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11 Focal length eyepieces
23 Accuracy of setting cross wires slides 28
24 Errors of wire tips
55 Summary measurement eyepieces.

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Measurements

Experiments for determining the focal length of the eye pieces of the East Equatorial.

Frank Waldo Obs. & Rec.

884.6	854.5	840.1	746.8	664.2	801.2	847.1	899.1	923.7
600.0	570.0	555.6	462.3	379.7	516.7	557.6	614.5	638.1
284.6	284.5	284.5	284.5	284.5	284.5	284.5	284.6	284.6

944.5
660.0
284.5

Eye Piece No. 3.

	E	F	E−F		E	F	E-F
A = 600.0	887.1	887.4	893.9	A = 560.0	847.1	847.6	853.0
B = 884.5	884.5	884.5	884.5	B = 844.5	844.5	844.5	844.5
	2.6	2.9	9.4		2.6	3.1	9.5

853.0 868.5 845.
.5 844.5
868. .5
853
15.0 = Diaphram to eye lens.

Eye Piece No. 5.

	F	E	E−F		F	E	E − F
A = 560	846.2	845.9	849.0	A = 550.	836.2	835.8	839.0
B = 844.5	844.5	844.5	844.5	B = 834.5	834.5	834.5	834.5
	1.7	1.4	4.5		1.7	1.3	4.5

A = 560
B = 844.4

854.6 844.7
.3 844.4
854.3 .3 Thickness of glass.
4.5
849.8
844.4
5.4 Diaphram of eye lens.

Eye Piece I IV I (Notches).

	E	F	E−F		E	F	E − F
A = 530.	817.5	819.5	874.5	A = 500	787.5	789.5	844.4
B = 814.4	814.4	814.4	814.4	B = 784.4	784.4	784.4	784.4
	3.1	5.1	60.1		3.1	5.1	60.0

8444 878.5 894.4 928.4
.3 3
878.2 928.1
844.4 894.4
33.8 Diaphram to eye lens. 33.7 Diaphram to eye lens.

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Eye piece I IV I Notches.

D = 96.0 Lens f, convexity toward eyepiece

F = 747.8

352.4 = E = 352.9, 351.7, 352.7, 351.8, 352.8 (19) E = 244.8, 244.0, 244.9, 244.4, 245.0 (11) = 244.6

352.4 − 244.6 = 107.8

747.8 − 96.0 = 651.8 + 139.5 = 512.3

Lens f Convexity away from eye piece

625.8 E = 627.5, 625.3, 624.5, 625.0, 626.8 (9.1) E = 515.7, 519.0, 517.0, 516.8, 517.9 (6.4) = 517.3

625.8 − 517.3 = 108.5

A = 150 5.4 = inequality in length.

B = 432.4

282.4 + 5.4 = 2|2 77.0

A = 138.5 = less. + 5.4

B 143.9 = greater

442.3 − 432.4 = 9.9 = from face of groove to hair lines.

300 − 187.9 = 112.1

143.9 − 31.8 = Thickness of F from surface to end.

298.8 − 200.0 = 98.8

143.9 − 45.1 = Thickness of F from face of groove to cut on Brass.

9.9 + 55.0 = Thickness of F from cut on Brass to Hair lines, Hole in Cardboard.

653.7 − 433.7 = 223.0

138.5 + 84.5 = Thickness from mark on D to cross hairs. Hole in Cardboard.

The Eye piece for focusing was on D.

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Eye. Piece II. III. III. (Notches).

A = 550 F 836.9 E 836.5 F-E 863.6
B = 834.4 834.4 834.4 834.4
2.5 2.1 29.2

876.7
3
876.4
834.4
42.0
29.2
12.8 Diaphram to eye lens.

A = 600 F 888.8 E 886.8 F-E 913.4
B = 884.3 884.3 884.3 884.3
4.5 2.5 29.1

Transpose

926.6
3
926.3
884.3
42.0
29.1
12.9 Diaphram of eye lens

Eye Piece II. III. II. (Notches).

A = 550 F 839.0 E 837.1 E-F 874.1
B = 834.4 834.4 834.4 834.4
4.6 2.5 39.7

886.6
3
886.3
874.1
12.2 Diaphram to eye lens

A = 600 F 887. E 886.7 E-F 924
B = 884.4 884.4 884.4 884.4
2.6 2.3 39.6

936.4
.3
936.1
924.
12.1 Diaphram to eye lens.

Eyepiece I IV I. Notches.

D = 231.6 lens E convexity toward eye piece.
F = 747.8

365.1
X
363.9 E = 363.0 E = 473.6 = 473.8
364.4 473.8
363.1 474.2
364.0 473.7
19.8 473.8
19.1

473.8
363.9
109.9

lens E, convexity toward eye piece.

533.0
532.8 E = 533.0 E 641.5 = 641.8
532.7 641.6
533.1 642.4
14.2 641.4
642.0
8.9

641.8
532.8
109.0

747.8
231.6
516.2
139.5
376.7

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Eyepiece 1.14.1. Obs. E. C.B.

F = 792.8 D 372.3

792.8
372.3
420.5
139.5
281.0

ε to D		ε to F	
699.6	610.8	583.2	494.1
9.1	8.8	3.3	5.4
8.6	8.9	E 4.0	4.2
E 8.7	E 9.8	3.4	E 4.4
9.0	8.2	3.7	3.1
699.00	65	26	1.2

699.00 − 609.30 = 89.70 583.52 − 494.24 = 89.28

F ~~E~~ 800.0 ε to I D = 400.0 ε to D

578.6	553.7	692.6	649.8
6.5	5.8	3.3	1.0
8.8	6.3	2.9	0.4
E 7.1	E 3.4	E 1.4	E 0.6
8.4	4.2	3.0	0.6
44	27.0	13.2	26

577.88 − 555.40 = 42.48 692.64 − 650.52 = 42.12

683.3 reading of A.
565.9 reading of E
117.4
138.5
21.1 Dist f from E.
Preceding position of eye piece.

600.0 = E
483.6 = A
116.4
138.5
22.1 Dist f from E
following position of Eyepiece

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F = 800.0 D = 200.0 Obs. 7th.

E toward F.

	601.9
	601.8
E	601.4
	601.5
	601.6

288.0
E strikes D.

E = 600.0
A = 492.3
107.7
1 38.5
20.8 dist. f from E Obs. 6th Rec. 7th.

F = 800.0 D = 200.0

E toward F

	602.6		288.9
	602.8		290.2
E =	603.0	E =	289.5
	602.8		289.4
	603.0		289.6
	602.84		289.52

(E = 600.0
A = 642.9
255.8
1 38.5
104.3 f from E)

E toward D.

	602.9		290.3
	603.1		~~290.9~~
E	603.0	E	290.2
	603.0		290.1
	602.9		290.2
	602.98		289.8
			290.16

600
200
600
139.5
460.5

800.
Return 55
reading ~~745.0~~ 745.0

reading of E. 683.74
return 602.84
289.52
313.32
339.14
25.82

Altered focus for D. D placed between B + A.

B = 425.1	B = 425.1	425.2	425.2	425.2	425.1
A = 105.1	A 103.6	102.4	102.4	102.6	102.4

3.6
24
2.4
2.6
2.4
24
2.64

Hence above reading of D must be diminished by
105.1 − 102.6 = 2.5

423.0
139.5
283.5

F	792.8	800.0	800.0
D − 2.5	369.8	397.5	197.5
D to F	423.0	402.5	602.5
E to D	89.70	42.48	313.32
F	89.26	42.12	312.86
E to f	21.1	21.1	20.8
	21.1	21.1	104.3
F to pinhole	53.0	55.0	55.0
reading pinhole	737.8	745.0	745.0
D to knife	84.5	84.5	84.5
reading knife	453.3	482.0	282.0

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Residuals

		f				
D	372.3	96.0	96.0	$v+u$ =	791.3	789.4
Cor.		84.5	84.5	$u-v$ =	108.1	108.1
		11.5	180.5	$2u$		681.5
				u		340.75
						340.75
F	792.8	747.8	747.8			897.7
Cor.		55.0	55.0	v	109.4	448.85
		802.8	692.8	$\frac{1}{u}$ =	29347	
			180.5			
			512.3	$\frac{1}{v}$ =	22279	
			1.7			
			Σ	$\frac{1}{F_f}$ =	51626	F_f = 193.7
		231.6	231.6	$v+u$ =	655.7	654.7
		84.5	84.5	$u-v$ =	109.4	109.4
		147.1	316.1	$2u$		545.3
				$2v$		272.65
				$2v$		764.1
		747.8	747.8	v		382.05
		55.0	55.0			
		802.8	692.8	$\frac{1}{u}$ =	36677	
			316.1			
			376.7	$\frac{1}{v}$ =	26575	
			375.7	$\frac{1}{F_\varepsilon}$	62852	F_ε = 159.1

	f	ε			
$v+u$ =	510.6	375.7	$\frac{1}{u}$	49679	.75103
$v-u$ =	108.1	109.4	$\frac{1}{v}$	32326	.41228
$2u$	402.5	266.3	$\frac{1}{F}$	.82005	1.16331
$2v$	618.7	485.1	F	121.94	85.96
u	201.25	133.15			
v	309.35	242.55			

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Eyepiece 1, IV, 1

Thickness E 3.1 focus = ~~159.1~~ 85.96

" f 5.1 " " ~~192.7~~ 121.94

pl. surf. of f 60.1

dist. opt. cnts. 57.9 ε 683.04 369.72 647.18 334.32 3d set

f 622.94 309.62 707.28 394.42

664.72 574.44

~~readily~~ pinhole & pl. surf. ε 616.8 508.1 ~~604.04~~ 514.34 1st set

f 676.9 588.2 604.62 514.34

~~hairs~~ readily & pl. surf. ε 658.08 615.60 612.44 570.32 2d set

2d Set f 597.98 555.58 672.54 630.42

pinhole 737.8 737.8 745.0 745.0 745.0 745.0

~~hairs~~ 454.3 454.3 482.0 482.0 282.0 282.0

~~pinhole & hairs~~ 283.5 283.5 263.0 263.0 463.0 463.0

ε Cornu D ε Cornu T

Pin hole to ~~plane~~ surface ε 121.0 208.7 73.08 163.36

" " " " " f 60.9 149.6 133.18 223.46 1st set.

Cross Hairs to pl. surface ε 162.5 73.8 210.42 120.04

" " " " " f 222.6 133.9 158.32 60.04

ε Cornu T ε Cornu D

Pin hole to pl. surface ε 86.92 129.40 132.54 174.68

" " " " " f 142.02 189.50 72.44 114.58 2nd set

Cross Hairs to pl. surface ε 176.08 133.60 130.44 88.32

" " " " " f 115.98 73.50 190.54 148.42

Pin hole to plane surface ε 61.96 37.28 97.82 148.68

" " " " " f 122.06 43.38 37.72 350.58 3d set

Cross Hairs to plane surface ε 401.04 87.72 365.18 52.32

" " " " " f 340.94 27.62 425.28 112.42

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F = 800 D = 300

E toward D.

	506.4	706.7	Extend F 600.2	Ref = ~~310~~ 278.2
	506.9	706.8	.3	9.2
507.08	E = 507.0	E = 706.4	.2	8.8
	507.4	706.7	.1	9.4
	507.7	706.5	.4	8.8
	4	706.62	600.26	4 398.84
		699.62		

B = 672.7

E = 535.8 — 136.9 — 143.9 — 7.

800. − 535.0 = 745

699.62 − 745 = 45.38 dist f from fiducial hole on F

from cut on E to f 105.48 " E " " " "

(second set)

	527.2		
	7.8		
	7.6		
	8.1		
	8.6		
4	43		
	527.86		

oc. 36.87

507.08

7

500.08 Reading of f

~~384.5~~ 115.58 dist f from hairs D.

1st set 60.10

55.48 dist E from hairs D.

These measurements with cut on E away from D.

84.5

55

139.5

check.

B = ~~495.8~~ 476.0

~~19~~ 18.8

~~287.8~~ 297.0

~~30 7.0~~ ~~295.8~~ 278.2

Check

A

520.0

501.2

18.8

297.0

295.8

278.2

B

525.8

495.9

29.9

257.8

257.9

500

139.5

360.5 dist from wire to hole in cardboard.

55.48

1st set 305.12 = dist E from fiducial hole.

360.5

115.58

244.92 = dist f from Rein hole.

360.5

45.38

315.12 = dist f from hairs on D.

360.5

105.48

255.02 = dist E from hairs on D

137.3 — 1320

143.9 — 1385

6.6 — 65

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500.0 F & D
445.0 μ - D
360.5 μ & h.
520
308.5
60.1
100.4
6.6 f & hair.

248.4 f Cl

107.0
55
520

69
34
310

800
706
93.4
6.6
100.0
55.0
45.0
60.1
105.1

360.5
105.1
255.4

500 D & F
137.6
362.4 μ & h.
43.7
318.5 h & f
60.1
258.4

μ & h = 258.2

800.0
55.
745.0
652.0
94.0
6.6
100.6

360.5
56.1
304.4

500.
137.6
362.4
520
310.4
60.1
250.3

699.62
3000
399.62
60.1
339.52

7000
3000
4000
60.1
339.9
84.5
255.4

f = 700.0

200.0
143.9
56.1
F

220.0
138.5
81.5
D

1.9

800.0
56.1
743.9

55.1
81.5
137.6

527.86
398.88
128.98

489.2
180.8
138.8
28.0

600
483.6
116.4
143.6
27.2

5.6

600.0
489.3
180.7
138.4
27.9

600.0
483.7
116.3
143.6
27.3

687.3
404.5
282.8
5.6
277.2
138.6
5.6
144.2

489.0
111.0
138.6
27.6

483.4
116.6
143.6
27.0

Optical Center.

506.8 420.3
6.4 420.3
506.6 420.3
20.3
486.3
13.2
473.1
365.5
364.5

600.6
396.48
91.38

396.88
27.6
426.48
500.26
73.78
36.89

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Measures A.B:

F = 500.0 A 4000

A = 632.4 B 682.6

A+B 282.6

637.5 5.1

B = A + 5.1 277.5

138.75 138.5

5.1

143.6 143.9

632.5

3500

2842.5

14.9

277.6

138.8

4.9

143.7

8929

A = 138.8

B = 143.65

8000

606.1

193.9

138.8

55.1

800.0

600.8

199.2

143.65

55.55

1' 100.0

2

3

4

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1" = 25.4 Mill.

33 ft. tape.

1 ft = ~~863.3~~

3 ft = 914.0

1 ft = 304.5

50 ft tape.

3 ft = 914.5 } 1'-4'

1 ft = 304.7 } 2'-3'

Readings

	2' 0" = 300		25.6	+.4
+.4	2' 1" = 325.8		25.2	-2 325.4
+.2	2' 2" = 351.0		25.5	+1 350.5
+.3	2' 3" = 376.5		25.3	-1 376.2
+.2	2' 4" = 401.8		25.4	401.6
+1.2	2' 5" = 427.2		25.5	+1 426.0
+1.3	2' 6" = 452.7		25.3	-1 451.4
+1.2	2' 7" = 478.0		25.2	-2 476.8
+1.0	2' 8" = 503.2		25.3	-1 502.2
+.9	2' 9" = 528.6		25.4	527.6
+.9	2' 10" = 553.9		25.4	553.0
+.9	2' 11" = 579.3		25.4	578.4
+.7	2' 12" = 604.5		25.2	-2 603.8
			25.4	15/12 = .125

Gurley Cloth Tape Millimeters Rod

8"-9"

0	= 300		
1	= 303.2	3.2	dif.
2	= 306.3	3.1	-0.1
3	= 309.3	3.0	-0.2
4	= 312.4	3.1	-0.1
5	= 315.6	3.2	-0.0
6	= 318.8	3.2	-0.0
7	= 322.1	3.3	+0.1
8	= 325.2	3.1	-0.1

Millimeters Cloth Tape Rod

decimals Cloth Tape

50 = 20

60 = 23.95 wooden rod.

50.5	= 20.19	.19	-.005
51.0	= 20.39	.20	+.005
51.5	= 20.59	.20	+.005
52.0	= 20.78	.19	-.005
52.5	= 20.98	.20	+.005
53.0	= 21.18	.20	
53.5	= 21.37	.19	-.005
54.0	= 21.57	.20	+.005
54.5	= 21.77	.20	+.005
55.0	= 21.96	.19	-.005
55.5	= 22.16	.20	+.005
56.0	= 22.36	.20	+.005
56.5	= 22.55	.19	-.005
57.0	= 22.75	.20	+.005
57.5	= 22.95	.20	+.005
58.0	= 23.15	.20	+.005
58.5	= 23.35	.20	+.005
59.0	= 23.55	.19	-.005
59.5	= 23.74		+.015
60.0	= 23.95	.21	

Steel Tape Millimeters Rod

2'	= 200.0		
2'.1	= 230.3	30.3	-0.3
2'.2	= 260.7	30.4	-0.1
2'.3	= 291.1	30.4	-0.1
2'.4	= 321.6	30.5	-0.0
2'.5	= 352.1	30.5	-0.0
2'.6	= 382.6	30.5	-0.1
2'.7	= 413.0	30.4	-0.0
2'.8	= 443.5	30.5	-0.0
2'.9	= 474.0	30.5	+0.1
3'	= 504.6	30.6	

Steel Tape Millimeters Rod

2'.10	= 200	3.	-.05
2'.11	= 203.	3.	-.05
2'.12	= 206.	3.1	-.05
2'.13	= 209.1	3.0	-.05
2'.14	= 212.1	3.0	-.05
2'.15	= 215.1	3.0	-.05
2'.16	= 218.2	3.1	+.05
2'.17	= 221.2	3.0	-.05
2'.18	= 224.3	3.0	-.05
2'.19	= 227.3	3.1	+.05
2'.20	= 230.35	3.0	-.05
		3.05	

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33 ft. tape

dec. Nelson.

10	=	00			
20	=	3.9×3	3.	3.93	
30	=	7.88		3.95	
40	=	11.81		3.93	
50	=	15.74		3.93	
60	=	19.69		3.95	
70	=	23.62		3.93	
80	=	27.55		3.93	
90	=	31.49		3.94	
100	=	35.48		3.99	35.56 3.94
110	=	39.37		3.89	35.50 3.92
					35.42

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1877phae.proj.00151

Accuracy of setting Compass Alidade
June 5th 1877. Gable of Memorial Hall.

294° 20' 10"	35"	decidedly to right 22' 40"
~~30~~		and equally " " left 17' 0.
20' 30"	55"	
18' 30"	65"	
19' 58"	15"	+ 3' 5"
19' 20"	15"	- 2 35"
19' 10"	25"	
18' 50"	45"	
18' 40"	55"	
~~20' 10~~	35"	
20 40	65"	
290		

294 19 35 ± 36" 41" 41.0"

Arc = Lemniscate

53° 59'	1
59.5	4
60.0	9
59.	1
58.5	6
59.	1
59.5	4
59	1
59	1
58.5	6
	34.5
10	2.9

59.1 ± .29
15".4

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1877phae.proj.1151

Comparison of graduations of 33 ft. tape.

Meters				1/8"
1.	=	3′	3″	2.9
2.	=	6	6	6.05
3.	=	9	10	1.40
4.	=	13	1	4.2
5.	=	16	4	7.0
6.	=	19	8	1.8
7.	=	22	11	5.2
8.	=	26	3	0.0
9.	=	29	6	3.2
10	=	32	9	6.2

Differences.

3′	3″	
		3.15
2	3	5.35
3	3	2.8
3	3	4.8
3	3	3.4
3	3	4.8
2	3	3.2
3	3	3.0

3	3	3.15
3	3	3.35
3	3	2.80
3	3	2.8
3	3	2.8
3	3	3.4
3	3	2.8
3	3	3.2
3	3	3.0

	Reduced	Correct.	Differences.
1	39.36	39.37	−.01
2	78.76	78.74	+.02
3	118.17	118.11	+.06
4	157.53	157.48	+.05
5	196.88	196.85	+.03
6	236.22	236.22	+.00
7	275.65	275.59	+.06
8	315.00	314.96	+.04
9	354.40	354.33	+.07
10	393.77	393.71	+.06

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Measurements for A+B.

A = 590.1
B = 586.7
3.4 dif.

611.4 = A.
341.3 = B
270.1

B = 559.4
A 562.9
3.5 dif.

568.8 = A
298.8 B
270.0

545.4 A
542.0
3.4

A = 630.4
B = 360.3
270.1

270.1 = sum.
3.4
2 | 273.5
136.75 = B.
3.4
133.35 = A.

244.3 B
514.3 A
270.0

476.9 A
208.85
270.05

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1877phae.proj.11511

Assume large notch in microm. as $+\frac{30}{30}$ Whole revolution

Readings of stationary wire. $\frac{30}{30}$

	56.1
	53.5
	54.3
Eye Piece I II I Notches	54.6
	55.2
	55.0
	55.0
	54.1
$\Sigma/8$	7.9
Reading of Stationary wire = 30 +	54.74

(End of Bars)

G = 100.0 C = 257.1 F = 876.7

Scale. contact. } Reading of Wire.

.5	=	~~48~~	75
1.5	=	~~44~~	25.5
2.5	=	39	79.5
3.5	=	35	26.0
4.5	=	30	75.0
5.5	=	26	22.9
6.5	=	~~21~~	67.0
7.5	=	17	12.9
8.5	=	12	61.0
9.5	= −	8	10

differences.

4	49.5
4	46.0
4	53.5
4	51.0

B = 353.6
1.3
352.3
352.3
136.75
352.3
136.75
115.55
out of 6 to turn of microm.

876.7 E
783.4 B.
782.1 B + glass
1.3 glass

C 538.9
B = 385.0
153.9
136.7
17.2
dist glass E from mark on C

E toward mark on C.

C = 257.0

3.5	=	35, 147
4.5		30, 61
5.5		26.50
6.5		21.53
7.5		16.97
8.5		12.46

E away from mark on C.

712.5 B
336.9
375.8
319.0 = C
313.5
56.8

136.7
200
336.7
313.5
23.2

dist. glass E from mark on C.

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1877phae.proj.1151

June 9th 1877 Probable Error of ability compass alidade ~~Table~~ for vertical angles. Object Memorial Hall.

				E.C.	Prob. W.H.P.
0.4	7.6	7.2	3		
4.4	11.2	6.8	1	0	4
2.8	9.6	6.8	1	0	4
~~4.6~~	11				
0.4	7.3	6.9	0	1	6
1.1	7.8	6.7	2	1	14
7.9	14.8	6.9	0	1	6
1.6	8.4	6.8	1	0	4
2.9	9.7	6.8	1	0	4
1.2	8.2	7.0	1	2	16
7.9	14.8	6.9	0	1	6
		68	.1		64
		6.88			.071

68.4

204

1 mm. = 6.8

.408"

Av. dev. = .1 mm mean = 6.8

Prob Er. = .086 mm. " = .66

" " " =

	41"	32"	diff two readings
Prob Er.	35"	28"	

W.H.P. obs.

Prob Er. diff readings

~~4.2~~ ~~0.6~~ 24".5 19".6 14".7

0.5	6.2	5.7	2	19
1.5	7.4	5.9	0	1
~~7.3~~	3.2	5.9	0	1
8.3	14.2	5.9	0	1
7.1	13.1	6.0	1	11
		5.88	.6	33 | 5
				.068

25"

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Probable error of vertical angles.

Viewed ~~Burnt Hill~~ Marker and observed vertical elevation of two triangulation signals. Moved alidade and repeated.

Mean deviation = .1 mm. objective lab obs. = .071 mm
Prob. Error = .086 " " " = .065
= 41." = 32"
= 35."

Diff of Obs.				Single Obs			
Mean Dev.	P. E.	Mean Dev.	P. E.				
mm .1	mm .086	41"	35"	.070	.060	29"	25"
.071	.064	29"	25"	.050	.043	21"	18"
.068	.061	28"	24"	.047	.040	20"	17"

Hence vertical angles may be relied upon within a contour alidade within about half a minute

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June 8 & 1877 6h. 74° 29.962 Cloudy

Blue Hill tel B

151.0 39.8 10.4 — 390 447 Rev. + .5
.13 — 37.0 38.94 .13
151.13 — 50.2 7.7 — 39.2 151.13
60.1 +112.19 = all Blue Hill.

1.520 39.8 10.2 — 39.4 44 39.94
tel A.

1.310 4.0.4 11.0 — 2.4.4.3 ?2433 + 1.7 136 .45
~~2.75~~
130.55 — 51.4 — 2.432
.434 2.432
130.55
112.65
112.19
54
112.42 = all Blue Hill.

1.310 40.4 11.0 — .431

Anby Ho. still of Cambridge + 2.6 16 .54

169.0 40.4 11.5 — 4004 10
.54
168.46 — 52.3 — 4004 400.20
168.46
231.74 — all GH.

10 3
53.4 — 54.3 — 3997

169.0 41.6 12.7 — 399.5

53.7 — 400.7

1690 41.1 12.6 — .1

.2666

151.0 Rev. 49.1 .266
38.94 .6
112.06 .16
16
111.90

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Continued Measurements of Eye Piece I II 7 Notches. W.P. Observer.

With f toward Marks on C.

G = 200. C = 426.3. F = 750.

The brass on C is away from G

Reading of stationary wire in Mic. = 30.4

Scale, Mill. Gm. } Reading of Mic. 30.49 = stationary mic.

40 = 38.66

39 = 39.45

46 = 35.15

50 = 31.17

57 = 25.92

63 = 21.38

69 = 16.85

75 = 12.36

B = 628.4

C = 500

128.4

118.6

10.2

B = 136.75

8.35 dist from f to End of brass on C.

---

44 = 34.69

50 = 30.26

55 = 26.50

62 = 21.26

68 = 16.74

74 = 12.26

C = 367.8

With f away from mark on C toward End of brass on C toward G

B = 746.0. C = 359.6

559.6 2 no.

186.4 359.6

136.75

49.65 = dist from f to End of Brass on C

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Measurements of Eye Piece II III III Notches

G = 100. C = 219.4 F = 545.2

Centigrams Revolution
scale. Mic.

1 = 42.20
2 = 38.86
3 = 35.355
4 = 31.85
5 = 28.25
6 = 24.63
7 = 21.01
8 = 17.40
9 = 13.845

43.4
588.6

& toward Micrometer T
& toward Outer brass.

C = 450.

B = 320.4

129.4
136.75
7.35

219.4
226.75 = reading of E.
29.2
255.95 = Reading of F
588.6
332.65 dist from F to scale.

B = 481.9
F 575.2
93.3
136.7
43.4
dist. of scale from mark on F

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Measurements of eye Piece II III II Notches

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Friday June 15th 1877. At Mr. Gaines's request looked for occultation of Uranus. F. M. obs.

Time conjunct. 11h 30m C.M.T. time in about 12h 40m
em. 11h 50m. Position angle 135° Computed altitude is used.

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Magnifying Power of various eyepieces
& Eyepieces.
Ring Micrometer 3. Effect of Diffraction.
Micrometer turned towards

	diam		light thr.		light thr.
205.6	794.4	12.073	1203.0 d	806.0 b	
204.6	795.4	12.069	1202.7 b	804.9 d	
208.5 b side	791.5	12.023 b	1202.1 d	807.4 d	
206.0	794.0	12.046	1202.0 b	806.7 b	
209.6 b side	790.4	12.065 b	1203.8 d	807.5 d	
	15.7	27.6	13.6	3.5	
806.9	~~793.1~~	1205.52	1202.72	806.50	
		793.1			
double diam =	~~4.71~~	~~462.1~~		double	thr.

