

Original

KG

11366

v. F31

Part III. 1876.

Observations
and
Reductions

Value 1 Rev. Microm. of
15^m Equatorial.

Summary of Results begins page 150.

$$\frac{1}{\text{mm}} = \frac{\text{in}}{0.03937079??}$$

0.0393704 S.T.E. Hergard.

Original.

Equatorial Observations.

1876. Vol 1. Part III.

2 groups of 9 at each end.

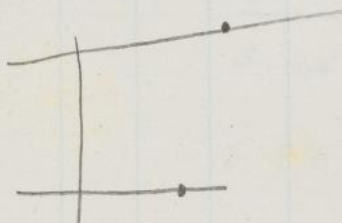
	14	9.9	
8	0	16.6	50
7	45	52.4	202.
	14	24.2	
	14	53.3	

8	0	16.6
7	46	8.3
	14	8.3

7	46	21.4
8	0	16.6
	14	9.9

~~13~~ ^w	53.3
10	55.2

2 groups of 9 at each end.



2°

1876. Oct. 9 (continued from Part II p. 89)

Same apparatus etc as above. N. Spring Gr. Chronograph.
Observations to determine zero of position by transits across
middle and movable wire.

Tel W. Micron set at 52,000 with head north.

$$\text{W. B.} = 41^\circ 26'$$

For coincidence with middle wire (Eye piece 1)

50.037	50.223
.063	.221
.044	.237
50.020	.220
.044	50.240

Transits of ϵ 2894. (Webb. p. 235)

Preceding Star		Following Star	
1 st wire	2 nd wire	1 st wire	2 nd wire
41.8	~~20.8~~ ^{5.7}	68.7	20.8
56.0	19.1	14.8	37.6
13.8	35.5	30.2	52.2
11.7	34.1	30.1	51.8
13.7	37.8	31.5	54.2
31.7	54.9	49.4	11.3
8 46.8	9.6	5.0	27.2
21 ^h 10 ^m 15.0	36.4	30.6	21 ^h 10 ^m 53.0

(Note in reading the chron. sheets Oct. 23. 1876 - It is possible I have inverted the order of the 2nd and third column above in observing - but I think not.)

[See part II. 1876. p 89]
 1876. Oct. 9. (Tuesday Morning) λ Ursae Min. W. Elong.

S.W. obs.

Tube above Polar axis - Tel. clamped - Daylight Ill. - power No 4.
 Observations 10^r.000 to 91^r.000.

1876. Oct. 9. Tuesday P.M.

λ Ursae Min. e Elong.

S.W.

Telescope as above - Observed 10^r.000 - 91^r.000. Daylight Ill.

5^h 50^m P.M. (mt.) Bar 29.999 alt 57.0 Ext. ther 55.4

Sept Max. & min ther.

6.40 P.M. [29.617 Bar. 56.0 alt ther] Max 55.0 min 54.0

Came down from dome at 21^h 6^m (Bar 312) and found shut had given out without last minute being secured after the following set of observations of λ Ursae minoris on p 13.

10 ^r .00	19	49	40.0	16 ^r .5	40.5
			53.5	17.	56.1
11		50	7.0	1	53
			21.2	18	23.0
12			35.0		38.1
			49.3	19	50.5
13		51	1.8		54
			16.2	20	19.0
14			31.0		32.0 ^{1/2}
			45.0	21	46.0
15			58.8		55
		52	13.8	22	13.8
16			26.1	22.5 [*]	27.6

23.0		42.4	37.0	2	13.0
		56.8			26.6
24	56	11.2	38		42.3
		26.1			55.8
25		40.0	39	3	8.0
		52.6			22.8
26	57	5.0	40		36.6
		21.0			51.3
27		34.0	41	4	4.5
		49.3			19.4
28	58	0.8	42		32.3
		16.2			46.7
29		30.0	43	5	0.0
		43.5			14.8
30		59.0	44		29.0
	59	13.0			42.0
31		24.2	45		56.0
		40.0		6	9.7
32		54.2	46		23.8
	0	7.8			37.4
33		21.4	47		53.2
		34.2		7	6.6
34		48.7	48		21.2
	1	1.8			35.3
35		17.7	49		48.5
		31.0		8	2.1
36		46.0	50		16.0
		58.4			32.0

51.0		44.3	65.0		26.2
		59.5			40.2
52	9	12.8	66.		54.5
		26.3		16	7.9
53		40.2	67		22.8
		54.1			35.8
54	10	8.3	68		51.7
		22.4		17	4.4
55		36.8	69		20.1
		49.2			33.8
56	11	3.6	70		47.0
		17.0		18	2.3
57		30.6	71		15.7
		43.7			28.2
58		57.5	72		42.4
	12	12.5			57.3
59		27.0	73	19	11.4
		42.5			25.0
60		55.5	74		39.0
	13	9.0			53.0
61		24.0	75	20	7.0
		52.0			20.5
62	14	6.0	76		34.8
		19.7(?)			49.3
63		37.0(?)	77	21	2.4
		48.8			17.4
64		59.2	78		31.1
	15	12.3			45.7

19 ⁵⁰		59.6
	22	13.5
80		27.5
		40.4
81		54.2
	23	9.0
82		23.2
		35.3
83		50.3
	24	4.0
84	24	18.1
		31.5
85		46.0
		58.2
86	25	13.0
		26.0
87		41.8
		55.8
88	26	8.1
		22.8
89		34.8
		50.2
90	27	5.0
	20 27	19.4
Last observation near 20 ^h 27 ^m . Band 312.		

Continued1876. Oct. 10. (Tuesday 6 P.M.) γ Ursa Minnis. U.S.

L.W.

Telescope W. Field Ill. Power 400

(The chronograph^{shut} is not in condition to be read because the
 marks follow no order - chronograph failed after 2 hrs. U.M.)

Clock comparison 6 A.M. Wednesday (Oct. 10. 1876.)

Rodham 1327 =	Band 312
$\frac{6^{\circ}0}{0} =$	$\frac{5^{\circ}2}{0} =$
8 ^h 45 ^m 0.0 =	8 ^h 47 ^m 5.4

1876. Oct. 11.

2 Ursae Minoris.

L.W.

Telescope above polar axis. Power 401.

10^{7.000} - 91.7⁰⁰⁰Bar. about $20^h.10^m = 30^{\text{in}}.088$ at $t = 50^{\circ}.0$

Tube Max 48.5 Min 48.0 at 6.40 P.M.

49.0	42.8
2.8	54.3
16.4	9.2
30.4	25.5
45.5	38.1 ⁽²⁾
59.0	51.4
13.0	4.6
27.3	18.8
40.1	32.3
54.8	48.5
8.8	0.7 ⁽²⁾
22.3	16.0
37.2	28.4
50.7	41.5
4.5	55.1
19.3	9.7
32.0	24.6
47.5	39.0
1.5	51.5
14.0	6.3
28.0	20.2

32.5	7.0
48.0	20.0
2.1	34.5
15.9	49.1
31.0	4.3
44.0	18.0
58.6	31.4
11.7	44.8
25.0	57.7
38.5	13.3
54.0	28.0
8.0	41.2
20.0	52.8
33.8	9.0
49.0	23.6/27
2.7	38.0
16.1	51.5
31.2	6.6
44.2	19.5
59.8	35.6
12.4	47.9
24.0	1.4
40.6	15.3
54.0	35.5

1.1	2.10
1.2	2.11
1.3	2.12
1.4	2.13
1.5	2.14
1.6	2.15
1.7	2.16
1.8	2.17
1.9	2.18
2.0	2.19
2.1	2.20
2.2	2.21
2.3	2.22
2.4	2.23
2.5	2.24
2.6	2.25
2.7	2.26
2.8	2.27
2.9	2.28
3.0	2.29
3.1	2.30
3.2	2.31
3.3	2.32
3.4	2.33
3.5	2.34
3.6	2.35
3.7	2.36
3.8	2.37
3.9	2.38
4.0	2.39
4.1	2.40
4.2	2.41
4.3	2.42
4.4	2.43
4.5	2.44
4.6	2.45
4.7	2.46
4.8	2.47
4.9	2.48
5.0	2.49
5.1	2.50
5.2	2.51
5.3	2.52
5.4	2.53
5.5	2.54
5.6	2.55
5.7	2.56
5.8	2.57
5.9	2.58
6.0	2.59
6.1	2.60
6.2	2.61
6.3	2.62
6.4	2.63
6.5	2.64
6.6	2.65
6.7	2.66
6.8	2.67
6.9	2.68
7.0	2.69
7.1	2.70
7.2	2.71
7.3	2.72
7.4	2.73
7.5	2.74
7.6	2.75
7.7	2.76
7.8	2.77
7.9	2.78
8.0	2.79
8.1	2.80
8.2	2.81
8.3	2.82
8.4	2.83
8.5	2.84
8.6	2.85
8.7	2.86
8.8	2.87
8.9	2.88
9.0	2.89
9.1	2.90
9.2	2.91
9.3	2.92
9.4	2.93
9.5	2.94
9.6	2.95
9.7	2.96
9.8	2.97
9.9	2.98
10.0	2.99

48 0	20.4
15	35 4
15 2	46 5
36 2	2 5
43 0	17.5
57 7	31 2
11 2	44 2
24 2	58 8
38 1	11 3
52 2	26 0(?)
7 0	—
20 0	49 5
34 0	4 0
46 5	18 4
2 3	32 6
17 5	47 0
31 3	2 2
45 9	15 2
57 5	31 0
12 5	44 0
26 0	55 9
38 8	7.0(?)
53 8	—
7 0	40 0

52.5		59.8
11.2		13.1
24.4		28.9
35.3		44.0
50.2		57.0
3.1		10.6
16.5		25.8
32.2		
46.8		
2.5	$\frac{1000}{1327}$	$\frac{12}{312}$
15.0	$0.50 \approx$	6.9
27.2		
43.0		
58.8		
10.0 (P)		
21.5 (P)		
35.0		
51.4		
5.5		
20.2		
35.2		
46.9		

1876, Oct. 18.

X Usae Min. (= elong.)

Dist. Obs & Recd.

Tel. Above. Unclamped - from 401 - Microm. screws made very free in its motion before beginning by loosening ²/₃ screws minutely.

Eye & Ear observations - Chron. Time 3451.

Began at 10^h. 00^m

10 ^h	25	43.3		3p1	4.0
		—	22 ^h		16.0
11	24 ^h	11.5			30.5
		23.0	23		45.3
12		38.5			58.5
		51.5	24	3p2	12.5
13	27 ^h	5.0			25.5
		13.0	25		39.0?
14		34.3			53.7
		48.5	26	3p3	7.0
15	28 ^h	2.0			21.5
		16.0	27		36.0
16		29.8			49.5
		44.8	28	3p4	3.2
17		58.5			19.5
	28 ^h	12.0	29		32.0
18		25.0			46.0
		39.5	30	3p5	0.5
19		53.5			14.3
	29 ^h 30	7.0	31		28.5
20		21.5			43.0
		35.0	32		55.5
21		49.0		3p6	9.0

33 [✓]		23.5			44.5
		37.5	45 [✓]		58.0
34		49.5		41 [✓]	11.5
	367	4.0	46		24.5
35		17.8			37.8
		32.5	47		52.5
36		46.5		44 [✓]	8.0
	378	0.5	48		13.1
37		14.0		26.2	24.2
		29.5	49		49.0
38		42.5		48 [✓]	3.0
		55.5	50		20.5 ? -
39	389	9.0			31.0
		23.8	51		45.0
40		37.3			57.5
		57.2	52	44 [✓]	12.0
41	3940	6.0			27.0
		21.3	53		41.0
42		34.0			54.0
		47.0	54	45 [✓]	8.0
43	401	2.5			21.5
		16.0	55		35.5
44		29.5			46
					17.46
					14.50

Mean 45^m 655^m 44^m

$$\begin{array}{r}
 79^m \\
 10^m \quad 44.6 \\
 21 \overline{) 89 \quad 44.6} \\
 \underline{4 \quad 14.50}
 \end{array}$$

56 [✓]	47	—		
57		16.0 ?		17.5
58		32.0	70 [~]	32.0
59		46.5		46.0
to 58	478	1.0	71	54 0.5
		11.5		15.0
59		26.0	72	26.5
		39.3		41.5
60		55.5	73	56.0
	489	—		545 11.0
61		22.0	74	24.0
		35.5		38.0
62		19.8	75	53.0
	4910	4.0		56 5.0
63		18.0	76	19.5
		31.0		34.0
64		45.5	77	47.0
		58.5		545 2.5
65	501	13.0	78	15.5
		27.0		29.5
66		41.0	79	44.5
		54.5		57.5
67	52	7.0	80	548 11.5
		21.0		26.8
68		35.5	81	39.0
		52.0		52.5
69	523	4.5	82	19 589 7.0

83 ^v		22.0 [?]	
		34.5	
		49.5	
84	$\overline{N}$ $\overline{N}^0$	3.2	
		18.5	
85		31.0	
		45.5	
86		58.3	
	1 ⁰	11.5	
87		26.5	
		41.0	
88		52.5	
	$\overline{N}$	7.5	
89		—	
		35.5	
90		48.5	
	3 ^x	3.5	
91		18.0	
		29.5	
92		45.5	
		59.5	
93.	$\overline{N}$	12.5	
93 ^v .500	= 20 ^h 4 ^m	28.0	

Definition fine at beginning
of the whole series, but
deteriorates in the middle &
latter part.

Bar 29.982

attn 53° 5

No 3. 49.0

No 4. 48.4

Chem 3451 = 19^h 10^m

Bisections made so rapidly
that in some cases unable
to get the observation. Went
in time for the next bisection.

Close { Temp. tube = 47° 5
Exh. room = 44.8

1876. Oct. 24.

2 Ursa Minoris. e elong.

S. W. obs.

Telescope W. Eyepiece No 4. Microm. screw in
Same condition as in previous set of observations.

Chron. Treadham 3451. J. F. M. Richards of
chronometer times called to him by S. W.

Clock Treadham 1327.

