
	w / e	w / e	w / e	w / e
Level Direct,	19.4 / 7.4	. / .	. / .	. / .
Reversed,	18.4 / 8.2	. / .	. / .	. / .
Sums,	37.8 / 15.6 15.6	. .	. .	. .
Difference,	3 | 22.2			
b. +.74	74			
	h m s	h m s	h m s	h m s
Wire, I.	IV .	V 27 27.5	50.7	36.6
II.	22 28.0	28.0	38 17.5	45 59.3
III.	23 28.5	29 28.5	44.8	21.7
IV.	24 28.0	28.5	12.4	44.4
V.	.	31 27.5	39 39.6	47 7.6
Sum,	5	0	165.0 225.	169.6 109.6
Mean,	23 28.17	29 28.0	45.00	21.92
Bb,	.	.	1.50 1.11	.99 .73
Ce,	.	.	1.50 +.14	1.06 +.10
Aa,	.	.	.16 .31	.41 .79
Corr'd Transit,	.	.	6.56	3.54
R. A.	.	.	18 32 53.86	18 40 30.97
Error of Timepiece,	.	.	+5 52.70	+5 52.57

α' − α

18 11 24.23
01 40.50
9 43.73

t' − t

17 39.58
7 32.18
10 07.40
9 43.73
−12.29 | −23.67 | +1.93 @ 1
12 29
11380
11061
3190

17 32.06
+7.52
17 39.58

372
862
.510
.040
86
16.90

5 52.57
.70
.70
.74
271

52.68
00.38
2.30

52.68
3.30
55.98

Err of 3451 = + 5 52.68

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 7 1879. Instrument, R.J. Observer, F.W.

Timepiece, 3427 Recorder, F.W.

Object,	α Serpentis			
Circle,	E	W		
	w | e	w | e	w | e	w | e
Level Direct,	19. | 7.4	17.7 | 8.8	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
	+6° 48	19 1 | 74 36.8 | 15.2 16.2 3|20 6 +.69		
Sums,	. | .		. | .	. | .
Difference,				
b. +69				
	h m s	h m s	h m s	h m s
Wire, I.	43 36.3	.	.	.
II.	57.6	.	.	.
III.	44 19.2	.	.	.
IV.	40.7	.	.	.
V.	45 2.0	.	.	.
Sum,	155 8 45.8	.	.	.
Mean,	19.16	.	.	.
	84			
Bb,	+.59	.	.	.
Cc,	102 +.10	.	.	.
Aa,	,58 1.12	.	.	.
Corr'd Transit,	20.97	.	.	.
R. A.	15 38 21.67	.	.	.
Error of Timepiece,	+ 5 59.30	.	.	.

84
~~84~~
~~59~~
84
.588
.54

193
58
1544
965
1,1194

59.30
52.68
3|6.62
+ 2.20 rate

3|6.82
2.27 rate 3451
59

59.30
1.14
16 00.44

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, July 31 1879 Instrument, Observer,

Timepiece, 3451 Recorder,

Object,	Kophirsch	ε Herculis	α Herculis	
Circle,	W	E	E	
	w | e	w | e	w | e	w | e
Level Direct,	17.5 | 8.0	19.6 | 6.4	. | .	. | .
Reversed,	19.0 | 6.4	. | .	. | .	. | .
Sums,	~~+19°34'~~ 14.4 36.5	+31°06'	+14°31'	.
Difference,	144 3⌊22 1	.		
b. ~~+.69~~	.74			
	h m s	h m s	h m s	h m s
Wire, I.	23.2	59.3	14 33.3	.
II.	16 57 44.7	1 24.2	55.3 2	.
III.	6.2	49.0	17.3	.
IV.	27.8	13.8	39.3	.
V.	49.3	2 38.6	16 1.4	.
Sum,	151.2 31.2	184.9 244.9	146.6 86.6	.
Mean,	6.24	48.98	17.32	.
Bb,	.85 +.63	1.14 +.84	.91 +.67	.
Cc,	1.02 −.10	1.17 +.12	1.04 +.11	.
Aa,	.55 1.08	.23 .45	.49 +.96	.
Corr'd Transit,	7.85	50.39	9.06	.
R. A.	16 51 59.83	16 55 42.74	17 9 11.23	.
Error of Timepiece,	+6 08.02	+6 07.65	+6 07.83	.

85
74
340
595
63

114
74
456
798
.8436

197
55
985
985
10835

197
23
591
394
4531

91
74
364
637
.673

197
49
1773
788
965

7.83
8.02
1.85
+6 07.92 Sumf 3451
59.30
8.62
10
4⌊8.52
2.13 .089
192
210

28
18
11

89
89
.979

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, August 2nd 1879. Instrument, Mer. R. T. Observer, F.W.

Timepiece, 3451 Recorder, F.W.

Object,	γ Serp. fr		11 Lyrae		β Lyrae.			
Circle,	W		W		W		Clouds.	
	w	e	w	e	w	e	w	e
Level Direct,							19.0	72.3
Reversed,							18.0	6.2
Sums,	+4°2'		+32°31'		+33°13'		37.0	~~13.5~~
Difference,							13.5 3)23.5	
b. +.78							.78	
	h m s		h m s		h m s		h m s	
Wire, I.	43.7		18 59 48.7		V 33.3			
II.	56 4.8		13.8				21.258 1.20	
III.	26.4		39.0		41.6		42516 21258	
IV.	47.4		4.6				25.5096	
V.	9.3		29.7		18 52 50.3		10 25.40	
Sum,	131.6		135.8 195.8		125.2		2 50.80 41.73	
Mean,	26.32		19.16		41.40 ~~41~~ .73		50.93 91	
Bb,	.79	+.62	1.17	.90	1.18	.91	.27 52.11	
Cc,	1.01	−.10	1.19	−.12	1.20 1.195	−.12		
Aa,	.62	+1.22	.21	+.41	.20	+.39		
Corr'd Transit,	28 06		0 35		52 11			
R. A.	18 50 16.05		18 54 28.52		18 45 40.11			
Error of Timepiece,	+6 12.01		+6 11.83		+6 12.00			

12.01
11.83
12.00
2.84
+6 11.95 Err of. 3451
7.92
4.03
13
2)3.90
1.95

1879phae.proj.1789B

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ...187 . Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object, Circle,	β Lyrae			
	w *e*	*w* *e*	*w* *e*	*w* *e*
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums, Difference, b.	. .	. .	. .	. .
	h *m* *s*	*h* *m* *s*	*h* *m* *s*	*h* *m* *s*
Wire, I.	V 1st 33.2	.	.	.
II.	3d 41.6	.	.	.
III.	5th 50.3	.	.	.
IV.	18 52 .	.	.	.
V.	.	.	.	.
Sum,	.	.	.	.
Mean,	.	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	.	.	.	.
Error of Timepiece,	.	.	.	.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 6 1879. Instrument, ... Observer, ...

Timepiece, 3451 Recorder, ...

Object,	ε aquilae	ζ aquilae	τ Draconis	τ Draconis
Circle,	+14°54′ m	m	m	m
	w e	w e	w e	w e
Level Direct,	17.7 7.0			
Reversed,				
Sums,		+13′41″	73° 8′	
Difference,				
b. +.75				
	h m s	h m s	h m s	h m s
Wire, I.	45.2	28.5	I 25.7	II 38.7
II.	0 7.3	50.6	38.2	51.3
III.	29.4	6 12.5	50.4	3.4
IV.	51.5	34.4	2.3	15.6
V.	13.2	56.5	22 14.4	23 27.5
Sum,	146.6	182.5 62.5	131.0 251.0	136.5 16.5
Mean,	29.32	12.50	50.20	3.30
Bb,	.92 .69	.90 .67	2.97 2.23	
Cc,	1.04 − .21	1.04 − .21	3.45 −.69	
Aa,	.48 +1.01	.50 1.05	−1.76	
Corr'd Transit,	30.81	14.01		
R. A.	18 54 11.55	18 59 54.59	19 17 55.04	
Error of Timepiece,	+6 19.26	19.42		

21.258
345
106290
85032
63674
7.324010
2
146.48

21 50.20
22 26.48
24 16.68
16.14
4
24 16.62 mean
15.24
2 | 1.38
345 | .69 | +.20 C.E.
690

3.30
13.24
16.54

α′ − α
19 17 55.04
59 54.59
18 00.45

24 16.62
1.54
23 18.16
6 12.96
18 5.20
00.45
22 6 | 4.75 | +2.10 ⓐ
452
230
226
40

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 6 1879. Instrument, ... Observer, ...

Timepiece, 3451 Recorder, ...

Object,	τ Draconis	τ Draconis	β Cygni	γ Aquilae
Circle,	E	E	E	E
	w e	w e	w e	w e
Level Direct,		18.6 6.7		
Reversed,		17.7 7.0		
Sums,		36.3 13.7 13.7	27°42'	10° 19'
Difference,		3|22.6 .75		
b. +.75				
	h m s	h m s	h m s	h m s
Wire, I.	IV	V 17.3	23.8	8.3
II.	16.4	29.3	47.4	30.0
III.	28.4	41.3	11.5	51.6
IV.	25 40.8	54.2	35.3	13.2
V.	~~25 53.9~~	27 6.7	19 32 59.7	19h 47m 35.0
Sum,	85.6	148.8 208.8	177.7 57.7	138.1 258.1
Mean,	28.53	41.76	11.54	51.62
Bb,			1.10 .82	.86 .64
Cc,			1.13 +.23	1.02 +.20
Aa,			.29 .61	.54 1.13
Corr'd Transit,			3.20	3.59
R. A.			19 25 54.10	19 40 34.33
Error of Timepiece,			+6 19.10	+6 19.26

41.76
26.48
15.28
15.19
47
15.24

28.53
13.34
15.19

6 19.26
19.42
19.10
19.26
10 4

+6 19.26
11.95
4|7.31 |+1.83 rate of 3451
13
33
32
11

Err of 3451

24|183|.076
168
150

12.15
11.85
.30
07

20
20 0

19.26
1.80
21.06

00.15 ~~3447~~
53 ~~1327~~
1327

37.10
30
00.05
6 19.3
40.85
53.00
+1 12.15

3.66
19.21
22.92

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug. 10. 1879. Instrument, R.T. Observer, ...

Timepiece, 3451 Recorder, ...

Object,	γ Cygni							
Circle,	W							
	w	**e**	**w**	**e**	**w**	**e**	**w**	**e**
Level Direct,	20.3	8.5	19.0	10.0	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
	+39°52'	18 3	20 3	8 5				
Sums,	.	36.9	39.3 18.5	18.5	.	.	.	.
Difference,		46 2	3 | 20 8					
b. +.70		4 5	.69					

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			13.3			.			.			.
II.			23.0			.			.			.
	25	28										
III.			32.0			.			.			.
IV.			41.4			.			.			.
			0.2									
V.			.			.			.			.
			9.4									
Sum,			27.6			.			.			.
Mean,			22.88			.			.			.
	1.30		91									
Bb,			.			.			.			.
	1.31											
Cc,			-.26			.			.			.
Aa,	+.06		+.12			.			.			.
			23.65									
Corr'd Transit,			.			.			.			.
R. A.	20	17	56.73			.			.			.
Error of Timepiece,	+6		26.92			.			.			.

19.26

4 | 7.66 | 1.90

400

366

360

60

24 | 1.90 | .080

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 11 1879. Instrument, RY, Observer, Fw.

Timepiece, 3451 Recorder, Fw

Object, Circle,	δ Lyrae ε							
	w	e	w	e	w	e	w	e
Level Direct, Reversed,	18.3	10.0	19.4 18.3	9.2 10.0				
Sums, Difference, b. +.62	37°55'		37.7 19.2 18.5 .62	19.2				

	h m s	h m s	h m s	h m s
Wire, I.	47.2			
II.	18 14.3			
III.	41.3			
IV.	8.4			
V.	35.4			
Sum,	146.6 206.6			
Mean,	41.32			
Bb,	1.27 +.78			
Cc,	1.27 +.25			
Aa,	.10 +.21			
Corr'd Transit,	42.56			
R. A.	19 12 13.47			
Error of Timepiece,	6 29.09			

126
62
252
756
.7812

6 29.09
29.92
2.17

1.80

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 12 1879. Instrument, Mer. Cir. Observer, WAR.

Timepiece, 1327 Recorder, G.W.

Object,	α Herculis	β Draconis		ι Aurigae
Circle,	.26	1.30		.64 32°58'
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	+14°32'	+52°28'		
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	21.5	54.0	.	22 0.0
II.	23.7	57.7	.	24.6
III.	10 25.7	0.8	.	27.0
IV.	27.8	4.2	.	29.6
V.	30.0	7.6	.	32.0
Sum,	128.7	4.4	.	35.2
Mean,	25.74	00.88	.	27.04
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	17 9 11.10 ~~5.23~~	17 27 44.46 ~~44.60~~	.	4 49 7.88
Error of Timepiece,	.	.	.	.

1.72
.26
1032
344
.4472
−.45
+1.75
+1.30

1.72
13
516
172
−2.236
+1.75
.49

+1 20.51 + 1.30 = +1 21.81
+1 19.28

1 14.64 + 1.30 = +1 15.94
1 16.42 − .49 = +1 15.93
1 15.94

172
64
688
1032
−1.1008
+1.75
.65

+1 15.16
65
+1 15.81

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 3 1879 Instrument, Mer. Cir. Observer, M.A.R.

Timepiece, 1327 Recorder,

Object,	α Herculis							
Circle,	.26							
	w	e	w	e	w	e	w	e
Level Direct,								
Reversed,								
Sums,								
Difference,								
b.								

	h m s	h m s	h m s	h m s
Wire, I.	21.8			
II.	24.0			
III.	26.1			
IV.	28.2			
V.	30.3			
Sum,	30.4			
Mean,	26.08			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	17 9 11.10			
Error of Timepiece,				

1 14.98 + 1.30 = 1 16.28

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug. 14 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	β Draco.	α Ophiuchi	δ Urs Min.	
Circle,	1.30	.22	16.90	
	w | e	w | e	w | e	w | e
Level Direct,				
Reversed,				
	52° 24′	12° 39′	86° 36′ 42	
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	55.3	34.2	~~45.9~~ 27.9	
II.	59.0	36.5	38.7 50.1	
III.	2.1	38.6	13 1.4	
IV.	5.5	40.7	13.7 25.0	
V.	9.2	42.9	34.7	
	131 1	192 9	191 5	
Sum,	120 11.1		180 11.5	
Mean,	2.22	38.58	1.64	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	17 27 44.40	17 29 22.44	18 11 17.90	
Error of Timepiece,				

17.2
22
34.4
344
.3784
175
1.37

1 17.82 − .49 = 1 17.33
1 16.14 + 1.37

1 17.51
84
1 17.42
16.28
1.14

1 43.74 + 16.90n
1 16.14 + .22n
27.60 + 16.68n

16.68) 27.60 (−1.65 = n.
1668
10920
10008
9120

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug. 19 1879. Instrument, Observer,

Timepiece, Recorder,

Object,	α Lyrae		ξ Aquilae				α Arietis	
Circle,	.80		nil				.42	
	w	e	w	e	w	e	w	e
Level Direct,								
Reversed,								
	38°40′		13°41				22 54	
Sums,								
Difference,								
b.								

	h m s	h m s	h m s	h m s
Wire, I.	11.3	12.5		21 43.7
II.	14.0	14.7	165 42	45.6
III.	16.6	16.8	330	47.8
IV.	19.2	19.0	660	50.1
V.	21.7	21.0	.69	52.3
Sum,	32 8	84 0	1.70 1.60	39 5
Mean,	16.56	16.80		47.90
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	18 32 53.56	18 59 54.50		h m s 2 0 24 .95
Error of Timepiece,				

165
91
165
1485
1.5015
19
1.70

165
24
660
330
.396
.40
1.70
1.30

1.65
8
1.320
1.70
.38

9
1 23.00 + .38 = 1 23.38
1 22.30 + 1.30 = 1 23.60
13.60
15 8
1 23.53

95
1 22.95 + 1.00 = 1 23.95
.55
8 1.40
.05

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug. 20 . 8 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,			ζ Persei α Tauri	
Circle,			29	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	31°88	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	.	.	21 . 7	.
II.	.	.	23 . 7	.
III.	.	.	25 . 8	.
IV.	.	.	27 . 9	.
V.	.	.	30 . 0	.
Sum,	.	.	29 1	.
Mean,	.	.	25.82	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	1,65 16 990
Corr'd Transit,	.	.	.	165 2640
R. A.	.	.	4 29 1.74 3 46 35 23	1.70 1.44
Error of Timepiece,	.	.	.	.

+1 24.08 + 1.44 =

1 25.52

~~.740~~

1879phae.proj.1789A

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 21 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	ξ aquilae		β Cygni					
Circle,	.24		5~					
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
	13°41′		−7°43′					
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								
	h m	s	h m	s	h m	s	h m	s
Wire, I.		15.2		14.7		.		.
II.		17.3		17.0		.		.
III.		19.3		19.3		.		.
IV.		21.7		21.7		.		.
V.		23.7		24.0		.		.
Sum,		47.2		46.7		.		.
Mean,		19.44		19.34		.		.
Bb,		.		.		.		.
Cc,		.		.		.		.
Aa,		.		.		.		.
Corr'd Transit,		.		.		.		.
R. A.	18 59	54 50	19 25	54 01		.		.
Error of Timepiece,		.		.		.		.

1 24.94 + 1.25 = 1 26.19

1 25.33 .84 = 1 26.17

1 26.18 Err of 13∿7

165
w

165
52
330
825
8580
1.40
.84

25.53
2 | 2.6,5
1 32 | .055
24) 120
120
120

1.26.18
57
1 26.75

24
55
120
120
1.32
26.75
28.07
1

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 23.9 1879. Instrument, Mer. Ci. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	α Orionis		β Tauri					
Circle,	13		.54					
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
	7°23'		28°30'					
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.		50	3.3		20	5.4			.			.
II.			5.4			7.6			.			.
III.			7.5			10.0			.			.
IV.			9.6			12.3			.			.
V.			11.7			14.7			.			.
			37 5			0 0						
Sum,			.			.			.			.
Mean,			7.5			10.00			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	5	48	39.84	5	18	41.78			.			.
Error of Timepiece,			.			.			.			.

1 27.66 +1.49 = 1 29.15

1 28.22 +.81 = 1 29.03

.18

1 29.09

1 29.09 Err of 1327

165
13
495
165
.2145
1.70
1.49

165
54
660
825
891
140
.81

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 24. 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	α Aquilae				α Arietis			
Circle,	.15				.42			
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	8° 33′				22° 54′			
Difference,								
b.								

	h m s	h m s	h m s	h m s
Wire, I.	21.1	.	50.0	.
II.	23.2	.	52.2	.
III.	25.2	.	54.5	.
IV.	27.3	.	56.8	.
V.	29.4	.	59.0	.
Sum,	26 2	.	227	.
Mean,	25.24	.	54.54	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	19 45 56.70	.	2 0 25 14	.
Error of Timepiece,	.	.	.	.

1 28.54 + 1.45 = 1 29.99

1 29.40 + 1.00 = 1 30.40

165
15
825
165
247

170
25
1.45

14 | 90 | .06
84
60

165
42
330
660
6930

140
6 | 39 | .065
36
15
325
65
.97
40
1 31.38

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ~~Aug 24~~ 28 1879. Instrument, R.J. Observer, G.W.

Timepiece, 3451 Recorder, G.W.

Object,	ϑ aquilae	31 ο Cygni	γ Cygni	ε Delphini
Circle,	E	E	W	W
	w / e	w / e	w / e	w / e
Level Direct,	18.3 / 12.0	. / .	. / .	19.9 / 11.5
Reversed,	19.9 / 11.5	. / .	. / .	. / .
Sums,	~~12°~~ 11′ 38.2 / 23.5	46°23′ . / .	39°52′ . / .	10°54′ . / .
Difference,	23.5 3⟌14.7			
b. +.50	.49			
	h m s	h m s	h m s	h m s
Wire, I.	49.5	14.9 15 55.2	5.3	49.8
II.	3.5	6.9 25.6	33.1	11.6
III.	10.4	7.9 16 57.0	25 0.8	34 33.2
IV.	18.3	13.1 28.3	28.6	54.8
V.	20 12 31.4	58.6	56.4	16.3
Sum,	113.1 53.1	284.7 284.7	124.2	165.7
Mean,	10.60	56.94	25 00.84	33.64
Bb,	.73 +.36	1.44 +.72	1.30 +.65	.87 +.44
Cc,	1.00 +.20	1.45 +.28	1.31 .25	1.02 .20
Aa,	.68 +1.43	-.10 -.21	.06 +.12	.53 1.10
Corr'd Transit,	12.59	7.73	1.36	34.48
R. A.	20 05 7.80	20 9 52.57	20 17 56.61	20 27 29.84
Error of Timepiece,	+ 7 04.79	+ 7 5.16	+ 7 04.75	+ 7 04.64

68
21
68
136
1428

53
21
53
106
110

7 .. 04.79
5.16
4.75
4.64
3 3 4
4.83
55.85
4⟌9.00 ⎣2.25

483
.94
7 5.77

65
10
.65

Ef 3451 7

24⟌2.25 ⎣.094
~~24~~ 6
90

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 29 1879. Instrument, Observer,

Timepiece, 3451 Recorder,

Object,	α Aurigae	α Aurigae	α Aurigae	
Circle,		W	45°52	
	w | e	w | e	w | e	w | e
Level Direct,	19.4 | 10.8	18.5 | 11 .6		
Reversed,	18.5 | 11.6			
Sums,	37 9 | 22 4 22.4		15 64 10 0 47 8 42 4	
Difference,	3|15 5			
b.	.52			
	h m s	h m s	h m s	h m s
Wire, I.	44.8	45.7	46.7	2.65
II.	54.7	55.9 -14	56.8	24.25
III.	5.3	6.1	7.3 11 0 8	45.4
IV.	15.3	16.4	18 0 8	7.3
V.	25.3 35 4	26.4 36.7	187.2 478 8 420	56 28.4
Sum,	180 8	187.28	898.8	14 05 179
Mean,			299.6	
Bb,			143 59.92 4.	14 55.92 +.72
Ce,			143 55.92	-.28
Aa,	143 21		-.08 .7	-.17
Corr'd Transit,	143 286 03	21 8 168 143 72		
R. A.			5 7 49 10	56.19 49.10
Error of Timepiece,				+7 07.09

α Orionis +7°23'
2.65
24.25
45.4
7.3
56 28.4
10 8 0
228 0
45.6 0
.042
+.20
1.18
74 0
α=5 4 8 40.03
5 7 7.37

~~58~~
.83
1.01
.58

58
121
28
146
1.18

7.37
7.09
46
7 07.23

7 45
7

0h 1327
29.2 3451
07.4
21.8
00
+1 38.2 Suf 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Aug 31 1879. Instrument, R.T. Observer, F.W.

Timepiece, 3459 Recorder, F.W.

Object,	θ aquilae		310 Cygni		310 Cygni			
Circle,	E		W					
	w	e	w	e	w	e	w	e
Level Direct,	17.5	10.2	18.5	9.2	.	.	.	.
Reversed,	18.5	9.2	.	.	.	.	.	.
Sums,	36.0 19.4 3|16.6	19.4 .	.	.	.	.	.	.
Difference,	.55							
b. +.55	−1° 11'		+ 46° 23'					

	h m s	h m s	h m s	h m s
Wire, I.	11 34.2	1.3 11.4	.	.
II.	55.2	21.7	.	.
III.	16.5	32.3	.	.
IV.	12 38.1	42.4 52.3	.	.
V.	59.2	3.3 —	.	.
Sum,	203.2 83.2	13.3 23.5 33.5	13|398.3 ⌊3.06 39 8 3 78	.
Mean,	16.64	44.3 54.5	3.06	.
Bb,	.73 .40	18 4.5 338.3 60. 398.3	1.45 +.80	.
Cc,	1.00 +.20		1.45 −.28	.
Aa,	.68 +1.43		−.10 −.21	.
Corr'd Transit,	18.67	.	3.37	.
R. A.	20 5 7.77	20 .	20 9 52.52	.
Error of Timepiece,	+ 7 10.90	.	+ 7 10.85	.

.73
.55
365
365
.4015

.68
.21
68
136
1.428

1.45
.55
725
725
.7975

7 10.90
85

7 10.87
7.23
39 | 3.64 ⌊.093
351
130
117
13

93
12
186
93
1.116
1.12

2√7/8
16

20 40 25.2
55
1.327
2458
7 10.9
14.2
5510
+ 1 40.8 Error 1327.
38.2
37 | 2.6 ⌊.070
25.9
.10

93
93
1.023

24
93
72
216
2.23
2.10
11.90
14.00

24
7
1.68

7
7
.77
.8
1 41.57
1.60
43.17

7

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 4 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1,3,5,7 Recorder, H.H.

Object,	α Hydrae	α Leonis	α Leonis	β Librae.
Circle;	−8° 8′	12° 34′		.16
Level	w e	w e	w e	w e
Direct,				
Reversed,				
Sums,				
Difference,		22		
b.	−.14	not used	.22	−8° 56′
	h m s	h m s	h m s	h m s
Wire, I.	21.3	43.4		13.7
II.	23.3	45.3	41.2	15.9
III.	25.3	47.6	43.4	18.0
IV.	27.4	49.8	45.4	20.1
V.	29.4	51.8		22.1
Sum,	26.7	37.7	10.0	89.8
Mean,	25.34	47.54	43.33	15 12 17.96
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	9 21 40.28	10 1 57.58	57.58	15 10 32.52
Error of Timepiece,			1 +	+1 47.36

1

+1 45.10 + 1.93 = 1 47.03
.96 47.09

165
22
330
33
36
170
1.34

45.75 + 1.34 = 1 47.09

165
14
660
165
2310
120
193

1.65
16
1.70
22
1.92

1 45.44
1.92
1 47.36

36
6
530
.06

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 6 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, Frod. 1327 Recorder, F.W.

Object,	51 H Cephei L.C.	α Aquilae	β Aquilae	51 H Ceph. L.C.
Circle,	87°14′	.15	.11	−20.64
	w . e	w . e	w . e	w . e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	−20.64	+8°33′	+6°7′	
	h m s	h m s	h m s	h m s
Wire, I.	~~13.7~~	40.0	9.2	54.0 7.0
II.	21.7	42.0	11.2	21.7 33.3
III.	33.3 47.8	44.1	13.3	44 47.8
IV.	2.6	46.1	15.2	2.6 16.3 33.7
V.	16.3	48.2	17.3	47.5 263.9 180 83.9
Sum,	121.7 120 241.7	20.4	66.2	443.9
Mean,	48.34	44.08	13.24	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	18 43 34.16	19 44 56.55	19 49 26.00	.
Error of Timepiece,	.	.	.	.

1205
446
59
6 | 75.9
126
63
189
19

16
45
48
37

478
4382

1 14.18 − 20.64 m
1 47.38 + 8.13 m

33.20 − 20.77 m

1 47.53 + .15 m
1 47.24 + .11 m
77
1 47.38 .13

148.83
37
49.20

1.57
10
3 | 1.47
.49

2077 | 33.20 | −1.60 = m.
20 77
124330
12432

1.60
13
480
160
1.208
1.65
1.45

1 47.38
−1.45
+1 48.83
47.36
2 ~~1.5~~

Emf .37

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 7 1879. Instrument, Observer,

Timepiece, 1327. Recorder,

Object,	α' Herculis	α Ophiuchi		
Circle,	.26	23		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+14°32'	+12°39'		
	h m s	h m s	h m s	h m s
Wire, I.	55.2	6.7		
II.	57.3	8.7		
III.	59.4	10.8		
IV.	1.5	12.9		
V.	3.7	15.0		
Sum,	297.1	54.1		
Mean,	59.42	10.82		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	17 9 10.68	17 29 22.06		
Error of Timepiece,				

1 48.74 + 1.28 = 1 49.97

1 48.76 + 1.28 = 1 50.04

.01

1 50.00

1 48.83

1.17

7

124

1 60
23

48
32

.368
.165

1.28

16
26

76
32

.426
.165

1.23

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept 8 1879. Instrument, Observer, Wak.

Timepiece, 1327 Recorder,

Object,	α Serpentis		ε Bootis		α Ceti		ζ Persei	
Circle,	12						61	
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.	+6°48′						+31°32′	

	h m s	h m s	h m s	h m s
Wire, I.	6.9	.	.	22.5
II.	8.9	.	.	25.0
III.	11.0	.	.	27.4
IV.	13.2	.	.	29.9
V.	15.2	.	.	32.2
Sum,	55.2	.	.	37.0
Mean,	11.04	.	.	27.40
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	15 38 31.08	.	.	3 46 35.88
Error of Timepiece,	.	.	.	.

16
12
32
16
19
165
1.45

1 49.96
145
1 51.41

1 51.52 +.67 = 1 52.19

160
61
16
96
98
165
.67

.52.19
51.41
12 ⌋ .78 ⌊.065
72

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 9 187 . Instrument, Observer,

Timepiece, Recorder,

Object,	α Lyrae	ζ aquilae		
Circle,	.80	.24		
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	+38°40′	+13°41′		
	h m s	h m s	h m s	h m s
Wire, I.	40.5	42.0	.	.
II.	43.1	44.0	.	.
III.	45.7	46.1	.	.
IV.	48.4	48.2	.	.
V.	51.0	50.2	.	.
Sum,	287	305	.	.
Mean,	45.74	46.10	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	18 32 53.17	18 59 54.25	.	.
Error of Timepiece,	.	.	.	.

1 52.57 + .37 = 1 52.94

1 51.85 +1.27 = 1 53.12

10 6

+1 53.03

160
8
128
165
.37

16
21
64
32
38
165
1.27

19
151.84 1.55
12
60
60
.66

055
22
220
110
1.320
10
1.42
53.03
1 54.45

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 10 187 . Instrument, Observer,

Timepiece, Recorder,

Object, Circle,	α Orionis .13			
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.	7° 2 3'			
	h m s	h m s	h m s	h m s
	20.4 27.5			
Wire, I.	29.5			
II.	31.6			
III.	33.9 -			
IV.	36.0			
V.	38.0 40.0 42.2			
Sum,	9 304.1			
Mean,	33.79			
Bb, Cc, Aa,				
Corr'd Transit, R. A.	5 48 40 35			
Error of Timepiece, ~~405'~~				

160
13
48
16
20'
165
144

53.44
1.44
54.88

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept 11, 8 1877. Instrument, Observer,

Timepiece, Recorder,

Object,	α Orionis	μ Geminorum		
Circle,	·13	.42		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	7 .23	22°34′		
	h m s	h m s	h m s	h m s
Wire, I.	31.0	32.4		
II.	33.1	34.9		
III.	35.2	37.1		
IV.	37.4	39.2		
V.	39.5	41.3		
Sum,	26 2	34 9		
Mean,	35.24	36.98		
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	5 48 40.40	6 15 41.80		
Error of Timepiece,				

1 54.84 +1.44 = 1 56.28

1 55.18 + .98 = 1 56.16

44

1 56.22

Err 1327 = 54.88

1.34

56.22

1 57.56

16

42

32

64

67

165

.98

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 12 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	α Bootis	δ Ophiuchi		
Circle,	,36	−06		
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	+19°49′	−3°23′		
	h m s	h m s	h m s	h m s
Wire, I.	1.8	54.2	.	.
II.	4.0	56.3	.	.
III.	6.2	58.3	.	.
IV.	8.4	0.4	.	.
V.	10.6	2.4	.	.
Sum,	31 0	171 6 120 . 291 6	.	.
Mean,	6:20	58.32	.	.
Bb,	.	.	.	.
Ce,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	14 10 10.46	16 8 3.17	.	.
Error of Timepiece,	.	.	.	.

16
36
96
48
.576
1.65
.07

16
6
.96

1 55.74 + 1.07 = 1 56.81
1 55.15 + 1.75 = 1 56.90

1 56.90
56.22
1.0 68
65 2 065
2
1.30
56

.16
24
30
65
1.95
56.90
15
1 56.75

30
5
15

1.95
56.90
58.85
58.70

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date,..187 . Instrument,.. Observer,..

Timepiece,.. Recorder,..

Object, Circle,				
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.				
Wire, I. II. III. IV. V.	h m s	h m s	h m s	h m s
Sum, Mean,				
Bb, Cc, Aa,				
Corr'd Transit, R. A.				
Error of Timepiece,				

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

31

Date, Sept. 14 8 1879 Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	β Tauri	δ Orionis.	α Tauri	
Circle,			,29	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.		−0°23'	+1°16'	
	h m s	h m s	h m s	h m s
Wire, I.	.	.	57.8	.
II.	.	.	59.8	.
III.	.	.	1.9	.
IV.	.	.	4.0	.
V.	.	.	6.2	.
Sum,	.	.	9.7	.
Mean,	.	.	1.94	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	5 8 .	5 25 52.70	4 29 02.57	.
Error of Timepiece,	.	.	.	.

16
29
144
32
46
165
1.19

1 59.87 + 1.19 = 2 01.06
50
2 00.56

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept 15-2 1879. Instrument,……………… Observer,………………

Timepiece,……………… Recorder,………………

Object,	β Lyrae	α Cor Bor.		
Circle,	,16	,51		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	−8° 56′	+27° 7′		
	h m s	h m s	h m s	h m s
Wire, I.	27.7	31.9		
II.	29.8	34.1		
III.	31.9	36.3		
IV.	34.0	38.7		
V.	36.1	41.1		
Sum,	9.5	32.1		
Mean,	31.90	36.42		
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	15 10 32.38	15 29 35.90		
Error of Timepiece,				

1 59.52 +1.91 = 2 01.43

2 00.52 +.85 = 2 01.37

2 01.40

Emf 1.327 + 2

0.56

11.84 ~~2~~ 76

77

.70

9
7
16.5
7
1.15.5
01.40
02.55

+ 2

16
16
.26
1.65
1.91

80
165
85

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 16 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	β Tauri	δ Orionis	α Orionis	
Circle,	+ .54	– .01	+ 13	
	w | e	w | e	w | e	w | e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+28° 30	-0° 24		
	h m s	h m s	h m s	h m s
Wire, I.		51.3	40.7	39.3
II.		53.3	42.9	41.3
III.		55.4	45.0	43.3
IV.		57.5	47.3	45.4
V.		59.6	49.6	47.6
Sum,		27 1	25 5	16 9
Mean,		55.42	45.10	43.38
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	5 18 42.59	5 25 52.79	5 48 40.54	40 504
Error of Timepiece,				

17
16
3 24
54
.86
1.65
.79

16
13
48
16
.21
1.65
1.36

2 0 4.56
1.36
2 0 5.92

2 02.63
1.63
2 04.26
20

2 0 2.84
1.36
2 04.20

Err of 1327 = 2 04.23

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept 17 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	ν Geminor		Sept	
Circle,	16° 30′			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.30			
	h m s	h m s	h m s	h m s
Wire, I.	47.3			
II.	49.5			
III.	51.7			
IV.	53.8			
V.	55.9			
	082			
Sum,				
Mean,	51.64			
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	6 30 46.48			
Error of Timepiece,				

16
30
48
1 61
1.17

2 05.06
1.17
2 06.23

2.00
1

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 19 1879. Instrument, Mer Cir Observer, W.AR

Timepiece, 1327 Recorder, F.W.

Object,	α Ophiuchi		α Herculis					
Circle,	23		.26					
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.	+12°39′		+14°31					

	h m s	h m s	h m s	h m s
Wire, I.	25.2	13.8	.	.
II.	27.3	15.9	.	.
III.	29.4	18.1	.	.
IV.	31.6	20.2	.	.
V.	33.7	22.3	.	.
Sum,	47.2	40.3	.	.
Mean,	29.44	18.06	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	17 29 21.86	17 9 10.48	.	.
Error of Timepiece,	.	.	.	.

1.65
23
495
330
.3795
165
1.28
1.25

+2 07.58 + 1.25 = +2 08.83
+2 07.58 + 1.22 = +2 08.80
+2 08.82

.16
26
96
32
.43
165
1.22

6.23 14
34) 2.59 (.076
238 84
210 78
1.064
8.82
9.88

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 20 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder,

Object,	μ Geminorum	γ Geminorum		
Circle,	41	30		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+22° 32′	+16° 30′		
	h m s	h m s	h m s	h m s
Wire, I.	47.8	52.4		
II.	50.0	54.6		
III.	52.3	56.8		
IV.	54.3	58.9		
V.	56.4	1.1		
Sum,	111	223.8 60 283.8		
Mean,	52.22	56.76		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	6 15 42.07	6 30 46.68		
Error of Timepiece,				

16
41
16
64
656
1.65

+2 10.15 +1.00 = 2 11.15
+2 10.08 +1.17 = 2 11.25
40
2 11.20
8.82

16
3
48
165
1.17

36 | 12.38 | 1.066
216
220
2
1.32
11.20
12.52
8
13.3
+2
+2

66
12
136
66
79
52

66
4
264
132
1.584
12.52
14.10
+2

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 23 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	λ Aquilae	β Cygni	α Arietis	
Circle,		.52	.42	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	.
Difference,				
b.	−5° 04′	+27° 43′	+22° 54′	
	h m s	h m s	h m s	h m s
Wire, I.	32.3	3.3	36.2	.
II.	5.7	5.7	38.4	.
III.	8.0	8.0	40.7	.
IV.	10.3	10.3	42.9	.
V.	12.7	12.7	45.2	.
Sum,	.	40.0	3.4	.
Mean,	.	8.00	40.68	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	18 59 53.39	19 25 53.49	2 0 25.82	.
Error of Timepiece,	.	.	.	.