Coincidence	~~1003.4~~		~~1205.52~~	1205.52	1202.7
obs. no. 4	093		~~793.1~~	806.9	806.50
diff. 1003.4	08.1		1998.62	2012.4	2009.2
	07.7		999.31	398.62	396.2

double diam = 398.62 396.2

~~1205~~ 09.1
06.9
4'1

Coincid. 1008.22 1006.2 1004.6

α Ursae Majoris 65.25 did not find.
294 35
291 35

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June 18th 23h. Sounded lines a glass a stem. Lay 2h. Found distance of edge 60.5 cut eyepiece

Focus Rear. reg by obs. 21.4		Focus W 7.1		
5.030	15.093	1505.7	507.5	~~E.P. Obs~~ Mk. Obs.
5.069	.060	8.7	6.2	
5.043	.070	9.5	9.5	Contact of
5.060	.081	11.0	6.1	Diaphragm.
5.085	.111	8.9	6.6	
287	415	43.8	35.9	
50.57.4	1508.30	1508.76	507.18	
1002.56		1001.48		

E.E.P. obs.		Mk. Focus	Chard focus dynam.
4.708	15.382	1531.0	1538.8
4.716	.376	29.0	1538.4
.728	.380	37.9	1543.0
.726	.374	37.8	1542.8
.717	.	45+	1540.4
95	312	changes below as eye moves.	
471.90	1537.8	1537.8	
1065.9 ~~40 06~~ 5.9	47.9	4.719	
		10.659	

.82.9	Tried softly
.815	without moving
.785	heads
.770	
.739	

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Eyepiece

No 3. Div. Lines	6.2 Div. Lines			Eyepiece 3
770.0	767.9	1255.9?	12.392	12.410
68.2	764.6	47.6	.386	.414
71.0	770.1	~~65.3~~ 50	.403	.398
69.3	768.3	50.2	.416	.396
72.0	767.1	55.4	.404	.406
350.5	38.0	50.6	12.545 12.402 .193 } 2.001	2.027
7.676 7710 .034		46.0		
770.10	767.60	1255.7 9.5	~~12~~ 12.400	12.405 7.673 4.732

Eyepiece 3	Eyepiece 4	Eyepiece 4.
7.675	8.166	11.918
.677	.164	.904
.654	.194	.916
.666	.152	.916
.691	.162	.904
63	338	58
7.673	8.1676	11.912 8.1676 3.7444

No. 5	No. 5	
~~11.127~~	8.976	
11.131	.966	
11.126	.961	
11.132	.949	
11.142	.968	
58	320	
~~11.132~~	8.964	Readings before this set at 6.5. After this at 6.0.5
11.132	11.132	
~~this at 6.0.5~~	2.168	

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No 7	No. 7	No 8	No. 8
9.416	10.697	12.037	8.058
.420	.692	.049	.042
.417	.702	.054	.035
.400	.701	.036	.053
.408	.685	.037	.046
61	671	213	234
9.412	10.715	12.043	8.047

10.715
9.412
1.303

12.043
8.047
3.996

No. 9	No. 9	No. 3	
9.456	10.658	12.420	7690
.446	10.664	.404	665
.444	.652	.404	674
.438	.634	.414	186
.443	.666	.412	674
227	274	54	393
9.445	10.655	12.411	7.679

10.445
9.655
0.790

10.655
9.445
1.210

12.411
7.679
4.732

No 2 found the 4 corr.

~~4.545~~	724	11.892	8.164
486	676	921	151
510	684	916	166
548	711	918	172
574	734	909	158
516	718	56	331
436	47	11.917	8166
70	709	8.162	
		3.7450	

.514
.706
1080 8

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No 6 ?8 (1941

9161	10926	10.544	9.540
16.5	92.7	.558	.552
14.9	92.4	.552	.556
16.7	92.9	.546	.554
15.4	92.9	.554	.543
296	35	248	5
9.159	10.927	10.5496	9.549
	9.159	9.549	
	1.768	1.0006	

8	10.56	9.56	1.00
9	10.441	9.664	.777

	I	II	III	Magnifying Power	II	Mag. Power from Annals Vol I	diff.
2	7.2452			206.2		206.	
1	10.659	10804?	10.6274	140.2		141.	+.8
3	4.732	4.732		315.8		316.	+.2
4	3.7444	3.7450		399.1		401.	+1.
5	2.168			689.6		688.	-1.6
6	1.764			850.7		861.	+11.
7	1.303			1146.6		1243.	+96.4
8	1.0006	1.00		1493.1		1561.	+67.9
9	~~+.790~~ +.778	.787		1891.3	1923	2004. ⊙	+81. +112.7
Sat.	3.996			373.9			
1							
2							
3	6.4746			230.8		229	-1.8
4	4.0534			368.6		373	+4.4

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No. 9.

10.445 9.664
10.438

10.4415
9 66
78

No. 2.

13.708
13.699
.656
.656
.667
386

13.6772
6.432

7.2452

No 2.

~~7~~.431
6.418
.416
.429
.446
.452
192

6.432

No 1.

4.796
.766
.784
.806
.758
410

4.782

No 1

15.397
.396
.432
.413
.409
47

15.4094
4.782

10.6274

Ring Nuc. No. 4.

12.062
.083
.049
.081
.053
328

12.0656
8.0122

4.0534 dif.

8.006
.016
.016
.009
.014
61

8.0122

Ring. Nuc. No. 3.

6.840
.804
.813
.826
.791
74

6.8148

13.303
.296
.273
.292
.283
447

13.2894
6.8148

6.4746

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Measurement of screw Dynamometer

+2 mm	−2 mm
15.944	6.084
16.007	.186
15.948	270
15.952	6.135
15.188.2	
.959	
292	
15.949	
6.135	
4|9.814	

~~4.051~~ 3.949

14.135

? 5\|10.186

2.037

? 5\|9814

1.9628

2.4535 = 1 Millimeter = .03937 in.

2.4535 \| .03937 \| .01605

24535

148350

147210

114000

10 turns of screw = 2.6 Millimeters.

−.08 =	+.08 =
6.056	13.974
6.097	.981
6.078	.946
6.084	.967
6.124	.956
435	324
6.0870	13.9648
	6.0870
	~~10~~ | 7.8778
	4|1.96945
	.49236

1,000000 \| 2.0314

98472

15280

14770

509

492

17

4

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−2 Mm.	= 13.840	
		1.82
−1	= 12.020	
		1.890
0	= 10.130	
		2.010
+1	= 8.120	
		1.960
+2	= 6.180	

1 inch = 25.4 mms $\frac{1}{50}$ inch = .508 mms

Diameter of Objective glass.

379 Mill. by steel scale.

377.4 dividers (point bent).

379.8 dividers

379.5 (correct.

.03937

26565

11385

34155

11385

149.4 0915

747.05 tubes of dynamics [illegible] = effective diam. of Object glass

1494.|77 1890

77

704

632

720

14940|2268

13604 .689.1

19320

17344

19760

19512

2480

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1877phae.proj.1151

Measure of focal lengths of Eye Pieces. with Scales

Eye Piece No. 2.

G = 20. F = 990

A = 258.2

133.35 / 266.7 = 2

800.5

542.3

266.7

809.0 = dist bet. scale lines.

hair

Unit 1/100 Millimeter

		& toward eyepiece		& from Eye piece.		
3	9.90	~~3.87~~		~~3 = 10.83~~		
9 =	13.27	3.37	×56.2	1 = 11.70		
12	14.99	1.72	×57.3	3 = 12.84	1.14	×57.0
16	17.28	2.29	×57.2	6 = 14.53	1.69	×56.3
19	18.99	1.71	×57.0	9 = 16.26	1.73	57.6
		27.7		~~12 = 17.96~~	1.70	56.6
		56.92		13 = 18.53	.57	57.0
						34.5
						~~56.90~~

Eye Piece I III I.

	& toward eyepiece			& from eyepiece.		
1	13.43			14.06		
		49	24.5		48	24.0
3	13.92			14.58		
		78	26.0		77	25.7
6	14.70			15.35		
		80	26.7		77	25.7
9	15.50			16.12		
		78	26.0		79	26.3
12	16.28			16.91		
		75	25.0		77	25.7
			18.2	17.68		27.4
15	17.03		25.64			25.48

Eye piece II III II.

	& toward eyepiece.			& from eyepiece		
1	11.12			9.05		
		0.97	48.5		.96	48.0
3	12.09			10.01		
		1.41	47.0		1.40	46.6
6	13.50			11.49		
		1.40	46.7	12.80	1.39	46.3
9	14.90					48.3
		1.40	46.7	14.25	1.45	
12	16.30					46.6
		1.42	47.3	15.65	1.40	35.8
15	17.72		1.2			47.16
			47.24			

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Eyepiece II III IV

ε toward eyepiece & ε away from Eyepiece

1	13.67	1.33	65	12.80	1.30	65.0
3	15.00	1.95	65.0	14.10	1.94	64.6
6	16.95	(?) 1.55	51.7	16.04	1.96	65.3
9	18.50	11.5	(?) 65.7	18.00	1.93	64.4
12				19.93		14.2
						64.8

Eyepiece No 5

ε from eyepiece ~~No 5.~~ ε toward Eyepiece

2.00 in	1	2 00	1.50	75.0	0 6	= .37 in	1.63	81.5
3.50 in	3	3 8	2.44	81.3	2 0	2.00	2.50	83.3
5.94	6	5 15	2.56	85.3	4 8	4.50		34.8
8.50	9	8 8						82.4
11.25	12	11 4	2.75	91.7				
				833.3				
				83.32				

Eyepiece No 4.

ε toward eyepiece & ε from eyepiece

0.34	1	0 1/16 in	5.5	.91	45.5
1.~~25~~ 2.5	3	1 4.0		1.38	46.0
2.63	6	2 10.0		1.37	45.7
4.00	9	4 00.0			
4.87	12	4 14.0	.87		43.5
					20.7
					45.17

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Miscellaneous Eye Pieces.
Eye Piece attached to small graduated Circle
E toward E, Piece E from Eye Piece

0	19	1	0m	1/10 m 0.3	= .02	
					.28	+14.0
4.56		3	0	4.9	= .30	
					.42	+14.0
11/31		6	0	11.5	= .72	
					.41	13.7
		9	1	2.2	= 1.13	
					.43	14.3
		12	1	9.0	= 1.56	14.0

Comparison of Eye pieces.

Eye Piece	E toward eyepiece.	E from eye Piece.	Ratios E toward E	Ratios E from E	Magnifying Power
No. 2	.56192 56.92	.56190	2 x 2.41	2 x 2.40	197.9
I III I	.25664	.25148	1 x 8.09	1 x 8.03	94.2
II III II	.47124	.47116	1 x 8.60	18.57	168.6
II III III	.65117	.64118	2 x 5.87	25.51	200.84
No. 5	83.32 1/100 inches	82.4 1/100 inches.	83.32		711.3
No. 4	45.17		45.17		390.2
Micrometer eyepiece	14.0				127.6

Dist from scale to ruled lines for the last three measurements is 4.5 mm less than for the previous readings.

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.0692
.03937
398 44
17076
51228
17076
.02240944

.2564
.03937
17948
7692
23676
7692
.00944468

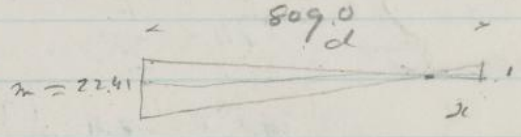
25
2548
.03937
17836
7644
22932
7644
.0100314476

6,48
.03937
4536
1944
5832
1944
.2551176

2.241

.4724
.03937
33068
14172
42516
14172
.018598388

Pour .657
.03937
4599
1971
5913
1971
.025866609



$x + 1 : 1 = d : x$

$23.41 : 1 = 809 : x$

$\frac{1}{x} + \frac{1}{d-x} = \frac{1}{f}$ find f

$\frac{F}{f}$ = mag. power.

682.84 cms.

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Eye piece No. 2.

$x = \frac{809.0}{22.41} = 36.104$

Then $\frac{1}{36.104} + \frac{1}{972.896} = \frac{1}{f}$

809.0 / 22.41 / 809.0 / 36.104 / 8 / 7 / 2.896 / 7 7 2.896

$.0277 + .00129 = .02899 = \frac{1}{f}$.

$f = 34.50$.

$M = \frac{F}{fi}$.

$M = 197.8$

34.5 | 6828.4 | 197.9

345
3378
3105
2734
2415
2830

Eye piece I III I.

$x = \frac{809.0}{10.09} =$ 10.09 | 809.0 | 80.83

809.0 / 80.83 / 718.17

80972 / 82800 / 80972 / 27280

Then $\frac{1}{80.83} + \frac{1}{718.17} = \frac{1}{f}$.

$.0124 + .0014 = \frac{1}{f} = .0138$

$i = 72.5$. $F = 6828.4$.

72.5 | 6828.4 | 94.2 M

6525
3034
2900
1340

Eye piece II III II.

$x = \frac{809.0}{18.6}$. 186 | 809.0 | 43.49

744
650
558
920
744
1760
1674

$x = 43.50 -$

809.0 / 43.50 / 765.50

$\frac{1}{43.50} + \frac{1}{765.50}$

$.0230 + .0013 = .0243 = \frac{1}{f}$.

$f = 41.1$

41.1 | 6828.4 | 168.6 $= M$

411
2718
2466
3524
3288
2360

II III III. Eye piece.

$x = \frac{809}{25.87}$ $\frac{809}{3514}$ 773.6

25.87 | 809.00 | 35.14 $= x$

7761
13290
12935
3550
2587
9630

Then $\frac{1}{35.14} + \frac{1}{773.6} = \frac{1}{f}$.

$.0280 + .0013 = .0293 = \frac{1}{f}$.

$f = 34.0$

34.1 | 6828.4 | 200.84 M.

68
284
272
120

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Eye piece No 5. 804.5

$x = \frac{804.5}{83.32} = \frac{9.85}{794.65}$

83.32 | 804.50 | 9.85 x.
74988
54620
50656
3964 0

$\frac{1}{9.85} + \frac{1}{794.65} = \frac{1}{f}$.

.1016 + .00125 = .10385 = $\frac{1}{f}$.

f = 9.6.

9.6 | 68284 | 7113 M.
672
108
96
124
96
280

Eye piece No 4.

$x = \frac{804.5}{45.17} = \frac{17.81}{804.50}$

4517 | 804.50 | 17.81
4517
35280
31619
36610
36136
4740

$\frac{1}{17.81} + \frac{1}{786.69} = \frac{1}{f}$,

.0560 + .00127 = .05727 = $\frac{1}{f}$

f = 17.5

17.5 | 6828.4 | 390.2 M.
525
1578
1575
3 40

Misc. eye pieces.

Eye piece with graduated circle.

$x = \frac{804.5}{14.0} = 57.46$

14.0 | 804.5 | 57.46
70 504.50
104 747.04
98
65
56
90

$\frac{1}{57.46} + \frac{1}{747.04} = \frac{1}{f}$

.0174 + .0013 = .0187 = $\frac{1}{f}$.

f = 53.5.

53.5 | 6828.4 | 127.6 = m
535
1478
1070
4084
3745
3390

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The results of the following work is given on page 40.
To find the magnifying power by means of a dynameter.

(2)

7.2452 | 14.9409 | 206.2
14 4904
45 0500
43 4712
1 5788

(3)

4.732 | 14.9409 | 315.8
14 196
7449
4732
27170
23660
35100

(1)

10.659 | 14.9409 | 140.2
10 659
42819
42636
18300

(4)

3.744 | 14.9409 | 399.1
11232
37089
33696
33930
33696
2340

(5)

2.168 | 14.9409 | 689.6
13008
19329
17344
20850
19512
13380

(6)

1.768 | 14.9409 | 850.7
14 144
8969
8840
12900

(7)

1.303 | 14.9409 | 1146.6
1303
1910
1303
6079
5212
8670
7818
8520

1.0006 | 14.9409 | 1493.1
10006
49340
40024
93160
90054
31066
30018
10420

1.794 | 14.9409 | 1881.3
794
7040
6372
7200
7137
990
990
200

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1877phae.proj:11511

3.996 | 14.9409 | 3.739

11 988

29529

27972

15570

11988

35820

31968

38520

6.4746 | 14.9408 | 2.308

12 9492

199160

194238

4922 00

4.0534 | 14.9408 | 3.688

12 1602

278060

243704

349560

324272

252880

.777 | 14.9409 | 19.23.

777

7170

6993

1770

1554

2160

3

3.281

22 6

12

270

2.54

1080

1350

540

685.80

642.14

2.96

2.54

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To find the focal lengths of eyepieces by dividing the focal length of object glass by Magnifying power.

Take focal length of object glass = 682.84 Cent. metres.

Log. 682.84 = 2.834368 | Log. focal length. | Focal length.

		1.684446	
I.	Log 141 = 2.14922,	Log. focal length =	48.356
II	.. 206 = 2.31387,	1.51981	33.099
III	316 = 2.49969,	1.33399	21.578
IV	401 = 2.60314,	1.23054	16.998
V	688 = 2.83759	.99609	9.911
VI	864 = 2.93651	.89717	7.8918
VII	1243 = 3.09482	.83886	6.900
VIII	1561 = 3.19340	.64028	4.368
IX	2004 = 3.30190	.53178	3.4024

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To find Magnifying Powers of eye pieces of small level Telescope, by Clarke. Elder's Martin Dove
Using Dynameter by Dolland. 7.11.5 Obs. + Comp

Short eyepiece.		Long Eyepiece.	
12.590	7.500	15.703	
12.622	7.493	15.735	4.39
12.613	7.490	15.750	4.415
12.619	7.485	15.711	4.43
12.589	7.498	15.732	4.423
Mean 12.607	7.492	15.718	4.430
7.492		Mean 15.726	4.418
5.115		4.418	
		11.308	

dif 5.115 / dif

5.115
.26
30690
10230
1.32990

11.308
.26
678 48
22618
2.94028

Short Eyepiece		long Eye piece	
12.587	7.505	4.360	15.725
12.605	7.521	4.400	15.729
12.575 ×	7.506	4.361	15.719
12.602	7.485	4.370	15.690
12.595	7.520	4.400	15.725
12.600	7.495	4.397	3.583
12.606	7.502	4.370	15.717
670	34	558	4.378
12.597	7.505	4.378	11.339
7.505		11.339	26
5.092		26	68034
dif.		dif	22678
			2.94814

.26 mm
5.092
30552
10184
1.32392

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diameter of object glass of large level = 42 mms

1,324 | 42. | 31.5 from 2nd set of obs.
3972
2280 short eye piece. Ill. Comp.
1324
9560

2948 | 42. | 14.3 from 2nd set of obs.
2948
12520 long eye piece.
11792
7280

1,33 | 42. | 31.5 from 1st set.
399
210 short eyepiece
133
770

2.94 | 42. | 14.3 from 1st set.
294
1260 long eyepiece
1176
840

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Summary of Measurements of Eye pieces of 8. Equatorial.

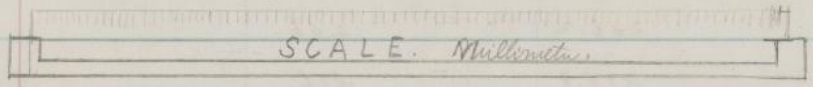
Eye Piece.	Scale.	DOLLOND DYN.	VOL. I. H.C.O. Au.
1.		140.2	141.
2.	197.9	206.2	206.
3.		315.8	316.
4.	390.2	399.1	401.
5.	711.3	689.6	688.
6.		850.7	861.
7.		1146.6	1243.
8.		1493.1	1561.
9.		1907.	2004.

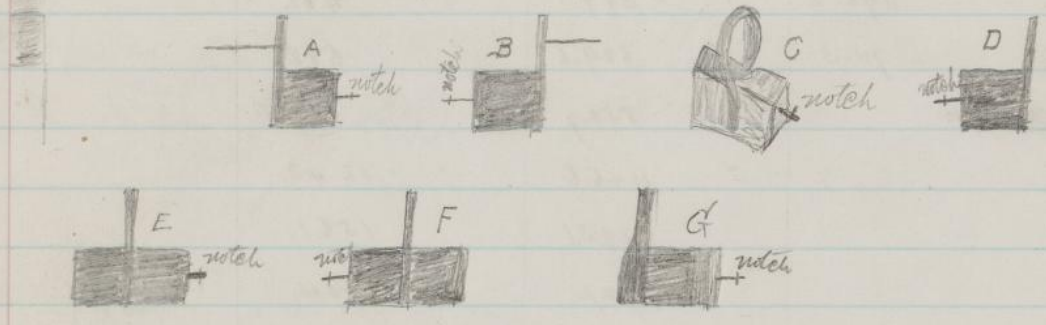
I III. I.	94.2
II III. II.	168.6
II III III	200.84

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The scale is graduated to Millimetres on one edge + to sixteenths of an inch on the other side





Notes. "F.W."

A + B have no holes in the upright piece at the end of the block. They are simply used for getting the thickness of glasses and getting the distance between any two objects on the scale.

C. has a very large hole in the upright piece in the center of the block - This will hold all the bar eye pieces that are connected with the draw-tube of telescope by means of a large screw.

D + E each have a smaller hole in the upright piece, and the higher powers can be fitted in. They are nearly the same, except E has a base on each side of the upright, and D has only one side.

F. Has a double base, with a grove on the upright for a small scale. to fit in. There is also a small hole through the upright. The scale was attached to F during nearly all the measurements.

G has a small hole in the upright; A small eye piece was put in this to focus the eyepiece to be measured. It was used for this purpose constantly.

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Summary of first Scale Measurements.

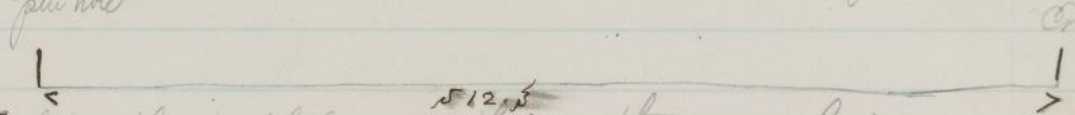
E = lens nearest diaphram
F = lens from diaphram.

m ——— D ——— n

	Thickness of E	of F	E(1) to F.	diaphram
No 3 =	2.6	3.0.	9.145	15.0
No. 5 =	1.7	1.35	4.15	5.14
I II I. =	3.1	5.1	60.5	33.75
II III III =	2.5	2.2	29.2	12.9
II III II =	4.6	2.5	39.7	12.1

The cross hairs were used simply to focus the eye piece on.

Discussion of I II I. E = lens nearest diaphram
F = lens from diaphram



Lens F "Lens f."

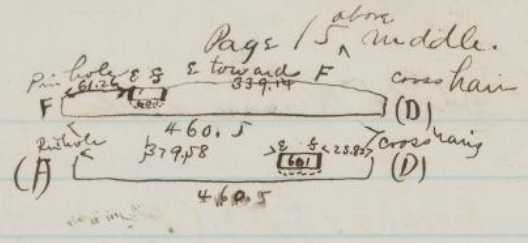
Dist. from Pin hole to cross hairs = 512.5

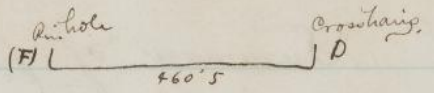
"Lens E".

Dist from Pin hole to cross hairs = 376.7

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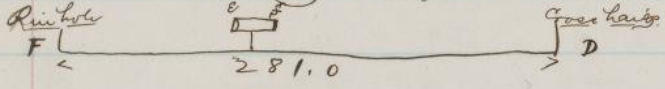
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IV I continued.

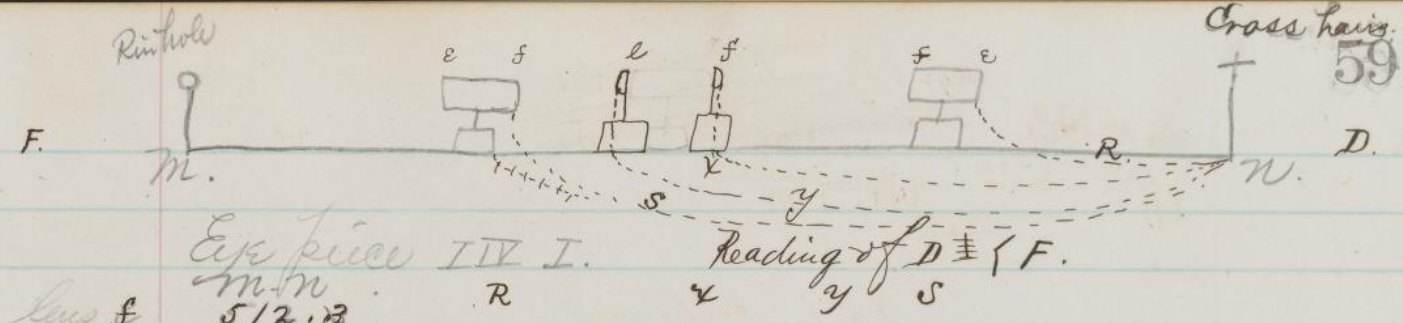
Measurements with the two lenses of the eye piece combined



Summary from Page 15.

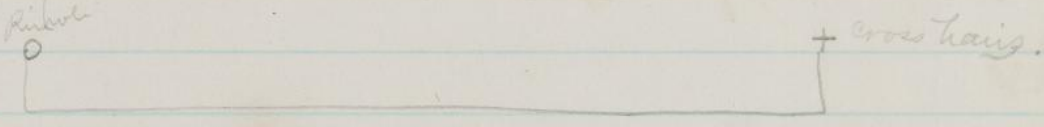
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Eye piece I II I. Reading of D ± F.
m n R x y s

lens f.	512.8
lens e	376.7
e & f Combined	281.0
e & f Combined	260.5



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August 2nd, 1877

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Photometer.

Disappearance of images of light.

Lamp of Lilac Microm. used.

I Horizontal Setting. Pin Hole

Disappearance

I	R	I	R
63.50	155.10	245 20	332 40
~~245 30~~	~~332. 40~~		
65, 10	156 50	246 20	330 0
63 30	156 50	242 20	337 0
65 30	158 20	245 20	335 10
67 50	160 10	248 0	330 40

II Whole aperture

63 20	155 40	244 20	332 40
63 40	156 0	244 10	332 0
63 20	156 0	244 0	331 40
63 40	156 0	244 0	331 50

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Cons of circles of 15" Equatorial Oct. 10 1877

S.T. ~~21h 34m 20s~~

R.A. ~~10 39 30~~ ~~22 58 40~~ ~~14 33~~

δ ~~33 5. 56~~ ~~22 58 40~~ 335 36 True δ

24 24

S.T. ~~19h 49m 30s~~ West RA 22 59 0

Hour circ. 10 50 30 δ 11 30'

Δδ 348° 30' True δ 14 33

Weisse 140 23h 9.3m Read.

−10° 0'

−6 57

5 56

1 1

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Oct. 10 1877.

Declination readings for comparison stars to locate Asteroid 0555. mags. Remarks.

A 9
B 3
C 2
A 9 2
C 1

B 9 8
A 8
A 5
B 7 – Rattle
B 1
B 9
C 9
8 Rattle
C 6
B 9
A 7
A 1
C 8
D 4
A 2
A 6
B 8
C 9
B 7

C 3
C 6
A 7
B 9
A 9
B 9

Rattle
D 1
A 3
D 2 6
B 8
C 3
A 3
C 4
B 4
C 0
C 9
A 8
A 3
B 7
C 2
A 7 7
B 9
A 9
A 4
B 4
A 6

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A 6		A 9	Lny Rattle	A 5
C 9		C 8		B 5
B 9		B 6		B 7
A 3		A 7		
C 8		B 4		
C 6		C 5		
C 1		C 5		
B 6		A 6		
B 5		C 3		
B 5		C 1		
C 9		A 7		
C 6		B 3		
C 8		C 6		
A 9		C 9		
A 9		C 6		
A 8		A 1		
C 9		B 8		
A 4		B 6	Double notch	
B 3		A 2		
B 0	Rattle	A 6		
B 0	Rattle	A 2		
C 3 9		A 4		
A 3		A 3		
C 3		B 4		
A 6		B 5		
A 8		B 4		
A 5		A 5		
C 4		B 4 9		
B 0		B 2 9		
B 7		A 4		

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Sens. Mags.