Chron. 3451

 $18^h \quad 38^m \quad 25.0 = 18^h \quad 38^m \quad 6.5$
 $39 \quad 10.0 = 38 \quad 51.5$
 $18^h \quad 40^m \quad \text{etc} \quad \text{Ther. No } \#2 = 60.6$

No. 4 = 60.5

Bar [29.543 + 62.7]

Ext. barometer 60.3

10 [~]	19 ^h	5 ^m	18.8	17 [~]	35.2
			35.3		50.0
11			48.0	18	9
		6	2.0		17.5
12			15.8	19	31.3
			28.8		45.5
13			43.0	20	48.2
			56.5		12.2
14		7	9.5	21	26.5
			24.0		40.0
15			39.3	22	53.8
			53.0		7.7
16		8	6.5	23	22.0
			21.7		35.5

24		49.0	37 ^r		50.5
	12	3.5		18	5.2
25		17.0	38		19.3
		32.0			34.2
26		45.3	39		47.6
	13	0.4			52.2
27		12.8	40	19	15.2
		27.0			30.1
28		41.0	41		44.3
		55.0			58.0
29	14	8.7	42	20	11.2
		22.0?			25.3
30		36.0	43		39.1
		49.5			53.4
31	15	3.6	44	21	6.3
		19.7			19.5
32		33.0	45		34.6
		46.5			49.2
33		—	46	22	3.2
	16	13.5			16.4
34		27.5	47		30.0
		41.5			44.0
35		55.0	48		58.2
	17	9.2		23	11.5
36		23.5	49		26.2
		36.5			40.0

50 ^r		53.5	63		56.7
	24	8.4		30	10.6
51		23.0	64		23.2
		36.7			38.7
52		48.5?	65		51.0
	25	4.0		31	5.5
53		16.6	66		19.6
		32.1			34.5
54		45.2	67		48.5
		59.3		32	2.0
55	26	12.2	68		15.0
		26.6			29.0
56		40.3	69		43.5
		54.1			56.0
57	27	8.4	70	33	10.5
		23.3			23.6
58		36.5	71		37.5
		51.0			52.2
59	28	5.0	72	34	5.0
		19.5			20.5
60		33.5	73		34.0
		47.2			47.0
61	29	0.3	74	35	1.5
		15.0			16.0
62		29.0	75		31.0
		43.5			43.5

76		53.6
	36	12.0
77		26.5
		40.1
78		54.5
	37	8.0
79		21.2
		35.3
80		50.0
	38	3.2
81		16.5
		31.0
82		45.5
		58.7
83	39	12.3
		27.0
84		<u>43.0</u>
19	39	
mean = 37^m		$49^s 30$

Temp. at close $60^{\circ}.6$ in tube of telescope.

J, F. M. being obliged to leave suddenly - the microm. wire was set ahead to 90° and the star transit bar set at about $19^h 42^m 30^s.0$

Barometer 29.504 at. th. $63^{\circ}.0$

Dome external th. = $56^{\circ}.2$

No 2. $57^{\circ}.3$

No 4. $57^{\circ}.1$

1876. Dec. { Comparison of.
 2 Usas Min. U.C. S.W. Obs. Hills Rd.
 Eye & Ear method - Chron. Time = #3451
 wt. = 7^h 45^m Bar = 29.512 alt. thn = 31.0 Ext. thn = 13.2
 some - Max = 17.0 Min = 17.0 Ext thn = 12.4

Del W. Microm. set at $127^{\circ} 38'$. Eyepiece No 4.

Close Focussing 1327 Chron. Time 3451.
 23^h 48^m 46.0 = 23^h 50^m 17.5
 49 41.0 = 51 12.5

Moved head of Microm. screw in its spindle so that the middle & movable wires are both coincident with the head reading 50.000
 in a + direction = +0.150.

Mic 10	Bar 0	1 ^h	20 ^m	8.5
	50			23.5
11.				38.5
				51.0
12		27 "	7.0	20.5
				33.2
				48.2
14		28 ^m	3.0	17.0
				31.5
				46.0
16				59.0
		29 ^m	15.0	
17				
				40.0
18				53.0

	1 st	30 m	8.0	e
19	"		22.5	
			36.5	
20			50.0	
		31 m	3.5	
21			17.5	
			32.0	
22			47.0	
			58.0	
23		32 m	12.7	
			27.5	
24			41.5	
			54.2	
25		33 m	8.0	
			23.0	
26			35.5	
			50.2	
27		34 m	3.5	
			17.0	
28			31.5	
			45.5	
29			59.0	
		35 m	13.3	
30			27.0	
			42.0	
31			57.0	
32		36 m	22.0	
			36.0	
33			51.0	

	16	37 m	5.52	
34			17.2	
			32.7	
35			46.5	
			58.5	
36	"	38 m	14.0	
			26.5	
37			42.5	
			56.0	
38	"	39 m	9.7	
			24.5	bad
39			38.5	bad
			51.5	bad
40	"	40 m	6.0	bad
			18.5	bad
41			32.0	
			46.0	bad
42	"	41 m	1.2	bad
			15.	bad
43			29.	bad
			42.	
mic 44			58	bad
45.50	"	42 m	11	bad
46.50			20	bad

Both 4 & 15 companions as believed to exist by nothing with them.

9 P.m. Ext. time = 9.8 Bar. as before. = 29.512

Dec. 1. 9 (Det. Aug) Flts 3451 = Flts 1327

14^h 37^m 0.50 = 14 35 31.0
 37 50.0 = 36 21.0

1877. April 17.

Began to measure the plate which Mr. Rogers lent me originally cut by Rutherford, and which had been compared with the Coast Survey screw by Rutherford supposed to be about 192 threads to the inch.

J. E. Hilgert, letter dated Nov. 4, 1876 gives as the result of the above comparison,

$$\begin{aligned} \text{"The length of your scale, from line 7 to 105, or 98} \\ \text{divisions,} &= 12.9572 \text{ mm.} \quad \text{Hence} \\ \text{1 interval} &= \frac{12.9572}{98} \text{ mm.} \end{aligned}$$

All readings made in terms of the lower screw

$$\begin{aligned} \text{Mercur as set in the following readings} &= 80^\circ 35' 40'' \\ \text{" " " for reading with } &= 170^\circ 58' 10'' \\ \text{the the Microm. screws in a direction } & \\ \text{parallel to the lines measured } & \end{aligned}$$

Supposed power of Microscope = 160 diameters.

1877. April 17. 9 am. Repetition made.

1877 April 18. 10.45 am. Thermometer set.

S.W.O.B.

* The first line ~~piece~~ following the single band.

			<u>I</u>		
43.4150	.1240	1	.5395	.1225	26
.5390	.1260	1-2	.6660	.1265	27
.6650	.1250	3	.7920	.1260	28
.7900	.1244	4	.9175	.1255	29
.9140	.1260	5	47.0440	.1265	30
44.0400	.1263	6	.1685	.1245	31
.1663	.1232	7	.2922	.1237	32
.2895	.1253	8	.4180	.1258	33
.4148	.1252	9	.5415	.1235	34
.5400	.1250	10	.6670	.1255	35
.6650	.1250	11	.7935	.1265	36
.7900	.1261	12	.9182	.1247	37
.9161	.1252	13	48.0440	.1258	38
45.0413	.1244	14	.1687	.1247	39
.1657	.1261	15	.2935	.1248	40
.2918	.1250	16	.4192	.1257	41
.4168	.1242	17	.5445	.1253	42
.5410	.1255	18	.6685	.1240	43
.6665	.1255	19	.7952	.1267	44
.7920	.1255	20	.9190	.1238	45
.9175	.1260	21	49.0445	.1255	46
46.0435	.1245	22	.1695	.1250	47
.1680	.1240	23	.2955	.1260	48
.2920	.1250	24	.4200	.1245	49
.4170		25	.5450	.1250	50

I

.6695	.1245	51
.7950	.1255	52
.9200	.1250	53
50,0455	.1255	54
.1695	.1240	55
.2940	.1245	56
.4202	.1262	57
.5448	.1246	58
.6700	.1252	59
.7960	.1260	60
.9210	.1250	61
51,0450	.1240	62
.1710	.1260	63
.2955	.1245	64
.4200	.1245	65
.5450	.1250	66
.6710	.1260	67
.7965	.1255	68
.9220	.1255	69
52,0470	.1250	70
.1716	.1246	71
.2960	.1244	72
.4213	.1253	73
.5468	.1255	74
.6715	.1247	75
.7980	.1265	
.9227	.1247	

I

53,0480	.1253 78
.1730	.1250 79
.2965	.1235 80
.4223	.1258 81
.5467	.1244 82
.6721	.1254 83
.7980	.1259 84
.9221	.1241 85
54,0478	.1257 86
.1730	.1252 87
.2975	.1245 88
.4230	.1255 89
.5480	.1250 90
.6710	.1230 91
.7980	.1270 92
.9215	.1235 93
55,0470	.1255 94
.1737	.1267 95
.2950	.1213 96
.4200	.1250 97
.5460	.1260 98
55,6720	.1260 99

73 x The last line before the
74 bands begin.

Reading m. line at end of
= 43,4152

Max. and Min. the at $11.45 = 56.0 \quad 55.5$

$$\begin{array}{r} 55.6720 \\ 43.4151 \\ \hline 12.2569 \end{array} \quad \begin{array}{l} 1.112511 \text{ (Logarithmic scale)} \\ \log = 1.088380 \\ \hline 0.024131 \end{array}$$

$$1.057160$$

$\therefore 1^{mm} 057160 = \text{value 1 rev. clark screw April 17}$

Between 43.42 and 55.67 at 55.7 (Max. & Min.)

1877. April 19. 9 am Set Max. & Min. Ther = $51^{\circ} 5'$

Circle reading, set 90° from position used = $351^{\circ} 0' 0''$

" " Set for following observation = $261^{\circ} 0' 0''$

1877 April 20. 9.15 am Set Max & Min = $58^{\circ} 0'$

(Scale 46.7)

47.0120

.1240

.1360

.1255

.2615

.1250

.3865

.1235

.5100

.1265

.6365

.1245

.7610

.1265

.8875

.1255

48.0130

.1250

.1380

.1233

.2613

.1257

.3870

.1256

.5126

.1234

.6360

.1263

.7623

.1157

.8780

.1368

49.0148

.1242

.1390

.1230

.2620

.1260

.3880

.1248

.5128

.1252

.6380

.1250

.7630

.1260

.8890

.1660

50.0550

.1345

.1895

.0735

.2630

.1255

.3885

.1255

.5140

.1248

.6388

.1257

.7645

.1255

.8900

.1260

51.0160

.1240

.1400

.1260

.2660

.1237

.3897

.1253

.5150

.1245

.6395

.1255

.7650

.1255

.8905

.1258

52.0163

.1247

.1410

.1230

.2640

.1255

.3895

.1250

.5145

.1250

.6395

.1255

.7650

.1250

.8900

Max & Min Ther at 11.30 am = 61.3 58.0

$$\begin{array}{r}
 59.2695 \\
 47.0120 \\
 \hline
 12.2575 \\
 \quad \quad \quad 69 \\
 \hline
 \therefore \text{res} = 12.9572 \\
 \quad \quad \quad \text{mm} \\
 \therefore \text{res} = 1.057160 \\
 \quad \quad \quad \text{mm}
 \end{array}$$

$$\begin{array}{r}
 1.1125112 \\
 1.088380 \\
 \hline
 0.024130 \\
 \quad \quad \quad 31
 \end{array}$$

Between $47''.01$ and $59''.26$ of Clark screw
 April 19, 1877. at temp. $59^{\circ}.1$ (Max. & Min. then)

I

I

53.0161	1261	2690	1250
.1911	1750	.3932	1242
.2639	0728	.5165	1233
.3905	1266	.6420	1255
.5161	2256	.7671	1251
.6410	1249	.8940	1269
.7665	1255	57.0180	1240
.8910	1245	.1423	1243
54.0162	1252	.2670	1247
.1420	1258	.3920	1250
.2665	1245	.5175	1255
.3918	1253	.6425	1250
.5171	1253	.7681	1256
.6407	1236	.8930	1249
.7662	1255	58.0178	1248
.8921	1259	.1432	1254
55.0172	1251	.1438	1250
.1432	1260	.2688	1250
.2680	1248	.3946	1258
.3928	1248	.5200	1254
.5180	1252	.6450	1250
.6422	1242	.7705	1255
.7672	1250	.8950	1245
.8930	1258	59.0205	1255
58.0185	1255	.1455	1250
.1440	1255	.2675	1240

(Scale = 59.0)

Ends on line next to double
bands.
$$\begin{array}{r} 25 \\ 51 \\ 58 \\ 77 \end{array}$$

(11.30nm Max & Min = 58.0 61.3 See p. 52)

V

L

1 2 3

40.2

mm

$$\begin{array}{r} 34 \overline{) 40.2} \\ \underline{10.05} \\ 13.4 \end{array}$$

$$\begin{array}{r} 1.1271 \\ 1.0021 \\ \hline 9.1213 \\ \hline 1.8808 \\ 2.0098 \\ \hline 102. \end{array}$$

→ Moved the head of the screw - $0.25 (\pm 0.3)$ to cause the head and scale to have the same reading.

11.20 P.M. Measure in ^{Pist} ~~the~~ W.A. Rogers ruled plate
Beginning with line A / / / / / /

Rogers Plate	Rogers Plate	Rogers Plate
50.6	50.6	50.2
.8	.2	.1
.2	.1	.01
.1	.0	.0
.0	.0	.0
.0	.0	.4
.6	.2	.3
.0	.8	[.5 d?]
.9	.7	.8
.7	.0	.2
.7	.3	.2
.5 ¹ .7	.0	.0
.0	.0	.0
.0	.0	.7
.0	.3	1.0
.2	.6	.8
1.0	.8	.1

Rogers Plate

50.2

.1

.0

.0

.3

.8

.5

.2

.2

.1

.0

.2

Cont'd 63 bands

63 lines

Rutherford Pl.

Corr. to mean

50.0

+0.2

99

.0

+.2

.2

+.0

.2

+.0

.2

+.0 95

.2

+.0 45

.15

+.1

.1

+.1

.2

+.0

.2

+.0 90

.3

-.1 40

.2

+.0

.2

+.0

.2

+.0

.0

+.2 85

.2

+.0 5

.1

+.1

.3

-.1

.2

+.0

.42

+.0 80

.0

+.2 80

.3

-.1

.0

+.2

.5

-.3

.2

+.0 77

.0

+.2 75

43

Rutherford Pl.