16
.52
32
80
.83
1.65
.82

+2 14.51
82
+2 15.33

16
42
32
64
.672

+2 14.86
98
+2 15.84
33
7 .51
.07
.5
35
34
+2 16.19

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 24 1879. Instrument,

Timepiece, 1327

Observer,

Recorder,

Object,	γ Gemin.			β Can Min								
Circle,	.30			.15								
	w		e	w		e	w		e	w		e
Level Direct,												
Reversed,												
Sums,												
Difference,												
b.	+16° 30'			+8° 32'								
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			59.0			50.4						
II.			1.1			52.6						
III.			3.2			54.6						
IV.			5.4			56.6						
V.			7.6			58.7						
Sum,			16 3			22 9						
Mean,			3 26			54 58						
Bb,												
Cc,												
Aa,												
Corr'd Transit,												
R. A.	6	30	46.80	7	20	38.33						
Error of Timepiece,												

16
3
48
165
.17

24
165
1.41

+2 16.46 +1.17 = +2 17.63
2 16.25 +1.41 = + 2 17.66

2 17.64

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 25 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	γ Geminorum	α Can. Min.		
Circle,	.30	.10		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+16° 30′	+5° 32′		
	h m s	h m s	h m s	h m s
Wire, I.	0.2	14.3		
II.	2.7	16.4		
III.	4.9	18.6		
IV.	7.1	20.6		
V.	9.3	22.7		
Sum,	24.2	92.6		
Mean,	4.84	18.52		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	6 30 46.82	7 33 00.87		
Error of Timepiece,				

16
3
.48
1.65
1.17

16
1.65
1.49

+2 18.02 +1.17 = +2 19.19
+2 17.65 +1.49 = +2 19.14
2 19.16 [illegible] 3.7.
17.64
1.52
19.16
-0.68

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, 26 Sept. 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	α ophiuchi						Sept. 27. α Can. Min					
Circle,	−3						.10					
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.	+12° 39′						+5° 32′					
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			35.8			.			16.3			.
II.			38.0			.			18.4			.
III.			40.1			.		35	20.5			.
IV.			42.3			.			22.6			.
V.			44.3			.			24.7			.
Sum,			0 5			.			10 2 5			.
Mean,			40.10			.			20.50			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	17	29	21.75			.	7	33	00.94			.
Error of Timepiece,			.			.			.			.

16
23
48
32
.368
165
1.28

2 18.35
1.28
2 19.63
19.16
11 1.47
44
30

43
12
17 2
86
1.03 2
19.16
2 20.19

16
10
16
.165
1.50

2 19.56
1.50
+ 2 21.06
19.63
38 1.43
1.52

4
12
96
21.00
22.10

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 29 1879. Instrument, ... Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object, Circle,	α Canis Min:											
	w		e	w		e	w		e	w		e
Level Direct, Reversed,												
Sums, Difference, b.	+5° 32′											
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.		17	15.5									
II.		19	17.6									
III.		21	19.7									
IV.		23	21.8									
V.		25	23.8									
Sum,			48 4									
Mean,			21.68									
Bb, Ce, Aa,												
Corr'd Transit,												
R. A.	7	33	00.98									
Error of Timepiece,												

20.70
1.50
+ 2 22.20

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 30 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object, Circle,	α Ophiuchi	~~δ Urs. Min.~~ 51 H. Cephei L.C. 92° 49′	η Serpentis	α Lyrae
	w . e	w . e	w . e	w . e
Level Direct, Reversed,		−20.64	.05	.80
Sums, Difference, b.	+12° 39′	87° 13.5′ ~~+86° 36′~~	−2° 56′	+38° 40′
	h m s	h m s	h m s	h m s
Wire, I.		8.6	17 22.8	35 9.2
II.		24.1	24.9	11.9
III.	21.205 20.446	45ᵐ 37.3	26.9	14.5
IV.	4|759	52.0	29.0	17.2
V.	.19 20.45 20.64	5.6	31.0	19.9
Sum,	189 27 2|53.8	125.6 60 185.6	34.6	22 7
Mean,	269 2.16 .27 52.00 49.84	37.12	26.92	14.54
Bb, Cc, Aa,	1.89 .14 1.75			
Corr'd Transit, R. A.	17 29	18 48 49.84	18 15 6.08	18 32 52.60
Error of Timepiece,				

162
91
162
1458
1.4742
19
1.66

14
135
540
135
.1890

1 47.28 − 20.64 n
2 20.84 − .05 n
33.56 + 20.64 n

20.64 ⌋ 33.56 ⌊ −1.62 = n.
20 64
1292
~~320~~
12 384
53 60

+2 20.84 − .05 n = 2 20.76
+2 21.94 + .80 n = 2 20.64
94
2 20.70
1.66
+2 22.36

162
5
−.081

162
8
1.296

Err of 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Sept. 30 187*9.* *Instrument,* Me. Ci. *Observer,* W.A.R.

Timepiece, 1327 *Recorder,* P.W.

Object,	α Geminorum.	α Gem.		
Circle,		.63		

	w	e	w	e	w	e	w	e
Level Direct,								
Reversed,								
Sums,								
Difference,								
b.	~~+32°8'~~		32°8'					

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	7	40	15.5		29	13.7						
II.			17.8			16.2						
III.			20.2			18.6						
IV.			22.5			21.0						
V.			24.8			23.4						
Sum,			0 8			429						
Mean,			20.16			18.58						
Bb,												
Cc,												
Aa,												
Corr'd Transit,												
R. A.				7	26	56.23						
Error of Timepiece,												

2 22.35 + .64 = 2 23.00

162
63
486
972
1.0206
1.66
.64

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 1 1879. Instrument, Mer. Ci. Observer, W: A. R.

Timepiece, 1327 Recorder, D.W.

Object,	α Herculis	α Ophiuchi	α Can. Min.	β Geminorum
Circle,	.26	.22	.10	.54
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	+14° 32′	+12° 39′	+5° 32′	+28° 19′
	h m s	h m s	h m s	h m s
Wire, I.	~~39.3~~	31 39.3	19.2	16.4
II.	~~41.5~~ 28 0	41.5	21.3	18.8
III.	30.0 32 1	43.6	23.3	21.0
IV.	34.2	45.7	25.3	23.4
V.	36.4	47.8	27.3	25.7
Sum,	160 7	179	164	58
Mean,	32.14	43.58	23.28	21.06
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	17 9 10.25	17 29 21.64	7 32 61.04	7 37 58.~~60~~ 28
Error of Timepiece,	.	.	.	.

162
26
972
324
.4212
1.66
1.24

162
22
324
324
.3564
1.66
1.30

+2 21.89 +1.24 = +2 23.13
+2 21.94 +1.30 = +2 23.24
37
+2 23.18 Err. of 1327.

2 22.24 +1.50 = +2 23.74
2 22.85 + .79 = .2 23.64
+2 23.69

162 162
1.66 54
1.50 648
810
.8748
1.66
.79

Date, Oct. 23 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, L. W.

Object,	α Ophiuchi	η Serpentis	51 H Ceph. Le.	
Circle,	.22	−.05	−20.64	
	w / e	w / e	w / e	w / e
Level Direct,				
Reversed,				
Sums,				
Difference, S				
b. = +0.15	+12°39′	−2°56′	92°49′	
	h m s	h m s	h m s	h m s
Wire, I.	31 40.3	17 24.3	45 12.5	
II.	42.3	26.4	26.0	
III.	44.4	28.6	40.5	
IV.	46.4	30.6	53.3	
V.	48.6	32.7	9.1	
Sum,	220	426	141 4 201.4	
Mean,	44.40	28.52	40.28	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	17 29 21.60	18 15 6.06	$\overset{6}{18}$ 43 49.03	
Error of Timepiece,				

+1 51.25 − 20.64n + m

+2 22.63 + .08n + m

o = + 31.38 + 20.72n

+2 22.80 +.22n + m

+2 22.46 −.05n + m

−1.52 = n, +2 22.63 +.08n + m

20.72) 31.38

20 72

10660

10360

3000

+.91

.152

1368

−1.383

20

+1.58 = m,

135

15

675

135

.2025

152

22

304

304

.3344

1.58

1.25

2 22.80 + 1.25 = 2 24.05

2 22.46 + 1.65 = 2 24.11

16

Error of 1327 = 2 24.08

23.69

.39

~~.64~~ .04

m = b sec φ − n tan φ.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 4.3 1879. Instrument, Meri. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object,	α Aquarii	ε Pegasi		
Circle,	−.02	.16		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	−0° 54′	+9° 20′		
	h m s	h m s	h m s	h m s
Wire, I.	58.8	39.2		
II.	1.0	41.4		
III.	3.0	43.5		
IV.	5.1	45.6		
V.	7.2	47.7		
Sum,	75 1 15.1	217 4		
Mean,	3.02	43.48		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	21 59 38.33	21 38 18.52		
Error of Timepiece,				

1.52
16
914
152
.24
1.58
1.34

+2 24.69 +1.55 = 2 26.24
+2 24.96 +1.34 = 2 26.30

2 26.27
24.08
2.19
+1.10 daily rate.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 5 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, F. 1327 Recorder, F. W.

Object,	η Serpentis	ξ Aquilae	α Ophiuchi	
Circle,	-.05	.25	.22	
	w · e	w · e	w · e	w · e
Level Direct,	. · .	. · .	. · .	. · .
Reversed,	. · .	. · .	. · .	. · .
Sums,	. · .	. · .	. · .	. · .
Difference,				
b.	-2° 56′	+13° 41′	+12° 39′	
	h m s	h m s	h m s	h m s
Wire, I.	17 27.7	14.7	31 43.5	.
II.	29.8	16.8	45.6	.
III.	31.8	18.9	47.7	.
IV.	33.9	20.9	49.9	.
V.	36.0	23.0	52.0	.
Sum,	9.2	44.3	38.7	.
Mean,	31.84	18.86	47.74	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	18 15 06.01	18 59 53.~~27~~ .81	17 39 21.56	.
Error of Timepiece,	.	.	.	.

15.2
.5
.08
1.~~5~~58
1.66

2 25.83 + 1.66 = +2 27.49

~~2 25.09~~ 96

26.78 + 1.20 = +2 27.38

.87

+2 27.44 Error of 1327

26.27

20 | 1.17 100 170

1.058
24
23.2
11.6
1.39.12
27.44
28.83
+2

15.2
22
30.4
30
33
1.52
1.20

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 7 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, Few.

Object,	α aquarii			
Circle,	-.02			
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	-0° 55			
	h m s	h m s	h m s	h m s
Wire, I.	2.4	.	.	.
II.	4.5	.	.	.
III.	6.6	.	.	.
IV.	8.7	.	.	.
V.	10.8	.	.	.
Sum,	35.0	.	.	.
Mean,	6.60	.	.	.
Bb,	.	.	.	.
Ce,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	21 59 38.30	.	.	.
Error of Timepiece,	.	.	.	.

15$^{8}_{2}$ 2 28.30 + 1.60 = 2 29.90 Err of 1327

27.44

2, 4 6

15

24) 1.15 (.05

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct 8. 1879. Instrument, Mer. Ci. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	η Serpentis	κ Draconis	λ Aquilae	ε Leonis
Circle,	−2° 56′	+72° 41	−5° 4′	+24° 20′
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	−.05	3.21	−.09	+.45
	h m s	h m s	h m s	h m s
Wire, I.	31.0	~~59.9~~ 46.1	2 18.0	41 27.8
II.	33.1	52.9	20.1	30.0
III.	35.2	59.9	22.1	32.3
IV.	37.2	6.8	24.3	34.5
V.	39.3	13.8	26.2	36.8
Sum,	25 8	179 5 120.5 299 5	10 9	11 4
Mean,	35.16	59.90	22.14	32.28
Bb, Cc, Aa,				
Corr'd Transit, R. A.	18 15 5 96	18 23 12.01	18 59 53.04	9 39 01.75
Error of Timepiece,				+2 30.53 90 +2 31.43 gmt 1327.

~~2 47.89 + 3.21 m.~~

1.52
5
.05

.15

2 29.20 + 1.63 = 2 30.83
2 29.10 + 1.73 = 2 30.83
2 30.83

.045
17
315
45
.765
10
.85
83
2 31.48

45
25
225
90
1.12

1.43
.83
.60

200
30.83
+2 32.83

1.52
.45
760
608
.684
1.58
.90

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 12 1879. Instrument, Mer. Ci. Observer, W. ak.

Timepiece, 1327 Recorder, F.W.

	h	m	s	h	m	s	h	m	s	h	m	s
Object,	α aquarii											
Circle,	−0° 54′											
	w		e	w		e	w		e	w		e
Level Direct,												
Reversed,												
Sums,												
Difference,												
b.												
Wire, I.			78.9									
II.			10.0									
III.			12.1									
IV.			14.2									
V.			16.2									
Sum,			10 4									
Mean,			12.08									
Bb,												
Ce,												
Aa,												
Corr'd Transit,												
R. A.	21	59	38.25									
Error of Timepiece,												

+2 33.83 +1.60 = +2 35.43

1.60

30.83

35.43
30.83
4.60

4,14.50
1.12

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 13 1879. Instrument, 1327 Observer, W.ak.

Timepiece, Mer. Cl. Recorder, Tw.

Object,	α Aquilae	ε Pegasi		α Can. min.
Circle,	−0° 54′	+9° 19′		+5° 32′
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	−.02	+.16		.10
	h m s	h m s	h m s	h m s
Wire, I.	8.5	41 48.9		35 32.0 34.2
II.	10.5	50.9		36.2
III.	12.6	53.0		38.4
IV.	14.6	55.1		40.3
V.	16.7	57.2		
Sum,	129	151		311
Mean,	12.58	53.02		36.22
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	21 59 38.22	21 38 18.40		7 33 01.40
Error of Timepiece,				

152
16
912
152
.24
1 ~~48~~
1.34

+ 2 34.36 + 1.60 = + 2 35.96
+ 2 34.62 + 1.34 = + 2 35.96

Smf. 1327 + 2 35.96

+ 2 34.82 + 1.43 = + 2 36.25

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct 14 1879. Instrument, ... Observer, ...

Timepiece, 1327 Recorder, ...

Object,	α Can. Min.		γ Pegasi	
Circle,			+14° 31	
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
got level today Sums,	. .	. .	. .	. .
Difference, ~~level made~~				
b. +.15			.26	
	h m s	h m s	h m s	h m s
Wire, I.	33.0	.	44.7	.
II.	35.0	.	~~47.1~~ 37 1	.
III.	37.1	.	39 3	.
IV.	39.2	.	41.4	.
V.	41.1	.	43 4 45 6	.
Sum,	35.4	.	6 8	.
Mean,	37.08	.	41.36	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	7 33 01.40	.	0 7 4.85	.
Error of Timepiece,	.	.	.	.

+2 35.68
1.43
Emf 1327 +2 37.11
36.25
.86

152
26
912
304
38 52
1.58
1.20

+2 36.51
1.20
+2 37.71 Emf 1327.
11
16|61 |.04

71
38
38 .09

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 17 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W. Oct. 17.8

Object,	α Aquilae	β Aquilae		α Hydrae
Circle,	+8°33'	+6°7'		-8°8'
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b. +.15	.15	.11		-.14
	h m s	h m s	h m s	h m s
Wire, I.	30.9	0.3	~~18.2~~	18.2
II.	33.9	2.4	~~20.2~~	20.2
III.	35.0	4.5	~~22.3~~	22.3
IV.	38.1	6.6	~~2 .3~~	24.3
V.	39.2	8.7	~~.4~~	26.4
Sum,	30 1	22 5		11 4
Mean,	35.02	4.50		22.28
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	19 44 55.95	19 49 25.40		9 21 41.27
Error of Timepiece,				

15
15
.25
1.58
.33

+2 39.07 + .33 = +2 40.40
2 39.10 + 1.40 = 2 40.50
.90
+ 2 40.45
Er of 1327

15
14
608
15
.2128
1.58
1.37

+ 2 41.01
1.37
+ 2 42.38

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 20 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object, Circle,	E. Pegasi +19°20'	α aquarii −0°54'	Polaris L.C. 88°40'16'	
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b. +.15	.16	−.02	−43.13	
	h m s	h m s	h m s	h m s
Wire, I.	56.0	15.8	42.9 48.0	
II.	58.1	17.9	54.7	
III.	00.2	19.9	13 17 15.2 21.2 26.0	
IV.	2.3	22.0	43.0 51.0	
V.	41m 4.4	24.0	1 56.5	
Sum,	121.0	99.6	358.5 180 178.5	
Mean,	00.20	19.92	19.83	
Bb, Ce, Aa,				
Corr'd Transit,			20.33	
R. A.	21 38 18.33	21 59 38.16	1 15 31.95	
Error of Timepiece,				

15.2
16
91.2
15.2
.24
1.58
1.34

4.25
600
17
24

4.07
0.92
6 | 3.15
.52
4
208
13
221

0.92
2.24
43.13

+2 41.87 + 1.34 = 2 43.21
+2 41.76 + 1.60 = 2 43.36
57
+ 2 43.28

2 41.87 + 1.13 = 2 43.00
2 41.76 + 1.35 = 2 43.11
43.06

+ 48.48 − 43.13 n
2 41.76 + .02 n
53.38 + 43.15 n

43.11 | 53.38 | −1.24 = n.
43.11
10.270
8622
1648

.124
16
744
124
198

1.24
91
124
1116
1.13
20
1.33 = m.

15
131
675
131
.20

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 21 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	α Aquilae			
Circle,	+8° 33'			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.15			
	h m s	h m s	h m s	h m s
Wire, I.	47 34.6			
II.	36.7			
III.	38.8			
IV.	40.8			
V.	43.0			
Sum,	193.9			
Mean,	38.78			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	19 44 55.90			
Error of Timepiece,				

1.24
.15
6 20
1 24
.1 8 6 0
1.3 3
1.1 5

+2 42.88 +1.15 V
1.15
+2 44.03

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct 23 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	β Leonis		oct 24 α Hydrae	α Leonis
Circle,	+15° 15′		−8° 9′	+12° 33′
	w · e	w · e	w · e	w · e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.27		.14	.22
	h m s	h m s	h m s	h m s
Wire, I.	12 × 32.0		23.0	40.6
II.	36.2		25.1	42.7
III.	44.8		27.1	44.8
IV.	49.1		29.1	47.0
V.			31.2	49.2
Sum,	162.1 40.52		135.5	224.3
Mean,	12 × 40.52		27.1	44.86
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	11 42 55.62		9 21 41.32	10 1 58.56
Error of Timepiece,				

1.24
.27
868
248
.3348

+2 44.90 +100
1.00
2 45.90
30

1.24
14
496
124
.1736
1.33
~~.16~~
1.50

+2 45.78
1.50
+2 47.28

124
22
248
248
.2728
1 33
1.06

+2 46.30
1.06
2 47.36 Emf 1377
45.90
+1.46 rate.
24) 1.46 1.061
14 4
20
14
244
61
.85
47.36
2 48.21

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 26 1879. Instrument, Meri. Observer, W. a R.

Timepiece, 1327 Recorder, F.W.

Object,	η Pegasi		α Peg					
Circle,	+29°36'		+14°34'					
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.	.57		.26					

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			8.1			30.6			32.7			.
II.			10.4			32.7			34.8			.
III.			12.9			34.8			36.9			.
IV.			15.3			36.9			39.0			.
V.			17.5			39.0			41.2			.
			14 2			24 0			34 6			
Sum,			.			.			.			.
Mean,			12.84			34.8			36.92			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	22	37	23.74	22	58	48.18			.			.
Error of Timepiece,			.			.			.			.

+2 49.10 + .63 = 2 49.73
+2 48.74 + 1.00 = 2 49.74

124
57
868
620
7068
133
.63

124
2
744
248
.3224
1.33

49.73
47.36
2 | 2.37
1.20

50.33

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct 27 1879. Instrument, Mer. Cir. Observer, Prat

Timepiece, 1327 Recorder, F.W.

Object,	γ Pegasi			
Circle,	+14° 31'			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.26			
	h m s	h m s	h m s	h m s
Wire, I.	49.7			
II.	51.9			
III.	54.0			
IV.	56.1			
V.	58.2			
Sum,	19 9			
Mean,	53.98			
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	0 7 4.83			
Error of Timepiece,				

1 24
26
7 44
2 4 8
.32 24

+ 2 49.15
1.00
2 50.15
Err. f. 1327 + 2 50.15
~~51.35~~
47.36
2.5 | 2.7 92 1.10
2.5
29

2 50.15
1.80
2 51.95

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 29 1879. Instrument, Mer Cir. Observer, W.A.R.

Timepiece, 1327. Recorder, F.W.

Object,	α Pegasi				δ Leonis			
Circle,	+14° 13′				+21° 11′			
	w	*e*	*w*	*e*	*w*	*e*	*w*	*e*
Level Direct,								
Reversed,								
Sums,								
Difference,								
b.	+.25				+.39			

	h	*m*	*s*	*h*	*m*	*s*	*h*	*m*	*s*	*h*	*m*	*s*
Wire, I.			33.2						28.2			
II.			35.3						30.3			
III.			37.4						32.5			
IV.			39.5						34.8			
V.			41.6						37.1			
Sum,			37.0						12.9			
Mean,			37.40						32.58			
Bb,												
Cc,												
Aa,												
Corr'd Transit,												
R. A.	22	58	48.15				11	7	43.11			
Error of Timepiece,												

124
25
.31
1.31
1.00

+ 2 49.25
1.00
+ 2 50.25

Err of 1327

130
39
117
39
.507
1.35
.85

+2 49.47
85
+ 2 50.32

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Oct. 30 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, P.W.

Object,	β Aquarii	α Virginis	Sun.	
Circle,	−6° 6′	−10° 32′	−14° 9′	
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. ~~40.8~~ ~~43.0~~ ~~44.9~~	. .
Difference,			24 1.9	
b.		−.18	−.25 4.1	
	h m s	h m s	h m s	h m s
Wire, I.	59.9	35.8	6.2 8.4 10.6	.
II.	2.0	37.9	25 41.4	.
III.	4.1	40.0	43.4	6.2 105.5 21117 .
IV.	6.0	42.2	45.5 47.9	55.8 .
V.	8.1	44.3	50.0	.
Sum,	20 1 .	00 2 .	259 4 300 55 94	.
Mean,	4.02	40.04	.	.
Bb,	.	.	~~22 13.1~~ 22 11.31	.
Cc,	.	.	3.89	.
Aa,	.	.	22 07.42 .	.
Corr'd Transit,	.	.	24 55.94	.
R. A.	21 25 55.55	13 18 51.47	22 07.42 ~~24 55.94~~	.
Error of Timepiece,	.	.	.	.

1.24
12
14
1.31
1.45

2 48.87
1.45
2 50.32 Err of 1327.

+2 48.57
1.54
+2 50.11

1.30
18
104
13
23
1.31
1.54

+2 48.52
1.62
+2 50.14 by sun.
2 50.11 by α virginis.

1.30
25
65
26
.325
1.30
1.62

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, oct. 31 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, F.W.

Object,	α Urs. Min. L.C.	α virginis.		
Circle,	88° 40' 19"	-10° 32'		
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. | .	. | .	. | .	. | .
Difference,				
b.	− 43.12	−.18		
	h m s	h m s	h m s	h m s
Wire, I.	49 2 54 5	35.8	.	.
II.	0.1 17m 20 7	37.9	14/20 44.066 40.917	.
III.	25.2	40.0	3.149 3.15 .6398	.
IV.	31 1 50.3	42.2	5 .1575 14 14 2559 2	.
V.	54 8 1.0	44.3	6300 6398 157 8957 2 220	.
Sum,	286 9 ~~180~~ 466 9 226 9	0 2 .	40 92 43.12 .	.
Mean,	25.21	40.04	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	1 15 32 05	13 18 51.50	.	.
Error of Timepiece,	.	.	.	.

1 53.16 − 43.12 n
2 48.54 − .18 n

0 = − 55.38 − 42.94 n

42.94 ⌋ 55.38 ⌊ -1.30 = n.
42.94
12440
12882

.18
1040
130
.14
1.35
1.49

2 48.54
1.50
50.04 Err of 1327
+2

32
16 ⌋ 28 ⌊ 18
16
120

50.04
.6
2 49.44

22
13
9
18
.162

37
21
16

18
24
72
36
.43
.16
.59

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 3d 1879. Instrument, B. T. Observer, FW.

Timepiece, 236 ~~+327~~ Recorder, FW

Object,	β Cancri	o Urs Maj.	δ Cancri	ε Hydrae
Circle,	E	W	W	W
Level	w / e	w / e	w / e	w / e
Direct,	19.4 / 18.5	20.0 / 18.2	. / .	. / .
Reversed,	20.0 / 18.2	. / .	. / .	. / .
Sums,	39.4 36.7	18.6 32.8 47.7 2.5	. .	.
Difference,	3)2.7(.009	.	.	.
b.	+9°34′	+61°49′	18°36′	+6°52′
Wire,	h m s	11 h 9 m s	h m s	h m s
I.	56.4	16.7 31.8	46.7	21.4
II.	7.7	21 46.7	8.9	42.5
III.	10 39.4	~~26~~ 1.8	38 ~~33~~ 31.4	41 ~~36~~ 3.9
IV.	1.2	15.8 29.7	54.3	25.7
V.	22.7	4460 4200 15)2604(1.73 15 110 105 50 44.8 59.7 14.8 28.9 43.7	16.5	46.4
Sum,	137.4 197.4		157.8	139.9 19.9
Mean,	39.48	1.73	31.56	3.98
Bb,	,86 .	1,96 .	,97 .	,82 .
Cc,	1.02 +.20	2,07 −.42	1,05 −.21	1,01 −.20
Aa,	,54 +2,16	−,66 −2.64	43 +1.73	,58 2.32
Corr'd Transit,	41.84	8.67	33.08	6.10
R. A.	8 9 61.11	8 20 18.28	8 37 52.47	8 40 25.78
Error of Timepiece,	+ 40.73	40.39	~~08~~ + 40.61	+ 40.32

assume c = +.20 C.E.

9h 15 20 = 1327
13 13.25 = 236

40.55
12 32.70
15 20.00
+2 47.30 Err of 1327.
2 50.04
90) 2.74 i.03 hourly rate.
27

24
3
72

8 40 25.78
20 18.28
α′−α = 20 07.50
20 2.77
124) 4.73) +4.00 S

25
9
16
3
.48
47.30
= 46.82

58
232

54
4
216

66
264

~~26~~ 1.01
41 3.78
21 1.01
20 2.77

40.73
40.61
40.32
166
+40.55

mean 236

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 5 187 . Instrument, Mer. Ci. Observer, W.a.R.

Timepiece, 137 Recorder, S.W.

Object,	ξ Cygni			
Circle,	+29°44′			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+57			
	h m s	h m s	h m s	h m s
Wire, I.	10 29.4			
II.	31.8			
III.	34.3			
IV.	36.6			
V.	39.1			
Sum,	21.2			
Mean,	34.24			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	21 7 50.12			
Error of Timepiece,				

1.3
57
51
65
.701
1.35
65

2 44.12
.65
2 44.77
50.04
5.27
51 1.05

.045
70
25

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 6-7 1879. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, F.W.

Object,	Sun.			
Circle,	-16°.3			
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. 135.3 43.25 178.55 89.25 29.25	. .	. .	. .
Difference,				
b.	-.29			
	h m s	h m s	h m s	h m s
Wire, I.	51m 34.1 36.6	.	.	.
II.	38.6 40.9	.	.	.
III.	43.2 53 15.3	.	.	.
IV.	17.1 19.4	.	.	.
V.	21.7 23.7	.	.	.
Sum,	290.6	.	.	.
Mean,	52m 29s.06	.	.	.
Bb,	51.88 3.88	.	.	.
Ce,	48.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	14 49 48.00	.	.	.
Error of Timepiece,	.	.	.	.

1.3
3
.39
.38
1.35
1.73

+2 41.06
1.73
+2 42.79 Sun f 1327.
44.77
40) 2.00 (.05

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 9 187 . Instrument, Mer. Ci. Observer, W.A.R.

Timepiece, 1327 Recorder, P.W.

Object,	δ Leonis		Nov. 10 ~~ε Bootis,~~	γ Pegasi
Circle,	+21° 11'		~~+14°49'~~,	+14°31'
	w e	w e	w +27°35' e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.36			
	h m s	h m s	h m s	h m s
Wire, I.	15.5		15.4	35.6
II.	17.7		17.7	37.9
III.	19.9		20.0	40.0
IV.	22.1		22.3	42.2
V.	24.3		24.7	44.2
Sum,	49.5		100.1	49.9
Mean,	19.90		20.02	39.98
Bb,				
Cc,				
Aa,				
Corr'd Transit,			14 39 43.85	
R. A.	11 7 43.42		~~14 10 10.43~~	0 7 4.74
Error of Timepiece,				

130
36
78
39
468
.35
.89

+2. 36.48
89
2 37.37
42.79
5.42
15
3 5.27
1.75 0.7

13
52
156
52
.676
1.35
.68

2 36.17
.68
2 36.85
37
48

26
13
78
26
.338

2 35.24
1.00
+2 36.24

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 10 1879. Instrument, Merid. Observer, WAR.
Timepiece, 1327 Recorder, A.W.

Object,	ζ Leonis			
Circle,	+24° 0′			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.44			
	h m s	h m s	h m s	h m s
Wire, I.	31.6			
II.	33.7			
III.	35.9			
IV.	38.1			
V.	40.6			
Sum,	29 9			
Mean,	35.98			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	10 9 61.14			
Error of Timepiece,				

135
.44
.52
.52
.572
1.35
.78

+2 34.84
.78
+2 35.62 Err 1327
36.85
1.23
28
1.51
35.62
1.13
34.11

35.62
4.50
31.12

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 15 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Nov. 16. Recorder, P.W.

Object,	δ Leonis	Polaris	Nov. 16. 1879 β Leonis	ε Virginis
Circle,	+16° 5′	−43.25	+2° 27′	+11° 36′
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.	+.39 +21° 11	88° 40′ 26.0″	+.4	.21
	h m s	h m s	h m s	h m s
Wire, I.	6.8	55.4 29.5 34.8		34.3
II.	9.0	55.0 17m 02.	21 .3	36.4
III.	11.3	7.3	23 .3	38.5
IV.	13.4	24 3 30.9	25 .3	40.7
V.	15.6	35.4		42.8
Sum,	6. 1	24 2 8 2.8		42 7
Mean,	11 22	17 0.31	23 30	38.54
Bb, Cc, Aa,		44.066 40.917 3.149 .525 4 2.10 23 2.33 40.92 43.25		
Corr'd Transit, R. A.	11 7 43.59 ~~11 7 56.64~~	13 15 27.57	11 44 26.50	12 56 11.77
Error of Timepiece,		525 88 26 528 176 2288		

13
39
117
39
.50
1.35
.85

~~2 14.58~~
+2 27.63
85
+2 28.48
35.62
5)17.14(1.40
5
21
20
1

5
1.30

2 26.80
1.30
+2 28.10

+2 26.77
1.08
+2 27.85

13
21
13
26
.27
1.35
1.08

+1 32.74 − 43.35 m
2 26.77 + .21 m
54.03 + 43.56 m
43.56)54.03(−1.24 m.
43.56
10.47
8712
17580

1.24
.91
124
1116
1.1284
20
1.32 = m.

15
1.35
675
135
2.025

17 0 93
15 27
+1 33
93

72
186
651
124)6696(54
620
496

28.
1 3 3
5 5
7 5 0
1 5
38
124)3960(32
372
240

124 : 72 :: 93 :

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 17 187 . Instrument, Mer. Ci. Observer, W.A.R.

Timepiece, 1327 Recorder, FW Nov. 20. 79

Object,	α Androm			α Ophiuchi
Circle,	+28° 26'			+12° 39'
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.54			+.22
	h m s	h m s	h m s	h m s
Wire, I.	34.7			39.0
II.	37.0			41.1
III.	39.4			43.2
IV.	41.7			45.3
V.	44.0			47.5
Sum,	46.8			16.1
Mean,	39.36			43.22
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	0 2 12.42			17 29 21.11
Error of Timepiece,				

124
54
496
620
.6696
132
.65

+2 26.94
.65
+2 27.59
27.85
11) .26 (.024 hourly rate 1327
22
40
20
96
48
.576

.58
3
1.74
27.59
+2 25.85

1.24
22
248
248
.2728
132
.05

+2 22.11
1.05
23.16 Err. 1327
+2 27.59
89) 4.43 (.05 hourly rate 1327
445

77
17
89

23.16
30
+2 22.86

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 23 1879. Instrument, Mer. Circ. Observer, A. S.

Timepiece, 1327 Recorder, O. C. W.

Object,		ν Arietis	δ Ceti,	41 Arietis.
Circle,				
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	36 H. Cass. 27 14.2 (6)	1st pt. 2 33 25.1	9 2 35 37.5 ang	last part. 2 45 15.4
II.	25.5 (8)	27.1	39.6	17.7
III.	35.0 (9)	29.5	41.7	20.0
		31.7	43.7	
IV.	.	34.4	45.8	.
V.	.	.	.	.
Sum,	.	147.8 33 29.6	208.3 35 41.7	53.1 45 17.7
Mean,	.	.	.	.
Bb, n tan δ	.	− 48	− 00	− .63
Cc,	.	+ 1.32	+ 1.32	+ 1.32
Aa, m	.	.	.	.
Corr'd Transit,	.	2 33 30.44	2 35 43.02	2 45 18.39
R. A.	.	2 32 2.17	2 33 21.78	2 42 57.27
Error of Timepiece,	.	1 28.27 wrong star	2 21.24	2 21.12

n assumed −1.24

m "

Δt = 2 23.16 Nov. 20.1

Δt = 2 21.18 Nov. 23.4

1.98 3.3

.18

T. 1327 loses .06 in 0.1 of a day

39
78
1.56
−.4836

505
1010
2020
62620

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 23-4 1879. Instrument, Mer Observer, Wak

Timepiece, Nov. 24. 1879 Recorder, F.W.

Object,	Sun		α ~~Leonis~~ Hydrae	
Circle,	−20° 36′		−8° 9′	
	w · e	w · e	w · e	w · e
Level Direct,	· ·	· ·	· ·	· ·
Reversed,	· ·	· ·	· ·	· ·
Sums,	· ·	· ·	· ·	· ·
Difference,				
b.	−.38		−.14	
	h m s	h m s	h m s	h m s
Wire, I. 4 19 180 239	0 40 2 42.4 44 6	0 40.2	56.0	.
II.	46.8 49 0	3 43.7	58.0	.
III. 0 49 3 47 6 4 3 18 2	3 34 7 37 0	4 ~~4~~ 39	0.1	.
IV.	39.2 41.4	2 11.95	2.0	.
V.	43.7	.	4.1	.
Sum,	419 0 240. 179	.	2 .	
Mean,	2m 17.90	.	0.04	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	15 29 29.83 wrong		9 21 42.86	.
Error of Timepiece,	.	.	.	.

124
38
99 2
~~3~~ 37 2
.471 2
1.32
1.79

+2 18.07
1.79
+2 19.86 Err of 1327
2 23.16
14.30 L
3| 4.40 L 1.47 daily rate
3
14
12 w
24| 147 L .06 ~~daily~~ hourly rate

1 24
14
49 6
1 24
17 36
1.32
1.49

+2 17.68
1.49
+2 19.17 Err of 1327
66
+2 18.51

21.19
19.17
31| 2.02 L .065
18 6
16 0

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 25 1879. Instrument, Merid. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	γ Pegasi		November 25–6 α Serpentis	
Circle,	+14° 31'			
	w e	w e	w e	w e
Level Direct,			+6° 49'	
Reversed,				
Sums,				
Difference,				
b.	.25			
	h m s	h m s	h m s	h m s
Wire, I.	17.3		31.9	
II.	19.5		34.0	
III.	21.6		36.1	
IV.	23.7		38.2	
V.	0 9 25.8		40.3	
Sum,	107.9			
Mean,	21.58		36.10	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	0 7 4.62		15 38 20.77	
Error of Timepiece,				

124
.31
1.32
1.01

+2 16.96
1.01
+2 17.97 Err. of 1327
19.17
15) 1.20 1.07
13
.91

124
12
248
124
.1488
132
~~1.47~~
1.17

+2 15.33
1.17
+2 16.50 Err. of 1327
17.97
) 1.47

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 26 1879. Instrument, Mer. Cir. Observer, W. a. R.

Timepiece, 1327 Recorder, F. W.

Object, Circle,	γ Pegasi		Sun. Nov. 26—7. 1879.	
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.	+.25			
	h m s	h m s	h m s	h m s
Wire, I.	15.1		15 4 15 99 1 03 15 52 14 54.9 57.2 59.6	
II.	17.2	.015972 .000474 .016446	1.6 4.0 16 39.2	
III.	19.3		41.4	
IV.	21.5		43.6	
V.	23.6	4 16.08 240 246.08	45.9 48.1	
Sum,	46.7	2.391076 2.216087	396.5 1.20. 516.5	
Mean,	19.34	.607663 4.038	15 51.65	
Bb, Ce, Aa,				
Corr'd Transit, R. A.	0 7 04.62		16 12 39.52	
Error of Timepiece,				

+2 14.72
1.01
2 15.73 Err of 1327.
17.97
24) 2.24 (.093 hourly rate.
216
80

13
279
93
1.209

15.73
1.25
14.48
2 21.15
65
2 12.33
11.52

+2 12.13
1.80
2 13.93 Err of 1327
15.73
16) 1.80 (.112 hourly rate.
16
20
16
40

139
1.24
39
1116
372
.4836
1.32
1.80

13.93
3.10
2 10.83

.112
.093
205
.103
24
412
206
2.47

2.47
60
3.07

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Nov. 29 1879. Instrument, Mer. Cir. Observer, Wark

Timepiece, 1327 Recorder, F.W.