5

5

8

10 Lost. Rattle-little late

8 Rattle. Rattle. " " 8 mag. A1. Rattle; little late

Rattle; little late

8

10 Lost

10 Centre of field

17 50
9 20
8 30

Search for Hecuba.
Point of Wick 140

0 20 24
8 30
28 54

10

9m 18p

Dec

0 26 8± 10 10 9 18 15 2

24 10 12 24 18

11

27 30 11 8 10 16 24

49 14 14 10 57 43

12 5

11 13

28 54.2 12 5 ? Hecuba 12 17 48

30 35.4 13 10 45 29

31 8.6 13 5 18 12

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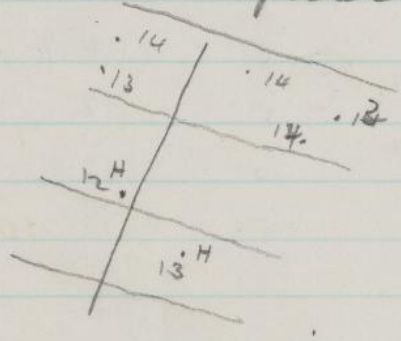
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Star supposed to be Hecuba ⓐ and a small following it- faint and 2.5' south.

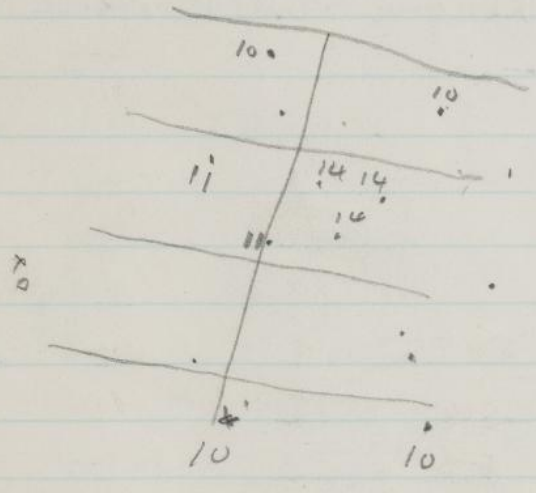
2 16.5

0	34	2.0	19.0	5.5
"	"	16.5	33.0	19.5
		46.5	460	46.0

Hecuba field



Field one field preceding Hecuba ~~one field foll.~~



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Oct. 11, 1877.

Chronographic record of stars observed near Hecuba p. 66

0	25	51.8		0	10
			15.4		
	26	7.2		12	10
			12.8		
		20.0		11	11
			38.2		
		58.2		8	11
			8.4		
a	27	6.6		14	12
			7.1		
		13.7		5	12
			18.3		
b		32.0		13	12
			64.7		
Hec. * ?	28	36.7		5	12
			101.4		
	30	18.1		10	13
			33.3		
		51.4		5	13

Brunhild found by transits on Oct. 27. Record in Book 21 p. 22.

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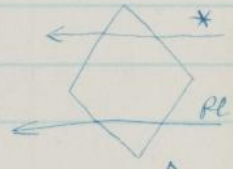
1877phae.proj.11513

Oct. 30, 1877

Observation of Brunhild (123) Mt Ols.

Transits over brass square inclined 45°

Chronographic Record.



$\Delta_1 + \Delta_2$	Comp. Star = DM +21°234 Entrance		Δ_1	123 Entrance		Δ_2
48.3	1 40	32.5	54.8	22.3	1 41 28.0	54.0	26.0
47.7	42	13.7	36.0	22.3	43 10.0	35.4	25.4
48.2	45	34.7	57.3	22.6	46 31.2	56.8	25.6
47.7	47	23.0	46.0	23.0	48 20.0	44.7	24.7
47.7	49	18.7	41.7	23.0	50 15.4	40.1	24.7
47.0	50	57.0	51 19.7	22.7	51 54.0	52 18.3	24.3
47.7	52	31.7	55.6	23.9	53 29.5	53.3	23.8
47.1	54	58.0	55 22.7	24.7	55 56.6	56 19.0	22.4
47.6	56	36.3	57 1.7	25.4	57 35.4	57.6	22.2

2 | 47.67

23.84

11 92

357.6

~~Diag. 889.8~~

~~53 2.2 = 58~~

357.6

.928 = cos δ

331.9

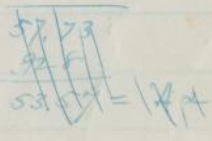
~~889.8 = Diag.~~

557.9 = 48

9' 17."9 =

Reduced to supposed transit thread

	*		Rl.		Δ RA			
1	40	43.6	41	41.0	57.4	Sidt	1	49	43.7
	42	24.8	43	22.7	57.9	S.T. Noon.	14	36	24.3
	45	46.0	46	44.0	58.0	Sidt Int	11	13	19.4
	47	34.5	48	32.4	57.9	Corr.		1	50.3
	49	30.2	50	28.1	57.9	Meant.	11	11	29.1
	51	8.4	52	6.2	57.8				
	52	43.7	53	41.4	57.7				
	54	10.3	56	7.8	57.5				
	56	49.0	57	46.5	57.5				



1h 50m 3.3

19.6 Corr.

1 49 43.7 True Sidt.

+ 57.78 = Δ RA

~~0' 52."6~~ = Δ δ

9' 17."9

Rl − *

DM 234 1 39 27 21 51

Corr to Rl +58 9

Oct. 30 Sidt 1h 50m Rl. (123) 1 40 25 22 0

corr. to Ephemeris RA −1m 16s

δ −7'

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Oct. 31 1877

Determination of dimensions of brass square used in Oct. 30, with "Clark Double Movement Micrometer."

1 rev = $\frac{1}{24}$ in. = 1.058

46.239		
~~37.436~~	65.947	19.605
46.234		
~~37.241~~	65.949	.584
		~~.708~~
37.331	56.986	.708
.250	.834	.715

19.65 = 0.82 in = 20.828 mill. log = 1.31865

log from 1" = 8.57989

Side of square 629."16 + log = 2.79876

5.59752

.30103

2 | 5.89855

Diagonal of square 889."8 log = 2.94928

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1877phae.proj.1151

Oct. 31 1877

Determination of

Oct. 30, with "bl

46.239
~~37.436~~ 65.947
46.234
~~37.241~~ 65.949

37.331 56.936
.250 .834

Observations of 1731 Nov. 1877
N.O.R. obs.
Ordnance Observation



Comparison stars

	α 1855	δ 1855
#1 =	1h 42m 9.2	21 32.8
#2 =	1 42 12.4	21 27.0

	Pl.	#1	#2
	h m s	h m s	h m s
ont	0 56 56.4	1 4 19	1 4 8.7
ep	56 58.4	4 5.3	4 11.6
cul:	57 17.0	4 42.4	4 41.8
sq.	57 20.7	4 44.6	4 44.7
	0 57 8.45	1 4 23.85	1 4 26.65
	1 6 5.574	1 13 8.3	1 13 9.8
	6 11	13 6.7	13 13.0
	6 18.0	13 44.0	13 42.8
	6 21.7	13 45.6	13 46.0
	1 6 9.55	1 13 24.90	1 13 27.90
	0 57 8.45		
	1 1 39.0		

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1877phae.proj.11511

Reduction in RA

Pl − *1

$-7^m\ 15^s.10$

15.35

$-7^m\ 15^s.22$

~~.929~~

~~6 44.32~~

Pl − *2

$-7^m\ 18^s.20$

,35

$-7^m\ 18^s.28$

~~.930~~

~~6m 47.60~~

Reduction in Dec.

Int. 1st to 2d

Pl	*1	*2
20.6	40.5	32.9
21.0	39.3	33.1
20.6	40.7	33.0
20.6	38.9	33.0
20.70	39.85	33.00
10.35	19.92	16.50

Δδ

Pl − *2

$-6^s.15$

3075

92.25

.93

$-85''.8 = -1'\ 25''.8$

Δδ

Pl − *1

30.27

1514

4541

.93

~~40869~~

~~13623~~

~~422,313~~

~~889.8~~

~~−467.5 = Δδ~~ diag.

~~−7' 47".5~~

454.1

.929

421.9

889.8

$-467.9 = -7'\ 47.9$

1	1	39.0	= Sid t in corr.
		28.8	Corr.
1	1	10.2	True Sid t.
14	56	7.1	
10	5	3.1	
	1	39.1	
10	3	24	= Mean time of Obs.

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Nov. 6, 1877

Observation of Brunhild

~~Arlt. Obs.~~



Transits over square.

Chron. Record.

		Ent.			Ext.	
*1 = DM 222 3	46	37.7	41.3	47.8	51.4	
*2 = DM 224	47	24.5	27.6	50.2	53.4	
Pl	49	27.0	31.3	50 11.7	15.5	Wll. Obs.
21° DM 222 *1 =	50	46.2	49.5	—	59.3	
224 *2 =	51	32.4	35.3	58.5	52 1.7	
Pl	53	35.0	—	54 19.9	23.8	
21° DM 222 *1 =	58	32.8	35.5	53.2	55.9	W.A.R. Obs
224 *2 =	59	19.3	22.5	55.3	58.5	
Pl 4	1	21.6	25.2	16.6	20.0	

Reduced to ruffled transit thread

Δ RA. used	Pl − *1	Pl − *2	*1	*2	Pl
Sid. t. 3 50	3m 6.8	2m 12.5	3 46 44.6	47 38.9	49 51.2
			44.6	38.9	51.5
3 54	3 6.6 Wll	2 12.4	50 52.8	51 47.0	53 59.4
				46.9	
4 2	3 6.4 WAR	2 11.4	58 44.4	59 38.9	4 1 50.8
			44.4	38.9	50.9
	3 6.60	2 12.27	3 52 7.3		

Pl − *	Pl − *2	Δ *1			
3m 6.70	2m 12.45	Wll.	3		
3 6.40	2 11.90	WAR.	~~4~~ 51	55.4	4 1 50.8
				31.8	81.8
			~~4~~ 3 51	23.6	4 1 19.0
			15 4	0.2	15 4 0.2
			~~13~~ 12 47	23.4	12 57 18.8
			2	5.7	2 7.3
			12 46	17.7	12 55 11.5

(Dec Reduced on page ~~87~~ 100)

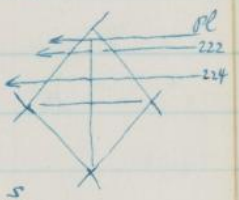
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1877phae.proj.11611

Nov. 7, 1877.

Observations of Brunhild. Will Obs.

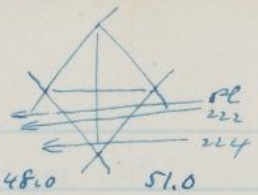
Chronographic record. Fort. 1327



		h	m	s	s	m	s	s		s	s
☌M.+21°	222	1	45	55.4	57.7	46	15.3	17.2		34.0	36.3
	224		46	41.8	44.5	47	9.5	11.4		36.2	38.6
	Pl		48	24.0	27.0		38.5	41.0		52.4	55.3
	222		49	42.3	44.6	50	2.0	3.6		20.5	22.8
	224		50	29.0	31.3		86.5	58.0	51	22.6	25.3
	Pl		52	10.8	14.1		25.2	27.9		37.7	41.5
	222		53	11.6	14.3		31.2	33.0		49.9	52.2
	224		53	58.4	54 1.0		25.7	27.6		52.1	54.6
	Pl		55	40.0	43.6		54.5	56.6	56	7.3	10.6
	222		56	47.7	49.9	57	5.9	7.8		23.0	25.3
	224		57	34.4	36.5	58	0.5	2.5		25.8	27.8
	Pl		59	18.7	19.0		29.0	31.6		40.7	44.0
							Readjusted				
	222	2	4	33.1	35.9		53.6	55.5	5	12.4	15.4
	224		5	19.3	22.4		47.9	51.0	6	14.9	17.6
	Pl		7	1.5	4.9		16.5	18.6		29.2	33.5

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222	2	8	18.0	20.9		33.9	35.9		48.0	51.0
224		9	20.5	23.3		—	—		34.2	37.0
Pl		10	35.6	38.5		56.6	58.8	11	16.2	19.2
222		12	10.5	13.2		28.6	30.5		45.5	48.4
224		13	12.8	15.6		23.0	24.9		31.6	34.5
Pl		14	27.6	30.7		51.2	53.3		13.7	16.7
222		15	43.4	45.6	16	1.3	3.5		18.2	21.1
224		16	45.7	48.7		55.8	57.7	17	4.6	7.5
Pl		18	6.3	3.4		24.0	26.2		46.4	49.5
222		19	23.0	25.6		44.3	46.3	20	4.1	6.9
224		20	25.3	28.2		38.5	40.4		50.4	53.5
Pl		21	40.0	43.1	22	6.6	8.7		31.6	35.3
224		23	8.1	10.9		22.7	24.1		35.6	38.6
Pl		24	22.5	25.6		58.5	52.6	25	17.2	20.9

2^h	7^m	$30.^s2$	Sid t mean
		33.4	bow
2	6	56.8	True Sid. t.
15	7	56.7	Sid Mean Noon
10	59	0.1	Sid Int.
	1	48.4	bow.
10	57	12.1	Mean time

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1877phae.proj 1151

Reduction of above.

Time of transit — Δ R.A

	*1	*2	Pl	Pl − *1	Pl − *2
1	46 15.98	47 10.33	48 39.70	2m 23.72	1m 29.37
	50 2.63	50 57.12	52 26.20	23.57	29.08
	53 32.03	54 56.57	55 55.43	23.40	28.86
	57 ~~26~~6.60	58 1.25	59 30.00	23.40	28.75
2	4 54.32	5 48.68	7 17.37	23.05	28.69
	8 34.62	9 28.75	10 57.48	22.86	28.73
	12 29.45	13 23.73	14 52.20	22.75	28.47
	16 2.18	16 56.67	18 24.97	22.79	28.30
	19 45.03	20 39.38	22 7.55	22.52	28.17
		23 23.33	24 51.55	2m 23.12	1m 28.22 / 28.66
			2 7 30.245	Δδ *1	Δδ *2

*1	Pl	*2	*1	Pl	*2	a	b	Mean	a	b	Mean
19.70	14.25	27.30	~~28.90~~	14.10	26.95	5.35	4.80	[5.08]	13.05	12.85	[12.95]
~~29.35~~	14.10	27.10	18.85	13.05	26.70	5.25	5.80	5.52	13.00	13.65	13.32
19.15	13.75	26.95	18.95	13.40	26.70	5.40	5.55	5.48	13.20	13.30	13.25
18.05	12.95	26.05	17.30	12.05	25.30	5.10	5.25	5.18	13.10	13.25	13.18
20.05	14.35	28.10	19.35	13.80	27.30	5.70	5.55	5.62	13.65	13.50	13.58
15.45	20.65	13.70	14.60	20.00		5.20	5.40	5.30			13.47
17.70	23.10	9.75	17.40	22.95	9.10	5.40	5.55	5.48	13.35	13.85	13.60
17.90	23.25	9.55	17.25	22.85	9.30	5.35	5.60	5.48	13.70	13.55	13.62
21.00	26.10	12.70	20.20	25.90	12.50	5.10	5.70	5.40	13.40	13.40	13.40
1°	27.50	13.90	~~27.50~~	27.50	13.70				13.60	13.80	13.70

	Pl − *1	Pl − *2
Nov. 7 2h 5m hd t. ΔRA	2m 23.12	1m 28.66
Δδ	−1′ 16.0″	−3′ 8.2″
Approx. position R.A	1h 33m 43s	2m 23.12 / 1m 28.66
δ	+ 21′ 15″	2m 13.53 / 1m 22.63

	~~5.384~~	~~13.71~~
	5.43	13.46
	27²	673
	81.5	201.9
	933	932
	7335	18171
	2445	6057
	75.795	187.767
	2445	4038
	76.0395	188.1708

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Nov. 9, 1877

Observations of Brunhild Wash. Obs.

Chronograph record Prod. 1327

Gm+20	251	*1	0h	35m	48.3s		51.0	36	14.8	16.9	40.3	43.2
	256	*2		36	56.4		59.3	37	17.6	19.6	38.0	40.9
	258	*3		37	34.0		36.9	—		—	38 18.3	21.1
	Pl			38	57.1		59.5	39	19.6	21.9	41.9	—
				40	11.6		14.5		38.0	40.1	41 4.0	6.8
				41	19.9		22.6		40.9	43.0	42 1.4	3.5
				41	57.4	42	0.2		20.0	22.0	41.7	44.7
				43	19.0		23.0		43.0	45.1	44 5.0	8.3
			1	3	57.7	4	0.7		8.3	10.4	17.6	20.6
				4	55.0		58.0	5	11.1	13.3	25.7	28.7
				5	355		38.6		50.0	52.3	6 3.6	6.1
				6	58.0	7	1.1		12.3	14.6	25.5	28.6
				7	59.3	8	2.3		9.7	—	19.0	21.9
				8	56.5		59.4	9	12.5	14.5	27.1	30.2
				9	37.2		40.0		51.7	53.7	10 4.8	7.6
				10	59.1	11	2.5		13.7	16.0	26.6	30.6

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Reduction of above.

Times of transit

Disappearances

	* 1	* 2	* 3	Pl
	h m s			
	0 36 14.47	0 37 17.33	0 37 56.15	0 39 19.53
	0 40 37.87	41 40.73	42 19.70	43 42.33
	1 4 7.87	1 5 10.60	1 5 49.70	1 7 11.93
	1 8 9.33	9 12.03	9 51.23	11 13.13
				0 55 21.73

Reappearances

0 36 17.03	37 19.93	37 57.00	39 22.07
40 40.47	41 43.03	42 22.37	43 45.47
1 4 10.57	5 13.33	5 52.33	7 14.77
8 12.10	9 14.70	9 53.77	11 16.37
			55 22.17

Δ RA

Pl − * 1		Pl − * 2		Pl − * 3	
Disap.	Reap.	Disap.	Reap.	Disap.	Reap.
3m 5.06	5.04	2m 2.20	2.14	1m 23.38	23.07
4.46	5.00	1.60	2.44	22.63	23.10
4.06	4.20	1.33	1.44	22.23	22.44
3.80	4.27	1.10	1.67	21.90	22.60
3m 4.34	4.63	2 1.56	1.92	1 22.54	22.80

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Reduction in δ

Disappearances Int. 1st to 2d transit

*1	*2	*3	Pl
26.5	21.2		22.5
26.4	21.0	22.6	24.0
10.6	16.1	14.5	14.3
10.4	16.0	14.5	14.6

Int. 2d to 3d transit

25.5	20.4		22.3
26.0	20.5	21.7	22.0
9.3	14.6	13.6	13.2
9.3	14.6	13.1	12.9

Reappearances Int 1st to 2d transit

25.9	20.3	—	22.4
25.6	20.4	22.0	22.1
9.7	15.3	13.7	13.5
—	15.1	13.7	13.5

Int. 2d to 3d transit

26.3	21.3	—	—
26.7	20.5	22.5	23.2
10.2	15.4	13.8	14.0
—	15.7	13.9	14.6

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Δδ Disappearances

Pl-*1 1st Int.	Pl-*1 2d Int.	Pl-*1 Mean	Pl-*2 1st Int.	Pl-*2 2d Int.	Pl-*2 Mean	Pl-*3 1st Int.	Pl-*3 2d Int.	Pl-*3 Mean
− 4.0	3.2	− 3.6	+ 1.3	1.9	+ 1.6	+ —	—	+ 0.25
2.4	4.0	3.2	3.0	1.5	2.25	+ 1.4	+ 0.3	+ 0.85
3.7	3.9	3.8	1.8	1.4	1.6	− 0.2	− 0.4	− 0.30
4.2	3.6	3.9	1.4	1.7	1.55	+ 0.1	− 0.2	− 0.05
		− 3.62			+ 1.75			+ 0.36
		181	Reappearances		.88			.18
		54.3			26.3			5.4
− 3.5	—	− 3.5	2.1	—	+2.1	—	—	
3.5	3.5	3.5	1.7	2.7	2.2	+ 0.1	+ 0.7	+ 0.4
3.8	3.8	3.8	1.8	1.4	1.6	+ 0.2	− 0.2	0.0
—	—		1.6	1.1	1.35	+ 0.2	− 0.7	− 0.25
		− 3.60			1.81			+ 0.05
		180			90			.02
		54.0			27.0			0.7

Mean Δδ

Mean t.	Pl-*1 Disap.	Pl-*1 Reap.	Pl-*2 Disap.	Pl-*2 Reap.	Pl-*3 Disap.	Pl-*3 Reap.
$0^h\ 55^m\ 22^s$	− 54.″3	−54.″0	+ 26.″3	+ 27.″0	+ 2.″8	+ 0.″7
	54.30		27.0		0.7	
Prod. 1327	= 54.15 × .933 = 50.″5		26.65 × .933 = 24.9		+ 1.75 × .933 = 1.63	
			Mean ΔRA			
	+ 3m 4.s34	4.s63	+ 2m 1.s56	1.s92	+ 1m 22.s54	22.s80
	4.63		1.92		22.80	
	3 4.48		2 1.74		1 22.67	

*1 = DM. + 20 1251

*2 = 256

*3 = 258

Approx. place of planet RA $1^h\ 32^m\ 17^s$

δ + 21 3

0 55 21.7
36.4
0 54 45.3
15 15 49.8
9 38 55.5
1 34.8
9 37 20.7

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Nov. 14

Jupiter and Venus Phot.

Vernier O right ascension

	314.2	340.2	
	311.2	341.0	
	309.7	342.6	Very hazy
	313.6	341.8	
6.30	314.8	341.5	

Search for Brunhilda

1	k	2		
	23.8	23.8		
		23.2		
	47.0			
		23.0	3	
	10.0			
	33.4	23.4		4
	56.4	23.0		
7.20		3 & 4		
		3.6	10	
	3.6			
		3.6		
	7.2	4.0		
	11.2			
		3.6		
	14.8			

Observations of Brunhilda

2d transit last 1st of planet

3d " pl. very faint partially cloudy

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Nov. 14, Mill. Obs.
Observations of Brimhild.
Chronograph record.
Disappearances only observed. Prod. 1327

DM 20°	240 = $*_1$	0h	2m	48.0s	3m	0.5s	3m	11.5s
	241 = $*_2$		3	29.0	3	48.1	4	5.6
	Pl		4	46.3	5	11.4	5	34.8
	241	$*_2$	6	50.3	7	9.3	7	27.3
	Pl			[7.8]	8	32.7	8	56.3
	240	$*_1$	9	55.5	10	8.1	10	19.2
	241	$*_2$	10	36.6	10	55.8	11	13.5
	Pl		11	54.2	12	19.0	12	43.3

Times of transits.

$*_1$			$*_2$			Pl		
0	3	0.00	0	3	47.57	0	5	10.83
		—		7	8.97		8	32.27
	10	7.60		10	55.30		12	18.50
						0	8	40.53
								44.4
						0	7	56.1
						15	35	32.6
						8	32	23.5
							1	23.9
						8	30	59.6

Δ Rt

Pl − $*_1$: 2m 10.83s
10.90
2m 10.86s
~~.936~~
~~2 2.48~~

Pl − $*_2$: 1m 23.26s
23.30
23.20
1m 23.25s
~~.936~~
~~+ 17.72~~

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Reduction in δ

Interval 1st to 2d transit			2d to 3d transit		
*1	*2	Pl	*1	*2	Pl
12.5	19.1	25.1	11.0	17.5	23.4
	19.0	[24.9]		18.0	23.6
12.6	19.2	24.8	11.1	17.7	23.3

Pl − *1

1st	2d	Mean
12.6	12.4	12.5
12.2	12.2	12.2
		12.35
		6 17
.′ 5.″2		= 185.2
		.936
		1668
		5556
		1111 2
		173.347 2

Pl − *2

1st	2d	Mean
6.0	5.9	5.95
[5.9]	5.6	5.75
5.6	5.6	5.60
		5.76
		2 88
1′ 26.″4		= 86.4
		.936
		80.87

Sid t. Frod 1827 — 0h 8m 41s

	Pl − *1	Pl − *2
Δα	+ 2m 10.86s	+ 1m 23.25s
	2′ 53.″3	+ 1 20.″9
Δδ	+ 3′ 5.″2	+ 1′ 26.″4

Approx. place of planet Rt 1h 28m 58s

δ + 20° 35′

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Dec. 7, 1877.

Computed place of Eva (164) R.A. $7^h 38^m 26^s$ δ $+35^\circ 13'$

DM. Stars between $7^h 33.^m5$ & $43.^m5$ and $+35^\circ 1'$ & $25''$

	No	Mag.	RA		δ
$+35^\circ$	1668	8.8	7 33	34	+35 35
	* 1669	8.7	33	34	1
	1671	9.3	35	31	0
	1675	9.5	36	51	9
	* 1679	7.5	39	8	15
	* 1680	8.5	39	8	20.5
	* 1682	9.2	39	33	20.5
	1684	9.1	40	29	10
	1685	9.5	41	3	25
	1686	9.4	42	2	8
	1689	9.5	42	50	13
	1691	9.1	43	11	18
	* 1692	8.8	43	18	18
	1693	7 43	49	35	10.5
	95	44	10		11
	96		15		17
	97		26		11.5
	98		43		14.
	1700	45	5		16

A 5^m at 7 31 13 +34 52

β Geminorum 7 37 57 +28 19

6 33

334 46

6 33

328 13

1st cut from 0' to 10' Rattle after Dm Stars last track but one at Dm at $6' 8.^m8$ 4th from last to arm by $\frac{1}{2}$ sec. Rattle without track in middle of cut in Dm 7.5 which went below each

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Set from 1 to 20 starting with very bright say 5 at 21 about 2 or 3 m. preceding the starting point of preceding set but a Dm between 7 & 8 from end at 19.
6 & 7

3d set. spoiled by cloud. last 4 were between 10 & 15 and missed in 2d set 4 Dm.