Corr. to mean

50.4

-0.2

.4

-0.2

.2

+.0

.0

+.270

.5

-.320

.2

+.0

.3

-.1

.0

+.2

.2

+.065

.0

+.245

.35

-.3

.2

+.0

.0

+.2

.2

+.06

.2

+.060

.0

+.2

.2

+.0

.1

+.1

.5

-.355

.2

+.045

.0

+.2

.01

+.1

.3

-.1

.0

+.080

.0

+.08

.2

+.2

49

52

$\therefore 1 \text{ Ruth. space} = 0.1322150^{\text{mm}}$

$$\sim \log = 1.1125112$$

$$\log 98 = 1.9912261$$

9.1212851

$$\log 50.1725 = \frac{9.121285}{1.700466}$$

$$\therefore \text{Final St.} = 7.420719 \times 10^6 = 2634577 \text{ mm}$$

∴ 1 ~~Rank~~ Sp. $7.420719 = 2634577$ mm
Req. Microm. space = 0.002634577.

$$\cdot 1212 = \log 0.1372$$

$\therefore 0.1 \text{ Microns. surface scale} = 0.000263 \text{ mm}$

$0.03 \text{ " } = \text{ mm. } 0.0000789$

assume $1^{\text{mm}} = 0.0394^{\text{in}} = 0.04$

$$0.\overset{\text{nan}}{00008} = 0.\overset{\text{in}}{0000032}$$

$\therefore$ It will suffice to call the mean value in terms of Roger's divisions = 50.2

Rutherford Pl.

Corr. to mean

50.2	.0
.0	+ .2
.0	+ .2 45
.5	- .3
.3	- .1
.2	+ .0
.2	+ .0
.2	+ .0 40
.1	+ .1
.1	+ .1
.1	+ .1
.2	+ .0
.2	+ .0 25
.1	+ .1
.0	+ .2
.7	- .5
.0	+ .2
.2	+ .0 30
.1	+ .1
.2	+ .0
.1	+ .1
.6	+ .2
.1	+ .1 15
.2	+ .0
.0	+ .2
40	

Rutherford Pl.

50.3	- .1
.0	+ .1
.2	+ .0 20
.5	- .3
.2	+ .0
.1	+ .1
.0	+ .2
.0	+ .2 15
.1	+ .1 14
.2	+ .0 13
.2	+ .0 12
.0	+ .2 11
.0	+ .2 10
.0	+ .2 9
.4	- .2 8
.3	- .1 7
.2	+ .0 6
.2	+ .0 5
.4	- .2 4
.2	+ .0 3
.1	+ .1

2.2279
1.9912
0.2367
1.725

98/169 Then 60°

∴ Mean value 1 div. Ruth. pl = 50.1725 Reg. Microm. pl.

Used the 5 middle spaces in the first 2
view.

1877. May 2. Temp 56°

are these observations to determine the value distortion
produced in a negative eye piece? S. W.
Feb 1878.

Observations on Meter Scale in upper room N. wing with NAK
microm. eyepieces adapted to SW. Small telescope.
Distant from scale 21¹/₂ to eyepiece.

Microm.	I	II	III	IV	V
0	9.70	8.15	18.20	16.03	1.53
10	12.00	10.45	21.09	18.31	3.81
20	14.29	12.78	23.78	20.60	6.11
30	16.57	15.08	25.07	22.90	8.41
40	18.87	17.37	27.38	25.21	10.70
50	21.13	19.65	29.64	27.49	13.00
60	23.40	21.85	31.85	29.75	15.22
70					

2.30	.29	.28	.30	.26	.27
.30	.33	.30	.29	.28	.20
.89	.24	.29	.31	.26	.21
.28	.29	.30	.31	.28	.27
.28	.30	.30	.29	.30	.22
116	117	147	140	138	117
2.290	2.292	2.294	2.280	2.276	2.284

∴ 0-10	2.290
10-20	2.292 +.002
20-30	2.294 +.002
30-40	2.280 -.004
40-50	2.276 -.004
50-60	2.284 -.042

$$\text{Average } 10.0 = 2.3$$

$$\therefore 0.1 = .023$$

Breadth of field lens = 0.5

sea field about $8''$ $10''$ from the eye.

	I	II	III	IV	V
0	1.35	3.85	3.68	3.03	1.46
10	3.63 ^{2.28}	6.13 ^{.28}	5.98 ^{.30}	5.30 ^{.27}	3.71 ^{.25}
20	5.92 ^{2.29}	8.45 ^{.32}	8.27 ^{.29}	7.60 ^{.30}	6.01 ^{.30}
30	8.22 ^{2.30}	10.74 ^{.29}	10.58 ^{.31}	9.90 ^{.30}	8.31 ^{.30}
40	10.52 ^{2.30}	13.03 ^{.29}	12.86 ^{.28}	12.20 ^{.30}	10.60 ^{.29}
50	12.81 ^{2.29}	15.32 ^{.29}	15.06 ^{.20}	14.48 ^{.28}	12.88 ^{.28}
60	15.05 ^{2.24}	17.58 ^{.26}	17.29 ^{.23}	16.71 ^{.23}	15.12 ^{.24}
chk	(1.37)	(.88)	(.68)	(.02)	(.43)

I	II	III	IV	V	VI
2.28	29	30	30	29	24
28	32	29	29	29	26
30	29	31	28	20? xj	23
27	30	30	30	28	23
25	30	30	29	28	24
38			14.6	24	20
2.276	2.300	2.300	2.292	2.248	2.244

0 - 10	2.276	
10 - 20	2.300	+ .024
20 - 30	2.300	+ .000
30 - 40	2.292	- .008
40 - 50	2.248	- .044
50 - 60	2.244	- .004

64

Apr May 2. 1877

Comparison of - tape
with standard meter bar

mm	mm
0-1	-0.1
1-2	0.0
2-3	+0.7
3-4	-0.6
4 ^m -5	-0.4
5-6	-0.2
6-7	+0.8
7 ^m -8	+0.2
8-9	+0.5
9-10	-0.1
+ 2.2	
- 1.4	
+ 0.8	

Comparison of

with standard

meter bar

mm	mm
1-3	0
3-6	-0.05
6-9	+0.05
9-12	0.0
12-15	0.0
15-18	0.0
18-21	0.0
21-24	0.0
24-27	0.0
27-30	0.0
30-33	0.0

Temp 56°.0

Comparison of

with standard

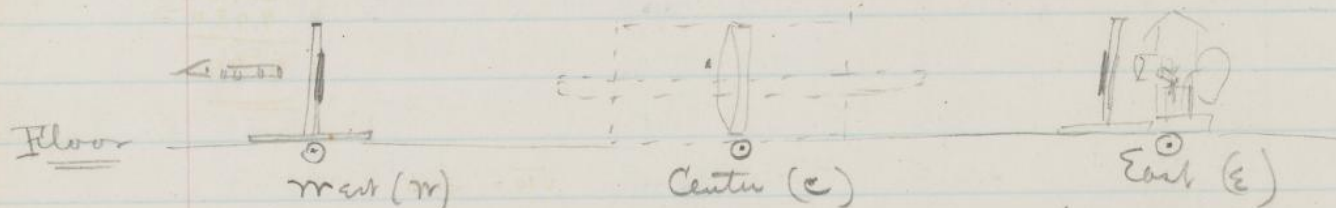
meter bar

mm	mm
1-3	0
3-6	-0.05
6-9	+0.05
9-12	0.0
12-15	0.0
15-18	0.0
18-21	0.0
21-24	0.0
24-27	0.0
27-30	0.0
30-33	0.0

66

77. May 3^d;Exp. Record S.W. O'Brien.Determination focal length $15\frac{1}{2}$ in. obj. glass of equatorial.Sens moved to 1st floor, south ^{part of building} building in Cambridge.

Sens collimated by reflections from glass surfaces of lamp held at the two upright glass plates.

4 Sens eyepiece of S.W.'s $1\frac{3}{8}$ telescope used. Equis. focus = 0.61 

Measurements from W toward C are negative.

" " " E " C " " "

" " " W from C " positive.

" " " E from C " f."

Chittenden 50 ft. steel tape.

Casella theodolite.

Thermometer Casella 3235.

" Max. & Min. Cars — ?.

A.B. & S. meter bar.

B.P.C. glass with human hair reticules.

Max 46.3

F_1 hit + 10 cm 10,000 cm²

$$\sqrt{10} = 3.16$$

12.20 $\bar{P}_{\text{H}_2\text{O}}$ 3235 46.9 $\bar{P}_{\text{H}_2\text{O}}$ 46.4

$$+ 9.980 = \text{I} \quad (1) \quad \text{I} - 10.107$$

$$\begin{array}{r} 9.980 \\ \hline 20.087 \end{array}$$

Dilemma Towards the negative
from the positive

time 12.36

$+35.325 \quad .639$
 $4.965 \quad .279$
 $4.965 \quad .721$
 $+ 4.517 \quad .169$
 $4.125 \quad .461$
 $+ 4.200 \quad .486$
 $4.580 \quad .106$
 $4.580 \quad .894$
 $+ 4.790 \quad .104$
 $4.675 \quad .011$
 $+ 4.700 \quad .014$
 $4.950 \quad .264$
 46.851
 $\therefore \text{mean} = 4.686$

$11.2 \mid 2533 \quad .226$

2533
 362
 0.2171

11.2 | 2533 .726

Line 12, 52

$$\begin{array}{r} 49.6000 \\ 6.8564 \\ \hline \end{array}$$

$$\begin{array}{r} 49.4000 \\ 6.6550 \\ \hline \end{array}$$

∴ Mean

$$1m = 3.28090$$

$$\Sigma w = 0.5159930$$

$$\begin{array}{r} ft \\ 42.7436 \end{array}$$

$$\begin{array}{r} ft \\ 42.7450 \end{array}$$

$$42.7443 = \underline{\underline{EC}}$$

$$1.6308782$$

$$0.5159930$$

$$1.1148852$$

$$\begin{array}{r} 777 \\ 75 \end{array}$$

$$\begin{array}{r} w \\ 13.0282 \end{array}$$

$$\begin{array}{r} 49.6000 \\ 2.5663 \\ \hline \end{array}$$

$$\begin{array}{r} 48.8000 \\ 1.7670 \\ \hline \end{array}$$

$$47.0337$$

$$47.0330$$

$$\begin{array}{r} w \\ 14.3355 \end{array}$$

$$47.0333 = \underline{\underline{W.C.}}$$

$$42.7443$$

$$89.7776 = \underline{\underline{E.W.}}$$

$$\therefore \underline{\underline{I.W.}} = \begin{array}{r} w \\ 27.3637 \end{array}$$

$$1.6724055$$

$$5159930$$

$$0.1564125$$

$$\begin{array}{r} 977 \\ 148 \end{array}$$

$$\Sigma w = 1.9531680$$

$$0.5159930$$

$$1.4371750$$

$$\begin{array}{r} 637 \\ 113 \end{array}$$

Time 12.50 Thru. 47.0 from 3235 46.5 from time.

E reads - 10^c.350

E.
^{fr}
 SW 6.756 }
 68.8565 } 6.8564
 6.9565 }

^{fr}
 ECP 6.754 }
 .655 } 6.6550
 6.556 }

^{fr}
 ECP 49.500 }
 49.600 } 49.6000
 49.700 }

^{fr}
 W 49.500 }
 49.600 } 49.4000
 49.300 }

Thru 46.5 23 47.0 12.30 time

Center Center
^{fr}
 SW 2.4665 }
 2.5665 } 2.5663
 2.6660 }

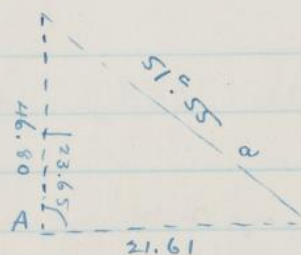
^{fr}
 ECP 49.500 }
 49.600 } 49.600
 49.700 }

^{fr}
 ECP 1.8680 }
 1.7670 } 1.7670
 1.6170 }

^{fr}
 SW 48.900 }
 48.800 } 48.8000
 48.650 }

31.7 from lens
 3235 = 47.0

27.5 from lens
 46.5 = max



$$\cos \frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}$$

	I	II	III	IV
	E. N.	R. S.	N. S.	N. N.
$a =$	51.55	50.85	48.70	48.50
$b =$	21.61	21.62	22.04	21.95
$c =$	46.80	45.97	43.58	42.20
$s = \frac{1}{2}a =$	119.96	118.44	114.32	112.65
$s - a =$	59.98	59.22	57.16	56.32
	8.43	8.37	8.46	7.82

Log. 5

	I	II	III	IV
$\log s =$	1.7780	1.7724	1.7571	1.7507
$s - a =$	0.9258	0.9227	0.9274	0.8932
$a.c. b =$	8.6653	8.6651	8.6568	8.6586
$a.c. c =$	8.3298	8.3375	8.3607	8.3747
$\frac{1}{2} = \cos \frac{A}{2} =$	19.6989	19.6977	19.7020	19.6772
	9.84445	9.84885	9.8510	9.8386
$\therefore \cos \frac{A}{2} =$	45° 39'.5	45° 5'.0	44° 48'.0	46° 24'.0
$\therefore \frac{A}{2} =$	91° 19'.0	90° 10'.0	89° 36'.0	92° 48'.0
z	1.3347	1.3349	1.3432	1.3414
c	1.6702	1.6625	1.6393	1.6253

$$\therefore \text{Inclination } \bar{E} = \begin{array}{r} 91^\circ 19'.0 \\ 90^\circ 10'.0 \\ \hline 90^\circ 45' \end{array}$$

$$N = \begin{array}{r} 92^\circ 48'.0 \\ 89^\circ 36'.0 \\ \hline 182^\circ 24'.0 \\ N = 91^\circ 12' \end{array}$$

$$\therefore \log 23.7 = 1.3747$$

$$\sin 45' = 8.1169$$

$$9.4916$$

$$\Delta_i E = + \underline{\underline{0.3101}}$$

$$23.0 \quad 1.3617$$

$$1^\circ 12' \quad 8.3210$$

$$9.6827$$

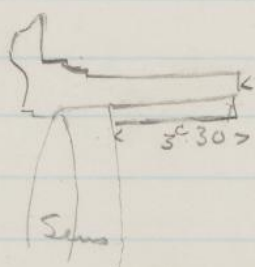
$$\Delta_i N = + \underline{\underline{0.4816}}$$

From the block near c it is

$18^{\circ}.48$ to the front edge of the box and from the front edge of the box to the