Object,	δ virginis	ε virginis		
Circle,	+4°3'	+11°36'		
	w · e	w · e	w · e	w · e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.07	+ 20		
	h m s	h m s	h m s	h m s
Wire, I.	51 34.8	13.4		
II.	36.8	15.5		
III.	39.0	17.6		
IV.	41.0	19.7		
V.	43.1	21.8		
Sum,	194.7	38.0		
Mean,	38.94	17.60		
Bb,				58.00 2 06 55 54 57 10 +1 16
Cc,				
Aa,				
Corr'd Transit,				58.0 = 1327
R. A.	12 49 33.48	12 56 12.07		57.10 = 3451
Error of Timepiece,				

124
7
.086 8

132
9
1.23

124
20
.24 8
25
1.32
1.07

+2 05.46 + 1.23 = +2 06.69
+2 05.53 + 1.07 = 2 06.66
+2 06.64 Err of 1327.
13.73
7.29
36
37.65 L 2.55 rate
6
16
15
15

6.64
2.55
+2 04.09

2 0 00 = 3451
56.75 = 1327
2 06.64
50.11
00 00
+1 09.89 Err of 3451

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, nov. 30 1879. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	δ Leonis			
Circle,	21° 11			
	w / e	w / e	w / e	w / e
Level Direct,	. / .	. / .	. / .	. / .
Reversed,	. / .	. / .	. / .	. / .
Sums,	. / .	. / .	. / .	. / .
Difference,				
b.	+.36			
	h m s	h m s	h m s	h m s
Wire, I.	42.5	.	.	.
II.	44.7	.	.	.
III.	47.0	.	.	.
IV.	49.~	.	.	.
V.	51.3	.	.	.
Sum,	34.7	.	.	.
Mean,	46.94	.	.	.
Bb,	.	.	.	.
Ce,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	11 7 44.08	.	.	.
Error of Timepiece,	.	.	.	.

1.24
.36
744
372
.4464
.44
132
.88

+2 02.86
88
+2 03.74 Err of 1327
6.64
2.90
24 | 3.00 | .125 hourly rate
24
60
48
120

3.75
1.25
2.50
+2

3645
21 18
15 27
125
625
125
1.875
1.93
2.50
0.57
+2

1.25
24
125
48
1000
500
600

03.74
60
57.74
+1

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 1 1879. Instrument, Mer Ci Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,		γ Virginis	Polaris S.C.	
Circle,		−0° 47′	88° 40′ 30″	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,			80.27 79.61 .66 33 79.61 79.94	
Difference,				
b.		−.01	−43.28	
	h m s	h m s	h m s	h m s
Wire, I.		37 29.7		4|3.149
II.		31.8	26.8	787 8
III.		33.8	16 30.3	2361
IV.		35.8	38.3 65.1	40.917 8
V.		37.9	32.55	43.27
Sum,		19.0		
Mean,		33.80	16 32.55	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.		12 35 34.93	1 15 19.94	
Error of Timepiece,				

1.07
91
1.07
963
.9737
20
1.17

12 20 48.35 = 1327
00 = 3451

12 20 48.35
2 00.05
~~11.30~~
48.30
00.00
+1 11.70

Err of +3.451

+1 58.87 − .01
1 12.61 − 43.28

+ 46.26 + 43.27

4327 | 46.26 | −1.07 = n.
4327
4327 | 309 |

60.05
1.21
+1 58.84

21 05
12 35
8 30

144
8
1.142
7
1.21

+1 12.61 − 43.28

1 58.87
1.18
00.05 Err of 1327.
2 3.74 hourly rate.
25.5 | 3.69 | .144
25.5
1140
1020
1200

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 2 187 . Instrument, Mer.Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W. Dec. 3

Object,	γ virginis		ε virginis				α virginis	
Circle,			+11° 36′				−10° 31′	
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.			1.21					
	h m	s	h m	s	h m	s	h m	s
Wire, I.		26.8		4.0		.		41.1
II.		29.0		6.1		.		43.2
III.		31.0		8.3		.		45.3
IV.		33.1		10.4		.		47.4
V.		35.1		12.5		.		49.6
Sum,		0		41.3		1.07 .18		26.6
Mean,		31.00		8.26		8.56 1.07 1.926		45.32
Bb,		.		.		.192		.
Cc,		.		.		1.17		.
Aa,		.		.		1.36		.
Corr'd Transit,		.		.		.		.
R. A.		34.95	12 56	12.16		.	13 18	52.26
Error of Timepiece,		.		.		.	+1	53.06 1.36 1 54.42

1 12.45 hourly rate of 3451
1 11.70 +.030
24 .75

1 56.05
1.18
1 57.23

1 54.42
57.05
24 2.63
5
2.58 .107
24
18

1 13.87
12.45 +.050
28 1.42 .050 rate 3451
1.40

+1 56.10
.95
+1 57.05 E. of 1327
13.74
16.69
48 16.43 26
48
163
144
190
+.134 hourly rate

1.07
.21
1.07
2.14
.2247
1.17
.95
9
1.206
157.05
+1 55.85

1.34
.16
8.04
1.34
.144
2.85
55
53.71

3451 =
1327 = 12 44 44.60
00 00
1 57.05
47.55
00
12.45
+1 Emporal

00 = 3451
40.20 = 1327
16.50
1 54.07
46.13
00
+1 13.87
Error of 3451

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 4 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W. Dec. 6.

Object,	δ Virginis		η Bootis	
Circle,			.34	
	w · e	w · e	w · e	w · e
Level Direct,	· ·	· ·	· ·	· ·
Reversed,	· ·	· ·	· ·	· ·
Sums,	· ·	· ·	· ·	· ·
Difference,				
b.	+.07		18°6'	
	h m s	h m s	h m s	h m s
Wire, I.	20.1	·	38.5	·
II.	22.1	·	40.6	·
III.	24.2	·	42.7	·
IV.	26.3	·	45.0	·
V.	28.3	·	13 50 47.2	·
Sum,	21 0	·	14 2	
Mean,	24.20	·	42.84	Dec. 6
Bb,	·	·	·	00 00 =3451 13 35 30.15 =1327 1 45.60
Cc,	·	·	·	+ 44.55
Aa,	·	·	·	00 +1 15.45 Enf 3451
Corr'd Transit,	·	·	·	12.45 3.00
R. A.	12 49 33.63	·	13 48 58.04	~~1.00~~ ~~1.00~~ .04 96 40
Error of Timepiece,	·	·	·	15.45 13.87 68)1.58(.023 rate. 136 220 204 16

107
7.
.0749
1.17
1.10

1 50.57
1.10
+1 51.67 Enf 1327
54.42
2.75
5
2.80 1.17 hourly rate.
24
40
24
160

1.17
6
1.23
51.67
+1 50.44

51.67
2.92
48.75

107
34
428
321
3638
1.17
0.81

1 44.80
.81
+1 45.61 Enf 1327
2.90
1 42.71

3.00
60
43

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec 8 1879. Instrument, Mer. Ci. Observer, W. A. R.

Timepiece, 1327 Recorder, F. W.

Object,	ε Virgin	Polaris L.C.		
Circle,	4° 36′	−43.30		
	w | *e*	*w* | *e*	*w* | *e*	*w* | *e*
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. | .	. | .	. | .	. | .
Difference,				
b. = +.14	20			
	h m s	*h m s*	*h m s*	*h m s*
Wire, I.	46 .7	26.0 30.9	.	18 , 58 15.45 3.13 7 3.20 .066 24)1.60 .067 1 44 160
II.	48 .9	36.4	.	.
III.	51 .0	16 55.9 0.0 8.4	.	.
IV.	53 .1	26.7 30.5	.	.
V.	55 .2	36.3	.	.
Sum,	4.9	25 11 9)11.1	.	
Mean,	50.98	16 1.23	.	
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	12 56 52.35	13 15 15.08	.	.
Error of Timepiece,	.	.	.	.

107
20
2 40
1 17
.96

1 20
91
20
1 08 0
1 09
1.20
1.29

~~17.23~~
+1 38.63
96
39.59
+1 39.59
45 6.1
6 .02

1 38.63
1.05
+1 39.68 Enf 1327.

24 6.10
24)3.05 1.27
24 65
48
170

46.15 −43.30 m
+ 98.63 + .20 m
52.48 + 43.50 m

43.50) 52.48 (−1.20 = m.
43 50
8.980
8 700
2800

0000 = 3451
12 15 21.15 = 1327
1 39.93
41.42
00.00
+ 1 18.58 Enf 3451

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 9 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	α Arietis	β Arietis		
Circle,	+22°53′	+20°13′		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.42	.37		
	h m s	h m s	h m s	h m s
Wire, I.	58.9	35.2		
II.	1.3	37.4		
III.	3.5	39.5		
IV.	5.8	41.7		
V.	8.0	43.9		
Sum,	17.5	47.7		
Mean,	3.50	39.54		
Bb,			[illegible] = 3451	
Cc,			1 10 20.1 = 1327	
Aa,			1 37.95	
Corr'd Transit,			42.15	
			[illegible]	
R. A.	2 0 26.39	1 47 62.41	+1 17.85	
Error of Timepiece,				

12
42
24
48
.504
1.20
.70

12
37
84
36
.444
1.20
.76

1 37.11 +.70 = 1 37.81
1 37.13 +.76 = 1 37.89

1 37.85
1 39.68
13 | 1.83 | .141 rate of 1327.
13
53
52/10

564
282
3.384
6.76
6.785
37.8
31.09
+1 31.09

error of 1327.

13
4/24
4/12
5/5
6.3
37.85
+1 31.61

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 11-12 1879. Instrument, Mer Ci. Observer, W.A.R.

Timepiece, 1327 Recorder, P.W.

Object,	Sun.		α Androm.		γ Pegasi			
Circle,	−23° 06′		+28° 26′		+14° 31′			
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.	.43		.04		.25			

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.		17	51.6 54 0			36.8			29.3			.
II. 17 51.6 20 58.7			56.2			38.9			31.5			.
III. 50 3 25			58 4 0 7			41.3			33.5			.
IV.		20	49.7 52 0			43.7			35.7			.
V.			54.1 56 3 58.7			46.3			37.8			.
Sum,			489 7 240 249 7			7 0			17 8			.
Mean,		19	24.97			41.40			33.56			.
Bb, 17 18 0.56 17 13 35.84			.			.			.			.
Cc, 4 24.72 240			.			.			.			.
Aa, 264.72			.			.			.			.
Corr'd Transit, 2.422787 2.216087			.			.			.			.
R. A. 0.638874	17	17	56.21	0	2	12.14	0	7	4.47			.
18 4.3539 0.56												
Error of Timepiece, 1756.21			.			.			.			.

1 20
43
6
3
48
51
1 29
78
1.80

1 28.76
180
~~1 29.54~~
1 30.56
Cp1327. +1

1 29.26 +.64 = 1 29.90
1 29.09 +.99 = 1 30.08

1 29.99
1 29.30
1 30.00 Err of 1327
37.85
7.85
15
3 | 8.00
6
20
18

1 20
54
64 8
60
.65
1 29
.64

12
25
60
24
30
129

2.67
24
27

1 44
444
222
2.66
5.32
130.00
124 68

hourly rate
+.11
13
333
111
1.44
1.50

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 15 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	β Arietis		Dec. 16. α Arietis	
Circle,	+20° 13'		+22° 54'	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.37		42	
	h m s	h m s	h m s	h m s
Wire, I.	17.8		38.0	
II.	20.0		40.2	
III.	22.1		42.4	
IV.	24.4		44.7	
V.	26.7		1 47.1	
	11 0		12 4	
Sum,				
Mean,	22.20		1 42.48	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 48 2.36		2 0 26.34	
Error of Timepiece,				

12
37
.84
36
.44
1.29
.85

+1 19.84
85
+1 20.69
1 30.00
9.31
18
3) 9 13
9
13

304 (24
.127
24
64
48
160

1.29
.50
.79

1 19.17

+1 16.14
79
+1 16.93
20.69
3.76
13.70
1.85
16.93
15.08

Exp. 3.7

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 17th 1879. Instrument, 1327 Observer, W.A.R.

Timepiece, 3451 Recorder, F.W.

Object,	α Urs. Min.	β Arietis	α Arietis	
Circle,	+88° 40′ 34″	+20° 13′	+22° 54′	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b. = +.14 s	+43.05	+.87	+.42	
	h m s	h m s	h m s	h m s
Wire, I.	39 6 43 5	~~6.4~~	1 34.9	44.066
II.	47 8 17 7.3	~~8.7~~ 49 10 9	37.0	40.917
III.	13 6- 18.1	13.0	39.2	6 | 3.149
IV.	37 6 44.0	15.2 17.4	41.6	.0525 40
V.	50 8	19.6	43.8	2.1000 3
Sum,	302 5 180.	26 1	46 5	2.13
Mean,	122.3 17 13.57	49 15.22	39.30	40.92 43.05
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 14 69.19	1 48 2.35	2 0 26.34	
Error of Timepiece,				

$$0 = +2^m\ 4.^s40 + 43.05n + m$$

$$1\ 12.92 + .40n + m$$

$$0 = 51.48 + 42.65n$$

42.65) 51.48 (1.27 = n.
4265
8830
8530
3000

.4
.508
1.35
.83

127
91
127
1143
1.1557

135
14
540
135
.19
1.16
+1.35 = m.

$$1^m\ 12.^s87 + .37n + m$$

$$1\ 12.96 + .42n + m$$

183 79

$$0 = 1\ 12.92 + .40n + m$$

1 12.92
83
+1 13.75 Er. of 1327.
16.93

24) 3.18 (.133 hourly rate.
24) 3.20 (.1
24
80
72
80

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 18 1879. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, F.W.

Object,	β Arietis	α Arietis		
Circle,				
Level Direct, w / e				
Reversed, w / e				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	7.2	31.2		
II.	9.5	33.3		
III.	11.7	35.7		
IV.	13.8	38.0		
V.	16.0	40.0		
Sum,	8.2	28.2		
Mean,	11.64	5.64		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 48 2.35	2 0 26.34		
Error of Timepiece,				

+ 1 09.29
+ 1 09.30

+1 9.30
.83

+1 10.13 Err of 1327.
13 .75

24) 3.62 (.151
24
122
120
20

13
453
151
1.963
10.13
08.17

000.0 = 3451
2 10 43.8 = 1327
1 10.13
33.67
0000
26.33

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 20 1879. *Instrument,* Mer. Cir. *Observer,* E.W. A.R.

Timepiece, 1327 *Recorder,* F.W.

Object,	δ Virginis	ε Virginis		
Circle,	4°3′	11°36′		
	w / **e**	**w** / **e**	**w** / **e**	**w** / **e**
Level Direct,	. / .	. / .	. / .	. / .
Reversed,	. / .	. / .	. / .	. / .
Sums,	. / .	. / .	. / .	. / .
Difference,				
b.	.07	.20		
	h m s	**h m s**	**h m s**	**h m s**
Wire, I.	31.7	10.2	.	.
II.	33.7	12.3	.	.
III.	35.8	14.4	.	.
IV.	37.7	16.5	.	.
V.	50 39.7	18.6	.	.
Sum,	28 6	72 0	.	.
Mean,	50 35.92	14.40	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	12 49 34.16	12 56 12.75	.	.
Error of Timepiece,	.	.	.	.

127
7
889
.09
135
1.26

127
20
2540
135
1.10

+1 01.56 + 1.26 = +1 02.82
+1 01.65 + 1.10 = +1 02.75
57
+1 02.78 Err 1327
10.13
59 | 7.35 | .125
59 12
155 250
145 125
118 1.500
270 3.00

62.78
3.25
-59.53

3451 =
1327 = 13 34 33.9
00
2.78
31.12
00
+1 28.88

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 21 1879. Instrument, Meri. Observer, W. AR

Timepiece, 1327 Recorder, DW.

Object,		β arietis		
Circle,		+.37		
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. | .	. | .	. | .	. | .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	.	59.0	.	.
II.	.	0.9	.	.
III.	.	3.2	.	.
IV.	.	5.3	.	.
V.	.	7.6	.	.
Sum,	.	76 0 16.0	. .	.
Mean,	.	3.20	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	.	1 48 2 .3.3	.	.
Error of Timepiece,	.	.	.	.

60.87
.89
+61.76
~~13.75~~
2.78
13)1.02
104

.080
125
2)205
.102

2.50
1.25
3.75
61.75
58.0

.080
.125
.125
3)330
.110
36
660
33
.396
.40
58.80
57.60

1 30 33.0 =3451 =1327
~~27.0~~
~~00~~
61.76
31.24
00.00
30 41 28.76

1 2
37
84
36
.44

1 27
37
88 9
381 9
.469
1 25
.89

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 23 1879. Instrument, Meri. Observer, J. C. M.

Timepiece, 1324 Recorder, F.W.

Object,	β Arietis	α Arietis	Polaris.	
Circle,			88° 40' 35"	
	w · e	w · e	w · e	w · e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	+37	+.42	43.05	
	h m s	h m s	h m s	h m s
Wire, I.	55.0	1 19.0	16 7.0	.
II.	57.1	21.2	11.6	.
III.	59.3	23.5	19.5	.
IV.	1.5	25.8	34.7 41.0 46.8	.
V.	3.9	28.0	44 11.3 16.8	.
Sum,	176.8 120 296.8	117.5	193.1 180. 373.1	
Mean,	59.36	23.50	41.45	
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	1 48 2.31	2 0 26.30	1 ~~14 64~~ 15 04.21	.
Error of Timepiece,	.	.	.	.

127
40
1.5080
1.36
.85

91
94
94
846
.8554
.19
1.04 cm.
38
.66

57.05
57.20
25
57.12 +.40
1 37.24 + 43.05
42.65 140.12 -0.94 = m
38 385 40
17350 .3760

57.12
85
57.97

57.12
66
57.78 Sup 1317
61.76
2 | 4.00
-2.00 daily rate.

2 10

0000 = 3451
27.70 = 1324
57.97
31.73
0000
+1 28.23

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 25 1879. Instrument, Mer. Ci. Observer, MAR.

Timepiece, 1327 Recorder, FW.

Object,	Enigmis	ϑ Arietis.	Palais Le	
Circle,			-43.05	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.20	~~20~~		
	h m s	h m s	h m s	h m s
Wire, I.	1.0	~~59.9~~	36.0 43.2	
II.	3.1	1 49 ~~0.9~~	48.7 6.2	
III.	5.2	3.2	15 12.2 20.8	
IV.	7.2	5.3	34.0 40.0	
V.	9.4	7.6	50.4	
Sum,	25.9		291.5 15. 9|111.5	
Mean,	5.18		12.39	
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	12 56 12.90	1 ~~48~~ ~~2~~.33	1 15 2.38	
Error of Timepiece,				

94.20
18.80
.19
1.04
.85

52.28
.85
53.13
57.78
2.5|4.65|1.90
2.5
2.15
2.25

53.13
2
51.00

+10.01 − 43.05
52.21 + .25
42.20 + 43.30 n.

43.30|42.20|−.97 = n.
38 97
3 230

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 26 1879. Instrument, Merc. Observer, J. F. M.

Timepiece, 1327 Recorder, W.

Object,	α Androm.	γ Pegasi		
Circle,	.54	.26		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+28°26	+14°31′		
	h m s	h m s	h m s	h m s
Wire, I.	51.2	51.2		
II.	~~53.3~~ 58 7	53.3		
III.	0.9	55.6		
IV.	3.2 5.6	57.6		
V.	8.0	59.9		
Sum,	16 4	27 6		
Mean,	3.28	55.52		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				00.02451 0 1.5 23.3=1327 57.95
R. A.	0 2 11.96	0 7 4.32		+1 31.35
Error of Timepiece,				

94
54
376
470
.5076
104
.53

94
26
564
188
.2444
1.04
80

51.32 +.53 = 51.85
51.20 +.80 = 52.00
385
51.92
53.13
11)1.21 (.110
11
11
11

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 27 1879 Instrument, Mer. Cir. Observer, WAR.

Timepiece, 1327 Recorder, FW.

Object,	α Arietis		Dec. 29 α Arietis	
Circle,	+42			
	w · e	w · e	w · e	w · e
Level Direct,	. · .	. · .	. · .	. · .
Reversed,	. · .	. · .	. · .	. · .
Sums,	. · .	. · .	. · .	. · .
Difference,				
b.	+22° 54′			
	h m s	h m s	h m s	h m s
Wire, I.	2 1 10.8	.	4.0	.
II.	13.0	.	6.3	.
III.	15.2	.	8.6	.
IV.	17.3	.	10.8	.
V.	19.5	.	13.0	.
Sum,	25.8	.	42.7	= 3407
Mean,	15.16	.	8.54	2 10 14.80 1327
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	2 0 26.26	.	2 0 26.25	.
Error of Timepiece,	.	.	.	.

94
42
188
376
.3948
1.94
.65

48.90
65
49.55 Sum f 1327
53.13
3.58
37 | 3.58 | .097
333
250

49.55
3.50
46.05

42.29
65
42.94 a f. 1327
49.55
2 | 6.61
3.30 | .137
24 | 3.30
24
90
72
180
168
13
411
137
1.781
1.794
42.94
41.18
+41.18

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Dec. 30 1879. Instrument, Meri. Observer, W.A.R.

Timepiece, 1327 Recorder, P.W.

Object, Circle,	α Arietis				Jan. 1. 1880 α Arietis.			
	w	e	w	e	w	e	w	e
Level Direct, Reversed,	.	.	.	.	.	.	.	.
Sums, Difference, b.	.	.	.	.	.	.	.	.
	h m s		h m s		h m s		h m s	
Wire, I.	0.1		.		52.2		.	
II.	2.2		.		54.5		.	
III.	4.5		.		57.0		.	
IV.	6.8		.		59.0		.	
V.	9.0		.		61.4		.	
Sum,	22 6		.		341		.	
Mean,	4.52		.		56.82		.	
Bb, Ce, Aa,	.		.		.		.	
Corr'd Transit, R. A.	2 0 26.24		.		2 0 26.22		.	
Error of Timepiece,	.		.		.		.	

00.00 = 3451
2 10 10.25 = 1327

38.28
65
38.93 Err of 1327

38.93
2.05
36.88

42.94
24) 4.00 (.167
24
160
144
160

30.60
65
+ 31.25 Err of 1327
38.90
2) 7.65
3.88

1.3
16
78
13
2.08
8
2.16
31.25
29.09

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 2 18~~79~~ 80 Instrument, Mer Cir. Observer, J. F. W.
Timepiece, 1327 Recorder, F. W.

Object,	ε Piscium	β Andromedae	Polaris.	
Circle,	+.13	+.70	+43.33.	
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b. +.14	+7° 14′	+34° 59′	+88° 40′ 36″.3	
	h m s	h m s	h m s	h m s
Wire, I.	57 6.0	3 23.7	10 56.4	~~1~~ 2.9 11 0.97
II.	8.2	26.1	11 0.6	
III.	10.3	28.5	11 59	1758 21-58.60 11 0.97
IV.	12.3	31.2	20 ~~21~~ 52.4	5957
V.	14.2	33.6	~~21~~ 58.9 ~~21~~ 66.5	16 29.78
Sum,	10	431		1778
Mean,	57 10.20	3 28.62	16 00.12 ~~16 29.78~~	20 59.27 11 0.97
Bb,				32 00 24
Cc,				16 00.12
Aa,				44.066 40.917
Corr'd Transit,				3.149 .525
R. A.	0 56 44.09	1 3 2.20	1 14 55.65	2.100 .31
Error of Timepiece,				2.41 40.92 43.33

89
13
267.
89
-.1157

0 = 26.11 + .13n + m + ΔT
0 = 26.42 + .70n " "

0 = 26.26 + .42n + m + ΔT

0 = 64.47 + 43.33n + m + ΔT
0 = 26.26 + .42n + m + ΔT

0 = 38.21 + 42.91n

m = b sec φ - n tan φ,

1.35
14
540
135
.19
81
1.00 = m.

.89
.91
89
801
.8099
-.81

26.11 + .88 = 26.99
26.42 + .38 = 26.80

+ 26.90 = E of 1327.

31.25
23) 4.35 (.189 hourly rate of 1327
23
205
184
210

42.91) 38.21 (.89 = n
3 619
34328
38820

00.0 = 3451
0h 24 57.9 = 1327
27.0
30.9
00.0
+ 1 29.1

16/24
64
3.84
80
4.64

16
13/48
16/8
2.00
.228
.269
34.78

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 4 187~~9~~. 80 Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder,

Object,	β Bootis	β Librae		
Circle,	+40° 52′	−8° 57′		
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. .	. .	. .	. .
Difference,				
b.		.16		
	h m s	h m s	h m s	h m s
Wire, I.	.	.	.	.
II.	.	.	.	.
III.	.16 20 .	.	.	.
IV.	3.20 20.14 .	.	.	.
V.	26.94 .	.	.	.
Sum,	.	.	.	.
Mean,	.	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	14 57 25.51	15 10 33.39	.	.
Error of Timepiece,	.	.	.	.

.89
.16
534
89
.1424

1.14

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 5 1879. 80 Instrument, Mer. Cir. Observer, J. F. M.

Timepiece, 1327 Recorder, F. W.

Object,	β Androm.	υ Piscium		Jan. 17
Circle,	+34° 59'	+26° 38'		.16
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.70	+.50		
	h m s	h m s	h m s	h m s
Wire, I.	3 11.2	2.9		35 35.7
II.	13.9	5.3		37.7
III.	16.3	7.5		39.7
IV.	18.8	10.0		41.9
V.	21.3	12.3		44.0
Sum,	31.5	38.0		49.0
Mean,	16.30	7.60		39.80
Bb,				
Cc,				
Aa,				
Corr'd Transit,			16 89 144 128 1424 100 1.141	
R. A.	1 3 2.16	1 12 53.58		15 10 33.55
Error of Timepiece,				6.45 1.14 7.59

.90
.70
.630
100
37

45
100
55

14.14 +.37 = 14.51
14.02 +.55 = 14.57
14.54 Sum of 1327
26.90
3)12.36 4.09 rate
12
36
24)409 17
24
169
168

17
15
85
17
2.55
14.53
12

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan 7 18~~7~~80. Instrument, Meri Observer, J.F.M.
Timepiece, 1327 Recorder, F.W.

Object,	γ Androm	α arietis		
Circle,	+41° 45′	+22° 54′		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	.89	42		
	h m s	h m s	h m s	h m s
Wire, I.	33.6	26.2		
II.	36.3	28.8		
III.	39.2	31.0		
IV.	42.0	33.3		
V.	44.9	35.4		
Sum,	46.0	5.2		
Mean,	39.20	31.04		
Bb,				
Ce,				
Aa,				
Corr'd Transit,				
R. A.	1 56 33.77	2 0 26.17		
Error of Timepiece,				

.89
.89
801
712
.7921
1.00
.21

.90
.42
180
360
.378
1.00
.62

5.43 + .21 = 5.64
4.87 + .62 = 5.49
11.13
+ 5.5.6

13
16
.78
13
.208
5.56
3.48

00.0 = 3451
2 7 33.14 = 1327
5.5
27.9
60
+1 32.1 Emf 3451

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan 8 1880. Instrument, Observer,

Timepiece, 1327 Recorder,

Object,	β Androm.			
Circle,	+70			
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	57.6			
II.	59.9			
III.	3 2.6			
IV.	5.3		m = +1.00	
V.	7.7		n = −.89	
Sum,	13.1			
Mean,	2.62			
Bb,				
Cc,				
Aa,				00.00 3451
Corr'd Transit,			0 45	27.85 = 1327 .85
R. A.	1 3 2.12		45	27.00
Error of Timepiece,	s + 0.87		+.1	00.00 33.00 Err of 3451 32.1

+ .9 = daily rate of 3451

89
1
.63
1.00
.37

+10.50
.37
+ .87 Err of 1327
556
23) 4.69 (.204
46
90
14
8 16
204
2.85

s
−.19

assume ~~+~~ .19 as the hourly rate of 1327.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 9 1880. Instrument, Mer. Circ. Observer, J. W. T. W.

Timepiece, 1327. Recorder, O. C. W.

Object,	α Coronae.	α Lyrae.		
Circle,				
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	15 29 21.7	18 32 34.9		
	23.9	37.8		
II.	26.1	40.3		
	28.3	43.1		
III.	30.8	45.5		
	33.2	48.2		
IV.	35.4	51.0		
	37.8	53.7		
V.	40.0	56.3		
	97.2	140.8		
Sum,				
Mean,	30.80	45.64		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	15 29 36.58	18 32 51.59		
Error of Timepiece,				

124.1

```
15 29 30.80          .512        .801
        +.54          .89         .89
15 29 31.34         4608        7209
      36.58         4096        6408
Error 1327— 5.24   -.45568     -.71289
                   +1.00        1.00
                   +.54         +.29
                                45.64
                                45.93
                                51.59
                 Error 1327 = — 5.66
```

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 11. 1880. Instrument, Mer. Circ. Observer, J. F. W.

Timepiece, 1327. Recorder,

Object,	v Piscium.			
Circle,				
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	1 12 33.9 36.3			
II.	38.7 41.0			
III.	43.3			
IV.	45.7 48.0			
V.	50.3 52.5			
Sum,	119.7			
Mean,	43.30			
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 12 53.50			
Error of Timepiece,				

.502
.89
4518
4016
−.44678
1.00
+.55

1 12 43.30
.55
43.85
53.50
Error 1327 = −9.65

rate −.13 per hour.

.24
52
26
3.12
20
3.32
9.65
−12.97

13
.14
52
13
1.82
13/14.82

14.80
3.12
17.92

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 14 1880. Instrument, Mer Ci Observer, F.W.

Timepiece, 1327 Recorder, F.W.

Object,	i Ceti			δ Androm								
Circle,	−9 28			+30°12								
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.	−.17			58								
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			56.0			32.0			.			.
II.			58.0			34.4			.			.
III.			0.1			36.8			.			.
IV.			2.2			39.0			.			.
V.			4.2			41.4			.			.
			0 5			33 6						
Sum,			.			.			.			.
Mean,			0.10			36.72			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	0	13	19.57	0	32	55.53			.			.
Error of Timepiece,			.			.			.			.

$0 = T - RA + n \tan\delta + \Delta T$

$$\begin{array}{r} 89 \\ \underline{17} \\ 623 \\ \underline{89} \\ 1.1513 \\ \underline{100} \\ 1.15 \end{array} \qquad \begin{array}{r} 58 \\ \underline{89} \\ 522 \\ \underline{464} \\ .516 \\ .52 \\ \underline{.50} \\ 48 \end{array}$$

$-19.47 \quad +1.15 \quad = - \quad 18.32$

$-18.81 \quad +.48 \quad = - \quad 18.33$

18.32 Err 1327

9.65

8.67

13

880

72

1.60

1.44

1.60

122

16

732

1.95

18.32

20.27

1224

488

24.4

2928

293

20.27

33.20

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 16 1880. *Instrument,* Mer. Cir. *Observer,* FW.

Timepiece, 1327 *Recorder,* FW.

Object,	27 Tauri	ζ Persei		
Circle,	+23° 41′	+31° 32′		
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.	+.44	+61		
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	30.4 32.6 35.0 37.1 39.3 41.9 44.0 46.3 48.5	46 3.9 6.2 8.4 10.9 13.7 16.0 18.4 20.8 23.2		
Sum,	355.1	121.5		
Mean,	39.46	13.50		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	3 42 37.74	3 46 37.72		
Error of Timepiece,				

.89
44
356
356
39 16
100
.61

89
61
89
534
.542

39.46
61
40.07
63.74
−23.67
76
143
−23.72
18.32
5.40
40
5.00 20
200

13.50
46
13.96
37.72
−23.76

00.00 = 3451
3 50 39.35 = 1327
23.72
63.07
0000
−3.07 Sw (3451)

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 18 1880. Instrument, Observer,

Timepiece, 1327 Recorder,

Object, Circle,	ν¹ Boötis + 41°14′		ξ Coronae seq. + 37°1					
	w	e	w	e	w	e	w	e
Level Direct, Reversed,					3451			
Sums, Difference, b.					1327	20.5	00 3.55 2.55 +1.00 Err of 1327.	
	h m s		h m s		h m s		h m s	
Wire, I.	35.9		50.3					
II.	38.4		52.9					
III.	41.3		55.6					
IV.	44.0		58.3		3451 1327 = 15 48		00.00 = 34 6.15	
V.	46.9		60.8				3.91 2.24	
Sum,	65		27.9				00 Err of 3451 − 2.24.	
Mean,	41.20		55.58					
Bb, Cc, Aa,								
Corr'd Transit, R. A.	15 26 37 34		15 34 5176					
Error of Timepiece, Jan. 16								

16 50 00.00 = 3451

37.5 = 1327

25.1

62.6

00

− 2.6

3.1

− .5

+ 1.s daily rate of 3451.

.84 76 3.46 + .32 = 3.78

.87 9 3.82 + .22 = 4.04

9 .684

.753 100

100 .32

1.22

782

+ 3.91 Err of 1327

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 19.3 1880. Instrument, Mer. Ci. Observer, P.W.

Timepiece, 1327 Recorder, P.W.

Object,	ζ Piscium.	Polaris U.C.	α Arietis	β Trianguli
Circle,	+29°27'	188° 40' 37"	+22°54'	+34°25'
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.		43.33	.42	.68
	h m s	h m s	h m s	h m s
Wire, I.	23.9	52.1	45.8 42.4	26.0
II.	26.5	15.8	49.5 49.8	28.4
III.	29.0	15 20.2	54.0 57.0 59.2	31.0
IV.	31.3	27.0	48.5 29.2 52.1 49.7	33.5
V.	wrong 33.6	49.7	26.5 28.7 30.9	36.0
Sum,	star.	164.8 104.8	32.9 35.3 ~~37.7~~	4.9
Mean,		15 20.96	14.3 30.86	30.98
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	1 5 4.30	1 14 40.46	2 0 26.00	2 2 25.76
Error of Timepiece,				

83
91
83
747
.7553
.19
+.95 = m

83
42
166
332
.3486

83
68
498
~~66~~ 4
564 4
.95
.39

+40.50 +43.33 m
+5.04 +.55 m
35.46 +42.78 m

42.78) 35.46 (.83 = m.
34104
13560

00.0 - 3451
1h 25 7.4 = 1327
5.5
-1.9 Err of 1327

+4.86 +.42 m
+5.22 +.68 m
08 110
+5.04 + .55 m

+4.86 + .60 = +5.46
+5.22 +.39 = +5.61
10 7

Err of 1327 = +5.54 hourly rate.
3 : 91 + .148
11) 11.6 3 (.148
11
5 30
44
90

5.52
.66
62.0
14.8
59.2
148
20.7
5.54
7.61

.4
59.2
296
3.55
3.54
9.09

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 20.8 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object, Circle,	β Coronae +29° 31			
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.	59.5			
II.	1.8			
III.	4.2			
IV.	6.6			
V.	9.0			
Sum,	21.1			
Mean,	04.22			
Bb, Cc, Aa,				
Corr'd Transit, R. A.	15 22 5345			
Error of Timepiece,				

57
83
171
456
.4731
95
48

+10.77
.48
+11.25 Err of. 1327
5.54
37) 5.71 (.154 hourly rate.
37
201
185
160

.152
24
608
304
3.648
3.70
11.25
14.95

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 23.4 1880. Instrument, Mer. Cir. Observer, A.S.

Timepiece, 1327 Recorder, J.R.E.