				Chronograph record		
		1st set			Repeated 54m later	
7	33	34.0	1669	7	33	33.6
		35.0	1668			34.6
		41.8	1			
		54.2	2			
		57.1	2			
		59.4	2			
34		26.6	1			26.5
		30.0	1			29.8
		31.0	2			30.7
		39.0	2			38.2
		43.0	2 (or ratch)			42.7 43.2
		57.5	2			57.5
35		0.5	2			0.0
		8.0	1			7.7
		11.5	2			11.0
		18.7	1			
		27.5	1			27.6
		30.0	1 Dm 1671			30.6 Dm
		44.0	1			43.8
36		0.1	1			0.0 7.0

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				12.5
7	36	16.3	1	15.8
		21.5	1	
		24.7	1	24.5
		43.8	1	43.5
				46.2
		59.0	2	58.9
				59.5
	37	31.8	1	24.2
				28.3
				31.1
		36.5	2	36.6
		53.8	2	53.5
	38	5.5	1	
				9.3
		21.0	2	14.8
				20.7 (2)
		42.3	1	
		53.2	1	53.0
				57.5
	39	2.1	1	1.7
		(12) natale	Dm	(12) Dm
		35.5	1	35.2
		36.1	1	35.7
		36.7	1	36.3
		49.3	1	
	40	0.2	1	0.2
				0.7
		11.0	2	11.0
				23.5
		30.5	1 ×	× 26.5
		33.5	2 Dm. 1684	33.5
	41	33.8	1	
		34.0	1	
		35.9	1	
		36.6	1	
		51.8	1	
	42	3.8	1 1686 (2)	3.5
		21.5	1	
		21.9	1	

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7	42	25.2		25.1
		25.5		
		31.0		
		40.9		40.7
		41.9		
		43.4		
		44.2		
		50.2	1689 7:1	50.2
		57.9	2	57.9
	43	2.2		2.1
		7.2		
		8.3		8.1
		29.5		
		38.0		
		44.5		43.1
		52.5	2	52.5
		58.2		
	44	10.0	15.6	14.2
		19.5	23.9	21.5
		36.1	34.1	29.7
		39.1		
		47.6	23	47.4
		58.5	2	
	45	10.5		
		11.2		
		17.3		
		18.4		
		27.5		
		29.5		

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7 45 31.0
43.6
47.2
46 14.2 $-^{s}.5$
16.8
25.5 6′ DM 8.^{m}8
27.3

~~Reduction in Dec. of Obs. of (123) p. 72~~

~~Interval of transits~~

Ent. $*^{1}$	Ex.	Ent. $*^{2}$	Ex	Ent. Pl	Ex
~~10.1~~	~~10.1~~	~~25.7~~	~~25.8~~	~~44.7~~	~~44.2~~
—	~~9.8~~	~~26.1~~	~~26.4~~	~~44.9~~	—
~~20.4~~	~~20.4~~	~~36.0~~	~~36.0~~	~~55.0~~	~~54.8~~

Pl−$*^{1}$ Ent.	Ex.	Pl−$*^{2}$ Ent.	Ex
~~34.6~~	~~34.1~~	~~19.0~~	~~18.4~~
—	—	~~18.8~~	—
34.6	34.4	19.0	18.8

(Divided by 2)

34.6
34.25
34.42
17 21
51 6.3
.933
4 4.67
15489
1 1 0 8 9
= 48 0.758
1 7 0 8
240.08
240.854

18.93
18.60
18.76
9 38
28 1.4
.932
253 2 6
8 4 4 2
2 2 0 5
262.205
+4′ 22.″26
+2′ 10.″9
11.″1

3 52 7.3 = Sid. time corr.
31.8 Corr
3 51 35.5 True S.T.
15 4 0.2 Mean Nom
12 47 35.3 Sid Int
2 5.7 Corr.
12 45 29.6 Mean $*^{1}$ 0.″2 + 4′ 0.″9 =

Results Nov. 6, 1877

Mean 12^{h} 45^{m} 30^{s} Pl−$*^{1}$ +8^{m} 6.^{s}60 +4′ 0.″9
Pl−$*^{2}$ +2^{m} 12.^{s}27 +2′ 11.″1

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2d set

Not repeated owing to clouds.

7 30 32.0 = DM. 1662

31 16.7

27.6

32.5

51.9

32 1.1

9.7

16.9

21.3

28.5

41.3

45.8

52.8

33 14.4

26.7

37.1

52.5

57.5

34 1.1

5.6

18.7

23.3

26.5

32.3

36.8

57.1

55.1

35 7.8

26.4

35 42.0

53.5

54.0

57.9

58.5

36 0.6

22.5

39.7

44.0

45.7

51.7 1675(?)

54.4

59.2

37 1.1

2.7

11.6

17.5

21.8

38 3.3

8.1

14.5

18.0

41.2

50.8

55.5

57.8

39 5.4

8.4 DM 1679

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1877phae.proj.11511

7	39	16.7		43	17.0	DM ?	1692
		32.3	1682 ?		22.3		
		42.8			23.7		
		47.5			30.9		
		51.8			37.2		
		54.0			37.7		
	40	17.4			46.0		
		20.5			59.0		2d time 50m ± later
		27.2		44	7.7		
		34.3			15.6	1696	14.2
		54.5			23.9		21.5
		58.6			34.1	×	× 29.7 v page 86
	41	5.8			37.3		
		28.8			40.6	1698 ?	
		35.2		45	6.5	1700	
		36.5			14.7		
		41.0			15.2		
		48.8					
		56.0					
		57.2					
	42	4.6					
		17.4					
		32.5					
		34.7					
		38.0					
		48.2					
		45.5					
		51.5					
	43	8.9	1691 ?				

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If planet was observed it was probably the star observed 7 40 30.5 the first time and 26.5 the second time. v page 85 There is also a discordance at 7 44 30 v. page 89 which is worth examining.

If planet was observed at 7 40 30 the correction to the computed place is + $2^m\ 0^s$ and − $5'$ (±2)

If planet was observed at 7 44 30 the correction is + 6^m (±)

Dec. 8, 1877

Computed place of planet 7 37 26 +35 28

Dm Stars between 7 32.5 and 42.5 & +35 15 and 40

+35	No	Mag	R.A.	Dec.
	1673	9.2	$7^h\ 35^m\ 40^s$	35 39
*	74	9.3	36 30	28
	76	9.5	37 45	33
*	79	7.5	39 8	15
*	80	8.5	39 8	20.5
*	82	9.2	39 33	20.5
	85	9.5	41 3	25
	87	9.2	42 9	32
	89	9.5	42 50	13
	91	9.1	43 11	18
*	1692	8.8	43 18	18

β Geminorum	$7^h\ 37^m\ 5^s.7$	+ $28^\circ\ 19'$
5^m	7 31 13	34 52
6^m	7 30 33	35 20

Dec Circ. Reading for	
β Geminorum	334 46
5^m	328 13

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Dec

30.0
32.4
40.1

10.1

15.2
19.9
27.8
43.9

3h 1m
13.2
25.1
37.2
41.6
42.6

filter · 1682 D.m.

27.4
26.8
53.2

26.4

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4570 0 1st set started with 1673
30-40
3 3
4 3
5 2
6 3
94
46
64
78
4

2d set ~~20-30~~ 15-20 by mistake, starting ± 2m earlier than 1674, ends with 2 Dms at ~~22 & 24~~ 17 & 19 between

3d set repeats 1st beginning ~~a bit~~ 2m earlier. Did not look for 1674 3 Rabbits means star precessing 45 too early, Took asteroidal groups within set thought between 25 & 30. Rabbit after

4th set- repeats 2d or rather between 20 & 30. Set last preceding the double DM was not made here.

2d Sheet

1. 30 to 40 as before Cloud intervals After 1st cloud interval observed asteroid groups.
2. 20 to 30 as before
3. Asteroid groups beginning with 1680
4. 1674 and on 25 to 35

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Chronograph Record-

Between 30' and 40'

1st set

~~7~~	~~35~~	~~40~~	~~2~~	~~Dec. 1872~~ ~~4h 28m~~ 5h 11m ~~4 28~~
7	33	25.9	2	25.5
		26.7	2	26.5
		37.0	1	36.0
		59.3	1	59.4
	34	~~34.4~~ 0.4	2	0.1
		~~3~~.4	2	0.8 2
		10.0	1	
		17.0	1	17.0
		18.5	2	17.6 2
		22.5	2	22.8
		37.3	1	36.8
		41.6	1	40.7
		47.0	1	46.5
		51.3	1	50.7
		56.2	1	56.0
		56.8	1	56.7
	35	4.6	1	4.4
		6.2	1	5.6
		25.3	1	24.6
		28.8	1	
		39.4	1	~~39.5~~

(over)

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4^h 0^m			4 28 30 min later		5 11	
7 35 40.0	2	DM 1673	40.2		39.5	
42.8	1		43.8	1	43.4	
53.8	1		53.1	+.5 1	53.4	
			0.7	1	0.7	
36 6.6	2		6.5	2	6.0	
13.5	1		13.0		12.6	
19.6	1		19.4		19.3	
28.4	2		29.0		28.2	
31.6	2	DM 1674	32.1	1	31.1	
			34.0	1		
~~39.4~~	~~2~~		36.5	2	35.9	
			38.3	1	38.0	
41.0	2		41.3		40.1	41.2
42.5	2		42.0		41.8	
			45.0	1		
49.0	2		48.2		48.9	
52.2	1		52.0			
58.7	1		58.0			
			6.4	2		6.6 6.9
37 10.2	2		10.1		10.0	
15.0	1		15.0		14.6	
18.5	2		18.1	1	17.6	1 16.9 [18.4]
23.5	2		22.6		22.9	2 ~~23.8~~
30.7	1		30.3		30.0	
31.8	2		31.6		31.3	
40.3	1		40.7		40.5	40.3
51.2	1		50.6			49.0
						9.0
38 10.6	2		11.0	1		
18.4	2		18.5			[18.5]
						26.8
28.5	1		28.6			[27.6]
29.3	1		29.2			
			42.0	1		
48.7	1		49.0			
54.2	2		54.0	1		

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39	1.3	1	1.2						S 35	S 40	
			5.3	1							
	6.2	1	5.9								
			10.3	2							
	14.4	2	14.2								
	20.6	1	20.9							19.7	
	36.5	2	36.5	2						37.7	
			41.7	1					40.2	40.3	
			44.0	1					42.6	42.8	
	46.8	1	46.5	1			46.8		45.7	45.7	
			49.0	1			48.5		48.8	48.7	
			51.0	1			50.0		49.6	49.5	
40	17.1	1	59.0	1	16.3	1	58.9	16.3	57.8	57.5	
			2.5	2	18.3	1	2.5		1.6	1.6	
			4.7	1			3.6		2.9	2.9	
	23.8	2	5.7	1	23.9	2	5.1	22.8			
			8.8	1							
	24.7	2	9.8	1	24.6	2		24.2	1		
			9.8	1	30.0	1		30.1			
			10.2	1	31.8	2					
	44.2	1			44.1	2					
	45.3	1			45.6	1					
	53.8	1			53.7						
	56.3	1			56.3						
41	1.0	1									
	6.2	2			6.0						
	16.0	1			15.7						
					23.8	1					
	34.5	2			34.3	1		34.2	1		
	40.5	1			40.5						
	45.6	2						44.8	2		
					51.5	1					
	54.5	2			54.7			54.0			
42	2.5	1			2.2			~~1.6~~	dm		
	5.6	1			5.3						
					6.5	2					
	12.0	1			11.6						
	14.0	1			14.5						
	21.4	2			21.5			21.0			
					48.0	1					
	51.6	2			51.8			51.0			
	58.7	1			59.4			58.0			
43	5.5	2			5.3						
	9.3	1			9.2			9.3			

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43	12.5 2	12.3	12.5
	15.3 1	15.5	15.0
		17.6 2	17.7
	24.3 1	24.6	25.6 2
	26.2 2	26.7	
	42.8 2	43.4	42.8
		52.3 1	51.1 2
			52.3 1
44	4.7 1	4.6	
	6.6 2	6.5	6.3
	13.2 2	13.3	12.3
	14.0 1	14.0	13.7
	20.8 1	21.2	20.5
	22.8 2	22.8	21.5 2
		29.3 1	29.5 1
	33.5 2	33.3	32.7
	42.0 2	42.1	41.7
			44.6 1
	47.7 2		47.1
	52.5 2		51.7
	55.3 1		54.8 1
45	5.3 1		

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15 h 25 (30) 4h 17m

7	33	31.6	1	34	21.6
		40.5	1		30.5
		43.2	2		33.2
		47.3	1		37.3
		50.3	1		40.3
		59.5	2		49.5
34		7.6	2		57.6
		9.3	2	34	59.3
		11.8	1	35	1.8
		22.0	1		12.0
		22.6	1		12.6
		25.6	2		15.6
		28.0	3		18.0
		36.3	1		26.3
		42.1	1		32.1
		54.4	2		44.4
		56.3	1		46.3
		57.7	2		47.7
		58.7	2		48.7
35		8.0	1		58.0
		8.7	1		58.7
		10.5	1	36	0.5
		19.8	1		9.8
		25.3	1		15.3
		26.8	1		16.8
		28.5	2		18.5
		35.3	1		25.3
		39.8	2	9m.167	29.8
		51.2			41.2
		52.0			42.0

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7	35	58.3	1	36	48.3
	36	12.5	1	37	2.5
		14.2	1		4.2
		16.4	2		6.4
		19.0	2		9.0
		28.0	2		18.0
		29.8	2		19.8
		33.8	2		23.8
		48.8	1		38.8
		50.3	2		40.3
	37	5.0	3		55.0
		9.5	1		59.5
		22.2	1	38	12.2
		26.2	1		16.2
		28.5	2		18.5
		31.3	1		21.3
		40.6	1		30.6
		44.5	1		34.5
		54.5	1		44.5
		55.8	2		45.8
		56.7	2		46.7
	38	3.0	2		53.0
		11.9	1	39	1.9
		19.0	2	Dm	9.0
		30.0	1		20.0
		43.6	2	Dm	33.6
		49.8	3		39.8
		56.0	1		46.0
		58.7	1		48.7
		59.5	3		49.5

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39.	5.7	1		55.7
	11.0	2		40-1.6
	12.7	2		2.7
	21.0	1		11.0
	21.6	1		11.6
	26.5	2		16.5
	52.5	1		42.5
40	3.5	3		53.5
	6.3	1		56.3
	9.6	2		59.6
	15.3	2	41	5.3
	19.7	1		9.7
	41.0	1		31.0
	44.5	1		34.5
	47.2	1		37.2
	50.0	1		40.0
	53.8	1		43.8
41	3.0	2		53.0
	4.3	2		54.0
	16.1	2	42	6.0
	20.9	1		10.9
	31.4	1		21.4
	45.0	1		35.0
	46.4	1		36.4
	51.1	1		41.1
	55.3	1		45.3
	57.6	1		47.6
42	2.5	1		52.5
	5.2	1		55.2

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42. 7 4 2 42 57.4
22.3 1 Dec 1891 43 12.3
29.4 1 Dec 1892 19.4

Reduction in Dec. of Obs. of (123) p. 72

Interval of transits

Ent. $*^1$	Ex.	Ent. $*^2$	Ex.	Ent. Pl.	Ex.	
10.1	10.1	25.7	25.8	44.7	44.2	WAR
—	9.8	26.1	26.4	44.9	—	WAR
20.4	20.4	36.0	36.0	55.0	54.8	WAR

Pl − $*^1$

WAR Ent.	WAR Ex.	WAR Ent.	WAR Ex.
34.6	34.1		
—	—		
34.6	34.1	34.6	34.4

Pl − $*^2$

WAR Ent.	WAR Ex.	WAR Ent.	WAR Ex.
19.0	18.4		
18.8	—		
18.9	18.4	19.0	18.8

34.35	34.50	18.65	18.90
17 17.5	17 25	9 32.5	9 45
51 5.25	51 7.5	27 9.75	28 3.5
.933	.933	.932	.932
480.73	482.83	260.73	264.22
240.4	241.4	130.4	132.1
+ 4′ 0.″4	+ 4′ 1.″4	+ 2′ 10.″4	+ 2′ 12.″1

Results Nov. 6, 1877

12h 45m 18s Pl − $*^1$ + 3m 6.70 + 4′ 0.″4 } WAR. Ob.
Pl − $*^2$ + 2 12.45 + 2′ 10.″4 }

12h 55m 12s + 3 6.40 + 4′ 1.″4 WAR. Ob.
+ 2 11.90 + 2′ 12.″1

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1877phae.proj.11511

of 97	4 17	4h 28m		Between 22 & 30 5h 25m		All of these are read 50s too little. Thus true reading of Dm 1674 is 36 30.2 29.8 fe.		
47.3	7 33	47.2	1	48.8				
59.5		59.4	1	58.5				
7.6	34	7.8	1	7.3				
9.3		9.8	1	9.4				
25.6		26.0	1	25.5				
		27.0	2					
28.0		28.7	2	27.7				
42.1		42.3	1	42.4				
		44.0	2	43.6				
54.4		54.6	1	54.2				
57.7		56.9	1	57.3				
	35	7.0	2	6.7	1			
8.7				8.7	1			
~~27~~		27.0	1	9.7	1			
28.5		28.9	1	35.3	1			
39.8	~~40~~	40.2		Dm 1674 39.8			39.8	
		51.7	1	51.2	2		51.2	1
	36	1.0	2	0.6			0.3	1
16.4		17.0	1	16.6			16.6	1
19.0		19.6	1	19.2			18.4	1
		23.0	2	22.2		Between 25 & 35 5h 28m	23.4	1
				24.8	2		26.9	2
28.0		28.7	1	28.2	1		28.4	3
				29.8	1		29.7	
29.8		30.5	1	~~Dm 1674~~ 30.4	2	~~29.8~~		
		31.4	2					
Copied from 2 pages back	33.8	34.7	1	33.8	1	[41.2]	1	33.8 38.0
	50.3	50.3	1	49.2	1	50.3	1	50.3 59.0
				50.3	1			
4.4 9.0	5.0	37 5.4	2	4.8		[6.6]	1	5.0
				14.2	2	8.9	1	13.8
				19.0	1	13.4	2	19.0
28.5		27.0	1	26.3		16.8	2	
15.0						[18.4]	1	
19.8		29.2	1	28.6		19.7	1	28.5
23.8						23.8	1	
						25.0	2	
31.3		31.2	1	30.7				
40.3						[40.3 1]		36.8
						~~49.0 2~~		37.6

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55.0	55.8 37	55.8 1	55.4	55.0 1	56.5
	56.7	57.5 1	56.3 1 0.6 1 1.8 2		56.5
	3.0 38	38 1	3.7 1	3.8 1 9.0 2	3.2
12.2	11.9	12.0 1	11.8		
18.5	19.0	19.5 1 Dm	19.5	18.5 1 26.8 2 27.6 2	19.6 29.7 33.4 37.0
		40.0 2	37.3 2 40.0		40.0
44.5 45.8	43.6	44.0 1 Dm	43.7	45.5 1 46.5 1	43.5
46.7	49.8	48.6 2			47.7
		50.6 2	50.2		50.3
53.0		53.2 2	52.4	53.2 1	52.8
		55.3 2	54.5		55.7
	58.7	58.9 2	57.3 2		58.7
	59.5	59.7 2	59.5		59.5
	39	7.5 2	7.5		7.5
Dm 9.0	11.6 12.7	12.0 2	11.5	9.6 2 2.	11.6
		13.4 2	13.0		12.9
20.0	26.5	28.5 1 ×	25.3 2 × 27.3 33.0 1 35.7 1 46.2	19.7 2 23.4 1 27.0 1 30.0 1 33.5 1 2 37.7 1 40.3 1 42.8 1 45.7 1 48.7 1 49.5 1 57.5 1 1.6 1 2.9 1 2	
Dm 33.6 46.0		46.2 1			
48.7		48.7 1	48.5		
	3.5 40	4.0 2	3.8		
49.5 1.6 2.7	6.3	7.1 1	6.7		
	9.6	10.0 1	10.0		
16.5	15.3	16.0 2	15.8		
		32.2 2	32.0		
42.5	41.0	41.4 1	41.2		
	44.5	44.8 1	43.6		
	47.2	47.4 1	47.4		
	50.2	49.5 2	49.7 1		
53.5	53.5	52.3 1	53.5		

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59.6	41	0.5	2		0.0
	3.0	3.2	1		2.6
	43	4.2	1		3.4
~~5.5~~					
	16.1	17.3	1		16.3
		32.9	1		32.6
	45.0	45.5	1		45.0
	46.4	46.8	1		46.5
	51.1	51.5	1		50.6
					55.6 1
		58.3	1		58.0
					59.0
~~7.4~~	7.4 42	7.5	1		7.2 2
					8.3 1
		18.0	2		17.8
		19.5	2		19.6
~~21.4~~		21.0	1		21.0
		21.8	1		21.8
~~22.3~~	22.3	23.3	1	Dlw	23.0
					26.2
~~29.4~~	29.4	30.0	2	Dlw	29.7

Asteroid not found.

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Feb. 5, 1878.

Eva (64) computed Rt $6^h\ 24^m\ 40^s$

$\delta + 42^\circ\ 43',4$

DM.	1561	8.5	6^h	22^m	8^s	(42)51,5	*
	1563	9.5		22	30	40,3	
	1565	9.0		22	50	41.3	*
	1569	9.1		25	34	54.9	* (164) Feb. 7 $6^h\ 23^m\ 36$ $+42^\circ\ 43',7$
	1571	9.3		25	59	35.5	*
	1573	9.5		26	10	31.3	*
	1575	9.5		26	19	44.8	.734 = cos δ
	1577	8.0		27	14	41.8	*
	1579	9.5		28	23	35.4	
	1580	9.1		28	34	32.4	*
	1582	9.1		29	44	35.9	
	1585	4.8		30	86	35.9	*
α Geminorum			7^h	26^m	51^s	$+32^\circ$ 9,3	

183 8

215 17

42 36

183 8

225 44

DM Stars suitable for Comparison

DM	1558	9.0	6^h	20^m	19,4	42° 43',4 cos δ
	1559	9.1		20	31	39.0
	1561	8.5		22	8	51.5
	1565	9.0		22	50	41.3 .735
	1571	9.3		25	59	35.5 .736
	1573	9.5		26	10	31.3
	1577	8.0		27	14	41.8 .735

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1877phae.proj.1151

31 = 54 15.5 ~~28~~

8
21

57
17
16
48
7
~~34~~
36
7
18 = 58 36

28 = 0 14

5 2 2.5
18
54
4
13
44
5
33
3
15 = 2 37.5

1st Chron. Set from 1563 to 1571(?) 40' to 50'
2d " dittu
3d "

4th 1563 to 1571 ~~45~~ 35 to 45

St Lr
48 9.8 Suspected
96 19.4
9.2 28.6
9.4 38.0

9.4 94
18.6 9.2 Not it
27.4 5.8
9.6

5th as with
6th dittu

10, 17, 12 like 4, 5, 6
13 14 1563 to 1577(?)
45 to 55'

7 After 1
8 false stroke with earth letter Cut
9

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1877phae.proj.11511

						45m later		
BM 1563	6	22	30.0 1	30.2	30.3	30.0	30.2	30.4
1565			48.2 1	48.4	48.6	48.3	48.6	48.5
			59.2 1	59.8	0.0	0.0	59.5	0.0
		23	3.6 1					
			14.7 1					15.2
			36.9 2	37.3	37.2	37.1	37.3	37.4
			43.8 2	43.6	43.8	43.6	43.7	44.0
		24	8.5 2	8.7	8.6	8.5	8.7	8.5
			10.5 2	10.2	10.4	10.7	10.7	10.6
			22.3 1	22.2	22.4			
			30.5 1	31.6	31.6	33.2	33.5	Found to be 1 era on Feb. 6
			34.0 1	34.3	34.2			
			50.8 2	50.9	51.0	51.0	51.0	51.0
		25	6.1 1	6.1	6.6	6.2	6.4	6.8
			12.5 1	13.0	13.4	12.7	13.0	12.8
			14.9 1	14.3 15.6	14.4 15.8	14.4 15.8 16.2	13.8 14.4 16.0	13.9 14.5 15.5
			33.5 2	33.7	33.6	33.7	34.0	33.9
			38.0 2	38.6	38.5	38.4 39.2	38.3	38.7 39.6
			44.1 1	44.4 2	44.7	44.3	44.5	44.6
			45.0 2	45.3	45.4	45.4	45.4	45.6
			54.7 1					
1571			57.7	58.0	57.9	57.5	57.5	57.4

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1877phae.proj.11511

						45 m. later		
1563	6	22	30.0	29.7	29.5	30.2	30.5	29.7
			39.2 1	38.8				
			48.2 2	48.0	48.0	48.5	48.6	47.9
			59.7 2	59.3	59.6	59.5	59.8	59.3
		23	3.6 2		22.2 24.3			
			41.4 1	41.1	41.1	41.8	41.5	41.0 45.0
			52.1 1	52.0	51.9	52.3 53.0 1	52.3 53.2	51.8 52.8
			55.1 1	56.5	56.2 58.0	56.9 58.0	56.9 58.8	56.3 57.7
		24	3.6 1	3.5	3.3		3.9	3.2
			4.1 1	4.0	4.0		4.3	3.7 4.6
			4.5 1	4.6	4.6		5.7	
			6.7 1	9.2				
			19.8 1	19.7	19.1		20.1	19.5
			28.1 1		28.0			
			31.1 2				32.1	
			33.3 2	35.0 1 38.4 1	35.0 38.4	35.7	36.0	35.0
			39.0 1			38.9	39.3	38.3
		25	6.3 1	5.5	5.4	6.1	6.2	5.7
			12.4 1	12.4	11.9	12.5	13.0	12.0
			13.8 1	13.5	13.5	13.9	14.0	13.6
			15.2 1	15.5	14.8 32.6 1	15.6 32.0 35.2	14.6 15.5	14.4 15.3 32.5 35.0 40.3
			40.5 1	41.9	39.5			
			44.0 2	47.2	47.5 1			
			57.5 1	57.3	57.0	57.9	57.6	57.2

Not found.

On 13th & 14th chron sets chron. failed.

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7 40 S.T.

19.2	19.2
37.4	18.2
57.4	20.0
17.0	19.6
36.6	19.6
56.0	19.4
	19.3

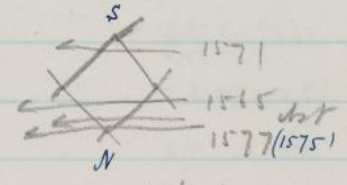
Feb 6. 1906.

19.2	19.2
38.0	18.8
56.4	18.4
15.2	18.8
33.6	18.4
19.0	19.0
	18.8

30m later

IT!

Observations by Chronograph.



In sets 3 & 4 1st tape of stator is 0.3 too soon.

In 6th set hit telescope with head just after 1st tape of 1571.

Order 1565 1, 2, 3,
* 1, 2, 3
1571 1, 2,
(1575) 1577 1,
1571 3,
(1575) 1577 2, 3

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1877phae.proj 1151

Feb. 6

22 30.1 Stars observed on Oct. 5 repeated.
46.3?
58.8 — v. p. 106 —

23 20.6 very faint.
35.1
41.9
54.3

24 1.4 *? = Stop watch shows this to be a planet.
6.2
8.3
21.4
29.8
35.1

25 4.1
10.3
12.2
13.6
31.3
35.4
42.2
42.5
56.8

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1877phae.proj.1151

Obsrn. Record of Wll. No.

Observations of Eva (164) Feb. 6, 1878.

Trans of transit. Brd. 1327

DM. 1565		(164)		DM 1571		1575	
8	37 46.8	39	12.0	41	6.6	41	33.2
	38 15.2		28.3		25.0		44.4
	42.0		42.9		41.2		54.1
	42 18.4	43	43.6	45	41.1	46	5.1
	48.0	44	1.0		57.4		17.6
	43 16.2		16.8	46	12.8		28.3
	46 56.0	48	20.5 [20.8]	50	18.3	50	42.4
	47 25.5		38.6		35.5		54.8
	53.3		53.9		50.3	51	5.8
	54 28.8	55	53.1 [53.4]	57	50.2		c.f. [15.5]
	58.0	56	10.6		c.f. [78]		27.3
	55 25.4		25.6		23.1	58	37.7
	58 ~~56.8 58~~	4	0 21.5	2	17.7	2	43.0
	59 25.5		38.0		38.2		54.9
	52.9		53.3		60.8	3	5.0
9	3 26.5	4	50.8	6	47.3	7	13.0
	55.5	5	7.6	7	5.3		24.5
	4 22.4		22.7		21.0		34.7

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1877phae.proj.11511

Mean of transits

D.M. 1565		(164)		D.M. 1571		D.M. 1575	
8	38 14.67	39	27.73	41	24.27	41	43.90
	42 47.53	44	0.47	45	57.27	46	17.00
	47 24.93	48	37.67 (77)	50	34.70	50	54.33
	54 57.74 (40)	56	9.77 (87) [9.35 (50)]	(58	6.65)	58	26.83
	59 25.07	9	0 37.60	2	34.57	2	54.30
9	3 54.80		5 7.03	7	4.53	7	24.07
		8	52 20.08				

Δ RA

Pl. − 1565		1571 − Pl.		1575 − Pl.		Δ RA
1m	13.06	1m	56.54	2m	16.17	
	12.94		56.80		16.53	~~Pl−1565 = 0m 53.42~~
	12.74 (84)		56.93		16.56	~~1571−Pl = + 26.10~~
	12.37 (47)		57.15 (56.78)		16.96	~~1575−Pl = + 40.37~~
	12.53		56.97		16.70	
	12.23		57.50		17.04	
	(68)					
1	12.84 (.735)	1	56.98 (.736)	2	16.66 (.734)	

Mpp. RA 6 22 50 — 25 59 — 26 19

24.23.84 (65)

2.02

2.36

6h 24m 2.4 — Mpp. RA of (164) — 8h 52m Sid. T. 1327 (uncorrected)

21 7

11 45 Mean T.