Back of the nearest edge of the cell it is $41^{\circ}.80$

Surface of the glass near the cell it is $3^{\circ}.30$



Main in Box

41.80

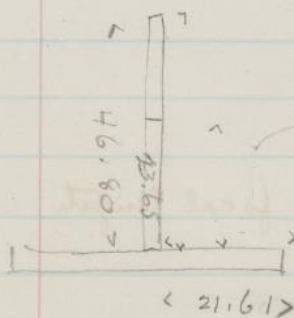
3.30

Semi

In the c, m

$\begin{array}{r} m \\ -45.10 \\ 96.65 \\ \hline 51.55 \end{array}$

End E North side



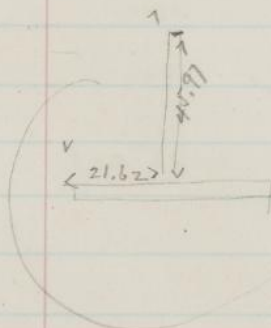
End E

Thickness of glass -

$\begin{array}{r} mm \\ 54.10 \\ - 3.25 \\ \hline 50.85 \end{array}$

End E

South side.



$$EW = 2736.^c37$$

$$\Delta i = \begin{cases} + 0.31 \\ + 0.48 \end{cases}$$

$$\Delta g = \begin{cases} - 0.15 \\ - 0.17 \end{cases}$$

$$\begin{array}{r} +.31 \\ +.48 \\ +.79 \\ +.49 \end{array} \quad \begin{array}{r} -15 \\ -17 \\ -32 \end{array}$$

$$2736.^c84 = EW + \Delta i + \Delta^* i + \Delta g + \Delta^* g = D.$$

$$\delta + \delta' = D + \text{setting } E_w + \text{setting } W_w$$

$$\begin{array}{r} \text{I} \quad 2736.^c84 \\ + 9.990? \\ - 15.07 \\ \hline 2731.^c77 \\ \hline \hline 2731.^c69 = \delta + \delta' \quad (\text{I}) \end{array}$$

$$\begin{array}{r} \text{II} \quad 2736.84 \\ - 10.23 \\ + 4.69 \\ \hline 2731.^c20 = \delta + \delta' \quad (\text{II}) \end{array}$$

Put $f =$ focal length

$$\begin{array}{r} \text{I} \quad 2731.77 f = 2731.778 - \delta'^2 \\ \text{II} \quad 2731.30 f = 2731.308 - \delta'^2 \end{array}$$

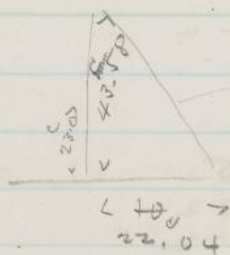
$$\text{Mean } 2731.535 f = 2731.5358 - \delta'^2$$

$$\text{I - Mean} = 0.235 f =$$

$$\text{Mean II} =$$

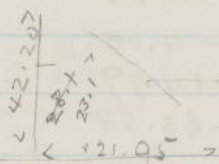
End π

S side



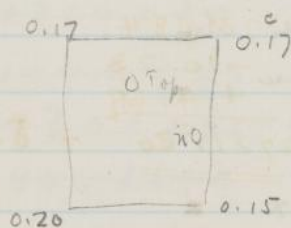
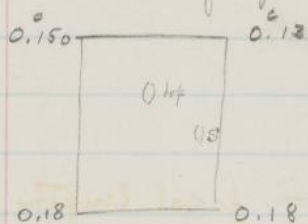
$$\begin{array}{r} 51.90 \\ - 3.20 \\ \hline 48.70 \end{array}$$

N. Side + moved 20°



$$\begin{array}{r} 51.70 \\ - 3.20 \\ \hline 48.50 \end{array}$$

Measures of glass thickness.

 ϵ

$$\begin{array}{r} .15 \\ .13 \\ .18 \\ .18 \\ \hline .21 \\ \Delta_{gR} 0.1522 \end{array}$$

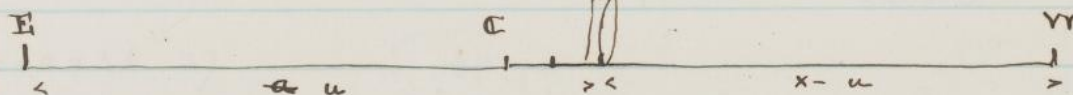
 π

$$\begin{array}{r} .17 \\ .17 \\ .20 \\ .15 \\ \hline .69 \\ \Delta_{gW} 0.1722 \end{array}$$

$$\begin{array}{r} 1522 \\ 1722 \\ \hline 0.3244 \end{array}$$

Reduction of preceding observations.

Page .



E C +

$$\begin{array}{r} 1302.82 \\ + 0.310 \\ - 0.152 \\ \hline \end{array}$$

$$1302.98$$

$$+ 9.99$$

$$1312.97$$

$$+ 4.00$$

$$1316.97$$

$$+ 63.58$$

$$u = 1380.55$$

C W +

$$\begin{array}{r} 1433.55 \\ + 0.482 \\ - 0.172 \\ \hline \end{array}$$

$$1433.86$$

$$- 15.07$$

$$1418.79$$

$$- 4.00$$

$$1414.79$$

$$- 63.58$$

$$x-w = 1351.21$$

$$1380.55$$

$$\phi = 2731.76$$

$$\log u = 3.1400364$$

$$x-w = 3.1307196$$

$$6.2707750$$

$$\log x = 3.4364425$$

$$2.8343325$$

$$\log f = 682.861$$

$$x-u \pm 2.00$$

$$682861$$

$$u = 1378.55$$

$$x-u = 1353.21$$

$$x = 2731.76$$

$$3.129423$$

$$3.131365$$

$$6.270788$$

$$3.436443$$

$$2.834345$$

$$(u-2) \quad 682.880$$

$$(u) \quad 682.881 > -0.020$$

$$(u+2) \quad .832 > -0.029$$

$$x-u \pm 2.00$$

$$u = 1382.55$$

$$x-u = 1349.21$$

$$x = 2731.76$$

$$3.140681$$

$$3.130079$$

$$6.270760$$

$$3.436443$$

$$2.834317$$

$$682.370$$

$$682.832$$

$$s = x \quad t = (x - u)$$

$$y = q(f) = \frac{st}{s+t} \quad df = \frac{(x+y)(x dy + y dx) - xy(dx + dy)}{(x+y)^2}$$

$$= \frac{x^2 dy + y^2 dx}{(x+y)^2} \quad \text{and } (x+y)^2 = \text{constant}$$

$$df = \frac{x^2 dy + y^2 dx}{(x+y)^2}$$

$$1302.98$$

$$+ 49.35$$

$$57$$

$$-10.228$$

$$+ 4.000$$

$$+ 63.580$$

$$+ 49.35$$

$$57$$

$$1433.86$$

$$+ 72.27$$

$$- 54.89$$

$$62$$

$$+ 4.686$$

$$- 44.000$$

$$+ 63.580$$

$$72.266$$

$$- 54.894$$

$$62.894$$

$$u = 13 \frac{60}{52.33}$$

$$x - u = 1370.97$$

$$2731.30 = x$$

$$\log u =$$

$$3.1310730$$

$$1.336347$$

$$x - u =$$

$$3.1395328$$

$$1.370058$$

$$6.2706376$$

$$6.2706723$$

$$\log x =$$

$$3.4363694$$

$$3.4363694$$

$$2.8342682$$

$$2.8343029$$

$$\therefore f = 682.815$$

$$1362.33$$

$$1368.97$$

$$2731.30$$

$$1358.33$$

$$1372.97$$

$$2731.30$$

$$682.838$$

$$- 638.2$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$+ 633.5$$

$$3.134283$$

$$3.136394$$

$$6.270677$$

$$3.436369$$

$$2.834308$$

$$u + 2 = 682.824$$

$$u = .815 - .009$$

$$u = .807 - .008$$

$$u - 2 =$$

$$3.133006$$

$$3.137661$$

$$6.270667$$

$$3.436369$$

$$2.834298$$

$$682.807$$

$$\text{Hypothesis I} + 2.00$$

$$+ 2.00$$

$$+ 4.00$$

$$+ 6.00$$

$$I \quad II$$

$$682.881 \quad .807$$

$$.861 \quad .815$$

$$.832 \quad .824$$

$$\text{Mean}$$

$$.844$$

$$.838$$

$$.828$$

$$\text{Assume } F = 682.828 \text{ (I.V.)}$$

$$\text{and also from other observations same date } F = 682.842 \text{ (E.C.P.)}$$

Mean value of Microm. Screw in terms of Clark Screw

$$1 \text{ rev. Microm. Screw} = 0 \text{ rev. } 30672 \text{ Clark Scr. (1876 II } 26)$$

Mean value 1 rev. Clark screw according to Coast Survey Standard,

$$1 \text{ rev. Clark Screw} = 1^{\text{mm}} \cdot 0570$$

$$\text{Focal length of object glass 15 in. equatorial} = 6828.3^{\text{mm}}$$

$$R = \frac{m}{F \sin 1''}$$

R = value in arc, 1 rev. microm. screw.

$$\log m = \log 1.0570 + \log 0.30672$$

$$\log F = \log 6828.3 = 3.834313$$

$$\sin 1'' = 4.685575$$

$$8.519888$$

approximate
reduction

$$0.024075$$

$$9.486742$$

$$9.510817$$

$$8.519888$$

$$= 0.324203^{\text{mm}}$$

SW

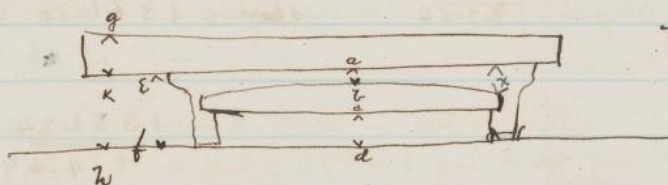
$$0.990929 = 9.7933 = \text{the mean value 1 rev. of the}$$

Micrometer screw, determined by the focal lengths
measured, and the Clark screw.

1878. March 15th 9

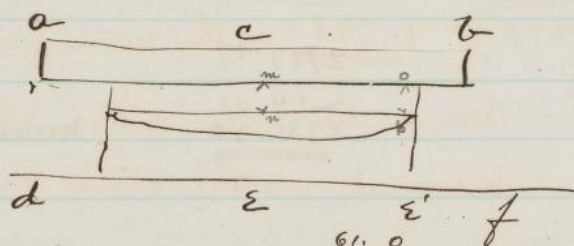
E.C.P. & S.M.O.

Measurement of the thickness of the object glass.

meter Bar.
Cell and lens

$$gh =$$

$$gk = 61.0$$



$$ab = 11.1$$

$$\text{Front Edge to lower edge of lens } x = \frac{17.5}{6}$$

$$mn = 11.1 \text{ obj. gl. in tube}$$

$$= 12.3 \text{ " " on floor.}$$

$$op = 17.5 \text{ " " in Tube.}$$

$ab =$	$bf = 146.1$	85.1	146.1	
$c =$	73.3	12.3	61.0	$= \text{cell.}$
$e =$	93.5	32.5	12.3	12.3
$e' =$	93.8	32.8	32.5	32.8
$ar =$	61.0	00.0	44.8	45.1
			85.1	85.1
			40.3	40.0
			Back	Center
				Back Edge.

Back [Edge thickness = 40.0] sharp focusing the line tangent to upper surface
 Center " = 40.3

We may assume $+2.3$

* Should not this value be preferred to 12.3 since in this case the object glass is turned downward - as in the measuring of the other surface. This gives $11.1 + 32.5 - 85.1 = 40.5$ for the center the edge and 34.8 for the edge.

$$ce = 13.0282^m$$

$$p_{\text{ref}} = +0.158$$

$$c \text{ to back of } = \frac{63.53}{67.56}$$

$$1366.51^{\text{cm}}$$

$$+ 9.990$$

$$2 E_1 \quad \underline{1376.500}$$

$$- 10.23$$

$$2 E_2 \quad \underline{1356.28}$$

I

$$1376.50$$

$$\underline{1351.24}$$

$$2727.74$$

$$+ 4.03$$

$$\text{check } \underline{2731.77}$$

$$3.25$$

$$41.80$$

$$\underline{18.48}$$

$$63.53$$

$$\text{thick. } + 4.03$$

$$\underline{67.56}$$

$$cw = 14.33.55$$

$$p_{\text{ref}} = +.309$$

$$1433.86$$

$$\underline{67.56}$$

$$\text{thick. } = 1366.30 = w \text{ to front of lens.}$$

$$\underline{15.06}$$

$$1351.24 = w_I$$

$$+ 4.69$$

$$1370.99 = w_{II}$$

II

$$1356.28$$

$$\underline{1370.99}$$

$$2727.27$$

$$+ 4.03$$

$$\underline{2731.30}$$

$$\text{mean } 2731.535$$

$$I \quad < \quad 1376.50 \quad > \quad \boxed{I} \quad < \quad 1351.24^{\text{cm}} \quad >$$

$$II \quad < \quad 1356.28 \quad > \quad \boxed{II} \quad < \quad 1370.99 \quad >$$

and the lenses are $4^{\text{cm}} .03$ thick.

$$II - I = - 20.22^{\text{cm}}$$

$$+ 19.75^{\text{cm}}$$

$$\therefore \text{across } d - d' = 19.985^{\text{cm}}$$

$$d + d' = \underline{2731.535}$$

$$f = \frac{2731.535}{4} - \frac{(19.985)^2}{4(2731.535)}$$

$$= 682.884^{\text{cm}}$$

$$\therefore f = \underline{682.299^{\text{cm}}}$$

$$f = \underline{682.848^{\text{cm}}}$$

$$\text{Avg } 19.985 = 1.3007042^2$$

$$2.6014084^2$$

$$\underline{8343469}$$

$$9767062$$

$$\underline{58488}$$

$$2.6014084$$

$$4.038467$$

$$\underline{8.562941}$$

$$= .03685$$

Sep 93 Aug.

79

1877 July 24th.

S. W. obs.

F. W. Renter.

Readings for coincidence.