Object,	α Aurigae	δ Orionis	36 Camelopardis	β Aurigae	3 Geminorum
δ ~~Circle,~~	+45°52'.6	+7°23'	+65°44'.5	+44°56'	+22°32'
		w e	w e	w e	w e
Level Direct,					
Reversed,					
Sums,					
Difference,					
b.					
	5h 08m	h m s	h m s	h m s	h m s
Wire, I.	0s.9	5 48 56.2	6 0 53.6	5 50 58.7	6 7 54.2
	3.9		58.7	61.2	56.2
II.	6.9	58.3	63.3	64.2	58.5
	13.0	60.5	68.6		
III.	18.7	62.3	73.4	67.2	60.7
	21.7	64.7	78.6	70.0	63.0
IV.	24.8	66.8	83.5	73.0	65.2
	12s.84		88.6		
V.		68.6	93.7	76.2	67.5
Sum,					
Mean,	8m 12s.84	49 02.49	1 13.56	51 07.21	8 00.76
Bb,					
Cc,					
Aa,					
Corr'd Transit,					
R. A.	5h 7m 52.75	5 48 42.98	6 0 57.75	5 50 47.06	6 7 40.81
	20s.09	19.51	21.81	20.15	19.95
	n tan δ = − 1.06	n tan δ = − 0.13	19.95	n tan δ = − 1.03	n tan δ = − 0.43
	m = +1.13	m = + 1.13	1.804) 1.86	m + 1.13	m + 1.13
Error of Timepiece, −ΔT =	20.16	−ΔT = 20.51	n = − 1.03	−ΔT = 20.25	−ΔT = 20.65

α Aur. 20.16 . . . . . . 5h 08m
β " 20.25 . . . . . . 5 51
mean 20.20 . . . . . . 5 30
δ Or. 20.51 . . . . . . 5 49
3 Gem. 20.65 . . . . . . 5 68
+ 20.44 = Clock Error at 5h 49m
or say 5h.8

tan 65°44'.5 = 2.219
" 22 32 = 0.415
1.804

sec φ = 1.354
b = 0.14
b sec φ = +0.19
−0.94
m = +1.13

tan φ = 0.913
n = −1.03
n tan φ = −0.94

At 20d.8, error = 11.25
" 23.4 " = 20.44
2.6 × 24h) 9.19
Hourly rate = 0.146
Previously deduced = 0.154 or .151
So use 0.15

Clock Error brought forward to 6h.9 = { 20.44
.16
20.60

.45 .15
.6 .01
.09 .16

On skipping determination of 20d.8
At 23d.4 20.44
" 19.3 5.54
4.1 × 24h) 14.90
.151

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan 24.2 187 . Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	Polaris	ζ Andromedae	δ Androm.		
~~Circle,~~	δ + 88°40' 36".9	+23°37'	(+30°12'.5) 3 Androm = 28°39'.8		
	tan δ = 43.309	w | e	w | e	w | e	w | e
Level Direct,					
Reversed,					
Sums,	1h 14m 09.0 12.0	tan δ = 0.437	tan 28°39'.8 = 0.546		
Difference,	18.6 37.0				
b.	44.1 49.1				
		h m s	h m s	h m s	h m s
Wire, I.	15 08.0 14.5	0 41 13.0 15.2	0 32 26.8 29.0		
II.	19.5 38.6	17.3 19.7	31.3 33.9		
III.	43.9 49.1	22.0 24.2	36.1 38.6		
IV.	16 07.8 13.1	26.6 28.7	40.8 43.1		
V.	18.9 37.9	31.0	45.8		
Sum,	42.0 48.9	9) 197.7	9) 325.4		
Mean,	17 06.9 12.6 18.6	21.97	36.16		
Bb,	21) 321 549.5		Must be 3 Andr. (not δ Andr.)		
Cc,					
Aa,	1h 15m 43.31				
Corr'd Transit,					
R. A.	1h 14m 36.32 66.99 22.44 42.87) 44.55	0h 40m 59.53 22.44 n tan δ = −0.44 m = +1.14	0h 32m 55.40 3 Androm = 13.65 22.51 n tan δ = − .57 +1.14		
Error of Timepiece,	n = −1.04	−ΔT' = 23.14	−ΔT' = 23.08		

tan 88 40 36.9 = 43.309
" 23 37 = 0.437
42.872

b sec. φ = +0.19
n tan φ = −0.95
m = +1.14

Mean Clock Error = +23s.11
at mean ^of^ time = 0h 37m or say 0h.6

23d 5h.8 20.44
24 0.6 23.11
18.8) 2.67

Hourly rate +0.142 ± several ×.001
Deduced day before .146

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan 25.3 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	Polaris	η Piscium	ν Piscium	43 Cassiopeiae	ε Cass.
Circle,	+ 88°40'36".9	+ 14° 43'.8	+ 4° 52'.9	+ 67° 26'.5	+ 63° 5'.4
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.		tan δ = 0.263	tan δ = 0.086	tan δ = 2.407	tan δ = 1.970
		h m s	h m s	h m s	h m s
Wire, I.	1h 15m 7s.8	1 25 22.2	1 35 30.0	1 33 35.7	1 45 57.1
	16.7	24.3	32.0	41.1	46 01.6
II.	20.8	26.6	34.1	46.5	6.1
	36.0	28.7	36.2	52.0	10.8
III.	42.7	30.8	38.2	57.2	15.4
	46.1	32.9	40.3	62.8	19.8
IV.	65.8	35.1	42.4	68.1	24.2
V.	71.4	37.2	44.5	73.3	29.3
	77.6	39.4	46.7	78.8	33.6
Sum,	9) 384.9	9) 277.2	9) 344.4	9) 515.5	8) 197.9 9) 137.9
Mean,	15m 42.8 (not good to hundr.)	25m 30s.80	35m 38.27	33 57.~~34~~ 28	46 15.32
Bb, Cc, Aa,					
Corr'd Transit, R. A.	1h 14m 35s.40	1 25 04.79	1 35 12.34	1 33 29.02	1 45 47.81
Error of Timepiece,	67s.4 26.0 ~~42.9~~ 41.4 ~~(With η Pisc.) n = −0.97~~	26.01 n tan δ = −0.25 m = 1.07 −ΔT = 26.83	25.93 − 0.08 + 1.07 −ΔT = 26.92	28.~~37~~ 26	27.51

tan 88°40'36".9 = 43.309
0.263
43.046

43.0) 41.4
− 0.96 = n
with Polaris + η Pisc.

43.309
0.263
43.04)

67.4
25.9
41.5

n = − 0.95
with Polaris + ν Pisc.

Considering the previous higher value of n, use;
n = − 0.96
n tan φ = − 0.88
b sec φ = + 0.19
m = + 1.07

Clock Error = 26s.88 ± 0.05
at 1h 30m = 1h.5

25h.5
0.6
24.9)

26.88
23.11
3.77

Hourly rate = 0.151
Previously deduced = .142

2.407
0.086
2.321)

28.26
25.93
2.33

With η Pisc. n = − 1.00

2.407
0.263
2.144)

28.26
26.01
2.25

With ν Pisc. − 1.05

1.970
0.086
1.884)

27.51
25.93
1.58
− 0.84

1.970
0.263
1.707)

27.51
26.01
1.50
− 0.88

Mean of 43 Cass. + ε Cass. with η Pisc. = 0.92
" " " " " " ν " = 0.96

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 26.3 1880 Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	Polaris	ϑ Piscium	θ Ceti	η Piscium	
Circle,	+ 88° 40' 36.8"	+ 26° 38'.2	− 8° 48'.2	+ 14° 43'.7	
		w . e .	w . e .	w . e .	w . e .
Level Direct,					
Reversed,					
Sums,		tan δ = 0.501	tan δ = − 0.155	~~η Piscium~~ tan δ = 0.263	
Difference,		sec δ = 1.118			
b.		.015 sec δ = 0.017 = ~~D~~ diurnal Aber.			
		h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	15 09.3 16.9 24.0 40.6 46.3 50.0 16 10.1 14.9 19.4 9)138 231.5 15 45.72 1h 09m 44.8 49.9 54.1 10 15.8 21.1 26.5 ~~15 09.3~~ ~~16.9~~ ~~24.0~~ 26 08.4 13.9 18.0 35.1 41.5 48.7 (46.5 50.9 48.7)	1 13 13.9 16.2 18.2 20.8 23.1 25.5 27.8 30.1 32.5	1 18 22.3 25.4 27.6 31.5 35.7 38.0 40.1	1 25 28.1 30.1 32.2 34.4 36.5 38.7 40.9	
Sum,		9)208.3	7)221.6	7)240.9	
Mean,		23.16	31.66	34.41	
Bb,	12)183 377.8 15 46.48				
Cc,	183 377.8 138 231.5				
Aa,	21)331 09.3 15 46.16				
Corr'd Transit,					
R. A.	1h 14m 34s.44 Diurnal Aberration = 0.65	1 12 53.5~~7~~30 Aberration .02	1 18 02.49 .02	1 25 04.76 .02	
	~~75.09~~ 35.09	53.5~~9~~.32	02.51	.78	
~~T Pol (corr)~~ ~~Error of Timepiece,~~	71.07	29.5~~7~~.84 n tan δ = − .47 m = + 1.05	29.15 n tan δ = + .15 m = + 1.05	29.63 n tan δ = − .25 + 1.05	

~~sec δ =~~

log .015 = 8.176

log sec δ = 8.363

log Aber. 9.813

43.31 71.07

0.50 30.43

42.81) 40.68

n = − 0.95

− ~~ΔT = 31.01~~

~~31.01~~

~~30.15~~

− ΔT = 30.42

− ΔT = 30.35

30.43

.42

.35

.43

3)1.20

So take error of Clock = 30.40

at 1h 25 Why not at $\frac{13 + 18 + 25^m}{3}$ = 1h 19m

43.31 71.07

− 0.15 31.12

43.46) 39.95

n = − 0.92

25.25 30.40

1.5 26.88

23.75) 3.52

Hourly rate = 0.148

Previously deduced {0.151, 0.142}

.151

Take n = − 0.94

~~K~~ tan φ = − 0.86

b sec φ = + 0.19

m = + 1.05

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan 28.3 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	48 H. Cephei	η Tauri	o Persei	β Persei
Circle,	77°17'.9	+23°44'.1	+31°54'.6	+40°29'.8
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.	tan δ = 4.437	tan δ = 0.439	tan δ = 0.622	tan δ = 0.854
	h m s	h m s	h m s	h m s
Wire, I.	~~3 05 (16.2)~~ ~~(25.9)~~	3 41	3 37	3 1
II.	3h 05m 16.2 (95.2)	(5)1.3 9.4 (0.3)	18.0 37.0 (27.5) 20.0 34.8 (27.4)	(5)0.5 (5)3.1 12.3 (5.4)
III.	25.9 (85.9)	(5)3.6 7.1 (0.3)	22.3 32.0 (27.2)	(5)5.8 9.5 (5.3)
IV.	35.2 73.6 (54.4) 45.0 63.8 (54.4)	(5)5.9 4.8 (0.3) (5)8.1 02.6 (0.3)	24.9 29.8 (27.3) 27.2	(5)9.0 6.8 (5.3) (10)1.4 04.0 (5.5)
V.	54.3 ~~54.3~~ ~~314.0~~ ~~54.3~~	0 0.3		
Sum,	5)271.9	03.1	246.0	~~03.0~~ 12.5
Mean,	54.38	3 41 00.34 ~~04.79~~	3 37 27.33	3 01 ~~00.32~~ 01.38
Bb, Cc, Aa,				
Corr'd Transit, R. A.	3 05 12.76 ~~12.69~~ ~~77.17~~ 2	3 40 23.08 2	3 36 49.92 ~~.69~~ 2 .94	3 00 23.54 ~~.68~~ 2 .56
Error of Timepiece,	~~77.19~~ 12.65 ~~18.27~~ ~~41.73~~ ~~-ΔT~~ -ΔT = +41.62	23.10 ~~41.69~~ -ΔT = +37.24 m +1.10	+37.39 m +1.10	37.82 m +1.10

4.437	37.24	n tan δ = -0.439	n tan δ: -0.622	n tan δ -0.85
0.439	4.38	37.90	~~38.10~~	~~37.03~~
3.998			37.87	~~38.07~~

But both values of n depend upon one pole star, and the previous value of n was taken 0.96

So use n = -1.00 ± several hundredths

n = -1.09

4.437 41.62
0.622 37.62
3.815 04.00

n = -1.05

n tan φ = 0.983
b sec φ = +0.19
m = +1.10 ± several hundredths

Clock error = { 37.90 .87 .93 } + 37.90

at 3h.25 Why not 3h 25m

28.d	3.h25	+37.s90
26	1.25	+30.40
2d	2h	50)7.50

Its only rate = +.150

α 23.68
2
.70
-ΔT 37.68
m +1.10
n tan δ -0.85
37.93

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Jan. 29.1 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, ~~Circle,~~ tan φ - tan δ	α Androm. +.440	γ Pegasi +.654		
	w . e .	w . e .	w . e .	w . e .
Level Direct, Reversed,				
Sums, Difference, b.	n = -1.00 about			
	h m s	h m s	h m s	h m s
Wire, I.	0 2 .	0 7 35.6		
II.	42.6 (3) 61.2 103.8	37.8 (2.2)		
III.	44.7 58.9 36	52.9 35.6 ~~9)17.3~~ ~~4.7~~ (48.4) 2.4		
IV.	47.1 56.5 36 49.7 54.0 3.7	50.8		
V.	.52.0 9)466.7	8)17.3 2.1 ~~52.9~~ 2.1		
Sum,		~~4)172.6~~		
Mean,	0 2 51.86	~~0 7 43.15~~ 4)177.1		
Bb, Cc, Aa,		0 7m 44s.27		
Corr'd Transit, R. A.	0 2 11.63 8	0 7 04.04 7		
Error of Timepiece,	11.55 2 11.57	03.97 2 03.99		

[By Hansen's formula] T' - a = 40.29
+.44
~~39.85~~
~~+40.73~~
+0.19 = b sec φ
40.92

Use γ Peg. only as a check against gross mistake.

By α Androm, Error of 1327 = 40.92

40.28 ~~39.16~~
.65 ~~.65~~
0.19
41.12 ~~39.81~~
~~40.28~~
.65
~~40.93~~

24.05
3.25
20.8) 2.82

40.92
37.90
2.82

Hourly rate = +0.145

Date, Jan. 31.2 1880 Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	o Piscium	50 Cassiopeiae	γ Androm.	β Trianguli.	α Arietis
		w · · e · ·	w · · e · ·	w · · e · ·	w · · e · ·
Level Direct, Reversed,					
Sums, Difference, b.	tan δ = +.1502 tan φ − tan δ = +.763	+3.047			+.4228 +.490
Wire,	1h 39m	h m s	h m s	h m s	h m s
I.	42.8 59.6 102.4	1 54 .	1 57 .	2 03 .	2 01 .
II.	44.9 57.4 .3	(3)9.8 29.8 6.6	9.8 31.9 41.7	2.9 22.9 25.8	3.9 21.9 25.8
III.	47.0 55.4 .4 49.1 53.2 .3	(4)3.6 23.1 6.7 (5)0.0 16.5 6.5	12.5 29.1 41.6 15.2 26.2 41.4	5.3 20.3 25.6 7.9 17.9 25.8	6.1 19.6 25.7 8.3 17.2 25.5
IV.	57.1	(5)6.8 09.8 6.6 03.1	18.0 23.6 41.6 20.9	10.3 15.3 25.6 12.9	10.6 15.0 25.6 12.8
V.	9) 460.5	9) 29.5			9) 115.4
Sum,			9) 187.2	9) 115.7	
Mean,	1h 39m 51.17s	1 54 03.28	1 57 20.80	2 03 12.86	2 01 12.82
Bb,					
Cc,					
Aa,					
Corr'd Transit,					
R. A.	1 39 04.65 2 .67	1 53 13.80 2 .82	1 56 33.33 02 .35	2 02 25.56 2 58	2 00 25.82 2 .84
Error of Timepiece,	46.50 0.19 1.012 × .762 .77 −ΔT = 47.46	49.46 ~~0.19~~	47.45 0.19 +(−1.00 × .02) +.02	47.28 0.19 −(−1.00 × .23) +.23	46.98 0.14 1.00 × .490 .49

3.047
6.150
2.897) 2.92
49.42
46.50
2.92

n = − 1.01

49.46 − gain of clock in ¼ hr. = 49.42

0.4654
0.4620
0.0034

~~47.47~~
−ΔT = 47.66

~~47.30~~
47.70

−ΔT = 47.66
~~47.46~~
.20

0.3353
0.5483
9.8370

Error of 1327 at 2h = +47.69s by these two time stars without pole star.

50h
0.05
49.95) 6.76
47.68
40.92
Hourly rate .135

by
306
0.8299
1.6986
~~9.1318~~
9.1320

3.047
.422
2.625) 1.80
49.46
47.66
1.80

3.047
.422
2.625

49.46
56.98
2.38

n = − 0.95

0.3945
0.4183
9.9763

Obs. o Piscium only to confirm value of n
But it is doubtful even for this since its time and as a check against is distant.
~~goes more in time.~~

N. B. ½ hr. of clock gaining would give 47.46 + .07 = 47.53

N. B. ~~¼ hr.~~ of clock gaining would change 47.66 to 47.66 + .01 = 47.67

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 1.2 1880 Instrument, Mer. Cir. Observer, A. L.

Timepiece, 1327 Recorder, J. R. E.

Object,	γ Androm.	α Arietis	β Triangul.	
Circle,				
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	1 57 .	2 01 .	2 03 .	.
II. III. IV. V.	13.2 35.5 48.7 16.0 32.9 9 18.7 30.0 7 21.6 27.2 8 24.4 24.4 9) 3.5	7.4 25.2 32.6 9.7 23.1 .8 12.0 20.9 .9 14.1 18.8 .9 16.4 16.4 9) 3.6.	6.3 26.5 32.8 8.9 24.0 9 11.3 21.5 8 14.0 18.8 8 16.3 16.3	.
Sum,	.	.	9) 3.6	
Mean,	1 57 24.39	2 01 16.40	2 03 16.40	.
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit,	.	.	.	.
R. A.	1 56 33.32 .02 .34	2 00 25.81 2 .83	2 02 25.55 .02 .57	.
Error of Timepiece,	51.05 0.19 +.02	0 50.57 +.19 +.49 51.25	50.83 0:19 +.23	.

-ΔT = 51.26 -ΔT = 51.25

51.26
47.66
24h) 3.60
.150

Neglecting the preceding determination and taking the error determined Jan 28.3 we have

1.1258
1.9765
0.1493

98h
3.25
94.75)

51.26
37.90
13.36

Mean hourly rate for 3 days .141

But as there has been a period of barometric depression it is probable there has been an active change of rate.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 22 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	η Piscium	ε Cassiop.	γ Androm.	α Arietis	β Triang.
Circle,					
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.					
		h m s	h m s	h m s	h m s
Wire, I.	1h 25m	1 46	1 57	2 01	2 03
52.1 54.7 62.8 56.5 60.9 58.5 II.	52.1 60.9 54.7 58.5 117.5 56.5 57 .4 58.5 9)13.4	24.5 60.9 85.4	16.9 38.9 55.8	11.0 28.8 39.8	9.8 28.9 38.7
		29.1 56.1 85.2	19.4 35.9 .3	13.0 26.5 .5	12.1 26.5 38.6
III.		33.4 52.0 85.4	22.4 33.1 .5	15.2 24.3 .5	14.7 24.3 39.0
IV.		38.5 45.5 84.0	25.2 30.6 .8	17.4 21.9 .3	17.2 22.2 38.4
V.		42.6 42.6 9)14.6	27.9 27.9 9)7.3	19.6 19.6 9)2.7	20.0 20.2 9)3.7
Sum,					
Mean,	1h 25m 58.38	1 46 42.51	1 57 27.81	2 01 19.30	2 03 19.41
Bb, Cc, Aa,					
Corr'd Transit, R. A.	1h 25m 04.62 2 .64	1 45 47.48 2 .50	1 56 33.30 .02 .32	2 00 25.80 .02 .82	2 02 25.53 2 .57
Error of Timepiece,	53.74 .19 −(−1.00 × .150) .15 54.08	55.01 0.19 −(−1.00 × −1.056) = −1.06 54.14 2h @ .15s = .03 54.17	54.49 0.19 0.02 54.70	53.48 0.19 .49 54.16	53.84 0.19 0.23 54.26

Seeing very bad. Tapping of chronograph also poor.

½h @ .15 = 54.08 .07 54.15

54.19
51.26
24) 2.93
Hourly rate .122

6d ~~E Cass~~

η Pisc. & α Arietis combined with ⅓ weight given to the latter would be independent of uncertainty in n, but again they agree without it.

Neglecting the preceding determination, the mean hourly rate for the last two days would be .135

But there is a "cold snap" which may have changed the rate. But again the thermometer in clock room has not felt it.

Combining ε Cassiop. with α Ariet. giving only half weight to the former would ~~about~~ nearly eliminate effect of uncertainty in the value of n on result and at the same time give the stars weight proportional to their distance from the pole. In this case they happen to check so well that the refinement is unnecessary, which speaks well for our value of n.

For a mean of all take $-\Delta T = 54.19^s$ at 2 h. discarding γ Androm. altogether. To include it would increase the ~~[illegible]~~ mean 0.1s

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 3.9 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object, Circle,	α Lyrae	β Lyrae		
	w . . | e . .	w . . | e . .	w . . | e . .	w . . | e . .
Level Direct, Reversed,				
Sums, Difference, b.	. .	. .	. .	.
	h m s	h m s	h m s	h m s
Wire, I.	18 33 .	18 46 .	.	.
II.	41.4 62.9 (104).3	29.0 48.8 (77).8	.	.
III.	44.2 60.0 .2 46.8 57.3 .1	31.4 46.1 .5 33.8 43.7 .5	.	.
IV.	49.6 54.9 .5	36.1 41.1 .2	.	.
V.	52.1 (52).1 9)1.2	38.7 38).7 9)6.7	.	.
Sum,	.	.	.	.
Mean,	18 33 52.13	18 46 38.74	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	18 32 51.94 .02 .96	18 45 38.60 .02 .62	.	.
Error of Timepiece,	~~0+~~ $60^s.17$ .19 .11 $-\Delta T' =$ 60.47	60.12 .19 .26 $-\Delta T' =$ 60.57	.	.

Take $-\Delta T' = 60^s.52$

42.65	60.52
2.00	54.19
40.65	) 6.33
Rate	+0.156

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 4.2 1880 Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Androm.	~~β~~ α Arietis ~~γ Androm~~	υ Persei	β Triang.
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.	1 57	2 01	1 31	2 03
II.	23.5 45.8 (69).3	17.8 ~~31.1~~ 35.8 ~~40.4~~ 53.6	~~27.8~~ 27.8 52.5 ~~[illegible]~~ 80.3	16.4 36.5 (5)2.9
	26.3 43.0 .3	19.9 ~~28.9~~ 33.5 .84	~~[illegible]~~ 30.9 49.3 .2	19.0 34.0 3.0
III.	29.0 40.1 .1	22.1 ~~36.7~~ 31.1 .2	34.0 46.2 .2	21.6 31.6 3.2
IV.	31.9 37.6 .5	24.3 28.9 .2	37.0 43.1 .1	24.0 29.0 3.0
V.	34.7 (34).7	26.7 26.7	40.0 40.0 9).8	26.7 26.7
Sum,	9)5.9	9)6.1		9)4.8
Mean,	1 57 34.66	2 01 26.68	1 31 40.09	2 03 26.53
Bb, Cc, Aa,				
Corr'd Transit, R. A.	1 56 33.26 2 .24	2 06 25.77 2 .79	1 30 38.68 2 .70	2 02 25.50 2 .52
Error of Timepiece,	61.42 .19 .02 61.63	60.89 .19 .49 61.57	61.39 .19 −.20 61.38	61.01 .19 .23 61.43

Uncertainty in rr cannot account for the variations — Average them.

− ΔT = +61.″50

61.50	61.50	.38
60.52	54.19	.63
7.h3) 0.98	48) 7.31	.57
	Hourly .152	.43
		4) 2.01
		.50

Hourly rate +0.134

Previous deter +0.156

Mean 0.145

Use +0.14

Hourly .152 rate discarding observ of Feb. 3.9 But this is not so legitimate as the method of averaging the two rates.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ~~Feb. 4. 2~~ 188~~6~~. Instrument, Mer. Cir. Observer, J. R. E.
Feb. 23.8 1880
Out of order. See p 167 Timepiece, 1327 Recorder, J. R. E. Seeing bad.

Object, Circle,	η Herculis			γ Draconis			α Lyrae			
Level Direct, Reversed,	w	e		w	e		w	e		w e
Sums, Difference, b.										
	h m	m	s	h	m	s	h	m	s	h m s
Wire, I.	17h 43m			17h			18h			
II.	43m 30.7	44m 17.2	107.9	55m 24.1	56m 30.2	114.3	34m 34.1	35 27.0	01.1	
	32.9	15.0	.9	27.7	27.0	4.7	36.7	24.2	0.9	
III.	35.2	12.6	.8	31.0	24.0	5.0	39.1	21.7	0.8	
	37.5	10.4	.9	34.0	20.7	4.7	41.9	18.9	0.8	
IV.	40.0	07.6	.6	37.5	17.2	4.7	44.8	16.6	1.4	
V.										
	43m 45.0	43m 63.2	8.2	55m 44.5	56m 10.7	5.2	34 50.0	35m 11.1	1.1	
Sum,	47.2	61.1	8.3	47.9	7.3	5.2	52.7	08.5	1.2	
	49.1	58.7	7.8	51.3	4.1	5.3	55.2	05.8	1.0	
Mean,	51.6	56.2	7.8	54.2	00.9	5.1	58.0	03.0	1.0	
	53.9		53.9	57.2		57.2	60.4		00.4	
			19) 18.1			19) 8.4			19) 9.7	
Bb, Cc, Aa,	17	43	53.95	17	55	57.44	18	35	00.51	
Corr'd Transit,										
R. A.	17	41	46.42 2 .44	17	53	49.13 2 .15	18	32	52.63 2 .65	
Error of Timepiece,		2 2	07.51 .19 +.39 08.09		2 2	08.29 .19 −.34 08.14		2 2	07.86 .19 +.11 08.16	

Time 18h 05m

Error +2m 08.13
38d 18h 05m = ~~1~~m 56.26
Residual 11s.87

2 08.13
2 02.13
38.5) 6.00
Rate .155

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 52 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	η Piscium			υ Persei			β Arietis			γ Androm		
Circle,												
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	1	26	.	1	31	.	1	49	.	1	57	.
II.	0.1	17.1	17.2	31.0	55.9	86.9	(5) 7.1	14.8	11.9	26.9	49.0	75.9
	2.1	15.0	.1	34.0	52.8	8	(5) 9.3	12.6	9	~~27.8~~		76.0
III.	4.3	12.9	.2	37.1	49.7	.8	1.6	10.2	.8	29.7	46.3	
	6.5	10.7	2	40.2	46.7	.9	3.8	8.1	9	32.2	43.4	75.6
IV.	8.6		8.6	43.5			5.9		5.9	35.0	40.8	75.8
V.			9)5.3			43.5			9)8.4	37.9		37.9
Sum,			.			9)3.9			.			9)8.2
Mean,	1	26	08.59	1	31	43.43	1	49	5.93	1	57	37.91
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	1	25	04.63 2 .65	1	30	38.66 2 .68	1	48	1.78 2 .80	1	56	33.24 2 .26
Error of Timepiece,			63.94 .19 .15 64.28			64.75 .19 -.20 64.74			64.13 .19 .54 64.86			64.65 .19 .02 64.86

.74
.86
.86
3) 2.46
.82

Discarding η Pisc. we have −ΔT = 64.82

N. B. J. R. E. is not satisfied about these occasional disregardings of observed stars.

υ Persei reduced to the time of β Arietis would be 64.74 + (0.3 × .14) = 64.78

So that all the stars would agree within 0.15

64.82
61.50
23.8) 3.32
Hourly rate .140 at 1h { 31 49 57 46m

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 52 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,				
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.				
II.				
III.				
IV.				
V.				
Sum, Mean,				
Bb, Cc, Aa,				
Corr'd Transit, R. A.				
Error of Timepiece,				

Date, Feb. 6.2 1880 Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Piscium	υ Persei			β Persei			ν Piscium			ο Piscium			
		w		e	w		e	w		e	w		e	
Level Direct, Reversed,														
Sums, Difference, b.														
	1h 26m	h	m	s	h	m	s	h	m	s	h	m	s	
Wire, I.–V.	3.7 20.7 24.4 5.8 18.6 .4 7.8 16.4 .2 10.0 14.1 .1 12.0 12.0 9) 1.1	1	31	.	3	01	.	1	36	.	1	40	.	
		34.4 59.2 37.6 56.1 40.6 53.1 43.8 50.0 46.8		93.6 .7 .7 .8 46.8 9) 7.6	21.0 42.8 23.8 39.9 26.2 37.1 29.1 34.6 31.8		63.8 .7 .3 .7 31.8 9) 7.3	17.3 11.1 27.8 19.4 13.1 25.7 15.2 23.7 21.7 17.3 21.7 23.7 ~~27.8~~ 25.7 19.4		38.9 .8 .9 39.0 19.4 9) 4.0	3.4 20.1 5.6 18.0 7.7 16.0 9.8 13.9 11.9		23.5 .6 .7 .7 11.9 9) 7.4	
Sum, Mean,	1h 26m 12.12	1	31	46.84	3	01	31.81	1	36	19.44	1	40	11.82	
Bb, Cc, Aa,														
Corr'd Transit, R. A.	1 25 4.62 .02 .64	1	30	38.64½ .66	3	00	23.51 2 .53	1	35	12.19½ .21	1	39	4.57 2 .59	
Error of Timepiece,	67.48 .19 .15 67.82			68.18 .19 −.20 68.17			68.28 .19 .10 68.57			67.23 .19 .83 68.25			~~70~~67.23 .19 .76 68.18	

−ΔT (1st Approx) = 68.00s at 1h 28m

64.82
24) 3.18
0.133 Approx. hourly rate.

3h 01m − 1h 28m = 1h 33m

~~93m @ .133 =~~

1h.55 @ .133 = .21

68.57
.21
68.36 β Persei reduced to 1h 28m

68.25
.18
.09
68.18 at 1h 41m
7

1 36
40
46
1h 41m

1 41
1 28
13 68.17
0h.2 @ .133 = .03
68.20 υ Persei reduced to 1h 41 checks well with the other three

The mean of γ Pisc. & υ Persei is independent practically of n So is β Persei. The discrepancies show that we need not be so particular to eliminate n

The mean of ν Pisc., ο Pisc. & ε Cassiop. will be affected by n to the same extent as a single star of the δ of υ Persei. An error of 5% in value of n will only make 0.01s in ΔT

68.18 at 1h 41m will serve for immediate clock purposes, but leaving the same unsatisfactory rejection already demurred at.

Date,..........................187 . Instrument,.......................... Observer,..........................

Page 146 Continued Timepiece,.......................... Recorder,..........................

Object, Circle,	E Cassiop.	B Urs. Min L.C.	Polaris U.C. ~~Each mean of 3 taps extended by eye graphically aided~~	α Ceti	o' Eridani
		w e	w e	w e	w e
Level Direct, Reversed,		. . . .	. . . .	. . . .	. . . .
Sums, Difference, b.		tan (δ+90°) = -3.640 tan φ .912 tan φ - tan δ = -4.552	Middle tap of each triplet 1h	. .	. .
		h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	1h 46m 38.1 74.6 112.7 42.7 ~~(7)~~0.0 .7 47.1 (6)15.5 .6 57.8 (6)0.8 .6 56.3 56.3 9) 2.9	2 50+ XXX 39.5 37.3 34.7 1m 45.5 32.0 4m 17.5 47.8 29.1 16.9 50.2 26.4 16.6 52.7 24.0 16.7 54.9 21.1 16.0 57.7 18.8 16.5 59.9 16.2 16.1 2m 03.0 13.5 16.5 6.0 2m 11.2 17.2 8.9 2m 8.9 19) 6.9	10m 19.3 22 13.7 33.0 10 50.2 21 44.5 4.7 11 19.1 21 14.1 3.2 11 47.7 20 43.6 1.3 12 16.5 20 15.0 1.5 12 46.6 19 44.8 1.4 13 15.1 19 16.3 1.4 13 44.4 18 47.0 1.9 14 17.0 18 16.3 3.3 14 44.1 17 46.2 0.3 15 18.0 17 16.3 4.3 15 44.9 16 46.0 0.9 16 16.4 16.4	2 57 0.9 17.7 18.6 3.0 15.5 .5 5.1 13.5 .6 7.1 11.4 .5 9.2 9.2 9) 2.4	~~4 06 2.23~~ 4 07 1.4 × 3.6 ~~15.0~~ 16.0 19.6 5.6 13.8 .4 7.7 11.8 .5 9.9 09.9
Sum, Mean,	1 46 56.32	2 52 08.36	25) 3.6	2 57 09.27	7(8) 5.4 4 07 09.~~60~~ 77
Bb, Cc, Aa,		. . .	1 16 16.14	. . .	
Corr'd Transit, R. A.	1 45 47.33 3 .36	14 57 04.~~70~~ 60 12 2 .06 ~~.76~~	24.30 1 14 ~~57.24~~ ~~1 16 16.14~~ ~~.02~~ ~~.32~~	2 56 01.82 .2 .84 67.43 .19	4 06 2.23 2 .25
Error of Timepiece,	68.9~~6~~ .19 -1.06 68.09	04.~~60~~ 3 ~~63.60~~ Aber. -.06 ~~.19~~ ~~4.59~~ 63.82 ~~.7~~ 4.54 63.~~77~~ 67	~~83.88~~ ~~111.82~~	.85 ~~2 56 01.82~~ .2 .84	6~~7~~7.56 .52 .19 +1.04 ~~78.58~~ 68.75

~~68.18~~ ~~11.11~~

T - a, ν + o Pisc. 67.23

67.60

.0857 ~~Mean~~ ~~3.76)~~ 3.63

.1583

Mean tan δ, ν + o .1177 n = - 0.~~9~~55

3.640

3.758

T - a, ν + o Pisc 67.23

($2^h 50^m - 1^h 37^m$) @ .14 .17

67.40

T - a, B Urs. Min 63.~~40~~ 82 ~~.67~~

Mean tan δ, ν + o ~~3.76~~

3.758) 3.~~80~~ .68 .82

~~n = -1.00~~

n = -1.01

67.40

63.82

3.76 13.58

- 0.95

T - a, ϑ Persei 68.18 68.47

$-0^h.3$ @ .14 - .04

68.14

~~11.82~~ 1.82

~~42.175)~~ 43.68

n = - 1.03

δ (Polaris) = 88° 40' 35."7

log tan δ = 1.63635

tan δ = 43.286

~~tan δ (ϑ Pers)~~ = 1.111

tan δ (ϑ Pers) 42.175

68.14

111.17

42.173) 43.03

n = -1.02

3.76) 3.78 n = - 0.98 .

~~3.76)~~ 3.73

1.00

8.1907 = log $0^s.021 \cos \varphi$

log ~~cos~~ δ (Polaris) = 6.3635

log Aberration 9.8268

Rt. A. $24^s.30$

Aberration 0.67

Correction R.A. 24.97

T - R.A. $111^s.17$

Mean value of n { -1.02 (greater weight) ~~-0.98~~ -0.95 -1.00

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ... 187 . Instrument, ... Observer, ...

Pl. 146, 7 continued Timepiece, ... Recorder, ...

Object, 54 Persei Circle,	ε Tauri	Gr. 750		
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	δ = 85° 14′ 36″ log tan δ = 1.0798 tan δ = 12.05	. .	. .
4h 13m Wire, I. 37.7 II. 57.7 95.4 40.1 ~~57.7~~ 55.1 .2 42.7 ~~55.1~~ III. 52.7 .4 45.2 ~~47.8~~ ~~52.7~~ IV. 50.1 .3 47.8 ~~50.1~~ 57.8 V. 9) 6.1	h m s 4 22 . 37.9 93.3 40.0 55.4 ~~95.4~~ ~~44.3~~ 53.1 93.1 ~~46.7~~ ~~51.1~~ 93.3 ~~48.8~~ 93.1 42.2 51.1 46.7 44.3 48.8 46.7	h m s ~~3~~4 ~~59~~ .1m (59)m 14.4 35.0 ~~49.4~~ 23.5 27.6 .51.1 32.1 19.7 51.8 41.0 10.1 .51.1 49.3 2m 2.1 .51.4 57.3 52.7 50.0 60 5.1 44.9 .50.0 14.7 36.6 51.3	h m s	h m s
Sum, Mean, 4 13 47.68	9) 5 .5 4 22 46.61	22.7 29.0 51.7 30.1 21.0 .51.1 38.8 12.9 51.7 47.6 1m 5.6 ~~.53.2~~ 56.2 0m 56.2	.	.
Bb, Cc, Aa,	.	21) 12.4 4h 0m 55.59	.	.
Corr'd Transit, R. A. 4 12 39.49 2 .51	4 21 38.66 2 .68	3 59 33.~~64~~ 42 ~~.19~~ ~~.81~~	.	.
68.17 .19 Error of Timepiece, +.23 68.59	67.93 .19 +.57 68.69	33.42 81.~~96~~ Aber. .19 ~~.98~~ 33.61 81.98	.	.

Supposing there were collimation error to account for discrepancy in m it would affect the value in the following proportion. (Taking as abscissa)

For 0.95 .06 - .02 = .04
" 1.02 .67 - .02 = .65
" 1.15 ~~.19 + .06 = .25~~
.19 - .06 = .13

Hence it could not be laid to collimation, even if we had not adjusted it to zero just before observing.

Gr. 750 81.98
β Urs. Mi 63.~~64~~82
18.~~26~~.16 Diff 15.69

12.05
- 3.64
15.69

1.1 @ .14 .15
15.69) ~~17.84~~ 18.04
~~m = -1.17~~
m = -1.15

~~82.21~~
63.82
18.39

o T at 4h 06 68.75
54 P " 13 .59
ε T " 22 .64
4h 14 68.68
~~68.00~~
2.8) .68

~~R.A. 33.42~~
~~Aber. .19~~
~~33.23~~
~~Transit 55.59~~
~~1m 22.36~~
~~1.1 @ .14 .15~~
~~Gr 750 red. to β Urs. Mi 0m 82s.21~~

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 7.3 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object,	~~η~~ Tauri			η Tauri			ζ Persei					
Circle,	27											
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	3	43	.	3 25.0	41 43.1	. 68.1	3	47	.			.
II.	5.7	23.7	29.4	27.1	41.0	.1	39.0	58.6	97.6			.
	8.0	21.7	.7	29.6	38.7	.3	41.4	56.0	.4			
III.	10.1	19.1	.2	31.8	~~33.7~~ 36.3	.1	43.9	53.8	.7			.
	12.6	17.0	.6	34.0	~~36.3~~	34.0	46.4	51.2	.6			
IV.	14.8		14.8	~~36.2~~		9).6	48.9		48.9			.
V.			9) 6.7						9) 7.2			.
Sum,			.			.			.			.
Mean,	3	43	14.74	3	41	34.07	3	47	48.80			.
Bb,			.			.			.			.
Ce,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	3	42	03.~~59~~ 44 .02 42	3	40	22.94 02 .92	3	46	37.41 02 .39			.
Error of Timepiece,			71.32 .19 .44 71.95			71.15 .19 .47 71.81			71.41 .19 .32 71.92			.

.81
.95
.92

−ΔT = 71.89 at 3h 44

71.89
68.18
3.71

26)3.71
.143 Approx. Hourly Rate

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 8.2 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	ν Arietis	~~δ Persei~~ ~~δ Ceti~~	~~δ η Persei~~ η Persei	δ Persei Feb. 9.2 J. R. E. obs.
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.		δ Persei		
	h m s	h m s	h m s	h m s
Wire, I.	2 33	2 34	2 43	2 37
II.	6.9 24.7 31.6	× 43.1	(5) 9.3 28.3 27.6	07.3 32.8 40.1
	9.1 22.3 31.4	28.9 41.1	02.8 24.8 27.6	10.5 29.5 40.0
III.	11.2 20.1 .3	30.8 39.0	06.4 21.0 .4	13.8 26.0 39.8
IV.	13.6 18.0 .6	33.0 37.0	10.1 17.2 .3	16.9 23.1 40.0
V.	15.8 15.8 9) 6.7	34.9 δ Ceti	13.9 13.9 9) 6.8	20.4 20.4 9) .3
Sum,		2 37 4.2 29.1 33.3 7.4 26.2 .6 10.5 23.0 .5 13.6 19.8 .4 16.8 16.8		
Mean,	2 33 15.74		2 43 13.76	2 37 20.03
Bb, Cc, Aa,		9) 6.6 2 37 16.73		
Corr'd Transit, R. A.	2 32 1.58 2 .60	2 36 1.98 2 2.00	2 41 58.69 .03 .72	2 36 1.98 2 2.00
Error of Timepiece,	74.14 .19 .52 −ΔT' = 74.85	74.73 .19 −.23 74.69	75.04 19 −.54 74.69	78.03 19 −.23

Error = +74.74s
at 2h 37m

74 { .85
.69
.69
.74

33
34
43
37

74.74
71.89
22.9) 2.85
Hourly rate .125
Previous .143
.134

77.99

77.99
77.91
77.95
at 2h 40m Feb. 9.2
Add 0h.3 @ .14 = .04
Error carried forward
to time of obs. of A. S.
= 77.99

1879phad.proj.1789R

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 9.2 1880. Instrument, Mer. Cir. Observer, A.S.