8 52 20.1
4.4
8 52 24.5
21 6 43.5
11 45 41.0
1 55.6
11 43 45.4

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1877phae.proj.11512

Reduction in δ.

Interval 1st to 2d transit				2d to 3d transit			
1565	(164)	1571	1575	1565	(64)	1571	1575
28.4	16.3	18.4	11.2	26.8	14.6	16.2	9.7
29.6	17.4	16.8	12.5	28.2	15.8	14.9	10.7
29.5	17.8	17.2	12.4	27.8	15.3	14.8	11.0
29.2	17.2	17.6	11.8	27.4	15.0	15.3	10.4
28.7	16.5	17.5	11.9	27.4	15.3	15.6	10.1
29.0	16.8	18.0	11.5	26.9	15.1	15.7	10.2
Mean 29.07	17.00	17.58	11.88	27.42	15.18	15.42	10.35

Pl − 1565

12.07
12.24
12.15
.735
8505
3645
6075
8.93025
4465
133.95 = 2′ 14.″0

42 41.3

Δδ
1575 − Pl
~~Pl − 1575~~

5.12
4.83
4.98
.734
3486
1494
3,655538
1838
54.″83 = 54.″8

42 44.8

1571 cannot be reduced until side of square is measured.

42 43.5
43.9
43.7

Approx δ of Pl. +42° 43′.7

		Approx. Result.	Computed in Circular 83
Feb. 6.5	RA	6h 24m 2.s4	6h 24m 4s
	δ	+42° 43′.7	+42° 43′.6

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1877phae.proj.1151

Aug 7th 1878. 10.15 Search for Eros

Found and brightness measured by Asst. T.

1563 est at 40

Connected with 1558 est at 43

1558

1559

Rl – 1571

34.58
30.60
32.59
.736
22813
9777
16295
32599
23.9 5365
+11 9 87
359.30
8-48.2
488.7
8' 8.9

23.986
11993
359.79
848.2
488.4 = 8' 8.4

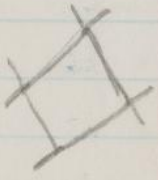
20 40
55
21 10
15
20
32
37
50
4
2 15

1558		1558	
43		43	
30		30	
38		38	
36		37	
35		36	Three
35	44	36	are just out
37	42	35	
38	wrong 43	0 35	
35	40	31	
37	42	32	
36		36	
40		33	
39		34	
34.5		28 40	
34.4		39.5	
33		36 35.	
36		34	
40		33	
35		36	
40	48	40	
34		35	
33		40	
34		34.5	

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2	31	39	07	43	
	35	34	11	42	
	42	35		40	
	40	40	Dm,	38	Dm 1565
		40	54	40	
		44		44	
3	12	34			
		37			
3	31	43	Asteroid 24		



1st Set Astr. four false starts before 2d of last star also one earlier, two seconds too

2d last 3d of Star 1 Little rattle after 3d of asteroid.

4th 2d of Asteroid ? notes; 3d too slow by .4 2d of 2d ✕ too late by .2

5th 3d of asteroid (long break) .5 too slow

Order 1565 1 2 Ast 1 1565 3 Ast 2, 3
1571 1, 2, 3, 1577, 1, 2, 3.

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1877phae.proj.11513

Harm. Record with δ0 copied from p. 113 for charting —

			RA	RA	δ	δ			Results RA	δ
DM	1558	6 20	19.4	19.3	43	43	1558	6 20	19.~~4~~	+42 43
	1559		31.7	32.8	30	30	1559		32	30
			40.6	41.3 41.8 42.2	38	38 37 36			41	38
			48.1	47.9	36	36			42	37
									42	36
									48	36
		21	5.1	5.3	35	35			5	35
			8.1	8.3	35	35			8	35
			11.0		~~42~~				11	42
			16.5		43				16	43
			19.0	19.0	40	31			19 19	31 40
			19.9	20.4	42	32			20 20	32 42
			22.8	22.7	36	36			23	36
				28.5	~~4~~	33			29	33
				28.9		34			29	34
			33.3	33.7	40	40			34	40
			37.7	37.9	39	39.5			38	39
			44.3		35 ~~34.5~~	35			44	35
			46.3	46.0	34	34			46	34
			48.6	47.0 48.0	33	33			47 48	33
			51.3	51.0	36	36			51	36
			54.0	53.9	40	40			54	40
		22	0.2	~~0.0~~	35	35			0	35
			5.6	5.6	40	40			6	40
			7.8	6.1	34	34.5			6	34.5
				10.8		43			8 11	34 43
			13.3	17.3	33	42			13 17	33 42
			21.6	23.9	34	40			22 24	34 40
			31.5	31.6	39	38			32	38
			34.9		34				35	34

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Results

		6	22	41.4		35			6	22	41		35
Dm 1565	N			49.3	49.2	40		Dm.1565			49		40
			23	0.7	0.6	40	40			23	1		40
				5.3	4.0	44	44				5		44
				15.8		38					16		38
				17.1		37					17		37
				31.3	31.5	43							

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1877phae.proj.1151

Chron. Record of
Observations of Eva (164) Feb. 7, 1878. Wll. Ob.
Times of ~~transit~~. Grnd. 1327

DM. 1565		(64)		DM. 1571		DM 1577	
9	10 29.5		11 24.2		13 57.8		14 59.0
	11 1.5		44.1		14 11.0		15 26.0
	32.9		12 2.7		23.9		52.0
16	17.5		17 12.3		19 45.6		20 47.2
	49.6		31.6		59.0		21 13.7
	— [20.1]		50.5		20 12.0		39.8
~~22~~	~~10.0~~						
22	10.0		23 4.3		25 37.6		26 39.7
	41.8		23.9		51.3		27 6.0
23	12.8		42.7		26 4.3		31.7
30	48.0		31 42.0		34 14.7		35 17.5
31	19.1		32 1.5		28.8		43.4 ~~43.~~
	58.0		~~19.4~~ 19.8		42.3		36 8.7
36	42.6		37 36.6		40 9.0		41 12.3
37	13.8		55.6		23.1		38.0
	44.2		38 ~~13.4~~ 13.9		36.9		42 3.3
42	22.3		43 16.0		45 47.6		46 51.6
	53.6		35.6		46 1.9		47 18.2
43	22.6		53.4		16.3		42.0

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1877phae.proj.11511

Reduction in RA

Mean of transits.

D.M. 1565	(164)	D.M. 1571	D.M. 1577
9 11 1.30	11 43.67	14 10.90	15 25.67
16 49.07	17 31.47	19 58.87	21 13.57
22 41.53	23 23.63	25 51.07	27 5.80
31 19.03	32 ~~35~~ 1.10	34 28.60	35 43.20
37 13.53	37 55.37	40 23.00	41 37.87
42 52.83	43 35.00	46 1.93	47 17.27
	166 7024		
	9 27 41.71		

Δ RA

Pl - 1565	1571 - Pl	1577 - Pl
$0^m\ 42.^s37$	$2^m\ 27.^s23$	$3^m\ 42.^s00$
42.40	27.40	42.10
42.18	27.44	42.17
42.07	27.50	42.10
41.84	27.63	42.50
42.17	26.93	42.27
0 42.16	2 27.36	3 42.19
~~.735 = 30.99~~	~~.736 = 1 48.46~~	~~.735 = 2 43.31~~
6 22 50	25 59	27 14

6	23	32.2
		31.6
		31.8
		31.9

9	27	41.7	Sid. t
		4.2	Corr.
9	27	45.9	True Sid. t.
21	10	40.0	Noon
12	17	5.9	Sid. Int.
	2	0.8	Corr.
12	15	5.1	Mean time

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Reduction in δ

Interval 1st to 2d transit — 2d to 3d transit

1565	(64)	1571	1577	1565	(64)	1571	1577
32.0	19.9	13.2	27.0	31.4	18.6	12.9	26.0
32.1	19.3	13.4	26.5	30.5	18.9	13.0	26.1
31.8	19.6	13.7	26.3	31.0	18.8	13.0	25.7
31.1	19.5	14.1	25.9	30.9	18.3	13.5	25.3
31.2	19.0	14.1	25.7	30.4	18.3	13.8	25.3
31.3	19.6	14.3	26.6	29.0	17.8	14.4	23.8
31.58	19.48	13.80	26.33	30.53	18.45	13.43	25.37

Δδ

Pl − 1565

$12^s.10$

12.08

Mean $12^s.09$

735

8463

3627

6045

8.886 15

4443

133.29

2′ 13.″3

42° 41.′3

43.5

43.1

42° 43.′3

Pl − 1577

$6^s.85$

6.92

$6^s.88$

735

4816

2064

344

5,05568

2528

75.85

1′ 15.″8

41.8

Pl − 1571

33.28

31.88

32.58

.736

22806

9774

1955

~~4624~~

~~23,9463~~ 23,9789

~~11973~~ 11989

~~359.2~~ 359.68

~~848.2~~ 848.2

~~4896 = 8′ 8.″0~~ 488.5 = 8′ 8.″5

Computed place

Approx result.

Feb. 7.5 RA $6^h\ 23^m\ 31^s.9$ | $6^h\ 23^m\ 34^s$

δ $+42°\ 43'.3$ | $42°\ 43'.7$

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Ephemeris of Eva (164)

		Rt	δ
Feb. 21	6 20	37	+ 42 32.0
22		39	30.4
23		44	28.8
24		51	27.1
25	21	0	25.4
26		12	23.6
27		26	21.8
28		41	19.9
Mar ~~1~~		58	18.0
2	22	17	16.0
3		36	14.0
4		57	11.9
5	6 23	19	+ 42 9.7

Stars in vicinity

15 1652	7.0	6 17 37.	+ 42 0.9	*
15 1654	9.5	19 33	38.0	
15 1655	9.4	19 37	10.3	
15 1656	9.5	20 18	4.5	
15 1657	9.4	20 19	6.5	*
15 1659	9.1	20 31	30.0	*
15 1660	9.4	21 35	20.5	*
1564	9.2	22 33	8.6	
1566	8.6	24 2	2.2	*
1567	9.5	24 7	22.5	
1568	9.3	25 17	11.6	*
1569	9.5	25 18	21.0	

.738 = cos δ

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Transit of Dkn 1560 and Eva?

10.2

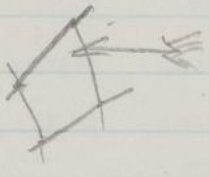
20.2

Transit of two stars either of which may be Eva

6.6	6.6		
13.2	6.6	20m later	6.8
20.2	7.0	1h "	7.0
~~6.7~~	6.2		
26.4			
	24		

6.6

2 = 32.6



Both stars observed.
Wrong taps twice. 2d * in
two of 1st sets.
Rattle after 3d of 1st * in 3d or
4th after Jarsac shows 0s. twice. to be doubtful

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Obsrn. Record Oct. 27, 1878

		(164)				(164)	Prod. 13 2 7
	*'	*²	DM. 1560	*'	*²	DM 1560
9 9	47.0	48.8	10 4.2	9 25 6.6	9.2	24.0
10	12.9	19.2	29.6	25 29.5	36.0	45.9
10	36.0	46.4	51.9	25 49.1	59.6	26 4.8
11	50.2	52.2	12 7.6	26 24.1	26.3	41.6
12	16.2	22.3	32.7	26 46.6	53.1	27 3.2
12	39.5	49.7	55.1	27 6.4	16.8	22.3
13	12.6	14.6	29.8	27 39.8	42.2	57.0
13	38.4	44.7	55.0	28 2.3	9.0	18.8
14	1.7	12.0	17.7	28 22.3 ?	32.4	37.8
14	35.6	37.5	52.9	28 58.0	29 0.2	15.2
15	1.4	8.0	18.2	29 20.2	27.1	36.9
15	24.7	35.4	40.7	29 40.6	50.5	56.1
15	57.4	59.3	16 14.6	30 10.6	12.8	27.9
16	23.4	29.7	39.9	30 33.2	39.7	49.6
16	46.9	56.8	17 2.7	30 53.0	31 3.2	8.8
17	20.1	22.5	34.4	31 30.4	32.8	47.6
17	46.5	53.2	18 2.9	31 52.7	59.4	32 9.5
18	9.5	20.5	25.6	32 12.1	22.9	28.5
23	50.5	52.6	24 7.6	32 47.4	50.0	33 5.0
24	11.6	18.2	28.1	33 10.0	16.8	26.5
24	30.3	40.7	45.9	33 29.9	40.7	45.8

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Red. in RA

Mean of transits

		(164) *	DM 1560	Δ DM − (164)
9h	10m	18,13 ~~11.97~~	28.57	10,44
	12	21.40	31.80	10.40
	13	43.77	54.17	10.40
	15	~~6.97 0.84~~	~~17,27 6.97~~	10.30
	16	28,60	39.07	10.47
	17	52.07	61.97	9.90
	24	17,17	27.20	10.03
	25	34.93	44.90	9.97
	26	52.06	62.37	10.31
	28	7.87	17.87	10.00
	29	25.93	36.07	10.14
	30	38.57	48.77	10.20
	31	~~58.37 51.73~~	68.53	10.16
	~~33~~	15.83	25.77	9.94
9h	22m	34.41	DM 1560 − (164)	10.19

~~.738~~
~~7.52~~

6 21 35 42 20.5

10 0.9

Approx. place, 6 21 25 42 21.4

9 22 34.4 Sid t.
− 3.8 Corr.
9 22 30.6 True Sid. t.
22 29 31.2 Noon
10 52 59.4 Sid. Int
1 47.0 Corr.
10 51 12.4 Mean time

Red. in δ

Int. 1st to 2d transit.

	(164) *	DM. 1560	Δ
	30.4	25.4	5.0
	30.1	25.1	5.0
	30.1	25.2	4.9
	30.5	25.3	5.2
	30.4	25.3	5.1
	30.7	25.5	5.2
	25.6	20.5	5.1
	26.8	21.9	4.9
	26.8	21.6	5.2
	26.8	21.8	5.0
	26.9	21.7	5.2
	26.9	21.7	5.2
	26.6	21.9	4.7
	26.8	21.5	5.3
			5.07

2d to 3d transit.

	(164) *	DM 1560	Δ
	~~4.9~~	27.2	22.3
	5.0	27.4	22.4
	4.6	27.3	22.7
	4.9	27.4	22.5
	4.3	27.1	22.8
	4.6	27.3	22.7
	4.7	22.5	~~17.8~~
	4.7	23.6	18.9
	4.6	23.7	19.1
	4.4	23.4	19.0
	4.2	23.4	19.2
	4.3	23.5	19.2
	4.5	23.5	19.0
	4.6	23.9	19.3
			4.60

4.60
4.84
~~.7438~~
~~3.582~~ ~~3572~~
~~1.794~~ ~~1786~~
(164) − 1560 ~~55.173~~ ~~53.588~~

4.84
.738
53.58

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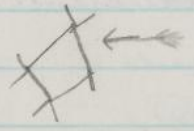
© Feb. 25 1877 Prod. 3451

8h DM. 1560 164 Will Obs. A.S Rec.

8h	3m 2	22.0	32.1
		45.6	50.4
	33m	8.0 (?)	8.0
	34m	49.5	60.0
	35	9.9	15.1
		29.6	29.3
	35	57.3	67.9
	36	18.0	23.4
		38.3	38.3
	37	2.2	12.6 (two a on by 0.3)
		23.0	28.2
		43.0	43.0
	38	28.0	38.6
		48.5	53.1 rej.
		9.0	9.0
	39	45.7	56.4
	40	6.4	12.0
		27.0	27.0

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In chron 5b. 

4th set false stroke before last tap.
In all but one or two sets common tap for last of star and planet. Middle sets. doubtful in several of early sets and lost in one.

Chron Record Prod. 1327

	DM 1560	(164)		DM 1560	(164)
8 58	18.8	29.8	9 3	28.0	38.4
	39.7	46.1		49.3	55.0
59	0.5	0.5	4	10.0	10.0
59	18.0	28.5	4	27.7	38.4
	39.0	45.2 ?		49.1	—[55.2]
9 0	0.2	59 59.6	5	10.0	10.0
0	21.6	32.0	5	23.3	[34.0]
	42.7	49.7 ?		44.5	50.5
1	3.9	3.3	6	5.6	5.6
1	18.6	30.0	6	22.0	33.—
	40.0	46.0		43.2	49.3
2	0.7	0.7	7	4.0	4.0
2	29.1	39.9	7	~~50.6~~ ~~20.15~~	& ~~1.8~~ ~~30.3~~
	49.9	56.3	8	12.2	17.7
3	10.6	10.6	8	33.1	33.1

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Reduction in RA.

Mean of transits

	~~δm~~	1560	(164)		Δ
	8	58 39.67	58	45.47	5.80
		59 39.07		44.43	5.36
ref'.	~~9~~	~~0 42.73~~		~~48.33~~	~~5.60~~
		1 39.77		45.57	5.80
		2 49.87		55.60	5.73
		3 49.10		54.47	5.37
		4 48.93		54.53	5.60
		5 44.47		50.03	5.56
		6 43.07		48.77	5.70
	~~8~~	11.97		17.53	5.56
			9	3 39.60	5.61
				4.8	
			9	3 34.8	~~5.38~~
					~~4.14~~
			22	33 27.7	
			10	30 7.1	
				1 43.2	
			10	28 23.9	

Chronom. do.

	1560	(164)	Δ
	32 45.37	50.17	4.80
	35 9.67	14.80	5.13
	36 17.87	23.20	5.33
	37 22.73	27.83	5.10
	~~38 48.50~~	~~53.57~~	~~5.07~~
	40 6.37	11.13	4.76
		8 36 25.43	5.02
		-4.8	~~.738~~
			~~3.70~~
		8 36 20.6	
		22 33 27.7	
		10 2 52.9	
		1 38.8	
		10 1 14.1	
		8 36 20.6	
		9 3 34.8	
		8 49 57.7	

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1877phae.proj:1151

Reduction in δ

Int. 1st to 2d transit			Int 2d to 3d transit		
DM 1560	(164)	Δ	DM 1560	(164)	Δ
20.9	16.3	4.7	20.8	~~16.6~~ 14.4	6.4
21.0	16.7	4.3	21.2	14.4	6.8
~~21.1~~	~~17.7~~		~~21.2~~	~~13.6~~	
21.4	16.0	5.4	20.7	14.7	6.0
20.8	16.4	4.4	20.7	14.3	6.4
21.3	16.6	4.7	20.7	15.0	5.7
21.4	16.8	4.6	20.9	14.8	6.1
21.2	16.5	4.7	21.1	15.1	6.0
21.2	16.3	4.9	20.8	14.7	6.1
21.6	15.9	5.7	20.9	15.4	5.5
		4.82			6.11
					4.82
					5.46
					.74
					4.04
					2.02

1560 − (164) = 60.″6 ~~60~~

Chromom 6b.

23.6	18.3	5.3	22.9	17.6	5.3
20.4	15.1	5.3	19.7	14.2	5.5
20.7	15.5	5.2	20.3	14.9	5.4
20.8	15.6	5.2	20.0	14.8	5.2
~~20.5~~	~~14.5~~	~~6.0~~	~~20.5~~	~~15.9~~	~~4.6~~
20.7	15.6	5.1	20.6	15.0	5.6
		5.22			5.40
					5.22
					5.31

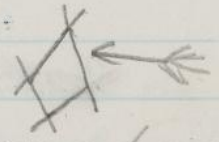
1560 − (164) = 58.″9

5.31
.738
3919
1960
58.79

.74
17
21 84
39 29
19 64
58.93

1877phae.proj.1151

March 1st 1878.



Observed two in nearly same position
Take stroke in 3d from last and 1st from
last always preceding true stroke.

blurry record.

DM	1560		x'	x² (164)
26	17.2		55.1	56.5
	48.5	27	10.3	11.6
27	19.4		24.0	25.3
27	58.2		36.1	38.1
28	29.5		51.0	53.2
28	59.9	29	5.0	7.2
29	31.3	30	9.6	11.4
30	2.5		24.3	26.1
	33.2		38.0	40.8
30	59.0	31	37.5	39.5
31	30.5		52.2	54.8
32	1.3		5.9	8.4
32	26.9	33	4.5	6.8
32	58.2	33	19.7	21.9
33	28.9		33.9	36.0

(164) − 1560 = often +21.6 or 23.7
field to be examined later

DM	1560		x'	x² (164)
39	44.9	40	23.3	25.0
40	16.8		38.5	40.7
	48.0		52.6	55.1
41	7.5		45.8	47.2
41	39.0	42	0.6	2.8
42	10.4		15.3	18.0
42	36.4	43	14.2 / ~~7.8~~	15.8
43	7.8		30.0	32.0
	39.3		44.5	46.9
44	10.5		49.1	50.8
44	42.4	45	4.0	6.1
	14.1		19.1	21.3
45	44.1	46	22.5	24.0
46	15.9		37.0	39.6
	48.1		51.7	54.3
47	11.9		50.1	57.9
47	43.9	48	5.2	7.3
48	15.1		19.7	21.9

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Reduction in RA

Mean of transits

1560		(164)		Δ	(164)		Δ
~~9 26~~	~~48.37~~	27	~~9.80~~	~~21.43~~	~~27~~	~~11.13~~	~~22.76~~
28	29.20		50.70	21.50	28	52.83	23.63
30	2,33		23.97	21.64	30	26.10	23.77
31	30.27		51.87	21.60	31	54.07	23.80
32	58.00	33	19.37	21.37	33	21.57	23.57
40	16.57		38.13	21.56	40	40.27	23.70
41	38.97	42	0.57	21.60	42	2.67	23.70
43	7.83		29.57	21.74	43	31.57	23.74
44	42.33	45	4.07	21.74	45	6.07	23.74
~~46~~	~~16.03~~		37.07	21.04	~~46~~	~~39.30~~	~~23.27~~
47	43.63	48	5.00	21.37	48	7.03	23.40

9 344 2,18

9 38 13.58

23.67

.674

14202

16569

9468

16,95358

9 38 13.6
5.1
9 38 8.5
22 37 24.3
11 0 44.2
1 48.2
10 58 56.0

~~23.67~~
~~738~~
~~16569~~
~~710~~
~~189~~
~~17.468~~

Reduction in δ

Int. 1st & 2d transit			Int. 2d & 3d transit		
1560	(164)	Δ	1560	(164)	Δ
~~31.3~~	~~15.1~~	~~16.2~~	~~30.9~~	~~13.7~~	~~17.2~~
31.3	15.1	16.2	30.4	14.0	16.4
31.2	14.7	16.5	30.7	14.7	16.0
31.5	14.8	16.7	30.8	14.1	16.7
31.3	15.1	16.2	30.7	14.1	16.6
31.7	15.7	16.0	31.2	14.4	16.8
31.5	15.6	15.9	31.4	15.2	16.2
31.4	16.2	15.2	31.5	14.9	16.6
31.9	15.3	16.6	31.7	15.2	16.5
~~31.8~~	~~15.6~~	~~16.2~~	~~32.2~~	~~14.7~~	~~17.5~~
32.0	15.4	16.6	31.2	14.6	16.6
		16,21			16.49

16.35
.738
12066
6033
180.99

16.35
.74
11445
6540
12.0990
605
181,5

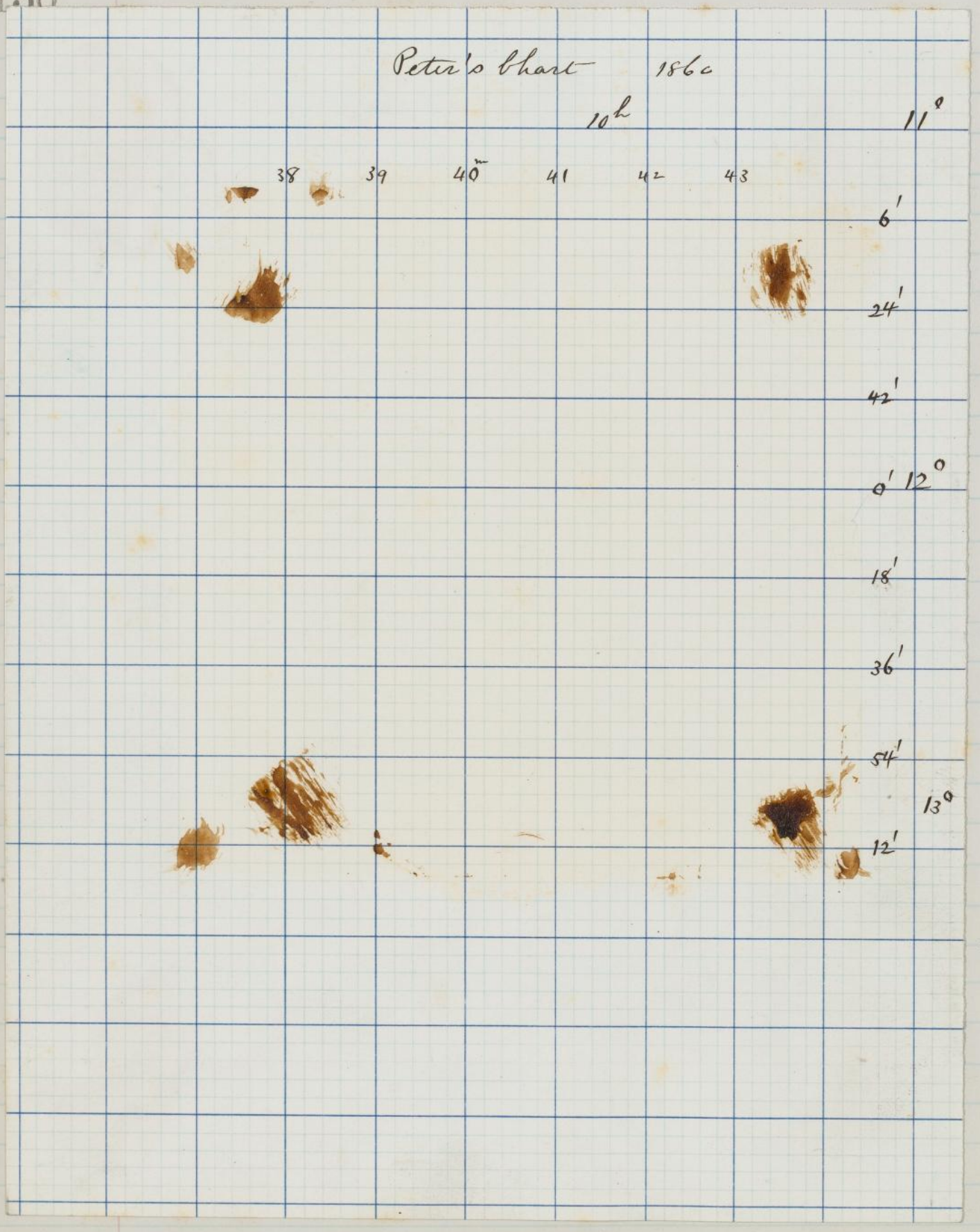
1560 − (164) = 3′ 1.″5

21
16.35

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Peter's chart 1860



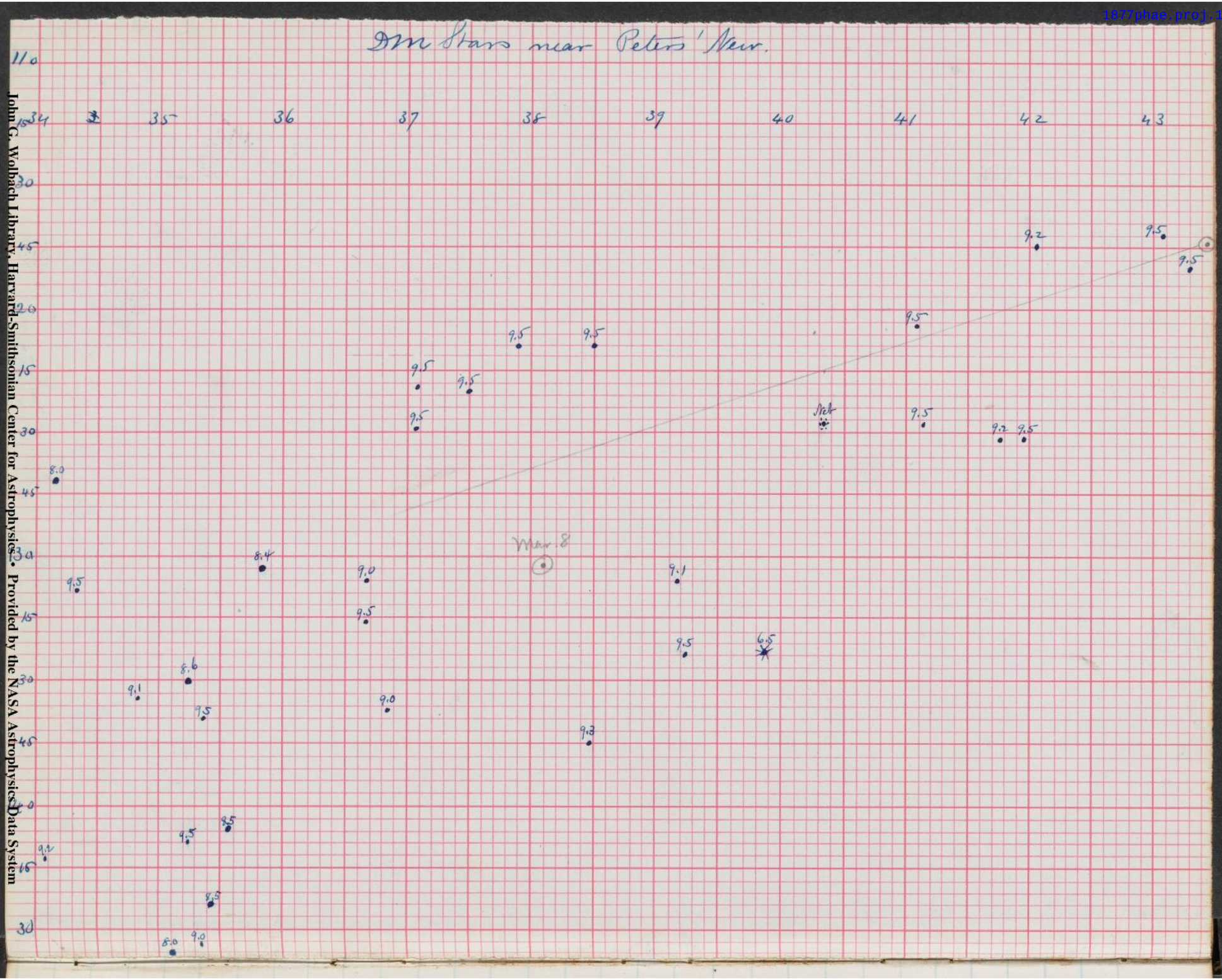
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Peters's New Planet