Casella 29563 76.5 11 AM

Fixed wire nearest micrometer head. (I)

24.938 24.961

24.939 24.968

24.928 24.967

24.947 24.972

24.935 24.982

Means: 24.9364 24.9700

Mean 24.9537

Middle wire. (II)

49.991 50.060

49.978 50.075

49.986 50.068

49.997 50.060

49.965 50.065

Means: 49.9834 50.0656

Mean 50.02450

Wire from the Micrometer (III)

75.162 75.242

75.178 75.242

75.169 75.233

75.150 75.237

75.161 75.228

Means: 75.164 75.2364

Mean

75.2002

50.0245

24.9537

25.1757 (II - III)

25.0708 (I - II)

+ 0.0949 = {(III - II) - (II - I)}

Wire illumination

Micrometer eye piece No 5

Marked 688. "equiv. from 0.396

The last wire has the instrument makes dot, on that side of its frame.

24.9374

24.9700

1074

24.9537

75.1640

12364

14004

75.2002

50.0245

25.1757

49.9834

50.0656

0490

50.0245

24.9537

25.0708

We assume that $4f = 2732 \text{ cm.}$ $\therefore f = 683 \text{ cm.}$
 and also that there is a ^{possible} displacement of as much as 5 cm. in
 the setting of e or w as measured from the ^{principal} ~~base~~ focus.

The effect on f would be $\frac{1}{683} - \left(\frac{1}{1371} + \frac{1}{1361} \right)$

.001464129	.0007347539
.001464148	.0007293946
	.0014641485
0.00000002	

$$d + d' = 682.848 \text{ cm}$$

$$d - d' =$$

$$\lambda = (n-1) e \frac{t}{w}$$

$$\frac{c}{4} - \frac{b-b'}{4(c)}$$

$$\frac{d+d'}{4} - \frac{1}{4} \left(\frac{d-d'}{d+d'} \right)$$

Microm. screw cut by Merz, in Munich.

81

July 24th, 1877. Microm. Cr. 1450. Eyep. M. $\frac{1}{5}$ in obj.
 Live nearest the instrument makers dot, bisected.

Micrometer. Thermometer 77.5 at 11.30 Am.

0.622 (III)

0.625

0.6233

0.622

Middle wire bisected. (II)

23.210 (I)

23.211

23.2110

23.211

9.998

9.998

9.9980

9.998

Last wire. (I)

32.517

32.516

32.5160

32.515

22.5877 (II - III)

22.5180 (I - II)

+ 0.0697 = {(III - II) - (I - II)}

Check.

Middle wire.

9.998

(II)

$\therefore 45.1057 = 50.2465$

$\frac{50.2465}{45.1057} \times 0.374203 = \text{value Microm. screw in m.m.}$

1.7011058

9.510817

1.211923

1.654231

9.557692 = 36155

$\therefore 1 \text{ rev. Microm. Microm.} = (\text{approx.})$

0.361155

Log = 9.557692

Continued fump. 18.

Gauss, *Simville f. Math.* 1856. p. 37. Give values as follows

$$f \text{ is too great by } \frac{1}{4}\lambda - \frac{\lambda}{4} \cdot \frac{(6'-6)^2}{c-\lambda}$$

$$\lambda = (n-1)e + (n'-1)e'$$

$$ne + n'e' = 4.15$$

$$n = 1.53 \text{ (Gauss, Sim. f. as above)}$$

$$n' = 1.62$$

$$4.15 : 4.15 - x :: 100 : 47 \quad *$$

$$\therefore x = 2.20 \text{ Crown} \quad \therefore 1.44 \quad (n-1)e = 0.763$$

$$4.15 - x = 1.95 \text{ Flint} \quad \therefore e' = 1.21 \quad (n'-1)e' = 0.750$$

$$\therefore \lambda = 1.513$$

* obtained by assuming (G.P. Bond Proc. Am. Acad. Vol. VI "on a new formula")

$$\text{Ref. 1st Surface crown} = +4.88$$

$$2 \quad \quad \quad +1.92$$

$$1 \quad \quad \text{Flint} \quad -1.95$$

$$2 \quad \quad \quad +7.35$$

$$\therefore \text{Thickness crown, flint} :: 53 : 47$$

$$\therefore \frac{1}{4}\lambda + \frac{\lambda}{4} \cdot \frac{(6'-6)^2}{c-\lambda} = 0.378 + \frac{1.513(19.985)^2}{4(682.848)(682.848 - 1.513)}$$

$$= \frac{151.3}{(683)(681)} = \frac{151.3}{465123}$$

$$= 0.00032465$$

$$\therefore f = 682.884$$

$$- .036$$

$$- .378$$

$$\underline{\underline{682.470}} = 268.6912 \text{ at } 47^\circ \text{F}$$

$$\text{when } 1 \text{ cm} = 0.393704 \text{ inches.}$$

July 24. 1877.

$$\begin{array}{r} 9.807 \\ .807 \\ .806 \\ \hline 9.807 \end{array}$$

9.807

$$\begin{array}{r} 12.579 \\ .579 \\ .579 \\ \hline 12.579 \end{array}$$

12.579

9.807

2.772

 $\therefore 1 \text{ rev} = \underline{\underline{0.36075}}^{\text{mm}}$ mm Froment

29563 = 77° 5'

m.m. Froment.

name right side up.

$$\begin{array}{r} 9.807 \\ .807 \\ .807 \\ \hline 9.807 \end{array}$$

9.807

$$\begin{array}{r} 12.576 \\ .576 \\ .575 \\ \hline 12.576 \end{array}$$

12.576

9.807

2.769

m.m. Secretan

name right side up.

 $\therefore 1 \text{ rev} = \underline{\underline{0.36114}}^{\text{mm}}$ mm "Secretan"

 $1 \text{ rev} = \underline{\underline{0.36116}}^{\text{mm}}$ east Survey

and class saw.

∴ Taking means

$$\begin{array}{r} \text{50.0} = \text{min P.} \\ \text{0.250} \\ \text{.250} \\ \text{.252} \\ \text{.251} \\ \hline \text{0.251} \end{array} \quad \begin{array}{r} \text{min S.} \\ \text{.253} \\ \text{.250} \\ \text{.250} \\ \text{.255} \\ \hline \text{0.252} \end{array}$$

1 Rev. W.A.R. Screw = 0. ⁱⁿ ~~0437957~~

Assuming that $1 \text{ mm} = 0.03937$
 $\quad \quad \quad .00503$

$$10w = 0.0001980311$$

$$\sin^2 a = 1 - \cos^2 a$$

July 25 - 1877. Trial Plate Birmingham Eng W.A.R. screws. The
lines are $\frac{1}{600}$ of an inch apart. Est. Temp bet 72° & 75° .

Temp. measured = 81°

[upper measurement]							
0	22	0.0		0.0		0.0	
4		8.3	8.3	8.2	8.2	8.2	2
8		16.8	8.5	16.6	4	16.6	4
12		25.1	8.3	25.0	4	25.0	4
16		33.5	8.4	33.3	3	33.3	3
20	2	41.9	8.4	41.7	4	41.8	5
24		50.2	8.3	50.2	5	50.2	4
28		8.8	8.6	8.7	5	8.7	5
32		17.2	8.4	17.2	5	17.2	5
36		25.8	8.6	25.5	3	25.8	6
40	22	34.2	8.4	34.2	7	34.1	3
44		42.8	8.6	42.5	3	42.7	6
48		11.2	8.4	11.0	5	11.1	4
52		19.8	8.6	19.3	3	19.7	6
56		28.1	8.3	27.8	5	28.0	3
60	2	36.6	8.5	36.2	4	36.2	2
64		44.8	8.2	44.8	6	44.8	6
68		13.2	8.4	13.0	2	13.1	3
72		21.8	8.6	21.2	2	21.5	4
76		30.0	8.2	29.8	6	30.0	5
80	12	38.3	8.3	38.0	2	38.1	1
84		46.7	8.4	46.3	5	46.5	4
88		15.0	8.3	14.7	4	14.7	2
92		23.3	8.2	23.0	3	23.0	3
96		31.7	8.4	31.3	5	31.2	2
100	2	40.1	8.4	39.8	5	39.7	5

8 div. from end there is a band of heavy lines ruled in

11 30 52 is wrong.

$$100 \text{ div.} = 0^{\text{mm}}.079$$

$$\therefore 1 \text{ div} = 0.00079 = 0^{\text{in}}.00003$$

July 26, 1877. Measures on 2 glass plates containing corrected rulings of N.A.R.'s Screw, preparatory to ruling equatorial reticule for opposition of Mars.

Plate I. (Unruled)		Plate II (Filled Sines)	
1	53.2	55.0	^{W. 412.} ^{55.2} 55.2° - 114 } 0.
2	53.4	54.2	53 54.0° + 06 - 10
3	3.7	54.1	52 54.50 - 44 - 16
4	3.7	53.3	53.50 + 56 + 28
5	3.7	53.5	54.00 + 06 - 28
6	4.0	53.8	54.00 + 06 - 34
7	4.0	53.8	54.10 + 04 - 40
8	4.0	53.8	54.00 + 06 - 36
9	4.5	53.5	(bad edge) 53.70 + 36 - 42
10	4.0	54.5	(" ") 53.70 + 36 - 78
11	4.1	54.5	(" ") 54.40 + 34 - 114
12	4.0	54.0	54.20 disculp = $\frac{1}{-14-86} \dots$
13	4.0	53.2	54.00 + 06 - 66
14	4.1	54.7	54.00 + 06 - 72
15	4.0	54.3	54.50 - 44 - 78
16	4.0	54.0	53.70 + 36 - 30
17	4.2	54.1	53.70 + 36 - 70
18	4.0	53.9	54.00 + 06 - 106
19	4.0	53.6	54.00 + 06 - 112
20	4.0	54.1	54.60 - 54 - 118
21	4.0	54.1	54.50 - 44 - 64
22	3.2	54.0	53.60 + 46 + 108
23	3.2	53.9	54.00 + 06 + 62
24	3.2	52.7	53.50 + 56 + 56
25	53.2	53.56	54.00 10 in = $\frac{1}{22470}$ in

July 26, 1897. Museum in Japan plates containing corrected values
 of V.A.R. series, corresponding to original & corrected values
 for distribution of errors.

Plate II (Plate Series)

Plate I (Plate Series)

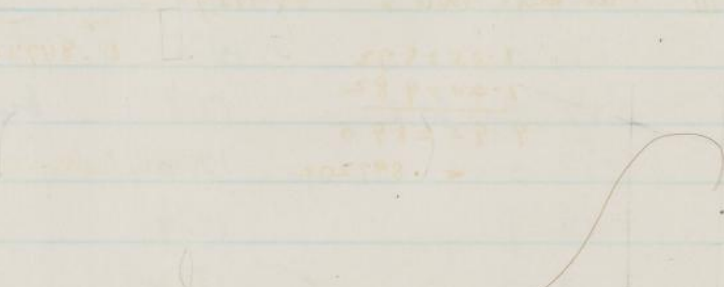
0.52	0.52	1
0.52	0.52	2
0.52	0.52	3
0.52	0.52	4
0.52	0.52	5
0.52	0.52	6
0.52	0.52	7
0.52	0.52	8
0.52	0.52	9
0.52	0.52	10
0.52	0.52	11
0.52	0.52	12
0.52	0.52	13
0.52	0.52	14
0.52	0.52	15
0.52	0.52	16
0.52	0.52	17
0.52	0.52	18
0.52	0.52	19
0.52	0.52	20
0.52	0.52	21
0.52	0.52	22
0.52	0.52	23
0.52	0.52	24
0.52	0.52	25
0.52	0.52	26
0.52	0.52	27
0.52	0.52	28
0.52	0.52	29
0.52	0.52	30
0.52	0.52	31
0.52	0.52	32
0.52	0.52	33
0.52	0.52	34
0.52	0.52	35
0.52	0.52	36
0.52	0.52	37
0.52	0.52	38
0.52	0.52	39
0.52	0.52	40
0.52	0.52	41
0.52	0.52	42
0.52	0.52	43
0.52	0.52	44
0.52	0.52	45
0.52	0.52	46
0.52	0.52	47
0.52	0.52	48
0.52	0.52	49
0.52	0.52	50
0.52	0.52	51
0.52	0.52	52
0.52	0.52	53
0.52	0.52	54
0.52	0.52	55
0.52	0.52	56
0.52	0.52	57
0.52	0.52	58
0.52	0.52	59
0.52	0.52	60
0.52	0.52	61
0.52	0.52	62
0.52	0.52	63
0.52	0.52	64
0.52	0.52	65
0.52	0.52	66
0.52	0.52	67
0.52	0.52	68
0.52	0.52	69
0.52	0.52	70
0.52	0.52	71
0.52	0.52	72
0.52	0.52	73
0.52	0.52	74
0.52	0.52	75
0.52	0.52	76
0.52	0.52	77
0.52	0.52	78
0.52	0.52	79
0.52	0.52	80
0.52	0.52	81
0.52	0.52	82
0.52	0.52	83
0.52	0.52	84
0.52	0.52	85
0.52	0.52	86
0.52	0.52	87
0.52	0.52	88
0.52	0.52	89
0.52	0.52	90
0.52	0.52	91
0.52	0.52	92
0.52	0.52	93
0.52	0.52	94
0.52	0.52	95
0.52	0.52	96
0.52	0.52	97
0.52	0.52	98
0.52	0.52	99
0.52	0.52	100

W. A. R.

1	12.3		13.0			
2	12.9		13.0			
3	12.9		12.8			
4	13.0		12.6			
5	12.8	63.5	12.8	64.0	63.0	64.5
6	13.0		12.6			
7	12.7		12.6			
8	13.0		13.4			
9	13.0		12.6			
10	12.8	64.1	(25) 12.7	63.4	64.2	63.9
11	13.0		12.5			
12	12.7		13.1			
13	12.9		12.6			
14	12.7		12.6			
15	12.5	64.5	12.6	64.3	63.6	63.7
16	12.6		12.8			
17	13.1		12.6			
18	12.5		12.6			
19	13.3		12.7			
20	12.9	63.7	12.5	62.6	63.5	62.6
21	12.6		13.0			
22	12.5		12.5			
23	12.5		12.5			
24	12.6		(50) 12.9			
25	12.9	62.9		62.5	62.8	63.0

Consider the thickness $t = \frac{L}{n}$, if $n = 15$

$$= \frac{1}{15} L$$



$$\frac{1}{15} L = \frac{1}{15} \times 1.5 \times 10^8 \text{ cm} = 10^7 \text{ cm}$$

$$\frac{1}{15} L = \frac{1}{15} \times 1.5 \times 10^8 \text{ cm} = 10^7 \text{ cm}$$

$$\frac{1}{15} L = \frac{1}{15} \times 1.5 \times 10^8 \text{ cm} = 10^7 \text{ cm}$$

$$\frac{1}{15} L = \frac{1}{15} \times 1.5 \times 10^8 \text{ cm} = 10^7 \text{ cm}$$

$$\frac{1}{15} L = \frac{1}{15} \times 1.5 \times 10^8 \text{ cm} = 10^7 \text{ cm}$$

Reduction of p 79 sheet.