Timepiece, 1327 Recorder, J.R.E.

Object, η Persei Circle, J.R.E. dr.		γ Persei	ρ Persei	β Persei	δ Arietis
		w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.					
	2h 43	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	02.4 31.7 34.1 5.9 27.8 3.7 9.8 24.2 4.0 13.4 20.7 4.1 16.9 16.9 9)8.8	2 58 ~~15.7~~ 38.2 59.6 97.8 41.0 57.0 98.0 43.6 54.2 97.8 46.3 51.7 98.0 48.9 48.9 9)8.5	ρ	3 01 30.6 52.2 82.8 33.1 49.7 .8 35.8 46.5 .3 38.7 44.1 .8 41.7 41.7 9)3.4	3 06 (5)6.1 14.0 10.1 (5)8.8 11.8 .6 00.6 9.6 .2 3.0 7.3 .3 5.0 5.0 9)1.2
Sum,					
Mean,	2 43 16.98	2 58 48.94		3 01 41.38	3 06 05.13
Bb, Cc, Aa,		2 57 12.8 40.4 53.2 16.4 37.0 3.4 19.9 33.8 3.7 23.4 30.2 3.6 27.0 27.0 9)6.9			
Corr'd Transit,		2 57 26.77			
R. A.	2 41 58.69 .03 .72	2 56 8.52 2 .54	2 57 30.98 2 31.00	3 00 23.45 2 .47	3 04 47.65 2 .67
Error of Timepiece,	18.26 .19 −.54 77.91	78.23 .19 −.42 78.00	77.94 .19 +.12 78.25	77.91 .19 +.10 78.20	77.46 .19 +.56 78.21
	94			~~78.20~~	

Error of 1327
at 2h 58m

(Mean of ρ + β) = 78.23

78.23
74.74
24.3) 3.49
Hly Rate = +.144
Previous .122
.133

Mean of γ Pers. + δ Ariet = 78.11
Mean of 4 would be 78.17 instead
of 78.23 as used before the other
two were worked up.

A graphical construction of a curve of residuals from a uniform rate of +3s per 24 sidereal hours from Jan 16, 0h sidereal time, with a smoothed curve repeatedly extended (eye & hand) by E.C.P. (principally) and J.R.E. (1/3 weight) leads to a prediction of the following residuals from the same curve;

Feb. 10th 0h sidereal, Prediction − Curve = +5s.94 Feb. 11th, 0h sid. P − Cv = +6s.06

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 10.8 1880. *Instrument,* Mer. Cir. *Observer,* J. R. E.

Timepiece, 1327 *Recorder,* J. R. E.

Object, *Circle,*	β Draconis	i Herculis	y Draconis	
	w e	w e	w e	w e
Level Direct, *Reversed,*				
Sums, *Difference,* *b.*				
	h m s	h m s	h m s	h m s
Wire, I.	17 29	17 37	17 55	
II. III. IV. V.	× 20.2 (5)6.4 16.8 13.2 (5)9.7 20.2 13.2 ·2.9 03.3 16.8 10.0 3.3 06.7 13.2 ·06.7 ~~10.0~~ 2)·4.1	15.8 40.0 55.8 19.0 36.9 5.9 22.1 34.1 6.2 25.0 31.0 6.0 27.8 27.8 9)8.7	(5)8.6 25.3 23.9 02.0 22.0 4.0 8.2 18.7 3.9 8.7 15.3 4.0 11.8 11.8 9)8.6	
Sum, *Mean,*	17 29 06.59	17 37 27.97	17 55 11.96	
Bb, *Cc,* *Aa,*				
Corr'd Transit, *R. A.*	17 27 42.82 .02 .84	17 36 4.77 2 .79	17 53 48.63 2 .65	
Error of Timepiece,	83.75 .19 −.39 83.55	83.18 .19 −.12 83.25	83.31 .19 −.34 83.16	

7 × .55 = 3.85
9 × .25 = 2.25
9 × .16 = 1.44
25 5)7.54
5)1.51
+ 83s.30 at 17h 39m

The rejection of β Drac. would have given 83.20
Hence there is an uncertainty of 0s.1

Graphical prediction, as noticed on preceding page would give

25d 17h 39m = 77.21
Residual 5.98
Predicted 83.19

83.30
78.23
38.7)5.07
Hourly rate .131

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 11, 1880 Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	~~D Persei~~ η Persei	θ Persei	41 Arietis	τ Persei	
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.		. .	. .	. .	. .
Wire, I. II. III. IV. V.	2h 43m 08.8 38.02 46.4 12.2 34.2 .4 16.0 30.4 .6 19.7 26.9 23.3 23.2 7)1.7	h m s 2 37 . 14.0 39.0 53.0 17.0 35.9 2.9 20.1 32.7 2.8 23.2 29.6 2.8 26.3 26.3 9) 3.8	h m s 2 44 . 11.5 30.0 41.5 13.8 27.7 5 16.0 25.2 .2 18.3 23.0 .3 20.7 20.7 9) 6.2	h m s 2 47 . (5)8.0 25.2 23.2 01.2 21.8 .0 04.9 18.4 .3 08.2 16.0 .2 11.5 11.5 9) 5.2	h m s . . . . .
Sum, Mean,	2 43 23.24	. 2 37 26.42	. 2 44 20.69	. 2 47 11.58	. .
Bb, Ce, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	2h 41' 58.60 2 .62	. 2 36 01.91 2 .93	. 2 42 56.64 2 .66	. 2 45 46.81 .02 .83	. .
Error of Timepiece,	84.62 .19 −.54 84.27	84.49 19 −.23 84.45	84.03 .19 +.40 84.62	84.75 .19 −.38 84.56	.

Error	Weight	Prod
(84).27	6	162
.45	7	315
.62	11	682
.56	6	336

30)1495
(84).50

.45
.27
.62
.56
4)1.90
.47

Mean (−ΔT) = 84.47 at 2h 31m
83.30
8.9)1.17
Hourly rate .131
Previous .131

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 12,3 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	η Gemin.	2 Lyncis	γ Geminorum	ε Gemin	
	w e	w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.					
	6h 09m	h m s	h m s	h m s	h m s
Wire, I.		6 10	6 32	6 38	
II.	(5) 9.6 17.7 17.3 02.0 15.2 .2	19.1 57.5 70.6 23.0 47.5 .5	8.8 25.9 34.7 10.9 23.8 .7	(5) 4.8 12.9 07.7 (5) 6.9 10.8 .7	
III.	4.1 13.0 .1 6.6 10.9 .5	27.2 43.2 .4	13.0 21.7 .7	× 8.5	
IV.	8.7 8.7	31.4 39.3 .7	15.1 19.5 .6	01.6 6.0 .6	
V.	9) 5.8	35.2 35.2 9) 2.4	17.2 17.2 9) 2.9	3.9 3.9 7) 5.9	
Sum,					
Mean,	6 09 08.64	6 10 35.27	6 32 17.32	6 38 03.84	
Bb, Cc, Aa,					
Corr'd Transit, R. A.	6h 07 40.67 2 .69	6 09 06.48 .03 .51	6 ~~36~~ 30 ~~35.75~~ 49.38 2 .40	6 36 35.75 2 .77	
Error of Timepiece,	87.95 .19 +.50 88.64	88.76 .19 −.75 88.20	87.92 .19 +.62 88.73	88.07 .19 +.44 88.70	

2 Lyncis, being more than twice as near the pole may have a wt. 1 while the other take a weight 2

1,28
20
1.46
1.40
7) 4.34
.62

Mean then of these Error = + 88.62 at 6h 17m
84.47
27.8) 4.15
Hourly rate .141
Previous .131
.136

Graphical construction justifies an hourly rate of .137 for the last 8 days
The variation from that being in no case as large as 0.2 and changing sign often. We may use for prediction this rate, starting at

12d 6h 17m
11 2 31
11 16h 28m Error = 88.62
84.47
86.55

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, 14. 2 1880. Instrument, Mer. Cir. Observer, J. R. E.
Timepiece, 1327 Recorder, "

Object, ϑ Persei Circle,			ρ Persei	β Persei
	w · e	w · e	w · e	w · e
Level Direct, Reversed,				
Sums, Difference, b.				
2~ 37 ~~24~~	h m s	h m s	h m s	h m s
Wire, I.			2 59	3 01
24.3 II. 49.4 73.7 27.7 46.3 4.0 30.5 III. 43.2 3.7 33.9 IV. 40.0 3.9 37.0 37.0 V. 9)8.3			(5)5.1 16.2 11.3 (5) 8.0 13.6 11 6 00.3 10.9 11.2 3.0 8.3 11.3 5.8 5.8 9)6.2	47.6 69.1 116.7 50.2 66.5 .7 52.9 63.9 8 55.6 61.0 .6 58.2 58.2 9)3.0
Sum,			2 59 5.69	3 01 58.33
Mean, 2 37 36.92				
Bb, Cc, Aa,				
Corr'd Transit,				
R. A. 2 36 01.84 2 .86			2 57 30.88 2 .90	3 00 23.35 2 .37
95.06 Error of Timepiece, .19 −.23 95.02			94.79 .19 +.12 95.10	94.96 .19 +.10 95.25

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 14.2 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	σ δ Persei	~~σ Persei~~	f Tauri	
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	3 23 .	.	3 25 .	.
II.	31.9 56.3 88.2	.	42.3 59.2 101.5	.
III.	34.8 53.1 7.9	.	44.6 57.1 .7	.
	37.9 50.1 8.0	.	46.8 55.0 .8	.
IV.	41.0 47.2 8.2	.	48.7 53.0 .7	.
V.	44.0 44.0 9) 0.3	.	50.9 50.9 9) 7.6	.
Sum,	.	.	. .	
Mean,	3 23 44.03	.	3 25 50.84	.
Bb,	.	.	.	.
Cc,	.	.	.	
Aa,	.	.	.	
Corr'd Transit,	.	.	.	
R. A.	3 22 08.88 2 .90	.	3 24 16.48 .50	.
Error of Timepiece,	95.13 .19 − .18 95.14	.	94.34 19 + 67 95.20	.

δ Persei 2 36 } 95.02 }
δ " 2 57 } 51 .10 } .12 J. R. E.
β " 2 60 } .25 }
σ " 2 83 } 84 .14 } .17 A. S.
f Tauri 2 84 } .20 }

At 3h 08m 95.15 = Error of 1327
29d 3h 08m @ 3s = 87.39
Residual = 7.76

95.15
88.62
44.9) 6.53

Hourly rate +.145
Previous .141
.143

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 15.8 1880. Instrument, Mer. Cir. Observer, J. R. E.

Also Feb. 16.8 subsequently worked up. Timepiece, 1327 Recorder, "

Object, Circle,	η Herculis Feb. 15.8			δ Herculis Feb 16.8			γ Draconis Feb 16.8			α Lyrae Feb. 16.8		
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	16	40	.	17	11	.	17	55	.	18	34	.
II.	17.2	38.9	56.1	41.2	59.3	100.5	19.9	46.3	66.2	25.6	46.9	72.5
III.	19.8	36.0	5.8	43.5	57.0	5	23.1	42.8	5.9	28.3	44.0	3
IV.	22.7	33.2	5.9	45.8	54.8	.6	26.2	39.3	5.5	31.0	41.5	.5
	25.4	30.7	6.1	48.0	52.4	.4	29.7	36.2	5.9	33.6	38.9	.5
V.	28.1		28.1	50.0		50.0	33.0		33.0	36.1		36.1
			0.0			9)2.0			9)8.5			9)1.9
Sum,			.			.			.			.
Mean,	16	40	28.00	17	11	50.22	17	55	32.94	18	34	36.21
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	16	38	47.59 2 .61	17	10	6.86 2 .88	17	53	48.81 2 .90	18	32	52.63 2 .65
Error of Timepiece,		1	40.39 .19 +.10 40.68		1	43.34 .19 +.45 43.98		1	44.04 .19 −.34 ~~44.55~~		1	43.56 .19 +.11 43.86

1 40.68
~~29d 16h 40m = 1 35.08~~
~~Residual 5.60~~
30d 16h 40m = 1 32.08
Residual 8.60

31d 17h 12m = 1 35.15
Residual 08.83

1 43.89
17h 55m = 1 32.24
08.65

18h 35m = 1 32.32
08.54

Time 17h 54m
Error 1m 43s.91
Residual 08s.67

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 16.2 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object,	ρ [illegible] Persei		δ Persei		ν Persei			
Circle,								
	w	e	w	e	w	e	w	e
Level Direct,								
Reversed,								
Sums,								
Difference,								
b.								

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	2	59		3	36		3	39				
II.	~~x~~	~~x~~		(5) 3.8	19.2	14.0	35.1	57.6	92.7			
	7.1	17.7	24.8	(5) 8.0	16.1	1	38.0	54.8	2.8			
III.	9.6	14.8	.4	0 0.9	13.1	.0	40.9	52.1	3.0			
	12.3		12.3	4.0	10.0	0	43.7	49.2	2.9			
IV.			5).65	7.1		7.1	46.6		46.6			
V.						9).2			9)4.0			
Sum,												
Mean,	2	59	12.30	3	36	07.02	3	39	46.44			
Bb,												
Cc,												
Aa,												
Corr'd Transit,												
R. A.	2	57	30.84$_{2}$ .86	3	34	24.95$_{2}$ .97	3	37	04.54$_{2}$ .56			
Error of Timepiece,		1 1	41.44 .19 +.12 41.75		1 1	42.05 .19 −.17 42.07		1 1	41.88 .19 +.01 42.08			

$5/6^h$ @ $.144^s$ = 41.75
.09
41.85
5 wires only

42.07
42.08
41.85 (½ weight)
1^m $42^s.03$ = Error at 3^h 38^m

102.03
95.15
48.5) 6.88

Hourly rate +.142
Previous .145
.143

$31^d\,2^h\,3^m$ @ 3^s = 1 41.75
1 33.26
8.49
Residual

3^h36^m = 1 42.07
1 33.45
8.62

3^h40^m = 1 42.08
1 33.46
8.62

Mean of Time 3^h 38^m
(") Error 1^m $42^s.03$
(") Residual $8^s.58$

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 17.2 1880 Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,	β Androm.	γ Androm.	α Arietis	β Trianguli
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	1 04 .	1 58 .	2 02 .	2 04 .
II. III. IV. V.	35.9 56.2 92.1 38.6 53.7 2 3 41.0 51.1 2 1 43.6 48.2 1.8 46.0 46.0 9).3	07.0 29.1 36.1 09.7 26.3 0 12.5 23.5 .0 15.3 20.8 .1 18.0 18 0 9).2	01.0 19.0 20.0 3.2 16.8 0 5.6 14.4 .0 7.9 12.2 1 10.0 10.0 9).1	(5)9.7 20.0 19.7 02.6 17.6 20.2 4.9 15.0 19.9 7.2 12.6 19.8 10.0 10.0 9) ~~8~~.6
Sum,	.	.	.	.
Mean,	1 04 46.03	1 58 18.02	2 02 ~~1~~0.01	2 04 09.96
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	1 03 1.52 2 .54	1 56 33.02 ~~33~~ 2 33.04	2 00 25.59 2 .61	2 02 25.29 2 .31
Error of Timepiece,	1 44.49 .19 +.22 1 44.90	1 44.98 .19 +.02 1 45.19	1 44.40 .19 +.49 1 45.08	1 44.65 .19 +.29 1 45.07
	32^d 1^h04^m @ 3^s = 1^m 36.13 Residual $8^s.77$	1^h58^m = 1 36.25 8.94	2^h 02 1 36.25 8.83	2 04 = 1 36.26 8.81

(See Solar Time Bk. p. 247) Error at 1^h18^m = 1^m 44.97

" " 3^h 38 = 1 42.03

21.7) 2.97

.137

Previous .143

Use .14

44.90
45.19
45.08
45.07
45.06

.81
.83
.94
.77
4) 3.25
$8^s.81$

Mean Residual $8^s.81$

Mean of Times $3^h 0^m$

(") Error 1^m $45^s.06$

Graphical Prediction gives for $18^d.5$ Mean Time Residual = $9^s.10$

" $19^d.3$ " = ~~$9^s.20$~~ 5

$9^s.20$

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 18.8 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, 〃

Object,	ε Herculis	π Draconis			
Circle,					
		w e	w e	w e	w e
Level Direct,		. .	. .	. .	. .
Reversed,		. .	. .	. .	. .
Sums,		. .	. .	. .	. .
Difference,					
b.					
	17h 57m	h m s	h m s	h m s	h m s
Wire, I.		17 12 .	.	.	
II.	23.1 42.4 65.5	32.6 53.2 85.8	.	.	.
	25.5 40.0 .5	35.1 50.6 7			
III.	28.0 37.7 .7	37.8 48.0 .8	.	.	.
	30.2 35.1 .3	40.2 45.6 .8			
IV.	32.8 32.8	43.0	.	.	.
V.	9) 6.8	43 0 9) 8.1	.	.	.
Sum,		.	.	.	
Mean,	$1\overset{6}{7}$ 57 32.76	17 12 42.90	.	.	
Bb,		.	.	.	
Cc,		.	.	.	
Aa,		.	.	.	
Corr'd Transit,		.	.	.	
R. A.	16 55 42.70 2 .72	17 16 52.68 2 .70	.	.	.
	1 50.04 .19	1 50.20 .19			
Error of Timepiece,	+.31	+.16	.	.	.
− Δ T −	1 50.54	1 50.55			

33d 16h 57m @ 3s = 1 41.12 17h 13m = 1 41.15

Residual. 9.42 9.40

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 19.3 1880. Instrument, Mer. Cir. Observer, A. S.

Timepiece, 1327 Recorder, J. R. C.

Object, Circle,	τ Tauri	4 Camelopard.	α Aurigae	β Aurigae	ι Tauri
Level Direct, Reversed,		w . e .	w . e .	w . e .	w . e .
Sums, Difference, b.					
Wire, I. II. III. IV. V.	4ʰ 36ᵐ 33.6 78.4 112.0 36.0 76.3 2.3 38.1 74.0 2.1 40.5 ~~45.9~~ 71.9 2.4 42.8 69.6 2.4 ~~45.9~~ 47.0 64.9 1.9 49.4 62.9 2.3 51.7 60.7 2.4 53.9 58.2 2.1 56.1 56.1 19)2.3	h m s 4 41 14.7 31.0 45.7 16.8 29.0 8 18.7 26.9 .6 20.8 25.0 .8 22.8 22.8 μ Eridani 4 39 41.0 71.1 112.1 44.6 67.5 .1 48.4 63.7 1 52.2 59.8 0 55.9 55.9 9)0.2	h m s 5 09 32.4 56.4 88.8 35.2 53.2 .4 38.6 50.3 .9 41.5 47.3 8 44.7 44.7 9)3.6	h m s 5 52 27.4 51.0 78.4 30.3 48.0 .3 33.2 44.9 .1 36.2 42.1 3 39.3 39.3 9)1.4	h m s ~~5 02~~ 4 57 40.2 58.0 98.2 42.3 55.9 .2 44.7 53.8 5 47.0 51.4 .4 49.1 49.1 9)1.4
Sum, Mean,			5 09 44.40	5 52 39.16	4 57 49.16
Bb, Cc, Aa,	4 36 56.12	4 39 56.02			
Corr'd Transit, R. A.	4 35 04.56 2 .58	4 38 03.51 3 .54	5 07 52.28 2 .30	5 50 46.69½ .71	4 55 57.52 2 .54
Error of Timepiece,	1 51.64 .19 +.49 1 52.22	1 52.48 .19 −.60 1 52.07	1 52.10 .19 −.12 1 52.17	1 52.45 .19 −.08 1 52.56	1 51.62 .19 +.52 1 52.33
	34ᵈ 4ʰ 37ᵐ = 1 42.58 9.64	4ʰ 40 = 1 42.58 9.49	5ʰ 10 = 1 42.65 9.52	5ʰ 52 = 1 42.73 9.83	4 58 = 1 42.62 9.71

Residuals

4 37	.22	.64
4 40	.07	.49
5 10	.17	.52
5 52	.56	.83
4 58	.33	.71
Mean ~~Time~~ 5ʰ 03ᵐ	1ᵐ 52.27	9ˢ.64
Time;	Err.	Residual

112.27
104.97
51.7 ~~27.7~~) 7.30

Rate for 2 days = +ˢ.141 hourly.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb 19.8 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,	E Herculis	π Herc.			
		w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.					
	16h 57m	h m s	h m s	h m s	h m s
Wire, I.		17 12			
26.7 46.0 II.	72.7	36.2 56.8 93.0			
29.1 43.7	.8	38.7 54.0 2.7			
31.5 41.1 III.	.6	41.1 51.4 2.5			
33.8 38.8	.6	43.8 49.0 2.8			
36.1 IV.	36.1	46.4 ~~46.4~~			
V.	9)2.8				
Sum,		20.4 72.2 92.6 23.3 69.6 .9 25.9 67.0 9 28.4 64.3 .7 31.0 61.8 .8			
Mean,	16 57 36.31				
Bb,		46.4 9)7.3			
Cc,					
Aa,		17 12 46.38			
Corr'd Transit, R. A.	16 55 42.09 73	17 10 52.05 71 67			
Error of Timepiece,	1 53.58 .19 +.31 ~~1 54.72~~	1 53.00 .19 +.16 ~~1 54.68~~			
	1 54.08	1 54.02			

34d 17h 05 1 54.05

1 44.14

Residue 9.91

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 20.2 1880 Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,	δ Persei	ν Persei		ε Persei
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.	3 36	3 39		
Wire,	h m s	h m s	h m s	h m s
I.	08.0 32.3 40.3	~~02.2~~ (4)8.4 10.7(5)9.1		3 51
II.	11.0 29.2 2	~~8.0~~ (5)1.3 7.9 .2		34.4 55.8 90.2
III.	14.0 26.2 .2	~~7.9~~ (5)4.0 5.0 .0		37.1 53.1 2
IV.	17.0 23.1 .1	~~10.7~~ (5)6.8 02.7 .5		39.9 50.7 .6
V.	20.1 201 9):9	(5)9.5 (5)9.5 .8 9)5.3		42.5 47.9 .4 45.0 ~~4~~50 9)1.4
Sum,	3 36 20.10	3 38 59.59		3 51 45.16
Mean,				
Bb, Cc, Aa,				
Corr'd Transit,				
R. A.	3 34 ~~25.~~ 24.85 2 .87	3 37 04.45 2 .47		3 49 49.9½ .93
Error of Timepiece,	1 55.23 .19 −.18 1 55.24	1 55.12 .19 +.01 1 55.32		1 55.23 .19 +.09 1 55.51
	$35^d\ 3^h\ 36^m$ = 1 45.45 9.79	$3^h\ 39^m$ = 1 45.46 9.86		$3^h\ 52^m$ = 1 45.48 10.03

For δ, ν, & ε { Time = $3^h\ 42^m$

Means { Error = $+1^m\ 55^s.36$

Residue $9^s.89$

1 15.36
1 12.27
22.6) 3.09
Hourly rate .137
for last day.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 21.2 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object,	δ Persei	ν Persei		ζ Persei	ε Persei
Circle,					
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.					
		h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	8^h ~~3^m 36^m~~ 3^h 36^m Sum 36^m 53.1 ~~37^m 56.1~~ 36^m 54.1 107.2 58.2 51.0 .2 59.1 48.0 .1 36 02.2 44.8 .0 05.3 41.8 .1 ~~107.6~~ 5.6	38^m ~~35^m~~ 39^m 35.1 30.8 65.9 37.9 27.9 5.8 40.6 25.1 5.7 43.3 22.5 5.8 46.3 19.7 6.0 ~~7.5~~ 9.2		~~3 57~~ 3^h 49 ~~37.8~~ 40.5 25.7 45.0 70.7 28.0 42.5 .5 30.6 40.1 .7 33.0 37.8 .8 35.6 35.6 9) 3.3	3 57 37.8 59.1 96.9 40.5 56.7 7.3 43.1 53.8 6.9 45.9 51.1 7.0 48.3 48.3 9) 4.4
Sum,					
Mean,	3 36 23.56	3 39 ~~0~~ 02.92		3 49 35.37	3 51 48.49
Bb,					
Cc,					
Aa,					
Corr'd Transit, R. A.	3 34 24.43 ~~.55~~ .12 ~~.67~~ .55 1 ~~58.67~~ .71 .19 −.17 ~~1 58.71~~ 1 58.73	3 37 04.43 ~~.45~~ .2 ~~.47~~ .45 1 58.47 .19 +.01 1 58.67 ~~1 58.28~~ .30 .19 +.01 ~~1 58.50~~ ~~1 58.50~~		3 46 37.17 .2 .19 1 58.18 .19 +.30 58.67	3 49 49.89 .2 .91 1 58.58 .19 +.09 1 58.86
Error of Timepiece,					

.73
.67 ~~Time~~ ~~from~~ δ, ν, ζ + ε
.67 ~~Time 3^h 04^m~~
.86 Time 3^h 44^m
~~.69~~
.74 Error 1^m 58.74

1 58.74
1 55.36
24) 3.38
Hourly rate .141

36^d 3^h 44^m : 1 48.47
Residual 1 0.27

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 22.2 1880 Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,		σ Persei	δ Persei	ν Persei
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	.	3 24 .	3 36 .	3 39 .
II.	.	(5)8.6 23.0 21.6 01.7 20.0 21.7	15.0 39.0 54.0 17.9 36.1 4 0	(5)5.1 17.5 12.6 (5)8.0 14.6 .6
III.	.	4.5 17.0 21.5	26.8 33.0 3.8	00.7 12.0 .7
IV.	.	7.8 14.0 21.8	24.0 30.1 4.1	3.4 9.0 .4
V.	.	18.9 10.9 9)7.5	27.0 27.0 9)8.9	6.2 6.2 9)2.5
Sum,	.	.	.	.
Mean,	.	3 24 10.83	3 36 26.99	3 39 ~~12~~ 6.28
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	.	3 22 08.69 2 .71	3 34 24.80 2 .82	3 37 04.40 2 .42
Error of Timepiece,	.	2 02.12 .19 −.18 2 02.13	2 02.17 .19 −.17 2 02.19	2 1.86 .19 +.01 2 2.06

σ, δ & ν

Time 3h 33

Error 2m 02s.13

722.13
118.74
23.9) 3.39

Rate s.142 hourly

37d 9h 33 = 2 02.13
1 57.25
Residual 10.88

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 2^{3}4 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object,	51 Aurigae	63 Aurigae	ψ^{5} Aurigae	27 Lyncis	31 Lyncis
Circle,					
		w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.					
	6h 32	h m s	h m s	h m s	h m s
Wire, I.		7 05	6 40		8 16
II.	19.0 40.6 59.6	22.8 44.0 66.8	3.5 26.3 29.8		35.5 58.7 94.2
	21.7 37.7 .4	25.3 41.6 .9	6.2 23.5 .7		38.6 55.7 3
III.	24.1 35.1 .2	28.0 38.8 .8	9.0 20.7 .7		41.3 52.9 2
	27.0 32.2 .2	30.8 36.0 .8	12.0 17.8 8		44.2 50.0 .2
IV.	29.7 29.7	33.1 33.1	14.9 14.9		47.1 47.1
V.	9)6.1	9)3.4	9)7.9		9)1.0
Sum,					
Mean,	6 32 29.68	7 05 33.88	6 40 14.88		8 16 47.11
Bb,					
Cc,					
Aa,					
Corr'd Transit,					
R. A.	6 30 23.57 2 .59	7 03 27.21 2 .23	6 38 08.55 2 .57		8 14 40.69 2 .71
Error of Timepiece,	2 06.15 +.19 +.09 2 06.43	2 06.15 .19 +.09 2 06.43	2 06.31 .19 −.04 2 06.46		2 06.40 .19 −.04 2 06.55

51, 63, ψ^{5} & 31

~~Time 7~~

Tri 7h 8m

Erro 2m 06.49s
1 54.89 = 38d 7h 8m
Residuae 11s.60

Erro = 2 06.50
by ψ^{5} & 31 at 7h 31
Provisional

2 06.49
1 54.74
51.4) 7.75
.151

8 16.8 1h.6 @ .14
6 40.2 = .22
1 36.6

.55
.46
.09

For stars of Feb. 23.8 see page 143   Calculation made after work on this page.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 24.2 1880.   Instrument, Tran. Cir.   Observer, J. R. E.

Timepiece, 1327   Recorder, "

Object, Circle,	α Persei	σ Persei	δ Persei	ν Persei	ε Persei
Level Direct, Reversed,		w . . / e . .	w . . / e . .	w . . / e . .	w . . / e . .
Sums, Difference, b.		. .	. .	. .	. .
	3^h 17	h m s	h m s	h m s	h m s
Wire, I.		3 24 .	3 36 .	3 39 .	3 51 .
II.	43.9 69.0 112.9	05.8 30.2 36.0	21.9 46.2 68.1	02.3 24.7 27.0	48.4 69.7 118.1
	47.0 66.0 3.0	09.0 27.1 6 1	24.9 43.2 .1	5.0 21.8 6.8	51.1 67.0 .1
III.	50.1 62.7 2.8	12.0 24.0 6.0	27.9 40.1 .0	7.9 19.0 6.9	53.7 64.3 0
	53.3 59.6 2.9	15.0 20.9 5.9	30.8 37.0 7.8	10.7 16.2 6.9	56.3 61.8 .1
IV.	56.5 56.5	17.9 17.9	34.0 34.0	13.3 13.3	59.1 59.1
V.	9) 4.1	9) 8.9	0.0	9) 3.9	9) 4
Sum,		.	.	.	.
Mean,	3 17 56.46	3 24 17.99	3 36 34.00	3 39 13.43	3 51 59.04
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit,		.	.	.	.
R. A.	3 15 47.23½ .25	3 22 08.64½ .66	3 34 24.75½ .77	3 37 04.36½ .38	3 49 49.82½ .84
	2 9.21 .19	2 09.33 .19	2 09.28 .19	2 09.05 .19	2 09.20 .19
Error of Timepiece,	-.25 2 9.15	-.18 2 09.34	-.17 2 09.25	+.01 2 09.25	+.09 2 09.48

E Read again by oversight

ε Persei. 3^h 51

48.5 69.7 118.2
51.1 67.0 8.1
53.7 64.2 7.9
56.3 61.8 8.1
59.1 59.1
9) .4

3 51 59.04

σ, δ, ν & ε

Time 3^h 37^m

Error 2^m $09^s.33$

Provisional

2 09.33
~~2 02.17~~
2 06.50
20.1) 2.83
.141

ξ Persei 3^h 48

36.2 55.7 91.9
38.7 53.1 1.8
41.1 50.9 2.0
43.5 48.2 1.7
45.8 45.8
9) 8.2

3 48 45.91
3 46 37.11 +.02
2 08.78
.19
+.30

ξ = 2 09.29
α = 2 09.15
Mean; 2 09.22

$0^s.2$ @ .14 = .03

Mean since α & ξ were calculated in addition,

Time 3^h 36

Error 2^m $09^s.29$

39^d ~~3~~ 3^h 36^m = 1^m 57.45

Residual $11^s.84$

practically diminish [illegible] in w, and applies to about the time

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 26.8 1880 Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,	ε Herculis	π Herculis	o Herculis		
		w | e	w | e	w | e	w | e
Level Direct, Reversed,		. | . . | .	. | . . | .	. | . . | .	. | . . | .
Sums, Difference, b.		. .	. .	. .	. .
		h m s	h m s	h m s	h m s
50.7 69.9 53.0 67.6 55.5 65.0 57.7 62.6 60.2 Wire, I. II. III. IV. V.	16h 57 120.6 .6 .5 .3 60.2 9)2.2	17 13 . 00.0 20.7 20.7 2.6 18.0 .6 5.2 15.5 .7 7.8 13.0 .8 10.4 10.4 8.2	18 05 . 00.4 19.1 19.5 2.7 17.0 .7 5.1 14.6 .7 7.3 12.2 .5 9.8 9.8 9)7.2	.	.
Sum,		.	.	.	.
Mean,	16 58 00.24	17 13 10.36	18 05 09.80	.	.
Bb, Ce, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit,		.	.	.	.
R. A.	16 55 42.96 2 .98	17 16 52.94 2 .96	18 02 52.30 2 .32	.	.
Error of Timepiece,	2 17.26 .19 +(.31 .03 2 17.79	17.40 .19 +(.16 .02 17.77	2 17.48 .19 +(.36 .04 2 18.07	.	.

-1h @ .14 -.14

Reduced to time of other two. } 2 17.93

Time 17h 05

Error 2m 17.83

~~41~~d 17h 05m 2m 5.13

Residual 12s.70

17.83

09.29

61.5 ~~+ 5.5~~) 8.54

Rate s.139 per hr.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 27.2 1880. Instrument, Mer. Cir. Observer, G. R. E.

Timepiece, 1327 Recorder, 〃

Object, Circle,		ρ Persei	β Persei	α Persei
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.		2 59 38.8 59.8 98.6 41.6 57.1 .7 44.0 54.6 .6 46.9 52.0 9 49.5 49.5 9) 3.3	3 02 31.0 52.9 83.9 34.0 50.0 4.0 36.6 47.4 4.0 39.2 44.7 3.9 42.0 42.0 ~~17.8~~ 9) 8.8	3 18 (5) 3.7 18.9 12.6 (5) 6.8 15.7 .5 00.0 12.6 .6 3.0 9.3 .3 6.2 6.2 ~~9.3~~ 9) 2.2
Sum, Mean,		2 59 49.37	3 02 41.98	3 18 06.24
Bb, Cc, Aa,				
Corr'd Transit, R. A.		2 57 30.63 2 .65	3 00 23.09 2 .11	3 15 47.16 2 .18
Error of Timepiece,		2 18.72 .19 +.12 2 19.03	2 18.87 .19 +.10 2 19.16	2 19.06 .19 −.25 2 19.00

Time 3^{h} 06^{m}

Error 2^{m} $19^{s}.06$

42^{d} 03^{h} 06^{m} = 2 06.39

Residual $12^{s}.67$

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 27th 1880. Instrument, Mer. Circ. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object, Circle,	η Herculis			ε Herculis			π Herculis		
	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.
Sums,	.		.	.		.	.		.
Difference,									
b.									
	h	m	s	h	m	s	h	m	s
Wire, I.	16	41	.	16	58	.	17	13	.
II.	(5) 8.6	19.7	~~18.3~~	(5) 4.0	13.0	7.0	03.5	23.8	27.3
	00.7	16.7	17.4	(5) 6.3	10.8	7.1	05.8	21.1	6.9
III.	3.3	14.0	17.3	(5) 8.7	08.2	6.9	08.1	18.6	6.7
	6.1	11.1	17.2	01.0	06.0	7.0	11.0	16.1	7.1
IV.	8.7		8.7	03.8		3.8	13.6		13.6
V.			9)4.6			9)4.8			9)4.6
Sum,			.			.			.
Mean,	16	41	08.66	16	58	03.53	17	13	13.51
Bb,			.			.			.
Cc,			.			.			.
Aa,			.			.			.
Corr'd Transit,			.			.			.
R. A.	16	38	47.92 2 .94	16	58	42.99 2 3.01	17	10	52.98 2 3.00
Error of Timepiece,		2	20.72 .19 +.10 21.01		2	20.62 .19 +.31 21.02		2	20.51 19 +16 20.76

Time 16h 57m

Error 2m 20.93

20.93
17.83
23.9) 3.10 (.130
239
710
717

20.93
19.06
13.85) 1.87 (.136
1385 .135
4850
415
700
~~821~~

After this date the pendulum-length of 1327 was changed and its error discontinuously altered.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Feb. 29.3 1880. Instrument, Mer. Cir. Observer, W. A. R.

29. See below. Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Gemin.	α Can. Maj.		
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.				
Wire,	h m s	h m s	h m s	h m s
I.	(7h ?) 6h 30	(7?) 6 39		
II.	32.0 49.3 81.3	35.9 57.0 88.9		
III.	34.1 47.1 1.2 36.3 45.0 1.3	38.0 50.8 .8 40.1 48.7 .8		
IV.	38.5 42.9 1.4	42.2 46.5 .7		
V.	40.7 40.7 9)5.9	44.3 44.3 9)3.5		
Sum, Mean,	6 30 40.66	6 39 44.39		
Bb, Cc, Aa,				
Corr'd Transit, R. A.	6h 30 49.17	6 39 53.60		
Error of Timepiece,	~~.49~~ −8.51 +.19 +{.62 {.06	−8.21 +.19 +{.62 {.06		
	−7.64	−7.34		

Before Feb. 29.3 the clock was stopped and pendulum lengthened.
Between Feb. 29.3 and 29. the weights on pendulum bob were altered.

Discontinuous change of rate here.
~~Discontinuous change of rate.~~
Wts. changed on pendulum,

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 1.2 1880 Instrument, Mer. Cir. Observer, W.A.R.
1.5 Timepiece, 1327 Recorder, J.R.E.