Dm. Stars $10^h\ 34^m - 44^m$ $+11^\circ\ 0' - 14^\circ\ 30'$

*	14°	2280	9.2	10^h	34^m	4^s	$+14^\circ$	131
*	12	2242	8.0		34	10	12	42
	13	2288	9.5		34	20	13	8
	13	2280	9.1		34	49	13	34
*	14	2281	8.0		35	7	14	37
*	14	2282	9.5			13	14	9
*	13	2290	8.6			14	13	30
*	14	2283	9.0			21	14	34
	13	2291	9.5			22	13	39
*	14	2284	8.5			27	14	24
*	14	2285	8.5			35	14	5.5
*	13	2292	8.4			47	13	3
		2293	9.5		36	40	13	16
*		2294	9.0			40	13	6
	12	2247	9.5		37	4	12	29
	48		9.5		37	5	12	39
*	49		9.5		37	30	12	20
	51	2295	9.0		37	51	12	9
					37	54	13	37
	13	2296	9.3		38	28	13	45
	12	2252	9.5		38	30	12	9
	13	2299	9.1		39	11	13	6
		2301	9.5			13	13	24
*		2302	6.5			52	13	23
*	12	2253	neb		40	20	12	28
		2254	9.5		41	5	12	4
		2255	9.5			6	12	28
*	12	2256	9.2			45	12	32
	11	2281	9.5			58	12	32
*	12	2257	9.2		42	3	11	45
*	11	2284	9.5		43	4	11	42
		2285	9.5			18	11	50
		2286	9.4			50	11	44

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St watch clock

23 0 21.5

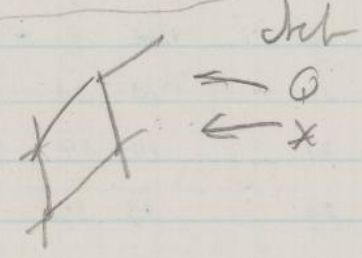
45.0 22.0

∴ Eva m Mer. 1 was the 2d of the two observed

March 5, 1878 Pulkowa

16.4	15.8	15.8	15.2
32.2	15.6	31.0	15.0
47.8	15.6	46.0	15.2
63.4		61.2	

Mer.



Observed this near planet

In 2d set two false shots before true ⊙3

				Δ	Daily Δ			Δ	Daily Δ
Mar. 1	10h	43m	27s			11°	44′.8		
				186.3	46.6			44′.4	11′.1
5		40	20.7			12	29.2		
					45.6				11.2
6	10	39	35.1			12	40.4		
							22 6		
8	10	38 1	30 5			13	3.		
15	10	33	35 ±			14°	22′ ±		
20	10	30	0 ±			15	0 ±		

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Pl	Net. 2253	2257
10 34 7.0	13.0	35 21.1
23.2	21.6	47.8
38.0	28.0	36 13.1

Pl	2257
36 42.6	37 56.6
52.5	38 17.3
37 1.3	38 36.0
38 58.1	40 12.9
39 8.4	40 33.2
39 17.2	40 52.5
41 25.1	42 40.0
35.7	43 0.3
44.5	19.8
43 43.2	44 58.0
53.4	45 18.5
44 2.8	38.0
46 15.4	47 30.1
25.8	50.6
35.3	48 10.0

10 40 22.8
6.5
10 40 16.3
22 53 10.5
11 47 5.8
1 55.8
11 45 10

Reduction in Rt
mean of transits

Pl.	2256	2257 - Pl
10 34 22.73	35 47.33	1m 24.60
36 52.13	38 16.63	24.50
39 7.90	40 32.87	24.97
41 35.10	43 0.03	24.93
43 53.13	45 18.17	25.04
46 25.50	47 50.23	24.73
10 40 22.75		1 24.80
		-.976
		+ 22.76

Red. in δ

Int. 1st to 2d transit			2d to 3d transit		
Pl	2256	Δ	Pl	2256	Δ
16.2	26.7	10.5	14.8	25.3	10.5
9.9	20.7	10.8	8.8	18.7	9.9
10.3	20.3	10.0	8.8	19.3	10.5
10.6	20.3	9.7	8.8	19.5	10.7
10.2	20.5	10.3	9.4	19.5	10.1
10.4	20.5	10.1	9.5	19.4	9.9
		61.6			

12 | 1230

10.27 × .976 = 10.02

Δδ 2257 - Pl = 2′ 30.″3 = 5.01 / 150.3

2257 = WB 716

1878.0 = 10h 41m 45.s81 +12° 32′ 5.″0
22.76
1 24.80 2 30.3
23.05

Pl 1878.0 = 10 40 21.04 +12 29 34.7

10	41	45.5	12	31.7
	1	24.8		2.5
1878.0 Appr. place	10h	40m	20.s7	+12° 29′ 2

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1877phae.proj.1151

March. 6. Examined Peters' New Pl and
124.6 pr. 7' N of 2256 . took approx places

8 51 124.4 7.2

		10	41	45.5	12. 31.7
			2	4.5	7.1
Appr. at 8 51		10	39	41.0	12 38.9
Corr. to 11 40				5.9	1.5
		10	39	35.1	12 40.4

Mar. 15

* possibly Pl. and
familiar star 5' n f 10 45

10 15.	22.4	22.4	22.2
	44.0	21.6	44.0
	65.8	21.8	66.0
	88.2	22.4	88.2
	109.8	21.6	110.0
		220	

No motion

Took chron. transits of stars in vicinity, the suspected star just shown not to be it, tho' in almost the exact computed place, being no. 7

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1877phae.proj.11511

Eye and ear transits of same by listening to sounder in the circuit

12.9

		δ S 26		Mean
18.3	7.7	~~16~~ 17.5 10.7	10.9	10.8
29.0	18.6	~~17.5~~ 25 21.1	21.3	21.2
39.4	49.0	~~25~~ 28 28.2	28.3	28.2
46.5	36.0	~~28~~ 23 35.4	35.3	35.4
53.7	43.0	~~23~~ 16 55.6	55.8	55.7
13.9	3.5	~~16~~ 15.5 71.4	71.3	71.4
29.7	19.0	22 98.6	98.7	98.6
56.9	46.4	27.5 120.4	120.6	120.5
18.7	8.3	26.5 144.2	144.3	144.2
42.5?	32.0?	24 150.8 +6[S]	151.1	151.0
29.1	38.8	19	11[h] 15[m]	
		20.5		
		18.5		

9.7	7.1	2.7	11.1	10.9
20.8	18.0		22.3	21.4 21.2
31.0	28.5	23.9	28.5	28.9 28.3
38.2	36.0	31.0	35.5	35.9 35.7
45.2	43.0	38.4	56.1	56.0 56.0
5.8	3.1	58.7	71.5	71.9
21.2	19.0		98.7	98.9
48.4	46.0		120.8	120.9
10.5	8.0		144.4	
34.1			151.1	
40.8				

Not found

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1877phae.proj.1151

Chron. record

10	26	7.3		31	35.8		11	2	38.1		8	1.9		34	6.9
		18.3			46.6				48.8			12.7			17.9
		28.4			56.6				59.4			23.1			28.1
		35.6		32	4.1			3	6.8			30.3			36.2
		42.8			11.4				13.6			37.3			42.4
	27	3.0			31.6				34.0			57.6		35	3.0
		19.0			47.2				49.5		9	13.3			18.6
		45.9		33	14.4			4	16.7			40.3			46.0
	28	8.0			36.5				39.0		10	2.7		36	7.9
		32.0		34	0.2			5	3.0			26.5			31.8
	29	38.1		35	6.5				9.3		11	33.1		37	38.2
	30	7.4			35.8				38.3		12	2.0		38	7.3
		43.8		36	12.4			7	14.7			38.5			43.9
		51.0			19.4				22.0			49.7			57.0

Δ from 1st

		10.0			10.8			10.7			10.8			11.0
		21.1			20.8			21.3			21.2			21.2
		28.3			28.3			28.7			28.4			28.3
		35.5			35.6			35.5			35.4			35.5
		58.7			55.8			55.9			55.7			56.1
	1	11.7		1	11.4		1	11.4		1	11.4		1	11.7
		38.6			38.6			38.6			38.4			39.1
	2	0.7			0.7			0.9			0.8			1.0
		24.7			24.4			24.9			24.6			24.9
		30.8			30.7			31.2			31.2			31.3
	3	0.1			0.0			0.2			0.1			0.4
		36.5			36.6			36.6			36.6			37.0
		43.7			43.6			43.9			43.8			44.1

Not found.

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DM Stars

+14°	+2266	7.6	10	29	43	14	26.1	
	× 67	9.4			51	13	56.6	
	× 69	7.8		30	15	14	40.8	
	70	9.5			30		9.5	
	72	9.3			48		38.2	
	× 73	8.8		31	34		45.4	
	74	9.1			38		11.2	
	× 75	8.5			55		35.4	
	76	9.4		32	3		25.1	
	× 77	8.5			13		39.6	
	× 78	9.2			44		35.6	~~6.0~~
	79	9.5		33	28		6.0	~~11.0~~
	× 80	9.2		34	4		11.0	~~36.8~~
	× 81	8.0		35	7		36.8	~~9.5~~
	× 82	9.5			13		9.5	~~33.8~~
	× 83	9.0			21		33.8	~~24.0~~
	× 84	8.5			27		24.0	~~5.7~~
	85	8.5			36		5.7	

6^m 10 39 57 +14 57
183 4
197 55

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Dm Stars

	×	2255	6.0	10	25	40	45.7	
14°		2264	9.4	10	29	12	14 46.6	
		71	9.1		30	32	48.9	Set on the 6m
15°	×	2224	8.2		29	49	15 25.4	10 25 40 14 45.7
	×	25	8.8		30	21	48.8	183 4 / 197 50
		26	8.9			38	11.0	or 348 18
	×	27	8.8		31	1	46.9	
		28	9.0			3	41.7	
		29	8.5			20	15 38.2	
	×	30	8.9		31	50	14 54.0	
15	×	2218	9.0		26	16	15 18.1	
	×	19	8.7		26	57	32.0	
	×	20	8.7		26	59	50.6	WB 4393
		21	9.3		27	53	15 29.0	
		22	9.5		28	27	14 58.8	
	×	23	9.0			39	15 14.4	WB 544

No. of Planet

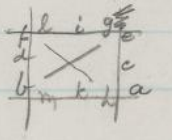
			Δ	Daily Δ	δ	Δ	Daily Δ
Mar. 1	11.7	10 43 27.6			+ 11 44.6		
			183.6	45.9		44.6	11.2
5	11.2	40 24.0			12 29.2		
			136.0	45.3		32.8	10.9
8	11.4	38 8.0			13 2.0	70.5	10.1
			294.0	42.0		~~31.5~~	~~8.8~~
15	8.5	33 14.0			14 ~~3.5~~ 12.5		
21		29 32	222	37	15 5	52	8.7
22		29 0			15 13		

Clinton

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1877phae.proj.01511

Measures of □ used in pl. observations



	54.961	74.582	54.940	74.580
ab	73.718	55.814	73.714	55.813
	54.942	74.593	54.941	74.539
cd	73.703	55.812	73.700	55.705
ef	54.886	74.~~537~~ 518	54.860	74.515
	73.646	55.736	73.624	55.734
gl	~~36.330~~ ~~56.024~~	56.021	36.~~339~~ 345	56.028
	55.092	37.250	55.095	37.252
ik	36.331	56.016	36.331	56.017
	55.091	37.244	55.090	37.248
lm	36.308	55.986	36.309	55.978
	55.~~701~~ 070	37.210	55.059	37.210

Δ

ab	cd	ef	gl	ik	lm
18.757	18.761	18.760	18.762	18.760	18.762
18.768	.781	.782	.771	.772	.776
.774	.759	.764	.750	.759	.750
.767	.784	.781	.776	.769	.768
18.766	18.771	18.772	18.765	18.765	18.764

771
772
765
765
764
18.767

$18.^{s}767 = 19.^{m}855$

Diagonal = 548.″2

log = 1.29787
"Fain" 8.51989

Side of square = 599.7 log 2.77798
5.55596
30103
2 5.85699
2.92850

Diag = 14′ 8.″2

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1877phae.proj.1151

March 22, 1878. Wash. Mn

Stars near new planet

17.1
22.4
30.4
45
47.5
52.3
3.5
15.2
52.4

16.5
21.7
29.5
44.5
47.0
51.5
53
25
145

10.5
15.5
23.0
38
40.5
43
45.5
46
56.0
8.0

5.0 4.0
10.0 9.5
17.8 17.1
32.5
37.5 31.7
41. 42.0
51.2 44
30 53.5
57.1

-3

10 15

5.3 5.2 5.0 5.0 5.5
13.3 13.0 12.5 12.8 13.1
27.9 28.0 27.5 27.5 27.7
30.4 30.5 30.0
32.5
35.2 35.0 35.0 34.5 35.0
36.5 35.5 36.0 37.0
46.4 46.0 45.5 46.2 46.5
58.1 58.0 57.5 58.0 58.1

St. watch

16
3.2
4.8

12.0 12.0
23.6 11.6
35.2 11.6
46.8 11.6
58.4

2d set

2.2
4.6
7.2

II.

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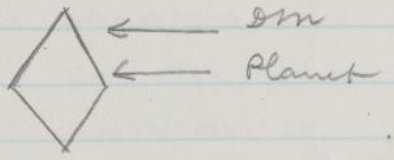
1877phae.proj.11511

2d set
½ hour later

8.0
13 0
20 5
35 5
41
42
44.
53.5
55

5.7
10.6
15.5
33 4
35
41 7
515
35

Observations of planet and DM 2223



In order.

Pl_1 $*_1$ $*_2$ Pl_2 $*_3$ Pl_3

5.0 4.9
12.5 12.8
27.5 27.7
33.0 33.8
34.0 3
36.0 36.0
45.5 45.8
57.5 57.8

Not satisfactory

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1877phae.proj.0151

Chron. Record.

Pl		Dm		Pl		Dm	
10	34 43.2	34	55.5	10	40 37.0		49.6
	35 8.4	35	3.4		41 2.3	40	57.5
	35 32.5	35	10.7		41 26.8		4.8
	35 58.6	36	11.0		41 36.0		48.5
	36 23.8		19.0		42 1.3	41	56.4
	36 48.0		26.0		42 25.8		3.7
	37 9.5		22.0		42 45.7		58.5
	37 34.8		29.8		43 10.9		6.2
	37 59.2		37.3		36.0		13.7
	38 19.6		32.0		43 55.3	44	7.4
	45.0		40.8		44 20.5		15.9
	39 9.1	38	47.3		45.4		23.3
	39 33.0		45.3		45 2.0		14.8
	58.0		53.2		27.2		22.7
	40 22.3		0.4		52.0		30.2

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RA Reduction δ

Mean of transits

	Pl (185)		Dm 2223	Δ
~~11~~	35 8.03	35	3.20	4.83
	36 23.47	36	18.67	4.80
	37 34.50	37	29.70	4.80
	38 44.57	38	39.77	4.80
	39 57.77	39	52.97	4.80
	41 2.03	40	57.30	4.73
	42 1.03	41	56.20	4.83
	43 10.87	43	6.13	4.74
	44 20.40	44	15.70	4.70
	45 27.07	46	22.57	4.50
10	~~39~~ 40 22.97		Pl − Dm	+4.75
				~~4.65~~
				~~4.58~~

Int 1st to 2d transit 2d to 3d

Pl (185)	Dm	Δ	Pl	Dm	Δ
25.2	7.9	17.3	24.1	7.3	16.8
25.2	8.0	17.2	24.2	7.0	17.2
25.3	7.8	17.5	24.4	7.5	16.9
25.4	8.0	17.4	24.1	7.3	16.8
25.0	7.9	17.1	24.3	7.2	17.1
25.3	7.9	17.4	24.5	7.3	17.2
25.3	7.9	17.4	24.5	7.3	17.2
25.2	7.7	17.5	25.1	7.5	17.6
25.2	8.0	17.2	24.9	7.4	17.5
25.2	7.9	17.3	24.8	7.5	17.3
		17.33			17.16
		17.16			
		17.24			
		.9650			
		16.6.37	=	~~2 1 46.4~~	
		83 18			
Pl − Dm		249.55	=	4′ 9.″6	

Dm 2223

Hb. Obs. 1878.0 10h 28m 40.s21 15° 13′ 39.″0

~~4.75~~ 4 9.6

(185) 1878.0 10 28 44.~~96~~ +15 17 48.6

Sid t 10 40 23.0

Clock corr. −14.8

0.666667
11111
198

	10	40	8.2	1	40	8.2
Sid Mean Sun	~~0~~	~~+~~	~~8.9~~	0	0	11.9
Sid Int	~~10~~	~~38~~	~~59.3~~ 44.7	1	~~39~~	56.3 44.8
Mean Int	~~10~~	~~37~~	~~14.6~~	10	38	11.5
Red to Berlin	~~5~~	~~38~~	~~8.6~~	5	38	5.6
Berlin t	~~16~~	~~15~~	~~20.2~~	16	16	17.1 = 22.d 677976

	11	39	56.3
		1	55.0
	11	38	1.3
	5	38	5.6
	17	16	6.9

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March 25, 1878

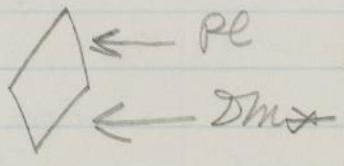
Stars near expected place

St. w.		10.25			10 50	
5.6	5.6	10.6	10.6	5.6	10.8	
11.4	5.8	20.8	10.2		22.0	
17.0	5.6	31.0	10.2			II.
22.6	5.6	41.0	10.0			

Chron comparisons made with DM 2220 a double star 8.5, 10 Posting. 250 D 6"

First two comparisons prec. False strokes in 2d before true DM_3

Several sets begun and abandoned. None of the observations as good as usual.



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1877phae.proj.21511

	Dm	pl
11	15 18.4	25.6
	31.5	38.6
	42.9	50.6
	16 5.4	12.0
	18.2	28.7
	29.7	37.8
	16 47.6	54.0
	17 0.3	7.9
	11.8	19.5
	17 31.9	38.5
	44.5	52.0
	56.0	18 4.0
	18 23.1	29.6
	35.6	43.2
	47.1	55.3
	19 26.0	32.3
	38.9	46.1
	50.2	58.4

	Dm	pl
24	18.9	24.6
	31.3	38.6
	42.8	51.3
25	10.5	16.4
	23.3	30.5
	34.4	43.1
26	50.1	55.6
27	2.4	9.9
	13.9	22.3
27	44.7	50.1
27	57.1	28 4.3
28	8.3	16.6
28	30.4	36.1
	42.9	50.0
28	54.0	29 2.6

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1877phae.proj.11511

RA Reductions δ

Mean of transit

	Dm	2220		(185)	Δ
11	15	30.93	15	38.27	7.34
	16	17.77	16	25.17	.40
	16	59.90	17	7.13	.23
	17	44.13	17	51.50	.37
	18	35.27	18	42.70	.43
	19	38.37	19	45.60	.23
	~~24~~ 4	31.00	20	38.17	.17
	~~25~~ 5	22.73	21	30.00	.27
	27	2.13	27	9.27	7.14
	27	56.70	28	3.67	6.97
	28	42.43	28	49.57	7.14
			~~20~~	~~63.7~~	7.24
			21	3.7	~~.962~~
					~~6.96~~

Inst. 1st & 2d transit 2d & 3d

Dm	185	Σ Δ	Dm	185	Σ Δ
13.1	13.0	26.1	11.4	~~25.4~~	12.0
12.8	13.7	26.5	11.5	23.6	12.1
12.7	13.9	26.6	11.5	23.1	11.6
12.6	13.5	26.1	11.5	23.5	12.0
12.5	13.6	26.1	11.5	23.6	12.1
12.9	13.8	26.7	11.3	23.6	12.3
12.4	14.0	26.4	11.5	24.2	12.7
12.8	14.1	26.9	11.1	23.7	12.6
12.3	14.3	26.6	11.5	23.9	12.4
12.4	14.2	26.6	11.2	23.5	12.3
12.5	13.9	26.4	11.1	23.7	12.6

26.45

23.62

25.04

.9620

24.068

1.2044

361.32 = 6′ 1.″3

14 8.2

2220 − R = + 8′ 6.″9

From W.C. & Rumker (½ wt)

1878.0 2220 = 10h 27m 1.s02 +15° 50′ 32.″3

~~6.96~~

~~7.24~~ − 8 6.9

~~7.98~~

1878.0 10 27 ~~8.26~~ 15 42 25.4

11 21.3.7

16.5

11 20 47.2

0 12 1.5

11 8 45.7

1 49.6

11 6 56.1

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Mar. 26, 1878.

Observations of Peters' New Pl. (185)

	Pl	DM 2220		Pl	DM 2220
10 52	58.6	53 19.3	11 0	24.8	45.7
53.	16.9	39.0 ~~34.5~~		43.1	1 5.6
	34.5 ~~39.0~~	58.8	1	1.0	25.4
54	26.4	47.2	1	43.0	2 4.0
	44.3	55 7.0 ~~2.2~~	2	1.2	23.9
55	2.2 ~~X.X~~	26.5		19.2	43.7
55	46.5	56 7.4 ~~4.5~~	2	58.0	3 19.0
56	4.5	27.1 ~~23.3~~	3	16.3	39.1 ~~34.~~
	22.5 ~~2.X.X~~	46.8		34.9	59.1
57	21.6	42.4			
	39.8	58 2.3 ~~5.X.8~~			
58	57.8 ~~2.3~~	22.0			
58	53.4	59 14.4			
59	11.9	34.2 ~~29.6~~			
	29.6	54.0			

Mean of transits

	(185)		DM		Δ
10	53	16.67	53	39.03	~~23~~.36
	54	44.30	55	6.90	22.60
	56	4.50	56	27.10	.60
	57	39.73	58	2.23 ~~27.11~~	.50
	59	11.63	59	34.20	.57
11	0	42.97	1	5.57	.60
	2	1.13	2	23.87	.74
	3	16.40	3	39.07	.67
					22.58
					~~.962~~
					~~21.74~~

10 58 22.2
17.1
10 58 5.1
0 15 58.1
10 42 7.0
1 45.2

10 40 21.8

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Reduction of δ

Int	1st to 2d transit		2d to 3d		
(185)	ΔM	Δ	(185)	ΔM	Δ
18.3	19.7	1.4	17.6	19.8	2.2
17.9	19.8	1.9	17.9	19.5	1.6
18.0	19.7	1.7	18.0	19.7	1.7
18.2	19.9	1.7	18.0	19.7	1.7
18.5	19.8	1.3	17.7	19.8	2.1
18.3	~~18.8~~ 19.9	1.6	17.9	~~17.9~~ 19.8	1.9
18.2	19.9	1.7	18.0	19.8	1.8
18.3	20.1	1.8	18.6	20.0	1.4
		1.64			1.80
		1.80			
		1.72			
		.962			
		1.6546			
		8273			
		24.82 = Δδ ±			

(position of square not noted)

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1877phae.proj.41515

Dm Stars.

Dm +16°	2124	9.4	10	22	6	16	11.5	
	25	9.4			55	16	49.6	
	26	9.1		23	25	15	53.6	
	27	9.4		24	21	16	32.9	
	28	9.5			47	16	25.0	
	29	9.5		25	57	15	59.1	
	30	9.2			58	16	45.8	
		6m		25	40	14	45.7	Dec. Circ. 197 50 or 348 18

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1877phae.proj.1151

Apr. 3d 1878

8's of stars observed; RA's recorded on chronograph. Stars are near planet (185) which is probably near the stationary point.

33
42
42
36
37 } 32
37 } 32
31
30
34
43
33
32
42
42
43
44
45
34
37½
33
30
45
45
34
42
41

33
39
32
38
44
42
34

2d time going over the ground, only the RA's recorded. Decl. between 30' & 35' have short break, between 35' & 40' a medium break and between 40' & 45' a very long break.