II - III	Measured by Merz. Mic.	25.1757	S. M. Mic.	22.5877
I - II	" " " "	25.0708	"	22.5180

$$\text{II - III 1 rev. Merz Mic} = \frac{22.5877}{25.1757} (\text{d.w.})$$

$$\begin{array}{r} 1.352872 \\ 1.400982 \\ \hline 9.952890 \\ = .897202 \end{array}$$

$$\begin{array}{r} 0.89720 = 0.288824 \\ + 0.324927 \\ + 0.025272 \\ \hline 722 \end{array}$$

$$1 \text{ Rev. Eq. Mic. II - III} = 0.323916$$

$$\text{I - II 1 rev. Merz Mic.} = \frac{22.5180}{25.0708} (\text{d.w.}) =$$

$$\begin{array}{r} 1.352530 \\ 1.399168 \\ \hline 9.953862 \end{array}$$

$$= .898177$$

$$\begin{array}{r} 1795379 \\ 1.77533 \end{array}$$

$$\text{Mean} = 0.897690$$

$$\text{Log} = 9.953126$$

$$= .89769 =$$

$$\begin{array}{r} 0.288824 \\ 0.324927 \\ 0.025272 \\ \hline 1166 \\ 325 \end{array}$$

$$1 \text{ Rev. Eq. Mic. from I to II} =$$

$$0.323993$$

$\therefore$ the ^{mean} value of the Eq. Mic. screw from

$$\begin{array}{l} \text{I to II} = 24.9037 \text{ to } 50.0245 = 0.323916 \\ \text{II to III} = 50.0245 \text{ to } 75.2002 = 0.323993 \end{array} \left. \begin{array}{l} \\ \end{array} \right\} \text{at } 77^\circ \text{ F.}$$

By direct measurement with I. M.'s screw.

$$\frac{27}{30} \text{ F which becomes at } 47^\circ \text{ F} = .323916 - .0000593 = 0.323857$$

$$\begin{array}{r} .0000061 \\ 30 \\ \hline .0001829 \end{array}$$

$$\begin{array}{r} 167628 \\ 59109 \\ \hline .00005910676 \\ 1817.19 \\ 167628 \\ 59109 \\ \hline 59276628 \\ 59290719 \end{array}$$

$$.323993 - .0000593 = 0.323934$$

Whence at 47° ~~44~~⁴⁷ E

The focal length in terms of a meter bar which in turn has been compared with a chesternan tape and with the mean of the micrometer values obtained by S.W. for his micrometer screw described in Proc. Am. Acad. vol 1878

is 6824.7^{mm}_0 And the screw value 25.0 to $50.0 = 0^{\text{mm}}.323857$
 50.0 to $75.0 = 0^{\text{mm}}.323934$

$$\therefore \frac{.32386}{6824.70000}$$

$$\begin{array}{r} 7.5103573 \\ 3.8340836 \\ \hline 5.6762737 \\ 4.6855749 \\ \hline 7.5104512 \\ 3.8340836 \\ \hline 5.6763676 \\ 4.6855749 \end{array} \quad \begin{array}{l} 0.9906988 \\ 0.9907927 \end{array} = 9''.7881 \quad \left. \vphantom{\begin{array}{r} 7.5103573 \\ 3.8340836 \\ \hline 5.6762737 \\ 4.6855749 \\ \hline 7.5104512 \\ 3.8340836 \\ \hline 5.6763676 \\ 4.6855749 \end{array}} \right\} \text{at } 47^{\circ} \text{ E}$$

$$= 9''.7902$$

Found in Vol I Annals p. XLV.

$$r = 9''.800 + 0''.00026(t - 50^{\circ})$$

$$- .0008 = .00026(-3^{\circ}) = -.0008$$

$$\therefore \text{By Rnd in Vol I, Ann.} = 9''.7992$$

$$\begin{array}{r} 3.8340836 \\ 7.5105986 \\ \hline 5.6765850 \\ 4.6855749 \\ \hline 0.9909401 \end{array} = 9''.7935$$

0 21

The first thing I noticed when I stepped out
 of the car was a sharp, cold wind. It felt like
 a giant hand reaching out to grab me. I
 shivered and pulled my coat tighter around me.
 The wind was so strong it made it hard to
 breathe. I could see my breath in the air.
 It was a strange feeling, like I was in a
 new world. The wind was everywhere, it was
 so loud. I could hear it in my ears. It was
 like a giant machine was running. I was
 so cold. I needed to get inside. I was
 so tired. I needed to rest. I was so
 alone. I needed someone. I was so
 scared. I needed help. I was so
 lost. I needed to find my way. I was so
 confused. I needed to know what was
 going on. I was so scared. I needed to
 get out of there. I was so alone. I
 needed someone. I was so scared. I
 needed help. I was so lost. I needed to
 find my way. I was so confused. I
 needed to know what was going on. I
 was so scared. I needed to get out of
 there. I was so alone. I needed someone.
 I was so scared. I needed help. I was
 so lost. I needed to find my way. I was
 so confused. I needed to know what was
 going on. I was so scared. I needed to
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 needed someone. I was so scared. I
 needed help. I was so lost. I needed to
 find my way. I was so confused. I
 needed to know what was going on. I
 was so scared. I needed to get out of
 there. I was so alone. I needed someone.

1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W
 1876phae.proj.1835W

Reduction of Observations of the
of the Meridian of the 12th
2. These observations were

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

$$p = 44.25$$

100

et Sequitur.

Reduction of Observations to determine Value of one Revolution
of the Micrometer Screw of the 15-inch Equatorial.
S. Waldo observer & Comp.

 α used, min.

$$\varphi = 42^\circ 22'.8$$

1876.

$$\delta = 88^\circ 38'.9$$

$$\cos t_0 = \cot \delta \tan \varphi$$

$$\begin{array}{r} 8.37276 \\ \hline \cos t_0 = 8.37288 \\ 9.96623 \end{array}$$

$$\cos t_0 = 8.33311$$

$$t_0 = 88^\circ 45' \quad 1^\circ 15'$$

$$= 6^h 5^m = 5^h 55^m$$

$$\cos z_0 = \cos \delta \sin \varphi$$

$$\begin{array}{r} 0.000672 \\ \hline 9.82870 \\ \hline 9.82882 \end{array}$$

$$z_0 = 47^\circ 36'$$

$$\underline{\underline{z_0 = 47^\circ 36' \text{ Mean Refr} =}}$$

$$\alpha = 1^h 13^m \quad \therefore \text{Elong} = 19^h 18^m \text{ s.t.}$$

$$\underline{\underline{\text{Elong} = 7^h 08^m \text{ s.t.}}}$$

late 1876. Clock used.

Oct 7 a E Bd 312 Comp. Fr 1327

Red.

Daily Rate 312

8 a W 312 " "

9 a E 312

9 2 45 312 " "

9 a W 312 " "

9 a E

✓ 10 a W

✓ 11 a -

18 a E

24 a E

Dec 1 a W

+ 1^s.8 per day

Err + 2^m

Hourly rate
= + 0^s.075

+ 1^s.8 per day

Err + 2^m

24 | 1^s.8 0^s.075
1^s.8
12^m

+ 3^s.0

Err + 2^m

Hourly rate
= + 0^s.125

24 | 3^s.0 1^s.25
24
6^s.0
1^s.25

Clock Comparisons.

Oct 7. 20 30 0.0 = 20 31 57.2
8 8 20 19. = 8 26 19.0
9 21 8 0.0 = 21 10 0.0
9 8 27 0.0 = 8 29 3.2
10 8 45 0.0 = 8 47 5.4
11 (about 9 P.M.) 0.0 = 6.9

Oct. 3^d P.M. - 3.10

Daily Rate

+ 0^s.30

9 - 1.32

+ 0.30

12 - 0.42

+ 0.46

25 + 5.64

Chn. 3451

24 18 38 30.6
25.0 = 18 38 6.5
+ 5.6
Dec 1 23 48 46.0 = 23 50 17.5

Dec 1 + 33.02

Dec 3^d + 35.16

- 18^s.5
1 21.5
1^m 40^s.0 = 100^s.00
38 | 100.00 (3^s.62

Oct 1 21.4 s.t.

42.44

Oct. 8.

312 = +

41.8

4 21.0

40.66

10

312 = +

2^m 5.4

13 20.9

41.40

17 20.5

41.62

Oct 7

+

1 57.2

23 23.3

42.40

9

+

2 0.0

Oct 7th 312 = +

2^s.8 in 2 days = 1^s.4 per day
2^s.2 in 1 day = 2^s.2
1^s.4

1898⁶ Oct. 7. A Unac. Min. E. Elong. 19^h 18^m

56° 5'

15^h 0 to 25^h 045^h 0 to 55^h 075^h 0 to 85^h 0

15 ^h 0 to 25 ^h 0	19 ^h	1	14.7	14.7	15 ^m	9.6	29 ^m	45.5
		1	29.0		5	23.6	29.	19.5
		1	42.0	42.0	5	37.5	29.	30.7
		1	58.0		5	54.2	29x	43.5
		2	11.7	11.7	6	7.3	29	59.1
		2	25.8		6	20.7	30	12.1
		2	39.3	39.3	6	33.5	30	26.6
		2	55.4		6	48.7	30	40.3
		3	6.5	6.5	7	2.0	30	54.2
		3	20.4		7	14.8	31	8.6
		3	35.4	35.4	7	29.3	31	22.1
		3	48.3		7	46.2	31	37.4
		4	2.0	2.0	7	57.9	31	52.4
		4	17.3		8	8.5	32	5.9
		4	30.5	30.5	8	25.6	32	18.8
		4	44.6		8	38.7	32	32.5
		4	59.0	59.0	8	51.9	32	48.0
		5	12.8		9	5.5	32	59.8
		5	27.8	27.8	9	19.0	33	13.8
		5	40.0		9	35.0	33	28.2
		5 ^m	58.5	55.1	19 ^m	46.9	19 ^h 33.	43.0
		2	67.56	32.40	17 ^m	29.40	Mean 32 ^m	54.46
			33.78	32.40				

4
8
12
20
20
64^m
60
384⁰
384⁰
4515⁶
60

215286

1^s.4 = 0".012 about for

1 rev. of Mic. Screw.

1. Rev. 24 times.

67.56
67.41
15
= 32.17

Mean	19 ^h	3 ^m	35.29	19 ^h	19 ^m	29.40	19	31	22.91
					3	35.29		17	29.40
					18 ^m	54.21		13 ^m	53.51

Am. Palt & Sun

20 ^h .000	19 ^h	1 ^m	35.29 ^{+1.0}	-	17 ^m	30.81	15.0
50.000		15	29.38 ^{0.0}	-	8	36.72	0.0
80.000		29	22.87 ^{-0.2}	+	10	16.77	0.2

20 to 50 13^m 54.09 - 0^s.5150 to 80 13^m 53.49 - 0^s.51

+ defines the neg. values & hence the positive values

$$-17^m \quad 29^s.81$$

$$-3 \quad 36.72$$

$$+10 \quad 16.77$$

$$13^m \quad 53^s.09 = 30r. \quad 20-50 = 833^s.09$$

$$13^m \quad 53^s.49 = \quad 50-80 = 833.49$$

$$\begin{array}{r} 1360 \\ 780 \\ \hline 53.09 \\ 833^s.09 \end{array}$$

$$\therefore \text{rev} = \begin{array}{r} 27.770 \\ 28.436 \\ \hline 1.45387 \\ 44357 \\ \hline 9.54692 \end{array}$$

$$\text{and } \begin{array}{r} 27.783 \\ 26.440 \\ \hline 1.45408 \\ 1.44378 \\ \hline 9.54692 \end{array}$$

$$+00049$$

$$0.99049$$

$$9''781$$

$$.005$$

$$\underline{9''776}$$

$$0.99070$$

$$9''788$$

$$\underline{\underline{9''783}}$$

Refr

04

7^h. ocl. 8^o 18^h (Monday Am) α Ursa. Min. (W) . 7^h 8^m 44^s 0

	15 ^m 6 ^s 25 ^s		45 ^m 6 ^s 55 ^s		78 ^m 6 ^s 88 ^s	
7 ^h	287	1 ^m 7.7	41 ^m	13.5	56 ^m	2.1
	287	32.5	1	27.2	6	18.7
	287	48.4	1	43.2	6	36.3
	288	1.5	1	57.6	6	46.1
	288	13.6	2	[11.0]	6	58.0
	288	28.3	2	24.8	7	12.0
	288	40.2	2	35.8	7	29.3
	289	52.4	2	50.1	1	44.2
29 30	9.2		3	2.2	1	55.6
29 30	21.6		3	18.0	8	7.5
29 30	37.0		3	32.3	8	22.3
29 30	50.1		3	48.1	8	36.2
30 31	4.2		4	1.8	7 58	52.0
30 31	18.4		4	15.0		
30 31	34.2		4	29.2	6 ^m	
30 31	46.3		4	40.0		
31 32	1.3		4	55.2		
31 32	13.5		5	9.5		
31 32	27.0		5	22.2		
31	42.0		5	36.2		
31	57.3		45	52.6		
7 ^h	29	37.00	7 48	32 ^s .64	7 57	27.25
						28.02

n. 7^h 8^m 9^s.1
 Corr. Rati & Error

20.000	7 ^h	29 ^m	37. ^s 00		+	19 ^m	28. ^s 90	19 ^m	30. ^s 30
50.000		41	32.62	5.6	+	33	24.52	33 ^m	31.62
80.000		55	27.21 ^{9.8}	4.6	+	47	19.11	47 ^m	38.81

$$\frac{14}{60}$$

$$\frac{840}{840}$$

14^m 1.32 841^s.32
 14^m 7^s.19 847.19

1^{mu} = 28^s.044 28.240

1.44784 1.45086
 9.54692 9.54692
 0.99476 0.99748
 9.880 9.942

omitting the term t (?)

$$13^m 55^s.62$$

$$13^m 54^s.59$$

$$\frac{13.60}{780}$$

$$55.62$$

$$54.59$$

$$835^s.62$$

$$834^s.59$$

$$27^s.854$$

$$27.820$$

Log 15000

$$9.54692$$

$$1.44489$$

$$1.44436$$

$$0.99181$$

$$0.99128$$

$$9''.813$$

$$9.801$$

$$- 0''.005$$

$$20-50 \quad 13^m 55^s.62 - 0.51$$

$$50-80 \quad 13^m 55^s.59 - 0.51$$

$$20-50 \quad 13^m 55^s.62 - 0.51$$

$$50-80 \quad 13^m 55^s.36 - 0.51$$

106

II. p. 781976 Oct. 9th (Mond P.M.)

α Ursae Min. E.