Object, Circle,	54 Persei	Polaris L.C. 88 40 30.7/91 19 29.3 1.6358	a Bootis	a Virginis	
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.		43.23	.36	-.19 .9125 .1859 1.0984	
Wire, I. II. III. IV. V.	4ʰ 12 22.9 47.8 II. 65.7 25.3 ~~40.2~~ .5 27.8 37.8 III. .6 30.3 35.2 .5 32.8 IV. 32.8 V. 9)7.1	h 13 m s 26ᵐ 10 ~~77.7~~ 16 07.2 ~~24.9~~ 5 42.0 15 36.9 78.9 11 10.9 15 07.4 .18.3 40.1 14 38.1 18.2 12 9.0 14 06.3 .15.3 38.1 13 39.7 .17.8 13 7.7 7.7 11)8.2	h 14 m 10 s (5) 9.0 16.5 15.5 0 1.3 14.4 .7 3.6 12.2 .8 5.7 10.1 8 7.9 7.9 9)7.7	h 13 m 18 s 42.1 ~~+~~ 44.2 56.9 101.1 46.3 54.9 .2 48.3 52.7 0 50.6 50.6 7)3.9	h m s
Sum,		.	.	.	.
Mean,	4 12 32.79	13 13 08.75	14 10 07.86	13 18 50.56	.
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	~~3~~ 4ʰ 12 ~~49~~ 3 03 ~~39.68~~ Aberration ~~+~~ 2 .05	13 14 07.25 -.2 .23	14 10 13.59 2 .61	13 18 ~~54~~.97 2 ~~54~~.99	.
Error of Timepiece, n(δ₁-δ₂)	- 6.26 + .32 + .23 + .02 ~~5.84~~	-58.48 Aberr. 07.25 -.67 06.58	-5.75 +.32 {+.56 .14	~~4.11~~ 4.43	.

-ΔT = - 5.69

57.83
~~58.48~~
8.75
~~52.73~~ .08
.82
~~53.56~~
2.90

-ΔT = -4.73

43.23
.36
42.87

.93 @ (avg) .088

log { 1.7288
1.6321
0.0967

.93 @ .096

08
~~52.73~~
.89
53.62
2.97

log { 1.7241
1.6321
0.0920

n = -1.25 4

or

~~x~~ 56.9
42.1 ~~54.9~~
44.2 ~~52.7~~
46.3 50.6
48.3

97.0
6.9
6.9
48.3
~~9.1~~
7) 3.1

Time 13ʰ 45ᵐ
Error - 4.82

5.69
4.82
0.87

58.48
6.55
51.93
1
51.94

.32
{ 1.10
.22
1.64

13 18 48.44
13 18 54.99
6.55
1.64
- 4.91

43.23
.19
43.42

0.1 @ .09

log 1.7155
1.6377
0.0778

n = -1.20

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 2.3 1880. Instrument, Mer. Cir. Observer, W. A. R.

2.7 Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	α Tauri	δ Orionis	ζ Ophiuchi	
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.			-.1791 +1.0916	
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	4 29 (5)0.2 7.7 (5)9.9 (5')2.6 5.3 7.9 (5')4.9 3.1 8.0 (5')6.9 1.0 7.9 (5)9.0 9.0 9)8.7	5 25 41.2 57.5 98.7 43.2 55.5 8.7 45.2 53.6 8.8 47.3 51.2 8.5 49.4 49.4 9)3.1	16 30 22.3 39.1 61.4 24.6 37.0 .6 26.8 35.0 .8 28.9 33.0 .9 30.8 30.8 9)7.5	
Sum, Mean,	4 28 58.97	5 25 49.34	16 30 30.83	
Bb, Cc, Aa,				
Corr'd Transit, R. A.	4 29 03.79 2 .81	5 25 54.45 2 .47	16 30 34.88 2 .90	
Error of Timepiece,	-4.84 +.32 n = -1.2 { +.62 +.12	-5.13 +.32 { +.92 +.18	-4.07 +.32 { +1.09 +.25	

-3.78 -3.71 ~~-2.39~~

-2.41

Time $4^h 42^m$

Error $-3^s.74$

11.8 @ .072 = -3.74

.85

-2.89

-2.65 ± .24

[±.24 not a "probable error", but that which would result were the mean used, one of the obs. being quite wrong.

4.82

3.74

15)1.08

Hourly rate +.072

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 3. 8 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Belongs with next page

Object,	α Herculis	α Oph.	α Can Maj.	15 Argus (2)
Circle,			−26° 12′.4	− 23° 57.8
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.			−.492	−.445
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	17 9 14.34 4.25 10 09 10.1 12.2 14.3 16.5 18.6 5)71.7	17 29 13.0 29.9 15.0 27.7 17.7 25.6 19.2 23.5 21.3 ~~23.5~~ ~~25.6~~ 42.9 .7 .7 7 21.3 9)3.3	7 03 22.0 40.4 62.4 24.2 38.0 2 26.8 35.9 .7 29.0 33.6 6 31.1 31.1 9)2.0	8 02 18.0 36.0 54.0 20.8 33.9 1 22.6 31.7 .3 24.8 29.2 .0 27.0 27.0 9)..4
Sum, Mean,	14.34 2 × 2.058 = 4.116 cos δ = .968) 4.116 (4.25 3872 2440 1936 5040	17 29 21.27	7 03 31.22	8 02 27.04
Bb, Cc, Aa,	17 09 10.09			
Corr'd Transit, R. A.	17 09 11.94½ .96	17 29 23.12½ .14	7 03 32.79½	8 02 28.42 2
Error of Timepiece,	− 1.87 + 32 {+.65 {+.13	−1.77 + .32 {+ .69 {+ .14	−1.59 + 32 n = −.97 {+1.30 −4 − 0.01	−1.40 + 32 n = −.97 {+1.36 −84 − 0.24

− .77 − .62

Stars do not agree very well, and value of n is also somewhat uncertain, but it will answer practical purposes.

Time 17h 19

Error −8.70

3.74
0.70
36.5) 3.04 (.083 Hourly rate.
2920
1200

n = −.7 ΔT = − 0.27

n = −.7 ΔT = −0.62

n		n = −.7 ΔT =	n = −.97 ΔT =
α Can Maj:	−.726	−0.27	−0.01
15 Argus	−.698 .722	−0.62	−0.24
β Can Min	−.707	+0.05	+0.26
β Gemin	−.698	+0.28	+0.38
δ Can. Maj	−.729	−0.38	+0.08

Upper Culm. −.716

Previous L. C. ~~−1.225~~ {−1.20 4 −1.25}
−1.225

Mean. −0.97

α Gemin. rejected.

5) .39

ΔT = (avg) + 0.08

Time 7h 26m

+0.08
−0.70

14.1) 0.78 (.056
705
75

Rate = +.056

Previous {.083 .072

Results not very satisfactory.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 4. 3 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	57 H. Cephei	β Can. Min.	α Gemin. (Double) (Position uncertain R.A.)	β Gemin.	δ Can. Maj.
Level Direct, Reversed,		w · e ·	w · e ·	w · e ·	w · e ·
Sums, Difference, b.	+87° 14′ 02.5″ 20.700	+8° 31.7 +.150	+32° 9.0	+28° 18.8 +.538	−26° 12.4 −.492
Wire, I. II. III. IV. V.	6ʰ 41 47.4 29.1 ~~88~~ 76.5 42 1.1 15.0 6.1 14.3 47 1.8 6.1 30.1 46.0 7.1 45.0 32.1 59.0 46 02.9 5.9 43 13.0 48.9 5.9 25.0 34.6 5.6 41.0	h m s 7 20 32.0 48.7 80.7 34.0 46.6 .6 36.0 44.5 .6 38.1 42.3 .4 40.2 40.2 9)2.4	h m s 7 26 49.8 69.1 118.9 52.0 66.6 .6 54.3 64.2 .5 57.0 61.9 .9 59.3 59.3 9)3.2	h m s 7 38 (5) 1.6 10.2 01.8 (5) 3.9 8.0 9 (5) 6.2 5.7 .9 (5) 8.7 3.2 9 01.0 01.0 9)8.5	h m s 7 03 ~~22.0~~ 40.5 62.5 24.2 38.0 .2 26.8 35.9 .7 29.0 33.6 .6 31.1 31.1 9)2.1
Sums, Mean,	54.1 21.2 5.3 44 10.9 ~~Sum~~ 6.1 7.0 24.9 44 52.0 6.9 38.0 38.0				
Bb, Cc, Aa,	21 3)2.4 0.8 .114 6 44 38.11	7 20 40.27 2	7 26 59.36 2	7 38 00.94 2	7 03 ~~33.43~~ ~~31.23~~ 31.23
Corr'd Transit, R. A.	6 44 13.83 .57	7 20 41.05 .02	7 26 59.23 .02	7 38 01.22 .02	7 03 32.79 .02
Error of Timepiece,	~~+14.27~~ 13.78	−0.80 +32 n = −.75 {+.76 −.23 +0.05	+0.71 +32 n = −.7 {+.28 +.08 +0.63	−0.38 +.32 n = −.7 {+.37 −.01 +0.28	(0.03) −1.68 +0.62 +.32 {+1.40 n = −.7 −0.42 −0.38

n = −.97 −ΔT = +0.26 n = −.97 −ΔT = +0.70 n = −.97 −ΔT = +0.38 n = −.77 −ΔT = +0.09

67.3
7.0
7.0
33.6
9)3.9
.43

20.700
.150
20.551

14.27
−.80
15.07 (.734
14385
6850
6165
6850

0.6 @ .08

15.07
5
20.55) 15.12 (.736 = n
14385
7350
6165
11850

−0.80
5
−0.75

13.78
−.75
14.53

lg 14.53 = 1.1623
lg 20.55 = 1.3129
9.8494

n = .707

13.78
−0.30
14.08

20.700
+.588
20.16

1.1486
1.3046
9.8440
n = −.698

13.78
−1.59
15.37

20.70
−.42
21.19

1.1872
1.3261
9.8611
n = −.726

20.70
−.44
21.14

13.78
−1.40
15.18

1.1839
1.3257
9.8588
n = −.729

9
.27

20.700
−.492
21.192

14.27
−1.68
15.95 (.752
14834
11156
10596
~~+679~~
8560

0.3 @ .08

15.95
.02
21.192) 15.97 (.753 = n
14834
113560
105960
76000

−1.68
3
−1.66

13.78
−1.66
15.44

lg 15.44 = 1.1886
lg 21.19 = 1.3261

n = .729

+0.62
2
0.64

13.78
+0.64
13.14

lg 13.14 = 1.1186
1.3261
9.7925

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 5½ 1880. Instrument, Mer. Cir. Observer, J.R.E.

Timepiece, 1327 Recorder, "

Object, Circle,	γ Persei	ζ Persei	ε Persei	c Persei
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	.	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	2 56 .	3 46 .	3 49 .	3 59 .
II. III. IV. V.	(3) 5.6 44.2 19.8 9.1 40.8 .9 (4) 2.5 37.3 .8 5.9 34.0 .9 9.4 30.4 .8 (5) 6.2 23.7 .9 9.7 20.0 .7	14.1 62.5 76.6 16.6 60.0 6 18.8 57.6 .4 21.2 55.1 3 23.9 52.8 .7 28.7 48.0 .7 31.0 45.7 7	24.6 78.0 102.6 27.2 75.5 .7 29.9 72.9 .8 32.7 70.1 8 35.3 67.4 .7 40.6 62.0 .6 43.3 59.4 .7 46.0 56.6 6	30.3 91.3 121.6 33.2 88.1 3 36.2 85.1 .3 39.3 82.1 4 42.4 79.0 .4 48.7 72.9 .6 51.7 69.8 5
Sum,	0 2.9 16.8 7 6.5 13.3 .8 10.0 10.0	33.4 43.0 4 35.7 40.8 .5 38.1 38.1	48.8 54.0 8 51.2 . 51.2	54.7 66.0 6 57.7 63.9 .6 60.8 60.8
Mean,	19) 17.3(.9	19) 5.0(.26 38 120	19) 6.5(.34 57 80	19) 14.1(.74 133 80
Bb, Cc, Aa,	19) 17.3(.91 171 20 ~~15.2~~ 1.1	. . .	. . .	. .
Corr'd Transit,	2 56 09.91	3 46 38.26	3 49 51.34	3 59 60.74
R. A.	2 56 07.86 2 .88	3 46 36.93 2 .95	3 49 49.62 2 .64	3 59 58.88 2 .90
Error of Timepiece,	+ 2.03 + .32 − .42 + 1.93	+ 1.31 + .32 + .30 + 1.93	1.70 + .32 + .09 2.11	1.84 + .32 − .17 1.99
n assumed = 1. Uncertainty eliminated from the mean.	+ 0.6 @ .08 + .05 + 1.98	− 0.2 @ .08 2 + 1.91	− 0.2 @ .08 2 2.09	− 0.4 @ .08 3 1.96

2 56.1
106.6
109.9
120.0
Time 3 33.1

Error 1s.99

Rate + 0s.079 hourly
for last ~~two~~ 2½ days.

Accordance
1.98 −.01 1.93
1.91 −.08 1.93
2.09 +.10 2.11
1.96 −.03 1.99
.055
~~2.~~ 2.0
~~1.~~
1.99

+1.99
−0.70
2.69

51h 33
17 19
34 14

34.2) 2.69 (.0787
2394
2960
2736
224

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 6/7 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	η Herculis			
Level Direct, Reversed,	w . e . . .	w . e . . .	w . e . . .	w . e . . .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I.	16 3~~7~~8 .	.	.	.
II.	26.0 79.5 105.5 28.8 76.7 5	.	.	.
III.	31.3 74.0 3 34.1 71.3 4	.	.	.
IV.	36.9 68.8 .7	.	.	.
V.	42.0 63.3 .8 44.7 60.5 2 47.1 58.0 2 50.2 55.3 5	.	.	.
Sum,	53.0 53.0	.	.	.
Mean,	19)13.6(.72 13 3 30	.	.	.
Bb, Cc, Aa,	. . 2 16 38 53.72	. . .	. . .	. . .
Corr'd Transit, R. A.	. 16 38 48.33 2 .35	. .	. .	. .
Error of Timepiece,	~~4~~.37 .32 +~~5~~.10 ~~5.02~~	.	.	.

Error = + ~~5~~4.79

5.79
1.99
37.1) 3.80 (.102
371
900

4.79
1.99
37.1) 2.80 (.0755
2597
2030
1855

~~Rate = +.10~~
Rate = +.075 hourly.

But only one star and rate subject to J. R. E.'s undetermined personal equation.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 7-8 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	Sun.		23 41	24 60 1440 60 23 60 1380 41 1421
Circle,	-.08			
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	1440 .60 86400 .
Sums,	. .	8. 23 17 54.21 9. 23 21 ~~35.33~~	86400 .	1421 | .016 86400 55700 .
Difference,			180 39.51 219.51	
b. 6 sec = +.32	-1.032	~~3 39.59~~ 3 41.12	.016	
	h m s	h m s	h m s	h m s
Wire, I.	55.8	880 .221.12	131702 21951	.
II.	58.0	.	351212	40 29.5 .
III.	59.9	Corr. 8. 23 17 54.21	221.12	240 2405 29.5 .
IV.	2.0	1 4.93	.	269.5 .0875 .
V.	4.2	8. 23 18 59.14	.	13475 18860 21560 235812.5
Sum,	49.9	.	2.344628 2.216087 .	88° 40' 29.52
Mean,	23 18 59.98	.	.560715 .	44.07 40.92 .
Bb,	.	.	3.64 .	3.15 for 6'
Cc,	.	.	.	.525 .0875 .
Aa,	.	23 17 54.21 -3.64	.	40.92 02.35
Corr'd Transit,	.	23 17 50.57 1 4.93	.	43.27 .
R. A.	23 18 ~~59.14~~ 55.50	18 55 50	.	.
Error of Timepiece,	.	.	.	.

n = -.72
-.08
.0576
+.06

1.2
.91
12
108
1.092
1.4

.91
× .72
182
637
.6552
× .32
.98 = m
.06
1.04

4.48 + 1.04
+5.52 Err of 1327

4.48
1.50
5.98 Err of 1327

1.3
.91
13
117
1.183
82
+1.50 = m

34
13
102
34
.44

19
103
1.26
1.50
1.76

5.60+1.06=6.66
4.86+1.76=6.62
Err of 1327 = 6.61
.30
6.30

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, May 8 1880. Instrument, Observer,

Timepiece, Recorder,

Object,	α Bootis	α Virginis		Polaris L.C.
Circle,	+19°48	−10°32		−43.27
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,			.91 63 273	48 36.0
Difference,			546 .5733	
b.	+.34	−.19		
	h m s	h m s	h m s	h m s
Wire, I.	14.9	55.8	32 .89 63 19 .569	13h 13m 4 3 12.0 17 7
II.	17.1	57.9	63 34 282 63 .1197	36.7
III.	19.3	59.8	189 4 2+.12	41 6
IV.	21.7	2.0	−.21 89 89 1.01	49 5 7.2
V.	14 9 23.9	4.3	.68	11 8 16.4
Sum,	46.9	49.8		196 6 180 9)376.6 6
Mean,	19.38	59.96		13m 41.84
Bb,			−22.44 − 43.27m	
Cc,			+4.86 ∓ .19m	
Aa,			0 = − 27.30 − 43.08m 43.08) 27.30 (−.63m.	
Corr'd Transit,		55 10	25848 1452.	
R. A.	14 10 ~~11.94~~ 13.78	13 18 ~~53.45~~		13 14 4.28
Error of Timepiece,				

72
34
288
216
.2448

19
72
38
133
.14

7.94 +.74 =
6.51 +~~1.12~~ =

8.68
7.63

18
72
88
44
18
4
13
14 22
14.5)64(.04

~~−7.66~~
−22.44

65
24
.41

98
.44
.74

.72
43
216
288
30.96
31.

98
14
~~72~~
1.12

13 32

+.89 = m.

+5.60 +.74 = 6.34
+4.86 +1.12 5.98
0.32

5.60 +.68 = 6.28
4.86 +1.01 = 5.87
15

6.08 Emf 1327.

~~6.66~~ Emf ~~1327~~

5.52

+6.16 {Emf 1327

.64

+.04

hourly rate.

5.60 +1.00 = 6.61
4.86 + 1.64 6.50

6.55
6.08
6.30 mean Emf 1327.

It was too cold for me to stay to ~~take~~ get at the m.

Pw.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, May 8 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	β Can. Min.	α Can. Mi.	β Eridani	β Orionis
Circle,	+8° 31′	+5° 32′	−5° 15′	−8° 20′
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.	+.15	+.10	−.9	−.15
	h m s	h m s	h m s	h m s
Wire, I.	7 19 42.0	7 32 4.5	58.9	48.2
II.	44.1	6.5	1.2	50.3
III.	46.3	8.6	3.1	52.3
IV.	48.3	10.7	5.1	54.3
V.	50.4	12.9	7.0	56.5
Sum,	31.1	43.2	15.3	11.6
Mean,	46.22	8.64	3.06	52.32
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	7 20 41.00	7 33 3.59	5 1 58.55	5 8 47.82
Error of Timepiece,	.	.	.	.

m = +.89
n = −.63

5.22 +.80 = 6.02
5.05 +.83 = 5.88 5.90

4.51 +.98 = 5.49
4.50 +.95 = 5.45
5.47

63
15
315
63
−.0945

.89
9
.98

.89
6
.95

5.22
1.08
6.30
6.18
6.24

5.05
1.13
6.18

4.51
1.37
5.88

4.50
1.38
5.88

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, May 8 187 . Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	α Orionis	α Can. min	α Columb.	Polaris &c.
Circle,	+7°23′	−26°12′	−34°8′	
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	+.13	−.49	−.68	
Wire,	h m 39 s ½	h m s	h m s	h m s
I.	41 43.2	32.7	18.7	39.0 46.0
II.	45.5	35.0	21.2	51.0
III.	47.3	37.3	23.7	13 13 8.6 13.0
IV.	49.5	39.4	26.1	16.0
V.	51.6 53 55 .9	41.7	28.5	35.5 41.6 46.1
Sum,	67 0	36 1	88 2	296 8 180 116.8
Mean,	47.44	37.22	23.64	12.98
Bb, Cc, Aa,		49 63 147 294 .3487 .9 8/170	68 63 204 408 .4284 .43 .89 1.32	
Corr'd Transit, R. A.	5 48 42.46	7 3 32.73	5 35 19.63	1 14 4.26 30 38 13 40
Error of Timepiece,				17 35 85 .51 .59 06.60

.63
.13
.189
.63
.0819
.87
.81

4.98
.81
5.79

4.49
1.20
5.69

4.01
1.32
5.33

+ 6.30 Err of 1327 at 13h 40m

+.035 = rate per hour of 1327.

see page 179. and Polaris 181

14 4.26
13 12.98
− 51.28 − 43.27m
5.60 + .34m
56.88 − 43.61m

4361) 56.88 (1.30 = m.
4361
13170
13083
0870

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 9-10 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object,	Sun			
Circle,	-3° 45'			
	w | e	w | e	w | e	w | e
Level Direct,				
Reversed,				
Sums,				
Difference,			1.23 .07 1.30 1.53 6.83	
b.	-.07			
	h m s	h m s	h m s	h m s
Wire, I.	23 25.8 27.9			
II.	29.9 32.0	.15972 ~~.00047~~		
III.	34.1 25 2.0	.015972		
IV.	4.0 6.1	.000474		
V.	8.1 10.3	.016446		
	180.2			
Sum,		2̄.216166		
Mean,	24 18.02	2.344999		63 7 461
		.561165		
Bb,		3.6405		-.05
Ce,				.89
Aa,				.94
Corr'd Transit,				
R. A.	23 25 12.49			
Error of Timepiece,				

23 25.8
25 10.3
36.1
180

60
24
1440
60
86400

10. 23 25 16.13
9 23. 21 35.33
3 40.80
180
220.80

23
60
1380
41
1421

2.344999
2̄.220108
.565107
2.344999

86400)1421(.0166
86400
57700
518400
5860000

23 25 16.13
3.64
23 25 12.49

24 18.02
12.49
5.53
.94
+6.47

2nd 13.27

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 10.3 1879. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, " & F. W.

5 3
4 2
1 1

Object, Circle,	Gr. 1450	31 Lyncis	β Cancri +9° 33′	o Urs. maj. 61° 7′	
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	+38° 25′ .79	~~+38° 28′~~ +43° 34′ .45	63 17 44′1 63 107′ +.17	1.81	
Wire, I. II. III. IV. V.	8h 25 6.2 27.3 33.5 8.9 24.8 .7 11.7 22.0 .7 14.0 19.3 .3 17.0 17.8 9)7.2 .80	h m s 8 14 ~~36.0~~ 36.0 58.8 94.8 38.9 56.0 4 9 41.8 53.3 5.1 44.7 50.2 4.9 47.4 47.4 9)4.1 .46	h m s 4.8 7.0 9.0 11.1 13.1	h m s 12.2 16.1 20.7 25.0 29.4 33.5 38.0 42.3 46.8	h m s ~~[illegible]~~ .91 .32 1.23 .17 1.06
Sum, Mean,			45.0 9.0	264.0 29.33	
Bb, Cc, Aa,	8 25 16.80	8 14 47.46			
Corr'd Transit, R. A.	8 25 9.79₂ .81	8 14 40.71₂ 50 .52	8 10 3.00	8 20 21.67	
Error of Timepiece,	6.99 +.32 +.12 7.43	6.94 +.32 −.03 7.23			

63
.81
.504
89
.39
6.99
7.38

7.43
7.23
+7.33

6.00
.88
~~6.88~~
6.00
1.06
7.06
6.24
~~6.24~~
.82
.41
+.02 hourly rate.

+7.66

7.66 + 1.81n
6.00 + .17n
1.66 + 1.64n
n = −1.

Err of 1327 = + 7.33 at 8h 20m.

Date, Mar 10.5 18~~7~~80 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E. & F. W.

Object,	Polaris	ε Virginis	δ Leonis	β Leonis	
L.C. Circle,	180°-88 40 9.6	+11°37	+21°11		
		w | e	w | e	w | e	w | e
Level Direct, Reversed,	13h				
Sums, Difference, b.	16 42.6 ~~15 13.8~~ 16 12.2 ~~15 13.8~~ 15 42.5 15 13.5 14 45.6 14 13.5	.20	.38		
		h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	13 44.0 13 15.7 11 46.8 11 18.4 10 45.6 10 11.0 12 45.7 12 15.1 ~~9 45.8~~ 8 17.3 7 44.1	12 55 13.0 14.9 27.8 17.0 27.4 21.1 25.4 23.2 13.0 29.7 42.7 14.9 27.4 .3 17.0 25.4 .4 19.0 23.2 .2 21.1 21.1 9)1.7 21.19	11 06 44.0 61.9 105.9 46.0 54.7 5.7 48.7 57.4 6.1 50.8 55.1 5.9 52.9 52.9 9)26.5 2.96		9 3 12 15.2 23.0
Sum, Mean,					47.5 12 15.83
Bb, Cc, Aa,	12 45.7 = probable middle 13) ~~217~~ 3m 403.5 159 180 (12m 13 13) 583.5 (44.89 29 52 26 63 3 52 115 104 11				
Corr'd Transit,		12 55 21.19	11 06 52.96		
R. A.	13 12 44.89 13 14 03.23 ~~48.47~~	12 56 14.97 2 .99	11 07 46.58 2 .60	11 42 59.25 2 .27	1 14 3.23
Error of Timepiece,		Assum m=-1 6.20 +.32 +.71 7.23	6.36 +.32 +.53 7.21	+.32 +.64	

14 13.5 = prob. middle

16 42.6 11 46.8 28 29.4
16 12.2 12 15.1 27.3
15 42.5 12 45.7 4.2
15 13.8 13 15.7 9.3
14 45.6 13 44.0 9.6
14 13.5 14)13.5
~~13 44.0~~ 11)157.5
~~13 15.7~~ 14.32

13 14 14.32
13 13 33.36
40.96
Diurnal Ab. .65
41.61

13 15.7 = prob. mid.

157.5
-46.8
-15.1
195.6
8.69
95.6
+3 11)125.6 9)125.6
13 13 11.42 13.96

16 42.6 12 45.7 28 88.3
16 12.2 13 15.7 7.9
15 42.5 13 44.0 6.5
15 13.8 14 13.5 7.3
14 45.6 45.6
9)35.6
3.96

13 13 ~~43.96~~
13 13 33

13 15.7 = prob. mid.

16 42.6 9 45.8 26 28.4
16 12.2 10 11.0 23.2
15 42.5 10 45.6 28.1
15 13.8 11 18.4 32.2
14 45.6 11 46.8 32.4
14 13.5 12 15.1 28.6
13 44.0 12 45.7 29.7
13 15.7 13 15.7

~~5)68.3~~
~~5)113.66~~
~~04.55~~

5)218.3
5)43.66
14.55

~~5)164.3~~
~~5)16.1~~ 3.22

~~13 13. 13.22~~ 13 14.55
R.A. 13 14 03.23 14 03.20
~~20.14~~ ~~48.68~~
69.99 11.35
Aberr .65

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 10.8 1880. Instrument, ... Observer, ...

Timepiece, ... Recorder, ... Mar. 11. 1880.

Object,		δ virginis		(α aquilae)
Circle,		+4° 3′		15
	w | e	w | e	w | e	w | e
Level Direct,	. | .	. | .	. | .	. | .
Reversed,	. | .	. | .	. | .	. | .
Sums,	. .	. .	. .	. .
Difference,				
b.		.07		+8° 33′
	h m s	h m s	h m s	h m s
Wire, I.	.	11 48 38.4	.	58.9
II.	.	40.4	.	1.0
III.	1 47.40 .60	42.4	.	3.0
IV.	.	44.5	.	5.0
V.	.	46.5	.	7.1
Sum,	.	82 2	.	15 0
Mean,	.	42.44	.	3.00
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	.	12 49 36.34	.	19 14 56.55
Error of Timepiece,	.	.	.	.

12 56
11 07
12 49
5 2
12 17

7.43
7.37
7.31
111
+ 7.37
6.61
.76
4
2|.80
24|1.40 |.017
24
160

+0 17 = hourly rate.
+7.37 = Err at 12h, 4m.

1.2
15
60
12
1.18
1.41
.23

6.45
1.23
7.68 Sub 12 27 @ 19 14
7.37
.31 1.31 |.01 rate.

.010
.017
.013 rate

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 12.4 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, ″

Object,	36 Lyncis	38 Lyncis	10 Leon. min.	
Circle,	~~+43~~ +43° 42′	+37° 18′	+36° 55′	
	w / e	w / e	w / e	w / e
Level Direct,	. / .	. / .	. / .	. / .
Reversed,	. / .	. / .	. / .	. / .
Sums,	. / .	. / .	. / .	. / .
Difference,				
b.	.96	.76	.75	
	h m s	h m s	h m s	h m s
Wire, I.	9 06 .	9 11 .	9 26 .	.
II. – V.	(5) 6.6 19.4 16.0 (5) 9.3 16.4 5.7 0 2.2 13.7 5.9 5.0 10.8 5.8 7.9 7.9 9)18.3 .92	6.7 22.6 43.3 65.9 9.2 25.0 40.9 .4 12.0 27.8 38.0 .8 14.8 30.2 35.7 .9 32.9 32.9 9)8.4 .93	52.2 78.0 73.0 125.2 54.9 73.0 70.3 .2 57.3 70.3 67.8 .7 60.2 68 265.2 .4 62.5 62.5 9)5.4 .60	.
Sum,	.	.	.	.
Mean,	9 06 07.92	9 11 32.93	9 26 62.60	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	9 06 00.75 .77	9 11 25.67 .69	9 26 55.66 .68	.
Error of Timepiece,	7.15 .32 ~~+~~ .04 7.43	7.14 .32 +.15 7.61	6.92 .32 +.16 7.40	.

1.2
.96
7
1.08
1.17
1.41
.24

7 1.2
.76
.27
.84
.87
1.41
.54

At 9h 14m
Err = +7.s48

7.37
.11
+.05

(7 .15
.24
7.39

7.14
.54
7.68

6.92
.54
7.46

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 15 18~~7~~80. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, "

Object,	γ ~~χ~~ Orionis	~~α Orionis~~	α Orionis	δ Urs. min. S.C.	η Geminorum
Circle,		3		180° − 86° 36′ 11.″8	
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.		. .	. .	. .	. .
Wire, I. II. III. IV. V.	5h 17 42.2 58.8 101.0 44.4 56.6 .0 46.4 54.7 .1 48.4 52.6 .0 50.5 50.5 9)4.6 .51	h m s 5 33 . 42.8 59.2 102.0 44.8 57.1 1.9 46.8 55.0 1.8 48.9 52.9 1.8 50.9 50.9 9)8.4 .93	h m s 5 47 . 41.2 57.9 99.1 43.2 55.8 .0 45.3 53.7 .0 47.4 51.6 .0 49.6 49.6 9)4.7 .52	h m s 6 . 18m 7m18.8, 7 54.6, 11 56.4 75.2 8 28.7, 11 21.7 6.3 9 03.0, 10 47.5 6.2 9 37.6, 10m11.0 4.0 .37.6 9)29.3 9.36	h m s 6 14 . 42.8 60.7 103.5 45.0 58.3 3 47.2 56.1 3 49.4 53.9 3 51.7 51.7 9)15.1 1.68
Sum,		.	.	.	.
Mean,	5 17 50.51	5 33 50.93	5 47 49.52	6 09 39.26	6 14 51.68
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit,	5h 18 43.34	.	.	.	.
R. A.	~~5 18 28.08~~ 2 .36 ~~10~~	.	5 48 42.32 2 .34	6 10 48.82 .27 .55	6 15 44.23 2 .25
Error of Timepiece,	~~2.41~~ 7.15 .32 {+.80 +.16} Assume n = −.12 as per F.W.	.	7.18 .32 {+.79 +.16} Assume n = −1.2 as per F.W.	.	7.43 .32 +{.50 .10} Assume n = −1.2 as per F.W.
	8.43		8.45	9.39	8.35

9.39
7.25
~~17.09)16.54 (.968~~
~~15381~~
~~11590~~
~~10254~~
~~1336~~

For 3 time stars mean t − r.a. = 7.25
Mean tan δ = {+.109, +.130, +.497, +.245} Rate .01
7.26
tan 86° 36.′2 = 16.848
17.09

9.29
7.26
17.09)16.55 (.968
15381
1169
10254
1436

8.43 − .08 = 8.35
8.45 − .08 = 8.37
8.35 − .05 = 8.30

Mean of time = 5h 46m
~~apparent~~
6 09
23

0.8 @ .017 = .014

Whence n = −0.97
Previous as per F.W. −1.20
1.1

Use mean

Mean 8.s34 = Error at 5h 46m
7.37
113.5) .97 (.009

Hourly rate = +.009
Previously deduced = +.017

Notice however that −0.97 would better ~~satisfy~~ accord the time stars

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 17.2 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	β Eridani			α Orionis								
Circle,												
	w		e	w		e	w		e	w		e
Level Direct,												
Reversed,												
Sums,												
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	5	02	.	5	48	.						
II.	(5) 5.6	12.1	7.7	39.7	56.3	96.0						
	(5) 7.87	10.0	7	41.87	54.2	5 9						
III.	(5) 9.87	8.0	.7	43.8	52.2	6.0						
	01.8	5.9	7	46.0	58.1	6 1						
IV.	3.9		3.9	48.0		48.0						
V.			2)7.7 .86			0.0						
Sum,												
Mean,	5	02	3.86	5	48	48.00						
Bb,												
Cc,												
Aa,												
Corr'd Transit,												
R. A.	5	01	58.39 2 .41	5	48	42.31 2 .33						
Error of Timepiece,	Assume m = -1.1 {		5.45 .32 +1.07 .11			5.67 .32 +.79 .08						
			6.95			6.86						

Error = 6.90 at 5h 25

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 17.3 1880. + 17.4
Instrument,
Observer,
Timepiece,
Recorder,

Object, Circle,	α Can. Min.	β Geminorum	ε Leonis	ζ ζ Leonis
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.				
Wire, I. II. III. IV. V.	h m s 7 33 . 00,~~x~~8 17,5 18.3 2,8 15,6 4 4,9 13,2 .1 7,0 11,1 1 9,0 9.0 9).9 .10	h m s 7 38 . (5)7,9 16,7 14.6 0,2 14,2 .4 2,6 11,9 .5 4,9 9,4 .3 7,1 7.1 9)1.9 .21	h m s 9 39 . 02,4 20,5 22.9 4,9 18,3 3 2 7,0 16,0 3.0 9,3 13,8 3.7 11,6 11 6 9)13.8 1.53	h m s 10 10 . 01,3 19,3 20.6 3,5 17,0 5 5,8 14,8 .6 8,0 12,3 3 10,1 10.1 9)2.1 .23
Sum, Mean,	7 33 09.10	7 38 07.21	9 39 11.53	10 10 10.23
Bb, Cc, Aa,				
Corr'd Transit, R. A.	7 33 03.43 2 .45	7 38 01.00 2 .02	9 39 05.33 2 .35	10 10 03.94 2 .96
Error of Timepiece,	n = -1.1 5.65 .32 {+.82 .08	6.19 .32 {+.37 .04	6.18 .32 {+.46 .05	6.27 .32 {.47 .05
	6.87	6.92	7.01	7.11

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 17.6 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	Polaris L.C.	ε Virginis	δ Virginis	~~β Leonis~~ γ Virginis
	w · e	w · e	w · e	w · e
Level Direct, Reversed,				
Sums, Difference, b.	lg ~~cot~~ = 8.3640 lg tan 1.6360 tan = 43.25			
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	~~8 44.1~~ .24 8 44.1 16 42.0 85.1 9 17.8 16 12.9 90.7 9 47.7 15 43.3 91.0 10 16.7 15 12.6 89.3 10 46.9 14 44.3 91.2 11 15.6 14 12.9 88.5 11 47.2 13 44.1 91.3 12 12.5 13 13.1 85.6 12 46.8 46.8	12 56 12.8 29.6 42.4 14.9 27.5 4 17.0 25.3 .3 19.0 23.2 3 21.2 21.2 9)1.6 .18	12 49 34.0 50.8 84.8 36.1 48.5 .6 38.1 46.3 .4 40.2 44.2 4 42.2 42.2 9)2.4 .27	13 18 52.1 69.1 1.2 54.3 67.1 4 56.5 65.0 .5 58.6 63.0 6 60.9 0.9 9)6.6 .73
Sum,	17)79.5 4.68			
Mean,	1 12 44.68	12 56 21.18	12 49 42.27	13 19 00.73
Bb, Cc, Aa,	1 13 14.18			
Corr'd Transit,				
R. A.	1 14 01.14	12 56 15.07	12 49 36.43 2 .45	13 18 58.27 2 .29
Error of Timepiece,	46.96 .68 46.29 6.09 52.38	Take n = -1.1 6.11 2 6.09 .32 .77 7.19	Take n = -1.1 5.82 .32 .84 .08 7.06	n = -1.1 5.44 .32 1.10 .11 6.97

43.25
.21
43.46

~~43.5)~~
43.46)52.38(1.205
4346
8920
8692
22800

~~8.~~

			26m
8 44.1	17 44.9	29.0	
9 17.8	17 15.1	32.9	
9 47.7	16 41.0	28.7	
10 16.7	16 12.9	29.6	
10 46.9	15 43.3	30.2	
11 15.6	15 12.6	28.2	
11 47.2	14 44.3	31.5	
12 12.5	14 12.9	25.4	
12 46.8	13 44.1	30.9	
13 13.1		13.1	

19)79.5
4.18

Error = +7.07 at 13h 01m

~~6.90~~
~~7.6)0.73~~
~~-0.11~~
~~.17~~ ~~Error at~~

~~Assuming it to have "dropped" a second its rate would be 7.6).17(.022 152 180 +.022~~

7.07
6.90
5.6).17
+.03

Rate for ~~very~~ too short an interval.

n = -1.20

Supposing (which is not to be proved) that the rate for 0.3 is very small.