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δ 30'-45'

Obsrm. Record

																Result Mean RA			δ
												10	21	42.0		10	21	42.0	33
														45.0				45.0	42
10	46	4.0		37.2		50			52	6.1	1	22		10.6		22		10.6	42
														11.6	11.1			11.4	31
		7.0		39.6						14.6	1			19.1	19.6			19.3	32
										30.9	1			35.9	35.9			35.9	32
		32.6		46.2						36.1	1			40.8	41.1			41.0	30-35
		33.6		48.6						49.8	1			55.2	54.8			52.0	30-35
		41.1		48.8					53	2.1	3	23		7.0	7.1	23		7.0	43
		57.9		49.2						27.9	1			32.8	32.9			32.8	33
	47	2.8								29.1	1			34.0	34.1			34.0	32
		17.2								33.8	3			38.7	38.8			38.8	42
		29.0								48.0	3			52.0	53.0			52.5	42
		54.8								55.1	3	24		0.4	0.1	24		0.2	43
														6.8				6.8	44
		56.0							54	2.5	2 or 3			7.5	7.5			7.5	45?
	48	0.7								8.3	2			12.8	13.3			13.0	39
		14.0								9.5	1			14.6	14.5			14.6	32½
		22.4								15.9	1	Dm 2127 2		20.6	20.9	Dm 2127		20.7	33
		28.8								18.0	1			22.9	23.0			23.0	30
		29.5								50.1	3			27.4				27.4	45
		34.8	2							54.8	2			54.5	55.1			54.8	45
		36.6								18.5	3			58.4	59.8			59.1	39
		42.5	Dm 2127							37.6	3			22.8	23.5	25		23.1	42
		44.9								44.9	2			42.0	42.6			42.3	41
		49.4								48.6	1			44.1				44.1	33
	49	16.5								53.5	3			49.7	49.9			49.8	39
		20.4							56	13.0	3			53.4	53.6			53.5	32
		44.8								18.4	2			58.7				58.7	38
	50	4.0												15.2		26		15.2	44
		6.1												17.6	18.0			17.8	42
		11.7												24.2	23.4			23.8	39
		15.4												~~26.6~~					
		20.7																	

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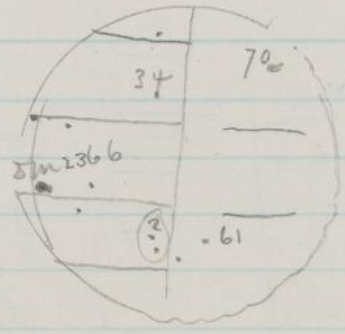
Dm Stars near (185) May 1.

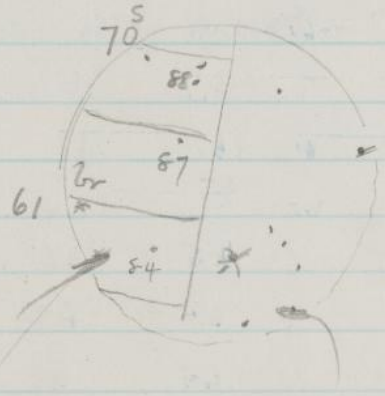
Dm 18°	2360*	8.2	10h	18m	33.9	+ 18° 7.7
	2361	9.0	19	34.8		37.4
	62	9.5		44.3		10.8
	64	9.5		53.0		49.7
	65	~~8.7~~ 9.5	20	27.3		37.9
double	66*	~~8~~.7		32.4		40.9
	67	9.5	21	56.9		3.6
	68*	8.2	22	19.9		42.0
	70	9.5	25	~~28.3~~ 6.6		47.2
	71*	9.0		8.6		20.8
	72*	7.5	25	30.9		37.5
			24	16.1		44.5
			1	14.8		7.0

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May 2





5.5
11.6
22
28.8
38.5
51.5
5.5
15
29
32
33 ?
52.5 Dm
57.2
45
5
8

4.0 Dm
11
21
24
39
51
56
145 *S
28
31
32 ?
57 ? Dm

Dm

~~8.1~~ 7.0
16.5 17
18.3 20
33.0 35
46.0 47
60.0 61 Br.
69.5 70.5
23.5 24
26.5 27
27.5 28 Dm
47.0 47 Dm
51.7
59.0
59.5
62.5

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May 3

4.0	Dm		
10		6.0	6
20	3-	16.	17
49 ?		3-	19
			34
65		45	46
73		61	62
88			
42 ?		69	69
111 5		84	85
16			
22		88 ?	87 3
23			
25			
29		107.5	108
		112	
		118	
		119	
		121	
5			
11		125	
22			
24			
39			
51 7			
7			
14			
30			
32			
53			



free, groups of last night

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Transit of Mercury May 5-6, 1878

Transits over micrmid lines - Chronograph -

Wllobs

A8Flint Recr

1.00	Morning O. Position, 305.54		
10.00	1st Set- 315.54		
11.50	N. Power too great-		
	O Pos. 270.0.4 (10)	275.1	wires 3, 4.
	Setting 280.0.4 (10)	"	3, 4
	unsteady	O Position	270.5
	wire 1, 2, 3, 4, 5-	New Set-	
	2nd. Set, wire 2, 3, 4, 5-	O	271.4
	3rd. " wire 3, 4, 5-	Reading	281.4
	4th. " " 2, 3, 4, 5-	wires	3, 4, 5, 6, 7
Beg. new set-	Pos Angle 285.0.4 (10)	2nd. Set.	
	wires 1 — 6	wire	3, 4, 5, 6, 7.
	wires 1 — 6		

Zero of Position	Reading	Wires	Notes.
15-5.5-			3rd. set - perfectly

Order 1δ, 2δ, 1α, 2α, 1δ', 1α', 2α', 2δ'

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1877phae.proj:11515

Transits over inclined lines — Afternoon.

W. H. Ob.
A. S. Flint, Rec.

Zero of Position	Reading	Wires	Notes
83.[0]20	90.[02]20	5	
		4, 5	last 5, cloudy
		4, 5	Red illumination
		4, 5	
		4, 5	
93.[02]2		3 4 5 6	Red illumination
		3 4 5 6	
		3 5 6	Lost 4
		3 4 5 6	
		3 4 5 6	
		3 4	Lost 5, 6
		4 6	
100.[02]2		2 3 4 5 6 7	
		2 3 5 7	
		2 3 5 6	
103.[02]2		2 3	Clouds
		2 4 5 6 7 8	
		2 4 5 6 7 8	

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1877phae.proj.1151

Measures of Diameter with filar micrometer.

W. Lobb,
A. S. Flint, Rec.

Zero of Position	Reading
34.9	104.9

Power 3.

Double distances.

48.0
50.662
2.662

Reading 34.9

46.0

2.662		
.708	48.0	
.553	50.708	
.632	2.708	
.574	48.000	
.552	refocused	
2.614	50.553	
1.307	2.553	
9.80 = 1 rev. Screw.	48.000	
12.81 = Diameter	50.632	
of Mercury.	2.632	
	50.000	
	52.574	
	2.574	
	50.000	
	52.552	
	2.552	

These measures were all made at intervals when the planet was dimly seen through the clouds. The definition was very poor, and consequently the results obtained have little value.

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1877phae.proj.00151

~~IIIII~~ Four measures of diameter.
W A R

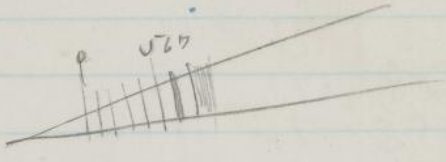
~~6~~ ~~2.2~~

Diff. Power III too high

4 20	5.7	7.2	1,5	1 min = ,01 inch nearly.
	5.8	7.1	1,3	1 Min = 10" nearly.
	5.7	7.2	1,5	
	6.2	7.3	1,1	
	6.0	7.2	1,2	
	6.1	7.2	1,2	
	6.0	7.3	1,3	
	5.5	7.0	1,5	
	5.8	7.2	1,4	
	5.6	7.1	1,5	
			1,37	

Power II

4 24	5.5	6.8	1,3
	5.6	6.9	1,3
	~~5.8~~ ~~6.0~~	7.1	1,3
	5.7	7.2	1,5
	5.8	7.3	1,5
	6.0	7.2	1,2
	5.9	7.2	1,3
	5.9	7.2	1,3
	6.0	7.2	1,2
	6.0	7.2	1,2
	6.0	7.2	1,2
	6.0	7.2	1,2
			1,35



The limb nearest the vertex is estimated in parts of one division. The limb furthest from the vertex is read more accurately since the tenths of a division are read directly by means of the short lines.

Very truly,

1877phae.proj.0151

W Woleseum. May 6

Saw Measures of diameter.

Power 2

~~6.0~~	~~7.1~~	~~1.1~~
6.0	7.3	1.3
6.1	7.2	1.1
6.0	7.1	1.1
6.1	7.3	1.2
6.0	7.2	1.2
6.1	7.4	1.3
6.1	7.3	1.2
6.1	7.2	1.1
5.5	6.8	1.3
		1.19

Reflected

6.0	7.1	1.1
6.0	7.1	1.1
5.9	7.1	1.2
5.8	7.0	1.2
5.9	7.1	1.2
5.9	7.1	1.2
6.0	7.1	1.1
5.9	7.2	1.3
5.8	7.2	1.4
5.9	7.1	1.2
		1.20

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1877phae.proj.0151

May 6

WAR

5 15	6.1	7.3	1,2
	6.0	7.2	1,2
	6.2	7.3	1,1
	6.0	7.3	1,3
	6.1	7.4	1,3
	6.1	7.3	1,2
	6.2	7.4	1,2
	6.0	7.3	1,3
	5.9	7.3	1,4
	6.0	7.3	1,3
			1,25

Power ~~III~~ II

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1877phae.proj.1151

block comparisons of Bond 312 and Frod. 1327 May 5-6, 1878. Will

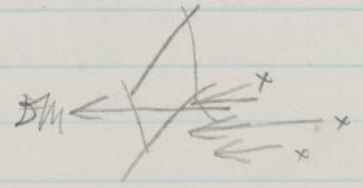
Recorded on chron. sheets

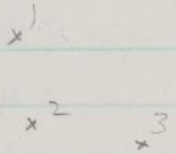
Bond 312			Frod. 1327			1327 − 312
1h	5m	20.8	1h	6m	0s	
	6	20.9		7	0	+ 39.17
	7	20.8		8	0	
1	56	20.8		57	0	39.15
	57	20.9		58	0	
2	37	21.0	2	38	0 rej.	
	38	20.7		39	0	39.25
	39	20.8		40	0	
4	27	20.8	4	28	0	
	28	20.8		29	0	39.20
4	36	20.7	4	37	0	
	37	20.7		38	0	39.30
6	10	20.7		—	0	
	11	20.7		—	0	39.30
8	41	20.6	8	42	0	
	42	20.5		43	0	39.48

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1877phae.proj.00151

6	Dm	May 7. Stars near (18ℓ)
13	7	3.6 (compared with May 2 k 3)
22.5	16.5	6.2
41		
52	35	9.0
7	46	
17	61	
30		
33	71	
34		
535	84	
54	85	Order DM 123
6 7	86	x^1 1 x^2 1 x^1 2 x^2 2 x^3 1
	107.5	x^2 3 x^3 2 x^3 3 x^1 3
	113	
	120	These three stars compared with DM 2368





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1877phae.proj.1151

May 7.

Stars following DM 2368 between 30′ and 45′

1 = 30-35
2 = 35-40
3 = 40-45

~~DM 2368 13 50 12.3 3~~

DM 2368	10	22	20.3	3	25	46.3	1
			25.0	2		47.4	3
			32.1	2		56.8	3
			33.0	1	26	1.1	2
			36.8	1			
			56.6	1			
		23	5.9	3 or 2			
			8.5	3			
			20.8	3			
			22.9	1			
			27.1	1			
			27.7	2			
			34.0	2			
			51.1	1			
			53.3	3			
			59.6	3			
		24	11.7	3			
			15.7	2			
			16.2	1			
			32.3	2			
			52.0	3			
			56.7	3			
			1.8	1			
		25	2.4	3			
			8.5	1			
DM 2372			30.1	2 or 3	rather		

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1877phae.proj.1151

In Stare -

	2384	7.7 *		31	13.7	17 55.0	= WB 10h 593 Lal. 20540
18°	2391 40	9.3	10	36	5.0	17 58.4	
	2395	9.4		36	52.5	18 16.7	
	96	9.3		36	53.8	39.0	
	97	9.3 *		37	18.5	10.2	= WB X 737
	98	9.5		37	46.7	27.1	
	99	9.2		37	54.8	18.0	
	2401	9.3 *		38	32.3	29.4	
	2407	9.5		40	58.1	18 5.0	
	08	8.9 *		42	15.6	17 54.1	= WB 831 R 3341
	09	9.3		43	8.1	18 18.6	
	2411	9.5		44	8.8	17 53.4	
	2256	9.5 *		34	28.0	46.0	
	2265	8.5 *		36	16.0	46.5	
17	2267	9.5	10	38	3.0	17 48.1	
	68	9.5		38	23.4	46.1	
	2271	9.4		38	46.2	51.4	
	2278	9.4		42	46.9	50.9	
	2279	7.0 *		42	57.0	48.4	

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1877phae.proj.0151

May 27, 1878.

Search for (185)

Stop. watch

	38	3.8	20 min. later
	7.6	3.8	3.2
10 50	11.0	3.4	6.4
	14.6	3.6	9.8

II

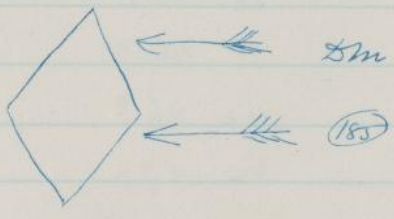
Observed by Thom, comparing with DM. 2384

5.5
21.5
30
35
40.5
41

In 1st set made taps for stars prob'ly DM stars between DM and planet:

2d set compared with DM 2397 but took only middle wire of 2397 Rej'

51.5
2
5
14
16.5



37
50
51
53
55.5

16	1	11.4
	1	0.4
16	0	11.0
4	20	24.5
11	39	46.5
	1	54.6
Mean time	11	37 51.9

16
27
25 DM
38 46
44

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1877phae.proj:11511

May 27, 1878. Wash. Obs.

Observations of (185) Eunike Prod. 1827

chron. record

Dm 2384			Other & possibly Dms mid. wire		(185)	
15	48	21.3	50	24.3	52	37.2
		33.9	51	5.6		51.5
		45.4	51	21.4	53	5.4

(185)		2397 middle wire			
54	4.1	56	5.4	56	42.4
	18.9				59.0
	32.5			57	15.2

Red. in RA.

Dm 2384		(185)		Mean of times — 2384		(185)		ΔRA (185) − 2384	
58	15.3	2	27.6	15	48 33.53	52	51.37	4m	17.s84
	25.6	2	43.8		58 25.40	2	43.77		18.37
	35.3	2	59.9		3 40.83	7	59.03		18.20
				16	1 11.39			4m	18.14
									4m 5.75

				2nt. 1st+2d	Σ	2nt 2d+3d	Σ
16	3	30.2	7 43.0	(2384 (185)		2384 (185)	
		41.2	59.2	12.6 14.3	26.9	11.5 13.9	25.4
		51.1	14.9	10.3 16.2	26.5	9.7 16.1	25.8
				11.0 16.2	27.2	9.9 15.7	25.6
					26.87		25.60
					25.60		
					26.24		
					.952		
					24.980		
					12.49		
					37 4.70	= 6′ 14.″70	
					14 5.2		

Appr. (185) RA 10 35 31.8

Dec. +18° 2′.9

Dm. 2384 1878.0 10 31 12.89 17 54 48.3 Weisse

14.88 48.2 Lal

Adopted 10 31 14.22 17 54 48.2 (185) − 2384 = + 7′ 53″.5

4 18.14 7 53.5

Appl. pl. (185) 10 35 32.36 18 2 41.7

32.52

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1877phae.proj.1151

June 5, 1878.

Transits of α Bootis over 10 line plate used in observing Transit of Mercury on May 5, 6-, to determine equatorial interval.

43.9	19.0	46.7	18.3	52.5	17.5
1.7	1.6	1.6	1.7	1.6	1.5
45.6	20.6	48.3	20.0	54.1	19.0
1.5	1.5	1.5	1.4	1.5	1.5
47.1	22.1	49.8	21.4	55.6	20.5
1.5	1.6	1.6	1.7	1.6	1.6
48.6	23.7	51.4	23.1	57.2	22.1
1.5	1.5	1.7	1.5	1.5	1.4
50.1	25.2	53.1	24.6	58.7	23.5
1.6	1.6	1.4	1.5	1.7	1.6
51.7	26.8	54.5	26.1	60.4	25.1
1.6	1.6	1.6	1.6	1.4	1.6
53.3	28.4	56.1	27.7	61.8	26.7
1.5	1.4	1.6	1.5	1.7	1.5
54.8	29.8	57.7	29.2	63.5	28.2
1.6	1.7	1.6	1.7	1.5	1.5
56.4	31.5	59.3	30.9	65.0	29.7
1.5	1.4	1.5	1.5	1.6	1.6
57.9	32.9	60.8	32.4	66.6	31.3
1.56	1.54	1.57	1.57	1.57	1.53

~~4~~
57
57
57
53

1.557
.941 cos δ
1.4651 eq. int.

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1877phae.proj.11511

Sm Stars

17°	2281	8.8*	10	44	27.5	17	14.8
	86	8.2*		46	13.0	16	58.2
	87	8.6*		46	29.2	17	20.2
	90	9.0*		46	57.2	17	22.9
	92	9.0*		48	27.2	17	3.0
	96	9.4		49	45.4	16	58.1
	99	9.5		51	54.2	17	~~10.0~~ 9.1
	2350	8.2*		51	54.8	17	15.6
	04	8.0*		53	21.4	17	3.2
16°	2181	8.8*		45	43.8	16	49.1
	85	9.0*		47	19.4		51.1
	86	7.9*		49	38.6		48.2
	2191	7.3*		51	12.5		24.9
	97	9.2*		52	8.1		45.9
(155)	June 12		10	~~49~~ 48	40	17	10.3
	13			49	40	17	5.8

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1877phae.proj.1151

June 12, 1878. Washington.

Observations of (185) Eunike. Prod. 1327.



*' = 17° 2292

*² = 2304

Chron. record.

* 2292	(185)	2304
16 17. 16.6	17 48.5	22 10.8
28.8	18 5.6	23.3
38.9	21.0	34.0
23 9.0	23 41.7	28 3.1
21.3	58.2	16.0
32.0	24 12.8	27.6
29 1.4	24 35.4	33 55.8
14.6	51.3	34 9.0
25.9	30 5.7	21.2
34 57.8	35 33.3	39 51.7
35 11.4	48.2	40 6.0
23.7	36 1.6	19.0

Star observed by mistake – planet not seen, probably on account of bright moonlight.

Red. in R.A.

Mean of times

2292	(185)	2304	185 − 2292	185 − 2304
16 17 28.10	16 18 5.03	16 22 22.70	36.93	− 4m 17.67
23 20.77	23 57.57	28 15.57	.80	18.00
29 13.97	29 50.80	34 8.67	.83	17.87
35 10.97	35 47.70	40 5.57	.73	17.87
	16 26 55.28		36.82	− 25.85
			.955	.955
			35.16	246.25
				− 4 / 6.25

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1877phae.proj.1151

Red. in Dec.

Int. 1st to 2d					Int 2d to 3d				
2292	(185)	2304	Σ'	Σ^2	2292	(185)	2304	Σ'	Σ^2
12.2	17.1	12.5	29.3	29.6	10.1	~~17.1~~ 15.4	10.7	25.5	26.1
12.3	16.5	12.9	28.8	29.4	10.7	14.6	11.6	25.3	26.2
13.2	15.9	13.2	29.1	29.1	11.3	14.4	12.2	25.7	26.6
13.6	~~14.9~~	14.3	28.5	29.2	12.3	13.4	13.0	25.7	26.4
			28.92	29.32					
			25.55	26.32					
			27.24	27.82					
			.955	.955					
			26.01	26.57					
			13.00	13.28					
			39 0.1	39 8.5					
			6 30.1	6 38.5					
			14 8.2	14 8.2					

(185) − ✱2292 = +7 38.1 | +7 29.7 = (185) − 2304

[This is a star and not (185) −]

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1877phae.proj.1151

June 14, 1878.

Transits of α Bootis over 10 line plate used in observing Transit of Mercury on May 5, 6.

$\delta = 19\ 48\ 57$ cos δ .941

46.0	13.5	40.3	6.4	33.0	1.7	33.6
1.6	1.3	1.7	1.6	1.6	1.5	1.5
47.6	14.8	42.0	8.0	34.6	3.2	35.1
1.5	1.7	1.5	1.6	1.4	1.4	1.5
49.1	16.5	43.5	9.6	36.0	4.6	36.6
1.5	1.5	1.5	1.4	1.6	1.8	1.6
50.6	18.0	45.0	11.0	37.6	6.4	38.2
1.7	1.6	1.5	1.6	1.5	1.4	1.5
52.3	19.6	46.5	12.6	39.1	7.8	39.7
1.6	1.6	1.6	1.6	1.6	1.6	1.5
53.9	21.2	48.1	14.2	40.7	9.4	41.2
1.5	1.5	1.6	1.6	1.6	1.5	1.6
55.4	22.7	49.7	15.8	42.3	10.9	42.8
1.6	1.6	1.6	1.5	1.6	1.6	1.7
57.0	24.3	51.3	17.3	43.9	12.5	44.5
1.5	1.5	1.6	1.5	1.6	1.5	1.5
58.5	25.8	52.9	18.8	45.5	14.0	46.0
1.7	1.6	1.6	1.7	1.5	1.7	1.7
60.2	27.4	54.5	20.5	47.0	15.7	47.7
1.58	1.54	1.58	1.57	1.56	1.56	1.57

.54
.58
.57
.56
.56
.57

1.566
.941

1.4736

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1877phae.proj.1151

June 14, 1878.

Transits of α Serpentis over 10 line Plate.

δ = 6 48 27 cos δ .993

34.4		54.3		20.6		43.6		8.3		33.0	
	1.4		1.5		1.4		1.3		1.4		1.5
35.8		55.8		22.0		44.9		9.7		34.5	
	1.4		1.5		1.5		1.6		1.5		1.4
37.2		57.3		23.5		46.5		11.2		35.9	
	1.4		1.4		1.4		1.5		1.4		1.5
38.6		58.7		24.9		48.0		12.6		37.4	
	1.5		1.5		1.6		1.5		1.4		1.5
40.1		0.2		26.5		49.5		14.0		38.9	
	1.5		1.5		1.4		1.3		1.6		1.4
41.6		1.7		27.9		50.8		15.6		40.3	
	1.5		1.3		1.5		1.5		1.3		1.5
43.1		3.0		29.4		52.3		16.9		41.8	
	1.5		1.5		1.4		1.6		1.6		1.4
44.6		1.5		30.8		53.9		18.5		43.2	
	1.5		1.6		1.5		1.5		1.5		1.5
46.1		6.1		32.3		55.4		20.0		44.7	
	1.5		1.6		1.6		1.5		1.5		1.6
47.6		7.7		33.9		56.9		21.5		46.3	
	1.47		1.49		1.48		1.48		1.47		1.48

59.2		24.5		48.2		1.47					
	1.4		1.5		1.5						
0.6		26.0		49.7		9					
	1.4		1.4		1.3						
2.0		27.4		51.0		8					
	1.5		1.4		1.5						
3.5		28.8		52.5		8					
	1.5		1.6		1.5						
5.0		30.4		54.0		7					
	1.5		1.5		1.5						
6.5		31.9		55.5		8					
	1.4		1.4		1.5						
7.9		33.3		57.0		7					
	1.5		1.4		1.5						
9.4		34.7		58.5		7					
	1.5		1.7		1.5						
10.9		36.4		0.0		8					
	1.5		1.3		1.5						
12.4		37.7		1.5		1.477					
	1.47		1.47		1.48	.993					
						1.4667					

Summary of Results

		No. of pts.	No. of obs.
June 5	1.4651	6	54
14	1.4736	7	63
14	1.4667	9	81
	1.4685	22	198

log = 0.16688

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1877phae.proj.11511

Stars near (188) June 25, 1878

O. Arg. 14865 $8^h\ 15^m\ 39^s\ 58^s$ $-16°\ 42'$
14844.5 8^h 38 57 −16 32
14815 7.8 37 4 −16 27

Stopwatch; transits between two stars, one suspected to be (188). 21. obs.

9 50

$14^s.0$	14.0	$13^s.6$	13.6
27.4	13.4	27.2	13.6
		40.4	13.2
			27.4
			67 8
			13.5

10 15 ~~Chronographic transits~~
1st set 30 to 40
Began with a double star preceding O. Arg 14815
Chron. failed.

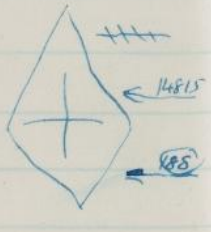
14.2	14.2
	13.6
27.8	
	14.2
42.0	
	14.4
56.4	
	14.1

Motion

Observed comparing with 14815

doubtful

Order 1st set * ' pl' ~~pl~~ * 2 * 3 pl 2 pl 3 (2) rej.
2d. * ' * 2 pl' * * 2 pl 2 * 3 pl 3



10 50 St Vard 14.6
29.0

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1877phae.proj.11511

Chron. Record

Brd. 1327

14815		(188)	
17 1	19.0	1	25.7
	36.6 (7.)		54.6
	51.4	2	12.4
2	41.3	3	6.9
3	2.3		21.5
	22.7		[34.2]
3	46.0	4	11.5
	7.2		26.3
	27.2		39.1
7	3.0	7	28.7
	24.4		43.6
	44.6		56.3
9	27.8	9	~~49.0~~ 53.6
	~~53.6~~ 49.0	10	8.1
10	9.2		20.9
10	36.6	11	~~58.0~~ 2.6
	~~2.6~~ 58.0		16.7
11	18.1		29.4

Reduction in α

Mean of transits

14815	(188)	Δ	
17 1 35.67	1 54.23	18.56	ref'.
3 2.10	3 [20.87]	.77	
4 6.80	4 25.63	18.83	
7 24.00	7 42.87	.87	
9 48.67	10 7.53	.86	
10 57.57	11 16.23	.66	
17 7 22.6		+18.80	

17 7 ~~22.6~~ 44.5

17 8 7.1

6 14 44.7

10 ~~54~~ 53 22.4

1 47.0

10 51 35

Reduction in δ

Int. 1st to 2d

14815	(188)	Σ
21.0	14.6	35.6
21.2	14.8	36.0
21.4	14.9	36.3
21.2	14.5	35.7
21.4	14.1	35.5

Int ~~2d~~ 1st to 3d

14815	(188)	Σ
20.4	[12.7]	33.1
20.0	12.8	32.8
20.2	12.7	32.9
20.2	12.8	33.0
20.1	12.7	32.8

35.82
32.92
34.37
.959
32.96
16 48
49 4.4
848.2
353.8 = +5′ 53.″8 (188 − *)

32.92

14815 = W.C. 6480

1878.0 14815 = 15 37 2.12 −16 28 50.1

W.C. = 2.10 53.3

15 37 2.11 −16 28 51.7

15 37 2.11 −16 28 51.7
+18.80 +56 53.8
+ 3.48 − 16.5
+ .07 + .5
Appl. 15 37 24.40 −16 22 ~~29.5~~ 13.9

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1877phae.proj.11511

June 26

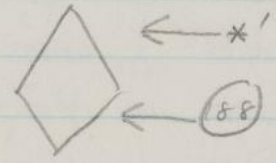
9 50

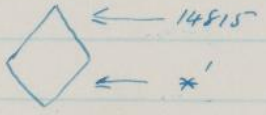
St W.

	8.6
8.6	8.2
16.8	7.8
24.6	7.8
32.4	8.1

8.8	
16.8	
25.2	
33.2	

9.0	9.0
	8.2
10.5–0 17.2	
	8.6
25.8	
	8.4
34.2	8.5





In 2d set chron. failed.

*' compared with 14815 to get its place
*' about 9m.

Reduction of (188) 86.