19^h 18^m

47.0

15 to 25^r45 to 55^r75 to 85^r

19	7	36.0
	7	42.7
	8	3.0
	8	17.8
	8	32.0
	8	45.0
	8	57.3
	9	14.0
	9	27.6
	9	40.7
	9	53.0
	10	7.6
	10	21.0
	10	36.2
	10	50.2
	11	3.0
	11	17.6
	11	32.2
	11	44.3
	11	59.0
	12	14.4

19^h 9^m 54.37

21 ^m	29.5
21	43.0
21	55.0
22	11.6
22	25.2
22	39.7
22	54.5
23	7.0
23	21.5
23	35.2
23	47.3
24	1.7
24	16.2
24	30.5
24	44.2
24	57.8
25	12.5
25	27.2
25	39.5
25	54.2
26	7.7

23^m 48.62
9 54.37

40 ^m	5.8
35	25.2
35	39.5
35	53.3
36	6.1
36	20.3
6	35.4
6	48.8
7	3.0
7	15.7
7	30.0
7	44.3
8	0.3
8	12.0
8	24.3
8	40.6
8	53.8
9	8.5
9	21.0
9	36.0
9	49.0
19 ^h 40	3.8

19^h 40 3.8
37^m 44.33

E. 19 19 6.10

Corr. Rate Error

20.000	19 ^h 7 ^m	54.37
50.000	21	48.60
80.000	35	44.29

± corr. for time.

-	11	11.73	-11	11.53 = 671.53
+	2	42.50	+2	42.50 162.50
+	16	38.19	+16	39.04

20 - 50 13^m 54.23 - 0.5150 - 80 13^m 55.69

20-50	$13^m 54^s \cdot 03 = 26^s + 1.80$	27.80	$\frac{9.5469}{1.4440}$	0.9909
50-80	$13^m 56^s \cdot 54 = 1.88$	27.88	$\frac{9.5469}{1.4453}$	0.9922

20 to 50	$9.782 - 0.005 = 9.775$
50 to 80	9.822
	9.817

876. oct 9.

λ Ursae Min. U.C.

II p. 83.

15^r - 25^r

45 to 55

75 to 85.

36	55 ^m	25.0
6	5	18.1
6	5	35.1
6	5	54.0
7	6	11.4
7	6	28.5
7	6	46.5
8	7	3.4
8	7	21.9
8	7	38.6
8	7	56.5
9	8	14.2
9	8	31.0
9	8	48.0
40	8	4.7
0	8	24.6
0	8	40.4
0	8	56.4
41		16.4
41		33.3
41 ^m		50.8
		95.8
		+ 54

mean 21^m $\frac{26.93}{2.99}$ (?)

53 ^m	39.3
3	58.5
4	16.6
4	35.5
4	51.0
5	6.7
5	27.7
5	45.0
56	3.7
6	21.9
6	39.6
6	58.0
57	14.2
7	29.4
7	51.2
8	17.2
8	26.1
8	45.2
59	2.4
9	20.5
59	37.2
	110.9
	+ 53

21

16.90

38^m

55.99

56^m

39.09

U. 19 47 21.2

Corr. Rate & Error

20.000	20 ^m	19 ^m	2.79 + 2 ^m 24.1	= 20	23	26.89	+ 34 ^m 5.69
50.000	36	55.97	+ 2 24.1	= 20	39	20.07	+ 51 ^m 58.87
80.000	54	39.05	+ 2 24.1	= 20	59	03.15	+ 69 ^m 41.95

 $\frac{36}{34} 5.69 + 7.56$
 $\frac{36}{34} 13.30$
 $51 58.87 + 26.74$
 $51 25.61 17^m 12.31$
 $69 41.95 + 64.46$
 $70 46.41 19^m 20.80$

33 58.10

14^m 53.1851 32.13 17^m 34.03

2.08

68 37.49 17^m 05.36

$$\frac{1}{6} (15 \sin 1'')^2 t^3 \quad \text{Log } t \quad 3.4940 \quad 3 \log t = 0.4820$$

$$\text{Log } \sin 1'' \quad 4.6856$$

$$t = \frac{52^m}{60} \quad 15 \quad \frac{1.1761}{5.8617} \quad 2(15 \sin 1'') \quad \text{Log} = \frac{1.7234}{9.2218}$$

$$t = \frac{69}{60} \quad 3119.5 \quad \text{a.c. Log } 6 = 1.4272 \quad 26.74$$

$$\frac{4140}{42} \quad 4182.5 \quad 3.6214 \quad 0.8642$$

$$1.7734$$

$$9.2218$$

$$1.8094$$

$$64.46$$

$$2(15 \sin 1'') \quad \text{Log} = 1.7234$$

$$\text{a.c. Log } 6 \quad 9.2218$$

$$\therefore \text{Log } \frac{1}{6} (15 \sin 1'')^2 = 0.9452$$

$$\frac{17}{15} \quad 53.18$$

$$17^m \quad 44.08$$

$$20^h \quad 21^m \quad 16.90$$

$$38 \quad 55.97$$

$$56 \quad 39.05$$

$$20 - 50 = 17^m 39.07 \quad 1.04$$

$$50 - 80 = 17^m 43.08$$

These values accepted April 20, 1880, as those intended for the times of transit from which the reduction is to be made.

896 Oct 9th 18th (Tuesday Am.)

α Ursae Min. W.

7^h 8^m

44°.0

15 ^h 25 ^m	45 ^h 55 ^m	75 ^h 85 ^m
7 ^h 43 33.5	7 57 54.8	11 ^h 51.0
43 48.0	8 1 9.3	12 5.6
4 1.4	8 21.3	2 18.5
4 15.0	8 38.0	2 33.3
4 30.9	8 52.0	2 45.0
4 44.1	9 6.3	3 0.2
4 58.4	9 20.8	3 13.8
5 13.4	9 33.8	3 27.3
5 26.6	9 47.7	2 40.0
5 40.9	60 2.3	3 54.5
5 52.4	0 16.6	4 9.9
6 8.3	0 27.2	4 23.8
6 21.4	0 41.2	4 36.0
6 35.8	0 56.3	4 51.2
6 49.3	1 9.4	5 6.2
7 2.6	1 24.8	5 20.1
7 17.4	1 39.0	5 34.3
7 30.1	1 52.8	5 50.0
7 59.3	1 5.6	6 0.4
8 14.1	2 19.9	6 14.3
48 27.0	8 2 33.0	8 16 29.8
7 ^h 45 ^m 55.71	8 0 19.61	8 ^h 14 ^m 9.77
46 21.68	45 55.71	0 19.61
	14 23.90	13 50.16
	13 47.92	

W. 7 9 8-10
Corr. Rate & Error

20,000 = 7 ^h 43 55.71	+ 34 47.61	t = 2087.6	Log =
50,000 58 19.59	+ 49 11.49	2951.5	
80,000 8 12 9.73	+ 52 1.63	3721.6	

8 14 9.73	
49 58 19.59	
7 46 55.71	
1 23.88	

Sug t	3 Sug t	+0.9452	
3.3197	9.9591	0.9043	8.023
3.4700	10.4100	1.3552	9.562
3.5707	71.21	1.6573	22.66
3.4944	10.4832	1.4284	45.42
			26.81

34 ^m 47.61	49 ^m 11.49	62 ^m 1.63
+ 8.02	+ 22.66	+ 45.42
34 55.63	49 34.15	62 47.05
	34 55.63	49 34.15
	14 ^m 38.52	13 ^m 12.90

$$20 \text{ } 50 = 13^m 53^s.18 \text{ } 40.511$$

$$50 \text{ } 80 = 13^m 54.91$$

Values adopted April 20, 1880, for the times of transit from which the reduction is to be made:

For 15 to 25 revolutions $7^h 46^m 21.68$ (see p. 110, foot of first column),
 + 2^m for clock error (see p. 112, also p. 101).
 Result $7^h 48^m 21.68$

For 45 to 55 revolutions $8^h 0^m 14.86$ (which seems to be the mean of the second column, p. 110) + 2^m as before.
 Result $8^h 2^m 14.86$

For 75 to 85 revolutions $8^h 14^m 9.77$ (see p. 110, foot of third column) + 2^m as before.
 Result $8^h 16^m 9.77$

The first difference for 30 revolutions is accordingly $13^m 53.18$ } (as in red ink
 and the second $13 \text{ } 54.91$ } (on this page)

1876 Oct. 9 (Sunday P.M.) 2 hrs. Min. $\underline{E}$ elong.

54° 5'

15^h 06^m 25^s 0

19 ^h	51 ^m	58.8
	52	13.8
	2	26.1
	2	40.5
	2	56.1
	3	10.5
	3	23.0
	3	38.1
	3	50.5
	4	4.0
	4	19.0
	4	32.0
	4	46.0
	5	1.5
	5	13.8
	5	27.6
	5	42.4
	5	56.8
	6	11.2
	6	26.1
	6	40.0
19 ^h	56	40.0
	4 ^m	18 ^s 94

45^h 655^s 0

5	56.0
6	9.7
6	23.8
6	37.4
6	53.2
7	6.6
7	21.2
7	35.3
7	48.5
8	2.1
8	16.0
8	32.0
8	47.3
8	59.5
9	12.8
9	26.2
9	40.2
9	54.1
10	8.3
10	22.4
10 ^m	36.8
20 ^h	

75^h 85^s 0

19 ^h	53 ^m	7.0
20	0	20.5
0	0	34.8
0	0	49.3
1	1	2.4
1	1	17.4
1	1	31.1
1	1	45.7
1	1	59.6
2	2	13.5
2	2	27.5
2	2	40.4
2	2	54.2
3	3	9.0
3	3	23.2
3	3	35.3
3	3	50.3
4	4	4.0
4	4	18.1
4	4	31.5
4	4	46.0
20 ^h	22 ^m	26 ^s 75
		- 13 ^s 95
20	22	12.80

Σ 19 19 6.1
 Ann. Rate & Error

20 ^h 00 ^m	19 ^h	52 ^m	18 ^s 94	+	33 ^m 12 ^s 84	1992.84
50.000	20	6	16.48	+	47 ^m 10 ^s 38	2830.38
80.000	20	20	26.71	+	61 ^m 20 ^s 61	3680.61

20	22	12 ^s 80
20	8	16.48
19	54	18.94

$$\begin{aligned}
 & 10-23 \quad 13^m \quad 56.32 = 50680 \\
 & 13^m \quad 57.54 = 20650
 \end{aligned}$$

These values accepted April 20, 1880, as those intended for the times of transit from which the reduction is to be made. (The first line read as 20^h 22^m 12^s 80).

Srgt

3 Srgt

3 logt + 0.9452

 $\therefore \frac{1}{6} (15 \sin 1'')^2 t^3$

3.2995

9.8985

0.8437

6.977

3.4519

10.3557

1.3009

19.99

3.5659

10.6967

1.6419

43.84

20 - 50 =

13^m57^s.54

- 0.51

50 - 80 =

13

56.32

14

876 Oct. 18

 α Ursae Min. E elong. 19^h 18^m

47°.5

	15 ^r to 25 ^r	45 ^r to 55 ^r	75 ^r to 85 ^r
19 ^h	28 ^m 2.0		5 53.0
	28 16.0		6 5.0
	28 29.8		6 19.5
	28 44.8		6 34.0
	28 58.5		6 47.0
	9 12.0		7 2.5
	9 25.0		7 15.5
	9 39.5		7 29.5
	9 53.5		7 44.5
	10 7.0		7 57.5
	10 21.5		8 11.5
	10 35.0		8 26.8
	10 49.0		8 39.0
	31 4.0		8 52.5
	31 16.0		19 ^h 59 ^m 7.0
	31 30.5		9 22.0
	31 45.2		9 34.5
	31 58.5		9 49.5
	32 12.5		~~32~~ 3.2
	32 25.5		0 18.5
	32 39.0		20 0 32.0
19 30	22.14	19 ^h 44 ^m 14.50	19 58 11.60
		17146	

	E 19	19	S.9			$T_{in} S.$
Cor. Rate ∇ Sur						
20.000	19	28	22.14	+	9 ^m 16.24	556.24
50.000		~~42~~	14.484	+	23 9.58	1388.58
80.000		56	11.562	+	37 5.66	2225.66

$$20 \text{ to } 50^r = 13^m 55.30$$

$$50 \text{ to } 80^r = 13^m 54.08$$

Logt + 0.9452

2. 7453	8.23 59	9.1811	0.5152
3. 1426	9.4278	0.3730	2.36
3. 3475	0.0425	0.9877	9.72

116

876. Oct 24

 α Uss. Min. E. elong. $19^h 18^m 60.6$

15.0 to 25.0

45.0 to 55.0

75.0 to 85.0

19^h	7^m	39.5
	7	53.0
	8	6.5
	8	21.7
	8	35.2
	8	50.0
	9	3.2
	9	17.5
	9	31.3
	9	45.5
	9	58.2
	10	12.2
	10	26.5
	10	40.0
	10	53.8
	11	7.7
	11	22.0
	11	35.5
	11	49.0
	12	3.5
	12	17.0
19^h	9^m	58.50

	21	34.6
	21	49.2
	2	3.2
	2	16.4
	2	30.0
	2	44.0
	2	58.2
	3	11.5
	3	26.2
	3	40.0
	3	53.5
	4	8.4
	4	23.0
	4	36.7
	4	48.5
	5	4.0
	5	16.6
	5	32.1
	5	45.2
	5	59.3
	26	12.2
19^h	23^m	53.47