Use n = -1.1 (mean) although one notices that -1.2 would better accord the time stars.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 17.9 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	α Aquilae		ζ Cygni					
	w	e	w	e	w	e	w	e
Level Direct, Reversed,								
Sums, Difference, b.								
	h m s		h m s		h m s		h m s	
Wire, I. II. III. IV. V.	19 44 54.2 70.8 125.0 56.3 68.7 5 0 58.3 66.6 4.9 60.3 64.4 4 7 62.5 62.5 9)4.1 .46		21 07 46.8 65.7 112.5 49.1 63.3 4 51.4 61.0 .4 53.9 58.6 5 56.2 56.2 9)2.0 .22					
Sum, Mean,	19 45 02.46		21 07 56.22					
Bb, Cc, Aa,								
Corr'd Transit, R. A.	19 44 56.73 2 .75		21 07 50.11 2 .13					
Error of Timepiece,	5.71 .32 +.76 .08		6.09 .32 +.59 +.05					

6.87 6.99

Error = +6.93 s at 20h 25

6.93
6.90
3

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 18.2 1880. & 18.8 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	Polaris	β Eridani		α Aquilae
Circle,				
	w e	w e	w e	w e
Level Direct,	. .	. .	. .	. .
Reversed,	. .	. .	. .	. .
Sums,	. .	. .	. .	. .
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	26 s 7 56.9 18 22.3 111.6 8 28.4 9 00.5 17 52.6 . 13.8 9 29.3 17 26.1 10 01.2 16 54.3 . 10.8 16 20.5 08.9 10 56.5 15 54.6 . 10.3 11 28.4 15 27.2 . 09.4 11 55.7 14 57.1 14.4	5 02 . (5)5.4 12.0 7.4 (5)7.4 9.9 3 (5)9.6 7.9 .5 01.7 5.8 5 3.8 9.8 ~~5~~ 9)6.5 .72	.	19 45 . (5)3.8 ~~10~~.4 4.2 (5)5.8 8.3 1 (5)7.9 6.2 .1 00.0 4.1 1 2.0 ~~2.0~~ 2.0 ~~4.1~~ 9).5 ~~6~~ .06
Sum,	12 22.2 14 30.4 14.3 12 57.3 13 24.0 13 52.7	.	.	.
Mean,	13 52.7 17)96.3 5.67	5 02 03.72	.	19 45 02.06
Bb,	1 13 58.67	.	.	.
Cc,	Error on clamp sheet 1 .	.	.	.
Aa,	1 14 53.67	.	.	.
Corr'd Transit,	.	.	.	.
R. A.	1 14 01.03 .67	5 01 58.36 2 .38	.	19 44 56.75 2 .77
Error of Timepiece,	01.70 ~~6.03~~ 53.67	5.34 n = -1.1 {+1 .32 .00 .10	.	5.29 .32 {+.76 +.08

6.76 ~~6~~.45

43.25
.09
43.34)46.91(1.08
43.34
357
34672
1028

6.03 53.67
5.34 6.76
11.37 46.91

n = -1.08 by this L. C.
~~Prev~~ n = -1.20 " previous L. C.
-1.14 = mean.

6.45
7.07
30.7) .62
-.020 Hourly rate since 17.d6

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 19. 8 1880. Instrument, Mer. Cir. Observer, ~~H. H. R.~~ J. R. E.

Timepiece, 1327 Recorder, J. R. E.

Object,	α Aquilae											
Circle,												
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	(57)4.1	10.7	4.8			.			.			.
II.	(56).1	8.6	.7			.			.			.
III.	(5)8.2	6.6	8			.			.			.
IV.	00.2	4.3	.5			.			.			.
V.	02.2		2.2 9)3.0 .33			.			.			.
Sum,			.			.			.			.
Mean,			02.33			.			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.	19	44	56.78 2 .80			.			.			.
Error of Timepiece,			5.53 .32 { .26 { 08			.			.			.

6.69

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 23 1880 Instrument, Mer. Cir. Observer, W. C. W.

Timepiece, Recorder, ~~W. C. W.~~ J. R. E. (W. C. W. read sheets.)

Object, Circle,	α Geminor	31 Lyncis		o Urs. Maj:
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	. .	. .	. .
Wire, I. II. III. IV. V.	h m s 7 27 . (5)5.5 15.2 10.7 (5)8.0 12.8 .7 0.5 10.3 .8 3.0 7.9 .9 5.4 5.4 9)3.6 .40	h m s 8 14 . 35.9 58.6 47.5 38.8 55.8 6 41.7 53.0 .7 44.2 50.1 .3 47.2 47 2 9)2.3 .26	h m s 8 38 . (5)2.2 9.6 1.8 4.4 7.4 8 6.6 5.2 .8 8.7 03.0 .7 01.0 1.0 9)8.1 .90	h m s 8 20 . (4)6.6 72.3 58.9 (5)1.0 68.1 9.1 (5)5.2 63.7 8.9 (5)9.4 59.4 8.8 0 3.6 55.0 8.6 1 2.2 46.2 8.4 16.5 42.2 8.7 20.8 38.0 8.8 25.0 33.6 8.6 29.5 29.5 19)7.3 .38
Sum, Mean,	7 27 5.40	8 14 47.26	8 38 0.90	
Bb, Cc, Aa,	. . .	. . .	. . .	8 20 29.38
Corr'd Transit, R. A.	7 26 58.98 2 59.00	8 14 40.~~32~~ 34 2 .36	8 37 54.~~68~~ 62 2 .64	8 20 21.40 4 .44
Error of Timepiece,	+6.40 +.32 {+.28	6.90 ~~6.55~~ .32 -.04 -.00	6.26 6.26 .32 .32 {.58 .76 .06 .08	7.94 +.32 {-.90 -.09
n = -1.1	{+.03 +7.03	7.18 ~~6.83~~	7.22 7.~~26~~ .42	7.27

See Abr. 30

7 27	7.03	+.28
8 14	7.18	-.04
8 20	7.27	+.58
8 22	7.22	-.90
B time = 8h 06m	+7s.20 = Error	+.005 = mean coeff. of n

7.20
6.45
36.3)+.75 (+.02

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 21.3 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	51 H. Cephei	β Canis Min	~~α Can. Min.~~ α Geminor	α Can. Min.	β Geminor
Circle,	U. C.				
		w · e	w · e	w · e	w · e
Level Direct,	20.69	· ·	· ·	· ·	· ·
Reversed,		· ·	· ·	· ·	· ·
Sums,		· ·	· ·	· ·	· ·
Difference,					
b.					
		h m s	h m s	h m s	h m s
Wire, I.	6h ~~9~~8m	7 20 .	7 27 .	7 33 .	7 38 .
42m 15.4 46 57.6 42 29.8 46 47.6 II. 42 43.5 46 37.4 42 58.6 46 17.7 III. 43 13.7 46 03.1 43 25.4 45 49.0 IV. 43 40.2 45 35.3 43 55.0 45 20.4 44 09.4 45 06.9 V. 44 23.0 44m 52.3 44 36.8	75.0 7.4 4.9 6.3 6.8 4.9 5.5 5.4 6.3 5.3 44 36.8	38.6 55.2 93.8 40.7 53.1 8 42.9 51.0 .9 44.9 49.0 .9 47.0 47.0 8.4	5)6.1 15.7 11.8 5)8.4 13.2 .9 01.0 10.8 .8 3.4 8.3 .7 6.0 6.0 9) 18.2	1.1 17.8 18.9 3.2 15.7 .9 5.1 13.6 .7 7.3 11.4 .7 9.4 9.4 3.6	5)8.1 16.8 14.9 00.3 14.5 .8 2.8 12.1 .9 5.1 9.9 15.0 7.4 7.4 4.0
Sum,	21) 794.1	.	.	.	.
3/ 794.1 7) 264.7 37.81 Mean,	6 44 37.81	7 20 46.93	7 27 5.91	7 33 9.40	7 38 7.44
Bb,		.	.	.	.
Cc,		.	.	.	.
Aa,		.	.	.	.
Corr'd Transit,		.	.	.	.
R. A.	6 44 6.55 +.34 7.89	7 20 40.80 2 .82	7 26 58.96 2 .98	7 33 3.38 2 .40	7 38 00.94 2 .96
Error of Timepiece,	~~30.50~~ 29.92	6.11 +.32 {+.76 +.08	n = -1.1 6.93 +.32 {+.28 +.03	6.00 +.32 {+.82 +.08	6.98 +.32 {+.37 +.04
		7.27	7.56	7.22	7.21

E Can. Maj.
6h 54m
5)2.1 11.0 03.1
5)4.6 8.5 3.1
5)6.9 6.2 3.1
5)9.1 03.8 2.9
01.5 1.5
~~03.8~~
13.7

6 54 1.52
6 53 56.29
2
.31
5.21

+20.69
− .55
21.24) 85.89

79.50
5.21
85.89

29.92
5.21
24.71

21.24) 24.71 (1.11
21 24
3470
2124
3460

n = −1.11

Double
? did not see them correctly.
Discard.
See Apr. 30

Error = +7.23
at 7h 30m

7.23
6.45
58.25) .78
Hourly rate = +.016
since 18d.8

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 21st 1880. Instrument, Un. Ci. Observer, Wat. A.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	η Herculis		α Herculis		α Ophiuchi		ε Cygni	
	w	e	w	e	w	e	w	e
Level Direct, Reversed,	.	.	.	.	.	.	.	.
Sums, Difference, b.	.	.	.	.	.	.	.	.
	h m s		h m s		h m s		h m s	
Wire, I.	16 38 .		17 09 6.		17 29 .		20 41 .	
II. III. IV. V.	45.1 66.5 111.6 47.8 63.7 5 50.6 61.1 .7 53.1 58.3 .4 55.8 55.8 97.0		10.2 27.3 37.5 12.3 25.2 5 14.5 23.1 .6 16.7 20.9 .6 18.8 18.8 7.0		21.6 38.7 60.3 23.8 36.4 .2 25.9 34.3 .2 28.0 32.1 .1 30.0 30.0 .8		18.6 38.3 56.9 21.0 35.9 6.9 23.6 33.4 7.0 26.0 31.0 7.0 28.4 28.4 4.2	
Sum,	.		.		.		.	
Mean,	16 38 55.78		17 09 18.78		17 29 30.09		20 41 28.47	
Bb, Cc, Aa,	. . .		. . .		. . .		. . .	
Corr'd Transit, R. A.	16 38 48.79 2 .81		17 09 12.44 2 .46		17 29 23.63 2 .65		20 41 21.74 2 .76	
Error of Timepiece,	6.97 .32 n z −1.1 { .10 .01 7.40		6.32 .32 .65 .06 7.35		6.44 .32 .69 .07 ~~.60~~ 7.52		6.71 .32 { +.25 +.03 7.31	

~~At 17h 05~~

16	38	7.40	.10
17	09	.35	.65
17	29	.52	.69
20	41	.31	.25
			.42
19	50	.40	
18	21	5) 8.98	
		7.40	

7.40
7.20
58.3) .20 (.003

Hourly rate since 18d
very small.

Hourly rate since 21.0
large if true.

At 18h 21m
Error = +7.s40

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 22/23 1880 Instrument, Mer. Cir. Observer, W. A. R.

Belongs to previous page. Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	~~ζ Cygni~~ β Aquilae		β Can. Min.	α Can. Min.	β Gem.
		w e	w e	w e	w e
Level Direct,					
Reversed,					
Sums,					
Difference,					
b.					
	19h 50m	h m s	h m s	h m s	h m s
Wire, I.			7 20	7 33	7 38
II.	24.2 40.8 65.0		38.6 55.2 93.8	1.1 17.8 18.9	58.1 16.8 14.9
	26.2 38.7 4.9		40.6 53.2 8	3.2 15.7 18.9	00.4 14.5 14.9
III.	28.3 36.7 5.0		42.7 51.1 .8	5.3 13.6 18.9	2.8 12.2 15.0
	30.3 34.5 4.8		44.8 49.0 .8	7.4 11.6 19.0	5.1 9.8 14.9
IV.	32.3 32.3		46.9 46.9	9.5 9.5	7.4 7.3
V.	4.0		46.90	4.2	4.1
Sum,					
Mean,	19 50 32.44			7 33 9.47	7 38 7.46
Bb,					
Ce,					
Aa,					
Corr'd Transit,	25.23				
R. A.	19 49 ~~21 7~~ 50.28		7 20 40.77½ .79	7 33 03.5½ .53	7 38 00.9½ .93
Error of Timepiece,	6.19 .32 + .81 + .08		6.21 32 .76 .08	5.94 32 .82 .08	6.53 32 .37 .04
	~~7.91~~ 7.40		7.37	7.16	7.26

Emn = +7.26 at 7h 30m

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 22nd 1870. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	η Serpentis	σ Sagittarii		
Circle,				
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	18 15	18 47		
II.	5.1 21.8 26.9 7.2 19.7 9	47.3 65.9 113.2 49.7 63.5 2		
III.	9.3 17.5 .8 11.3 15.4 7	52.0 61.1 .1 54.3 59.0 3		
IV.	13.4 13.4	56.7 56.7		
V.	3.7 .41	5.5 .61		
Sum,				
Mean,	18 15 13.41	18 47 56.61		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	18 15 07.74 2 .76	18 47 51.36 2 .38		
Error of Timepiece,	a = −1.1 5.65 .32 { .96 { .10 7.03	5.23 .32 { 1.41 { .14 7.10		

∴ Error = +7.07 at 18h 31m

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 23.8 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, B. R. E.

Object, Circle,	λ Aquilae	γ Aquilae	α Aquilae	
Level Direct, Reversed,	w . e . . .	w . e . . .	w . e . . .	w . e . . .
Sums, Difference, b.	. .	. .	. .	. .
Wire, I. II. III. IV. V.	h m s ~~19 00~~ . 18 59 . 51.7 68.3 120.0 53.8 66.2 0 0 55.9 64.2 0.1 58.0 62.1 0 1 60.0 60.0 .2	h m s 19 40 . 32.0 48.9 80.9 34.1 46.8 9 36.2 44.7 .9 38.3 42.6 .9 40.5 40 5 4.1	h m s 19 45 . 5)4.6 11.3 05.9 5)6.7 9.2 9 5)8.8 7.1 .8 00.9 5.0 9 03.0 03.0 8.5	h m s . . . . .
Sum, Mean,	. 19 00 00.02	. 19 40 40.46	. 19 45 02.94	
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	. 18 59 53.42 2 .44	34.35 .147 19 40 ~~35.06~~ 2 .37	. 19 24 56.86 2 .88	. .
Error of Timepiece,	5.58 .32 n = 1.1 { 1.00 .10	5.99 .32 .73 .07 7.11	6.06 .32 .76 .08 7.32	.

7.00

Error at $19^h\ 28^m = +7^s.11$

7.11
7.07
25) .04
.002

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 24th 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Aquilae	α Aquilae		
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.	19 46	19 44		
II.	32.8 43.3 49.7 82.5	55.2 71.9 127 1		
III.	34.9 45.4 47.4 .3	57.2 69.8 .0		
IV.	37.0 47.4 45.4 4	59.4 67.7 1		
V.	39.0 43.3 3 41.2 41.2	61.4 65.6 .0 63.6 63.6 7) 4.8		
Sum,	9) 1.7	.53		
Mean,	.18 19 40 41.18	19 45 03.53		
Bb, Ce, Aa,	7			
Corr'd Transit, R. A.	19 40 34.48 .50	19 44 56.92 2 .94		
Error of Timepiece,	6.68 .32 { .73 { .07	6.59 .32 .76 .08		

7.80 7.75

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 25:3 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	β Can. Min	α Geminorum	β Geminorum	β Can Min	α Can Min
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.					
Wire,		h m s	h m s	h m s	h m s
I.	7h 20m	7 27 .	7 38 .	7 20 .	7 33 .
II.	26.7 28.8	(5)16.7 16.1 12.8 (5)9.2 13.7 9	(5)8.6 17.5 16.1 1.0 15.0 0	39.2 55.9 95.1 41.3 53.8 5.1	01.7 18.2 19.9 3.7 16.1 8
III.	30.8	01.6 11.2 .8	3.3 12.7 .0	43.3 51.6 4.9	5.8 14.1 9
IV.	32.9 35.0	4.0 8.8 .8 6.3 6.3	5.7 10.3 0 8.1 8.1	45.3 49.6 4.9 47.5 47.5	7.8 11.9 .7 9.9 9.9
V.		9)3.6 .40	9).2 .02	9)4.5 .50	9)8.2 .91
Sum,					
Mean,	7 20 47.50	7 27 06.40	7 38 08.02	7 20 47.50	7 33 9.91
Bb, Cc, Aa,					
Corr'd Transit,					
R. A.	7 20 40.73½ .75	7 26 58.89½ .91	7 38 00.87½ .89		7 33 03.31
Error of Timepiece, ~ 2 - 1.1	6.75 .32 .76 .08	7.49 .32 ~~.32~~ .28 ~~.26~~ .03 ~~.03~~	7.13 .32 .37 .04		6.60 .32 .81 .08
	7.91	8.12	7.86		7.81

Should 8.12
have rejected. See Ap. 30

Error = 7.92 at 7h 30m

Should have corrected ± .20
and used

.91
.86
.81
7.86
8.12
.26

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 25th 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	δ Leonis	β Leonis	~~ε Virginis~~ α Virginis	Polaris L. C.
	w · · e · ·	w · · e · ·	w · · e · ·	w · · e · ·
Level Direct, Reversed,				
Sums, Difference, b.	· ·	· ·	−.19 · ·	log cos δ: 8.3647 log tan δ: 1.6353 δ = 43.78 12h 43.78 .19 43.97
Wire, I. II. III. IV. V.	h m s 11 07 . 44.9 62.7 107.6 47.1 60.3 .4 49.5 58.3 .8 51.7 56.0 .7 53.8 59.6 9)7.3 53.81	h m s 11 ~~43~~ 43 . 5)8.0 15.0 13.0 5)9.9 12.8 2.7 02.1 10.7 2.8 4.2 8.6 2.8 6.3 6.3 9)3.6 40	h m s 13 ~~18~~ 19 . 5)3.4 10.2 3.6 5)5.5 8.1 .6 5)7.6 6.0 .6 5)9.8 3.9 .7 01.8 1.8 01.81	h m s m 40.3 16 12.7 7m 47s.5 15 42.2 8 17.2 15 14.8 8 48.3 14 45.1 9 14 13.5 9 46.6 13 45.9 10 17.5 13 14.5 10 ~~45.7~~ 45.7 12 45.2 11 15.6 12m 16.9 11m 46.4 Add 1m to readings
Sum, Mean,	. 11 07 53.81	. 11 43 06.40	. .	.
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	. 11 07 46.60 2 .62	. 11 42 59.33 2 .35	~~55.37~~ 13 18 55.37 .02 .39	58.90 −.65 1 13 58.25
Error of Timepiece,	7.19 .32 n = −1.1 { .53 .05 8.09	7.05 .32 n = −1.1 { .64 .06 8.07	6.42 .32 n = −1⅛ { 1.10 .14 7.98	42.89 ~~74~~ ~~43.56~~

Error = 8s.08 at 11h 25

~~8s.08 = Error at 11h 25~~

~~Mean of this with former base?~~

δ Leonis

R. A. = 46.60

Diurn. Abn. +.02

Rogers' corr. +.04

46.66

53.81	
46.66	
7.15	
.32	
n = −1⅛	.53 .07
8.07	

β Leonis

59.33
.02
+.01
59.36

~~59.35~~

06.40

59.36

7.06

.32

n = −1⅛ { .64 .08

8.10

δ 8.07

β 8.10

α Virg. 7.98

8.05

42.89

6.42

~~36.47~~

42.99) 49.31 (1.15

4299

6320

4299

20210

n = −1.15

~~43) .761 (.018~~

43

331

43) .177 (.004

172

7	47.5	16	40.3	24m 27.8
8	17.2	16	12.7	29.9
8	48.3	15	42.2	30.5
9	×	15	14.8	
9	46.6	14	45.1	31.7
10	17.5	14	13.5	31.0
10	45.7	13	45.9	31.6
11	15.6	13	14.5	30.1
11	46.4	12	45.2	31.6
12	16.9			12m 16.9

17) 91.1

13m 15s.36

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 25th 1870 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	α Aquilae	β Aquilae		
Circle,				
	w e	w e	w e	w e
Level Direct,				
Reversed,				
Sums,				
Difference,				
b.				
	h m s	h m s	h m s	h m s
Wire, I.	19 45	19 49		
II.	55.3 12.1 7.4	24.9 41.4 66.3		
III.	57.6 10.1 7 59.6 8.0 6	27.0 39.3 3 29.1 37.3 4		
IV.	01.7 5.8 .5	31.2 35.3 .5		
V.	3.8 3.8 917.0	33.2 33.2 931.7		
Sum,	.78	.19		
Mean,	19 45 03.78	19 49 33.19		
Bb,				
Cc,				
Aa,				
Corr'd Transit,				
R. A.	19 44 56.95 2 .97	19 49 26.94 2 .46		
Error of Timepiece,	6.81 .32 ~ = -1.1 {.76 .08	6.78 .32 {.81 .08		
	7.97	7.94		

Error = +7.96

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 2&3 1880 Instrument, Mer. Cir. Observer, W. C. W.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,								
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.			.			.			.			.
II.			.			.			.			.
III.			.			.			.			.
IV.			.			.			.			.
V.			.			.			.			.
Sum,			.			.			.			.
Mean,			.			.			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit,			.			.			.			.
R. A.			.			.			.			.
Error of Timepiece,			.			.			.			.

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, 26.2 Continued 187 . Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object, Circle,	ν Aurigae	β Aurigae	~~β Aurigae~~ α Orionis	
Level Direct, Reversed,	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	. .	.	. .	.
Wire, I. II. III. IV. V.	h m s 5 43 . 9.5 20.8 40.3 12.2 28.1 .3 14.9 25.5 .4 17.5 22.8 .3 20.1 20.1 9)1.4 20.16	h m s 5 50 . 42.1 65.5 107.6 45.0 62.6 .6 48.0 59.6 .6 50.9 56.7 .6 53.8 53.8 9)7.2 53.80	h m s 5 48 . 40.9 57.6 98.5 43.0 55.4 .4 45.1 53.3 .4 47.1 51.3 .4 49.2 49.2 9)1.9 49.21	h m s . . . . .
Sum, Mean,	. .	. .	. .	. .
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	5 43 12.33 Corr for M. A. R. Aberration +.05 +.02 12.40	~~44 56 09.1~~ 7.1 5 50 45.88 −.06 +.02 45.84	5 48 42.15 −.03 +.02 42.14	. .
Error of Timepiece,	7.76 .32 {+.10 {+.01	7.96 .32 −{.08 −{.01	7.07 .32 {+.79 {+.08	.
	+8.19	8.19	8.26	

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 26, 1880. Instrument, Mer. Cir. Observer, J. R. E.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Gemin.		ε Gemin.		ξ Gemin.			
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								

	h m s	h m s	h m s	h m s
Wire, I.	6 30 .	6 36 .	6 38 .	
II.	47.2 64.4 111.6	33.1 51.6 84.7	33.7 50.8 84.5	.
	49.3 62.2 5	35.4 49.1 4.5	35.8 48.7 5	
III.	51.6 60.0 .6	37.8 46.9 4.7	38.0 46.5 .5	.
	53.6 58.0 6	40.0 44.6 4.6	40.0 44.3 .3	
IV.	55.7 55.7	41.4 42.4	42.1 42.1	.
V.	9)7.0 55.79	9)2.9 42.32	9)1.9 42.21	.
Sum,	.	.	.	.
Mean,	.	.	.	.
Bb,	.	.	.	.
Cc,	.	.	.	.
Aa,	.	.	.	.
Corr'd Transit, R. A.	6 30 ~~48.74~~ 48.74 Corr. for R. Aberration +.02 +.02 48.78	6 36 35.08 −.01 +.02 35.09	R.A. 6^{h} 38 35.21 .2 +.01 +.02 35.24	.
Error of Timepiece,	7.01 .32 {+.62 {+.06	7.23 .32 {.44 {.04	6.97 .32 {+.69 {+.07	.
	8.01	8.03	~~7.82~~ 8.05	

Winlock (see previous page)		Error	coeff.n
ν Auriga	5^{m} 43	8.19	+10
β "	51	.19	−8
α Orion	49	.26	+79
	5^{h} 48	$+8^{s}.21$	+27

Edwards		Err.	coeff.n
γ Gem.	6^{h} 30	8.01	+.62
ε "	36	.03	+.44
ξ "	38	.05	+.69
	6^{h} 35	$+8^{s}.03$	+.58

Uncertainty of 10% would cause error of only .06 in E.
only .03 " W.
only .03 " difference.

Mean $+8^{s}.12$ at 6^{h} 06^{m}

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 28.3 1880.
(Mar 29.8
Instrument, Mer. Cir.
Timepiece, 1327
Observer, W. A. R.
Recorder, J. R. E.

Object, Circle,	α Can. Min.	δ Urs. Min.	η Serpentis	ζ Aquilae	
		w · e	w · e	w · e	w · e
Level Direct, Reversed,		. . . .	. . . .	. . . .	. . . .
Sums, Difference, b.		. .	. .	. .	. .
	7h 33m	h m s	h m s	h m s	h m s
Wire, I.		18 10m 45.3	18 15 .	.	.
II.	2.9 19.4 22.3	22.3 – 58.0 – ~~45.45~~	08.1 24.6 32.7	.	.
	5.0 17.3 .3	10m 10.2 – 11m 8.6 – ~~33.4~~	10.1 22.4 .5		
III.	7.1 15.3 .4	9 58.2 4.	12.1 28.3 .4	.	.
	9.2 13.3 .5	9 48.9			
IV.	11.2 11.2	9 35.8 .	14.1 18.3 .4	.	.
	9)1.7	18 10m 45.3	16.2 162		
V.	.19	10m × 10m 58.0 ×	9)2.2 .24	.	.
Sum,		10 22.3 11 8.6 90.9 10 10.2 11 20.7 9 58.2 11 32.6	.	.	.
Mean,	7 33 11.19	9 48.9 11 43.3 9 35.8 11 55.9 9 24.2 12 06.4	18 15 16.24	.	.
Bb,		9 13.3 12 18.5 9 01.1 12 29.8 12 41.3	.	.	.
Cc,		12 53.0	.	.	.
Aa,		13 05.1 13 16.9 13 27.9	.	.	.
Corr'd Transit,	3.26 .02	? 13 39.0 54.01 ~~54.07~~ −.06	07.96 +.04	~~55.10~~ 54.84	.
R. A.	7 33 −.02 3.26	18 10 +.27 54.22	18 15 +.02 08.02	18 59 −.02 +.02 54.84	
Error of Timepiece,	7.93 .32 n = −1⅛ {.82 .10	.	8.22 .32 n = −1⅛ {+.96 +.12	.32 n = −1⅛ {+1.00 .10	.

9.17

9.17
7.96
62.7)1.21 (.019
627
5830 .02
5643

Err = +9.17
at 7h 33

18 11 20.7
11m 8.6 11m 31.6 40.2
10 58.0 11 43.1 41.1
10 45.3 11 55.9 41.2
10 × 12 06.4 ×
10 22.3 12 18.5 40.8
10 10.2 12 29.8 40.0
9 58.2 12 41.3 39.5
9 48.9 12 54.0 42.9
9 35.8 13 05.1 40.9
9 24.2 13 16.9 41.1
9 13.3 13 27.9 41.2
9 01.1 13 39.0 40.1

23)19.7

197
184
130
138

11m 20.86
10 54.22
26.64

16.85
−0.05
16.9)18.42 (1.09
26.64
8.22
16.9
2520
1521

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 29th 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. C.

Object, Circle,	γ Aquilae	α Aquilae	β Aquilae	
Level Direct, Reversed,	w e	w e	w e	w e
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	19 40 34.9 51.6 86.5 36.9 49.4 3 39.0 47.3 .3 41.0 45.2 2 43.1 43.1 9) 1.4 16	19 45 57.2 14.0 11.2 59.3 11.9 2 01.4 9.8 .2 03.5 7.7 2 05.6 5.6	19 49 26.7 43.3 70.0 28.7 41.2 69.9 30.8 39.1 9.9 32.9 37.0 9.9 35.0 35.0 9) 8.7 .97	
Sum, Mean,	19 40 43.16	19 45 05.60	19 49 34.97	
Bb, Cc, Aa,				
Corr'd Transit, R. A.	34.61 ~~35.16~~ 0 .02 19 40 ~~35.20~~ 34.63	57.05 −.01 +.02 19 44 57.06	26.45 +.01 +.02 19 49 26.48	
Error of Timepiece,	8.53 ~~7.76~~ .32 1.1 +1/6 { +.73 .097	8.54 .32 1.1 +1/4 { .76 .097	8.49 .32 1.1 ~~+1/7~~ { .81 ~~.108~~	
	9.75 ~~9.65~~ ~~9.70~~	~~9.71~~ 9.69	~~9.72~~ 9.70	

Cm = ~~+9.[illegible]~~ at 19h 45m
~~+9.70~~
+9.68

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar. 30. 3 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Orionis	α Orionis	μ Geminorum	~~ε Can Maj.~~ γ Geminorum	ε Leonis.
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.		. .	. .	. .	. .
Wire, I.	5 18	5 48 .	~~7~~6 15 .	6 30 .	9 39 .
II. III. IV. V.	43.4 60.0 103.4 45.4 58.0 .4 47.6 55.9 .5 49.6 53.8 .4 51.7 51.7 9)6.4 51.71	42.2 59.0 101.2 44.3 57.0 .3 46.6 54.9 5 48.7 52.8 .5 50.8 50.8 9)6.3 50.70	43.9 61.8 105.7 46.1 59.5 .6 48.4 57.3 7 50.7 55.0 .7 52.9 52.9 9)7.6 52.84	48.9 66.0 114.9 51.0 63.9 4.9 53.1 61.8 4.9 55.3 59.7 5.0 57.5 57.5 9)4.2 57.47	5.4 23.4 28.8 7.7 21.1 .8 9.9 19.0 .9 12.1 16.7 .8 14.4 14.4 9)3.7 .41
Sum,		.	.	.	.
Mean,		.	.	.	9 39 14.41
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	5 18 43.10 −.04 +.02 43.08	5 48 42.09 −.03 +.02 ~~42~~ 42.08	6 15 43.98 −.03 +.02 43.97	6 30 48.68 +.02 +.02 48.72	9 39 5.32 ~~+.3~~ ~~+.2~~ 5.27
Error of Timepiece,	8.63 .32 .80 .08	8.78 .32 1.1 {.79 .08	8.87 .32 1.1 {.50 .05	8.75 .32 .62 .06	9.14 .34 n = −1.1 {+.46 +.05
	9.83	9.97	9.74	9.75	9.99

5 18	9.83	
5 48	.97	
6 15	.74	
6 30	.75	.80
9 39	.99	.79
		.50
		.62
		.46
6h 42	9.86	6.34

Error = +9.86 at 6h 42

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 30.8 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	γ Aquilae		α χ Aquilae		α Aquilae		β Cygni	
	w	e	w	e	w	e	w	e
Level Direct,	.	.	.	.	.	.	.	.
Reversed,	.	.	.	.	.	.	.	.
Sums,	.	.	.	.	.	.	.	.
Difference,								
b.								

	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	19	40	.	19	45	.			.	19	26	.
II.	35.2 37.3	52.0 49.9	87.2 2	5)7.8 5)9.7	14.2 12.2	12.0 11.9			.	5)4.0 5)6.4	12.7 10.4	6.7 8
III.	39.4	47.8	.2 0	01.7	10.1	11.8			.	5)8.8	8.0	.8
IV.	41.4	45.6	43.6	03.9	8.0	11.9 6.0			.	01.0 07.4	5.7	.7 3 4
V.	43.6		9)5.2 .58	06.0		9)8.6 .96			.		.	9)3.4 .38
Sum,			.			.		.	.			.
Mean,	19	40	43.58	19	45	05.96			.	19	26	03.38
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit, R. A.	19	40	34.64 .00 +.02 34.66	19	44	57.08 −.01 +.02 57.09			. .	19	25	54.07 00 .02 .09
Error of Timepiece,	2 = −1.1		8.92 .32 .73 .07			8.87 .32 .76 .08			.			9.29 .32 .39 .04
			10.04			10.03						10.04

Err = +10ˢ.04 at 19ʰ 34

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ...187 . Instrument, ... Observer, ...

Timepiece, ... Recorder, ...

Object, Circle,				
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.				
II.				
III.				
IV.				
V.				
Sum, Mean,				
Bb, Cc, Aa,				
Corr'd Transit, R. A.				
Error of Timepiece,				

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 3/4 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	α Hydrae			ε Leonis			α Leonis			ζ Leonis		
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	9	21	.	9	39	.	10	02	.	10	10	.
II.	44.5	61.1	105.6	5.7	23.8	29.5	2.4	19.3	21.7	4.4	22.4	26.8
III.	46.6	59.1	.7	7.9	21.4	.3	4.6	17.1	7	6.7	20.2	69
	48.7	57.0	7	10.1	19.2	3	6.8	15.1	.9	9.0	18.0	7.0
IV.	50.8	54.9	.7	12.4	17.0	.4	8.9	13.0	.9	11.2	15.8	7.0
V.	52.8		52.8	14.6		14.6	11.0		11.0	13.3		13.3
			9)17.5			2)6.1			9)8.2			9)4.0
			52.83			14.68			10.91			13.44
Sum,			.			.			.			.
Mean,			.			.			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit, R. A.	9	21	43.89 +.01 +.02 43.92	9	39	5.20 + .03 .02 5.25	10	02	1.63 +.01 .02 1.66	10	10	3.85 +.05 .02 3.92
Error of Timepiece,		w=-1.1 {	8.91 .32 1.05 .11			9.43 .32 .46 .05			9.25 .32 .69 .07			9.52 .32 .4766 .047
			10.39			10.26			10.33			10.35

Error = +10.34 at 9^h 48

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Mar 31.5 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	δ Virginis	ε Virginis	Polaris	
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I.				
II.				
III.				
IV.				
V.				
Sum,				
Mean,				
Bb,				
Ce,				
Aa,				
Corr'd Transit,	36.57	15.22		
R. A.	12 49	12 56		
Error of Timepiece,	.32 :84 ,08	.32 .77 .07		

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr 1st 1880. Instrument, Mer. Cir. Observer, W.A.R.

Timepiece, 1327 Recorder, J.R.E.

Object, Circle,		ε Leonis	α Leonis	ζ Leonis
	w e	w e	w e	w e
Level Direct, Reversed,				
Sums, Difference, b.				
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.		9 39 6.0 24.1 30.1 8.3 22.0 3 10.7 19.7 .4 12.9 17.4 3 15.1 15.1 9)1.2 15.13	10 02 3.0 19.9 22.9 5.1 17.7 8 7.1 15.6 .7 9.2 13.4 .6 11.3 11.3 9)3.3	10 10 4.9 22.9 27.8 7.0 20.6 .6 9.2 18.3 5 11.6 16.0 .6 13.8 13.8 9)7.3
Sum, Mean,			11.37	13.81
Bb, Cc, Aa,				
Corr'd Transit, R. A.		5.18 +.03 +.02 9 39 5.23	01.74 +.01 +.02 10 02 1.77	3.83 +.05 3.02 10 10 3.90
Error of Timepiece,		9.90 .32 .46 .05	9.60 .32 .69 .07	9.91 .32 .47 .05
		10.73	10.68	10.75

Error = $+10^{s}.72$ at 9^{h} 57

10.72
9.86
51.2) 0.86
.017

Steady hourly rate since Mar. $30^{d}.3$

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 18 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	λ Aquilae	β Cygni	γ Aquilae	α Aquilae	β Aquilae
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.					
		h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	19 00 5)6.1 12.7 8.8 5)8.0 10.6 .6 00.3 8.5 .8 2.3 6.4 .7 4.4 4.4 9)3.3 04.37	19 25 55.0 × 5)7.3 11.3 8.6 5)9.6 8.9 8.5 06.6 (See below) 8.56	19 40 26.1 43.1 69.2 28.2 40.9 .1 30.3 38.7 .0 32.4 36.7 .1 34.5 34.5 9) 4.9	19 45 1.9 10.1 12.0 4.0 8.0 12.0 6.0 6.0 ~~8.0~~ 18.5 2,058 20.6 8.	19 49 28.0 44.8 72.8 30.1 42.8 2.9 32.2 40.7 2.9 34.3 38.5 2.8 36.4 36.4 5) 3.8
Sum, Mean,		5)5.0 2.058 6)1.7 2.06 4 4.28 5)7.26 8.232 5)5.0 3.23	+ 10s 34.54 error in reading shut 10. 44.54	22.6 16.464 24.7 5 26.9 82.320 ~~22.66~~ ~~31.0~~ 113.3 61.0	36.42
Bb, Ce, Aa,		06.6 2.06 2.06 1.129 4.54 6774 2252 2.31474		~~82.8~~ 31.0 06:01 19 45 ~~06.10~~ Error in reading shut 1 ~~07.10~~	
Corr'd Transit, R. A.	54.70 −.02 18 59 +.02 54.70	54.14 .00 19 25 +.02 54.16	34.70 .00 19 40 +.02 34.72	57.14 −.01 19 44 +.02 57.15	26.54 +.01 19 49 +.02 26.57
Error of Timepiece,	9.67 .32 +1.00 .10 n = −1.1	10.12 .32 .39 .04	9.82 .32 .73 .07	9.86 ~~9.95~~ .32 .32 .76 .76 .08 .08 11.02	9.85 .32 .81 .08
	11.09	10.87	10.94	~~11.11~~	11.06

Error = ~~+10.9~~ +11.00
at 19h 32

2.320
4
9.28
(5) 5.0
4.28

11.00
9.86
60.8) 1.14
+ .019

of steady
hourly rate since Mar 30d.3

2.32
6.6
4.28
4.28
8.56

sec δ: 82.32
1.011
.90552
82.32
83.23
113.3
~~0.0~~
30.1

12.0
12.0
6.0
30.1
60.1

19 45 07.01
19 44 57.15
9.86

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Ap. 23 1880 Instrument, Mer. Circ. Observer, W. C. W.

Timepiece, 1327 Recorder, J. R. E.