Mean of transits

	(188)	*'	Pl − *' Δ
	16 17 54.33	19 33.60	−1m 39s.27
16 26 30	26 43.43	28 22.87	39.44
40			
16 27 10	29 23.63	31 2.77	39.14
6 18 41.3	31 58.86 60	33 37.73	39.13
10 8 38.7 2	199.99		
1 39.7	16 26 30.		−1m 39s.24

10–6–8.9 Camb. M. ☿

	α	δ
Pl − *'	−1m 39s.24	5' 13".3
*' − 14815	+1 1.42	8 57.6
Pl − 14815	−37s.82	14 10.9

	(188)	*'	Σ
Int. 1st & 2d	21.3	17.1	38.4
	21.8	17.2	39.0
	21.0	17.4	38.4
	20.7 19.9	17.5	38.2 37.4
			38.50
			35.85
			37.18
			.959
			35.66
			17 83
			53 4.9 = ~~8' 54.9~~
			848.2
			313.3 = 5' 13".3

Int 2d & 3d	(188)	*'	Σ
	19.9	15.9	35.8
	20.1	15.9	36.0
	19.9	16.1	36.0
	19.5	16.1	35.6

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Phsm. record

	(188)		14815 ✱ 2		14 ✱′
16	17	33.5	19	16.9	34	21.2	35	21.6
		54.8		34.0		32.2		33.5
		14.7		49.9		41.8		44.0
	26	~~22.2~~ 23.3	28	6.1	35	57.3	36	58.0
		44.0		23.3		8.3		9.7
		4.1		39.2		18.2		20.3
	29	3.0	30	45.8	37	33.8	38	34.3
		24.0		3.2		44.6		46.0
		43.9		19.3		54.3		56.7
	31	38.3	33	20.7	39	11.2	40	12.0
		59.0		38.2		22.4		23.9
		18.5		54.3		32.1		34.4

Not (188) but a star.

Reduction of ✱′ − 14815

	α					δ					
	Mean of transits					Int. 1st to 2d			Int. 2d to 3d		
	14815		✱′		✱′−14815	14815	✱′	Σ	14815	✱′	Σ
16	34	31.73	35	33.03	+1m 1.30	11.0	11.9	22.9	9.6	10.5	20.1
	36	7.93	37	9.33	1.40	11.0	11.7	22.7	9.9	10.6	20.5
	37	44.23	38	45.67	1.44	10.8	11.7	22.5	9.7	10.7	20.4
	39	21.90	40	23.43	1.53	11.2	11.9	23.1	9.7	10.5	20.2
					+1 1.42			22.80			
								20.40			
								21.60			
								.959			
								20.71			
								10 35			
								310.6			
								848.2			
	15	37 2.11	−16	28 51.7							
		3.48		−16.5							
		−37.82		+14 10.9							
		.01		0.9							
Apf. place	15	36 27.78	−16	14 56.4							

537.6 = 8′ 57.6

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1877phae.proj.11515

June 28, 1878.

a+b

Sept. et Oct. Obs.

10 0	3.2	3.2
	5.8	2.6
	9.0	3.2
	11.8	2.8
	15.2	3.4
a: b	18.6	

c and d

22.0	22.2
44.2	22.2
66.5	22.3
88.4	21.9
110.2	21.8
	220.4

* and supposed (188)

1 hour later

2.6	
5.2	
8.0	

d has moved

1 hour later II

21.6	21.6
43.2	21.6
64.2	21.0
21.4	21.4

118.7 zero of position

45

163.7 setting of circle

The plate used for asteroid measures since Nov. 7, 1877 and whose dimensions are given on p. 139 is accidentally broken. For tonight a plate with tin foil lines ruled thus ‖ is used, the zero of position found and the plate inclined 45°



Several broken sets on chronograph - all reject.

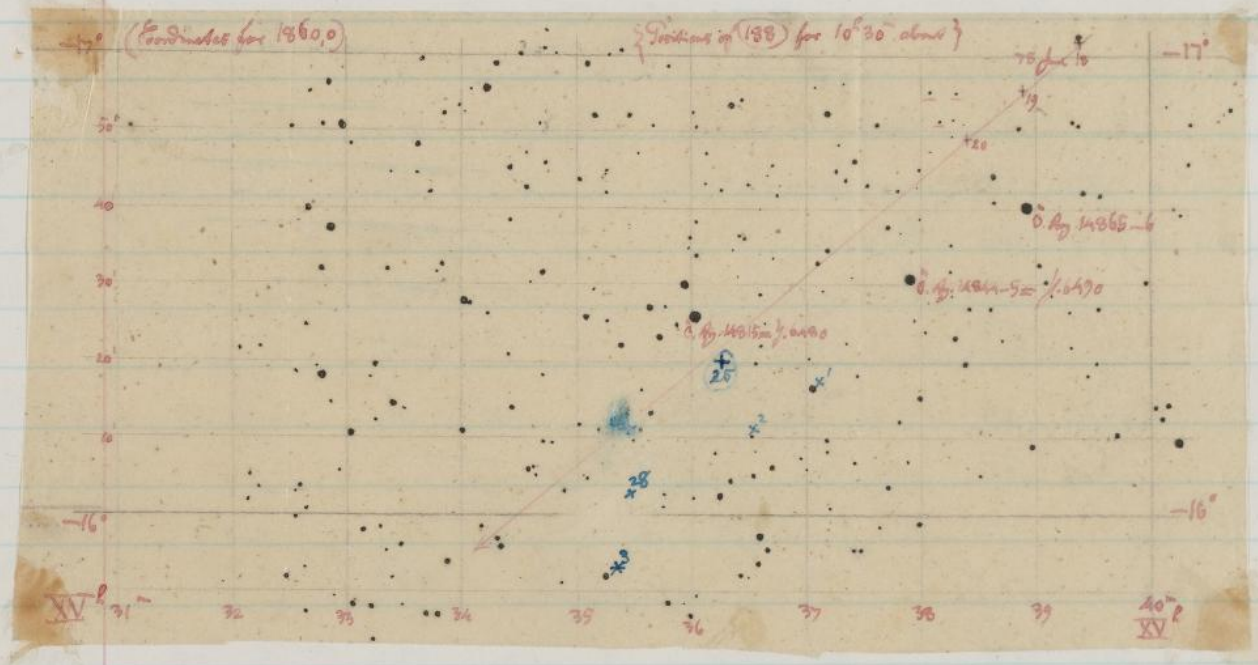
Order (188) x^2 then x^2 and x' compared. For comparison between x' and 14815 v. preceding page.

On account of difference in δ wires 1 & 2 only could be used for southern star.

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Peters' Chart for Patt of (188)



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Chron. record. -36.4 Bvd. 1827

(188) June 28, 1878. M.U.Ob.

Wmio		(188)	Wmio	x^2	Wmio	x^2	Wmio	x'
14	2 7	15.9	1 8	22.7	2 13	3.3	1 13	40.6
	3	34.8	2	48.2	3	22.3	2 14	2.6
	1	46.0	3	59.6 ?	1	33.2	3	15.3 (2)
		61.9		70.9		36.5		103.2
	16	28.8	17	33.0	18	32.8	19	14.5 (3)
		48.3	18	1.9		51.8		32.3
		57.8		95.9	19	16.0		46.8
		86.6				148.8		
	20	18.4	21	26.6	22	27.4	22	57.4
		37.5		51.9		46.6	23	27.0
		50.4		78.5		49.7		24.4
		68.8				77.1		
	24	20.2	25	31.2	26	18.6	27	2.0
		39.5		52.6		37.7		18.0
		54.9		83.8		54.4		37.3
		75.1				73.0		20.0

~~22.7~~

~~48.3~~

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Reduction in α

Mean of transits over wires 1 & 2

(188)	x^2	$188 - x^2$ Δ	x^2	x'	$x^2 - x'$ Δ
17 7 30.95	8 35.45	−1m 4.s50	13 18.25	13 51.60	− 33.35
16 48.3 30	17 47.95	4.65	18 54.40	19 23.40	[29.00] rej.
20 34.40	21 39.25	4.85	22 38.55	23 12.20	33.65
24 37.55	25 41.90	4.35	26 36.50	27 10.00	33.50
17 17 21.55 wire 183		−1 4.59	wire 183		− 33.50
7 4/30.40	8 41.15	[0.75 rej.]	13 27.75	13 57.95	[30.20] rej.
17 17 21.6			26 46.05	27 19.65	33.60
36.4					33.52
17 17 58.0					
6 26 34.4					
10 51 23.6					
1 46.7					
10 49 36.9					

Reduction in δ

Interval (188)	x^2	Σ	Interval x^2	x'	Σ
30.1	25.5	55.6	29.9	22.0	51.0
29.0	27.9	56.9	43.2	17.8	[61.0] rej.
32.0	25.3	57.3	22.3	29.6	51.9
34.7	21.4	56.1	35.8	16.0	51.8
		225.9	36.7	35.3	52.0
		56.48			51.68
		.959			.959
		54.16			49.56
		2708			2478
		2/8124 = 2/13′ 32.″4			2/7434
		6′ 46.″2			371.7 = 6′ 11.″7

14815 =	15h 37m 2.s11	−16° 28′ 51.″7
$x' - 14815^-$	+ 1 1.42	+ 8 57.6
	− 33.52	+ 6 11.7
$x^2 - x'$	− 1 4.59	+ 6 46.2
(188) − x^2	15 36 25.42	−16 ~~54~~ 6 ~~47.2~~ 51.7
1878.0 Mean place (188) +	3.48	+ 1.4
Red. to Appl.	+ .03	
Corr. Diff. Refr.		
Appl. (188)	15 36 28.93	−16 7 11.2

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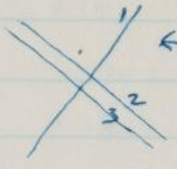
1877phae.proj.11511

July 1, 1878. W. U. Ob.

Preceding x^3 (v. chart p. 179) about 30^s and north 5′ 6′ are two stars either of which may be (188). ~~Chart~~ Transits taken
55′ – 45′, 45′ – 35′ chronogr. failed partly
55′ – 45′, 45′ – 35′, 35′ – 25′, calling x^3 52′
In 2d and 3d ~~chart~~ sets x 14800, 1 is distinguished by a rattle, in 1st set x^3 by rattle.

	Zero of pointing
236.3	228.8
45	45
281.3	273.8
rej.	

Both stars observed being compared with two preceding about same R.A.; these two must be later determined if found that either of the suspected stars is the planet.



← two comp x^s, two susp. x^s

Wire 3 not always taken.

6. Mag. S. ~~D.M.~~ Stars

14713	9	15	30	58 4	−15	18.4
720	9		31	11 36		14.2
737	9		32	20		6.4
778, 9	9		34	40		9.8
785, 6	9		35	11		10.3
800, 1	7.5		35	55		37.2 = 33.5 (186.0)

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(1860.0) $*^3 = 52'$

Stars near (188) path.

Results referred to $*^3$ / 14800 / 14800

	55′ − 45′	45′ − 35′	35′ − 25′	55′ − 45′	45′ − 35′	35′ − 25′
	7 47.5 2	9 43.2 3	12 34.0 1	−1m 32.5s b	−1m 58s e	−2 13 e
	54.3 2	49.5 2	42.0 1	26 b	51 d	5 e
	59.1 1	54.2 2	45.8 1	21 a	47 d	1 e
a = 55-50	8 5.7 2	55.6 2	48.3 1	14 b	45 d	1 58 e
b 50-45	18.6 1	10 ~~0~~ 0.6 1	54.0 1	1 1 a	40 c	53 e
c 45-~~40~~ 35	20.6 2	4.5 2	55.5 1	0 59 b	36 d	51 e
d ~~40~~ 35-30	21.6 1	15.5 2	13 2.7 1	58 a	25 d	44 e
e 35-~~30~~ 25	22.7 1	21.9 2	49 2	57 a	19 d	42 f
f ~~30~~ 25-25	24.2 1	40.2 2	6.8 1	56 a	−1 0 d	40 e
g 25-20	24.3 2	41.8 2	13,4 1	56 b	0 59 d	33 e
	28.5 2	45.3 1	16.0 2	54.5 b	56 c	30 f
	37.4 2	55.0 1	20.2 1	~~4~~ 3 b	46 c	26 e
	40.0 2	59.6 1	27.1 2	40 b	41 c	19 f
	47.2 2	11 5.9 1	37.7 1	33 b	35 c	1 9 e
	53.0 2	8.0 2	55.5 2	1 27 b	33 d	0 51 f
	59.2 1	15.9 1	58.5 2	21 a	25 c	48 f
	9 0.2 1	19.2 1	14 14.0 1	20 a	22 c	~~33~~ e
	10.0 1	20.4 2	14.5 1	−0 10 a	20 d	32 e
	$*^3$ 20.0 1	21.3 1	18.4 1	———	19.5 c	28 e
	———	22.1 2	27.8 1		19 d	19 e
	12 2.0 2	24.4 2	36.4 2	+0 21 d	16 d	−0 11 f
	8.0 2	34.4 2	14800 46.6 1	~~33~~ 27 d	−0 6 d	+0 4 e
	11.4 1	14800 40.8 3	51.0 1	31 c	+0 5 ~~d~~ c	5 f
	12.0 1	45.4 2	51.6 2	31 c	7 ~~d~~ c	8 f
	12.5 2	47.6 1	54.2 2 59.5 1	+0 32 d	7 c	13 e
		48.0 1	15 1.8 1		8 d	15 e
		48.7 2	5.2 3 7.2 2		13 d	19 g 21 f
		54.0 2	13.7 1		15 c	27 e 32 f
		56.0 1	18.3 2 22.8 2			36 f

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Comp.	x^1	x^2	Surf.	1	2
17 30	10.2	17.0		36.0	38.9
	21.0	29.2		46.0	51.0
~~31~~	~~21.8~~				
33	33.9	40.9	34	25,4	32.5
	45.7	51.9		38.7	56.9
35	17.6	24.6	36	9.3	16.6
	29.2	35.9		22.3	40.3
36	59.4	37 6.2	37	50.9	58.3
37	10.9	17.3	38	3.9	22.0
38	39.2	46.2	39	~~9.6~~	~~14.4~~
	50.3	56.9		31.0	37.6
39	9.6	14.4		43.2	1.5?? 2.6??

July 2, 1878.

Neither of stars observed last night has moved. Transits taken of same stars observed last night. Star 27^5 prec. $*^3$ last night not there tonight and probably is the planet. Could not find additional star in the vicinity with any certainty and abandoned the observation. Slightly hazy sky.

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45-35	35-25	55-45	55-45	45-35	35-25
~~53.2 2~~					
~~56 2~~	38.5 1	43.0 2	~~36~~ ~~24~~	2 0	
2.0 2					
~~50.5 1~~	42.6 2	44.3 1	35	51	
4.1 1					
~~44.8 1~~	43.7 1	54.5 2	25	49	
6.4 2					
~~42.6 1~~	44.9 1	58.5 2	23	47	
8.0 2	0.6 1	4.0 1	15	45	
8.8 1	2.3 2	8.6 2	11	44	
13.5 1	4.0 1	18.8 2	1	40	
17.4 2	12.3 2	19.6 1	2 0	36	
28.4 2	15.6 1	21.8 1	58	25	
34.8 2	22.8 2	27.8 1	52	18	
52.5 2	24.8 1	29.0 2	50	1 d	
53.4 2	39.3 1	35.7 2	44	1 0	
55.6 2	44.6 1	44.2 2	35	57	
57.0 1	46.0 2	46.2 2	33	56	
8.0 2	54.1 1	03.0 2	26	45	
18.0 1	54.9 2	58.2 1	21	40	
18.4 1	57.2 1	19.4 2	1 0	35	
20.5 2	5.2 1	22.0 1	57	33	
38.2 1 *	28.6 1	7.0 2	35.8 2	43	25
41.5 2	32.0 1	11.3 1	38.2 2	41	21
42.6 1	33.2 2	17.7 2	45.2 2	34	20
50.9 1	35.0 2	28.7 1	57.6 2	22 b	18
52.6 1	36.0 1	45.9 2	58.4 1	21	17
53.0 3	37.2 2	49.2 2	57.5 1	20	16
57.8 2	47.5 2	58.6 1	9.2 1	-0 10	0 6
	53.3 1 *	3.2 1	19.4 1		
	0.8 1	5.0 1			
	1.3 2	5.4 1			
	6.5 1	19.1 1			
	8.6 1	26.0 -			

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Observations to determine focal length of West Equatorial.

Transits with West Equatorial over Tr. of Mercury Plate III

1878. Sept. 12. Jupiter foll. limb

0.4	19.0	18.6
0.1	18.5	18.4
0.7	19.3	18.6
0.3	19.0	18.7
0.2	18.7	18.5
0.2	18.8	18.6
ch. f.		18.567

Equatorial Diameter of Jupiter

3.0	3.0	1.26874
3.0	3.0	9.96910
2.8	3.0	1.17609
3.1	2.9	2.41393
3.0	3.1	
3.1	3.2	
3.1	3.0	
2.9	3.1	
3.1	3.2	
3.1	3.3	
3.3	2.9	
2.8	3.0	
2.9	3.0	
3.1	2.8	
3.0	2.8	

36 | 1089 = 3.025

Sept. 16. Jupiter

Δ prec. limb	Prec. limb		Foll. Limb		Sat. I		Δ foll. limb	Δ Sat I
18.3	0.1	18.4	3.1	21.4			18.3	~~18.7~~
.6	0.0	18.6	3.0	21.6	4.2	22.9	.6	18.7
.3	0.8	19.1	3.6	22.1	4.8	23.3	.5	.5
.7	0.2	18.9	3.3	21.8	4.3	22.9	.5	.6
.4	0.0	18.4	3.0	21.5	4.2	22.7	.5	.5
.5	0.7	19.2	3.8	22.4	4.9	23.3	.6	.4
.5	0.7	19.2	3.8	22.2	4.8	23.3	.4	.5
.5	0.4	18.9	3.3	22.0	4.5	23.0	.7	.5
.4	0.6	19.0	3.5	22.2	4.6	23.2	.7	.6
.6	0.6	19.2	3.8	22.2	4.8	23.3	.4	.5
.4	0.9	19.3	3.8	22.4	4.9	23.3	.6	.4
.4	0.7	19.1	3.8	22.3	4.9	23.3	.5	.4
.4	0.8	19.2	3.9	22.5	4.9	23.4	.6	.5
.6	0.2	18.8	3.5	21.7	4.1	22.7	.2	.6
.4	0.6	19.0	3.4	22.0	4.5	22.9	.6	.4
.5	0.1	18.6	3.0	21.6	3.9	22.4	.6	.5
.7	0.0	18.7	3.1	21.5	3.9	22.2	.4	.3
.6	0.0	18.6	3.0	21.4	3.9	22.3	.4	.4
18)88			0.6	19.3			.7	
			0.4	18.9			5	
							20.103	17.83

Int. 18.^{s}489 — 18.^{s}515 — 18.^{s}488

log Int. 1.26692 — 1.26752 — 1.26689

log cos δ 9.96904 — 9.96904 — 9.96904

" 15 1.17609 — 1.17609 — 1.17609

" m 2.41205 — 2.41265 — 2.41202

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Sept. 16

	α Bootis			Jupiter foll. limb			
0.6	19.2	18.6	0.2	18.6	18.4	1.26766
0.9	18.9	.0	0.4	19.0	.6	9.96904
0.1	18.7	.6	0.9	19.3	.4	1.17609
0.6	19.5	.9	0.6	19.0	.4	2.41279
0.1	18.3	.2	0.0	18.4	.4	
0.0	18.0	.0	0.1	18.8	.7	
Reject		18.383	0.9	19.4	.5	
Too dark to see			0.7	19.2	.5	
lines.			0.5	18.7	.2	
Observation abandoned.			0.0	18.6	.6	
1.26442			0.0	18.4	.4	
9.97347			0.1	18.7	.6	
1.17609			0.8	19.3	.5	
2.41398			1.0	18.4	.4	
			0.1	18.6	.5	
			0.0	18.5	.5	
			0.0	18.6	.6	
			0.9	19.5	.6	
			0.4	19.0	.6	
			1.4	19.0	.6	
			0.0	18.5	.5	
			0.9	19.4	.5	
			0.6	19.2	.6	
			0.2	18.9	.7	
			0.1	18.7	.6	
			0.2	18.7	.5	
			0.3	18.8	.5	
			0.9	19.3	29 | 151	.4
			0.1	18.9	18521	.8

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Sun's following limb

Sept. 18

Plate III

		Δ
0.3	17.4	17.1
0.0	17.2	17.2
0.3	17.3	.0
0.6	18.0	.4
0.2	17.4	.2
0.2	17.5	.3
0.9	18.0	.1
0.8	17.8	.0
0.2	17.5	.3
0.7	17.9	.2
0.0	17.2	.2
0.4	17.6	.2
0.6	17.9	.3
0.5	17.5	.0
0.9	17.9	.0
0.2	17.3	.1
0.1	17.6	.5
0.6	17.6	.0
0.1	17.3	.2
0.3	17.5	.2
0.9	17.9	.0
0.6	18.0	.4
0.0	17.4	.4
0.0	17.1	.1
0.0	17.4	.4
0.7	17.9	.2
0.2	17.3	.1
0.0	17.0	17.0

		Δ
0.8	18.1	17.3
0.1	17.3	.2
0.2	17.4	.2
0.0	17.0	.0
0.0	17.2	17.2

23/60

17.^{s}182

1.23507

9.99981

1.17609

2.41097

2d pet.

		Δ
0.8	18.2	17.4
0.6	17.7	.1
0.2	17.6	.4
0.3	17.9	.6
0.2	17.5	.3
0.0	17.4	.4
0.5	18.0	.5
0.1	17.5	.4
0.5	17.7	.2
0.4	17.6	.2
0.6	18.0	.4
0.6	17.8	.2
0.2	17.6	.4
0.9	18.2	.3
0.9	18.2	.3
0.9	18.0	.1
0.5	17.6	.1
0.5	17.7	.2
0.3	17.8	.5
0.2	17.7	.5
0.3	17.3	.0
0.8	18.0	.2
0.6	18.1	.5
0.3	17.6	.3
0.9	18.1	17.2

25/87

17.^{s}308

1.23825

9.99981

1.17609

2.41415

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Sun's foll. limit.
Eclipse plate R.A. lines 1–4.

		Δ
0.9	9.0	8.1
0.2	8.4	8.2
0.6	9.1	8.5
0.2	8.0	7.8
0.4	8.8	8.4
0.9	9.1	.2
0.0	8.5	.5
0.4	9.0	.6
0.0	8.2	.2
0.0	8.4	.4
0.7	9.2	.5
0.8	9.2	.4
0.1	8.6	.5
0.6	8.9	.3
0.9	9.3	.4
0.3	8.9	.6
0.8	9.3	.5
0.1	8.7	.6
0.9	9.7	.8
0.0	8.3	.3
0.5	9.0	.5
0.2	8.9	8.7

22/90

$8^{s}.409$

0.92474

9.99981

1.17609

2.10064

Diameter of Jupiter obtained incidentally from observations on pp. 186 and 190

	Sept. 16	Sept. 18
D′ =	$3^{s}.025$	3.019
log D′	0.48073	0.47986
" cos δ	9.96904	9.96902
" 15	1.17609	1.17609
" D	1.62586	1.62497
D	42″.25	42″.17

Mean Value 42″.21

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Jupiter

Sept. 18 Unused Transit of Mercury plate ~~IIII~~ (III) Transit of Mercury Plate II.

Lines 1–2. Both limbs. Eq. Diam. of Jup.

Prec. Limit		Δ	Foll. Limit		Δ			Foll. Limit		Δ
								0.4	19.0	18.6
0.5	~~3.5~~ 7.0	6.5	3.5	10.0	6.5	3.0	3.0	0.3	19.0	.7
0.2	6.9	.7	3.2	10.0	.8	3.0	3.1	0.7	19.0	.2
0.4	7.1	.7	3.6	10.0	.4	3.2	2.9	0.6	19.1	.5
0.2	6.9	.7	3.3	10.0	.7	3.1	3.1	0.9	19.2	.3
0.0	6.5	.5	2.9	9.6	.7	2.9	3.1	0.9	19.3	.4
0.7	—	—	3.7	10.2	.5	3.0	—	0.6	18.9	.3
0.3	7.0	.7	3.4	9.9	.5	3.1	2.9	0.4	18.8	.4
0.1	—	—	3.2	—	—	3.1	—	0.9	19.5	.6
0.3	6.7	.4	3.3	9.8	.5	3.0	3.1	0.9	19.3	.4
0.3	7.0	.7	13.4	9.8	.4	3.1	2.8	0.2	18.8	.6
0.6	7.4	.8	3.8	10.4	.6	3.2	3.0	0.9	19.5	.6
0.~~8~~ 8	7.2	.4	3.5	10.1	.6	2.7	2.9	0.6	19.2	.6
0.0	6.5	.5	2.9	9.6	.7	2.9	3.1	0.2	18.8	.6
0.6	7.0	.4	3.5	10.2	.7	2.9	3.2	0.5	19.2	.7
0.8	7.4	.6	3.9	10.6	.7	3.1	3.2	0.8	19.3	.5
0.1	6.6	.5	3.2	9.8	.6	3.1	3.2	0.9	19.3	.4
0.0	6.7	.7	3.0	9.6	.6	3.0	2.9	0.4	18.9	.5
0.9	7.3	.4	3.8	10.2	.4	2.9	2.9	0.0	18.5	.5
0.2	7.0	6.8	3.3	9.9	6.6	3.1	2.9	0.1	18.5	.4
		17/100			18/105	36/1087		0.7	19.0	.3
		~~38/225~~						0.9	19.3	.4
		6.5~~8~~88			6.583	3.019		0.3	18.9	.6
		0.81875			0.81842			0.4	19.1	18.7
		9.96902			9.96902					24/118
		1.17609			1.17609					18.492
		1.96386			1.96353					1.26~~4~~6 99
										9.96902
										1.17609
										2.4~~8~~321 0

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II.

Results.

If m = the linear measure between the lines used,
n = the observed angular measure
$m = n\,F \sin 1''$ ∴
F (= focus) = $\frac{m}{n \sin 1''}$

	Object Observed	No. of Obs.	log n	log $n \sin 1''$	log m	log F	F
Sept. 12	4 foll. limb	6	2.41393	7.09950	9.04953	1.95003	89.132 in
16	" prec. limb	18	2.41205	7.09762	"	1.95191	89.518
	" foll. limb	20	2.41265	7.09822	"	1.95131	89.394
	" Sat. I	17	2.41202	7.09759	"	1.95194	89.524
	α Bootis	6	2.41398	7.09955	"	1.94998	89.120 rej.
	4 foll. limb	29	2.41279	7.09836	"	1.95117	89.366
18	⊙ foll. limb	33	2.41097	7.09654	"	1.95299	89.740
	" " "	25	2.41415	7.09972	"	1.94981	89.086
	" " "	22	2.10064	6.78621	8.74640	1.96019	91.240 rej.
	4 prec. limb	17	1.96386	6.64943	8.60638	1.95695	90.562
	" foll. limb	18	1.96353	6.64910	"	1.95728	90.632
	" foll. limb	24	2.41210	7.09767	9.04953	1.95186	89.508

Combining by weights gives —

Plate II 89.444 in 172 determinations
Plate III 90.598 35 "

A change of .01 affects the result —
With Plate II .05 in
" " III .14 in

The values assumed for m were
Plate II .11208
" III .04040

OVER.

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The value of m adopted for Plate II was supposed to be right but the original records were lost.
The following determinations of the plates were made with Prof. Rogers micrroscope. $.01 = \frac{1}{7984}$ in.

Plate II		Plate III	
10.384		7.259	
19.460	9.076	10.492	3.233
19.462		10.881	
10.388	9.074	7.649	3.232
10.642		7.452	
19.717	9.075	10.687	3.235
19.852		10.623	
10.778	9.074	7.390	3.233
19.636	9.076	7.495	3.232
10.560		10.727	
	9.0750 = 0.11366		3.2330 = 0.04049

These values for m give a correction to the results from Plate II + 1.346
" " III + .106 and
the following are the values of F.

From Plate II F = 90.790 172 determinations
III 90.704 35

As the latter set have but ⅓ weight of the former we have for final result, (true to hundredths.)

Focal length of West Equatorial 90.784

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