~~35.0~~ 31.0
~~43.5~~
Mean $19^h 37^m 49.32$ $\Sigma 19$ 19 5.7

Cor. Radi r Error

20.000	=	19	7	58.50	- 11 ^m	7.20	- 667.20
50.000	=		21	53.44	+ 1 ^m	48.94	+ 108.74
80.000	=		35	49.26	+ 16 ^m	43.56	+ 1003.86

$$20.650 = 13^m 54.94 - 0.51$$

$$50.680 = 13^m 55.82$$

2.8243	8.4729	9.4181	0. ^s 262
2.0365	6.1095	7.0547	0. ^s 00
3.0015	9.0045	9.9497	0. ^s 89

1876.

$$\sin \phi = 9.8286900$$
$$\lg \phi = 9.9602281$$

$$\phi = 42^\circ 22' 48.6''$$

 α

5

Oct 7	α	hrs.	min	e					
8	α	"	"	w				$\Delta \delta = 0.37110$	
9	α	"	"	e	1^h	14^m	$7^s.1$	$+88^\circ$	$39' 12''$
9	λ	"	"	u	19^h	$+47^m$	$21^s.2$	$+88$	$56 18''$
9	α	"	"	w				$\Delta \delta = 0.26784$	
9	α	"	"	e					
18	α	"	"	e					
24	α	"	"	e	1^h	14^m	$7^s.3$	$+88$	$39 18''$
Dec 1	α	"	"		1	13	53.7	$+88$	$39' 31''$

$$\cos t_0 = \cos \delta \tan \varphi$$

$$\cos Z_0 = \cos \epsilon \cos \delta \sin \phi$$

Δ Oct. q	Col δ	Col. δ by φ	To	Area δ	Area δ Sin φ	Z.
Δ Oct. q.	8.3712175	8.3314456	88° 46' 15"	0.000120	9.828810	47° 36' 20"
~~2~~ Oct 24	8.3706794	8.3309075	88 46 21"			
Δ						
λ Oct q.	8.2679153	8.2281434	89° 1 52"	0.000084	9.828774	47° 36' 35"
		Δ Oct. q =	5	55" 1.5		
		24 =	5h	55m 1.4		

$$\alpha \quad \lambda = 5^h 56 \quad 7.5$$

$$14 \quad 7.1 \quad \underline{19 \quad 47 \quad 21.2}$$

$$\begin{array}{r} \alpha \quad 25 \\ \pm \quad 5 \end{array} \quad \begin{array}{r} 14 \\ 55 \end{array} \quad \begin{array}{r} 7.1 \\ 1.0 \end{array}$$

$$\text{ocl. q. } \left\{ \begin{array}{l} e = 19^{\text{th}} \quad 19^{\text{th}} 6.1 \\ w = 7^{\text{th}} \quad 9^{\text{th}} 8.1 \end{array} \right.$$

$$\text{Oct. 24} \begin{cases} e = & 19 & 19 & 5.7 \\ w = & 7 & 9 & 7.7 \end{cases}$$

$$\text{Assume } 1u = 9''.80 \quad 30us = 29''.400$$

$$1^s.960 \quad \text{Sug} = 21.2923$$

$$8.2678$$

$$\lambda \text{ Urae min.} \quad 1058^s$$

$$3.0245$$

$$1.2923$$

$$8.37118$$

$$\alpha \text{ Urae Min.} \quad 834^s$$

$$2.9212$$

$$\text{Sug } t$$

$$3 \log t$$

$$3.0245$$

$$9.0735$$

$$3 \log t \quad 9.0735$$

$$2.9212$$

$$8.7636$$

$$1.7234$$

$$\text{a.c.b. } 9.2218$$

$$0.0187$$

$$9.0735$$

$$8.7636$$

$$8.2678$$

$$8.37118$$

$$1.044$$

$$1.1761$$

$$1.1761$$

$$8.5184$$

$$8.3108$$

$$8.7636$$

$$1.7234$$

$$9.2218$$

$$\text{Cor. } \lambda \text{ Urae min.}$$

$$\alpha \text{ Urae min.}$$

$$0^s.0330$$

$$0.0205$$

$$9.7088$$

$$1^s.044$$

$$0^s.511$$

$$0.174$$

$$60 / 0^s.511$$

$$1u = 0^s.083$$

$$0^s.008$$

$$0.12$$

$$0.000106$$

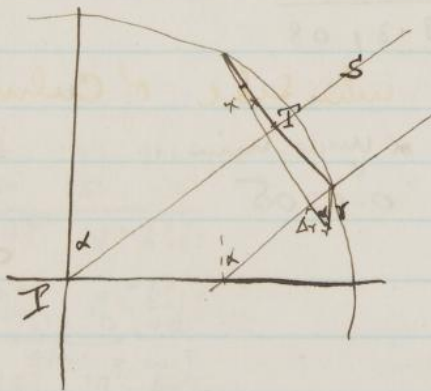
Since the Equatorial was moved in R.A. until the star would transit its middle thread and direct there at the transverse threads, we can no longer consider the effect of refraction and verticality as acting at elongation ~~or culmination~~ when the star has a ~~small~~ ^{large} hour angle.

We shall have for the correction for verticality, putting t = the interval between the mean of 15-25 and 45-55

$$- \frac{1}{6} (15 \sin 1'')^2 t^3$$

$$\begin{aligned} \text{which for } \alpha \text{ near min} &= -0.511 \\ \lambda \quad \quad \quad &= -1.044 \end{aligned}$$

^{corr. for}
The refraction will be proportional to the $\sin$ of the hour angle. for in the figure let



r = difference of the refraction at the two extremities of a short arc I at the time when PS has the hour angle α .

The angle α being small we may assume with all necessary exactness

that $\Delta r = r \sin \alpha$.

and if we assume the differential refraction for 60 rev. per min. at 90° to be 0".37 we have

α		Δr
0°	0 th	0.00
15	1	0.14
30	2	0.19
45	3	0.26
60	4	0.32
75	5	0.36
90	6	0.37
105	7	0.36
120	8	0.32
135	9	0.26
150	10	0.19
165	11	0.14
180	12	0.00

Whence we see that 1th outside of Culmination is insensible in Δr .

∫ We have then

1916. Oct 24	88° 39' 18" + 9.776	30 hrs. = 13 ^m 55.38	Δt at 60° 6	x lunar Min.
Oct 7	88 39 11 0 9.799	53.79	2.38 + 0.028	56.5
Oct. 9	88 39 12 v 9.789	56.93	0.79 + 0.009	54.5
Oct. 18	88 39 15 † 9.783	54.69	3.93 + 0.046	47.5
Oct 9	88 39 12 v 9.789	54.96	1.69 + 0.020	47.0
Oct. 8	88 39 11 0 9.799	55.49	1.96 + 0.023	44.0
Oct. 9	88 39 12 v 9.789	54.03	2.49 + 0.029	44.0
			1.03 + 0.012	

Oct. 9 88 56 18. = 17^m 41.07 47.0 λ lunar Min.

$$\begin{array}{r} 66 \\ 1020 \\ 41.07 \\ \hline 1061.07 \end{array}$$

$$\log 1061.07 = 3.02572$$

$$0.5 = 9.69897$$

$$\log \cos \delta = \frac{8.26784}{0.99253}$$

$$9.829 \text{ } 64.04$$

$$13^m 53^s + \Delta t$$

$$\frac{66}{78^{\circ} 53^s} \log 15 \cos \delta =$$

$$\frac{1.04}{60.4} \times 15 \cos \delta = .260 \cos \delta$$

$$\log \left(\frac{15}{30} \cos \delta \right) = \log .5 =$$

$$9.69897$$

$$9.69897$$

$$+ \log \cos \delta =$$

$$8.37110$$

$$9.07007 = 0.0118$$

$$\log 833 =$$

$$9.07007$$

$$2.92065$$

$$= 0.012$$

$$2.92065$$

$$\log 833 = 2.61962$$

^{on} But δ must be taken out for each date.

+	8.37056	0.99018	9.776
0	8.37119	0.99081	9.799
v	8.37110	0.99072	9.789
†	8.37083	0.99048	9.783

Am Refr. Mer. λ Urae Min. = $-0''.005$

" Incl " " " = $-0.5083 \cos 15. = -0''.0041 - 0.0028$

λ Urae Min = -0.0049

λ Urae Min	$9''.804 - 0''.008$	60.6
	9.808	56.5
	9.835	54.5
	9.803	47.5
	9.812	47.0
	9.828	44.0
	9.801	44.0

λ Urae Min. $9''.829 - 0''.005$ 47.0

Investigating tree whether the screw maintains the same value in different parts of the screw.

	I - II	II - III	III - IV	IV - V
Sept. 13.	9.753	9.809	.803	.756
28	.856	.744	.816	.809
Oct 30	.875	.749	.817	.756
3	<u>.858</u> + <u>3542</u> .835	<u>.807</u> 3109 .777	<u>.772</u> 3208 .802	<u>.809</u> 3130 .782
	V - VI	VI - VII	VII - VIII	VIII - IX
	9.818	.789	.754	.756
	.795	.786	.743	.809
	.812	.817	.791	.894
	<u>.792</u>	<u>.813</u>	<u>.788</u>	<u>.866</u>
	3217	3225	3076	3325
	.804	~~35~~ .806	.769	.831
		9".835	+ 0.035	+ 35
		.777	- 0.024	- 24
		.802	+ .001	1
		.782	+ .019	19
		.804	+ .003	3
		.806	+ .005	5
		.769	- .032	32
		.831	+ .030	30
		<u>6406</u>		<u>74</u>
		9".8007	= 9".8007	<u>75</u>

Assume

$$1 \text{ rev.} = 0^{\text{in}}.01278 \quad \text{Log} = 8.10653 \quad \therefore \text{freq.} \\ (\text{tan}) \text{ Log } q''_{70} = .67185 = 272.07 = 22.51.67 \\ q''_{80} = .67642 = 269.22 = 22.44 \\ q''_{90} = .68099 = 266.40 = 22.20$$

Assume $1 \text{ rev} = q''_{80}$ at 60° F .

$$\therefore \text{Focal length} = 22.44 = f \quad 4f = 89.76$$

$$\text{Put } d+d' = 90^{\text{ft}}.1$$

$$\therefore 22.44 = 22.52 - \frac{(d-d')^2}{360.4} \\ \quad \quad \quad .08 \\ \quad \quad \quad \underline{28.832}$$

$$\therefore \underline{\underline{d-d' = 5^{\text{ft}}.37}}$$

$$\text{Put } d+d' = 89.9$$

$$\therefore 22.44 = 22.475 - \frac{(d-d')^2}{359.6} \\ \quad \quad \quad .04 \\ \quad \quad \quad \underline{14.384}$$

$$\therefore \underline{\underline{d-d' = 3.79}}$$

The least positive value of $(d+d') = 4f$ since $u = \frac{x \pm \sqrt{(x^2 - 4)}}{2}$

$\therefore$ We can approach as near as possible to $4f$, and the correction

$\frac{(d-d')^2}{4(d+d')}$ decreases at the same time.

May 21st 9. 1878.

Mes

File

Apr 2. 1877

Assuming $1^{\circ}.000 = 9^{\circ}.800$ at $60^{\circ}F$ (Micrometer)" $1^{\circ}.000 = 0^{\circ}.041667 = \frac{1}{24}$ in. (Clocks Screw)" $1^{\circ}.000$ Microm. = $0^{\circ}.30674 \pm .00029$ Clocks Screw

we have

$$1' \text{ of arc} = \frac{60}{9.800} = \overset{\text{in}}{6.122442} \quad \text{Log} = 0.78692$$

$$1 \text{ rev. N.C. Microm.} = 0^{\circ}.041667 \overset{(.61979)}{\times} \overset{(.48671)}{0.3067} = .012779 \text{ inches}$$

 $\therefore 1' \text{ of arc} =$ at the sidereal focus of the
great equatorial.

1" " =

2" " =

$$25 \text{ revs. of the Microm. screw} = 25 \times 9^{\circ}.800 = 245^{\circ}.00 = 4^{\circ} 5^{\circ}.0$$

$$\begin{array}{r}
 \overline{2.61979} \\
 \overline{1.48671} \\
 \hline
 \overline{2.10650} \\
 \overline{0.78692} \\
 \hline
 \overline{2.89342} \\
 \overline{0.0782384} \\
 \hline
 1' = 0^{\circ}.0782384
 \end{array}
 \quad
 \begin{array}{r}
 \overline{2.61979} \\
 \overline{1.48671} \\
 \hline
 \overline{2.10650} \\
 \overline{0.08792} \\
 \hline
 \overline{2.19442} \\
 \overline{0.015647}
 \end{array}$$

$$\begin{array}{r}
 1'' = 0^{\circ}.001304 \\
 2'' = 0^{\circ}.002608
 \end{array}$$

May 21st. 9. 1878.

Measure of the Eccentricity of the Screw Head &c. of the
filan Micrometer. Index + 5.0

	70 ⁰⁰⁰ _{42.5}	50 ⁰⁰⁰ _{42.5}	30 ⁰⁰⁰
.250	47.5 - 0.0	47.5 - 0.1	
.500	- 0.2	0.0	
.750	- 0.3	0.0	
1.000	0.0	- 0.3	
.250	0.0	0.0	
.500	0.0	0.0	
.750	0.0	- 0.4	
2.000	- 0.4	0.0	
.250	+ 0.1	+ 0.1	
.500	0.0	+ 0.1	
.750	- 0.1	- 0.4	
3.000	- 0.5	- 0.5	

The deviations include the variations of the stand, and the

$$\frac{1}{75}$$

$$\frac{1}{750}$$

$$\frac{1}{7500}$$

$$\frac{1}{75000} = \frac{1}{32000}$$

$$0.2$$

$$9''.8$$

$$1 \text{ div} = 0''.098$$

$$1 = 0''.01$$

$$\frac{d}{0.2}$$

$$0.1$$

$$\frac{0.3}{425} = \frac{1}{145}$$

$$\begin{array}{r} 9''.8 \\ .002 \\ \hline 0.0196 \end{array}$$

$$\begin{array}{r} 1 \text{ Rev.} = 0''.01278 \\ .002 = \frac{.002}{0''.00002556} \end{array}$$

1876. Repl. 13. λ Ura. min.

9."7883

10''

In consideration of my duties at
the observatory being restricted to the
management of the time service, to
~~abandon to the~~ & for. of my present
salary, which is to be applied to
And the observatory furnishing an assistant
who shall perform the ordinary routine
work thereof, & abandon to the
observatory & for per annum of my
present salary.

noted

1876, vol. I, pt 3

noted

noted