Object,	40 Lyncis						10 Leonis Min			o Leonis		
Circle,												
	w		e	w		e	w		e	w		e
Level Direct,	.		.	.		.	.		.	.		.
Reversed,	.		.	.		.	.		.	.		.
Sums,	.		.	.		.	.		.	.		.
Difference,												
b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I.	9	13	.			.	9	27	.	9	34	.
II.	48.1	68.1	116.2			.	5)5.6	16.3	11.9	49.2	65.9	115.1
	50.8	65.7	.5				5)8.3	13.8	12.0	51.1	63.9	.0
III.	53.2	63.2	.4			.	00.9	11.1	12.0	53.3	61.7	.0
	55.7	60.5	.2				3.5	8.6	12.1	55.5	59.6	.1
IV.	58.1		58.1			.	6.0		6.0	57.6		57.6
V.			9)1.4			.			.0		.	9)4.8
Sum,			58.16 .			.	9	27	06.00			57.53
Mean,			.			.			.			.
Bb,			.			.			.			.
Cc,			.			.			.			.
Aa,			.			.			.			.
Corr'd Transit, R. A.	9	13	47.46 +.07 +.02 47.55			. .	9	26	55.42 -.12 +.02 55.32	9	34	47.37 +.04 +.02 47.43
Error of Timepiece,			10.61 .32 .22 .02			.			10.68 .32 .16 .02			10.10 .32 +.73 .07
			11.17						11.18			11.22

Error = +11.19 at 9h 24

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, ~~Mar~~ Apr. 4.0 1880 Instrument, Mer. Cir. Observer, W. A. R.
" 4.8 Timepiece, 1327 Recorder, J. R. E.

		☉		δ Urs. Min		51 Cephei H. C.		η Serpentis	
Object, Circle,									
		w	e	w	e	w	e	w	e
Level Direct, Reversed,									
Sums, Difference, b.				tan δ = 16.84 16.84 −.05 16.89	47.0 35.1 24.4 11.6 13 01.5 12 49.8		tan δ = −20.70 −.05 20.65		tan δ = −.05
		h m s		h m s		h m s		h m s	
Wire, I. II. III. IV. V.	0 55 04.6 6.5 8.8 10.8 12.9 16.9 19.0 21.1 23.2 25.2 27.3 29.3 31.5 33.7 37.8 40.0 42.0 44.0 46.0	0 57 55.1 53.1 57.0 48.9 46.9 42.7 40.7 38.6 36.5 34.5 29.9 28.0 26.1 21.9 19.7 17.7 15.6 13.4	~~0.59.7~~ .59.7 .6 .8 .7 .8 .6 .7 .7 .7 .7 .2 .5 .8 .7 .7 .7 .6 .4	09m 08.1 19.6 31.6 43.6 9 55.1 10 06.0 18.3 29.4 40.8	38.5 25.2 13.8 12 01.6 11 50.7 38.6 26.8 16.7 11 04.0 10m 52.4	40m 55.6 41 07.2 25.2 39.5 41 53.3 42 08.1 22.5 36.5 42 51.3 43 05.3 19.1 34.2 43 47.7	46 38.2 25.1 46 10.1 45 55.6 42.0 26.3 13.7 45 00.0 44 45.0 31.3 16.7 44m 02.1 .94.8 6.3 5.3 5.1 5.3 4.9 6.2 6.5 6.3 6.6 5.8 6.3 47.7 25)321.6 47.86	18 15 10.7 27.1 12.8 25.1 14.9 23.1 16.9 21.0 19.0	37.8 7.9 8.0 7.9 19.0 5)78.6 15.96
Sum, Mean,				18h 11m 27.60		18h 43m 47.86			
Bb, Cc, Aa,									
Corr'd Transit, R. A.	23.09 +.02 −3.62⁵	0h 56m 29.82 0 56 ~~29.66~~ .08	18)11.6 359.64 29.82 ~~23.09~~ .11	18 10	More Correction 55.93 +.27 −.05 56.15	18 4~~3~~4	00.87 −.34 −.27 00.26	18 15	8.14 +.02 +.04 8.20
Error of Timepiece,	19.~~51~~46 29.82 10.~~31~~ .36	10.3~~1~~6 ~~7.14~~ .32 ~~.91~~ .80 ~~.09~~ .08 6	.71		28.55 10.76 ~~39.31~~ 17.79	12.40 10.76 23.16	~~+47.60~~ ~~10.76~~ ~~36.84~~	n = −1.1	10.76 .32 +.96 .10

11.~~63~~.56

Approx. Error of 1327 = + 11.~~63~~ 556
at 0h 57m
(By Sun, no correction for Ephemeris place being made.)

.9125
.1057
.8068

9m 08.1	13 47.0	55.1	
19.6	35.1	4.7	
31.6	24.4	6.0	
43.6	11.6	5.2	
9 55.1	13 01.5	6.6	
10 06.0	12 49.8	5.8	
18.3	38.5	6.8	
29.4	25.2	4.6	
40.8	13.8	4.6	
10 52.4	12 01.6	4.0	
11 04.0	11 50.7	4.7	
16.7	38.6	5.3	
26.7		26.7	
		20)15.1	
		27.60	

12.14

16.89)17.79
n = − 1.05 for δ Urs. Min

20.65) 23.16
n = − 1.12 for 51 H. Cephei

37.54) 40.95
n = − 1.09 for both polar stars.

~~16.84~~ 16.84 28.55
20.70 12.40
37.54 40.95

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr 4.8 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	β Cygni			γ Aquilae			α Aquilae			β Aquilae		
	w		e	w		e	w		e	w		e
Level Direct, Reversed,												
Sums, Difference, b.												
	h	m	s	h	m	s	h	m	s	h	m	s
Wire, I. II. III. IV. V.	19 5)6,2 5)8,7 01,0 3,3 5,6	26 15,0 12,7 10,3 8,0	11.2 4 .3 3 5.6 9)5.8 05.64	19 ~~31.1~~ 37.4 39.4 41.6 43.7 45.9	40 54.2 52.1 50.0 48.0	91.6 .5 6 .7 45.9 9)7.3	19 5)9.7 02.0 4.0 6.1 8.0	45 16.6 14.5 12.3 10.3	16.3 5 .3 .4 8.0 9)1.5	19 29.3 31.3 33.4 35.6 37.7	44 46.0 43.9 41.8 39.7	75.3 2 .2 .3 37.7 9)5.7
Sum, Mean,						45.81			08.17			37.63
Bb, Cc, Aa,												
Corr'd Transit, R. A.	19	25	54.24 :02 -.00 54.26	19	40	34.79 .02 -.00 34.81	19	44	57.13 -.01 +.02 57.14	19	49	26.63 +.01 +.02 26.66
Error of Timepiece,			11.38 .32 a=-1.1 { +.39 +.04			11.00 .32 .73 .07			11.03 .32 .76 .08			10.97 .32 .80 .08
			12.13			12.12			12.19			12.17

18h	15	+12.14	.96
19	26	.13	.39
	40	.12	.73
	45	.19	.76
	49	.17	.80
			.73
19h	23	+12.15	

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 5th 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	δ Leonis	ε Leonis	ζ Leonis	α Leonis	β Leonis
Level Direct, Reversed,		w e	w e	w e	w e
Sums, Difference, b.					
Wire, I. II. III. IV. V.	11h 07m 21.0 38.7 59.7 23.2 36.4 .6 25.4 34.2 .6 27.6 32.0 6 29.8 29.8 9)7.3 .81	h m s 9 38 39.4 57.6 97.0 41.7 55.3 .0 44.0 53.0 .0 46.2 50.8 .0 48.5 485	h m s 10 09 38.1 56.1 94.2 40.3 53.9 .2 42.6 51.7 .3 44.9 49.3 .2 47.1 47.1 9)1.0	h m s 10 01 36.1 53.1 89.2 38.2 51.0 .2 40.3 48.9 .2 42.4 46.8 .2 44.7 44.7 9)5.5 .61	h m s 11 42 33.8 57.0 84.8 36.0 48.9 .9 38.0 46.7 .7 40.2 44.4 .6 42.3 42.3 9)3.3 .37
Sum, Mean,	11 07 29.81	9 38 48.50	10 09 47.11	10 01 44.61	11 42 42.37
Bb, Cc, Aa,					
Corr'd Transit, R. A.	46.56 +.03 +.02 11 07 46.51	5.13 +.03 +.02 9 39 05.18	3.79 +.05 .02 10 10 03.86	01.57 +.01 +.02 10 02 01.60	59.32 +.01 +.02 11 42 59.35
Error of Timepiece,	−16.80 +.32 +.53 +.05	−16.68 +.33 n = −1.1 {+.46 +.05	−16.75 +.32 +.47 +.05	−16.99 +.32 +.69 +.07	−16.98 +.32 +.64 +.06
	−15.90	−15.85	−15.91	−15.91	−15.96

Note. Before taking the [illegible], the clock 1327 was disturbed by W. A. R. Discontinuity of error the result:

~~Error = −15.89 at 9h 56~~

Error = −15.91 at 10h 31

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Ap. 6.8 1879 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	β Cygni	α Aquilae	β Aquilae	θ Aquilae	
		w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.					
	19h 25m	h m s	h m s	h m s	h m s
Wire, I.		19 44	19 49	20 04	
II.	/ 45.2	31.0 47.8 78.8	7) 9.4 ✗	41.0 57.6 98.6	
	✗ 42.9	33.0 45.7 7	01.5 13.9 15.4	43.0 55.4 4	
III.	✗ 40.5	35.1 43.6 .7	3.6 11.9 .5	45.0 53.3 .3	
	33.4 38.1 71.5	37.2 41.5 7	5.7 9.9 6	47.2 51.3 5	
IV.	35.8 35.8	39.3 39.3	7.7 7.7	49.2 49.2	
V.		9) 3.2 37.36	7) 5.2 .74	9) .20 .22	
Sum,	✗ 59.2 17.9 56.7 71.6 17.2 54.5 1.7	Error in making sheet 1.			
Mean,	19.6 52.1 1.7 22.1 49.9 2.0	19 44 38.36	19 49 07.74	20 04 49.22	
Bb,	11) 9.3 35.85				
Cc,					
Aa,	19 25 35.85				
Corr'd Transit,	54.30 -.00 +.02	57.29 -.01 +.02	26.69 +.01 +.02	08.35 +.00 +.02	
R. A.	19 25 54.32	19 44 57.30	19 49 26.72	20 05 08.37	
Error of Timepiece,	-18.47 +.32 {+.37 +.04	-18.94 +.32 {+.76 +.08	-18.98 .32 {+.81 +.08	-19.15 .32 {+.93 +.09	
	-17.74	-17.78	-17.77	-17.81	

Error = -17.77
at 19h 45m

17.77
15.91
31.2) 1.86 (.06
187 2

Rate = -.06

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 7, 4 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	ε Leonis	α Leonis	δ Leonis	Polaris Lo. C.
	w . e	w . e	w . e	w . e
Level Direct, Reversed,	. .	. .	. .	. .
Sums, Difference, b.	. .	. .	. .	. .
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	9 38 . 36.9 55.0 91.9 39.1 52.7 .8 41.3 50.3 6 43.6 48.0 .6 45.8 45.8 9)7.7 9 38 45.86	10 07 . 33.5 49.4 83.9 35.6 48.3 3.9 37.8 46.2 4.0 39.9 44.1 4.0 42.0 42.0 9)8.8 .98	11 07 . 18.3 36.0 54.3 20.6 33.4 5 22.8 31.6 .4 25.0 29.4 .4 27.2 27.2 9)1.8	13 12m 42.1 42.1 12m 11.4 13 10.4 .81.8 11 41.0 13 41.4 82.4 11 08.4 14 10.5 .78.9 10 42.6 14 39.1 .81.7 10 10.8 15 06.7 77.5 9 42.5 15 38.3 .80.8 9 11.6 16 08.3 79.9
Sum,	05.10 +.03 +.02	.	.	16 35.4 8 13.5 17 06.1 .79.6 7 43.3 17 35.2 78.5
Mean,	9 39 05.15	10 01 47.98	11 07 27.20	18 04.0 18 32.3 19)3.2
Bb, Ce, Aa,	. . .	. . .	. . .	13 12 40.20 .
Corr'd Transit, R. A.	-19.29 +.32 {+.46 {.05	01.56 +.01 +.02 10 02 01.59	46.55 +.03 +.02 11 07 46.60	58.48 +.18 -.67 13 13 57.99
Error of Timepiece,	-18.46 .	-19.61 +.32 {+.69 {+.07	-19.40 +.32 {+.53 {-.05	2h @ .05 -77.79 -{19.40 {.10 58.29
		-18.53	-18.50	

9 38
10 01
11 07
10h 15m

18.46
18.53
18.50
18.50
17.77
14.57).73
Hourly rate = -.05

Error = -18.50 at 10h 15m

43.14
.39
43.53

lg 58.29 = 1.7656
lg 43.53 = 1.6388
0.1268

n = -1.34

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 8.2 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1227 Recorder, B. R. C.

Object, Circle,	β Eridani	δ Orionis	α Orionis	γ Geminorum	
Level Direct, Reversed,		w . e . . .	w . e . . .	w . e . . .	w . e . . .
Sums, Difference, b.		. .	. .	. .	. .
	5h 1m	h m s	h m s	h m s	h m s
Wire, I.		5 25 .	5 48 .	6 30 .	.
II.	32.7 41.0	40.9 26.3 38.7 65.0	12.6 29.2 41.8	19.0 36.1 55.1	.
III.	34.7 38.9 36.9	28.3 36.9 .2 30.5 34.6 .1	14.6 27.1 .7 16.7 25.0 .7 18.8 23.0 .8	21.0 34.0 .0 23.2 31.9 .1	.
IV.	73.7 73.6 36.9	32.7 32.7	20.9 20.9	25.4 29.7 .1 27.6 27.6	.
V.	184.3 5 1 36.86	324.0 .57	97.9 .88	94.9 .54	.
Sum,		.	.	.	.
Mean,		5 25 32.57	5 48 20.88	6 30 27.54	.
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	58.05 +.01 5 01 +.02 58.08	53.86 −.10 5 25 +.02 53.78	41.93 −.03 5 48 +.02 41.92	48.52 +02 6 30 +.02 48.56	. .
Error of Timepiece,	21.22 +.32 +1.00 +.10	21.21 +32 +.92 +.09	−21.04 +.32 +.79 .08	−21.02 +32 +.62 +.06	.
	−19.80	−19.88	−19.85	−20.02	

,80 01
,88 25
,85 48
1.02 30
19.89 5 41

Err = −19.89 at 5h 41

19.89
18.50
19.5) 1.39 (.07
1 365

20.02 − .06 = 19.96
19.80 + 4 = 19.84
Extreme discrepancy = 0.12
" residual = .07

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 9.2 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	β Tauri	δ Orionis	ζ Orionis	
Level Direct, Reversed,	w . | e . w . | e .	w . | e . w . | e .	w . | e . w . | e .	w . | e . w . | e .
Sums, Difference, b.	. .	. .	Connaissance des Temps uncorrected. ∴ Given ½ weight.	. .
	h m s	h m s	h m s	h m s
Wire, I.	~~7~~ 5 17 .	5 25 .	5 34 .	.
II.	12.3 31.1 43.4	22.9 39.4 62.3	12.5 29.1 41.6	.
III.	14.8 28.8 .6	25.0 37.3 .3	14.7 27.0 .7	.
IV.	17.1 26.4 .5	27.0 35.3 .3	16.7 24.9 .6	.
	19.4 24.1 .5	29.0 33.2 .2	18.9 22.9 .8	.
V.	21.8 21.8 9)6.8 21.76	31.1 31.1 9)1.2 .13	20.9 20.9 9)7.6 .84	.
Sum,	Error in reading = 1m .	.	.	.
Mean,	5 18 21.76	5 25 31.13	5 34 20.84	.
Bb, Cc, Aa,	. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	43.88 −.01 +.02 5 18 43.89	53.85 −.10 +.02 5 25 53.77	. 43.27 +.22 5 34 43.49	. .
Error of Timepiece,	−22.13 +.32 n = −1.1 { +.37 +.04 }	22.64 +.32 { +.92 +.09 }	22.65 +.32 { +.95 +.10 }	.
	−21.40	−21.31	−21.28	

2 × .40 = .80
2 × .31 = .62
1 × .28 .28
5 5)1.70
~~21.38~~
21.34

At 5h 25m
Error = −21.34

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 8-9) 1880. Instrument, Mer. Cir. Observer, W. & R.
Out of order) Apr 10.5 Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	Polaris			Polaris Apr. 10.5 L. C.
	w | e	w | e	w | e	w | e
Level Direct, Reversed,	. | . . | .	. | . . | .	. | . . | .	. | . . | .
Sums, Difference, b.	. | .	. | .	. | .	43.14 . 13
	h m s	h m s	h m s	h m s
Wire, I. II. III. IV. V.	. . . . .	. . . . .	13 10.8 .70.8 12 11.3 13 40.1 111.4 11 43.3 14 12.0 5.3 11 12.7 14 41.0 3.7 10 42.9 15 09.3 2.2	~~14 14 41~~ ~~14 12.0~~ ~~13 40.1~~ 13 10.8 12 40.3 12ᵐ 40.3 12 11.3 13 10.8 24 82.1 11 43.3 13 40.1 3.4 11 12.7 14 12.0 4.7 10 42.9 14 41.0 3.9
Sum, Mean,	. .	. .	× 15 39.2 × 9 43.9 16 08.9 2.8 9 13.0 16 39.4 2.9 8 45.2 17 08.7 3.9 8 15.6	10 × 15 09.3 × 9 43.9 15 39.2 3.1 9 13.0 16 08.9 1.9 8 45.2 16 39.4 4.6 8 15.6 17 08.7 4.3
Bb, Cc, Aa,	. . .	. . .	× 7 15.6 G. Ho. . .5	8 × 7 15.6 .17)28.3 ~~13 12. 41.66~~
Corr'd Transit, R. A.	58.58 +.18 -1 13 +.67 59.43	. .	13 13 10.53 13 13 57.93 49.40	~~13 12 41.66~~ 59.08 +.18 13 13 −.67
Error of Timepiece,	.	.	76.93 24.12 52.81	G. Ho. ~~78.27~~ 24.12 54.15 ~~59.93~~ 58.59 ~~78.27~~ −76.93

13 10.8 13 10.8
12 40.3 13 40.1 26 20.4
12 11.3 14 12.0 23.3
11 43.3 14 41.0 24.3
11 12.7 15 09.3 22.0
10 42.9 15 39.2 22.1
10 × 16 08.9 ×
9 43.9 16 39.4 23.3
9 13.0 17 08.7 21.7
8 45.2 15) 7.9
8 15.6 .53
8 ×
7 15.6

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 10.5 1880 Instrument,.................... Observer,....................

Timepiece,.................... Recorder,....................

Object, Circle,	δ Leonis	β Leonis	δ Virginis	ε Virginis	
Level Direct, Reversed,		w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.		. .	. .	. .	. .
	11h 07m	h m s	h m s	h m s	h m s
Wire, I.		11 42 .	12 49 .	12 55 .	.
14.0 31.7 II.	~~45~~.7	26.9 44.0 70.9	04.1 20.7 24.8	42.9 59.6 102.5	.
16.1 29.4	.5	29.0 41.9 9	6.1 18.6 .7	45.0 57.6 6	.
18.3 27.2 III.	.5	31.2 39.7 .9	8.3 16.5 .8	47.0 55.4 .4	.
20.6 25.1	.7	33.3 37.6 9	10.4 14.9 8	49.2 53.3 5	.
22.9 3.7 IV.	22.9	35.4 35.4	12.4 12.4	51.2 57.2	.
V.	9)7.3 .81	9)4.0 11 42 ~~35~~.44	9)3.5 12 49 12.39	9)2.2 12 55 57.23	.
Sum,		.	.	.	.
Mean,	11 07 22.81	.	.	.	.
Bb, Cc, Aa,		. . .	. . .	. . .	. . .
Corr'd Transit, R. A.	46.54 +.03 +.02 11 07 46.59	59.32 +.01 +.02 11 42 59.35	36.61 −.02 +.02 12 49 36.61	15.27 +.04 +.02 12 56 15.33	.
Irreg. Error of Timepiece, n = −1.1	−23.78 +.32 +.53 .05	−23.91 +.32 +.64 .06	−24.22 +32 +84 .08	−24.10 +.32 +.71 .07	.

−22.88 −22.89 −22.98 23.00
.05 .07 .09 .07
−22.83 −22.82 −22.89 −22.93

07 .88
42 .89
49 .98
56 1.00
11h 89 −22.94

E Virg at 12h 55
0.3h @ .06

−24.10
.02
24.12

~~43.14~~
.21
43.35

~~49.40~~
~~24.12~~

43.35) 54.15 (1.25
43 35
1 080 0
867 0
213 00

43.35) 52.81 (1.22
43 35
9 460
8 670
7900

n = −1.22

For n = −1.1 Error = −22.94
" " = −1.2 " = −22.87

At 12h 09

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 11.8 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object,	51 H. Cephei	γ Aquilae	α Aquilae	β Aquilae	θ Aquilae
Circle,	L. C.				
		w e	w e	w e	w e
Level Direct, Reversed,					
Sums, Difference, b.	20.69 .10 20.79				
	18 43 06,1	h m s 19 40	h m s 19 44	h m s 19 ~~48~~ 49	h m s 20 04
Wire, I. II. III. IV. V.	43 19.7 42 58.8 13.5 43 35.7 42 39.5 15.2 43 50.4 42 23.9 14.3 42 09.8 44 17.7 41 54.7 12.5 44 32.7 41 41.1 13.8 44 47.4 41 26.4 13.8	00.4 17.4 17.8 2.6 15.3 9 4.7 13.2 .9 6.8 11.1 9 9.0 9.0 9)8.5	23.0 37.9 62.9 25.2 37.7 2 9 27.2 35.7 2.9 29.4 33.6 3 0 31.4 31.4 9)4.1 31.34	~~42.1 58.7~~ 100.8 44.1 56.7 8 46.3 ~~54~~.6 .9 48.3 52.6 .9 50.6 50.6 9)4.0	34.1 50.8 84.9 36.2 48.7 9 38.2 46.6 .8 40.2 44.4 .6 42.2 42.2 9)3.4 42.38
Sum, Mean,	45 00.3 41 12.6 12.9 45 15.0 40 59.8 14.8 45 29.3 39 43.2 12.5 45 44.7 39 30.4 15.1 45 56.7	8.94		~~50.44~~ 57.6 9.1 1.7 54.6 7.1 7 56.7 5.0 .7 58.7 2.9 6 0.7 0.7	
Bb, Cc, Aa,	21) 144.7 06.87			9)7.4 0.82	
Corr'd Transit, R. A.	57.70 −.27 −.32 18 43 57.11	34.99 .00 +.02 19 40 35.01	57.43 ~~56.78~~ −.01 +.02 19 44 57.44	26.83 +.01 +.02 19 49 26.86	08.49 .00 +.02 20 05 08.51
Error of Timepiece,	50.24	−26.07 +.32 Assum. n=−1.1 {+.73 .07	−26.10 +.32 {+.76 .08	−26.04 +.32 {+.81 .08	−26.13 +.32 {+.93 .09
		−24.95 .08 −24.87	−24.94 .07 −24.87	−24.83 .08 −24.75	−24.79 .10 −24.69

.07 40 .18
.10 44 .15
.04 49 .11
.13 64 −.02
.08 49 .10

26.08
.10
~~26.18~~
25.98

19h 44
18 44
1h.6
.06
.096

50.24
26.18
20.79) 24.06 (1.15
2079
3270
2079
11910
13395

n = −1.16

−24.87
.95
.94
.83
.79
.88

50.24
25.98
20.79) 24.26 (1.16
2079
3470
2079
13910
13395

Error = −24s.88 at 19h 49 on value of n = −1.1
" = −24.80 " " " " " " " = −1.2

24.88
22.94
31.6) 1.94 (.06 rate.
1896

.87
.87
.75
.69
.80

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 12.0 1880 to 12.2 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. C.

Object, Circle,	Polaris	ι Orionis	α Orionis	μ Geminorum	γ Geminorum
Level Direct, Reversed,	43.12	w . . e . .	w . . e . .	w . . e . .	w . . e . .
Sums, Difference, b.	.10 43.22	−.105	. .	. .	. .
Wire, I. II. III. IV. V.	1h 14m 24.1 13 24.3 15 24.3 24.3 48.6 12 27.3 × × 11 26.3 17 22.4 24.85 48.7 10 27.1 18 20.9 24.0 48.9 9 30.0 19 21.7 25.55 57.1 8 27.6 20 19.6 24.6 49.2 11)270.6	24.1 h m s 5 29 59.8 01.8 3.9 6.0 8.1 10.2 12.1 14.2 16.3 9)72.4 08.04	h m s 5 48 . 6.9 23.5 30.4 9.0 21.4 4 11.1 19.3 .4 13.1 17.2 3 15.2 15.2 9)1.7 15.19	h m s 6 15 . 08.5 26.3 34.8 10.7 24.0 7 13.0 21.9 .9 15.2 19.6 8 17.4 17.4 9)3.6	h m s 6 30 . 13.4 30.6 44.0 15.6 28.4 0 17.8 26.3 .1 19.9 24.1 0 22.0 22.0 9).1 22.01
Sum, Mean,	13 24.3 12 27.3 11 26.3 10 27.1 9 30.0 8 27.6 24.60	5) 9.8 16.3 16.1 7.8 14.2 0 3.9 12.1 0 6.0 10.2 2 8.1 8.1	. .	17.40 . .	. .
Bb, Cc, Aa,	1 14 24.60 + ~~1 13 24.60~~	9).4 08.04 . . .	. . .	. . .	. . .
Corr'd Transit, R. A.	59.27 +.18 +.67 1 13 60.06	34.91 −.04 +.02 5 29 34.89	41.88 −.03 +.02 5 48 41.87	43.76 −.03 +.02 6 15 43.75	48.46 +.02 +.02 6 30 48.50
Error of Timepiece,	24.54 ~~24.54~~ 35.46	−26.85 +.32 a = −1.2 { +1.02 +.20	−26.68 +.32 { +.79 .16	−26.85 +.32 { +.49 .10	−26.49 +.32 { +.62 .12
		−25.31	25.31	−25.44	25.33

~~24.54~~
~~26.85~~
43.22)~~51.39~~
n = −1.19

~~35.46~~
~~26.85~~
62.31

Error = −25.40 at 6h 00

26.85
.26
~~27.11~~
26.59

4.3 @ .06

~~24.54~~
~~27.11~~

24.54
26.59
7.95

43.22)51.13(1.18
43 22
7910

n = −1.18

25.40
24.80
10.3).60(.058
515
850

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Ap. 12.5 1880. Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	Polaris	~~β Leonis~~ γ Virginis	~~γ Virginis~~ β Leonis	δ Virginis	ε Virginis
	L. C.	w · e	w · e	w · e	w · e
Level Direct, Reversed,		· ·	· ·	· ·	· ·
Sums, Difference, b.	43.12 .14 42.98	· ·	· ·	· ·	· ·
Wire,	13 h -6 40.9 -7 I. 43.3 18 34.5 -8 41.7 76.2 17 36.4 -9 II. 39.7 6.1 16 36.6 -10 40.9 7.5 15 37.2 11 III. 38.3 5.5 14 38.4 ~~12 IV. 36.6~~ 5.0 13 40.3 40.3 12 36.6 V. 11)90.6 38.24	75.4 9.7 8.3 6.9 9.3 8.6 86.6 13)114.8 38.83 h m s 12 35 . 2.6 19.1 21.7 4.7 17.0 .7 6.7 15.0 .7 8.8 12.9 .7 10.8 10.8 9)7.6 10.84	h m s 11 42 . 24.1 41.0 65.4 26.3 39.1 .4 28.4 37.0 .4 30.6 35.0 6 32.8 32.8 9)6.6 32.73	h m s 12 49 . 1.5 18.1 19.6 3.5 16.0 .5 5.6 13.9 .5 7.7 12.0 7 9.9 9.9 9)7.2 9.80	h m s 12 55 . 40.1 57.1 97.2 42.3 54.9 2 44.3 52.8 .1 46.5 50.7 2 48.6 48.6 9)5.3 48.59
Sum, Mean,	~~13 13 38.24~~	·	·	· ·	
Bb, Cc, Aa,	13 12 38.83	·	·	·	·
Corr'd Transit, R. A.	13 13 59.34 +.18 -.67 58.83	12 35 37.86 .00 +.02 37.88	11 42 59.31 +.01 +.02 59.34	12 49 36.61 -.02 +.02 36.61	12 56 15.28 +.04 +.02 15.34
Error of Timepiece,	~~20.59~~ 80.00	n = -1.2 -27.04 +.32 {+.90 .18	-26.61 +.32 {+.64 .13	-26.81 +.32 {+.84 .17	-26.75 +.32 {+.71 .14
		-25.64	-25.52	-25.48	-25.58

26.81 .21
26.75 .07
26.78 .14
~~0.3~~
0.3 @ .06 .02
26.80

Error = -25.55 at 12h 30

80.00
26.80
42.98) 53.20 (1.24
4298
10220
8596
16240
n = -1.24

25.55
25.40
6.5) .15
.023

25.55
24.80
16.7) .75 (045
.668
820

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Ap. 13.3 187 . Instrument,.................. Observer,..................

Timepiece,.................. Recorder,..................

Object, Circle,	α Gemin.	β Gemin.			ε Leonis			α Leonis			ζ Leonis			
		w		e	w		e	w		e	w		e	
Level Direct, Reversed,		. .		. .	. .		. .	. .		. .	. .		. .	
Sums, Difference, b.		.		.	.		.	.		.	.		.	
		h	m	s	h	m	s	h	m	s	h	m	s	
Wire, I. II. III. IV. V.	7 26 21.9 41.4 24.3 39.0 26.7 36.5 29.2 34.1 31.7	7 23.9 28.2 28.6 30.9 33.2	37 42.7 40.3 38.0 35.6	. 66.6 .5 6 .5 33 2 9)2.4	9 28.7 31.0 33.2 35.4 37.7	38 46.7 44.4 × 39.9	. 75.4 .4 .3 37.7 9)4.8	10 25.3 27.6 29.6 31.7 33.9	07 42.3 40.2 38.1 36.0	. 67.6 8 .7 .7 33.9 9)7.7	10 27.3 29.6 31.8 34.1 36.4	09 45.4 43.1 40.9 38.6	. 72.7 .7 .7 .7 26 4 9)3.3	
Sum, Mean,	63.3 3.3 3.2 3.3 31.7 9)14.8 31.64			33.27 . .			37.69 . .			83.86 . .			36.36 . .	
Bb, Cc, Aa,	18.4 18. 3.3 0.4 5.52 17.6 57 2 3.3 60.72 52.8 52.8 5.80	17.4 33 5 2 2 52 57.42	17. 0.4 16.6 3.3 49.8 49.8 55.78	. . .	14.5 .6 13.1 3.3 45.3 45.3 49.83	14.5 .6 13.9 3.3 41.7 41.7 45.87	. . .	12.5 .6 11.9 33 357 357 39.27		. . .	13. 0.9 12.1 3.3 363 363 39.93		. . .	
Ap. 10 per table Corr'd Transit, 3.3 R. A.	58.58 −.06 7 26 +.02 +.02 58.56	7	38	00.57 −.06 +.01 +.02 00.54	9	39	5.07 −.05 +.03 +.02 5.07	10	02	1.53 −.04 +.01 +.02 1.52	10	10	3.74 −.04 +.05 +.02 3.77	
Error of Timepiece, r = −7.2	−26.92 +.32 +.28 .06			27.27 +.32 +.37 .07			27.38 +32 +.46 +.09			−27.66 +.33 +69 +.14			−27.41 +.32 +.47 +.05	
	−26.26			−26.51			26.51			−26.51			−26.53	

Reject

~~I have subsequently found occasion to reject this star. See Ap. 30~~

Should have been corrected +^{s}.20 and used.

Error = −26^{s}.51 at 9^{h}21

26.51
25.55
21.9).96(.044
876
−.840

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr 14.2 1880 Instrument, Mer. Cir. Observer, W. A. R.

Timepiece, 1327 Recorder, J. R. E.

Object, Circle,	β Tauri		~~α~~ Orionis		μ ~~α~~ Geminorum		γ Geminorum	
	w	e	w	e	w	e	w	e
Level Direct, Reversed,								
Sums, Difference, b.								
	h m	s	h m	s	h m	s	h m	s
Wire, I.	5 18		5 48		6 15		6 30	
II. III. IV. V.	6.7 25.6 9.1 23.2 11.5 20.8 13.8 18.4 16.1	32.3 3 .3 2 16.1 9)1.2	5.3 22.0 7.4 20.0 9.5 17.9 11.5 15.9 13.7	27.3 4 .4 .4 13.7 9)6.2	5)2.6 38.3 5)5.8 36.0 24.8 22.6 11.4 20.3 13.6 18.1 15.9	31.9 .8 7 .7 15.9 9)8.0	11.8 29.2 14.0 27.0 16.3 24.8 18.4 22.6 20.5	41.0 0 1 0 20.5 9)4.6
Sum, Mean,		16.13		13.69		15.89		20.51
Bb, Ce, Aa,	11 1.5 12.5 4.2 250 570 5350		11.5 1.2 12.7 4.2 254 508 53.34		13.5 1. 14.5 4.2 290 580 60.90		14.7 4.2 294 588 61.74	
Corr'd Transit, R. A.	5 18	43.87 -.05 -.01 +.02 43.83	5 48	41.91 -.05 -.03 +.02 41.85	6 15	43.79 -.06 -.03 +.02 43.72	6 30	48.49 -.06 +.02 +.02 48.47
Error of Timepiece,	x = -1.2	-27.70 +.32 +.37 +.07		-28.16 +.32 +.79 +.16		-27.83 +.32 +.50 +.10		-27.96 +.32 +.62 +.12
		~~-26.83~~ -26.94		~~-26.65~~ -26.89		-26.91		~~-26.71~~ -26.90

Error = -26.91 at 5h 58

26.91
26.51
20.6) .40 (.019
.206
1940
1854

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 12.0 18~~7~~80. out of order Instrument, Meridian Circle Observer, W. A. R.
Not used to base time upon, but afterward for correction to Sun. Timepiece, 1327 Recorder, O. R. E.

Object, Circle,	☉				
	w | e	w | e	w | e	w | e	
Level Direct, Reversed,	. .	. .	. .	. .	
Sums, Difference, b.	. .	. .	. .	. .	

			h	m	s	h m s	h m s	h m s
		1h 23m 46.4	1	26m 38.1	50m ~~24~~.5			
Wire, I.		48.5		36.0	24.5			
		50.8		34.0	24.8			
II.		52.9		31.9	24.8			
		54.9		29.9	24.8			
III.		59.1		25.5	4.6			
		24m 1.1		23.5	4.6			
IV.		3.2		21.5	4.7			
		5.3		19.2	4.5			
V.		7.3		17.3	4.6			
		9.4		15.1	4.5			
		11.7		13.1	4.8			
Sum,		13.7		11.0	4.7			
		15.8		08.9	4.7			
Mean,		20.0		04.6	4.6			
		22.1		02.5	4.6			
Bb,		24.1		27 00.5	4.6			
Cc,		26.3		26 58.2	4.5			
Aa,		28.4		56.0	4.4			
					19) 11.8			
	22m 1.53				2) 24.62			
Corr'd Transit,	15 42.30	42.39	1	25	12.31			
R. A.	~~3.6~~	+.02						
	3s.68	-3.68	1	25	38.73			
		38.73			-26.42			
Error of Timepiece,					+.32			
					+.75			
					+.15			
					-25.22			

.9125
cos +9° 0′ 1584
.7541

Error of 1327 by ☉ uncorrected for ephemeris below = -25.22

By Sun -25.22
" stars -25.15
Deduced -.07
correction to Sun.

Apr ~~12d 12h 30 -25.55~~
Apr. 12d 6h 00 -25.40
" 11 19 49 -24.80
11 11 (11.2) .60

-25.40
.25
-25.15

.0536
4.6
32
214
.246

6h 00
1 25
4h 35

HARVARD COLLEGE OBSERVATORY TIME SERVICE.

Date, Apr. 14-15 1880
= 15.0

Instrument, Mer. Cir. | Observer, W. A. R.

Timepiece, 1327 | Recorder, J. R. E.

Object, *Circle,*		⊙						
		w	*e*	*w*	*e*	*w*	*e*	*w*	*e*
Level Direct,		.	.	.	.	.	.	.	.
Reversed,		.	.	.	.	.	.	.	.
Sums, *Difference,* *b.*		.	.	.	.	.	.	.	.

		h	m	s	h	m	s	h	m	s	h	m	s
Wire, I. II. III. IV. V.	1 34 ~~48~~ 48.7 50.8 53.0 55.0 57.1 35 01.3 03.3 05.4 07.6 09.8 11.9 13.9 16.0 18.2	1	37 40.7 38.5 36.5 34.2 32.2 28.0 26.0 23.9 21.8 19.7 17.6 15.4 13.2 11.2	29.4 3 5 .2 3 .3 3 .3 ~~4~~ 5 .5 3 2 4			.			.			.
Sum, *Mean,*	22.2 24.3 26.5 28.7 31.0	37 36	07.0 04.9 03.2 00.9 58.7	. 2 2 .4 3			.			.			.
Bb, *Cc,* *Aa,*		1	36	19) 6.8 2) 29.36 14.68 .			. . .			. . .			. . .
Corr'd Transit, *R. A.*	46.90 +.02 −3.70 43.22	1	36	. 43.22			. .			. .			. .
Error of Timepiece,	.9125 .1778 .7347			−28.54 +32 +.73 +.75			.			.			.

−27.34

Error of 1327 by uncorrected sum = ~~−28.54~~ −27.34

28.54
26.91
19.6) 1.63

27.34
26.91
19.6) .43 (.022
393
380

−.022 = long rate